

**A Second Summary
of the
Horticulture and Propagation
of
California Native Plants
at the
Rancho Santa Ana
Botanic Garden,
1950-1970.**

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Edited by: Bart C. O'Brien

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**Please email corrections and/or questions about this document to:
bobrien@rsabg.org as Rancho Santa Ana Botanic Garden expects to be
publishing a printed version of this manuscript later in 2012.**

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Rancho Santa Ana Botanic Garden Mission Statement:

Rancho Santa Ana Botanic Garden is devoted to the collection, cultivation, study, and display of native California plants and to graduate training and research in plant systematics and evolution. Through all its programs, the mission of the Garden is to make significant contributions to the appreciation, enjoyment, conservation, understanding, and thoughtful utilization of our natural heritage.

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TABLE OF CONTENTS

HEADINGS	Page
TABLE OF CONTENTS	ii
DISCLAIMER	iii
NOTES	iii
REFERENCES	iii
JOURNALS	iv
ABBREVIATIONS	iv
ROOTING COMPOUNDS	iv
OTHER PRODUCTS	v
FUNGI OR WATER MOLDS	v
FUNGICIDES	v
HERBICIDES	vi
INSECTICIDES	vi
INSECTS	vi
EDITOR'S INTRODUCTION	vii
AUTHOR'S INTRODUCTION	viii
AUTHOR'S PREFACE	ix
HISTORY	1
THE SITE	1
THE CLIMATE	2
THE GARDEN	4
THE NURSERY	7
PLANTS listed alphabetically by genus (<i>Abies</i> to <i>Zigadenus</i>)	10

DISCLAIMER: Products mentioned by name in the text (and listed below), were used in the past at Rancho Santa Ana Botanic Garden, these products are not necessarily recommended or endorsed by Rancho Santa Ana Botanic Garden at this time. Some of these, especially many of the chemical products, are no longer used and some of them are now illegal. Always use caution and follow current laws, regulations, and label recommendations when using chemical products. Remember, this text documents the time period from 1950 to 1970.

NOTES about the text:

Ed: refers to an editorial comment or clarification, [always in brackets], made by Bart O'Brien.

In the text, a "trace" of seed/seeds indicates that less than one-eighth ounce of seeds were collected and/or sown.

In the text, "° F" indicates temperatures in degrees Fahrenheit.

In the text, "Virus X" is an affliction of Monterey pines (*Pinus radiata*). It is not known to be a virus, but was a syndrome that affected these pines.

REFERENCES cited in the text:

Austin, Mary Hunter. 1903. **The Land of Little Rain.** Houghton, Mifflin and Company. Boston and New York.

Bailey, Liberty Hyde. 1927. **The Standard Cyclopedia of Horticulture.** The Macmillan Company, New York, New York.

Baldwin, Bruce G., Douglas H. Goldman, David J. Keil, Robert Patterson, Thomas J. Rosatti, and Dieter H. Wilken (Editors). 2012. **The Jepson Manual, Vascular Plants of California.** Second edition. University of California Press, Berkeley, Los Angeles, London. (Balwin et al., 2012) [TJM2]

Everett, Percy C. 1957. **A Summary of the Culture of California Plants at the Rancho Santa Ana Botanic Garden 1927-1950.** Rancho Santa Ana Botanic Garden, Claremont, California. (Everett, 1957. Pgs:)

Hickman, James C. (Editor). 1993. **The Jepson Manual, Higher Plants of California.** First edition. University of California Press, Berkeley, Los Angeles, London. [TJM1]

Munz, Philip A. 1968. **Supplement to A California Flora.** University of California Press, Berkeley, Los Angeles, London. (Munz, 1968)

Munz, Philip A., and David D. Keck. 1959. **A California Flora.** University of California Press, Berkeley, Los Angeles, London. (Munz & Keck, 1959)

Sunset Western Garden Book. (There are many editions of this indispensable book on plants and gardening in California. All editions include many California native plants.)

Wolf, Carl B. 1938. **The North American Species of Rhamnus.** Monographs, Botanical Series, Number 1. Rancho Santa Ana Botanic Garden, Orange County, CA.

Van Rensselaer, Maunsell, and Howard E. McMinn. 1942. **Ceanothus.** Santa Barbara Botanic Garden, Santa Barbara, CA.

JOURNALS cited in the text:

Aliso. Scientific journal of Rancho Santa Ana Botanic Garden, Claremont, CA.

Brittonia. Scientific journal of New York Botanical Garden, New York, NY.

Bulletin of the American Penstemon Society. Journal of the American Penstemon Society.

California Horticultural Society Journal. Former journal of the California Horticultural Society, San Francisco, CA. Now a part of **Pacific Horticulture**.

Gardeners' Chronicle. London, England. Now a part of **Horticulture Week**.

Journal of the Royal Horticultural Society. Wisley, England. Now published as **The Garden**.

Lasca Leaves. Former journal of the Los Angeles State and County Arboretum, Arcadia, CA.

Madroño. Scientific journal of the California Botanical Society, Berkeley, CA.

Pacific Coast Nurseryman. Former nursery industry professional journal, Glendora, CA.

Proceedings of the California Academy of Sciences. Scientific journal of the California Academy of Sciences, San Francisco, CA.

ABBREVIATIONS used in the text:

CF (one mention) – unknown.

CMA (one mention) – unknown.

osb. (one mention) – unknown.

PMA (four mentions) – unknown.

SMA (20 mentions) – unknown.

ROOTING COMPOUNDS referred to in the text:

CUTstart is a trademarked product for rooting cuttings.

CUTstart XX is a trademarked product for rooting cuttings.

CUTstart XXX is a trademarked product for rooting cuttings.

Hormex is a rooting compound.

Hormodin #2 is 0.3% indole-3-butyric acid.

Hormodin #3 is 0.8% indole-3-butyric acid.

IBA is indole-3-butyric acid, a synthetic auxin rooting hormone, IBA.

Indole-3-acetic acid is a plant auxin used for rooting cuttings, IAA.

Rootone is a registered trademarked product of synthetic rooting hormone with a fungicide.

OTHER PRODUCTS referred to in the text:

Agriform is a slow release fertilizer.

Blue Whale is a brand of fertilizers made from whales, likely similar to fish emulsion.

Colchicine is a chemical used to induce polyploidy in plants.

Con-Rock is a finely crushed granite.

Jiffy pot is a brand of press-molded peat moss pots.

SUPERthrive is a trademarked horticultural product.

Tree Seal is a registered trademarked product for sealing tree wounds, grafting, etc.

Vaseline is a brand of petroleum jelly.

Wilt-Pruf is a registered trademarked anti-transpirant.

FUNGI or WATER MOLDS referred to in the text:

Anthracnose blight is caused by the fungal pathogen *Apiognomonia veneta* (syn: *Gloeosporium platani*) and attacks California sycamore (*Platanus racemosa*).

Armillaria mellea is a fungal pathogen known as oak root fungus.

Botryosphaeria ribis is a fungal pathogen causing branch die-back.

Damp-off is a term for fungal infections that kill seedlings.

Fusarium wilt is a fungal pathogen that clogs vascular vessels.

Phytophthora is a water mold pathogen causing root rot.

Puccinia triticina (syn: *Puccinia graminis* ssp. *tritici*) is wheat rust whose alternate host includes members of the genus *Berberis*.

Rhizoctonia is a fungal pathogen causing root rot, collar rot, damp-off, etc.

Seiridium cardinale (syn: *Coryneum cardinale*) is a fungal pathogen causing cypress canker on some members of the genus *Cupressus*.

Verticillium wilt is a fungal pathogen that blocks the xylem vascular tissues.

FUNGICIDES referred to in the text:

Captan is a chloroalkylthio fungicide.

Fermate is ferric dimethyldithiocarbamate, a fungicide, also known as ferbam.

Morton Soil Drench is methylmercury dicyano diamide, a fungicide.

Orthocide is a fungicide containing Captan.

Terraclor is pentachloronitrobenzene, a fungicide.

Thiourea is most likely ethylene bisdithiocarbamate, a fungicide.

HERBICIDES referred to in the text:

2,4-D is 2,4-Dichlorophenoxyacetic acid, an herbicide.

2,4,5-T is 2,4,5-Trichlorophenoxyacetic acid, an herbicide.

Agent Orange is the mixture of 50% 2,4-D and 50% 2,4,5-T, and is an herbicide.

Aminotriazole is 3-Amino-1,2,4-triazole, 3-AT, amitrole, or amitrol, an herbicide.

Simazine is an herbicide in the triazine class.

INSECTICIDES referred to in the text:

Chlordane is an organochlorine compound used as a pesticide.

Cygon 267 is a systemic insecticide-miticide.

DDT is dichlorodiphenyltrichloroethane, a synthetic insecticide.

Isotox is an organochlorine insecticide, also known as lindane.

INSECTS referred to in the text:

Ceanothus stem gall moth (*Periploca ceanothiella*).

Lace bug (*Tingitidae* sp.).

Manzanita leaf-gall aphid (*Tamalia cowenii*).

Oak twig girdler (*Agrilus angelicus*).

on *Coreopsis* (*Agromyza seniventris* Fallen).

Vegetable weevil (*Listroderes cosbiroctris*).

Yucca moth (*Tegeticula maculata*), technically this is now a hesperoyucca moth.

Bart O'Brien, Director of Special Projects

Rancho Santa Ana Botanic Garden, March 2012

Editor's Introduction:

Percy Charles Everett was born in Sierra Madre in 1902 and died on August 5, 1973. He was recruited by RSABG Botanist Carl B. Wolf to work at the Rancho Santa Ana Botanic Garden. Everett was hired in 1934 as Corresponding Secretary and Keeper of the Herbarium. In 1939, Everett became the garden's second Superintendent (succeeding the garden's first Superintendent, Ernest R. Johnson), a position that he held until his retirement in 1967.

We are especially grateful to Kathleen (Percy Everett's daughter) and Bruce Chester for giving Everett's manuscript to John Dourley of Rancho Santa Ana Botanic Garden (Dourley was Everett's successor and was the garden's third Superintendent) on July 7, 1984.

This second "Summary" has been a long-standing project to reach completion. The unfinished manuscript was written by Percy C. Everett from some time in the late 1960s to sometime in the early 1970s. It is not known how many versions the manuscript went through, though there are two existing "originals" for the first section, covering *Abies* to *Anemone occidentalis*. There have been no attempts to standardize all of the text entries and headings, so some of these may come across to the reader as idiosyncratic, and that is indeed the case. Since the manuscript was unfinished, the editor has rewritten and/or rephrased portions of the text to clarify the information and to make portions of the admittedly uneven text more readable and understandable.

Rancho Santa Ana Botanic Garden's long-time research mycologist and editor of the garden's scientific journal, **Aliso**, Richard K. Benjamin, PhD, had told this writer that his first editing job at the garden had been Everett's first "Summary" publication. He conveyed that it had been his biggest editorial challenge due to the complexity of the data and formatting. This second "Summary" is considerably different from the first volume. This volume summarizes much of the data and edits out nearly all of the accession numbers for the plants, and many of the specific dates when seeds were sown and when plants were planted.

Nomenclature follows Munz & Keck (1959) and Munz (1968), but has been parenthetically updated as necessary to Baldwin et al. (2012) for the convenience of current readers.

This project would not have been completed without the ongoing support of Rancho Santa Ana Botanic Garden, and a grant from the Saratoga Horticultural Research Endowment (administered by the University of California, Davis) that brought the project across the finish line roughly 40 years after Everett had stopped working on it.

Bart C. O'Brien, Director of Special Projects

Rancho Santa Ana Botanic Garden, March 2012

Author's Introduction

Since the days of the earliest botanical and horticultural expeditions to the Pacific coast, the many facets of the California flora, such as its great diversity and the large number of endemic populations, have captured the interest of the botanist and horticulturist. During the past 75 years, and particularly since 1900, this ever-increasing interest has been most evident. Hundreds or perhaps thousands of articles and books on a wide variety of subjects pertaining to the California flora have been published. In one way or another, all of these studies, such as technical descriptions, propagation, culture, and the necessity for preservation, have provided a broad basis for the knowledge about these plants. Written by people from all walks of life, these studies, observations, and descriptions have appeared in a wide variety of publications on the local, national, and international level. The staffs of the several California botanic gardens which have been largely founded for the study, culture, and preservation of our native flora have greatly increased our knowledge about hundreds of interesting native plants.

Percy C. Everett, Superintendent Emeritus

Rancho Santa Ana Botanic Garden, 1970

Preface

A comprehensive work titled, "A Summary of the Culture of California Plants at the Rancho Santa Ana Botanic Garden, 1927-1950" by this writer, was published by the botanic garden in 1957. It covered the period during which the Garden was located on the original site in Rancho Santa Ana, Orange County, California, to the time of moving to its second home in Claremont, Los Angeles County, California, in 1950. The original "Summary" provided in some detail the history of our results in growing some 450 genera represented by over 1,500 species, subspecies, or varieties, plus many hundreds of hybrids and cultivars of the native plants of California. The wide use of the original "Summary" as a reference work, the constant and increasing number of requests for additional and up-to-date information, the mass of recorded data on the successes and failures in our new environment, and the retirement of the writer in 1967, all emphasized the need of adding another chapter to that which has already been published.

This second "Summary" covers the years from 1951 through about 1970, as well as pertinent information relating to our moving activities during 1950. While publishing costs do not permit the great amount of detail included in the first "Summary" we have attempted to consolidate as much information as possible describing our experiences in handling over 400 genera, representing some 1,300 species, subspecies, or varieties. In addition, the history of some 300 hybrids and cultivars that have been the result of natural and controlled crosses, and the selection of superior strains of species are all included. We trust that we have provided the information necessary to make this work a valuable addition to all that has been written relative to the successful propagation, growing, and conservation of our native flora. To this end, we dedicate this work.

Percy C. Everett, Superintendent Emeritus

Rancho Santa Ana Botanic Garden, 1970

History

The historical background of this institution is probably familiar to many of the users of this publication. However, the following remarks are addressed to the researchers who have no knowledge of our background. The Rancho Santa Ana Botanic Garden was founded by Susanna Bixby Bryant in 1927, primarily for research in the field of local botany and to preserve the native California flora, as well as bring together in a comparatively small area as many of the native plants that could reasonably be expected to be grown successfully in Southern California. Originally located on a 200-acre site centered within the boundaries of Rancho Santa Ana, an historic Spanish Land Grant, it was situated on a commanding promontory of the Chino Hills overlooking the Santa Ana River and southward to the Santa Ana Mountains in Orange County, California. In the immediate years following the death of Mrs. Bryant in 1946, the Board of Trustees, after considerable study, voted to move the Garden to a selected site in the City of Claremont, Los Angeles County, California. The former location of this Garden was in the center of a large commercial ranch operation. This remoteness from the mainstream of scientific and cultural activities, plus the exciting prospects of greatly strengthening and widening the scope of the Garden's purposes by its association with the academic community of the Associated Colleges of Claremont, brought about an affirmative decision by the Board of Trustees. The rapid expansion in many directions, the growth of the Garden in both its scientific and horticultural endeavors during this 16 year period has abundantly borne out the faith of all those who were responsible for making this momentous decision to move. This auspicious beginning serves as a measure for the future accomplishments of this institution.

The Site

The San Gabriel Mountain Range and its westward extension to the Coast Range almost bisect the County of Los Angeles in an east-west direction. Situated near the south-facing base of this lofty range, against the most easterly point of the County line, lays the city of Claremont, at an elevation of about 1,200 feet. Almost centered within the boundary of the city, the Rancho Santa Ana Botanic Garden occupies an 80-acre plot, directly north of the campuses of the Associated Colleges of Claremont, and about two blocks north of Highway 66. In this section of the city there is a large, flat area which rises to about 75 feet above the surrounding countryside, at an elevation of 1,350 feet. Locally, it is known as Indian Hill Mesa. The Garden occupies a small portion of the east side of the mesa, which is fringed with a scattered stand of beautiful old California coast live oaks (*Quercus agrifolia*). The remainder of the acreage, totaling some 60 acres, lies below the mesa to the east, north, and northwest. The entire acreage is relatively flat with a gentle slope from north to south. The old site with its many deep canyons, its wide variety of exposures and heavy clay soils was in sharp contrast to our present growing conditions.

About a million years ago the San Gabriel Mountains did not exist in anything like their present height and structure. They were a gently rolling lowland with an essentially clay soil structure. Later on, hard resistant rocks began rising through three distinct fault zones, and eventually emerged into the present lofty peaks, some of which rise over 10,000 feet in elevation, and which are divided by very steep-walled, precipitous canyons. In the processes of erosion, sand, rocks, and boulders were washed down over the surrounding country, covering most of the area, except for the hard, resistant caps left from previous geologic ages. One of the "caps" is Indian Hill Mesa. The name is derived from reports of the Tongva tribe's use of this site as a campsite.

The soils of the mesa is a very finely textured clay that is not sticky when wet, nor does it crack open when dry as does the more common clay around here (known as adobe). However, prolonged periods of rainfall or overhead irrigation tend to pack the soil to a degree that there is a gradual diminution of water absorption. Therefore, the soil needs quantities of mulching materials to keep it open and friable. Prior to our occupation of the site, it was used for growing cut flowers, grain, and in an earlier day a portion had been used for a small golf course. On the whole, our plants have grown very well in this clay soil, but proper conditions must be maintained at all times. About thirty inches below the surface begins an almost impenetrable hardpan of considerable depth. A strict control on irrigation is necessary to prevent root-rotting problems. The surrounding acreage below the mesa is a very quickly drained sandy, granitic loam, well laced with rocks from the smallest to boulder size, and which were spewed originally over the plane from the deep, sharply drained canyons to the north. Generally, this type of soil is highly recommended for the best culture of our native plants. While the bulk of our plantings are being grown in this type of soil, there are many species that grow better in the clay soil of the mesa. At the time of the acquisition of the site, this portion of the acreage was covered almost solidly with sage brush (*Artemisia californica*), white sage (*Salvia apiana*), black sage (*Salvia mellifera*), and scattered clumps and individual specimens of California toyon (*Heteromeles arbutifolia*), laurel sumac (*Malosma laurina*), lemonade-berry (*Rhus integrifolia*), and California coffee-berry (*Rhamnus californica*). On the east slopes of the mesa was a scattering of the aforementioned plus *Eriodictyon trichocalyx* and poison oak (*Toxicodendron diversilobum*) as well as the magnificent stand of California coast live oaks (*Quercus agrifolia*). The gentle north slope of the mesa was covered with some of the salvias in the sunnier portions plus grasses and quantities of Johnny-jump-ups (*Viola pedunculata*) under the scattered coast live oaks. The violas gradually disappeared as their natural environment was changed by the introduction of irrigation and other types of plantings.

The Climate

The climate in the Pomona Valley falls under the general classification of an interior climate, the major influences on it being exerted by the continental air masses from the north, northeast, and east. The Pacific Ocean to our west and southwest has comparatively little effect on our average climate, determining its character not more than 15 to 25% of the time. Favorably situated on the south-facing slopes of the hills bordering the San Gabriel Mountains, we are rated as being in a thermal belt. Before the encroachment of urbanization, thousands of acres of citrus crops were raised. In the more protected and warmer locations, limited acreages of other crops, such as avocados, are raised. Presently these same crops, primarily lemons, are still being raised on a much reduced scale. This section is ideal for camellias and many other relatively hardy garden plants, besides supporting a large number of what may be termed semi-hardy or semi-tropical plant material.

The first daily Garden weather records were started in December 1929, at the old site. Until interrupted by our move in 1950, the day to day temperatures were recorded by clock activated thermographs, and the yearly rainfall records and other pertinent weather data were noted. After our move to Claremont, we resumed this activity in 1953, and have since recorded similar weather information here. In 1960, we added a hydrothermograph to correlate the percentage relative humidity with the temperature.

Two temperature stations, one relative humidity station, and one rain gauge are in operation. The hydrothermograph and rain gauge are located in the center of our portion of Indian Hill Mesa. A thermograph is located in the plant community section to the north. This station may be moved from time to time, but usually not more than once every five years. During the coldest months, the U.S. Weather Bureau Fruit Frost Service maintains a maximum-minimum temperature station in the plant community area.

In the Claremont-Pomona area, over a ten-year period the winter low temperatures have ranged from 27° F to 23° F, and the all-time lows from 23° F to 17° F. However, in the 15-year period of this report, there have not been more than a half-dozen times when the winter minimum temperatures have fallen below 25° F in the garden, and then only for a night or two. Minimum winter temperatures on the average range in the 32° F to 40° F bracket. The maximum winter temperatures will average in the 60° F to 75° F range with days both below and above the average. Average minimum summer temperatures fluctuate between 40° F and 60° F, and the maximums range from 70° F to 85° F. Throughout the year, temperatures over 90° F will be recorded on an average of 30 to 45 days, including a few over 100° F. The hottest recorded temperature in this period was 110° F on one day in the garden.

The periods of lowest humidity occur during the fall months with some interspersed in the winter months. This condition is caused by a very hot and sometimes quite cold, dry wind locally known as "Santa Anas." Triggered by the build-up of a high pressure system over the land area to the northeast and low pressure to the southwest over the ocean, the "Santa Anas" flow down, often at great velocity, over the dry, hot deserts and across Southern California. The sections below the several main passes through the mountains usually bear the brunt of these windstorms. Locally, the moisture content of the air may be as low as five to seven percent. It is our period of greatest fire hazard in the hills and mountains. Fortunately for us in Claremont, the lofty peaks to the north guard our immediate area from all but occasional "Santa Anas," which mostly flow by to our east and west. However, we feel the full effects of the high electrical content and extreme dryness of the air.

Summer relative humidity averages between 40 and 55% with short periods of lower or higher humidity. It is of interest to note here that while we have recorded the relative humidity in the garden for a comparatively short time, there has been a gradual increase in the percentage of humidity along with increased urbanization.

Starting in the late spring and continuing through the summer months, usually through September, a moderate to strong southwesterly wind blows nearly every day. Since the wind flows over a considerable distance of heated land, there is quite a drying effect on the plants. Moisture losses must be compensated by some additional irrigation.

In 1950, we were informed by the U.S. Weather Bureau in Pomona that the average rainfall up to that date for the Claremont-Pomona area was about 18 inches. Fifteen years later, our records show a drop in rainfall to 17.29 inches. During this period, there were two years with less than ten inches (registering 6.55 and 7.28 inches) and for three years the precipitation totaled a little over 20 inches (the greatest being 35 inches). During the remaining years, the rainfall fluctuated between 12 and 18 inches. Following the rainy season, which is usually between November and March, long periods of dry weather, sometimes as much as six to nine months in duration may ensue. The most appreciated rains are those that come in April and May. Regular irrigations can then be delayed until July, as June is usually a cool month.

Smog is now a part of our daily thinking about the climate. We do not need to elaborate about this condition, since our area has been pretty well publicized about its smog. The Pomona Valley is surrounded by high mountains to the north and east and hills to the south and west. Lying directly in the path of the air currents from the west, we receive not only our own pollution, but that of Los Angeles to the west. The smog condition is most severe when there is moist air flowing inland from the coast, and at the same time there is a warm blanket of air above called a temperature inversion. The effect of smog on our plantings has not been disastrous at the date of this report, but it has been deleterious to the health of many species. Undoubtedly as time goes on, there will be an accumulative effect which could be disastrous. While we have made no detailed study on the long-term results, we have collected some data which will be noted under the discussion of the plant species itself.

The Garden

In late 1949, we began the removal of a large portion of the irrigation systems at the old site. It then consisted of some 30 miles of various sized galvanized pipe, including large quantities of one- and two-inch diameter pipes, plus many hundreds of various length sprinkler stands, and hydrants.

Since the growth of trees and shrubs require the most time, their propagation was increased to the full capacity of the nursery at the old site. Some 10,000 plants were ready for planting out by the time we were prepared to start planting operations at the new site in March 1951.

Surveying the boundaries, the initial project at Claremont, was started in July 1950. Upon the completion of this job, the entire acreage was laid out in a 100 foot square grid pattern. At the corners of each grid, a two-inch numbered galvanized pipe was driven into the ground. The irrigation lines were engineered to this grid system as were all landscaping plans, trails, road, and the recording of the locations of all the future plantings. As soon as the boundaries were established, two miles of six-foot high chain-link fence and all necessary gates were installed.

Upon the pattern of the grid system, 11 miles of irrigation lines, consisting of four-inch welded steel pipe, one- and two-inch galvanized steel pipe reclaimed from the old site were put underground and installed in all sections of the Garden. A hydrant (hose bib) was placed at each corner of every 100-foot grid over the entire Garden. After a year of experience, a large reservoir adjacent to the property and a pressure system were added. The irrigation system has given us an adequate and efficient supply of water at all times. Our water is delivered to us by the local public utility company, and for the first few years was exclusively pumped from wells nearby. As the population of the surrounding areas increased, additional water brought from the Colorado River has been mixed with the local supply, particularly during the summer months. While the salt content is rather high, our plantings have not suffered unduly during this 16 year period. However, as time goes on, there may be a build-up of salts in the soils which may prove to be unsatisfactory. This water should be treated for nursery propagation, but for the period of this report the necessary equipment had not been installed.

In consultation with the staff of the garden, the landscaping plans were laid out by the former landscape architectural firm of Hahn and Hoffman of Sierra Madre, California. In general, besides the locations of all the roads, trails, buildings and service areas, the plans called for the establishment of 21 plant communities in the 50-acre plot to the north and west of the mesa, and miscellaneous kinds of plantings on the mesa and adjacent areas. In addition, plans were made

for special gardens for distinctive types of flora in concentrated areas. A two-acre plot on the mesa was set aside for experimental work of all types, such as the testing of selected plant-types, species and hybrids, controlled hybridizations, and any other project under study by the staff and others. This area is fenced and visitors are generally not allowed in this section.

The plantings, other than in the plant communities, are mixed with a large variety of the best trees and shrubs. Among these are large plots of annuals, perennials, and a wide variety of bulbous species. Two large pools, 700 feet apart were constructed and connected by a meandering stream for the growth and display of moisture and water-loving plants. Vernal pools were later added in an attempt to produce this specialized kind of flora. Other sections are given over to the natural display of slope and groundcovers.

The special gardens consist of a desert garden, desert sand dunes, coastal sand dunes, rock garden, and a home demonstration garden. The latter garden was developed in 1961, and is a show place for many kinds of native plants useful in the home garden.

The principle of the California plant communities was first proposed in 1949 by Philip A. Munz and David D. Keck. Essentially, a plant community is a group of plants that live naturally under similar conditions, particularly as to climate; or it is "an aggregation of living organisms having mutual relationships among themselves and to their environment." Originally, Munz and Keck proposed 29 plant communities. Our studies indicated we could reasonably expect to establish 21 of these on a large scale, and perhaps in time develop miniature groups which appeared to be the most difficult as far as ecological factors are concerned. The latter are the highest altitudinal zones, coastal salt marshes, desert alkaline flats, etc. Presently, we have established quite successfully the following plant communities: coastal sage scrub (essentially, this is the original native plant material growing here), north coastal scrub, creosote bush scrub, shadscale scrub, sagebrush scrub, yellow pine forest (presently includes some species from higher elevation communities), Douglas-fir forest, mixed evergreen forest, north coastal coniferous forest, redwood forest, closed-cone pine forest, northern juniper woodland, northern oak woodland, southern oak woodland, foothill woodland, pinyon-juniper woodland, Joshua tree woodland, and chaparral. The chaparral plant community is divided into northern, central, southern, and island chaparral belts.

In the Director's Annual Report [*Aliso* 6 (2): 83-100. 1965.], he stated that the garden's live plantings were represented by 112 plant families, 407 genera, and 1,345 species, subspecies, or varieties. In addition, some 200 to 300 cultivars and hybrids were being cultivated. Many species, which we had failed to establish successfully, had also been raised. During these years of rapid growth, an average of about 12,000 plants per year had been added to all sections of the Garden. The largest numbers of plants that were added in any one year totaled 22,000 in 1962, and seldom were less than 10,000 per year.

However, not all of this was accomplished without encountering several problems. Some of them were quickly overcome, and others have been much more difficult, requiring the expenditure of a considerable amount of time, energy, and money. The most immediate and serious problem was the control of the large population of the two species of rabbits which inhabited the brush areas by the thousands. Complete control has never been accomplished, although the numbers at one time were reduced to only a few animals. The invaluable aid and advice of the County of Los Angeles Weed and Rodent Control Department provided us with the several avenues of attack on this very serious problem. The first and most immediate action was to make our chain-link fence

that surrounded the garden as rabbit proof as possible. This was accomplished by attaching an 18-inch wide, one-inch mesh of poultry netting to the bottom portion of the two-mile chain-link fence surrounding the entire garden. Twelve inches of this netting was attached above ground, and six inches were bent outward, covered with dirt, and held down by heavy rocks. Soon after installation, we discovered the smaller brush rabbits (cottontails) were crawling over the top of the 12 inch portion above ground. It became mandatory to attach an additional two-miles of netting above the first twelve inches. However, we still had a monumental task in controlling the rabbit population already inside the fence. We used every conceivable means from trapping, shooting, and poisoning, to early morning drives, when all the gardeners would line up across a designated area and slowly move them toward an open gate or corner. During the first three years, well over 3,500 rabbits by actual count were eliminated by one means or another. However, the problem has been a constant one, and several other means have been employed to protect the young plants. The principal method has been to surround each new plant with a wire cage made from the one-inch mesh, 18-inch wide poultry netting. Each cage is supported by a one-inch wide, 20-inch long pointed redwood stake. As the cages are of variable diameters, strips of poultry netting are cut to lengths to meet our needs and the ends stapled to the redwood stake. It is necessary to maintain several thousands of the cages; otherwise few plants would survive through the first year or two.

Rodents, such as gophers, field mice, and rats, while at times causing considerable damage, are more easily controlled, but we had to be ever watchful for their periodic invasions. A family of foxes became permanent residents and an occasional coyote would spend some time in the garden. Needless to say, we gave them every protection and encouragement to stay, as we had considerable evidence of their cooperation in our control efforts.

In recent years one of the most serious problems has been the great increase in the populations of quail and other seed-loving birds. It has become almost impossible to produce any sort of wild flower display by broadcasting the seeds into open ground, a procedure that has been followed for many years. To protect the small seedlings from being eaten, or destroyed by the hordes of birds, the plots are surrounded by poultry netting, or protected by other means. In recent years, many kinds of annuals have been raised in the nursery to planting size, but this is a prohibitive operation of any large scale. Studies carried on in cooperation with the California Department of Fish and Game have been undertaken but no satisfactory control has been found. Since the garden is a bird sanctuary, and every effort is made to protect them, this unhappy situation is one that appears, at least for the time being, to defy a suitable answer.

As one might expect, the problem of weed control, particularly after each area was cleared of the native brush, was one of continuing effort. Until the advent of satisfactory chemical controls, and we tried many formulas, hand hoeing and small machinery were the principle methods for eliminating the very serious weed problem. When larger areas came under cultivation, spraying with weed oil preparations was practiced. Later, with the advent of simazine, we mixed it with the weed oil and found this mixture very effective. This gave a control on both the pre-emergent period and the weeds that had already germinated. This weed control mixture is very effective but caution must be exercised in the continuous use of simazine. There appears to be a "build up" of the chemical in the soil, and should be discontinued for a year or so. We seldom used the weed control mixture more than once a year and usually prior to our expected rainy season.

The natural brush areas contained a considerable amount of poison oak (*Toxicodendron diversilobum*), and the control of this noxious plant was a continuous action for the first half-

dozen years. Two methods for its eradication were used: grubbing it out by men not susceptible to the rash, or by spraying, where possible, with a low volatile 2,4-D and 2,4,5-T combination. [Ed: This 50% to 50% combination of these two chemicals is "Agent Orange."] This latter method is the most effective weapon.

Initially, plant diseases and harmful insects were relatively minor problems. As the plantings increased, there was a gradual buildup of various diseases and harmful insect populations. This is to be expected in a relatively virgin area. The standard methods for control were inaugurated when necessary and have been increased yearly as more pests and diseases became established. While the problems that beset some of our plantings were most discouraging at times, we seldom failed to find an answer. Diseases and insects will be discussed under the individual plants involved.

One of the most discouraging problems that have arisen in recent years has been vandalism. Senseless destruction of both equipment and plants has been on the increase, and has assumed serious proportions. Not only does this factor greatly increase operational expenses, but it is somewhat demoralizing to all those closely involved in the development of the garden. It is to be hoped there will eventually be a solution to cope with the destructive attitudes of a relatively small portion of the visiting public.

Construction of the two- and three-story administration building was initiated in 1951, and was fully completed and occupied in January 1952. This building provides for the staff offices, laboratories, workrooms, library, and herbarium. A two-story wing, providing additional laboratories, herbarium space, study rooms for graduate students, and a 100 persons capacity assembly room, was added in 1958. During the first three years, all of the roads, trails, service areas, and a parking lot for 100 cars were constructed and paved with the exception of the paving of the roads in the plant community section. These paths were paved for the first time in 1965.

The Nursery

The site chosen for the nursery is located at the northeast base of the mesa, and is approximately one acre in size. Construction of the following facilities was started in the early fall of 1950: a 32-foot by 60-foot greenhouse, a 25-foot by 30-foot potting shed and storage area, a 40-foot by 50-foot aluminum lath house, a 25-foot by 100-foot service building, a five-room house for the nurseryman, and we transformed a small building constructed of rock to be a seed storage facility. Most of these facilities were fully operative six to eight months later.

The greenhouse, divided into two compartments running the length of the house, was placed in a north-south direction. The design and all-metal construction eliminated all intervening roof supports, thus permitting easy access to all the benches. Under the outer perimeter benches were six vented gas heaters and a like number of large fans for cooling and humidifying the interior. The roof vents were operated by hydraulically controlled valves. As some of the original design and equipment proved to be inadequate, the greenhouse was completely renovated in 1960. Over the entire glass roof was erected a one-inch galvanized pipe frame to support saran-cloth (providing 50% shade) two-feet above the glass. Sheets of expanded steel mesh replaced the redwood boards used on the steel frame benches, thus providing much better air circulation around all growing materials and nearly sterile bench conditions. The heating system was changed to under bench circulating hot water, and cooling was provided by a combination of the large, under bench fans plus the addition of two evaporative coolers.

The two long greenhouse compartments were divided into four rooms, one of which was equipped for rooting cuttings and other propagative materials. This equipment included a Binks humidifying system, and evaporative cooler and fans, bench heating cables, misting system, extra lighting plus all the necessary automatic controls for efficient operation. The other three rooms have their own, but simpler, sets of humidifying, heating and cooling systems, all under separate controls.

The potting shed, or head house, is located between the greenhouse and the lath house, and is separated from each by a truck-width road. Large sliding doors at each end provide easy access to either facility. The inside of the building is divided into two rooms, the one opposite the entrances to the greenhouse and the lath house being used for all preparatory growing activities. It is provided with a built-in desk placed between two large, metal-covered benches, and under bench storage areas. The other room has space for two large soil bins, a peat moss wetting in, and other nursery equipment storage.

The aluminum lath house is about 75% drip proof, and has proved to be a very satisfactory and economical investment. No maintenance has been required since its initial construction in 1951. The laths were placed to provide 50% shade, but can be easily changed for more or less shade. In 1959, an additional ten feet was added at the north end of this structure. In this additional space, deep growing bins constructed of redwood were added. The entire floor of the house is covered with several inches of chicken scratch size crushed granite, thus providing quick drainage and an easily maintained and clean surface for the placement of canned or potted plants.

The metal and wood service building, lying in an east-west direction, was divided into generous sized rooms for drying and cleaning seeds, tool storage, maintenance and storage areas, and a garage for automotive and other mechanical equipment.

The seed storage building was constructed with very thick rock walls several years prior to our development. We added fireproof shingles to the roof, thick insulating boards to the ceiling, and installed a thick, insulated door covered with metal. Sufficient shelving to store several hundred two-quart, wide-mouthed Mason jars, and many insect proof cans of various sizes was built against each wall, allowing for working space in the center of the room. The room temperature in the winter maintains an average of 50° F to 60° F, while during the summer months it increases to the 70° F range. The latter temperature is a bit higher than we had planned for, but it is not excessive. On the whole, this facility has proved to be very efficient.

In a small unused space in a workroom located in the administration building, a walk-in seed cold-stratification and holding room was constructed. Heavily insulated on all sides and with narrow open shelving on each side of the room, hundreds of lots of seeds sown in flats or stored in jars, plus other kinds of live materials, can be stored for any period desired at temperatures which are controlled to fluctuate between 35° F and 40° F. While somewhat inconveniently located away from the nursery, nevertheless all propagation materials can be transported without too much difficulty.

In 1960, a 35-foot by 60-foot screen house was added to our nursery facilities. Essentially, it is a standard all-metal greenhouse modified to our specifications. A standard, glass-covered roof was installed over which saran cloth (providing 50% shade) was attached to and supported by a frame of one-inch galvanized pipe that was two-feet above the glass. Covering all sides of the outside framework up to four-feet above the cement foundation, a fire and water proof material was used. Above this to the eaves of the house, a fine mesh, plastic window screening was substituted

for the usual standard glass. Entering the screen house only through a single door, one steps onto a five-foot wide concrete corridor running the entire length of the building. The remainder of the house is divided into six rooms measuring ten-feet wide and 30-feet long. Each room contains galvanized steel benches on each side and at one end. Separating each room from floor to bench height, the same fire and waterproof material was used as on the outside of the structure. Above that to the ceiling, the fine-meshed plastic screening was used. Each room is entered through a self-closing aluminum door off of the corridor. The floors are covered with medium sized crushed granite, and water is piped into each room. Heating and cooling equipment was not installed. The air temperature inside the house closely approximated those on the outside, thereby providing for a more natural growing condition. But at the same time, those uncontrollable portions of the weather, such as wind and rain, are either completely controlled, or are reduced to such a degree that little harm is done. This house has been a great asset, since one can run closely controlled studies in it.

Percy C. Everett, Superintendent Emeritus
Rancho Santa Ana Botanic Garden, 1970

PLANTS listed alphabetically by genus (*Abies* to *Zigadenus*)

***Abies* Mill.**

Fir.

Pinaceae. Pine Family.

Trees (evergreen).

The successful culture of the several species of this genus in this locality needs optimum growing conditions. The generally raw state of this new site precluded extensive early plantings until we had a better understanding of the soils, the climate, and the necessary cultural requirements of each species. Some early plantings were made, but the results were so poor that further propagation was stopped until more favorable sites could be provided. Our experience indicates there is no serious problem with seed germination, provided the seed is fresh. Cold-stratification of the seeds prior to sowing is helpful but unnecessary. If used, the seed should not be cold-stratified for longer than one month. It should be sown in a deep flat or seed bed where the slow-growing seedlings can develop into strong specimens before planting. The seedlings can be transplanted to their permanent site or established in containers before planting. Greater attention to soil preparation and provision of other optimum conditions will be necessary to successfully cultivate these difficult species.

***Abies bracteata* (D. Don) Poiteau.**

Santa Lucia Fir.

Propagation: Two seed collections were sown; one of doubtful viability failed to germinate. The second collection was divided into two lots. Lot 1: X/26/56, one-quarter ounce, SMA, first germination XI/24/56, maximum germination I/15/57, 34 plants. There were no losses of seedlings during the transplanting processes until, during a period of unseasonably hot weather, 20 plants in gallon-cans were killed by fumes from soil sulphur that had been added to one lot of PMA. Another lot without the soil sulphur survived. Lot 2: X/26/56, one-eighth ounce, 100% sphagnum, cold-stratified for 45 days. Only five plants were raised. All seedlings were grown in gallon-cans for two years, but they had made little growth before planting.

Culture: Two collections, the first of eight plants, six to 26 inches tall, and the second with five plants, 11 to 13 inches tall, were dug, put in five-gallon-cans and moved to the Claremont site in March 1951. Within two weeks, both collections were planted in their new location, an open flat with well-drained rocky, decomposed granite loam. As there was no shade, burlap was used to provide some protection during the first years. The two plants that survived are now 23-years-old, three to six-and-a-half feet tall and spreads from three to four feet wide, and in fair condition. Fertilization and soil treatment experiments are being carried on in an attempt to provide a more suitable habitat for these rare trees. Nine plants were raised from the above seed collections and planted on the mesa in a clay-loam soil in the shade of maple trees. None lived more than three years, principally because the heavy leaf-drop during the winter months smothered the small plants. It is our opinion that complete shade is not necessary to establish this species in our locality.

***Abies concolor* (Gordon & Glend.) Lindl. ex Hildebr.**

White Fir.

Propagation: Four seed collections were processed between 1951 and 1954. Within one month after harvesting, seeds were sown untreated in September, October and November in SMA. Germination began after 14 to 50 days with maximum germination within two months. From four ounces of seed we obtained about 600 seedlings. At the proper time, these were transferred to four-inch pots with PMA and later shifted to gallon-cans. No matter how carefully the seedlings were treated, our losses were high during the interim periods. During a period of unseasonably hot weather, 45 plants in gallon-cans were killed by fumes from a small amount of soil sulphur that had been added to acidify the potting mix. Other lots lacking the sulphur were not affected. Additional seed lots were sown within three years of the original date of all the collections. Germination occurred in only one lot, and this was excellent even after the seed had been stored for three years. The growth of the seedlings in the gallon-cans was extremely slow.

Culture: A total of 159 plants were set out from gallon-cans and only two have survived. The plants were placed in a variety of locations, such as in sun, semishade and shade, and in rocky, well-drained decomposed granite loam and clay soils. The majority were dead within two to three years. However, two have lived in a tight clay soil in the shade of maple trees. Although sprawling, the plants are now 14-years-old, about three feet tall by four feet spread and in good condition.

***Abies grandis* (Douglas ex D. Don) Lindl.**

Grand Fir.

Propagation: I/13/60, one-half ounce, SMA, osb., first germination IV/10/60, maximum germination V/26/60, 92 plants. Cold-stratification for one month probably would have hastened germination. The seedlings were grown in the deep seed bed and developed roots up to 13 inches long and tops four to six inches tall. Roots were clipped before transplantation to gallon-cans on II/6/61, PMA, where the seedlings became well-established prior to being set out in permanent locations.

Culture: A total of 84 plants were used in three different areas. XI/22/61, 35, six to 12 inches tall, planted in full sun, rocky, decomposed granite loam with a thick mulch. V/19/66, 33 alive, 18 inches to six-and-a-half feet tall and spreads of two-and-a-half to seven-and-a-half feet wide, good condition. The hot summer sun does not seem to affect growth or appearance. A second group of 20 was planted in semishade and shade with a similar type of soil. Growth has not approached that of the first lot, due chiefly to competition from large, previously established trees, but survival has been good. A third lot of 28 were used in sun and semishade, and tight clay soil. None of these lived. Note 1: A small tree nearly six feet tall and eight feet wide was presented to the garden. It was balled and planted in a semishaded location in well-drained soil. After five years of excellent growth, the tree was killed by oak root fungus (*Armillaria mellea*), indicating that the species is susceptible to this deadly fungus. Note 2: The success of this species in this locality indicates that it can be successfully grown here.

***Abies magnifica* A. Murray bis.**

California Red Fir.

Propagation: One collection of seed was processed and divided into two lots. Lot 1: IX/4/57, three-eighths ounce, SMA, cold-stratification until XII/17/57; first germination XII/26/57,

maximum germination I/28/58, 65 plants. Fifty-seven were shifted to four-inch pots, and later 53 to gallon-cans, using two soil mixes as follows: 42 cans with one-quarter loam, one-quarter perlite, one-half fir bark plus peat moss; 11 cans with one-quarter loam, one-quarter perlite, one-half fir bark with 5% Blue Whale. No appreciable response for either type of soil mix was noted. Lot 2: No sowing date, one-half ounce of seeds were sown untreated, SMA; first germination XII/15/58, maximum germination II/16/59, 34 plants. Losses were minor during the potting periods, and finally, 26 were put in two-gallon-cans on XII/23/59.

Culture: The plants of both lots did not attain heights of over four inches in the nursery even though they were grown there for over two years. All plantings, either in sun, semishade or shade, clay or rocky, decomposed granite loam, died within two to four years.

***Abronia* Juss.**

Sand-Verbena.

Nyctaginaceae. Four O'Clock Family.

Annuals and Perennials.

Several collections of seed from the wild and from cultivated plants have been grown here for each of the following species: *Abronia latifolia* Eschsch., *A. maritima* Nutt. ex S. Watson, *A. pogonantha* Heimerl, *A. turbinata* Torr. ex S. Watson, *A. umbellata* Lam., *A. umbellata* ssp. *alba* (Eastw.) Munz, *A. umbellata* ssp. *platyphylla* (Standl.) Munz, *A. villosa* S. Watson, and *A. villosa* var. *aurita* (Abrams) Jeps. [Ed: *A. umbellata* ssp. *alba* and *A. u.* ssp. *platyphylla* are not recognized in TJM2.] Our results followed the pattern as recorded in my first report (Everett, 1957. Pgs: 10-12). All of our seed was sown directly into the areas in which the species was to grow. The coastal species were sown in the coastal dune garden and the desert species were scattered through the desert dunes and desert garden. The seeds of several lots were examined and a high percentage were empty, thus providing evidence for such poor results. Germination was sporadic, occurring over a period of several months, the quickest being about one month. The coastal species (*A. latifolia*, *A. maritima*, *A. umbellata* and vars. *alba* and *platyphylla*) were less successfully grown than at the former site, except for *A. umbellata* ssp. *platyphylla*. This variety was brought from the former location as well as new wild collections and established here after 1954. It did very well for at least six years, and since then has been occasionally observed from year to year. All the other entities have not lasted more than two to three years. Some died from too much heat and others from frosts, but not less than 28° F temperatures. *Abronia villosa* and var. *aurita*, after once started in the desert dune and desert garden areas, have spread through these sections, producing fine displays each season from May to early fall. The flowering season is later here as well as in near coastal areas. All kinds of sand-verbena appear to prefer sandy top soils for best results. The coastal species also need warmer winter and cooler summer temperatures.

***Abutilon palmeri* A. Gray.**

Indian-Mallow.

Malvaceae. Mallow Family.

Shrubby Perennial.

Propagation: Two original collections of seed came from plants cultivated in the gardens of persons who had gathered the seed in the wild. Using our standard procedures, the results indicated a low percentage of viable seed, which is often the case in the Mallow Family. However, our nursery history was good, the losses being minor while shifting through three-inch to five-inch pots to growing in gallon-cans. Germination took three and 17 days with maximum germination in 20 to 25 days. One lot flowered within a year in the nursery. Three collections of seed were harvested from our cultivated plants. We tested them for better germination by using the hot water treatment for a period of 17 hours plus cold-stratification for intermittent periods of one to three months. Of the several lots we tested, one collection had a higher percentage of viable seed and has consistently had good germination, both with soaking in hot water and cold-stratification. The last lot was sown in 1966 and the eight-year-old seed germinated within four days, producing over 150 seedlings from a trace sown without any previous treatment. However, the seedlings seemed weak and most of them died in the nursery. Soaking the seed in water appears to help in germination; but fresh, good quality seed is best. Results seemed consistent when sown in August, September, October, or May.

Culture: We did not realize how frost-tender this species is until after raising the plants for one year in the garden. They were used in two locations in the desert garden, which was quite open at that time (1954 and 1955). We also used some in our plant community section in full sun. The first winter season told us this plant would stand temperatures a little under 32° F. Some were killed outright, others sprouted from near the root crown the following spring. None of the plants lived for more than five years, but they did grow well during the warmer summer months, producing flowers and seeds in quantity to permit more extensive plantings later on. They are now under high shade, and while some frost damage is noted, the plants in the most protected positions live on through the year. The flowering period here lasts for several months, in fact almost all year. While the plant is not greatly attractive, the deep orange flowers are handsome.

***Acacia greggii* A. Gray.** [Ed: *Senegalia greggii* (A. Gray) Britton & Rose. TJM2]

Catclaw.

Fabaceae. Pea Family.

Shrub.

Propagation: Five collections of seeds were raised between 1951 and 1958. The first four received the hot water treatment. The seed was soaked for 24 hours prior to sowing directly into gallon-cans with PMA, or loam and perlite. The resulting germination was poor, due to the seed rotting. To prevent rotting, the seeds of the last collection were dusted with Terraclor before sowing two or three seeds in each gallon-can. The resulting 90% germination indicated that Terraclor was beneficial. All collections were sown in July, August, September, and October, and germination occurred in five to seven days with maximum germination within ten to 15 days. The seedlings quickly produced very long roots, and for this reason we sowed the seed in gallon-cans. A better solution would be taller containers such as the square tar paper pots often used.

Culture: Our supply of plants was used in an open, sunny flat where the soil is a well-drained, rocky decomposed granite loam. The results have been successful, although initial losses from a variety of causes was about 50%. The last planting made in 1958 in better soil has not suffered any losses to date, and the plants are growing vigorously. These have attained heights of five to

ten feet and have spread from five to ten feet wide; they have produced seed for the past six years and appear in all ways to be growing normally. Our plantings receive not more than three irrigations per season, but the species will accept considerably more water without any danger. It will also grow extremely well in heavier, less well-drained soils (Everett, 1957. Pg: 12).

***Acalypha californica* Benth.**

California Copperleaf.

Euphorbiaceae. Spurge Family.

Shrub (evergreen).

Propagation: Seed and rooted cuttings from our original material grown at the former site have provided us with all the necessary plants for the present garden. The seed, sown in SMA and variations thereof, invariably germination within six to eight days, reaching maximum germination in two to three weeks. It was sown in several different months, but that sown in August and September had the highest percentage germination, volunteer seedlings, etc. One lot of cuttings taken on May 5th was soaked for 24 hours in a 1:20,000 solution of IBA. Rooting started 26 days later and 98% rooted. Tip cuttings with a semihard base were taken on July 25th and stuck in 100% perlite. On August 8th they were removed, treated with Rootone and inserted in one-quarter peat moss, three-quarters perlite, then put under intermittent mist in a cold frame with 99% rooting in seven days. Tip cuttings taken on August 6th, 1962, from plants growing in cans in the lath house were not treated, inserted in CMA, and put in the cutting room with intermittent mist. The rooting started in 18 days with 100% success until all were killed by a sudden change in temperature to 23° F. The only problem encountered in raising the young plants was during the germination period when damp-off fungus often caused damage. Otherwise, the seedlings were raised easily through the nursery.

Culture: Our previous experiences indicated that this species will not tolerate temperatures below 27° F unless the plants are somewhat sheltered. It was not always possible to protect earlier plantings here; therefore many of our plants were killed by frosts. Those plants that were protected have survived and attained good size, and a number are 15-years-old. Flowering and seeding begin the second year or, often, during the first season. The species has spread itself around into various parts of the garden through the ease with which the fallen seed germinates in a wide variety of habitats. This plant is most colorful when growing under the more natural stresses of dryness and less rich soils (Everett, 1957. Pg: 12).

***Acamptopappus sphaerocephalus* (Harv. & A. Gray) A. Gray var. *hirtellus* S.F. Blake.**

Goldenhead.

Asteraceae. Sunflower Family.

Shrub.

Propagation: One collection harvested in the wild in May 1952, was sown in September 1953. Germination began in eight days and only four seedlings were produced. Until December 1956, additional lots were sown but failed. Two lots of seed harvested from our cultivated plants were sown a year apart in a variation of SMA, and produced only three plants. A very small percentage of the seed produced is viable.

Culture: Eight plants were raised and used in the garden. At this date, two are alive and in fair condition. The oldest is 13 years and is 13 inches tall by 30 inches spread. Flowering began the second year, producing small amounts of seed each year, usually of very poor quality.

***Acanthomintha ilicifolia* (A. Gray) A. Gray.**

Thornmint.

Lamiaceae. Mint Family.

Annual.

Culture: One seed collection was sown on 1/12/55 in our rock garden. Within 15 days, there was abundant germination and flowering began in April. The seed was left to naturalize in the area, but after three years the species had disappeared.

***Acer circinatum* Pursh.**

Vine Maple.

Aceraceae. Maple Family. [Ed: Sapindaceae. Soapberry Family. TJM2]

Shrub.

Propagation: Fresh seed and two or more months of cold-stratification are necessary for proper results. We tested our several collections with and without cold-stratification, and while we germinated seed in only one lot without cold treatment, the best results came with two to 12 months of intermittent cold-stratification. As the seedlings transplant easily, it seems best to cold-stratify the seed at least four months and then sow it thickly in a deep flat or bed where the young plants can develop into hardy specimens before setting out.

Culture: Two collections of three and one plants, respectively, were moved from the former site and replanted here in two locations. One collection of two plants was located on the mesa in tight clay-loam soil near a stream and with shade from large trees. These plants are alive, in good condition, have produced a little infertile seed for the past 12 years, and are four to nine feet tall by eight feet wide. They are now 26-years-old. No special treatment is used except that being near a stream, they get a sufficient supply of moisture. The second collection of one plant was planted in an open area with considerable sun but in well-drained, rocky, decomposed granite loam. This plant grew well for several years, attaining a size of six feet by five feet before dying after a severe heat spell. The seedlings raised here have not fared well. Three have survived out of 12 planted in a well-drained, semishaded location. They are 12-years-old and measure two to seven feet tall and have spreads from two to four feet wide. Another lot, planted in and beside an intermittent stream, tight clay, shade and semishade, have had too much competition from other more vigorous shrubs and trees. Survival and growth have been poor during the past 12 years (Everett, 1957. Pg: 13).

***Acer glabrum* var. *torreyi* (Greene) Smiley.** [Ed: the var. is not recognized in TJM2.]

Mountain Maple.

Shrub (deciduous).

Propagation: Six collections were processed between 1951 and 1966. Two collections failed to germinate and four were poor to fair. Two lots that received no treatment failed to germinate,

while others in the same collection that were cold-stratified produced a few seedlings. The cold-stratified seeds were placed either in jars with wet sand or in flats with standard mix. The best results were obtained from one ounce of two-year-old seed first put in a glass jar with 100% sphagnum. After one year, 15 seedlings were sprouted in the jar. Upon removal and potting, the remaining seed was sown in a flat of SMA. Intermittent periods of cold-stratification for another five months produced 11 more plants.

Culture: Fifty-five seedlings grown in one and two gallon containers for more than a year in the nursery were planted mostly in semishaded locations with well-drained rocky soil. However, the hot summers were not to their liking and only one plant, now 12-years-old, measures five feet tall and five feet wide, remains alive and in good condition. Producing the seedlings in deep flats or beds and allowing them to attain greater size before planting would seem a more successful method for growing this difficult plant. Note: One seed collection of the **var. *diffusum* (Greene) Smiley** was sown and cold-stratified but failed to germinate.

***Acer macrophyllum* Pursh.**

Bigleaf Maple.

Tree.

Propagation: Cold-stratification for two to three months is the recommended method for seed germination. However, only one lot of our nine seed collections from various parts of California was started in this manner. We grew all the plants we desired by sowing the seed in flats, usually in SMA. Different kinds of seeding media seemed to make little difference. After two to three months, germination starts and may occur over a period of a year. The hot water treatment on one lot was ineffective. Another lot receiving cold-stratification produced good results, but it was no better than other non-treated lots. Quantities of volunteer seedlings appear wherever planted. If possible, the production of seedlings in deep flats or beds is a better method for growing superior specimens. The dormant seedlings can be easily transplanted bare-root to containers, field rows, or permanent sites.

Culture: Four plants, four to six feet tall, of one collection and one plant 22 inches tall of another collection were raised at the former site and were balled and moved in March 1951. They were planted here in April 1951 and all are now alive except one plant that failed to survive transplanting. They were set out in well-drained rocky loam in full sun, and are 20- and 23-years-old respectively, having grown in that time to 15 feet by 20 feet and 23 feet by 35 feet. Bountiful crops of seed have been produced for the last 12 years. Numerous plants from nine collections have been used throughout the garden. Plants one to two feet tall when set out are now 15 to 25 feet tall with equal or greater spreads. Two handsome specimens, the largest in the garden, are 16-years-old, 40 feet tall, spreading 40 to 50 feet, with trunks 15 inches in diameter. Growth rates are largely controlled by the type of care provided. Seed production usually begins within five years. Relative to disease problems, we have had a few trees attacked by the *Fusarium* wilt, but this has not been extensive. Our chief concern is knowing the species is not resistant to oak root fungus (*Armillaria mellea*), and this probably holds true for all the other species of this genus. Several fine specimens in an area impregnated with the disease have succumbed.

***Acer negundo* L. ssp. *californica* (Torr. & A. Gray.) Wesmael.** [Ed: the ssp. is not recognized in TJM2]

California Box Elder.

Propagation: The same nursery procedures are applicable here as for *Acer macrophyllum*. We processed four seed collections, three of which did not receive cold-stratification. They were sown during October and December; germination began within 17 to 28 days, and while we got enough plants, the percentage was poor. The last collection was sown in one-third sand, one-third peat moss, one-third perlite, and was cold-stratified for 47 days. Germination started nine days after removal from the refrigerator. The seedlings were grown in containers, shifting up to two-gallon sizes, where they attained sizes of three to five feet in a few months.

Culture: This is an extremely hardy tree and no troubles were encountered in any area we selected. Trees eight- to 15-years-old have grown from three to seven feet when planted to as much as 35 feet tall. Some specimens produced flowers and seed from the third year after planting, others as much as five or six years later. Such bounteous seed crops have been produced that thousands of seedlings spring up each year, necessitating a considerable amount of labor in their removal. The only disease problem has been the well-known blight which attacks this tree throughout the country (Everett, 1957. Pgs: 13-14).

***Achillea borealis* L. ssp. *arenicola* (Heller) Keck.** [Ed: the ssp. is not recognized in TJM2]

Yarrow.

Asteraceae. Sunflower Family.

Perennial.

Propagation: There are no problems in growing this entity. Seed germinates readily without any treatment, or it may be increased by divisions.

Culture: We have never recollected this plant as we had much material at the former site to bring over here. Six clumps were moved and planted in a moist location in clay-loam soil. Seeds have spread to many parts of the garden, and volunteer plants appear in many locations. At times the plant may almost become a pest, but it is easily controlled.

***Achlys triphylla* (Sm.) DC.**

Vanilla-Leaf.

Berberidaceae. Barberry Family.

Perennial.

Propagation: We have had no experience with this species other than by digging creeping rootstocks and putting them in flats until growth was renewed.

Culture: Our two plants were planted in clay-loam soil in a shady, moist location with mulch. They made no growth but were kept alive for two years.

***Aconitum columbianum* Nutt.**

Western Monkshood.

Ranunculaceae. Buttercup Family.

Perennial.

Propagation: Only one collection of seed was processed and germination was a failure. We used our regular SMA for one lot, later burning pine needles on the flat, and the second lot a year later was cold-stratified, but there was no germination.

***Actaea rubra* (Aiton) Willd. ssp. *arguta* (Nutt.) Hult.** [Ed: the ssp. is not recognized in TJM2]

Baneberry.

Ranunculaceae. Buttercup Family.

Perennial.

Propagation: Intermittent cold-stratification for periods of two to three months seems to be the method for germinating this seed. We had success by sowing the seed in December, in SMA, cold-stratifying for nearly two months, and returning to cold-stratification four months later for another period of four months. We attained maximum germination after 15 months. A third lot sown untreated in September and not given cold-stratification until two months later provided excellent germination after four months cold-stratification. A period of six to ten months seems to be required for initial germination. We were able to get well over 200 seedlings from about one-eighth ounce of seed. Later attempts with the same seed collection ended in failures.

Whether the seed was too old or not, we cannot say.

Culture: During 1965, we planted about 200 plants in conditions as similar to the natural habitat as we could provide. The first year there was good growth from most of the plants, with many flowering within a year. About 25 plants have survived, and one vigorous plant has produced a nice crop of seed. In the proper locale, this plant would make an interesting and colorful addition to a perennial garden.

***Adenostoma fasciculatum* Hook. & Arn.**

Chamise. Greasewood.

Shrub (evergreen).

Rosaceae. Rose Family.

Propagation: Hot water treatment, cold-stratification for varying periods of time, burning over seeded flat, soaking in sulphuric acid of varying concentrations, and no treatment have been tried with the five collections of seeds we sowed since our last report. The quickest initial germination occurred with soaking for 15 minutes in concentrated sulphuric acid, but one untreated lot provided the most seedlings. Germination time was 50 days. Our observations indicate that the quality of the seed is paramount in what type of germination takes place. Garden collected seed did not provide any greater number of seedlings than seed harvested in the wild, nor was it as good. We used our standard seeding mix and seed was sown in August, October, and December. One lot of garden-harvested seed of the **var. *obtusifolium* S. Watson** was treated with sulphuric acid for 15 minutes and good germination started within 18 days. Only minor problems and losses occurred during the time in the nursery for either species or variety.

Culture: Our collections brought in from a variety of localities have all performed exceedingly well. Losses have been minor and growth has been good. Our oldest plants have been in the garden since 1951. They started producing flowers and seeds within three years and are now up to nine feet tall by 12 feet spread. Other later plantings have grown equally well, and some have

exceeded the above growth rates to ten feet by 15 feet. The var. *obtusifolium* has also performed equally well, growing to eight feet tall by 12 feet wide in 15 years.

***Adenostoma sparsifolium* Torr.**

Ribbon Wood. Red Shank.

Shrub.

Rosaceae. Rose Family.

Propagation: On two seed lots sulphuric acid was used to soak the seeds for 15 minutes (resulting in 7 seedlings) and for 30 minutes (resulting in 1 seedling). A hot water treatment on another lot of garden-harvested seed gave poor results; and no treatment on another freshly harvested seed from the wild produced hundreds of seedlings from only a few traces of seed. This lot of seed was collected in November while there was snow covering the bushes. It was sown the following day in SMA, and initial germination occurred in 17 days. Four years later, the second lot was sown in October and germination began in 12 days. Other lots sown in July and September germinated equally fast even after the seed was five-years-old.

Culture: Our first planting of this species was made in 1953, and except for removals and an occasional plant dying, all have done exceedingly well. Flowering and seeding started within three to four years and plants about one foot tall when set out are now up to 15 feet tall by 15 feet spread. They are assuming all the characteristics of mature plants.

***Adiantum jordanii* Mull. Hal.**

California Maidenhair.

Perennial.

Pteridaceae. Brake Family.

Propagation: Three lots of plants and one of spores were handled with varying success. One lot of plants did not withstand transplanting from the wild, while two other collections grew quite well. We tried to germinate one lot of spores, but with no success.

Culture: One planting was destroyed by birds scratching out the newly set out lot. The second and most recent collection is growing, but not happily, under a large oak. It is at its best during the spring.

***Adiantum pedatum* L. var. *aleuticum* Rupr. [Ed: *Adiantum aleuticum* (Rupr.) C.A. Paris. TJM2]**

Five-finger Fern.

Perennial.

Pteridaceae. Brake Family.

Propagation: One attempt to germinate spores was a failure, and two collections of plants from the wild were easily established in greenhouse pots in a mixture of sand, peat moss, loam, and perlite.

Culture: Our two collections planted in 1963, while not growing vigorously, have maintained themselves quite well in different types of areas, both being in shade with plenty of moisture. Our climate and conditions here are not conducive to vigorous growth.

***Adolphia californica* S. Watson.**

Shrub.

Rhamnaceae. Buckthorn Family.

Propagation: Seeds harvested from plants growing at the former site were sown in peat moss and loam, and covered with sphagnum moss in October 1950. Nine days later germination started and good results were obtained without any other treatment. A second lot sown in January 1951 gave even better results but no quicker germination with peat moss and perlite then covered with sphagnum moss. Since then, it has not been necessary to raise additional plants.

Culture: Since June 1930, when the first collection was made of this species, it was not necessary to raise additional plants until our move to this site. Our planting here in 1951 has done equally well, growing vigorously in a completely drained, rocky, decomposed granite loam in full sun. Flowering and fruiting began within three to four years, and the group of plants have now grown together into one large clump, three to five feet tall, spreading out ten to 15 feet. Profuse flowering during March and April attract hordes of bees. It is our opinion that this plant could be used successfully for erosion control in difficult areas.

***Aesculus californica* (Spach) Nutt.**

California Buckeye.

Shrub or Tree (deciduous).

Hippocastanaceae. Buckeye Family. [Ed: Sapindaceae. Soapberry Family. TJM2]

Propagation: Several procedures were used in starting our collections of seed. Equally good results were obtained by sprouting the seed in moist one-half peat moss and one-half perlite, sowing directly into various size containers or into deep seed beds. The latter method is preferred as better root systems are obtained and the species can be planted bare-root directly into its location, provided the plants are at their dormant stage. When the conditions are right, it would be even better to sow the sprouted seed directly into the permanent locations. We found that less vigorous plants were grown if they had been started in gallon-cans or larger containers. There is no problem in starting the seed if the medium is not kept too moist as the seed rots easily.

Culture: One collection harvested from plants at the former site and six from widely scattered natural areas have been planted. It was necessary to locate six collections in our very rocky, decomposed granite loam. In those areas mortality was high, but in one lot placed in our heavy clay area only two plants were lost in the first of six years. These were all bare-root plants soaked in a Hormex solution before setting out. However, other lots without Hormex treatment put in heavier soil have fared well. Growth in the rocky soil has been much slower and plants are less vigorous, as indicated by the difference in initiation of flowering and fruiting. It took from five to eight years in the rocky soil areas while only two years in the clay-loam soil. Growth rates have been more than twice as fast in the clay-loam soil, with plants six-years-old being up to seven feet tall and ten feet spread while most container-grown plants in the rocky areas have not

attained those sizes in over 15 years. Therefore, it is recommended that plantings of this species be located in heavier soils (Everett, 1957. Pg: 16).

***Agastache urticifolia* (Benth.) Kuntze**

Horse Mint.

Perennial.

Lamiaceae. Mint Family.

Propagation: One collection from the wild plus three from our cultivated plants germinated equally well in five to ten days when sown in SMA or slight variations thereof. No problems were encountered in bringing the seedlings to size for planting, which was usually done from four-inch or five-inch pots.

Culture: Located in semi-shaded spots in partially moist soil, our plantings performed well for two or three years. However, the species appears to be somewhat transitory under our conditions, growing happily for a time, flowering profusely and producing enough seed to keep us in supply. As the species becomes somewhat weedy, it cannot be considered a choice plant.

***Agave deserti* Engelm.**

Perennial.

Agavaceae. Century Plant Family.

Propagation: Using our SMA, seed germinated readily within five to seven days without any treatment. The seedlings grow quite slowly but can be transferred to pots without any difficulty. If propagating by seed, our recommended procedure is to sow the seed in a deep box or bin and let the seedlings acquire good size before transplanting bare-root to the chosen site. Offshoots from old plants or the mature plant can be readily established in the permanent location.

Culture: Four of our seven collections were moved from the former site and placed in our plant community sections or the desert garden in very rocky, decomposed granite loam. The losses from moving were minor, and we are now growing specimens that are over 35-years-old. These have continued to produce flowers and seeds, attaining large normal clumps. Two seedling collections planted in 1957 and 1959 respectively suffered high mortality the first three to four years, but since then there have been no losses. Plants one to two inches tall by one to four inches spread when planted are now one to three feet tall with spreads to four feet, but they have not started flowering. This indicates that even under cultivated conditions, it takes more than ten years for flowering to be initiated. No irrigation has been applied since the plants became well established.

***Agave shawii* Engelm.**

Perennial.

Propagation: No treatment is necessary to germinate the seed, which takes from five to ten days. The simplest way to propagate the species is to take offshoots from mature plants and set them in where they are wanted. All of our present material was moved from the former site.

Culture: Our collections came from the old site as offshoots or mature plants. Since then they have grown to the point where it is necessary to remove many plants to keep the areas from

being overrun. Extremely hardy, no additional care is necessary after the initial planting. Our oldest plants moved from the old site are now 35-years-old.

***Agave utahensis* Engelm. var. *nevadensis* Engelm. ex Greenm. & Roush.**

Perennial.

Propagation: Since 1950, one seed collection from the wild and two from our own plantings have germinated within seven to 12 days without any treatment. Other collections have been brought in from the wild. Our procedure is to dry and treat any mutilated roots and establish them in sandy soil mixtures in pots before transplanting. Seedlings grow slowly and need to be grown for some time in deep flats or bins where they may grow to size before transplanting.

Culture: Eighty-six plants growing at the former site were moved to six-inch pots before planting in their present site. In May 1951, 50 were used in one site and 22 in another. A severe weed problem and overwatering in one area necessitated a large amount of maintenance around the plants, which caused excessive loss. All attention was stopped and since then losses have been negligible. We have had the plants for 30 years and several have flowered and produced seed each year. Additions have been made from these harvested seed collections as well as from other wild sources. This is a very hardy entity that needs to be completely left alone.

***Agoseris heterophylla* (Nutt.) Greene.**

Mountain Dandelion.

Annual.

Asteraceae. Sunflower Family.

Propagation: Sowing directly into the open ground is the simplest method for germination the seed, which occurs from nine to 12 days.

Culture: In November we sowed one lot in a field row and another in an area for naturalizing. Both lots grew vigorously and began flowering the following March, making a good display. Since the species is a rather weedy type, we discontinued further culture.

***Alisma triviale* Pursh.**

Perennial.

Alismataceae. Water-Plantain Family.

Propagation: Our one collection of plants from the wild was placed directly in the pond where it was to grow. Volunteer plants appeared in all wet spots, which indicates the seed would need to be fresh when sown and the media kept very moist.

Culture: This entity needs to be kept in a constantly wet area or in a pond for successful growth. Quantities of plants have appeared in several wet areas as well as growing so vigorously in the pond that periodic reduction of many plants has been necessary.

***Allium* L.**

Wild Onion.

Perennial.

Amaryllidaceae. Amaryllis Family. [Ed: Alliaceae. Onion Family. TJM2]

The propagation and cultural methods we have pursued during the past 15 years have followed pretty much the same pattern. Therefore, it seems unnecessary to repeat the processes for each species. We will outline here the methods we have followed and, where necessary, more specific details will be noted under each species.

Propagation: The germination of seed is relatively simple since no pretreatment is necessary. For convenience, we usually sow the seed in September, in a flat or seed pan using one-quarter peat moss, one-quarter perlite, one-half sandy loam, covering the seed with sphagnum moss. Germination requires from 12 to 117 days; however, the average is 40 to 50 days. The time required for germination seems to vary quite a bit within the species and from one to another. It has been noted that those species that are easily grown and produce quantities of volunteer seedlings germinate the quickest. When sown in September, nearly all seed lots germinate in November, a few in December, and a few in October. Two collections were sown in July and one in August, and all germinated within 25 days. The majority of seed was sown in the same year as collected in May and June, but five-year-old seed gave good results. The maximum germination usually occurs within three months, and the young seedlings should be watered carefully to prevent damp-off. About May, the tiny shoots will begin to brown, an indication of the dormant period setting in. Gradually increasing the period between watering, the small seedlings are dried off within a month or two. There was a time when we stored the dried flats in a cool room and restarted watering in September or October, but recently we have tried removing the small bulblets, storing them in a cool room, and planting them during the following fall months. Oftentimes we found that many bulbs rotted when restarted in the flat after a dormant period. This last method has been successful.

Noting that several species produced numerous volunteers in their permanent locations, we have experimented sowing the seed directly into the desired site. This procedure has been most successful and we plan to pursue that course wherever practical. Bulbs usually are easily transplanted from the wild, whether by restarting and increasing the number in pots or, if in sufficient quantities, directly sowing in the site. If the bulbs are collected during their natural dormant period, they should be stored in a cool room or put in pots or flats without more than moistening the soil. We store such material at about 38° F, until September when some of the bulbs may already be starting growth.

Culture: Whenever possible, we have tested the various species in more than one type of habitat. Generally, our experience indicates that most kinds like a heavier soil, but many species have grown naturally in our well-drained rocky granite loam. All need sun to some degree, a good amount of water for good growth, and after their flowering period is past, watering should be stopped. Flowering begins three to four years after sowing the seed. Many collections of wild onions were put out during the first years at this site. Gradually, the character of the plantings in those areas changed, more irrigation was necessary and, as a result, a number of species rotted or were overgrown and died.

On the other hand, species found in wet spots would rot when given a like situation here. Some lots were eaten by rodents, and other species just didn't like our area. About nine species of the 23 we have handled are well established, some of them having been with us from the former site for over 30 years (Everett, 1957. Pgs: 17-19).

***Allium acuminatum* Hook.** – One 1949 collection of nine bulbs was moved to this site, made excellent growth, and increased to 20 bulbs the first year. It did not appear next season. No additional collections of this species have been made.

***Allium amplexans* Torr.** – Our original collection made in 1937 was brought over from the former site and has been increased by growing five collections of seed. Four numbers have been added from the wild, most of which increased for a few years and then disappeared for various reasons. Three additional seed collections from these latter ones have been grown. In all lots, seed germinated within 17 to 24 days.

***Allium bisceptrum* S. Watson.** – Two 1956 collections of bulbs were grown successfully for three to five years, and then disappeared because rodents had eaten the bulbs. One lot of seed harvested from these collections failed to germinate.

***Allium burlewii* A. Davidson.** – One seed and one bulb collection were introduced in 1952 from the higher reaches of the San Gabriel Mountains. The seed failed to germinate and the bulbs failed to grow after the third year; however, flowers were produced the second year. It may be too hot and dry in this location.

***Allium campanulatum* S. Watson.** – Prior to 1956, two bulb collections and two harvested seed lots from the bulbs were added to several sites. None progressed and were written off within three to five years except one seed collection from Kern County. It produced over 350 bulbs which, with additions made from subsequent collections, plus sowing seed directly in the area, have gradually produced an attractive display in the rock garden.

***Allium dichlamydeum* Greene.** – One lot of bulbs brought here in 1966 has grown and flowered well in a flat, but it is too early to state how it will grow here over a period of years.

***Allium falcifolium* Hook. & Arn.** – Two collections of bulbs failed after the second year, and one of seed took six months to germinate, but the bulblets subsequently rotted.

***Allium fimbriatum* S. Watson.** – Ten lots of seeds, seven from the wild and three from our garden plants, were germinated within 19 to 117 days, the quickest being from a wild collection. These plus three lots of bulbs have been used in our desert garden and the desert dune section. None of them have persisted for more than two to five years. A few still remain from recent introductions. The **var. *denticulatum* Traub.** [Ed: *Allium denticulatum* (Traub) McNeal. TJM2] has done much better, growing fairly well for at least ten years in our rocky, granite loam. Seed-produced plants flowered within four years. One bulb of the **var. *diabolense* Traub.** [Ed: *Allium diabolense* (Traub) McNeal. TJM2] failed to develop, while several seed-produced collections and mature bulbs of the **var. *mohavense* Jeps.** did not develop well, but persisted for several years in the edge of the desert dune garden.

***Allium haematochiton* S. Watson.** – This species was introduced to our collections in 1949 from the old site and since has moved itself into numerous areas of the garden. Four harvested seed lots have been produced, germinating from 15 to 37 days, the latter being sown in July. Thousands of seedlings have spread out in a wide area from the central planting. Clumps of bulbs can be pulled out without dangerously decreasing the numbers. Further production on our part will not be necessary. (Three years to flower; five years when seed is sown directly into ground.)

***Allium hoffmanii* Traub.** – This species was brought here in 1958. After growing in a pot in the nursery for a year, it was used in our bulb section on the mesa. It did not last for more than a year.

***Allium hyalinum* Curran.** – Thirty bulbs collected in 1952 were planted at the edge of our artificial stream on the mesa, a spot where it is almost constantly wet, clay-loam soil. They thrived, and from this lot we have grown (from seed) hundreds of additional bulbs which have been used in other spots along this stream. Seed germination varied from 25, 27, 29, and 92 days, the results always good. In all places the species has thrived and we consider it one of our best.

***Allium lacunosum* S. Watson.** – One 1949 bulb collection was grown in the nursery for three years and during that time seed was harvested and sown for additional bulb production. Initial germination started within periods of 39, 46, and 58 days. Growth in the nursery required two years and several lots were planted in November 1951 and 1952, in a flat, rocky, granite loam area. While there was a gradual reduction in plantings, they lived for at least nine years until smothered by buckwheat and sage (*Salvia*) plants.

***Allium lemmonii* S. Watson.** – It required 38 and 48 days respectively to germinate two lots of seed harvested from a group of bulbs collected in Modoc County in 1950. The original lot produced flowers and seeds after the second year in the nursery. In October 1951, they were planted in a rocky, granite loam area in sun. The collections were all gone within five years.

***Allium monticola* A. Davidson.** – A few bulbs collected at 9,000 feet in the San Gabriel Mountains were planted directly into the section set aside for bulbous materials, a well-drained, rocky, granite loam. This collection only survived two years.

***Allium platycaule* S. Watson.** – Two 1950 bulb collections, one from Lassen County and the second from Modoc County, were started in the nursery and then shifted to separate garden sites in October 1951. The Lassen County lot, set in a rocky, granite loam, survived for three years, flowering for one season. The Modoc County collection of 30 bulbs was placed near the base of a live oak tree in a prepared mound of crushed rock and loam. In this shady, but dry area it has continued to grow for the last 15 years. Each year a few flowers and small amounts of seed have been produced. The only germination period recorded is for 57 days, and only a few bulbs have been grown which have not survived. The original lot of bulbs has been moved to another similar site where they continue to grow.

***Allium praecox* Brandegee.** – Our material is a direct descendent of the bulbs collected on Santa Catalina Island in 1932. Several hundred seedlings were produced in 1946 and grown in the nursery until our move was completed. (Volunteer seedlings noted.) In 1951 these were placed in their permanent site of rocky, granite loam near the base of some trees that provide afternoon shade. This group is well-established, as well as several others on the mesa, in heavy clay-loam soil. Several lots were started from seed, the germination period being anywhere from 14 to 74 days. Flower production occurs within two to four years, and this species has been a satisfactory one to grow.

***Allium serratum* S. Watson.** [Ed: *Allium serra* D. McNeal & F. Ownbey. TJM2] – Our plantings are all direct descendants from a group of bulbs brought to the garden in 1937 from the San Joaquin Valley. Production of additional material has been prolific, not only from volunteer seedlings appearing around permanent plantings, but also by eight harvested seed lots. These took from 12 to 113 days to germinate, but usually not more than two to three weeks. Our first

large group of seed produced bulbs started at the former site in 1946. Grown in the nursery beds for several years until our move was completed, they were set originally in a rocky, granite loam area. Since then large groups have been added to the mesa bulb section where they appear to be much happier.

***Allium tolmiei* Baker.** – Bulbs were collected in Lassen County in 1950, weakly produced flowers and seeds for two to three years and then disappeared. One lot of seed harvested took 38 days to germinate and about six bulbs were planted in our rock garden in February 1954. Up to 1960 they were very weak and had not flowered. In subsequent years, the collection disappeared.

***Allium unifolium* Kellogg.** – We acquired our first seed in 1963 and the resulting one seedling appeared 112 days later. After potting it rotted. In 1964, we were given two pots filled with bulbs, and following directions, we planted them during February in our stream, which remains quite moist most of the year. The first season they flowered beautifully and produced some seed. The following year, none of the bulbs could be found as they had rotted. The harvested seed was sown in sand, peat moss, perlite, and covered with sphagnum moss. About 40 days later, the seed flat was put under cold-stratification for about one month. Seven days after removal, germination started and over 150 bulbs were produced. The seedlings were grown in a flat until dried off and removed the following September, about seven months. Stored in a cool room, the small bulblets were held until November 1965 and planted adjacent to the stream. They have done splendidly there, along with another lot of bulbs subsequently acquired. Flowering and seed production has been excellent. It appears that the bulbs cannot be planted in areas that remain constantly wet but prefer to be dried off a bit.

***Allium validum* S. Watson.** – One wild seed collection in 1950 failed to germinate. No other material was acquired until August 1965, when two lots of bulbs were brought in while in flower. They were grown in pots until the following March, 1966, when they were planted beside the stream on the mesa. Since then they have made little growth. The future of this species here is rather doubtful.

***Alnus oregona* Nutt.** [Ed: *Alnus rubra* Bong. TJM2]

Red Alder.

Tree.

Betulaceae. Birch Family.

Propagation: Two seed collections in October 1953, sown in SMA during November, germination in 14 days, producing an abundance of seedlings within the following month. Attempts to grow more seedlings of the same type four years later resulted in complete failure. Another seed lot procured in October 1959 and cold-stratified for three-and-a-half months, produced three seedlings 12 days after removal from the cold, but then died in the flat. Additional attempts to initiate germination with cold-stratification were unsuccessful. Whether cold-stratification had anything to do with the poor germination cannot be stated. Seedlings, both in the nursery and in the wild, can be moved easily and rapidly grown to three feet or more in a year in the nursery.

Culture: In February 1941, seedlings one- to two-years-old were dug in the wild and established at the former site. By 1948, many of these trees had attained heights of 30 feet. We balled and moved four of the smallest, five to six feet, to our present location in March 1951. Of necessity,

we had to plant them in a flat, rocky, granite loam site in full sun. It was soon evident they couldn't stand the move. Subsequent collections have suffered heavy losses in similar situations, but those planted near the stream on the mesa in clay-loam soil have attained sizes of 30 feet or more, produced seed for several years and, except for attacks by bark borers which severely weakened many, have done very well. One tree in the plant community section has been in good condition for 12 years and is over 11 feet tall by 12 feet wide. It does need a lot of water to keep in good condition, as this species would in any situation.

***Alnus rhombifolia* Nutt.**

While Alder.

Propagation: Fresh seed sown in flats germinate well without any special treatments; seven-year-old seed failed to start. One lot harvested from cultured trees at the former site produced only a few plants after two sowings. Germination usually lasted ten to 18 days when sown in our SMA. One lot of cuttings rooted poorly, and only one plant survived to be planted. In April, 25 cuttings of new growth taken from the base of a tree were inserted in one-quarter peat moss and three-quarters perlite, and given intermittent mist, bottom heat, and four hours of extra light per day. Two months later, only two had rooted and the remainder failed. One of these was grown successfully. A second lot of 30 tip cuttings was taken the middle of June and dipped in Terraclor before inserting and providing the same treatment as above. One rooted in the latter part of July. On August 6th, the remaining cuttings were treated with Hormodin #2. On September 18, six were potted off. However, these all dried up, a condition that often results when kept under mist too long. Some collections still handled under the **var. *bernardina* M. & J.** [Ed: the var. is not recognized in TJM2] produced only a few trees from cultured seed but otherwise have grown as well in all respects.

Culture: Trees grown from seed harvested from plantings at the former site, planted in the clay-loam soil of the mesa beside our stream, have attained 50 feet and more, with trunks to 18 inches in diameter in a period of 16 years. Seeding has occurred for at least ten years. Other material used in the plant community section, where conditions are not so conducive to rapid growth, have fared very well. A 1952 planting has lost only two trees, the remainder attaining heights of 30 feet with spreads to 18 feet. Seed was produced within four years. One vigorous lot of seedlings grown under the var. *bernardina* grew to five feet in the nursery. During the first year in the plant community they were girdled by the flat-headed apple borer which eventually caused all to die except one tree. Otherwise, we have had no problems with borers or other insects.

***Alnus tenuifolia* Nutt.** [Ed: *Alnus incana* (L.) Moench ssp. *tenuifolia* (Nutt.) Breitung. TJM2]

Mountain Alder.

Propagation: Untreated fresh seed germinated in 11 days when sown in our SMA. The seedlings grew very slowly until they were gallon-can size, after which they grew to three to four feet tall within a year. Twenty untreated greenwood side shoots, taken in May, rooted in 45 days under intermittent mist and bottom heat.

Culture: Fifteen plants established in our yellow pine forest section have grown exceedingly well in the rocky, granite loam with thorough monthly irrigation during the growing season. Seed was produced in the third year and 15-year-old plants are now up to 13 feet tall by 12 feet spread. They are more shrub-like than trees due to heavy branching from the base. Specimens used on

the mesa in clay-loam soil did not prosper well and appeared somewhat sickly. They were not used along the stream but were provided enough water to have done better than they did.

***Amblyopappus pusillus* Hook. & Arn.**

Annual.

Asteraceae. Sunflower Family.

This coastal annual species was sown in November directly into our coastal sand dune garden, where it germinated in seven days. Slugs and damp-off killed all the plants by the following February.

***Ambrosia chamissonis* (Less.) Greene.**

Perennial.

Asteraceae. Sunflower Family.

Propagation: The first collection was sown untreated on December 31, 1954, directly into our coastal sand dune garden, where first germination occurred February 14, 1955. The next number gathered in October 1964 was sown in SMA on November 11. Some germination occurred December 17. The flat was cold-stratified from February 10, 1965, to February 26, 1965, after which much better germination took place. A second lot of this collection was sown in September 1966, cold-stratified for a month, and much better germination started October 25. This indicates that short periods of cold-stratification help germination. There were no problems during the potting processes, all seedlings growing without loss.

Culture: The first number sown directly into location survived for three to four years, but the site did not seem favorable due to considerable litter from an oak tree. Frost has taken its toll of subsequent plantings from nursery stock. A few degrees below freezing are not to the liking of this plant or its **var. *bipinnatisecta* (Less.) B. Boivin.** [Ed: the var. is not recognized in TJM2], which was sown directly into location in coastal sand dune garden. About half the young plants recovered and went on to produce flowers the following August, 1966. This weedy species is not thought to be a good garden plant. (Volunteer seedlings produce good growth in summer.)

***Ambrosia chenopodiifolia* (Benth.) W.W. Payne.**

Shrub.

Propagation: Seed harvested in 1949 from our original collection gave indifferent germination through several years. Untreated seed was sown periodically in SMA from 1951 through 1957. One lot produced 16 plants, another nine, and the others none. The germination period was 12 to 16 days. We did not use cold-stratification or other treatments at any time, but might have benefitted from it. Once started there has been no difficulty in raising the plants to planting size.

Culture: All of our plants were used in the chaparral section in full sun and rocky, granite loam. Without any attention, a large percentage have survived, flowered and produced seed within three years from seeding.

***Ambrosia dumosa* (A. Gray) W.W. Payne.**

Burro-weed.

Shrub.

Propagation: Untreated seed will germinate in three to 13 days and produce more than 100 seedlings from a trace amount of seed sown in our SMA. Four-year-old seed germinates equally well. We had no problem raising the seedlings to planting stage.

Culture: Our plants have been used in our desert garden and plant community section. Without any attention, they have maintained themselves very well, although losses occurred from frost and other causes. Volunteer seedlings have appeared in abundance, even though one site was particularly poor for any kind of plant used.

***Ambrosia eriocentra* (A. Gray) W.W. Payne.**

Shrub.

Propagation: A 1949 seed lot sown in September 1951 appeared in four days and after plants reached planting size, an invasion of mice cut them down. Seed harvested from our original 1930 collection produced only two plants in five days. These in turn grew to produce more seed which brought us only two more plants. Apparently, the seed is of poor quality.

Culture: The three plants alive in the garden have grown well, attaining sizes to eight feet spreads and three feet heights, flowering and producing seeds. Volunteer seedlings have never been noted within the areas, indicating generally poor seed is produced.

***Ambrosia ilicifolia* (A. Gray) W.W. Payne.**

Shrub.

Propagation: Two numbers sown in September 1963 produced seedlings in five days without any treatment. There was no problem in raising the seedlings in the nursery.

Culture: Setting out our first group in February 1964 was a mistake, since these plants were found to be frost-tender. About 50% were killed by a few degrees below 32° F. Since then, any plantings were made after the danger of frost was past, usually in April. However, the plants are so frost-tender that they can be nipped even after they are somewhat acclimated. Strong plants are growing in well-drained, rocky, granitic loam. Flowering and fruiting started the second year from seed.

***Amelanchier pallida* Greene. [Ed: *Amelanchier utahensis* Koehne. TJM2]**

Western Service-Berry.

Shrub.

Rosaceae. Rose Family.

Propagation: July and August appear to be the proper months for collecting the seed, as all other lots harvested in September or October failed to germinate. When tested they proved to be infertile. The first lot harvested in August 1952 produced five seedlings after four months of cold-stratification. Later collections immersed for 30 minutes in sulfuric acid, washed thoroughly, and cold-stratified for nearly four months produced seedlings either prior to or within a few days after removal from cold-stratification. Three months cold-stratification is enough. Whether the sulphuric acid soak helped cannot be determined as there were no controls. Our experience indicates that it would be more efficient to produce this species in a deep bin,

allowing sufficient time for growing a strong root system and plant, and when dormant, to plant bare-root.

Culture: Insufficient time has elapsed since 1965 for us to state how successfully we can grow this species, but judging from our field observations of the type of habitat in which it grows, there should be no problem once the plants settle in. There has been high mortality to date. Also, it appears that better results will be obtained, in both growth rate and survival, in the heavier clay-loam soil than in the well-drained, rocky, granitic loam. In the future, only minor irrigation will be necessary.

***Amorpha* L.**

False Indigo Bush.

Shrubs.

Fabaceae. Pea Family.

Propagation: Native seed of *A. californica* Nutt. collected in August 1952 and seed from cultured plants of *A. fruticosa* L. var. *occidentalis* (Abrams) Kearney & Peebles [Ed: the var. is not recognized in TJM2] growing at the former site both germinated within five days without any pretreatment. Reduced numbers of seedlings germinated with the same seed collections when five- or more-years-old. Perhaps soaking in water or other pretreatment should have been tested for the older seed. No problems were encountered in growing the seedlings in containers to planting size.

Culture: Since November 1953, there has been 50% loss in the planting of *A. californica*, the principal cause being severe chewing by rabbits. Our plants are noted as being in good condition and measure from two to six feet tall and have spread from two to five feet wide. These plants have produced flowers and seeds since June 1955. In a slightly more protected position but with the same rocky, granitic loam soil, *A. fruticosa* var. *occidentalis* has fared much better, as 30 (out of original 32 planted) were alive in October 1953. These plants range in size from about two to 15 feet tall have spread from two to 17 feet wide and are in excellent condition. These specimens have produced flowers and seed since June 1955.

***Amsonia brevifolia* A. Gray.** [Ed: *Amsonia tomentosa* Torrey & Fremont. TJM2]

Perennial.

Apocynaceae. Dogbane Family.

Propagation: Native seed plus that harvested from cultivated plants in the garden germinated in four to seven days without any pretreatment. Our seed was sown in September and October, but since all the branching of this species completely dies back to the root crown each winter, it is recommended that the sowing of seed be withheld until January or February. Our seedlings began to go dormant in a month or two, after which there was considerable rotting. Once the plants are growing normally, there is no problem except excessive watering in the nursery.

Culture: There is one plant remaining of two introduced in October 1952. Each year since June 1955, it has produced an abundance of flowers and seeds from which we have increased our plantings. It dies back completely each winter, and its measurements differ each season, growing to more than two feet tall by three feet spread. Seedlings grown here have suffered over 90%

losses the first year or two, after which two or three plants in each lot have settled down and seem completely at home. Some frost damage in unprotected areas has been observed from time to time.

***Anaphalis margaritacea* (L.) Benth. & Hook. f.**

Pearly Everlasting.

Perennial.

Asteraceae. Sunflower Family.

Propagation: Three native seed collections and one of rooted plants were handled between 1954 and 1964. The rooted plants were easily established in cans, and the seed germinated easily and well within periods of seven to 16 days. Only one lot had been cold-stratified for a period of 24 days, but it was unnecessary. Seedlings were grown without trouble to four-inch pots with only one or two percent losses.

Culture: At no time have we successfully established the species at this site. A collection introduced in 1955 grew to mature size, flowered, produced seeds and a few volunteer seedlings were noted, but the entire planting was reported dead in 1959. This was also true for the several later introductions. Heavy losses occurred during the summer months due to rotting. This was not so at the old site, where it became well established on a north slope (Everett, 1957. Pg: 21).

***Andropogon glomeratus* (Walter) Britton et al.**

Beard Grass.

Perennial.

Poaceae. Grass Family.

Propagation: Our only collection failed to germinate, but the experience of others indicates that no pretreatment is necessary.

Culture: A clump of this grass was planted directly into a dry stream bed in April 1963, and since has become established in this site.

***Anemone occidentalis* S. Watson.**

Pasque Flower.

Perennial.

Ranunculaceae. Buttercup Family.

Propagation: An August 1961 collection of native seed was sown the following November without any pretreatment. Excellent germination occurred in 20 days. They were potted off within 30 days, and the roots of the tiny seedlings were very long. The following February, the young seedlings in pots began to go dormant, but in April they restarted growth. Later sowing, February or March, would have been better, but when such results occur, watering should be stopped or held to the very minimum. Following this procedure, our losses were only minor and a fine quantity of young plants was grown for the garden. A year later a second lot, sown in October 1962 and cold-stratified for two-and-a-half months, failed to germinate. The seed appears to be short-lived.

Culture: Our endeavor to grow this species here met with failure, fewer plants appearing each season for three years. They were grown in a well-drained mound in shade and to our knowledge never flowered.

***Anemopsis californica* (Nutt.) Hook. & Arn.**

Yerba Mansa.

Perennial.

Saururaceae. Lizard-Tail Family.

Propagation: The species is easily increased by moving established plants or sowing the seed. No pretreatment is necessary; our records indicate either freshly collected or ten-year-old seed will germinate readily from 26 to 34 days. We cold-stratified one lot for one-and-half months but no appreciable gain was noted. While taking longer, a colony may be started by sowing the seed directly into the site. Since the plants go completely dormant in the winter, it would be best to sow the seed in January or February instead of September or October

Culture: One lot of seeds was sown directly into a site in the garden, and another group of plants became slowly established in our rocky, desert garden stream bed. Another group of plants used in a slight depression of clay-loam soil grew rampantly, even though water requirements were not met. Still other collections set in the mesa stream either became overrun by more rampant growing species or succumbed completely. Our lesson seems to be that the species needs a moderately moist site in clay-loam soil to do its best here. Flowers and seeds are produced within two to three years.

***Angelica hendersonii* J.M. Coult. & Rose.**

Perennial.

Apiaceae. Carrot Family.

Propagation: Our first native seed was sown a few days after gathering in October 1964. Good germination resulted 20 days later and maximum germination in another 18 days. Another collection was gathered in August 1965 and sown in September, and was cold-stratified for a month. These did not produce the results of the previous lot. However, there is a chance the seed may not have been as good. Again, our nursery results indicated this perennial rooted species should be sown in January or February to get away from the interrupted seedling growth which usually occurs here the first two months of the year.

Culture: We have used our plants in and adjacent to our mesa stream both in sun and shade. The results appear to indicate that it will be difficult to establish permanent colonies. Strong plants up to five feet tall have flowered one-and-a-half years from seed, but succumbed after seasonal growth. Another group has been growing more slowly and they are two- to three-years-old and one or two have flowered, but viable seed has not been produced.

***Anisocoma acaulis* Torr. & A. Gray.**

Annual.

Asteraceae. Sunflower Family.

Propagation and Culture: A number of collections from native stands or from the garden's cultivated plants produced equally good results when sown in our desert garden, in sandy granitic soils. Seed was sown between November and January and the germination period ranged from 14 to 34 days, the most abundant stands occurred soon after rains. Flowering began in late March or early April. Small quantities of seeds were harvested from time to time, but since 1960, the damages caused by rabbits, birds, slugs and increasing amounts of root rots, there has been little if any seed produced. While there was some indication of naturalizing, the stands did not increase.

***Antirrhinum breweri* A. Gray.** [Ed: *Antirrhinum vexillocalyculatum* Kellogg. TJM2]

Annual.

Scrophulariaceae. Figwort Family. [Ed: Plantaginaceae. Plantain Family. TJM2]

Propagation and Culture: Seed gathered from a native stand in 1952 was sown in our rock garden in January 1955. Germination was recorded 35 days later with flowering starting in June. This unattractive species grew so rank in our area, it was discarded.

***Antirrhinum kelloggii* Greene.**

Annual.

Scrophulariaceae. Figwort Family. [Ed: Plantaginaceae. Plantain Family. TJM2]

Propagation and Culture: In July 1963, following a fire in the foothills above us, this species was gathered and sown directly into a site in the garden the following November. Fifty-five days later, germination was recorded and the unattractive flowers appeared the latter part of May. It was necessary to resow the area in January, which may have accounted for the longer germination period. This species has not been continued.

***Antirrhinum multiflorum* Pennell.**

Annual or Perennial.

Propagation: Seeds directly sown into a site in the garden germinated slowly and the results were poor. Year-old, untreated seed took 14 days to produce an abundance of seedlings, and those subjected to one month of cold-stratification produced excellent results in six to 14 days after removal from refrigeration. While cold-stratification may help, it is unnecessary. There were no problems in raising the seedlings to planting size.

Culture: Under a variety of conditions, this species was short-lived here. While flowers appeared within a year from seed, there was little or no seed produced.

***Antirrhinum nuttallianum* A. DC.**

Annual or Biennial.

Propagation and Culture: A short-lived species, our seed from native stands was sown in December 1952 and 1956, on the site, in semi-shaded, well-drained loam soil or on the mesa in clay-loam soil. Germination required 29 days in 1952 and four years later sown in the clay-loam soil, it was 18 days. In any case, the young plants were relished by rabbits. They destroyed most of the plantings, which were soon abandoned.

***Antirrhinum ovatum* Eastw.**

Annual.

Propagation and Culture: Our original 1948 seed was sown at this site in December 1955, in our simulated sand dune garden. The following March, germination began, flowering started in June 1956, but the stand was so poor that little or no seed was produced. Additional amounts of seeds were harvested at the old site and were directly sown into a garden site until 1958. Germination was sporadic, some lots coming up within 13 days while others took nearly two months. In all cases, the results were poor, and growth was weak with the species gradually dying out. A similar but shorter history was recorded for *A. vagans* **A. Gray** [Ed: *Antirrhinum vexillocalyculatum* Kellogg. TJM2] and *A. virga* **A. Gray**, the latter failing to germinate.

***Apiastrum angustifolium* Nutt.**

Annual.

Apiaceae. Carrot Family.

Propagation and Culture: Seeds were gathered from a native stand in June 1965. The seeds were directly sown into a garden site in November and began germinating in seven days. Damp-off and slugs took their toll, and the stand was recorded as dead in February 1966.

***Aquilegia eximia* Planch.**

Columbine.

Perennial.

Ranunculaceae. Buttercup Family.

Propagation: Seeds may be directly sown into garden sites or started in flats without any pretreatment. Germination occurs from 16 to 25 days and maximum germination is reached within a month. We have had no trouble raising the seedlings in containers to planting size.

Culture: Our original seed was gathered from native stands in 1947. Subsequent collections of seed have been procured from our cultivated plants in the garden. As a consequence, the species became highly variable due to hybridizing with *A. formosa* var. *truncata* or *A. pubescens*. The results have been to gradually discard our present seed collections. Otherwise, the species grew normally, developed into fine flowering specimens within a year, but on the whole were short-lived under our conditions. We used the species in a number of types of garden habitats but results were usually the same.

***Aquilegia formosa* DC. var. *truncata* (Fisch. & C.A. Mey.) Baker.** [Ed: the var. is not recognized in TJM2]

Perennial.

Propagation: Numerous lots of seeds from native stands or from our cultivated plants germinated equally and consistently from 15 to 20 days without any pretreatment. Seed may be sown directly into garden sites as demonstrated by our own procedures and the abundant supply of volunteer seedlings that appear every year. Seedlings are equally easily to grow to planting size.

Culture: The best stands are produced in the clay-loam soil of the mesa under semishaded conditions. Seed sown in October or November will produce flowering plants by the following June or July, and quantities of seed will follow along shortly. Plants are usually rather short-lived, two to four years being the maximum in our area. In less well-drained soils, overwatering will easily cause crown rotting and quick death of the plants.

***Aquilegia pubescens* Coville.**

Columbine.

Perennial.

Propagation: No seed treatments are necessary. Untreated seeds sown in flats begin germinating in 15 to 30 days. Those sown directly into garden sites can take up to several months to begin germinating. However, numerous volunteer seedlings appear around our plants in the garden each year.

Culture: This species became happily established in our rock garden even though the original seed lot was gathered at 10,500 feet elevation. The collector noted that there was a wide variation in flower color, ranging from lemon yellow to deep lilac. Our plants have tended to be of the lighter shades at this elevation. Thousands of seedlings appear each season, many having to be removed, and there is great color variation among the plants, indicating hybridization with *A. eximia* and *A. formosa* var. *truncata*, both of which have been grown in adjacent areas.

***Arabis* L. Rock-Cress. [Ed: *Boechea* A. Love & D. Love. TJM2]**

Biennial or Perennial.

Brassicaceae. Mustard Family.

Propagation: Seeds may be sown directly into garden sites, or in seed-flats. Germination requires six to ten days for the several species and varieties that we raised in flats and a little longer when sown in the open. We encountered no trouble with any of the several collections raised in pots to planting size.

Culture: Used in a variety of sites, the following species and varieties were raised successfully: *A. blepharophylla* Hook. & Arn., *A. holboellii* Hornem. var. *retrofracta* (Graham) Rydb. [Ed: *Boechea retrofracta* (Graham) A. Love & D. Love. TJM2], *A. pulchra* S. Watson. [Ed: *Boechea pulchra* (S. Watson) W.A. Weber. TJM2], and *A. sparsiflora* Nutt. var. *californica* Rollins. [Ed: *Boechea californica* (Rollins) Windham & Al-Shehbaz. TJM2] Quickly growing to one to two feet tall, flowering and producing seed within one year after seeding, they were on the whole short-lived in our area. Most of the material needs to have a complete rest after flowering and seeding, May to July. Additional irrigation causes root rot through the summer and a consequent high mortality. Generally, there was little attraction for the garden among these species.

***Aralia californica* S. Watson.**

Elk-clover.

Perennial.

Araliaceae. Ginseng Family.

Propagation: Dormant roots dug in February or March are easily established by planting them directly into the garden, or by planting them in containers in the nursery. Fresh seed germinates much quicker and better than one- or two-year-old material. One lot of two-year-old seed took four months to produce only four plants, while freshly gathered seed from native stands started germinating in 60 days without pretreatment, and eventually produced over 100 seedlings. Another lot from native stands was subjected to nearly three months cold-stratification, and started germinating 16 days after removal. This last number was sown in January and maximum germination was recorded in May. Sowing at this time permitted the young seedlings to grow continuously without going dormant, a much better procedure. Other sowings were made in September or October.

Culture: A collection of small plants brought to the old site in 1941 grew to be a fine, large stand. As much as possible of this clump was moved into large containers in February and March 1951. This material was replanted in this site in July 1951 under the limbs of a large spreading oak. Here the collection continued to prosper and become the source of additional propagation material. Additional collections from the wild have been grown in several locations, always in complete shade. Even so, the plants become rather disreputable after the hot weather starts in July or August. Up to that time, fine, healthy-growing plants give an exotic look to the scene. Upon the advent of cooling weather, new growth will sprout up to grow until cold weather dormancy sets in. It may take four to five years for seed-grown plants to produce flowering and seeding plants, and they will have attained heights of five feet and spreads of eight feet or more at the end of this time.

***Arbutus menziesii* Pursh.**

Madroño.

Tree.

Ericaceae. Heath Family.

Propagation: Cuttings, grafting, and layering are some methods used for producing this species. Unless there is a specific reason, the use of seed is entirely satisfactory, since the seedlings come quite true to species by this means. Five numbers of seeds were gathered in the wild and one from cultivation. Garden trees have been propagated since 1950. The outside pulp of the fruits was removed as soon as possible after harvesting. Seeds cold-stratified for two or three months start germinating from ten to 20 days after removal, while non-treated seeds take 20 to 30 days. Unless it is desirable to hold the seed for a period of time before seedlings are wanted or sowing at a particular season is more convenient, there is no advantage to be gained by cold-stratification. Freshly harvested seed, or those that are several-years-old, will start readily, and with equal results. We encountered no serious problems in shifting the seedlings from the flats through four-inch or five-inch pots to one- and five-gallon containers, where they were grown to fair-sized specimens. Although we have not followed this practice, observation indicates that seed could just as well be sown in a deep bin, in a lath house or under similar conditions, and the young plants grown to required size. They could then be established in containers for a short time or put out bare-root, if followed by frequent enough irrigations until settled in. A much stronger root system and better future growth would occur by this long-term procedure.

Culture: Our first planting was made in April 1951, from five-gallon containers with specimens four feet to five feet tall. The location was a flat, unshaded area with a slight depression

containing a deeper covering of loam over the rocky, granitic soil. While there were some losses the first year, there has been little to record except fine growth. Fifteen-year-old trees are now developing into handsome specimens 12 to 22 feet tall with spreads to 16 feet. Flowering and seeding began within five years after setting out in the garden. The trees are irrigated on an average of four- to six-week intervals through the dry season, which means about four or five applications of water per year. Other periodic collections have been raised and planted in a variety of locations, both in well-drained sites and in the tight clay of the mesa. In less well-drained areas, particular attention must be exercised in both planting and irrigation, otherwise, the trees will soon die from one of several species of root rotting fungi. The crown of the plant must never be planted below ground surface in any site, and established trees should not be watered until there is some indication of stress. Deep, less frequent irrigations are best, and the frequency depends on the kind of climate and soil. The species should not be planted in lawns, even though it makes a handsome specimen tree.

Besides the above mentioned root rot fungi, the species is not resistant to oak root fungus (*Armillaria mellea*). If this serious fungus is known to be present in the soil, this species should not be used. One or two sprays per year to control aphids may be necessary to prevent excessive leaf rolling, and in some native areas, the tent caterpillar does serious damage.

***Arctostaphylos* Adans.**

Manzanita.

Shrubs.

Heath Family.

Propagation: Specific information on the methods used to produce our collections of manzanitas is detailed in the discussion following each botanical entity. During the early stages of the development of this site, most of the species and varieties were grown from seed. As interesting and specific types evolved or were added to our stock, the plants were started from cuttings.

The seed of the manzanita has a hard, impermeable coat and a usually dormant embryo; and therefore, the seeds are slow to germinate. As a result, various pretreatment processes have been used to induce quicker germination, such as soaking in sulfuric acid or hot water for varying lengths of time; mulching; burning pine needles, straw, or excelsior over seeded flats; varying periods of cold-stratification alone or in combination with the preceding treatments; and no pretreatments. While varying degrees of success were obtained by using the above methods, either singly or in combinations, the most consistent results were obtained by soaking in concentrated sulfuric acid for as long as 18 hours, followed by varying periods of cold-stratification in an average temperature of 38° F. Upon one occasion, seed that had passed through the digestive tract of foxes was tested, but no conclusive information was obtained, although it appeared to help. By whatever method used, the germination period ranges from two or three weeks for the species with stones that break up into individual nutlets against several months to one or more years for those that remain a single stone.

Since the production of manzanitas from seed is slow, erratic, and the lots more often than not contain hybrids, even from wild collected stock, it is quicker, more successful, and surer to produce the species, varieties, and selected clones by asexual means. While we have successfully rooted cuttings of many species throughout the year, we prefer, and get best results, when cuttings are taken during the cooler months, when we do not have the serious handicap of high

temperatures. Tip cuttings of some firmness, three to six inches long, are preferred. There are a number of species and hybrids that root easily without any pretreatment, but usually, we use one of the root-inducing chemicals on the market. If it appears to be necessary, the cuttings are soaked in, or sprayed with, a fungicide such as Captan before inserting into the cutting media (usually a mix of 50% peat moss and 50% perlite). For some kinds, our experience has taught us that it is best to stick the cuttings into individual pots, particularly the hairy-leaved and stemmed species or those that require prolonged periods for rooting and do not do well under intermittent mist. While bottom heat is generally used, we have rooted many kinds without it.

When seedlings or rooted cuttings are ready for shifting to pots, we transfer them to three- or four-inch plastic pots with the appropriate soil mixture. Most of the species can be grown to planting size in gallon containers within a year, and usually with a very good percentage of survival.

Culture: There are still many unanswered questions relative to the correct cultural procedures for this beautiful group of plants. Some species and varieties are more cosmopolitan in their tastes and can be grown quite satisfactorily under a wide variety of conditions, while others are most errant in their habits. On the whole, the group can handle many situations, except for the most soggy, wet areas. Even there, if the soil is well-drained sand, they are most happy. It has been stated by this writer and by many others that the manzanitas must be grown in well-drained soils, preferably of a sandy nature. Considering the types of hard, rocky, tight clays in which many kinds are found in nature, this statement may bear questioning. Certainly we have found that if the irrigation is carefully timed, plants are much more vigorous in our area when they are planted in the tighter clay soil of the mesa rather than in the completely drained sections of the plant communities, where the soil is a rocky, decomposed granite loam with more rocks than loam. The well-drained sites are the safest, to be sure.

When first set out, the plants are watered by basin or overhead irrigation, depending on the situation. As they become established, the irrigation periods are lengthened until two or three irrigations a year are provided. However, we are finding that in our location, the manzanitas require more water than had been our practice to provide. As an example, we have been able to virtually eliminate the amount of branch dieback on all groundcover types, as well as a number of species, by irrigating quite frequently but for shorter periods. On the other hand, overwatering can cause chlorosis in our tight clay-loam soil. This can be controlled by the application of chelates or extra amounts of nitrogen.

A study carried on at the old garden site indicated that the main cause for the severe branch dieback was caused by a fungus, *Botryosphaeria ribis* Gross. & Dug. This fungus continues to be a serious problem, particularly after the plants reach an age of eight- to ten-years-old. However, we feel this condition can be alleviated by never permitting the planting to reach the wilting point, and to experiment with different cultural practices.

The manzanita leaf-gall aphid (*Tamalia cowneii*) causes a brilliant red swelling (gall) to appear along the edge of the leaves, much like a "cauliflower ear." The main infestation occurs in September or October and for a time makes a striking display. Later on, the gall turns brown, producing an untidy appearance. Many plants are not affected, even among the same clone or species, but it is prevalent enough to warrant control. This may be done most effectively and easily by the application in August of one of the systemic sprays. While minor individual problems have arisen from time to time, and except for the serious branch dieback problem, and

considering the diversity of habitats from which the species have been collected, and the establishment of all of these diverse elements in one area, we believe the manzanitas are growing rather well here. (See: **California Horticultural Society Journal** 25(2): 37-52. 1964., and Everett, 1957. Pgs: 24-31).

Hybrids – There is a vast population of plants of the genus *Arctostaphylos* residing in all parts of California. Through species instability and the closeness of one species to another, there have arisen in the native population a large number of plants of hybrid origin or the species has changed in some manner to make it a useful garden subject. The plant explorer interested in our native flora and those desiring to find a different kind of useful garden plant have all been quick to bring these to our attention. Numerous collections of cuttings and seeds have been brought in by our own staff as well as receiving many interesting clonal selections from other persons and institutions. Hundreds of plants have been planted from time to time in our experimental plot as well in selected sites in the garden. These are all being constantly evaluated. Many weaknesses have shown up in some and have quickly passed away from the scene. A few hold great promise, and in time will be introduced to the gardening public.

***Arctostaphylos andersonii* A. Gray.**

Heartleaf Manzanita.

Propagation: Presoaking the seed from four to eight hours in concentrated sulfuric acid produces fair germination within one-and-a-half to two-and-a-half months. Cold-stratification after soaking in the acid does not increase the percentage of germination. Cuttings treated with Rootone rooted 99% within 14 days. Transferring the seedlings and rooted cuttings through pots to gallon-cans was carried out with good results.

Culture: Vigorous growth occurred during the first four years, after which there was a sudden collapse of many plants during the next three years. Well-established plants became better acclimated to the area and losses slowed down. Since the site was in the undeveloped redwood section, there was no shade available, a condition this species appears to need in this locality. Other plantings in the clay of the mesa and shadier, well-drained sites fared much better. In 1963, we acquired three lots of cuttings of the **var. *imbricata* (Eastw.) Adams ex McMinn.** [Ed: *Arctostaphylos imbricata* Eastw. TJM2]. Being material directly from the wild, the results only ranged from only 10% to 50% rooted. The losses in the nursery were high; therefore there were only a few plants available for the garden. These have not been tested long enough to make any appraisal. However, some plants have grown to two-and-a-half feet tall by three-and-a-half to four-and-a-half feet spread in four years, and seed was produced the second year. The **var. *pallida* (Eastw.) Adams ex McMinn.** [Ed: *Arctostaphylos pallida* Eastw. TJM2] has much the same history as the species. One lot of seedlings planted on the mesa 16 years ago contained several hybrids. One particularly vigorous specimen has survived and is worthy of comment. It is a beautiful gray-leaved specimen 14 feet by 24 feet, has little branch dieback—the branches touching the ground appear to have rooted—and produces quantities of white flowers in January and February, but has never set any fruit, one sure sign of hybridity.

***Arctostaphylos auriculata* Eastw.**

Propagation: One small lot of seed pretreated for 17 hours in concentrated sulfuric acid and cold-stratified for nearly two months germinated poorly, producing only five seedlings. Only two were raised for planting. Two lots of cuttings were handled; one number of brittle wood was

brought in directly from Mount Diablo, treated with Rootone, and took 62 days to root and we got only four out of 50. A second lot of much better quality wood from the same area and taken at the same time fared much better. The initial rooting started within 39 days and we acquired 63 out of a possible 78. However, due to the prolonged period for rooting, and the hairy stems and leaves, caused an excessive accumulation of salts to cling to the cuttings and when removed from under the intermittent mist, many dried up, such that even with the closest of attention our losses were high.

Culture: Since all of our material was acquired in November 1963, and not planted until November 1964, there has been little time to assess this species. On the basis of what we observe, and with only one planting dying, it would seem the future results will be good. Within a span of two-and-a-half years, one planting in rocky loam has grown from four to ten inches when planted to seven to 20 inches high by 15 inches to three-and-a-half feet spread. Others used on the mesa in clay-loam soil are now two to two-and-a-half feet tall by two-and-a-half to four feet spread, and all are in excellent condition.

***Arctostaphylos canescens* Eastw.**

Hoary Manzanita.

Propagation: Four collections of seed in 1954 and one in 1956 brought in from the wild produced two hundred seedlings from four ounces of seed. The best germination resulted from 17 to 20 hours soaking in concentrated sulfuric acid and the fresh seed. Attempts to produce additional stock in 1958 and 1960 resulted in failure or only a few seedlings. Only one lot produced more in 1960 than 1954, 100 seedlings against 27 in 1954. One lot of 17 cuttings was taken from our cultivated plants in April 1964. Root initiation began in 25 days and 12 rooted out of 17; however, all were lost during the transfer to pots and cans. The hairiness of the leaves and stems accumulated too much salt and the cuttings dried up after removal from the mist. Two seed lots from the wild of the **var. *candidissima* (Eastw.) Munz.** [Ed: the var. is not recognized in TJM2], harvested in 1954, produced many more seedlings than the above with the same treatment. From one lot of cuttings taken from our cultivated plants in March 1964, 50% rooted in 45 day. Another lot of 40 cuttings taken in June 1964 began rooting in 27 days, and 35 out of 40 rooted. Results were just as bad as the species in bringing them to planting-out size.

Culture: All of our plants were used in the plant community section, where full sun and rocky decomposed granite loam are the conditions. Excellent growth was made for the first four or five years, after which several plants each year would suddenly collapse, one day appearing healthy, and dead the next day. Additional or lesser amounts of water gave no answer. The species appears to have a weak root system and is highly susceptible to root rot fungi, even in perfectly drained soil. We have not used either species or variety on the mesa in clay-loam soil. It is our feeling that it might do better. From seed-produced plants, fruiting begins within five to six years.

***A. canescens* var. *sonomensis* (Eastw.) Adams.** [Ed: *A. c.* ssp. *sonomensis* (Eastw.) P.V. Wells. TJM2]

Propagation: Our first material was received in 1962 as two potted plants. From these, we took 18 cuttings in September 1963 and another lot of 17 cuttings in July 1964. Both lots rooted 100%, with root initiation starting in 31 and 36 days respectively. An additional two lots of cuttings were brought in from the type locality in November 1963. One lot of 35 cuttings began

rooting in 45 days, and a selected clone of 22 cuttings started rooting in 39 days. A total of 31 were rooted, but many died after removal from under the mist. No seed collections have been processed to date.

Culture: Out of a total of 15 planted in 1964 and 1965, ten were alive in 1967; the best specimens are those plants growing in the clay-loam soil on the mesa. Plantings in the chaparral section have grown more than double in size in three years and have started producing seed.

***Arctostaphylos cinerea* Howell.** [Ed: *Arctostaphylos* x *cinerea* Howell. This is now considered a hybrid between *A. canescens* and *A. viscida*. TJM1]

Del Norte Manzanita.

Propagation: Seed received in 1949 from Louis Lake Edmunds, Danville, California, was sown in January 1950. It was first treated for one hour in concentrated sulfuric acid and soaked for one hour in hot water. Germination started 75 days later, but maximum germination was not attained until March 1951, when there were 28 seedlings from a trace of seed. There were no losses in the nursery.

Culture: In a very rocky loam in full sun, 17 plants, four to eight inches tall, in good condition, were planted in 1951. After the second year, it was evident that all but one were *A. hookeri*. They were all maintained as such until 1966, when all plants except the *A. cinerea* were removed. This plant in 1967 was five-and-a-half feet tall by nine feet spread, in good condition, and had produced fruit since 1957.

***Arctostaphylos columbiana* Piper.**

Columbia Manzanita.

Propagation: The germination record of this species has always been very poor. Two collections made in 1953, four in 1959, and one in 1964 never produced any seedlings or only a few from any one sowing, no matter what pretreatment method was used: freezing the seed in jars with wet sand over prolonged periods, months of cold-stratification at a time or broken intervals, soaking in hot water, and varying numbers of hours soaking in concentrated sulfuric acid. While the most seedlings were obtained through soaking in sulfuric acid for 18 to 20 hours, there were times when no seedlings came up, even in the same lot of seed. From a total of four ounces of seed sown over a period of three to four years, 102 seedlings came up. Once the seedlings came through, there was little difficulty in raising them to planting size. In November 1963, 30 cuttings were taken from our cultivated plants. Root initiation began in 29 days, and 27 eventually were rooted and potted off. In July 1964, 20 cuttings were taken from the same collection; rooting began in 29 days and 16 were rooted and potted off. From another collection in the garden, we took 14 cuttings in November 1963 and seven rooted, the first in 34 days. Equally poor seed germination occurred for the **var. *tracyi* (Eastw.) Adams**. Seeds that were presoaked for seven-and-a-half hours in concentrated sulfuric acid produced one seedling within a year. Ten months later, a second lot of these seeds were cold-stratified in sand for nearly nine months, soaked for 24 hours in sulfuric acid, and three seedlings came up. From these plants growing in the garden, 12 cuttings were taken in November 1963 and two rooted, taking 39 days to start roots. A second lot of 15 cuttings taken in April 1964 took 35 days to root and we got 11 plants. Only one plant from the two lots was raised for planting.

Culture: Between 1954 and 1966, several collections have been added to the plant community area, mostly in sun but with some shade from surrounding trees. Growth has been rapid, some plants attaining heights to five feet and spreads to 11 feet in four years. Our oldest plantings are now 13-years-old, six to ten feet tall by eight to 12 feet spread, and have produced seed for at least eight years. Our few plants of the **var. tracyi** are growing in a more rugged situation and the 11-year-old plants are two feet tall by three to five feet spread, and have not produced any seed.

***Arctostaphylos crustacea* Eastw.**

Brittleleaf Manzanita.

Propagation: Seed gathered in 1930 was tested for germination in 1955, but failed to produce seedlings after 21 hours of soaking in sulfuric acid and holding in flat for six months. Seed harvested from plants growing at the old site produced a few seedlings after three hours of soaking in sulfuric acid and 24 hours of the hot water treatment. The best results were obtained from a 1962 collection that produced 30 seedlings from one-quarter ounce of seed after soaking in sulfuric acid for 17 hours and cold-stratifying for four months. Eighteen cuttings taken in July 1964 from these plants in gallon-cans in the lath house started rooting in 36 days and resulted in a total of 15 plants. Only minor losses occurred during the nursery growth stages. The **var. rosei (Eastw.) McMinn**. [Ed: *A. c. ssp. rosei* (Eastw.) V.T. Parker et al. TJM2], acquired through gifts of established plants in cans, was increased by taking cuttings from these plants during November 1964, untreated but in individual pots, all rooted and in October 1965, treated with Rootone, 98% of which rooted. The first lot took 38 days to root, and the second 30 days – the treated cuttings rooting a little faster.

Culture: Only minor losses have occurred during the past 15 years, the plants being fine specimens two-and-a-half to six-and-a-half feet tall by 11 to 13 feet wide. Fruiting began about the seventh year and has been sparse. The **var. rosei** has done exceedingly well, having attained sizes of two-and-a-half feet tall by four feet spread in two years.

***Arctostaphylos cruzensis* Roof.**

Arroyo de la Cruz Manzanita.

Propagation: On June 12, 1963, cuttings were taken from the topotype plant at Arroyo de la Cruz. Transporting them to the garden in an ice box, we stuck and treated 33 tip cuttings with Rootone. On July 11, 1963, rooting started and we got 29 plants. A total of 13 were raised for our plantings.

Culture: The 13 plants in gallon-cans were used in a plot on the mesa where we have a tight clay-loam soil. Here since November 1964, the plants have made a fine low and tight ground cover, vigorously spreading out to form specimens spreading to eight feet wide and heights of not more than eight inches. Only when the plants become too dry do they show any branch dieback, and this summer (1967) we had air temperatures to 109° F.

***Arctostaphylos glandulosa* Eastw. var. *cushingiana* (Eastw.) Adams ex McMinn forma *repens* J.T. Howell.** [Ed: *A. g. ssp. cushingiana* (Eastw.) J.E. Keeley et al. TJM2]

Huckleberry Manzanita.

Propagation: Only one lot of cuttings has been handled since we obtained our first plants in 1953. Tip cuttings were taken in July 1962, treated with Rootone, rooting began in 18 days and 95% were rooted.

Culture: Our original plants were acquired in 1953 from the late Mr. Louis Lake Edmunds of Danville, California, and they were planted in well-drained, rocky, granitic loam. While excessive burrowing by moles and other factors tended to slow down growth, this form appears to be naturally slow. After a protective barrier was placed around the plants, they have developed into a single clump nine inches tall by three to four feet spread. Neither flowers nor fruits have been produced during the past 15 years.

***Arctostaphylos densiflora* M.S. Baker.**

Sonoma Manzanita.

Propagation: The only lot of seed we have used was acquired in 1947, and was thought to be of hybrid stock. Two lots were sown in January 1950. The first lot of three-quarters ounce of seed was soaked for three hours in concentrated sulfuric acid, and then soaked for 24 hours in the hot water treatment. When no germination occurred by August 1950, pine needles were burned over the flat. First germination did not occur until January 1951, a few days over a year. We potted off a total of 40 seedlings, and probably would have gotten more if the flat was held longer. The second lot, sown at the same time and with the same amount of seed, was given the hot water treatment for 24 hours. At the same time as lot 1, pine needles were burned over the flat in August 1950. Again, germination did not occur until January 1951. A total of 64 seedlings were procured. All of the seedlings proved to be remarkably uniform and were not considered to be hybrids. This species is more easily produced from cuttings. Rooted branches and cuttings from the wild plants have been grown and rooted successfully. Tip cuttings taken from cultivated plants, from plants growing in the nursery or in the garden, during March, May, July, October or November, were treated with Rootone; all rooted within a month and at least 90% of each lot rooted.

Culture: From the standpoint of appearance throughout the year, the small amount of branch dieback, diversity of use, the acceptance of general garden culture with more than normal amounts of water, has gained for this species a place of high esteem and is probably our most useful and satisfactory manzanita. While some losses have been experienced, its general history for the past 16 years has been excellent, performing well for screening, background and specimen plantings. The four most notable cultivars, namely, *A. densiflora* 'Harmony', *A. densiflora* 'Howard McMinn', *A. densiflora* 'James West', and *A. densiflora* 'Sentinel', all introduced and provided by the Saratoga Horticultural Foundation, have all performed admirably. [Ed: Three of these cultivars, 'Harmony', 'Howard McMinn', and 'Sentinel' are hybrids involving *Arctostaphylos densiflora*, and are introductions of the Saratoga Horticultural Foundation. While only the fourth, 'James West', is considered a selection of *Arctostaphylos densiflora*, and was introduced by Louis Edmunds' native plant nursery in Danville in 1947.]

Three plants of 'Harmony' in gallon-cans were received in February 1960, and planted in March 1960, on the mesa in a fine clay-loam soil. Two of these plants subsequently died, but the third is now a plant five feet tall with a 15 feet spread, and in all ways a handsome and vigorous plant, thickly clothed with leaves, but does not flower profusely for us. Additional plants raised from cuttings are doing exceedingly well in the same area. 'Howard McMinn' has been established

since March 1960, and this handsome plant is one of the best: flowering profusely, showing no evidence of decline, and easily reproducible by cuttings. We have a fine stand of this cultivar growing on the mesa, the original plants being six feet tall by 12 feet spread. 'James West' was the first of these cultivars introduced here, in January 1958, coming to us as established plants in gallon-cans from Louis Lake Edmunds. One of the original remains, a beautifully mounded plant two-and-a-half feet tall with a spread of ten feet. Flowers profusely but does not produce any seed. It has been one of our most satisfactory cultivars, doing well in full sun or partial shade. 'Sentinel' came to us in February 1960 as plants in gallon-cans. Its first growth was rather open and rangy, but in the last two years, it has become more thickly clothed with leaves. Plants are now five to six feet tall with spreads eight to ten feet; flowering is not abundant. The naturally open branching habit could be used to advantage by training the structure to yield a plant of considerable interest.

***Arctostaphylos edmundsii* J.T. Howell.**

Little Sur Manzanita.

Propagation: Two collections of seed, one from the wild, the second from cultivated plants, took 27 to 42 days to germination after being soaked in concentrated sulfuric acid for 19 hours, the longest period being to the seed harvested in the garden. A second lot of this same collection of garden seed, sown a year later, germinated in 24 days after seven hours of soaking in sulfuric acid. In 1962 and 1963, seed from several selected plants in the garden were sown. Pretreated with 19- and 20-hour periods of soaking in sulfuric acid, all lots germinated in 22 to 27 days, the quickest being from 20 hours of soaking. Since there is great variability shown among the plants of this species, both in the wild and in cultivated material, asexual reproduction is necessary. Our records indicate that we have taken cuttings at nearly all times of the year, and consistently they all show about the same results in number rooted, usually well within the 90% bracket. There has been considerable difference in the time before initial rooting starts, and the time of the year did not seem to make much difference. A collection from the wild, treated with CUTstart XX took 49 days to root and had the poorest percentage. Garden-selected material using CUTstart XX took 25 and 27 days, while Rootone-treated cuttings took 25 to 64 days. Non-treated cuttings took 47 and 57 days, and one lot with bottom heat and four extra hours of light took 45 days. While the percentage of non-treated cuttings was just as high, the treated cuttings produced roots much quicker. All seedlings and cuttings were easily grown through the nursery.

Culture: Selected from a single clone in the wild, the late Mr. Louis Lake Edmunds gave us in 1950 our first start of three plants in gallon-cans. Since no shade was available in 1951, they were planted in full sun, in rocky, decomposed granite loam. Since then they have thrived and the three plants have now become one large clump, two-and-a-half feet tall with a spread of 19 feet by 16 feet. Flowering began in January 1954 and first seeding was recorded in 1957; however, earlier fruiting probably occurred. Subsequently, many hundreds of rooted cuttings have been used extensively in many parts of the garden. It has performed well in any situation, whether in full shade, semi-shade, sun, sharply or poorly drained soils, massed or individual plants, severely clipped groundcovers, or in naturalistic plantings. During prolonged wet periods or in low ground where water may accumulate, the outer leaves touching the ground will die out. Therefore, we have recommended that its best use is on mounds, where the moisture drains away quickly. During the cool winter months the leaves turn a deep ruddy brown, adding to the

attractiveness of the plant, particularly when in full flower in January. Sharp frosts as low as 23° F have nipped the new tender branch tips, but the mature growth has remained unharmed.

***Arctostaphylos elegans* Jeps.**

Konocti Manzanita.

Propagation: Only two collections have been handled during the past 15 years. One seed collection from wild plants was harvested in October 1954, and was sown after a 20 hour soak in sulfuric acid. A month later, only six seeds had germinated. A second sowing of the same collection in October 1956 failed to germination after receiving the hot water treatment and soaking for seven days. We have not attempted cuttings since our material has not been quite suitable.

Culture: Five plants, measuring three to ten inches tall, in good condition, were planted in the yellow pine forest section, in full sun and rocky, decomposed granite loam. Until 1965, all were alive, but two were poor and were removed. The remaining plants are two to five feet tall with spreads of four-and-a-half to eight-and-a-half feet. To date, no seed has been produced. A lone plant from this seed lot was used in another location and has done moderately well, but has never flowered or seeded. A second collection of seven plants produced from cuttings was received from Strybing Arboretum in March 1963. They were planted in the foothill woodland section on October 28, 1963. They are all doing well in 1967, having grown from eight to 18 inches tall to plants 27 inches to four feet tall by 14 inches to two-and-a-half feet spreads. No fruit or flowers have been set to date. This species is a most attractive one, but generally, little mention has been made of it in literature.

***Arctostaphylos glandulosa* Eastw.**

Eastwood Manzanita.

Propagation: Eight collections of seeds, harvested in various localities from San Diego County to Humboldt County between 1947 and 1965, have been processed in the nursery. Germination was never abundant, but no matter what process was used—soaking in sulfuric acid for periods of four, five, six, 19 or 20 hours, hot water treatment and soaking for several days, cold-stratification or none, burning pine needles or excelsior over the flats—all produced anywhere from none to 40 seedlings, even within the same lot of seeds. One-eighth ounce sown in October after soaking for five hours in water began germinating in two months and produced 40 seedlings, while other lots with more drastic treatments ended up with less seedlings and took from four or five months to two years to germinate. One example is a Lake County collection in 1954 sown two months later after a 20 hour soak in sulfuric acid, began germination in four months, reached maximum germination in two years, and produced seven seedlings. A second lot of the same collection, sown two years later and first soaked in boiling water and allowed to remain in the water for seven days, failed to germination after two years. The third lot, sown on October 14, 1958 after soaking for four hours in sulfuric acid, and then cold-stratified until April 14, 1959, when germination had started. Ten seedlings were potted off. The fourth lot was sown October 4, 1960, four years after collecting. It was treated to 19 hours in sulfuric acid, cold-stratified until March 10, 1961, but germination did not start until January 4, 1962 with maximum germination in March 1962. A total of 52 seedlings were potted off. While we have not resorted to rooting cuttings, we know that it can be done satisfactorily and is the preferred method, if proper material is available. Two lots of the **var. *adamsii* Munz.** [Ed: *A. g. ssp.*

adamsii (Munz) Munz. TJM2] were raised from seed, the best production from fresh seed with six hours in sulfuric acid. Ten years later, the second lot was sown after a 19 hour soak in sulfuric acid, then cold-stratified for five months. Only one seedling came up seven months later. All cuttings taken on Mount Diablo in November 1963 failed to root except for two and these later died in the nursery. A 1953 seed collection of the **var. *crassifolia* Jeps.** [Ed: *A. g. ssp. crassifolia* (Jeps.) P.V. Wells. TJM2] produced 54 seedlings from one-quarter ounce of seed that was soaked for six hours in sulfuric acid when sown two months after harvesting in the wild. Germination began 33 days later. Four years later, another sowing was made, the seed being soaked for seven hours in sulfuric acid. Only eight seedlings came up, starting 28 days later. About 95% of softwood tip cuttings taken in May from garden plants began rooting in 36 days when given only bottom heat and four hours extra light. A total of nine collections, four of seed and five of rooted cuttings, have been handled since 1954. Seed germination results were much like the species, taking from two to several months to produce a moderate amount of seedlings after the usual pretreatments or combinations thereof. Rooted seedlings, cuttings from wild plants, or from plants established in the nursery all were grown or rooted with excellent results. From a very few seeds of the **var. *mollis* Adams.** [Ed: *A. g. ssp. mollis* (Adams) P.V. Wells. TJM2], gathered in the wild in 1964, we got 19 seedlings after treating the seed for 19 hours in sulfuric acid and five months cold-stratification. The only accession received, in 1963, of the **var. *zacaensis* (Eastw.) Adams ex McMinn.** [Ed: the var. is not recognized in TJM2] failed to germinate after similar treatment.

Culture: The lack of large quantities of seedlings has been offset by the successful growth of this species in the garden, where it has been used in a variety of habitats. Generally, losses have been small, our two to 15-year-old plantings registering no losses or only an occasional plant. Sizes range, on an average, from two to seven feet tall with spreads of three to 12 feet. Flowering and seeding have been abundant from the third or fourth year after setting out.

Sixteen plants of the **var. *adamsii*** were planted in November 1953. All 16 are alive and in good condition, having attained sizes of 15 inches to six feet tall by three to nine feet spreads; flowering and fruiting began in 1956. The **var. *crassifolia***, a somewhat sprawling group, has grown equally well. Of the 46 planted in November 1954, 40 are alive, in good condition, three to five feet tall and spreads of two-and-a-half to 14 feet; fruiting began in 1959. Several collections of the **var. *cushingiana* (Eastw.) Adams ex McMinn.** [Ed: *A. g. ssp. cushingiana* (Eastw.) J.E. Keeley et al. TJM2] have also done very well. Our first number, set out in 1955, has registered no losses, while a number of other collections have done almost as well. Fruiting was recorded in the fifth to seventh years. A number of selected types from Mount Vision (Marin County) are being observed, all of which appear to be establishing well here. Our first collection of the **var. *mollis*** was added in November 1965, and while only one plant has died, it is too early to assess the final results here.

***Arctostaphylos glauca* Lindl.**

Bigberry Manzanita.

Propagation: Seed harvested from our garden plants produced few seedlings in 1950 and 1951 when given the usual treatments. Another collection in 1952 from wild plants produced the most seedlings five years later (1957) when treated for 15 hours in sulfuric acid. Again, cuttings, both from cultivated plants and direct from the wild, rooted exceedingly well when treated with Rootone, usually taking 25 to 30 days to start rooting.

Culture: This Southern California species grows happily for us. Our oldest plants were set out in 1951, began producing seed within five years, and have grown to sizes of five to ten feet tall by eight to 18 feet spreads. Moderate amounts of branch die-back have been noted, but the most serious handicap to its appearance occurs during the fall, winter and spring months, when the new leaf growth is attacked by the manzanita leaf-gall aphid (*Tamalia cowenii*), causing a brilliant, but highly distorted leaf edge. This in time turns brown, leaving a messy looking plant.

***Arctostaphylos hookeri* G. Don.**

Monterey Manzanita.

Propagation: While our best results were obtained from seed harvested from our own plants and soaked for 24 hours in water first brought to boiling, and while subsequent collections produced enough seedlings by this same method, we found that burning pine needles over the flat several weeks later seemed to give added impetus and quicker results. Even soaking up to 19 hours in sulfuric acid did not seem to have any harmful effects on wild harvested seed. However, again, production by cuttings is the most satisfactory method, and a necessary procedure to produce the several interesting clonal selections that have been introduced to the nursery trade, and which are discussed below.

Culture: This species has been grown far more successfully here than at the old site. Our earliest planting was made in April 1951, and consisted of 35 plants grown in five-gallon containers at the old site, being started from seed in 1948. Since it was necessary to get the plants out of the cans and as no other more suitable site was ready, it was necessary to place the plants in full sun in a very rocky, decomposed granite loam. We soon learned that if the plants were to survive, it would be necessary to apply more frequent irrigations. This procedure stops severe branch die-back, and we carry on this procedure in all of our plantings when necessary. There are now 32 plants alive in this planting; seed production began in 1952, and they have spread out to 15 feet and to four-and-a-half feet tall. Subsequent collections have not only been used in the plant community sections, but in a variety of other situations, particularly the clonal cultivars that have been introduced to cultivation, and **ssp. *franciscana* (Eastw.) Munz.** [Ed: *Arctostaphylos franciscana* Eastw. TJM2]. Our oldest **ssp. *franciscana*** planting, set out in 1951, was raised from seed of doubtful authenticity, and therefore there was considerable variation among the seedlings. However, these have thrived and been used in a variety of situations. Since that time, collections of authentic cutting grown material have been added, and most of these have done well, either in sun or high shade, the latter position being preferred here. Five plants in gallon-cans of *A. hookeri* ‘**James Roof**’ were acquired in 1961. It appears to be slightly lower growing than *A. hookeri* ‘**Monterey Carpet**’, another cultivar of the species, which we have successfully grown since 1960. Both types have accepted full sun, tight clay soil and general garden culture without any problems and have made excellent groundcovers. Another cultivar, *A. hookeri* ‘**Mills**’, acquired in 1961, has received little attention and, while it has maintained itself, we have little knowledge of its worth. Additional plants need to be grown to be used in more suitable locations. Plants of *A. hookeri* ‘**Wayside**’ were received in 1960 and since then have developed into a large clump on a small rock mound about 18 inches tall with a 15 feet spread. There has been little about the clone to attract any amount of attention, being similar to other selections, even though there has been no difficulty in raising it.

***Arctostaphylos hooveri* P.V. Wells.**

Propagation: In February 1963, we acquired 27 cuttings directly from the type plant. These were Rootone-treated and handled in the usual manner. Rooting started 42 days later and we potted off 19 cuttings. We raised eight of these for planting in the garden.

Culture: Of the eight plants set out in October 1963, there are now five alive in good condition, 13 inches to two-and-a-half feet tall by spreads of seven inches to three-and-a-half feet. Up to May 1967, no flowering or fruiting had been recorded. At this time, it is too soon to fully assess the history of this species here.

***Arctostaphylos insularis* Greene ex Parry.**

Island Manzanita.

Propagation: Seeds harvested in 1949 from large plants at the old site were sown in January 1950, after three hours of soaking in sulfuric acid followed by 24 hours of soaking in water first heated to boiling. Eight months later, pine needles were burned over the flat. First germination began on IX-26-50 with maximum germination a month later, and 100 seedlings were potted. In September 1952, a second lot from this same seed collection was given six hours sulfuric acid bath and sown. Nineteen days later germination started and maximum germination was recorded a month later, and 75 seedlings were potted. Two lots of a 1958 seed collection from Santa Cruz Island were sown in 1960, the first in January and the second in October. Both were given a 19-hour bath in sulfuric acid. Lot one was cold-stratified for nine months, and germination began 14 days later. Lot two was cold-stratified for about five months and began germination soon after removal. While only 34 and 24 seedlings were potted off from the respective lots, there is indication that long periods of cold-stratification are not necessary for this species, and further that seed from cultivated plants may give better results and that older seed may germinate faster. These are all questions that need more controlled testing to prove one way or the other. These seedlings from the wild contained a number of hybrids, again indicating that none of the species grown from seed can be assumed to be true type. There has been no difficulty in growing the seedlings to adequate planting size within a few months. While we have not rooted cuttings of this species, we assume it would be as easily done as any other species.

Culture: In our opinion, the success with which we have grown this species, both here and at the old site, and its handsome growth habit and appearance put this entity at the top of the list as the finest of all the arboreal types within this genus. On the whole, there has been only minor branch die-back; the plant needs little attention, will apparently accept wide climatic conditions, and in all respects is a good all-around plant to grow. It is the only species observed here that sporadically produces flowers and fruits throughout the year, and holds the fruiting clusters for a longer time. Flowers have been noted in mid-summer, early fall, and winter with a great abundance from January through March. Our oldest plantings, set out in May 1951, when last measured in May 1966, were six-and-a-half to 11 feet tall with spreads of eight to 16 feet, in excellent condition, and had produced flowers and fruits since 1953.

***Arctostaphylos manzanita* Parry.**

Parry Manzanita.

Propagation: Twelve collections, eight of which were of seed, have been introduced to the garden since 1951, the greatest number being brought in during 1954. Propagation from seeds has been our entire supply of plants, the two numbers of cuttings from the wild having failed to

strike roots. Seed germination has been sporadic, often taking more than a year under a variety of treatments or combinations thereof. Usually, we obtained more than enough seedlings to provide adequate quantities for our needs.

Culture: All of our collections have performed satisfactorily in all locations. The tall, arborescent nature of the plant makes it an ideal subject to use for specimen and background plantings or to train into artistic display shrubs, the long twisting branches making it an ideal plant for this purpose. While our records show only minor losses during the past 13 years we have been growing the species, severe branch die-back since the tenth year indicates more trouble ahead unless the disease can be controlled. Flowering and fruiting have started from the third to fifth year, and plants have attained sizes of three-and-a-half to 11 feet tall by spreads of five to 15 feet. Only one collection of the **ssp. *laevigata* (Eastw.) Munz.** has been grown, and it has done as well as the species.

***Arctostaphylos mariposa* Dudley in Eastw.** [Ed: *Arctostaphylos viscida* Parry ssp. *mariposa* (Dudley) P.V. Wells. TJM2]

Mariposa Manzanita.

Propagation: Between 1950 and 1954, three lots of seeds were handled. Only one collection produced more than a very few seedlings, and this occurred after soaking for four hours in sulfuric acid, followed by 24 hours in water first heated to boiling. After the first few seedlings came up, the flat was allowed to remain bone dry for four months, then pine needles were burned over the flat and germination began within ten months after sowing. Maximum germination occurred 13 months after sowing, and a total of 89 seedlings were potted from one ounce of seed. Other lots were treated up to 20 hours in sulfuric acid, but only a few seedlings came up.

Culture: This species has been used in the plant community section, where the soil is a sharply drained, rocky, granitic loam. The results have been generally good, with 15-year-old plants having attained sizes of four to eight feet tall by eight to 14 feet spreads; fruiting began the fourth year after planting.

***Arctostaphylos mewukka* Merriam.**

Indian Manzanita.

Propagation: Searching under the plants of this species, we gathered a few seeds which, after 20 hours in sulfuric acid, produced a total of four seedlings within one year, the first sprouting in three months. These were grown through the nursery, planted, and nine years later, cuttings were rooted to give us an additional 24 plants. A total of 29 out of 34 Rootone-treated cuttings were rooted, with initial rooting starting in 17 days.

Culture: The original three plants were set out in November 1955, six to 12 inches tall and in good condition. An additional plant was added two years later but died, and the first three are still in excellent condition, two to three feet tall and with spreads of five to six feet. Branches have rooted wherever they touch the soil; no fruiting has been noted to this date. Plants produced from cuttings have not fared as well, with about 55% lost within five years. Sizes range from 18 inches to two-and-a-half feet tall by 18 inches to three feet spreads, and no fruiting to date.

***Arctostaphylos montereyensis* Hoover.**

Propagation: A few seeds from the type plant were sown in January 1965 after 17 hours of soaking in sulfuric acid. Germination began in three months, but only six seedlings came through. Four of these were grown to be planted out.

Culture: In March 1966, four were planted on the mesa in a tight clay-loam soil. It is too early to assess their response in this location.

***Arctostaphylos morroensis* Wiesel. & B. Schreib.**

Morro Manzanita.

Propagation: Of five lots handled between 1950 and 1965, two collections were seeds and three were of cuttings, two of the latter from the wild and one from cultivated plants. Fifty seedlings were obtained from five-eighth ounce sown in 1950 after three hours in a sulfuric acid bath, followed by 24 hours in the hot water treatment; and after several months of drying between intermittent germination, pine needles were burned over the flat. First germination started in nine months and the maximum occurred 12 months after sowing. Seed sown in January 1965 germinated in April 1965, after 17 hours in sulfuric acid bath plus two months of cold-stratification. The germination began prior to removal from the cold. Non-treated cuttings from our cultivated plants rooted about 95%, but were much slower, taking two months when taken in May 1958. They were given four extra hours of light each day, but it is doubtful if this helped. Non-treated cuttings collected from the wild rooted somewhat quicker, requiring 27 days, but with much poorer percentages. Rootone-treated cuttings from the wild did not root any faster and produced fewer plants, since the quality of the cutting material was very poor. Losses were high during the growing stages in the nursery.

Culture: This coastal species has proved to be one of the hardiest and most successful of the manzanitas grown here. Growing in the most severe conditions, only two have died from a group planted in February 1951. They were eight to 24 inches tall, in good condition when planted, and they are now five to nine feet tall by seven to 13 feet spread. Other more recent plantings have fared equally well, growing particularly well in the heavier clay soils. Brilliantly colored fruits appear after an abundant flowering of handsome pinkish blooms. Our first fruiting was recorded within three years after planting.

***Arctostaphylos myrtifolia* Parry.**

Ione Manzanita.

Propagation: Ten numbers were handled between 1957 and 1964. One lot of poor quality seed failed to germinate. From another lot of very few seeds gathered from plants growing in a different location from the Ione area, we produced five seedlings from untreated, but cold-stratified, seed. The seed was soft and green when sown. Three were grown to be planted in 1965. Seedlings and plants were moved from the wild with some success. One lot of cuttings from the wild failed to root, but from another we got 50% to root. Cuttings taken from plants in gallon-cans in the nursery, treated with Rootone, rooted 100%. It took 31 days to begin rooting. Losses in the nursery were high, ranging from 75% to 100%, and therefore not many plants were available for use in the garden.

Culture: In all locations, except on the mesa in the tight clay-loam soil, our results have been a total loss. A few plants remain and are making a little growth in the mesa location. It has been

suggested that the soil must be kept to a pH of at least 4.5, therefore this may be the secret of growing this handsome small plant.

***Arctostaphylos nevadensis* A. Gray.**

Pinemat Manzanita.

Propagation: Until 1954, this species resisted our efforts to root cuttings, germinate seeds, or to transplant seedlings from the wild. Viable seed found in Siskiyou County produced 53 seedlings from one-half ounce of seed after a 20-hour bath in sulfuric acid. Seedlings began to appear in two months and the bulk had germinated within 11 months. Additional amounts were sown in 1956 and 1957, both resulting in failure. A very small amount of seed gathered in 1964 produced a few seedlings after 17 hours of sulfuric acid plus cold-stratification for nearly five months. Germination started within five days after removal from cold. Rooted plants and cuttings from the wild were handled successfully in September 1963. A total of 18 out of 22 plants were grown plus 117 out of 120 semihard tip cuttings treated with Rootone were rooted, beginning root initiation in 20 days. These were brought directly into the garden from 8,000 feet elevation in the Sierra Nevada. Other attempts at rooting cuttings from our cultivated plants have not been nearly so successful.

Culture: At no time have we been able to say that we can grow this species successfully here. While our oldest plants are now 12-years-old, losses have been high and the plants have not been happy here.

***Arctostaphylos nissenana* Merriam.**

El Dorado Manzanita.

Propagation: The gift of a plant in a gallon-can in November 1963 gave us the necessary material to introduce this species here. Seven cuttings taken from this plant in February 1964, treated with Rootone, all rooted, taking 37 days to initiate roots. Subsequent collections, one of rooted plants and a tiny amount of seed, have added to our total. Soaked for 17 hours in sulfuric acid, a very few seeds were sown and cold-stratified for five months, after which germination began in five days, to be completed the following month. A total of 13 seedlings were produced and five were raised to planting size.

Culture: Since our plantings are not more than four-years-old, it is too soon to assess the results; however, the latest recorded data indicates it may grow well here.

***Arctostaphylos nummularia* A. Gray.**

Fort Bragg Manzanita.

Propagation: The five collections handled between 1959 and 1964 were all grown from cuttings, either taken in the wild or from plants growing in the nursery. Hormone-treated cuttings took from 26 to 53 days to start rooting, and results were from poor to excellent, the best results were obtained using young tip growth, either from the wild or from the nursery. During the growth period in the nursery, losses were high, due principally to drying up of the stems after removal from the intermittent mist. The fine hairs on the stems collected an excessive amount of salts, causing this serious condition. Only rooted seedlings or cuttings have been handled of the **var.**

sensitiva (Jeps.) McMinn. [Ed: *Arctostaphylos sensitiva* Jeps. TJM2] Our records indicate much the same data as for the species.

Culture: The history of this species here has been discouraging. None of the plants have lived more than five years, although a variety of conditions have been provided. This species, like *A. myrtifolia*, grows naturally in very distinctive habitats, both as to soil, moisture and surroundings, and therefore needs special handling all its own. While **var. sensitiva** has performed somewhat better, a few plants having attained 12 years and produced a few flowers and fruits, the total history has not been good.

***Arctostaphylos obispoensis* Eastw.**

Serpentine Manzanita.

Propagation: The usual procedures have been followed in germinating three collections of seed, sulfuric acid bath, sowing, and cold-stratification. The usual fair germination rates were recorded. Two lots of cuttings, both taken in March, rooted 97% for one lot and complete failure for the second, the latter being very poor wood from the wild. The first lot of cuttings was taken from a selected plant in the garden with unusually deep pink flowers. [Ed: This form, selected by Everett in 1964, was later named **Arctostaphylos 'Lester Rowntree'**. This plant was introduced by Rancho Santa Ana Botanic Garden in 1982.]

Culture: The records of this hardy species show a loss of not more than six plants during the past 15 years. Hybridization is apparent in those collections raised from seed. Growth rates have been good, ranging six to ten feet tall with spreads of ten to 20 feet. Fruiting has been recorded from the third year in the garden. All in all, this is a very satisfactory species to grow.

***Arctostaphylos otayensis* Wiesel. & B. Schreib.**

Otay Manzanita.

Propagation: Six out of 28 semihard and hardwood cuttings collected in the wild in December 1954 were rooted after Rootone treatment. It took two months to initiate rooting. Only two of the rooted cuttings were grown to planting size. Three more plants from exactly the same source of cuttings as our originals were received as gifts. Additional seedlings two were raised from seed harvested from our two original collections. Sulfuric acid bath for 19 hours and five months of cold-stratification produced 116 seedlings from three-quarters ounce of seed. Germination occurred in five days after removal from cold-stratification, and was completed a month later.

Culture: This species has adapted well to our area; the recorded loss over a period of ten years has been one plant, while of the six-year-old seedlings, eight have died. They are all planted in rocky, decomposed granite loam and shaded slightly by larger surrounding shrubs. Flowering and fruiting began within two years for the cutting grown plants and four years for the seedlings. Ten-year-old plants are now four to seven feet tall with spreads of five to seven feet. Seedlings have grown somewhat faster, being three to six feet tall and having three to ten feet spreads within six years.

***Arctostaphylos pajaroensis* (Adams) Adams.**

Pajaro Manzanita.

Propagation: An adequate number of seedlings were obtained by giving the seed a four-hour bath in sulfuric acid plus a 24-hour soaking in water first heated to boiling. Other tests with longer sulfuric acid baths produced equally good results, it appears that either combinations or any one method was satisfactory for our needs. There was no problem in growing the seedlings or cuttings to planting size.

Culture: This species has performed extremely well here, losses being at a minimum. Vigorous growth has been recorded in all areas, particularly in the heavier clay sites. The ripening stages of the fruits are particularly handsome, being bright red and later softening off to deep, rich browns.

***Arctostaphylos parryana* Lemmon.**

Parry Manzanita. (NO! That's A. manzanita!!)

Propagation: Our one collection was received in March 1963 as six rooted cuttings. Two of these survived to grow to planting size. Two seed collections of the **var. *pinetorum* (Roll.) Wiesl. & B. Schreib.** [Ed: *Arctostaphylos patula* Greene. TJM1] gathered in 1954 were subjected to several pretreatments, such as hot water treatment and soaking for seven days (no germination); soaked for five minutes in Thiourea plus cold-stratification for six months yielded three seedlings; sulfuric acid bath for 17 hours yielded three seedlings; four hours plus six months yielded no germination; seven hours only yielded no germination; 19 hours plus six months yielded no germination; 18 hours plus flat sunk in outside seed bed yielded ten seedlings in 1961 from six-year-old seed. A second collection of seed, produced in 1954, 19 seedlings after 15 hours in sulfuric acid; no germination the following years with less time in sulfuric acid plus cold-stratification until in 1960, seed subjected to 19 hours plus six months cold-stratification produced 20 seedlings. Not until given at least 19 hours of sulfuric acid plus six months cold-stratification did we acquire adequate seedlings. All other methods failed or produced only two or three seedlings.

Culture: Planted in October 1963, the two plants of the species, eight to 12 inches tall, have grown in four years to two to three feet tall and with five to six-and-a-half feet spreads, and are in good condition situated in rocky, granitic loam in full sun. The record for the **var. *pinetorum*** has been quite satisfactory, growing normally, but not producing any seeds until the tenth year, and this in only one lot. Other groups from five to ten years have not produced seeds, a long time for the genus.

***Arctostaphylos patula* Greene.**

Greenleaf Manzanita.

Propagation: A variety of methods used to germinate the seed of a 1947 collection have been detailed in a former report (Everett, 1957. Pgs: 28-29). While seedlings were produced in every lot, the best results were obtained from three hours of soaking in sulfuric acid plus drying out the flat and restarting watering a few months later. Subsequent collections of seed produced the most seedlings from 18 and 19 hours in sulfuric acid plus cold-stratification for five months. Cuttings taken from a selected plant in the wild rooted in 28 days when treated with Rootone. However, the results were poor in bringing them to planting size, all of them dying in the nursery. For seedlings, we had no serious problem in growing good plants for the garden.

Culture: A planting of 25 plants in 1951 has grown very well here, there being a loss of only three plants, and these occurred after the tenth year. The specimens of this planting, in full sun and rocky, decomposed granitic loam, have attained sizes of two to five feet tall by three to 13 feet spreads, they are in good condition although there has been an increasing amount of branch die-back since the tenth year. Seeds have been noted since the fifth year of growth.

***Arctostaphylos pechoensis* Dudley ex Abrams var. *viridissima* Eastw.** [Ed: *Arctostaphylos viridissima* Eastw. TJM2]

Propagation: Five numbers of wild seed were obtained between 1949 and 1965, either from the mainland, Santa Catalina Island, or Santa Cruz Island. Nineteen-hour soaking in sulfuric acid plus cold-stratification periods of five to ten months always produced the most seedlings. There has not been any particular reason to grow plants from cuttings, but there should be no problem.

Culture: All of our plantings have grown exceedingly well, with minor losses recorded over a period of six to 15 years. Growth has been rapid, six-year-old plants attaining sizes of three to six feet tall with spreads of five to 12 feet. Seeding has started the third year. Our oldest plants are seven to ten feet tall by eight to 14 feet spread. There has been a minimum amount of branch die-back. All plantings have been in rocky, decomposed granite loam, and have received not more than two irrigations per summer.

***Arctostaphylos pilosula* Jeps. & Wiesel.**

La Panza Manzanita.

Propagation: We acquired seven plants in 1963 that had been started from cuttings. After growing them in the lath house for six months, 60 tip cuttings were treated with Rootone and 99% rooted. Fifty were grown to planting size plus the original seven plants.

Culture: This entity has grown rapidly in rocky, decomposed granite loam, but losses have been excessive, 24 having died in four years. Plants had attained sizes of three to six feet tall with four to eight feet spreads; fruiting began the fourth year.

***Arctostaphylos pringlei* Parry var. *drupacea* Parry.** [Ed: *A. p.* ssp. *drupacea* (Parry) P.V. Wells. TJM2]

Pink-bracted Manzanita.

Propagation: A 19-hour soaking in sulfuric acid before sowing plus three months cold-stratification produced the most seedlings from two collections gathered in the wild, the first in 1955 and the second in 1957. In one group, we found a plant that had very deep pink flowers. Cuttings were taken in September 1962, treated with Hormex and Wilt-Pruf, and each cutting put in a three-inch pot. They were not put under intermittent mist because of the extreme hairiness of stems and leaves. First roots were recorded 66 days later, and a total of 37 out of 50 were rooted. It is doubtful if the Hormex had any effect on the rooting, and the Wilt-Pruf was used to cut down on evaporation, since the cuttings were not under mist. Growing the seedlings and cuttings to planting size was no problem.

Culture: Excepting *A. stanfordiana*, in our opinion this entity has the most beautiful flowers. The large, deep rosy pink clusters of flowers drooping handsomely over the plant create a most pleasing picture. Grown since 1952, a very low percentage of losses have been recorded, the

plants attaining heights of three to seven feet and spreads of five to 12 feet. A particularly deep pink-flowered clone was selected and grown from cuttings. Unfortunately, only one plant has survived on the mesa and it has not flowered to date.

***Arctostaphylos pumila* Nutt.**

Dune Manzanita.

Propagation: To have plants available after our move to Claremont, propagation from seed was started in 1948. Subsequently, five additional collections of seeds plus two of cuttings have been grown. Pretreatments with sulfuric acid baths for 18 to 20 hours plus six months cold-stratification consistently gave us the best results from seed, while hormone-treated cuttings rooted well. During the growing-on period in the nursery, only minor losses were noted.

Culture: This Monterey Bay species has grown exceedingly well for us in sun, semishade, and shade, proving to be one of our most hardy and dependable plants for low mounding effects or semi-prostrate groundcovers. Plants grown from seed are variable in growth habits, ranging from less than two feet tall to six feet, and spreading out as much as 16 feet. The soft gray-green of the small leaves and rather slow uneven growth makes this species a useful garden plant. Mortality over the past 16 years has been very low in both tight clay soil and well-drained rocky granitic loam. Branch die-back has been a minor problem, and if plants are not over-irrigated, one can expect a long life for this species. One of our best clones of this species is eight inches tall and has spread to 12 feet wide. This plant is growing where it only receives morning sun. It has been propagated for groundcover use at the garden. The small white flowers and greenish fruits do not make much of a display, but the plant's growth habit and other hardy features make it one of the best choices for garden use.

***Arctostaphylos pungens* Kunth.**

Mexican Manzanita.

Propagation: While pretreatment of seed for six or seven hours in sulfuric acid bath has produced the most seedlings, it took a year or more to acquire an adequate number of seedlings. A 17-hour soaking in sulfuric acid started germination in 22 days, indicating longer treatments in sulfuric acid would be more satisfactory. One group of softwood tip cuttings was rooted without any pretreatment, but only 40% rooted, requiring 40 days to initiate rooting. Growing the seedlings and rooted cuttings to planting size posed no particular problem in the nursery. The **var. montana (Eastw.) Munz.** [Ed: *Arctostaphylos montana* Eastw. TJM2] was produced only from seed, which was much more erratic in its response to various pretreatment procedures. As an example, the first lot of a wild seed collection was sown three months after harvesting. It was pretreated with a 19-hour sulfuric acid bath plus cold-stratification for nine months, and yielded only five seedlings. The second lot of the collection was sown a year after harvesting, given the same pretreatment, but only six months of cold-stratification. Germination in both lots started within a few days after removal from cold-stratification, but over 100 seedlings came up from the second lot. A total of ten lots of seeds from four field collections have been sown in the nursery and none of them showed any consistency in germination, going from complete failure to a few or many seedlings.

Culture: The history of this species at the old site was one of almost complete failure, due to the severe branch die-back that occurred there. The results here have been just the opposite: very

little branch die-back has occurred, the plants have grown vigorously, and there has been a minimum of losses. For our principal planting, set out in November 1953, there has been no recorded loss. The plants range in heights from four to nine feet and spreads of six to 15 feet; seed was produced in the third year and they have produced heavy crops every year since. The history of the *var. montana* has not measured up to the species, being a much more difficult entity to grow. Losses have been high and the condition of the plants has generally not been as good. It took from four to ten years for seed production to start, the length of time depending on the vigor of the collection. The quickest seed production was recorded for that collection that gave the quickest and best seed germination, while the longest time was ten years for a collection from which we got few seedlings and was a slow germinator. Our oldest planting, made in 1954, has plants ranging in height from 15 inches to two feet and spreads of three to eight feet. A more vigorous lot in six years has plants one to four feet tall by 15 inches to ten feet spreads, and fruiting began the fourth year.

***Arctostaphylos rudis* Jeps. & Wiesel.**

Shagbark Manzanita.

Propagation: Forty cuttings of semihard wood taken from wild plants were received in February 1965. These were treated with Rootone, 98% rooted, with root initiation beginning in 37 days. Only two rooted cuttings were lost in the nursery before the plants were set out in the garden.

Culture: In November 1965, 35 plants, six inches tall with spreads of ten to 16 inches and in good condition were planted in full sun in rocky, decomposed granite loam. After two years, 32 were alive and in good condition, eight to 18 inches tall and one to three feet spreads. It is too soon to make any assessment of the species here.

***Arctostaphylos silvicola* Jeps. & Wiesel.**

Silverleaf Manzanita.

Propagation: One collection of seed acquired in 1947 was first sown in January 1950 after soaking for 24 hours in water first heated to near boiling. Two seedlings emerged three months later, and after burning pine needles over the flat eight months after sowing, an additional three seedlings came up. While the flat was held for over a year, no further seed germinated. Seed was harvested from one plant in 1956 and not until given a 19-hour bath in sulfuric acid four years after harvesting did we acquire a sufficient number of seedlings. In 1962, 1964, and 1965, cuttings made in May, June, August, and October all rooted 98–99% and took 20 to 24 days to start roots. This is the most satisfactory method for production of this species when sufficient material is available. The nursery record indicates that no problems arose in raising the plants, either seedlings or cuttings, to planting size.

Culture: Two plants were set out in 1951, one in full sun and rocky, decomposed granite loam, and the second in a rocky clay in partial shade. The first plant was recorded dead in 1965, having attained a size of four feet by nine feet. The plant in semishade is still living, in fine condition, and has grown to about the same size as did the first plant. From it we have obtained additional plants through seed and cuttings. The seedlings produced a number of hybrids and therefore cannot be considered as a true species. While the younger plantings, now five-years-old, have done well, there has been about a 10% loss.

***Arctostaphylos stanfordiana* Parry.**

Stanford Manzanita.

Propagation: Several lots of five seed collections from the wild, cuttings from both wild and cultivated plants, and rooted cuttings have been handled between 1950 and 1964. All of the seed collections pretreated in the usual manner germinated indifferently, except for one, which is of interest to record here. Gathered in Humboldt County in October 1959, the first lot was sown on January 20, 1960 after soaking for 19 hours in a sulfuric acid bath, then cold-stratified for nine months. Three seedlings were noted. Lot two was sown in October 1960, pretreated in the same manner but cold-stratification period reduced to six months. Germination started nine days after removal from cold-stratification and over 200 seedlings were recorded a month later. On the whole, all cuttings, either from the wild or from selected cultivated plants, had a high percentage of rooting, for both pretreated and untreated cuttings. Usually taking from 20 to 30 days to initiate rooting, we obtained 90 to 99% rooting. Several lots of untreated cuttings rooted just as quickly and with as high percentages as the treated cuttings. Recorded nursery data indicates a low mortality during the growing-on stages before planting. The **var. *bakeri* (Eastw.) Adams**. [Ed: *Arctostaphylos bakeri* Eastw. TJM2] was first acquired in 1960 and since then additional collections have been added, all of them cutting-produced material from wild locations. Less success has attended our efforts with this variety, particularly if the wood was a little old. We had a 40 to 50% take in nearly all cases, all material having been treated with one of the rooting compounds. We noted that after a rain, the undersides of the branches would burst out with little root producing nodules, and any branch touching the ground was securely fastened by roots.

Culture: The great masses of flowers, shading from light to dark pink, produced each year by this handsome species, has made it our favorite of this large genus. In our opinion it is one of our outstanding native shrubs, even though it may be considered rather temperamental. Used extensively in our earliest plantings on the mesa, we found it short-lived in this poorly-drained area if it received too much water. However, some of the earliest plantings made in 1952 are still alive in the same area and where they have received a minimum of irrigation. At the same time, plants set out in 1951 in the plant community section where the soil is a rocky, decomposed granite loam, are mostly alive. In this area, we noted severe branch die-back and plants rapidly disintegrating. Additional irrigation was provided and the plants returned to their normal appearance. While there still is some branch die-back, it is not nearly so prevalent and there have been no losses of plants. Later plantings in other areas, while not faring quite so well, have gone along with a minimum percentage of losses. Our oldest plantings, 15 years in the garden, have attained sizes of four to seven feet tall with spreads of eight to 15 feet. Seed has been produced from third and fourth years after setting out. ***A. stanfordiana* 'Trinity Ruby'**, a clone selected for the deep pink flowers, has been tested for three years. To date our observations indicate that the flowers, while a good pink, are not as outstanding as some already selected from several of our own collections. It will bear further watching. The **ssp. *bakeri*** was first added to our collections in 1960. Since then, cutting-grown material from the wild plus additional material taken from plants in the nursery have given us a good representation of this rare subspecies. Our oldest plants have grown to six feet tall with spread of eight to ten feet in six years. Flowering and seeding has been sparse, but the plants are very healthy, appearing much stronger than the species here. A clonal selection called ***Arctostaphylos bakeri* 'Louis Edmunds'** was presented in 1961, and while it has made equal growth with the other specimens, it has shown no special features to separate it from the general run of the plants of this subspecies.

***Arctostaphylos subcordata* Eastw.** [Ed: *Arctostaphylos crustacea* Eastw. ssp. *subcordata* (Eastw.) V.T. Parker et al. TJM2]

Santa Cruz Island Manzanita.

Propagation: A few seeds acquired in 1963 produced 15 seedlings after a pretreatment of 16 hours in sulfuric acid plus four months cold-stratification. Sporadic germination occurred over a period of a year. Cuttings taken from the plants in the nursery rooted quite well on two occasions when material was taken in April and July.

Culture: A total of 36 plants were set out in November 1965, but it is too early to accurately assess the success of this species here.

***Arctostaphylos tomentosa* (Pursh) Lindl.**

Shaggybarked Manzanita.

Propagation: Five wild collections of seeds and three lots of cuttings taken from a selected plant in the garden have been handled between 1950 and 1965. Seed germination increased with the number of hours soaked in a sulfuric acid bath prior to sowing, the maximum time being 19 hours plus six months cold-stratification. Since the leaves and stems of this species are very hairy, the rooting of cuttings was more difficult. The best percentage was obtained by inserting the individual cuttings in a three-inch pot after being treated with Rootone. Kept in the "cutting room" with high humidity, about 55% rooted, while other lots were less successful under intermittent mist. February appears to be the best month to make the cuttings. Seeds of the **var. *tomentosiformis* (Adams) Munz.** [Ed: *Arctostaphylos crustacea* Eastw. ssp. *crinita* (Adams) V.T. Parker et al. TJM2] and **var. *trichoclada* (DC.) Munz.** [Ed: *Arctostaphylos tomentosa* (Pursh) Lindl. ssp. *bracteosa* (DC.) Adams. TJM2] were gathered in the wild in October 1953. Very poor germination occurred, and few plants were obtained, even with prolonged soakings in sulfuric acid.

Culture: Depending on the location in the garden where some soil conditions appear to cause trouble, the various plantings have grown well once they became settled in. Our oldest plantings, now 15-years-old, have grown to three-and-a-half to six-and-a-half feet tall with spreads of ten to 15 feet. Production of seeds began in the sixth year. This species has been used on a hot, dry bank next to a well-used path. The soft gray green leaves, arranged in ascending whorls on the stems, creates an architectural pattern interesting to most visitors. The necessity for more frequent clipping along the path has created a very effective bank covering and an interesting pattern. Effective use has also been made as a tall groundcover, where plants range from three to five feet tall, spreading out as much as 12 to 15 feet. A small degree of branch die-back has been noted and normal irrigation appears to be accepted. The **var. *tomentosiformis*** and **var. *trichoclada*** have performed very well, the former having lost three plants in ten years, while only two have died of the latter. Seed production has been slow, none having been recorded to date for **var. *tomentosiformis*** and not until the ninth year for **var. *trichoclada***. Sizes range from 15 inches to five feet tall and spreading from four to ten feet wide.

***Arctostaphylos uva-ursi* (L.) Spreng. var. *coactilis* Fern. & Macbr.** [Ed: the var. is not recognized in TJM2]

Bearberry.

Propagation: Numerous collections of seeds and cuttings have been grown, usually with very poor results for seed germination with the usual pretreatments, and on the whole, a good percentage of cuttings rooted, particularly of material taken from cultivated plants. Many times rooted branches are found and may be started easily in flats or pots. Cuttings seem to root as easily and as quickly untreated as those treated with hormone powders.

Culture: There appears to be a considerable amount of hybridization among the wild stands of this species in California, and as a consequence, we have acquired numerous collections from not only all parts of California where it is found, but many other states, and Canada. Plants from seeds and cuttings have been raised and studied in our experimental plot. Plants raised from seeds and cuttings from other states and Canada have been weak and usually have not survived. Cutting-grown materials from the north coast and the Sierra Nevada, where this species is found, have grown well in most areas in the heavier soils, but have been short-lived in the hot, rocky, decomposed granite loam sections of the garden. Plants of the **var. *coactilis*** moved from the old site and planted in full sun have been the exception, doing especially well in full loam, but with more loam in the soil. A large clump, now 25-years-old, not more than one foot high has a spread of nearly 30 feet in all directions, and it is irrigated about every three to four weeks during the dry months. The cultivar *Arctostaphylos uva-ursi* '**Radiant**' does splendidly here in the tight clay-loam soil, provided enough moisture is present, otherwise the branches die back severely, the same as for other types of this species. Said to produce fruits, this cultivar has never produced during the six years we have grown it. As with all the forms of this highly variable species, most of it being what appears to be hybrids, along the California coast, it would be expected, and is true, that the entity grows with less trouble under some filtered shade, but does grow well here in full sun provided it is irrigated frequently enough.

***Arctostaphylos uva-ursi* 'Point Reyes'.**

Propagation: This clonal selection does not produce seed because it is sterile, indicating the clone is a hybrid of unknown origin, but undoubtedly one parent is a form of *A. uva-ursi*.

Reproduction is easily accomplished by cuttings taken at any time of the year. We have grown thousands of plants by this method, either treated or untreated cuttings rooting equally well, but the treated materials rooting somewhat faster. Root initiation normally starts within 20 to 30 days. Rooted branches may be carefully removed from the parent plant and can be established in nursery flats in order to attain larger-sized plants in less time. There have been no problems in growing and producing these plants to planting size in the nursery.

Culture: Our original four plants were received from the late Louis Lake Edmunds, Danville, California, in January 1949. The following May, they were planted at the old site and grown there until February 1951, at which time they were removed and put in gallon-cans. In April 1951, they were planted at the present site, in rocky, decomposed granite loam in full sun. The original four plants are still alive, and in 17 years have grown into one clump about two feet tall with spreads of 15 feet by ten feet. While flowering has occurred regularly, no seeds have ever been set. At the time we received the plants, Mr. Edmunds told me he had grown the plants from cuttings which he collected on Point Reyes, Marin County, near the lighthouse. He stated that he had observed the leaves thickly clothed the entire long branching system, instead of only a portion, as so often is the case in this complex. We grew additional plants in 1955 from cuttings, and planted them in the tight clay-loam soil on the mesa, in full sun. Observing that the established plants began to show a considerable amount of branch die-back during the hot

summer months, we increased the amount and frequency of irrigation. This proved to be the answer to our problem, and even though temperatures ranged over 90° F on many days during the summer months, the plants remained in a healthy condition. After several years of observation, tests were made to determine the reasons for not setting any seed. It was definitely established that the clone was of hybrid origin. Since they reacted so well here, it was introduced to commercial growers in 1962. In poorly drained areas, the plants may turn yellow, a chlorotic condition indicating too much water. This can be overcome by reducing the amount or frequency of irrigations and applying a nitrogen fertilizer. The leaves will return to their normal green in about ten weeks. We have used this clone extensively as a groundcover, and it has been effective in every way, and has proved to be a popular item with commercial growers.

***Arctostaphylos virgata* Eastw.**

Bolinas Manzanita.

Propagation: Seeds collected in 1954 on Mount Vision in Marin County germinated extremely poorly, even with the most vigorous pretreatments, when attempted on several occasions up to 1960. In November 1963, cuttings taken from a particularly fine specimen rooted slowly and poorly, and all died in the nursery.

Culture: Gophers, excessive heat, and other causes killed all of our plants over a period of six years. One plant fruited, but since the manzanita species hybridize so readily, it is of little use to harvest seed in the garden.

***Arctostaphylos viscida* Parry.**

Whiteleaf Manzanita.

Propagation: Twelve collections of seeds, one from our cultivated plants, and 11 from several locations in the wild, have been processed, but being one of the more difficult species to germinate, even with the most vigorous pretreatments, not many, but enough, seedlings were raised for our purposes. No cuttings have been attempted. Seedlings collected in the wild have been successfully raised and established in the garden.

Culture: The history of this species here has been good, except for the untidy appearance caused by a high degree of susceptibility to branch and leaf die-back. The survival of the fourteen collections, ranging from four to over 15 years in age, has been very good, only minor losses having been recorded. Except for a few plants, all of the material has been used in the various plant communities in which it has been found in the wild. While our present observations indicate that the species appreciates a little heavier soil, it is too early to categorically say this is true. Our largest specimens have attained sizes of four to 12 feet tall with spreads of five to 16 feet. Seed production usually started within the first four years. There is a high degree of variability among the various collections raised from seed.

***Argemone* L.**

Prickly Poppy.

Annuals or Perennials.

Papaveraceae. Poppy Family.

Propagation: During the past 15 years, we have grown two species and two subspecies of this genus. Our best and quickest germination occurred when fresh seed was sown and pine needles were burned over the flat. The first seedlings appeared in 19 days and maximum germination occurred within one month. The seedlings were pricked off to two-inch pots, and later moved to four-inch pots, and when sufficiently large in the latter container, they were planted out in the garden. The potting mixtures should be fast draining, and care exercised in watering. The largest percentage of seed lots were sown directly into the areas where they were wanted. No additional treatment was provided in the open areas. In such cases, germination was much slower, usually taking up to three months, depending somewhat on the age of the seed. We found generally that older seed was slower to germinate, as well as the amount of seedlings produced being much less.

Culture: Under cultivation, the species of this genus appear to be short-lived. This could be quite true in the native areas, too. However, in most cases, volunteer seedlings appear from year to year, keeping each entity from disappearing. We found it necessary to provide good drainage, full sun, and a minimum amount of irrigation for best results. The following species and subspecies were raised: *A. corymbosa* Greene., *A. munita* Durand & Hilg., *A. munita* ssp. *robusta* G. Ownbey. [Ed: the ssp. is not recognized in TJM2], *A. munita* ssp. *rotundata* (Rydb.) G. Ownbey. [Ed: the ssp. is not recognized in TJM2].

***Aristolochia californica* Torr.**

California Dutchman's Pipe.

Perennial Climber.

Aristolochiaceae. Pipevine Family.

Propagation: We have never been able to collect viable seed, and therefore, have no experience to record. Being a rambling, vine-like plant, rooted branches are easily found and can be started readily. We dug some of the branches and moved them to areas where we want the plants to grow. The flowers are pollinated by fungus gnats. The gnats do not deliberately collect pollen or nectar, but get disoriented inside the flowers and often end up pollinating them by accident.

Culture: Bare-root plants were first acquired in 1930 and were grown continuously at the old site. Seventeen rooted plants were moved to gallon-cans in March 1951. In July 1951, these were planted on a shady north slope of tight clay-loam soil. In February 1952 an uncounted number of rooted runners were added to our planting in the same area. In 1955, rooted runners were transplanted to another site under oaks on a very steep bank in extremely hard clay. In both sites, the vine-like plants have ranged widely, displaying naturalistic and good ground covering qualities. Flowering has been abundant, but no seed production has been observed.

***Armeria maritima* (Mill.) Willd. var. *californica* (Boiss.) Lawrence.** [Ed: *Armeria maritima* (Mill) Willd. ssp. *californica* (Boiss.) A.E. Porsild. TJM2]

Sea-Thrift.

Perennial.

Leadwort Family.

Propagation: Seeds harvested from one collection introduced here in 1954 have been grown on successive occasions by sowing in flats or directly where wanted in the garden. In either case no pretreatment of seed is necessary. (All seed sown October–February). Germination occurs more rapidly in flats, taking from six to ten days, while when sown in open ground will usually respond in ten to 15 days. Either way, we were able to produce all the plants we needed. We never grew them in larger than four-inch or five-inch pots when produced in the nursery, and these were ready to plant out in the garden in four months.

Culture: Plants were used in sun or semishaded locations in an area with sandy loam soil. While the plants grew equally well in the various areas, they were longer lived here in a semishaded spot. Flowering and seeding occurred in a year. Generally, our plantings have lasted from three to six years, but since replacement is simple, there has been no problem of having sufficient plants for a nice display.

***Arnica longifolia* D.C. Eaton ssp. *myriadenia* (Piper) Maguire.** [Ed: the ssp. is not recognized in TJM2]

Perennial.

Asteraceae. Sunflower Family.

Propagation: A 1950 seed collection sown in a flat in September took 16 days to start germinating without any pretreatment. Raised to planting size in four-inch pots, there were no losses during the interim.

Culture: A total of 18 plants were set beside a moist stream area on the mesa. About three months later, in July 1954, plants to four-and-a-half feet tall were recorded as flowering and seeding. In April 1956, they were noted as all being dead with notation that this species is probably a short-lived perennial.

***Arnica viscosa* A. Gray.**

Perennial.

Propagation: Two collections were acquired in August 1961 and sown in November, one with nearly four months cold-stratification and the other without any treatment. The cold-stratified seed came up in 14 days after removal from cold, while the untreated seed took 30 days from time of sowing. A second lot sown about a year after the first and untreated took 16 days to germinate. All lots were raised in three-inch pots to planting size with little or no losses.

Culture: Plantings were made in a rock garden mound with a mixture of crushed rock and sandy loam. Uninteresting flowers were noted on a few plants four months after they were planted in the garden. The plantings gradually disappeared until none were left four years later.

***Artemisia arbuscula* Nutt.**

Shrub.

Asteraceae. Sunflower Family.

Propagation: Two numbers of seed were collection in Lassen County in October 1952. The seed was sown the following September 1953, and excellent germination occurred within five to six days. Additional lots were sown in 1956 and 1957, but none of them germinated, indicating the

life of the seed is short. While there were some losses in the seedling stage, we grew 107 to planting size.

Culture: Several sites were chosen for this species, all of them well-drained and of rocky loam. A total of 70 were used in the plant community section and ten years later there were two alive and in poor condition. The largest size attained was six to ten inches tall with spreads of eight to 16 inches. Flowering started during the third year, but no attempt was made to harvest seed. Additional studies need to be made to grow this species satisfactorily here.

***Artemisia douglasiana* Besser.**

Perennial.

Propagation: One lot of seed was acquired in October 1953, sown in November and germination started eight days later without any pretreatment. Only 55 were potted off and 50 were raised in gallon-cans to suitable size for planting.

Culture: Planted in November 1954, there has been no problem with this species. Growing in full sun in a very rocky loam, the planting has spread out by underground runners until it covered an area more than ten feet square and have reached heights of four to six feet.

***Artemisia dracunculus* L.**

Perennial.

Propagation: A trace of seed sown in September 1953 from a collection gathered in October 1952 started germinating in six days without any pretreatment. Only 30 seedlings were potted off and grown to planting size.

Culture: This species was used in open, sunny locations with either rocky loam or tight clay-loam soil. In both areas it performed equally well, but has been longer lived in the rocky loam site. While there has been a decrease in the size of the clump, now three feet by four feet, each year for the past 13 years the plants have flowered and seeded, and go completely dormant in the winter, dying to the ground.

***Artemisia ludoviciana* Nutt.**

Perennial.

Propagation: Three small bare-root plants were brought in from the wild in May 1964. These were planted in five-inch pots and grown to planting size without any losses.

Culture: Planted in November 1964, these three plants have attained excellent size in a rocky, dry stream bed of our desert garden. They are two feet tall by three feet spread and in excellent condition. Flowering and seeding started the second year.

***Artemisia pycnocephala* (Less.) DC.**

Coast Sagebrush.

Woody perennial.

Propagation: Sowing seeds, digging and transplanting volunteer seedlings and rooting cuttings are methods we have used in producing our supply of plants. Sowing seed in flats during the fall

months produces seedlings within six to eight days. Plants dug in the wild and volunteer seedlings in the garden have been moved with ease. Sixty-six percent of the cuttings rooted when taken in April and treated with CUTstart XX. Additional experimentation in the rooting of cuttings has not been carried on. Rooting took 15 days, but there was a considerable loss in the transplanting process, over 50% dying before planting.

Culture: Seedlings growing at the old site from an original collection made in 1930 were transferred to this site and since then volunteer seedlings have fulfilled our needs for this species. It grows rapidly in our heavier clay soils and since its growth habit becomes ragged with age, it can be treated as a biennial, replenishing about every two years. There are two forms of this species, one a rather tall plant to three feet and the other grows low and compact, with slender flowering stems to not more than a foot tall. A particularly fine, low compact plant was grown on from cuttings, but did not continue to prosper and was short-lived. In general, the species is short-lived here, but as seedlings occur in quantity, there is no problem in preserving the species.

***Artemisia rothrockii* A. Gray.**

Shrub.

Propagation: Our only seed collection gathered in October 1952 failed to germinate when sown on three different occasions.

***Artemisia spinescens* D.C. Eaton.**

Prostrate shrub.

Propagation: A total of 22 small plants were moved from the wild to the garden nursery in May 1958. Eighteen survived and were grown on for outside planting.

Culture: At the time, our rock garden seemed to be the most suitable site for growing this desert species. At first, the plants seemed to prosper and they flowered in 1960, two years after planting. They did lose their tight, compact growth, becoming much more open and less attractive. Since more irrigation was used in the area, these tough, hardy plants succumbed to root rots and were all gone within six years. It is now believed that they would have persisted if left completely without any additional water other than natural rainfall.

***Artemisia tridentata* Nutt.**

Great Basin Sagebrush.

Shrub.

Propagation: Several collections of seed were gathered between 1952 and 1957. All of the seed that was sown gave poor to excellent results, usually starting to germinate from five to 14 days without any pretreatment when sown in flats. There were no problems encountered during the raising of the seedlings to planting size from gallon-cans. Seed of the **ssp. *parishii* (A. Gray) H.M. Hall & Clem.**, when first sown in a flat failed to germinate. The flat was dumped nearby on a rocky mound where it came up abundantly. Seed harvested from these plants germinated in five days when sown in a flat in 1962, producing an abundance of seedlings.

Culture: Except for a few plants used in the desert garden for educational purposes, all of the material grown has been placed in the various plant community sections. While all of the plantings have grown vigorously, attaining heights and spreads of several feet in a few years as

well as producing flowers and seeds within two years, there have been more than minor losses during the period. During one year, we used Aminotriazole to control the weeds and this species was highly intolerant of this product, which caused many of the plants to die. Our largest specimens have attained sizes of five to six-and-a-half feet tall with seven to 12 feet spreads within eight years. The *ssp. parishii* in three years have developed into specimens to eight feet tall, having spreads of up to nine feet, developing into large, handsome plants. Flowers and seeds were produced in three years.

***Aruncus vulgaris* Raf.** [Ed: *Aruncus dioicus* (Walter) Fernald var. *acuminatus* (Rydb.) H. Hara.]

Goat's Beard.

Perennial.

Rosaceae. Rose Family.

Propagation: Non-treated seed will germinate in 11 to 36 days, averaging about 15 days, when sown in flats. Dormant clumps of roots can be divided without any trouble, as occurred when we broke up a large clump growing at the old garden preparatory to moving it to this site.

Culture: Some of the plants produced from seed acquired in 1937 and grown at the old site were removed, a few divided into several plants, and moved to our new location. One of these plants, now over 25-years-old, is alive and growing fairly well. Other seedlings have been used in shady locations under large oaks, and when once established, they are seen each season as plants up to three feet tall and with equal spreads. However, they have never been as luxuriant as those found in the wild, nor can they hold their leaves during hot weather. Flowering has been sparse and some seed produced, but volunteer seedlings have not been observed.

***Asarum caudatum* Lindl.**

Wild-Ginger.

Perennial.

Aristolochiaceae. Pipevine Family.

Propagation: We gathered seed from our plants in May 1954. It was sown in August 1954, and first germination was recorded March 23, 1955, and a few seedlings appeared from time to time until flat was dumped in June 1955. All of the seedlings were raised to planting size. Divisions are relatively easy to establish, either in pots or by direct planting to the site.

Culture: Since this species naturally grows in deep shade, it is necessary to provide similar situations in cultivation. In November 1951, broken pieces, rooted stems, and plants were moved from the old site and used in shady spots under oaks. After developing satisfactory clumps, additional material was moved to locations in clay-loam soil, where it has grown satisfactorily, gradually spreading over considerable areas. Even in the deepest shade, the leaves will become somewhat scorched during our hottest summer temperatures. It best develops in cooler, moister climate situations, but has proved a satisfactory groundcover for most of the year for us.

***Asarum hartwegii* S. Watson.**

Sierra Wild-Ginger.

Perennial.

Propagation: One collection of seed harvested from cultivated plants failed to germinate; three numbers of rooted stems and plants were established in pots in the nursery, but with some difficulty, being slow to take root.

Culture: We have not grown this species with any degree of success. The oldest plant in the shade of oaks, topped with humus and in well-drained soil, gradually deteriorated until all were gone by the sixth year.

***Asclepias albicans* S. Watson.**

Milkweed.

Shrub.

Asclepidaceae. Milkweed Family. [Ed: Apocynaceae. Dogbane Family. TJM2]

The remaining three plants at the old site were transferred bare-root in November 1951, but none of them survived (Everett, 1957. Pg: 33).

***Asclepias erosa* Torr.**

Perennial.

Propagation: Dormant roots can be moved with fair success and seed germinates readily without any treatment, although we tried cold-stratification on one lot. Seed sown in loose soil mixtures germinated within five days on several occasions – even three years after it was collected.

Culture: Seven plants were moved from the old site in February 1951, put in five-gallon-cans where only two survived. These were planted in August 1951 in a semishaded, very well-drained area where the plants lived for nearly five years. It was discovered that the soil was impregnated with some oil. A later collection grown from seed has spread in an area of rocky, decomposed granite loam in full sun. Flowering and seeding began the second year. The plants gradually form colonies by spreading underground root systems, but not with any degree of vigor. Each year the plants die completely to ground and after winter dormancy restart growing in the late spring months.

***Asclepias subulata* Decne.**

Shrub.

Propagation: Several collections of seed, both from wild and cultivated plants, all had poor quality seed and few seedlings were produced, but a 1958 seed collection had excellent quality seed and as a result several hundred seedlings were obtained. Regardless of the quality, all seed started germinating in four to ten days. While equally good results were recorded for sowings made in October and April, the best plants were produced from the later sowing. There were some losses during the growing stages in the nursery, particularly in gallon-cans during the summer months.

Culture: Some losses were first incurred when young plants were set out during October or November, due to sudden drops in temperature. One year, temperatures plummeted to 23° F and all plants, both young and older, were killed. Realizing early plantings are dangerous, it is recommended that seed be sown later and plantings put out in the spring after frost. Once established, our plantings have been hardy, receiving little attention during the year. In seven

years, plants have grown to six feet tall and up to eight feet spread. Flowering and seeding begins from three to five years. Each spring season hordes of very yellow aphids attack our plants and need to be controlled by spraying.

***Aster chilensis* Nees.** [Ed: *Symphyotrichum chilense* (Nees) G.L. Nesom. TJM2]

Common Aster.

Perennial.

Asteraceae. Sunflower Family.

Propagation: Seed can be germinated easily without any pretreatment, but we made divisions from a long-established planting at the old site that had been established there in 1938.

Culture: Direct planting of several clumps beside a moist stream soon became well established, spreading over several areas within two years. However, they do not produce as good a show of flowers as at the old site. The plants are scraggly, becoming infested with mildew in late summer and the flower quality is poor. Generally not as satisfactory as at the old garden site.

***Aster foliaceus* Lindl. var. *parryi* (D.C. Eat.) Gray.** [Ed: *Symphyotrichum foliaceum* (DC.) G.L. Nesom var. *parryi* (D.C. Eaton) G.L. Nesom. TJM2]

Perennial.

Propagation: Two-year-old seed from the wild took six days to come up in a flat. Seedlings were easily handled in the nursery and plants were ready for setting out in six months.

Culture: We expected this species to perform very well in the garden, as they were planted in coarse, loose soil and were not disturbed. These plants go completely dormant each winter, and were not seen during weeding operations on the site (as these occurred before new growth sprouted). The plants spread out as much as three feet, but suddenly were recorded dead in their third year, due in all probability to being over maintained.

***Aster greatae* Parish.** [Ed: *Symphyotrichum greatae* (Parish) G.L. Nesom. TJM2]

Perennial.

Propagation: Root divisions are easily established either in pots or directly into the garden site. While seed has not been sown, it is assumed to germinate as readily as any other species.

Culture: Seven plants set out beside a running stream grew so rampantly they soon had to be controlled. As a consequence, they were not as attractive as when observed in nature, where conditions are more strenuous. The flower size and color was poor, and the plants are not the sturdy specimens they should be.

***Aster occidentalis* (Nutt.) Torr. & A. Gray.** [Ed: *Symphyotrichum spathulatum* (Lindl.) G.L. Nesom. TJM2]

Perennial.

Propagation: First collected in September 1954, the seed was sown a few days later and germinated in eight days. From this trace of seed, over 150 seedlings were obtained. Another lot from this same collection was sown in September 1957, and germinated in five days with a like

amount of seedlings produced. All seedlings were easily grown to planting size in four-inch pots in three months.

Culture: Used in our rock garden, plants set out in January 1965 spread out quickly and did reasonably well until 1958 when irrigation was neglected. As a result all of the plants died, which is not surprising since this is an inhabitant of moist mountain meadows.

***Aster oregonensis* (Nutt.) Cronq.** [Ed: *Sericocarpus oregonensis* Nutt. TJM2]

Perennial.

Propagation: Good quality non-treated seed will start germinating in nine days and produces quantities of seedlings within a month. Single plants can be moved, easily divided or as clumps, and readily established by direct planting or first establishing in containers.

Culture: Our original collection was acquired in 1941 and was grown at the old site until it was moved to Claremont in March 1951, after first establishing it in containers. The location available at that time was too hot and the planting disappeared in two years. Additional collections raised from seed were used in more suitable sites and have continued to prosper here.

***Astragalus* L.**

Rattleweed, Locoweed.

Annuals and Perennials.

Fabaceae. Pea Family.

Propagation: Numerous species have been raised from seed and, invariably, the records show the seed begins to germinate on the fourth day when sown in a flat. Seed sown directly into the open ground, depending on the conditions present, will take up to two months, however, the average time is about a month. Due to the usual poor quality of the seeds, the resulting number of seedlings are few in relation to the amount of seeds sown. Insect larvae invade the pods and eat much of the seed, and it is difficult to find an uncontaminated seed crop.

When the seedlings are raised in containers, care must be exercised since they are highly subject to damp-off fungi. Open beds must be well protected from bugs, rabbits, and rodents.

Culture: Newly planted seedlings must be protected from rabbits, birds, and any other destructive forces. The various species may be grown in clays, loam, or rocky loam areas. Some appear to do best in the heavier soils. None of the perennials have lived more than a few years, on the average about three to six years, depending on the species and its natural habitat. Since flowers and seeds are produced the first season, it is not difficult to preserve most of the kinds by replenishing the supply of seedlings every two to three years. Several species and varieties have been maintained for 15 to 20 years in this manner. These plants tend to naturally go dormant during the summer months, so they should not be irrigated at that time. This can prove difficult since interplantings with other plants that require some summer irrigation can cause rotting of the *Astragalus*. Open dry areas are the best for the plants we have grown. The following species and varieties have been grown with some degree of success during the past few years. Some of them have grown naturally and successfully, while others have not done as well here as at the former site: ***A. antisellii* A. Gray.** [Ed: *A. trichopodus* (Nutt.) A. Gray var. *phoxus* (M.E. Jones) Barneby. TJM2], ***A. asymmetricus* E. Sheldon.**, ***A. coccineus* Brandegee**, ***A. didymocarpus***

Hook. & Arn., *A. douglasii* (Torr. & A. Gray) A. Gray, *A. douglasii* (Torr. & A. Gray) A. Gray var. *parishii* (A. Gray) M.E. Jones, *A. insularis* Kellogg, *A. inyoensis* Coville, *A. lentiginosus* Douglas var. *albifolius* M.E. Jones, *A. lentiginosus* Douglas var. *fremontii* (A. Gray) S. Watson, *A. lentiginosus* Douglas var. *variabilis* Barneby, *A. leucopsis* (Torr.) Torr. & A. Gray. [Ed: *A. trichopodus* (Nutt.) A. Gray var. *lonchus* (M.E. Jones) Barneby. TJM2], *A. menziesii* A. Gray. [Ed: *A. nuttallii* (Torr. & A. Gray) J.T. Howell. TJM2], *A. miguelensis* Greene, *A. minthorniae* (Rydb.) Jeps. [Ed: *A. minthorniae* (Rydb.) Jeps. var. *villosus* Barneby. TJM2], *A. nuttallii* (Torr. & A. Gray) J.T. Howell, *A. oophorus* S. Watson, *A. pomonensis* M.E. Jones, *A. serenoii* (Kuntze) E. Sheldon. [Ed: *A. serenoii* (Kuntze) E. Sheldon var. *shockleyi* (M.E. Jones) Barneby. TJM2], and *A. wootonii* E. Sheldon. [Ed: *A. allochrous* A. Gray var. *playanus* (M.E. Jones) Isely. TJM2].

***Athyrium filix-femina* (L.) Roth var. *californicum* Butters.** [Ed: *Athyrium filix-femina* (L.) Roth var. *cyclosorum* Rupr. TJM2]

Lady Fern.

Perennial.

Aspidiaceae. Fern Family. [Ed: Woodsiaceae. Cliff Fern Family. TJM2]

Propagation: More easily established from root divisions, but can be propagated by sowing spores, an experience we have not pursued. Our collections were first established in containers in our highly humidified cutting room. The plants would be kept in the greenhouse until such time as they are sufficiently well established to permit setting out.

Culture: Only a few specimens have been tested and while they have made satisfactory growth in shade in well-drained humus, they do get burned during the hot weather periods and then do not look very happy. If the air could be kept more humid, their appearance would be normal.

***Atrichoseris platyphylla* (A. Gray) A. Gray.**

Tobacco-Weed.

Annual.

Asteraceae. Sunflower Family.

Propagation: Several attempts to germinate the seed of two collections gathered in the wild proved fruitless except for two occasions. Except for one lot, all seeds were sown in the open ground. It took the seeds at least two months to emerge and this always occurred in February, even when sown in the nursery.

Culture: Only once did we flower a plant, and this was a very poor representation. Usually all seedlings—what few we could germinate—died from rot caused by the colder, wet winters than what this species usually finds in the wild.

***Atriplex canescens* (Pursh) Nutt.**

Wingscale.

Shrub.

Chenopodiaceae. Goosefoot Family.

Propagation: Several untreated seed collections from the wild sown in flats started germination on the sixth day. Three accessions of scarified seeds harvested in January 1958 and November 1956 were received from the U.S. Forest Service. It was stated that generally, germination is increased by storage of the seed in sealed containers that are kept at room temperatures. Three lots, each containing 200 seeds, were soaked for four minutes in Thiourea prior to sowing. Two of these lots started germinating in four days, one lot in five days, but only 30, 13, and 17 seedlings were produced. In all cases, germination was poorer with Thiourea-treated seed than without treatment. Another lot was sown of the collection that produced 13 seedlings from Thiourea-treated seeds, and germination occurred in six days and 60 seedlings were produced from one-quarter ounce of seed. In all cases, it appears that the percentage of viable seed is low, but for our needs, more than enough plants were produced. Of a total of 172 seedlings potted off from flats, none were lost in the process of raising them to planting size. The **ssp. linearis (S. Watson) Hall & Clements**. [Ed: *A. canescens* (Pursh) Nutt. var. *linearis* (S. Watson) Munz. TJM2] was equally simple to raise, germinating in five days and with excellent results when grown under our nursery conditions and practices.

Culture: All of our collections have grown rapidly and no problems were encountered in raising them to maturity. Plants from six- to 15-years-old have attained sizes of five to seven feet tall and up to 18 feet spread. It has been necessary to thin-out two plantings, as they were encroaching on other plantings. Flowering and seeding began in the third year. No losses occurred in the **ssp. linearis**. The only reduction in numbers came from removal for thinning the area. Plants grew to three to six feet tall and with spreads of seven to 12 feet in eight years. Seeding had been recorded in that period.

***Atriplex confertifolia* (Torr. & Frem.) S. Watson.**

Spiny Saltbush.

Shrub.

Propagation: A 1952 seed collection over a period of five years produced few seedlings with very erratic germination periods, ranging from 14 days to six months. The older the seed, the better the germination. This was particularly true for one lot that had been cold-stratified for three months, at which time seedlings appeared before removal from the cold. A 1957 collection on two occasions came up in five and eight days, respectively, without any seed treatment, and each time produced over 100 seedlings from a trace of seed. Apparently the quality of the seed was poor for the first group.

Culture: Few losses have occurred over a period of ten years, and all plants have grown satisfactorily. The collection with which we had difficulty in germinating has grown much slower with ten-year plants 18 inches to three feet tall and three to five feet spreads, while the second group have attained sizes of six to seven feet high and nine to 17 feet wide. First flowering and seeding were recorded in the second year for one planting. However, a second planting still had not flowered after eight years.

***Atriplex hymenelytra* (Torr.) S. Watson.**

Desert-Holly.

Shrub.

Propagation: Seed may be sown directly into open ground, seed beds, or flats with the most prompt germination resulting in flats. Seeds gathered in 1950 from a planting at the old site of the garden produced better results after the second year; another lot took only five days to germinate when soaked for 24 hours in water. The usual period has been 15 to 18 days to start germination. The best production occurred when then seed was cold-stratified for one month. Good germination had started before removal from cold-stratification. While these methods may have helped, it is not necessary to pretreat the seed.

Culture: To date, two to three years has been the limit for growing this species here. Damage by rabbits and birds, and winter rotting of roots, both of seedlings and mature plants, have all taken their toll. Only a few wire-protected plants have lived to three years and these are in fair condition. Undoubtedly, a more alkaline sandy loam would be most beneficial for proper growth.

***Atriplex lentiformis* (Torr.) S. Watson.**

Quail Bush.

Shrub.

Propagation: Excellent germination began in five days after sowing a trace of seed. Since this is the only collection it has been necessary to raise, no further experience has been acquired.

Culture: Excellent growth has been maintained since the plants were first set out in May 1959. The plants became so large, it was necessary to remove 44 of them in 1965. The most recent observation notes the plants have grown to six to 12 feet tall and have spreads of 15 to 25 feet. Flowering and seeding dates have not been recorded during the eight-year period.

***Atriplex lentiformis* (Torr.) S. Watson ssp. *breweri* (S. Watson) H.M. Hall & Clem.**

Propagation: A 1949 collection of seed gathered from plants growing at the old garden site since 1933 produced numerous seedlings on two occasions when they were sown in 1950 and 1956. Twelve and 16 days were required for seedlings to emerge, the best and faster results being from the 1956 sowing.

Culture: There has been no problem in raising this subspecies. Growing in a rocky, decomposed granite loam, plants have attained heights of three to eight feet and widths of four to 14 feet. Flowers and seeds have been produced since 1953 after being planted in December 1951 as plants that were 12 to 15 inches tall.

***Atriplex leucophylla* (Moq.) D. Dietr.**

Seascale.

Perennial.

Propagation: A period of one to two months is required for germination to start when seed is sown in the open ground, while seedlings begin to emerge in a matter of eight or nine days if sown in a flat. Not only much quicker results occur, but a great many more seedlings come up by the latter method. No problems arose during the period in the nursery, nearly 100% of the seedlings potted off were transplanted to the garden.

Culture: This species has been short-lived here where it has been used on sandy loam mounds. Flowering and seeding have occurred within a year, but none of the plantings have lived more

than two or three years. Consequently, several repeat plantings have been made. Volunteer seedlings have not been recorded as occurring within the areas.

***Atriplex polycarpa* (Torr.) S. Watson.**

Cattle-Spinach.

Shrub.

Propagation: Seed sown from two collections germinated in five and six days without any pretreatment. All seedlings were raised through the nursery without any trouble.

Culture: Most of the first planting set out in November 1954 was frozen the first winter, however, additional plantings did not suffer from this fate. Rapid growth was made, and flowering and seeding occurred the third year. Many seedlings were noted within the area. Eight- and ten-year-old plants attained heights of two to six feet and spreads of five to 15 feet.

***Azolla filiculoides* Lam.**

Duckweed Fern.

Aquatic Perennial.

Salviniaceae. Salvinia Family. [Azollaceae. Mosquito Fern Family. TJM2]

Culture: Plants were gathered from two small pond areas, one on Santa Catalina Island and the other in Humboldt County. The first disappeared, but the latter has become well established and has made a good display of this interesting aquatic plant.

***Baccharis pilularis* DC.**

Prostrate Coyote Brush.

Shrub (evergreen).

Asteraceae. Sunflower Family.

Propagation: This species may be propagated from seeds and all types of cuttings, taken at nearly any season of the year. If one does not mind a highly variable group of plants, then seed may be sown in a flat or seed bed. The seed requires from five to 15 days for germination to start, averaging five to eight days. When the seedlings have made sufficient growth, they are easily transferred to pots or cans and grown on to whatever size is desired. There is no problem in procuring a large quantity of seedlings quickly in following this procedure. Should selected types or only male plants be wanted, then one must start plants from cuttings. We have successfully moved full-grown plants, cut off branches and stuck them in the ground, and taken all types of wood for cuttings. Plants can be moved quite easily, but only a poor percentage of unrooted branches stuck in the ground grow. Soft tip cuttings without any rooting-inducing hormones will take root in 18 to 30 days. While we have had satisfactory results almost any time of the year, we prefer to take cuttings during the winter and spring months. Percentages of rooted cuttings have shown considerable variation from 40% to 90%, with the best results from cuttings taken from plants growing in containers in the lath house. Since it has not been necessary to grow otherwise, the **ssp. *consanguinea*** (DC.) C.B. Wolf. Chaparral Broom. has been grown only from seed, which on the average will germinate in nine days. There are no problems in handling the seedlings in the nursery.

Culture: Our oldest plantings were set out in December 1951 and since then there have been no losses, the plants growing vigorously in a very rocky, decomposed granite loam in full sun, and have shown no ill effects, even under severe heat waves. Even though produced from seed, flowering and seeding began during the second year, and the plants have attained heights of three to six feet and widths of eight to 21 feet. Many other plantings have been made, particularly on difficult steep banks where this plant is at its best. On flat ground, this species will in time produce mounds up to two feet or more and unless clipped early and regularly once a year, it will lose its best effects as a groundcover. If it is used on a flat surface, clipping should start when the plants have sufficiently filled in and should be done at least once a year. We plan to clip ours in January and the new growth will have filled in by two months. And if this practice is pursued regularly, there will not be any noticeable amount of bare, woody branches visible after clipping. During the fall and winter, the leaves turn grayish, to return again to green in the early spring. This is natural, but can be offset by feeding with nitrogen in July or August and keeping well irrigated. Steep banks, in hot or temperate situations, are ideal locations for this hardy plant, as it is low-growing and spreads out, gradually creating low mounds that need minimal care. Plantings subject to stresses caused by severe drought, often if the soil is difficult to penetrate with water, are attacked by a lace bug (*Tingitidae* sp.). In other types of climates, the species may be subject to other pests, but we have no other insect problems. Plants are growing well in California City, a very difficult desert environment in Kern County.

We have continued our search for superior clones of this species. In October 1959, while searching for such types on the Twin Peaks in San Francisco, we came upon several interesting forms. Collecting both seed and cuttings from several plants, we produced 270 seedlings and 82 rooted cuttings, all of which were planted in experimental areas. Two male plants were selected as being superior, one of them came from the group of seedlings and the other from a selected cutting-grown plant that was the best of all observed on Twin Peaks. The seedling was designated as 'Twin Peaks #1' and the cutting grown as 'Twin Peaks #2'.

'Twin Peaks #1' is a faster and taller grower, a lighter green with smaller leaves and quite pleasing appearance. 'Twin Peaks #2' should not grow to more than 18 inches tall, is slower growing, has dark green, more coarse leaves, and branches tend to point downward. It has become the most popular of the two selections and has, since its introduction, been used widely, doing particularly well in and around Dallas, Texas.

The *ssp. consanguinea* was planted in full sun, in rocky, decomposed granite loam and like the species has shown great vigor. In the several collections grown, only one plant has been recorded as lost since November 1954, when the variety was first set out. Flowering and seeding start the second year, and the plants were last recorded as having grown to six to nine feet tall and eight to 16 feet wide. This variety could be a useful plant for erosion control in the proper areas.

***Baccharis plummerae* A. Gray.**

Shrub.

Propagation: Two October 1958 seed collections from Santa Cruz Island were easily grown in January 1959. Seedlings began emerging in seven days, and while there were some problems with damp-off at all stages of growth in the nursery, there were plenty of plants for setting out.

Culture: This species has not been as hardy here as the other ones raised. Somewhat protected sites were chosen, one in rocky, decomposed granite loam and the other in a tight clay-loam soil.

Losses have been more severe in the clay-loam soil, having dropped more than 75% in eight years while the other has been a little over 50%. Some rabbit damage was incurred as the plants are more succulent than the other species raised. They appear to do better when left undisturbed and with a minimum of irrigation. Flowering and seeding began the first year, even before the plants left the lath house.

***Baccharis sarothroides* A. Gray.**

Shrub.

Propagation: Seed gathered in November 1950 from plants growing at the old site, which had been grown from seed collected in January 1938, were sown in September 1952. Seedlings began emerging in five days and provided more than enough for this species. None of them were lost in the nursery before setting out.

Culture: Grown in full sun in rocky, decomposed granite loam, vigorous growth was made for 13 years, at which time in 1966, a large percentage of the planting was destroyed by a fire set by vandals. Plants had attained heights of ten to 15 feet and spreads of 15 to 25 feet and flowering had been profuse each year since 1954. Many of the plants hit by the fire are sprouting from the crown and in time will be as large as the original plantings. Many volunteer seedlings appear in adjacent areas.

***Baccharis sergiloides* A. Gray.**

Desert Baccharis.

Shrub.

Propagation: A collection grown at the old site since 1933 provided seed in November 1950 for our plantings at Claremont. Sown in September 1952, seedlings began appearing in six days. Only a small portion of the seedlings were used and these were easily grown in the nursery.

Culture: Set out in October 1953, only two plants have been recorded as dying, the remainder growing rapidly in rocky, decomposed granite loam in full sun. Ten-year-old plants were recorded as six to ten-and-a-half feet tall by seven to 16 feet spreads. Profuse flowering and seeding has been noted since the second year.

***Baeria* F. & M. [Ed: *Lasthenia* Cass. TMJ2]**

Gold Fields.

Annual.

Asteraceae. Sunflower Family.

Once established, this easily grown genus, containing nine species and five varieties, seldom needs any renewal. The only problem we have had is to protect it from birds. It is not choosy about its location or soils, but does prefer full sun for best development. For all species and varieties, germination occurs from five to 15 days, depending on what kind of culture is provided. It should not be sown much before October. Volunteer seedlings in the garden never appear before October no matter how much of the area is irrigated during the summer or after the seed has fallen in April or May. Seeds sown in October or November will invariably flower in March (rarely April). In fact, the flowering time is always the same regardless of when the seeds

are sown. Since the plants complete their life cycle so quickly, seeds are in great demand by scientists, particularly those of *B. chrysostoma* **F. & M.** [Ed: *Lasthenia californica* Lindley. TJM2] or its **var. gracilis (DC.) H.M. Hall.** [Ed: *Lasthenia californica* Lindley. TJM2]. We have grown the following species and subspecies at this location: *Baeria chrysostoma* since 1950, *B. c. ssp. gracilis*, the same strain since 1936, bringing it here from the old site; *B. minor* **(DC.) Ferris.** [Ed: *Lasthenia minor* (DC.) Ornduff. TJM2] since 1958, and **ssp. maritima (A. Gray) Ferris.** [Ed: *Lasthenia maritima* (A. Gray) M.C. Vasey. TJM2] since 1935, bringing it here from the former location. [Ed: for *Lasthenia glabrata* Lindl., see that entry under the letter “L” later in this publication.]

***Baileya* Harv. & A. Gray.**

Desert Marigold.

Annual or Perennial.

Asteraceae. Sunflower Family.

To cultivate this genus successfully, the same conditions must prevail as outlined in my first report (Everett, 1957. Pg: 41). We continue to grow the same “Pachalka Spring” strain of *B. multiradiata* **Torr.** we first started with in 1935 at the old site. However, we have never grown it quite as abundantly and vigorously as we did at the former location. The plants are not as large, and the flower stems and heads are shorter and smaller. Seedlings appear and flowering plants can be observed at almost any time of the year, although the best period is May to July. Sown in flats or pots, the seed will start germinating in five to seven days, but scattered in the open, it may take two weeks or more. While classified as a biennial or perennial, in cultivation it should be renewed as an annual. For continuous summer color, we have used this species in our home demonstration garden, where we have planted it from pots into confined sections, and in this manner have had good results. *B. pauciradiata* **Harv. & A. Gray.** has not been collected, and while *B. pleniradiata* **Harv. & A. Gray.** has been gathered in the wild on several occasions, the results here have not been exciting, the stands usually fading out before much seed is produced.

***Balsamorhiza* Nutt.**

Balsam Root.

Perennials.

Asteraceae. Sunflower Family.

Only three collections of seed have been acquired of this genus, *B. deltoidea* **Nutt., B. hookeri Nutt.,** and *B. sagittata* **(Pursh) Nutt.** None of them have been established here, either from the seed failing to germinate or plants rotting before established.

***Bebbia juncea* (Benth.) Greene.**

Sweet Bush.

Shrub.

Asteraceae. Sunflower Family.

Propagation: Seeds gathered from plants originally established at the old site in 1932 were sown in October 1950 and again in September 1952. The first sowing came up in two days and the

second in five days. Production was good, but we experienced some difficulties from damp-off while the young plants were growing in the nursery.

Culture: All of the first 27 plants set out in 1952 were destroyed by rabbits and of the second lot of 42 plants planted in November 1953, only one remains after a series of setbacks from frosts each season. This plant was last recorded as being three feet tall by four feet spread, in fair condition. Seed has been produced since 1954.

***Beloperone californica* Benth.** [Ed: *Justicia californica* (Benth.) D.N. Gibson. TJM2]

Chuparosa.

Shrub.

Acanthaceae. Acanthus Family.

Propagation: Plantings established in 1931 at the former site were the sources for seed harvested from June through August 1949. It was sown in October 1950 and two days later was up. A second sowing in 1952 emerged in five days, and a third sowing in September 1955 took three days – all lots providing an abundance of seedlings. No problems were encountered during the interim nursery stage.

Culture: Following our usual pattern of planting during the fall and early winter months, we soon found this procedure unsatisfactory for this desert plant. Our first plantings were destroyed by a frost in January 1952 by temperatures to 25° F and by predation from rabbits. Additional plantings in more protected sites had a better survival record, but not until the surviving plants had attained several years of age were they able to go through the winter season without some frost damage. Established plants do very well here and provide almost year-round bloom and are fine plants for hummingbirds. Plants in our oldest plantings are 14-years-old and measure three to five feet tall and have spread from five to 12 feet wide. Flowers and seeds have been produced from the first year. Plants were even flowering in the gallon-cans in the lath house before they were planted in the garden.

Yellow-flowered plants have been found in the wild, and we have raised seed from such plants. To date, none of the plants has produced yellow flowers, all being red.

***Berberis* L.**

Barberry.

Shrubs.

Berberidaceae. Barberry Family.

The section of the genus under discussion is better known in horticulture as *Mahonia*. It is represented in California by thirteen species and one variety. We have acquired and are growing all of them except ***B. dictyota* Jeps.** [Ed: *B. aquifolium* Pursh var. *dictyota* (Jeps.) Jeps. TJM2], ***B. sonnei* (Abrams) McMin.** [Ed: *B. aquifolium* Pursh var. *repens* (Lindl.) Scoggan. TJM2], and ***B. fremontii* Torr.** All of the other species are being grown successfully and there are no apparent problems. Seedlings produce long roots that are sparsely branched. They appear to be long-lived and will be good assets for the garden. As the plantings are not far distant from each other, garden-harvested seeds may contain a large percentage of hybrid stock. Often quite handsome types are produced and these selected types can be increased by cuttings that thereby

continue the clone, either for horticultural introduction or for one's own interest. One such clone is now being tested for possible introduction to the nursery trade. (See *B. amplexans* below.)
[Ed: This plant is *Berberis* 'Golden Abundance'.]

The genus *Berberis* is an intermediate host for the serious wheat rust (*Puccinia triticina*). Before any species or selected clone can be marketed interstate, it must be subjected to tests performed by the Wheat Rust Control Laboratory at the University of Minnesota. The following native species have been tested and passed as being immune or resistant to this devastating fungus: *B. amplexans*, *B. aquifolium*, *B. piperiana*, and *B. pinnata*.

***Berberis amplexans* (Eastw.) Wheeler.** [Ed: *B. aquifolium* Pursh var. *repens* Scoggan. TJM2]

Propagation: Cold-stratification for three to four months gives the best results for germinating the seeds. Periods of shorter duration will start germination but not until months later will maximum germination take place. We have moved plants to 12 inches tall successfully from the wild and from the former garden site. While we have not made cuttings of this species, we have successfully rooted selected hybrids grown from seed lots of this species.

Culture: Ranging from five- to 25-years-old, all of our plantings of this species have grown exceedingly well here, almost doing equally well in either the very rocky, decomposed granite loam or the tight clay-loam soil of the mesa. Three plants, five to ten inches tall, after having been grown at the old site for ten years, were dug and moved successfully to five-gallon-cans in February 1951. In May 1951, they were re-established at this site, and ever since have done splendidly, having attained sizes of six to eight-and-a-half feet tall and spreads of 14 by 15 feet wide. These plants provided seed for later additional plantings in various sections of the garden, where they have grown without any trouble. One lot of seed obtained from bushes growing close to *B. aquifolium* contained an unusual number of variants among the seedlings. Several of these have been observed with interest and one was so outstanding, we have continued to produce it by cuttings, a process which has been entirely successful. A great deal of enthusiasm has been shown by horticulturists and the plant is now being tested for Wheat Rust immunity. If these tests prove the clone immune, it is planned to market the plant under the name of *Berberis* 'Golden Abundance'.

***Berberis aquifolium* Pursh.**

Oregon Grape.

Propagation: A large stand of this species, which was originally produced from seed purchased from the late Theodore Payne in 1928, growing at old site was the source of the harvested seed used to grow the plants for use in this site. Since we desired to have large plants to start with, we sowed three lots in September 1948, one without any treatment, the second using the hot water treatment, and the third we put in a jar of moist sand to cold-stratify for 71 days. There was one-eighth ounce of seed for each lot. Non-treatment took 27 days to start and by March 5, 1949 there were 40 seedlings; Lot two - took 32 days and by March 5, 1949 there were 30 seedlings, and the cold-stratified seed was sown on December 7, 1948 and started germinating in 30 days and produced 100 seedlings by March 5, 1949. Selected plants have been reproduced by cuttings rooted within one to two months, each selection being treated with a root inducing compound. Where it took 53 days to start cuttings taken in May and treated with Rootone, a second lot took 28 days when taken in October, soaked for 18 hours in cold water and treated with Hormex. An attractive plant that produced a large percentage of purple leaves throughout the year was

observed for several years and later was reproduced by cuttings. When planted nearby in a sunnier position, the purplish leaves were no longer apparent and further study was discontinued.

Culture: This well-known species is relatively easy to grow, provided a good supply of water is provided and in some areas placed in a semi-shaded position. We have grown it under large oaks, where it has prospered. Since our strain is of unknown origin, we have not used the species widely. It is considered to be native to California, although I have never found any native stand that can be said to be this species. This species is highly subject to attack by leaf chewing insects, and many gardeners have become discouraged from using the plant to any extent. Several compact types have been introduced to horticulture, and while making handsome, green plants, they seldom if ever produce the bright yellow flowers and deep purple fruits, a great part of the charm of the plant.

***Berberis haematocarpa* Wooton.**

Propagation: One collection acquired in July 1957 and raised from seed that began germinating in 14 days without any pretreatment.

Culture: Planted in November 1958, 59 plants were used in the plant community section and 15 otherwise. Initially grazed severely by rabbits, there were some losses recorded, but after protection was provided, the plants have been growing slowly but steadily in a very rocky site. This species has not developed as nicely here, exhibiting much of the rugged appearance of the native stand in the New York Mountains. Sizes are 14 inches to eight feet tall and nine inches to nine feet wide, the smaller ones having been set back by over-grazing by rabbits. No flowering or fruiting has been recorded to date.

***Berberis higginsiae* Munz.**

Propagation: This species was first acquired in July 1929, and was grown under the name of ***B. fremontii*** at the old site. In July 1950, one-eighth ounce of seed was harvested from these plants and sown on October 18, 1950. Over 200 seedlings were obtained from the seed that started in 14 days and came up very evenly, with maximum germination reached within a month after sowing. No losses occurred among the seedlings in the nursery.

Culture: Handsome specimens have developed in the several locations where this species has been used. After observing the plants in their native habitat, it is difficult to believe our cultivated specimens are from the same source. A great interest has been shown by all who have observed its stature, handsome gray foliage, and abundant flowering and fruiting. First planted in December 1951, flowering began in the spring of 1959 and fruiting was observed in June 1959. Plants to ten feet tall and 15 feet wide may be observed in any of our plantings, all of which were set out in a very rocky, decomposed granite loam.

***Berberis nervosa* Pursh.**

Long-leaved Oregon-Grape.

Propagation: Several collections of seeds and rooted plants were gathered between the years 1951 and 1965. Rooted runners or plants may be re-established in flats or pots before planting. Seeds, often of poor quality, need several months cold-stratification. Out of six collections of seeds, one from cultivated plants, only two produced any seedlings. One lot, sown 13 days after harvesting, needed repeated periods of cold-stratification to produce 29 seedlings over a period

of nearly two years from one-eighth ounce of seed. However, seedlings appeared while still under the first period of three-month cold-stratification, and necessitated removal. On a second attempt nine months after the original harvesting, one-quarter ounce of seed was sown in June and cold-stratified until germination started in December while still under cold-stratification. Another collection of seed taken in August 1965, sown in late September, cold-stratified until early December began germination 19 days after removal. Therefore, cold-stratification from three to six months appears to be necessary. No problems were encountered raising the seedlings in the nursery.

Culture: This species appears to do best here under our large oaks where the duff is thick and loose, and the soil is either well-drained, rocky, granite-loam, or tight clay-loam. In both cases, where high shade and sufficient water is provided, healthy specimens have spread over the surrounding areas six feet to 20 feet, depending on the age of the plants. To date, none of the plants have produced seed, except for an early group that was moved from the old site in 1951, established in our redwood section, and produced a few seeds which were not viable. This planting did not last more than two years since there was not enough shade in the area.

***Berberis nevinii* A. Gray.**

Nevin's Barberry.

Propagation: It is generally recommended that seed be cold-stratified up to three months for best germination. Our experience indicates that it is not necessary to cold-stratify the seed as we have had equally good results without the cold treatment. In fact, we never used cold-stratification until 1957, when we sowed a lot that had been harvested in the garden at the old site in June 1949. While good results were obtained, we had previously sown a like amount of seed without cold-stratification and produced more seedlings. It takes 30 to 90 days to start germination. No problems were encountered in raising the seedlings in the nursery. Seedlings produced extremely long roots that were difficult to handle.

Culture: While some of the young plants started slowly, all plantings have grown as well here as at the former location. There have been relatively few losses, and what few have died may be attributed to unavoidable circumstances. Most of our plants are direct descendants of a seed collection gathered in the San Fernando Valley in 1935 and grown at the old site, additional seed was harvested from those plants. However, we have plants that have been started from seed gathered in other locations in Southern California. It is interesting to note that Wandalee Thompson of Lake Hughes, California, at 3,600 feet elevation, reports that some year-old plants grown from a seed collection made in a new location for the species withstood temperatures down to 10° F without any losses. Production of seed occurred in May and June or even as late as October.

***Berberis pinnata* Lag.**

California Barberry.

Propagation: Three collections of seed harvested from our cultivated plants were handled. They were cold-stratified for periods of three to five-and-a-half months. One three-month and the five-and-a-half-month lot had started germinating before removal from cold-stratification, while the other three-month treatment germinated within seven days after removal. None of the seed was tried without cold-stratification. Many of the seedlings of two lots were runty and had to be

discarded, otherwise, there was little trouble in raising the seedlings to planting size. A few cuttings and sparsely rooted branches of the **ssp. insularis Munz.** were brought from Santa Cruz Island. By treating them with Hormodin #2, we were able to start five out of a possible 11 semihard to hard wood material. Three survived and were grown to planting size. Seed gathered from these plants in May 1962 produced a good quantity of seedlings after three-and-a-half months of cold-stratification.

Culture: Two accessions (originally acquired in 1941) of five plants each from established plantings at the old site were transplanted to five-gallon-cans in February 1951. In April 1951, three plants of each number were planted in their present site, in full sun and very rocky, decomposed granite loam. All of them are alive, in good condition, and have been the source of seeds since June 1954. They are presently six to nine feet tall and six to 11 feet wide. Other later additions have done exceedingly well while others have not been so happy. In difficult situations the leaves have been riddled by leaf-chewing insects, an indication the plants are in a weakened condition. The juvenile leaves of **ssp. insularis Munz.** are quite smooth, having few prickles on the leaf edge, but as they mature they are more pronounced but not so much as the species. Handsome specimens have been grown in our heavy, tight clay on the east side of the building. Started from cuttings acquired in 1958, planted in their present site in March 1959, they produced their first crop of seed in May 1962. The original three plants have attained sizes of six to ten feet tall by four to six feet wide. None of the serious leaf-chewing insect problems have been observed, but some of the leaves appear to get burned either from excessively hot sun or from salts in the soil. Seedlings raised these plants are remarkably uniform. Fruiting has been recorded since the third year, and plants have attained heights and spreads of six feet.

***Berberis piperiana* (Abrams) McMinn.** [Ed: *B. aquifolium* Pursh var. *aquifolium*. TJM2]

Propagation: Production from seedlings may be accomplished by cold-stratifying the seed for about three months. Several collections have been processed, and if cold-stratified for any longer periods, more often than not, the seeds will have started growing before removal from the cold. This may be followed by trouble with the damp-off fungus. There is some indication that seed cold-stratified in a jar with damp sphagnum moss produces somewhat better results, at least our records indicate a greater quantity of seedlings when using such methods. Cuttings proved difficult to root, even with the use of CUTstart XX, XXX, or Rootone. Cuttings were procured in June, September, and February, the latter period proving to be the best. Cuttings were presoaked in cold water for 19 hours, treated with CUTstart XX, put in individual pots and were placed under our fogging system (with no intermittent mist). About 52% rooted using this method, whereas previously only one to five percent rooted.

Culture: Four plants of each number established at the old site in 1941 were moved to five-gallon-cans in February 1951 and moved to Claremont. The following May, they were planted in their respective sites here. Two survived the move and were alive until December 1964, when they were removed during thinning of additional plantings. All additions of seedlings have grown exceedingly well, spreading into very large clumps up to nine feet tall and spreading to over 12 feet. Flowering and seeding began in March and April, 1955, of material set out in November 1953.

***Berberis pumila* Greene.** [Ed: *B. aquifolium* Pursh var. *repens* (Lindl.) Scoggan. TJM2]

Propagation: Our propagation of this species has all been done through the use of rooted runners or sucker growth. Putting them in pots, flats, or other containers in a loose soil mixture, kept in a high humidity room, they can be readily re-established.

Culture: A very hardy species, our material was first planted at the old site in 1941. The remaining five plants were moved to eight-inch pots for transfer to Claremont in February 1951. They were set out here in May 1951, and two survived the move and are still alive, now making one large clump six feet tall and 13 feet wide. This collection has grown much taller than found in the wild but may be accounted for by the shady location in which it is presently growing. Other collections of rooted suckers are well established and growing nicely in both rocky, decomposed granite loam and tight clay-loam soil, the latter being more normal for the species. Sparse flowering has only been recorded but no fruiting has been noted.

***Berberis repens* Lindl.** [Ed: *B. aquifolium* Pursh var. *repens* (Lindl.) Scoggan. TJM2]

Propagation: Two seed collections acquired in 1951 and 1952 failed to germinate with cold-stratification.

Culture: Two plants acquired in 1957 from the Santa Barbara Botanic Garden and planted under a large oak tree have spread to a clump six feet by ten feet wide and not reaching more than six to eight inches tall. None of the plants have ever flowered or fruited. The stolon-like runners have been readily lifted and re-established in containers for plantings in other areas. This clone is a fine horticultural plant, well suited to most garden conditions.

***Betula occidentalis* Hook.**

Water Birch.

Shrub or Tree (deciduous).

Betulaceae. Birch Family.

Propagation: While we acquired sufficient plants for our needs, germination from either untreated or cold-stratified seeds was poor. Seed harvested in July 1950 from our cultivated plants at the old site, when sown the following October, produced one seedling in four months. A second attempt produced 12 seedlings with germination starting in 14 days when sown in August 1951. The seed was sown very shallowly on chopped sphagnum moss. Wild harvested seed gathered in October 1953 and 1954 took over four months to germinate, even when one lot had been cold-stratified for nearly four months. Apparently, much of the seed may be of poor quality. Mature or young plants are easily moved and offer no problems in re-establishing.

Culture: Six large specimens were severely pruned back on April 1, 1952 and moved bare-root from the old site. They were immediately replanted in a stream bed, where they quickly became well established. They have grown so vigorously and so large that it has been necessary to remove four. The remaining specimens are 18 to 20 feet tall and spreading out 20 feet or more. Seed has been produced for many years. A ten-year-old specimen, growing where moisture is not so abundant and the soil is a very rocky granitic loam, has attained a height of seven feet and a spread of six feet and is generally in poor condition. Therefore, this streamside species, for best growth, must be grown where water is plentiful. And, where space needs to be conserved, material should be placed at least 50 to 75 feet apart

***Bidens* L.**

Bur-Marigold.

Perennial.

Asteraceae. Sunflower Family.

Two species, closely allied, have been started successfully along a stream and around a pool. Seeds of *Bidens cernua* L., the nodding bur-marigold, were sown streamside in January 1953, but germination did not occur until the seed stood in water for some time, as recorded April 6, 1953, a four-month period. And probably the period in which germination would start in any case and not before. Gradually, the species germinated and after a period of four or five years could not be found. *Bidens laevis* (L.) Britton et al. was introduced in December 1956, when seeds were sown around a pool. First germination occurred in February 1957, but few plants were seen. Not until August 1959 did this species really get started and since then it has almost become a pest and needs to be thinned out considerably each season as millions of seeds are produced. During its flowering season in August and September, a period when color is needed, fine splashes of color are noted along our stream and around the pools.

***Blechnum spicant* (L.) Roth.**

Deer Fern.

Perennial.

Blechnaceae. Deer Fern Family.

Two collections of plants were brought in during 1963 and 1964. Both numbers were easily established in pots in the greenhouse. Strong growing plants were placed in shady, humus filled spots above the edge of a stream and pool. While the plants prospered for about a year, there was a gradual recession in the health of the plants until all were gone within three years. More specialized care and further soil preparation will be necessary to successfully cultivate this lovely fern.

***Blennosperma bakeri* Heiser.**

Annual.

Asteraceae. Sunflower Family.

We acquired seed of this species in 1964. Since there was such a small sample of this vernal pool species, we sowed it in a flat in the nursery, where it germinated in four days. Nearly 200 seedlings were obtained and grown after which it was used in our artificial vernal pool. There it made a fine display, beginning in February 1967. Seed was harvested in May, and the species will be added to our list of annuals.

***Bloomeria crocea* (Torr.) Coville.**

Golden Stars.

Perennial.

Amaryllidaceae. Amaryllis Family. [Ed: Themidaceae. Brodiaea Family. TJM2]

Propagation: Pretreatment of seed is unnecessary as it will germ in seven to 15 days when sown in a flat. It may also be sown directly into the open ground where desired. Germination under such circumstances will be slower but good. Corms dug in the wild are readily moved.

Culture: This species usually is found in heavier soils, but we have grown it happily in well-drained rocky granitic loam. The species should be placed in an area where after the flowering and seeding period is over in May and June, it can be left without any disturbance or irrigation. If rodents are prevalent in the vicinity, either the corms should be dug or wire protection provided. If the corms become too close to the surface, scratching birds and mice will eat them, particularly when new growth is emerging. A long-lived and satisfactory bulbous plant if left undisturbed. Neither of the two varieties of *B. crocea* or *B. clevelandii* S. Watson. have been raised, the latter only recently having been acquired.

Botrychium multifidum (Gmelin) Rupr. ssp. *siliafolium* (C. Presl) Clausen. [Ed: *Sceptridium multifidum* (Gmelin) M. Nishida ex Tagawa. TJM2]

Grape Fern.

Perennial.

Ophioglossaceae. Adder's Tongue Family.

Two plants collected in August, 1965, were established in pots in the nursery. The following March, 1966, they were planted in a prepared pot beside a pool. Unfortunately, children seeking pollywogs in the pond killed the plants.

Boykinia Nutt.

Perennials.

Saxifragaceae. Saxifrage Family.

Propagation: While two to three months cold-stratification does no harm, in fact, may improve germination, it is not necessary, as seedlings will begin to emerge in 12 to 15 days. We began growing *B. elata* (Nutt.) Greene. [Ed: *B. occidentalis* Torr. & A. Gray. TJM2], in 1958, when we acquired several plants moved easily from the wild. Two collections of seeds of *B. major* A. Gray., were made in 1958, and both failed to germinate. *B. rotundifolia* A. Gray. soon produced seeds after the plants were planted in 1964. Quantities of seedlings of *B. rotundifolia* were produced in eight days after three months cold-stratification, which probably is unnecessary.

Culture: *B. elata* has grown much better when used in a shady part of the rock garden, where the area is covered with a layer of crushed granite rock. Provided with excellent drainage and occasional irrigation, the plants developed into healthy specimens with flowering occurring sometimes before being set out in the garden - at least within eight to ten months or less. Numerous volunteer seedlings have been noted, which is a good thing since the plants do not seem to live more than three to four years. When compared to plants grown in well-drained soils, plants grown in heavier soils performed nearly as well but did not live as long. *B. rotundifolia* developed quickly adjacent to the stream on the mesa. Outstanding for the size of the leaves in comparison to other species of the genus, it is more robustly attractive for its foliage rather than the flowers which are insignificant. It has been easily and readily grown but is rather short-lived for us.

***Brickellia* Ell.**

Shrubs.

Asteraceae. Sunflower Family.

Propagation: Of the 14 species and one variety listed for California, we handled seven species between 1952 and 1966. These are: ***B. arguta* B.L. Rob.** [Ed: *B. atractyloides* A. Gray var. *arguta* (B.L. Rob.) Jeps., ***B. californica* (Torr. & A. Gray) A. Gray.**, ***B. desertorum* Coville.**, ***B. grandiflora* (Hook.) Nutt.**, ***B. greenii* A. Gray.**, ***B. incana* A. Gray.**, and ***B. microphylla* (Nutt.) A. Gray.** On average, fresh seed starts germinating in five to seven days, but often emerges as quickly as three days or it may take as long as ten days. When sown in the open ground, it may take 30 days to emerge. In any case, germination should be completed within 30 to 50 days. Germinability of the seed drops off rapidly after the first year and seed over three-years-old usually produces few, or no, seedlings. There is no need for treating fresh seed as germination is usually very good. During the period when the seedlings are being raised in the nursery, careful handling must be exercised to keep them alive. The most critical period is after shifting to gallon-cans and carrying the species through the summer. Naturally going into dormancy at this period, and with the continuation of watering being necessary, many plants are lost from root rot. And it is this carry-over of some root rot fungi in the can that continues to cause losses after the plants are set out.

Culture: The majority of the species of this genus grow naturally in very dry locations, particularly in the higher desert sections and dry eastern slopes of the mountain ranges. All of our plantings have been placed in the best drained locations we could provide. The most serious effects on the plants came from frost, a rather surprising cause. Either a planting would be wiped out or seriously weakened in the first few years. And our frosts were not severe, seldom going below 25° F and mostly not much below 30° F. Once the species became well established, they continued to survive for a number of years, the oldest ***B. californica***, doing well for over 16 years in a more protected location. ***B. incana*** and ***B. microphylla*** being two others that have become established and have survived for at least 16 years. Flowering and seeding usually began the second or third year.

***Brodiaea* Sm.**

Perennials.

Amaryllidaceae. Amaryllis Family. [Ed: Themidaceae. Brodiaea Family. TJM2]

Propagation: There really is no problem in producing most of the species of this large genus. Corms gathered from native habitats may be readily re-established in pots, nursery beds or the open ground. [Ed: This procedure is not recommended.] This is the quickest method to acquire flowering plants sooner. Seed is easily germinated without any pretreatment in flats, pots, nursery beds, or even where they are to be grown permanently. More specific information is provided under each of the following species discussed here. (See also Everett, 1957. Pgs: 45-48.)

The periods for seed germination vary considerably. The average time ranged from three to five weeks, however, it could be as short as eight days and as long as four or five months, all within the same species. A few species consistently took longer to emerge, such as ***B. ida-maia***, while, as would be expected ***B. pulchella* var. *pauciflora***, ranged from ten to 15 days. The majority of

the collections were sown in September while others seeded as early as July and as late as January. Lots that took up to three to four months to germinate usually reached maximum germination in a month, while those coming up quicker took two to three months to reach maximum germination. Very few seed lots failed us, and mostly from a trace of seed we would get several hundred corms, the viability being generally good. However, it was noted viability was reduced in three to four years. The following kinds of seeds were handled and the germination rates are listed:

***Brodiaea bridgesii* S. Watson** [Ed: *Triteleia bridgesii* (S. Watson) Greene. TJM2] – One lot, 98 days.

***Brodiaea californica* Lindl.** – Four lots, 18 to 29 days.

***Brodiaea congesta* Sm.** [Ed: *Dichelostemma congestum* (Sm.) Kunth. TJM2] – Two lots, two and four months.

***Brodiaea coronaria* (Salisb.) Engl.** – Three lots, 77 days, four months, one year.

***Brodiaea coronaria* var. *macropoda* (Torr.) Hoover.** [Ed: *B. terrestris* Kellogg ssp. *terrestris*. TJM2] – Corms only.

***Brodiaea elegans* Hoover.** – Nine lots, 17 to 64 days.

***Brodiaea hyacinthina* (Lindl.) Baker.** [Ed: *Triteleia hyacinthina* (Lindl.) Greene. TJM2] – 17 lots, 17 days to six months.

***Brodiaea ida-maia* (Alph. Wood) Greene.** [Ed: *Dichelostemma ida-maia* (Alph. Wood) Greene. TJM2] – 11 lots, 16 days to four-and-a-half months, averaging three months, but a lot sown in a flat for three-and-a-half months was then cold-stratified for four months and it then came up in four days after removal.

***Brodiaea jolonensis* Eastw.** – One lot, four months.

***Brodiaea laxa* (Benth.) S. Watson.** [Ed: *Triteleia laxa* Benth. TJM2] – 15 lots, 16 days to four-and-a-half months. One lot sown directly into garden site took 49 days and another sown in a lath house seed bed took 27 days.

***Brodiaea lutea* (Lindl.) Mort.** [Ed: *Triteleia ixioides* (W.T. Aiton) Greene. TJM2] – 19 lots, 11 days to four-and-a-half months, but averaging 25 to 35 days. One lot sown in open seed bed took 54 days.

***Brodiaea lutea* var. *scabra* (Greene) Munz.** [Ed: *Triteleia ixioides* (W.T. Aiton) Greene ssp. *scabra* (Greene) L.W. Lenz. TJM2] – One lot, three-and-a-half months.

***Brodiaea minor* (Benth.) S. Watson.** – Corms only.

***Brodiaea multiflora* (Benth.) A. Heller.** – 19 lots, 11 days to four-and-a-half months, but averaging 15 to 30 days. One lot seeded in a nursery seed bed took 27 days and another sown in an open garden site took two months.

***Brodiaea orcuttii* (Greene) Baker.** – Two lots, 14 and 29 days.

***Brodiaea peduncularis* (Lindl.) S. Watson.** [Ed: *Triteleia peduncularis* Lindl. TJM2] – One lot, four-and-a-half months.

***Brodiaea pulchella* (Salisb.) Greene.** [Ed: *Dichelostemma capitatum* (Benth.) Alph. Wood. TJM2] – Six lots, eight to 46 days in flats and two-and-a-half months when sown in open ground.

***Brodiaea pulchella* var. *pauciflora* (Torr.) Mort.** [Ed: *Dichelostemma capitatum* (Benth.) Alph. Wood ssp. *pauciflorum* (Torr.) Keator. TJM2] – Three lots, ten, 11, 15 days.

***Brodiaea venusta* (Greene) Greene.** [Ed: *Dichelostemma* x *venustum* (Greene) Hoover. This is now considered to be a hybrid between *Dichelostemma ida-maia* (Alph. Wood) Greene and either *Dichelostemma congestum* (Sm.) Kunth or *Dichelostemma multiflorum* (Benth.) A. Heller. TJM1] – Corms only.

***Brodiaea volubilis* (Kellogg) Baker.** [Ed: *Dichelostemma volubile* (Kellogg) A. Heller. TJM2] – 16 to 63 days, but two sown in a lath house seed bed came up in 27 days.

Besides the seed collections used, there were additional numbers of corms gathered in the wild which were all easily established in the nursery before planting in a permanent location in the garden. [Ed: This procedure is not recommended.] Presently, we keep track of our plants in the garden by placing short three-inch square stakes (with a metal name tag nailed to them) in the planting beds.

Culture: The brodiaeas are readily cultivated in most types of soils provided they are used where only minimal or no irrigation is carried on during the summer dormancy period, usually from May to September for the majority of species, and that adequate protection against birds and rodents is provided. Birds and mice will dig into the soft soils, eradicating the newly planted material, and rabbits will nibble off all the new growth when the corms begin to sprout during the early fall months. Gophers will eat the corms so protection will be needed underground as well as above. If used in heavy soils, which they all appreciate, and once established, colonies will thrive for many years and keep growing in size. Flowering occurs usually in three to four years from seed, but mature corms will produce the first year. Depending on species, flowering occurs from February to July in cultivation. Presently, a comprehensive study is being made of all the species that make up the genera *Bloomeria*, *Brodiaea*, *Muilla*, and other related groups. Extensive collecting has been done and will be continue for some time. Most of the species native to California and adjacent areas are in hand and being grown in pots and being intensively studied. Many of the species have not been incorporated in the general plantings of the garden and will not be discussed here. The following species and varieties are only those that have been used in the garden:

***Brodiaea bridgesii* S. Watson** [Ed: *Triteleia bridgesii* (S. Watson) Greene. TJM2] – First received as seed in 1963, it planted in permanent site in November 1965, and it is too early to assess its reliability here.

***Brodiaea californica* Lindl.** – Of three numbers used, two were lost after three years due mainly to being misplaced and the third has been poorly established on the mesa in tight clay-loam soil.

***Brodiaea congesta* Sm.** [Ed: *Dichelostemma congestum* (Sm.) Kunth. TJM2] – Three collections, one of seed and two of corms were added in 1965, these were planted in 1966, in rocky, decomposed granite loam. It is too soon to assess their growth here, but they are growing vigorously and should be successful.

***Brodiaea coronaria* (Salisb.) Engl.** – Two numbers of bulbs and six of seeds were set out between 1951 and 1956. Lack of experience in this area, rodents, birds, and overgrowing shrubs

caused all of these collections to be lost within five to eight years with one recorded as being over ten years.

***Brodiaea coronaria* var. *macropoda* (Torr.) Hoover.** [Ed: *B. terrestris* Kellogg ssp. *terrestris*. TJM2] – Was put out in 1957, but was overgrown and lost within two years.

***Brodiaea elegans* Hoover.** – Most of our material has been derived from an original collection of corms made in 1933. Seed harvested from this number plus two other lots acquired in 1949 and 1956, have provided us with fine representations of this species, doing well in semi-shaded, well-drained areas, or in tight clay-loam soil.

***Brodiaea hyacinthina* (Lindl.) Baker.** [Ed: *Triteleia hyacinthina* (Lindl.) Greene. TJM2] – Numerous seeds have been harvested from two original collections acquired in 1937, grown at the old site and transferred here in 1951. Many fine stands are located in various areas, all doing quite well, particularly where located in tight clay-loam soil.

***Brodiaea ida-maia* (Alph. Wood) Greene.** [Ed: *Dichelostemma ida-maia* (Alph. Wood) Greene. TJM2] – Corms received in 1942 have provided us with the basis of our present material added to this site in 1952. Under a large oak tree, the collections have grown through harvesting seed plus dividing the numerous corms. Handsome specimens with flower stems to three feet tall were noted each year. Growing in full sun or semishaded situations the species appreciates being undisturbed and drying out each season. Over irrigation will kill the species readily.

***Brodiaea jolonensis* Eastw.** – One number of seed gathered in 1963 produced 89 corms which were set out in tight clay-loam soil in 1965. Enough time has not elapsed to fully assess the degree of success we will have with this pretty species.

***Brodiaea laxa* (Benth.) S. Watson.** [Ed: *Triteleia laxa* Benth. TJM2] – Numerous collections of seeds and corms, both from the wild habitat and our cultivated beds, have been added to various spots and most of them have become readily established, each year, producing handsome stands of flowers that added materially to the spring scene.

***Brodiaea lutea* (Lindl.) Mort.** [Ed: *Triteleia ixioides* (W.T. Aiton) Greene. TJM2] – Seed derived from wild stands in the Carmel area plus that harvested from our cultivated plants, have been the source for this species first started in seed beds in 1948, moved to this site in 1950 and 1951, and here well established in several locations. Well-drained rocky areas, sun and semishade, and sunny spots on the mesa in tight clay-loam soil have proved successful in most cases.

***Brodiaea lutea* var. *scabra* (Greene) Munz.** [Ed: *Triteleia ixioides* (W.T. Aiton) Greene ssp. *scabra* (Greene) L.W. Lenz. TJM2] – Was introduced in 1951 and 1957, both were lost within three years but 1967 additions should become established without trouble.

***Brodiaea minor* (Benth.) S. Watson.** – Was added in 1957, but we have no record beyond 1959, when a few flowering stems were noted as being badly eaten.

***Brodiaea multiflora* (Benth.) A. Heller.** – Our current plants were grown from a 1946 collection of seeds that were gathered from ten-year-old corms growing at the old site. These new corms were set out here in Claremont in November 1951. Excellent stands have become established from the original plantings and from subsequent collections of seed harvested and grown during the intervening years. It can be reported as growing happily and abundantly here.

***Brodiaea orcuttii* (Greene) Baker.** – Seed started in 1949 produced over 5,000 corms which were transferred in 1951 to a rocky, dry area. Riddled by mice and moles, the collection eventually faded away after about ten years. However, it should have been placed in heavy soil with a vernal pool situation in the spring months.

***Brodiaea peduncularis* (Lindl.) S. Watson.** [Ed: *Triteleia peduncularis* Lindl. TJM2] – A few corms from the wild were sent to us in 1949. They were grown in pots until October 1951 when they were added to a rocky, well-drained area. Eventually, the rodents and birds weakened the colony such that within ten years it was lost. Seed harvested from this number produced additional corms, but most of them faded within a few years.

***Brodiaea pulchella* (Salisb.) Greene.** [Ed: *Dichelostemma capitatum* (Benth.) Alph. Wood. TJM2] – Seed harvested from native stands at the old site produced quantities of corms which were readily established here. This species is native to all rocky sections of the garden and were originally found on the clay banks of the mesa. Since many plants have been added to the banks, the species has been lost there but is abundant in all other parts of the garden.

***Brodiaea pulchella* var. *pauciflora* (Torr.) Mort.** [Ed: *Dichelostemma capitatum* (Benth.) Alph. Wood ssp. *pauciflorum* (Torr.) Keator. TJM2] – Is found in dry open places of our deserts, has been sparsely established in our desert garden section since 1961. It has not been observed in flower, only the foliage appearing each season.

***Brodiaea stellaris* S. Watson.** – Corms brought in from its native habitat in November 1963 were used on a hot, steep clay bank in February 1964. They sprouted and grew after planting, but later observation indicated the corms had all been dug out by birds.

***Brodiaea venusta* (Greene) Greene.** [Ed: *Dichelostemma* × *venustum* (Greene) Hoover. This is now considered to be a hybrid between *Dichelostemma ida-maia* (Alph. Wood) Greene and either *Dichelostemma congestum* (Sm.) Kunth or *Dichelostemma multiflorum* (Benth.) A. Heller. TJM1] – One lot of corms from the wild were lost two years after setting out in 1951. They were observed as growing satisfactorily and the following year had disappeared.

***Brodiaea volubilis* (Kellogg) Baker.** [Ed: *Dichelostemma volubile* (Kellogg) A. Heller. TJM2] – This species was added to our collections in October 1951, when 75 corms raised from seed gathered in June, 1948, were planted in a sunny location of rocky, decomposed granite loam. Rodents eating the corms and birds digging them out of the ground depleted the number, but we managed to protect them and they eventually produced seed each year which could be used to replenish the species in other areas. In 1964 the remaining corms, measuring three-quarters of an inch in diameter were moved to a more suitable location. Flowering and seeding began the third year after setting out. An interesting phenomena about the flowering stems, which may reach eight to ten feet, is that some twist clockwise and some counter clockwise. This peculiarity is being studied by a scientist in Australia, to whom we have sent several collections of seed. To date we have not received any reports concerning his studies. Also, the stems often become detached from the corms many days before flowering is completed and the seed will ripen satisfactorily.

***Bursera microphylla* A. Gray.**

Elephant Tree.

Tree.

Burseraceae. Torchwood Family.

Propagation: We received a few seeds in May, 1955, which were given hot water treatment for 19 hours. Germination failed. In December 1966, we received some well-established plants in gallon-cans. Before sowing, ten seed of one lot was leached for 16 hours in running cold water. The seed was sown in 25% peat moss, 75% fine sand with added nutrients. Germination occurred in four days and four seedlings out of the ten were produced. A second lot of 20 seeds were leached for 20 hours in running cold water and 20 seeds were not leached. The same seeding media as lot one was used. Fourteen came up in the leached group and only two in the control. The germination period was 13 days. Leaching the seed in running cold water is a necessary pretreatment of the seed of this tree.

Culture: Since we have had the small trees for such a short period, we are unable to state what success will attend our efforts to grow this interesting species. However, they are set out in well-drained rocky granitic loam and with some attention given to properly establish them, they should grow well here.

***Cakile edentula* (Bigelow) Hook. ssp. *californica* (A. Heller) Hult.** [Ed: the sp. is not recognized in TJM2]

Sea Rocket.

Annual.

Brassicaceae. Mustard Family.

Propagation: When sown in the open ground, germination will take four to five months, starting in February or March if sown in November. Quicker response (13 days) may be obtained by sowing in a flat but to get maximum results may take up to 90 days. Seventy days cold-stratification appeared to give some benefit.

Culture: Open ground culture or transplanting from pots produced flowering plants within eight months after sowing, but the total results were generally poor, the material succumbing to root rot caused by necessary irrigation during warm summer days.

***Calandrinia ciliata* (Ruiz & Pav.) DC. var. *menziesii* (Hook.) Macbr.** [Ed: the var. is not recognized in TJM2]

Red Maids.

Annual.

Portulacaceae. Purslane Family. [Ed: Montiaceae. Miner's Lettuce Family. TJM2]

Propagation: May be sown in flats or open ground. In the open ground, seed will start sprouting in 14 days, and may be quicker in flats. Our practice was to sow in open ground.

Culture: Our material was derived from a collection made in 1937, grown rather successfully at the old site, but much less so here. Sown in an open rock garden situation, scattered plants were noted for three successive seasons after which they disappeared. The entity has not been raised since 1959.

***Calliandra eriophylla* Benth.**

Fairy Duster.

Shrub.

Fabaceae. Pea Family.

Propagation: Seed harvested in the wild in March, 1958, was first sown September 1958. No pretreatment is necessary as seed will start emerging in three days and be completed in ten days. We sowed Terraclor treated seed into gallon-cans, with several seeds per can. As many as two to three seeds came up in each container and were allowed to grow there until ready for planting eight months later. A second lot of the same collection was sown in December 1958, in the same manner but without Terraclor. All of the seed rotted. Seed harvested in August 1962 in the garden produced seedlings in three days with no treatment of any sort. The seeds were sown (three per pot) in five-inch pots in October, 1962 and maximum germination occurred in 11 days (over 100 seeds germinated). None of the seedlings or young plants were lost while they were being grown in the nursery.

Culture: Introduced to our collections in 1959, this species has grown without any problems except for some severe losses the first winter when a sudden sharp frost occurred. Flowering occurs speedily, having been recorded the first year from seed and seedlings have been noted around parent plants in several locations. The species appears to appreciate extra watering and except in poorly drained soils, it will accept normal garden culture, as well as getting along without any attention once thoroughly established. Our plants, now eight-years-old, have attained heights of up to three feet and spreads of five feet.

***Calocedrus decurrens* (Torr.) Florin.** [Ed: synonym: *Libocedrus decurrens* Torr.]

Incense-Cedar.

Tree.

Cupressaceae. Cypress Family.

Habitat: Mountain slopes and canyons, 2,400 to 8,200 feet, from northern Baja California (Mexico), to Oregon, and western Nevada.

Propagation: Usually by seeds that produce best germination with two to three months of cold-stratification, though seeds sown without cold-stratification typically germinate well. Seeds sown in September began germinating in 13 days and reached maximum germination in 27 days with excellent results. Another wild collection took nearly three months for maximum results and was poor. Cold-stratification probably would have improved results. Seedlings may be easily transplanted from the wild, seed beds or flats. Cuttings have not been tried, but it is assumed they will root. No problems were encountered in raising the seedlings in the nursery, but it is recommended the seedlings be transplanted bare-root if possible to avoid coiled roots.

Culture: Successfully raised in all conditions, this hardy tree has been a useful species to grow. Growing well in either tight clay-loam soil or well-drained rocky granitic loam, trees in 15 years have attained heights of 15-20 feet and spreads of three to six feet. No seeding has been recorded during the period.

***Calochortus* Pursh.**

Mariposa-Lily. Star-Tulip. Butterfly-Tulip.

Perennial.

Liliaceae. Lily Family.

This genus contains about 60 species (34 in California) found in many different habitats in temperate western North America, from British Columbia (Canada) to the Dakotas and Guatemala. It contains many of considerable beauty and horticultural interest. The chief difficulty is that no one seems to be able to grow them consistently for any length of time, except perhaps for a few species. Attacked easily by rot producing fungi, a sought after food by rodents and birds, and requiring specific growing conditions and close attention, they are somewhat frustrating to raise. During the past 15 years, we have raised 18 species and four varieties, and none of which can be said to have been grown with a high degree of success. There is no problem in starting the seed, which usually comes up in great abundance, though damp-off fungus must be guarded against at all times, as it can strike quickly. Mature bulbs are readily maintained in pots, flats, and beds in the nursery. Our problem was in maintaining them properly after they were planted out in the garden, where such close attention could not be provided. Heavy leaf drop, overgrowing plants, rodents, birds with long bills (California thrashers and others) digging out the new young shoots or rabbits eating them off, all conspired to cause an early demise for most species. It seems to be definitely established that the bulbs must have a complete drying out after the completion of the seeding period and should not be watered or disturbed in any way. Either well-drained soils or, for some species, our clay-loam soil has provided the best sites and where there is no possibility of being overgrown by shrubs, large annuals, or perennials. The following is a resume of the history of the species in this location. (See also Everett, 1957. Pgs: 48-50.)

***Calochortus albus* (Benth.) Benth.**

Fairy Lantern. Globe-Lily.

Habitat: Shaded open woods and brush, often rocky soil, below 5,000 feet in California.

Propagation: Nine seed collections have been raised since 1950, all of them from the wild except for two harvested from our plantings. Sown in flats or loose open ground, seedlings began to appear from 40 days to three months. Germination occurred rapidly after one to two months of cold-stratification, though seedlings that germinated while they were in cold-stratification usually rotted. Therefore, not more than one month of cold-stratification is recommended.

Culture: Most of our collections were placed in well-drained granitic loam under large oak trees. In all cases, flowering started within four years from seed, two numbers produced seed which was used to raise additional plants. Usually, there has been a rapid deterioration of each number until most of them were gone after five to seven years. However, one plant has survived for ten years and a most successful group three-years-old have been growing nicely in a semishaded position near a large oak in well-drained rocky duff, which seems to be to the liking of this species.

***Calochortus amabilis* Purdy.**

Habitat: Rocky or loamy soil of dry brushy slopes or woods, to 3,000 feet, North Coast Ranges, California.

Propagation: A collection of mature bulbs and one of seeds was acquired in 1966. The seed was sown directly into a garden site and germinated well but are too young to assess. The bulbs were easily started directly in the selected site.

Culture: One group of bulbs were placed four inches deep in well-drained leafy rocky loam under a large oak and another group were used on the mesa in a tight clay-loam soil and planted two inches deep. The groups both flowered handsomely and indications are the lot in the well-drained site will continue, but those plated in the tight clay-loam soil rotted after two years.

***Calochortus amoenus* Greene.**

Habitat: Partially shady grassy slopes of leafy loam, 1,800 to 4,500 feet, western foothills of Sierra Nevada from Madera to Kern counties.

Propagation: Forty to fifty days are needed to begin germination without pretreatment, however, ten days after removal from seven months of cold-stratification produced an abundance of seedlings. The usual procedure was followed in the nursery for bulb production.

Culture: One lot produced flowers and seeds for eight years and as with the other seven collections used in selected sites of either well-drained rocky loams or clay, gradually disappeared or rotted out from too much leaf covering. Flowering started in four years from seed.

***Calochortus catalinae* S. Watson.**

Habitat: In heavy clay soils of open grassy or brushy slopes, below 2,000 feet from San Luis Obispo County to San Diego County, and the Channel Islands, California.

Propagation: Germinates rapidly, taking only one to two weeks to produce an abundance of seedlings. Extremely careful nursery procedures must be followed to ward off the damp-off fungus, which quickly attacks this highly susceptible species. Good germination resulted from seven-year-old seed.

Culture: Our efforts to establish this handsome species which naturally grew so abundantly at the old site in the adobe clay has met with failure to date. Apparently our tight clay-loam soil is not to its liking since all efforts have met with failure.

***Calochortus clavatus* S. Watson.**

Habitat: Dry often rocky slopes, below 4,000 feet, cismontane central California to Los Angeles County.

Propagation: Only eight to 20 days are required for germinating seed of this species as recorded for the seven numbers handled between 1949 and 1963. Three lots were cold-stratified but germination started so quickly that often most of the seedlings had germinated before they were removed from the cold. This usually caused those seedlings to rot, and is therefore not recommended unless adequate steps are taken to prohibit the damping off fungus.

Culture: None of the introductions have been established no matter in what site they were placed. Our records indicate most of them disappeared within two years.

***Calochortus coeruleus* (Kellogg) S. Watson var. *fimbriatus* F. Ownbey.** [Ed: the var. is not recognized in TMJ2]

Beavertail-Grass.

Habitat: Dry woods at 2,000 to 6,000 feet, Inner North Coast Ranges.

Propagation: Our only seed collection took four-and-a-half months to germinate without any pretreatment. Cold-stratification might have speeded the process. A collection of bulbs took three months to start growth, both lots coming from the same area and processed at the same time, September 28, 1949.

Culture: After being set out in October 1951, none were found to be alive two years afterwards.

***Calochortus concolor* (Baker) Purdy.**

Goldenbowl Mariposa.

Habitat: Dry mountain slopes, granitic, 2,000 to 7,500 feet, San Bernardino Mountains to northern Baja California (Mexico).

Propagation: Two seed collections were processed, 48 days to three-and-a-half months to germination, fair results.

Culture: Neither lot, one in 1952 and the other in 1963, grew for more than a year or two.

***Calochortus elegans* Pursh var. *nanus* Wood.** [Ed: the var. is not recognized in TJM2]

Habitat: The open woods Siskiyou County to Oregon, 5,000 to 7,500 feet.

Propagation: Two lots of mature bulbs were started in the nursery in pots, taking nearly five months to start growth.

Culture: Neither collection of bulbs were established, one lot never appeared and the second number, while producing leaves during each of six seasons, failed to appear during the seventh year.

***Calochortus invenustus* Greene.**

Habitat: In the dry, granitic soils of pine woods, 4,500 to 9,000 feet, mountains of central and Southern California to San Diego County.

Propagation: A trace of seed acquired in August 1952, was sown in September 1952, and took four months to germinate. This higher altitude species might have benefitted from cold-stratification.

Culture: No results were evident after planting, the young plants failing to start.

***Calochortus kennedyi* Porter.**

Desert Mariposa.

Habitat: Dry rocky slopes or heavy soil of open brushy flats, 2,000 to 6,500 feet, California deserts to Nevada and Arizona.

Propagation: Between 1948 and 1958, five collections of seeds and one of mature bulbs were processed in the nursery. The bulbs were sprouted in a pot and planted. The seeds were either sown with no pretreatment or were cold-stratified for periods not exceeding 20 to 30 days. In all cases except one the seed had germinated nearly 100% in 15 to 20 days under cold-stratification.

Untreated seed started within 18 days up to three-and-a-half months. The seeds placed under cold-stratification were mixed with sand or finely crushed granite or sphagnum. In all cases germination was rapid. If cold-stratification is used, the seeds should not be left in over 15 days. The cold-stratified seed was sown in flats and grown for three years in the nursery until bulbs were large enough to put in the garden.

Culture: All of the collections were placed in the most suitable site we could provide, and yet only one number survived for six years, the others dying out in one to four seasons. None of them ever flowered although healthy appearing plants came up for several seasons.

***Calochortus luteus* Lindl.**

Habitat: Below 2,000 feet in heavy soil of open places, Coast Ranges, Sierra Nevada, Santa Cruz Island, and central California

Propagation: Ten collections were handled, nine of seed and one of bulblets. Germination time was somewhat erratic, one lot coming up in six days and others taking 26 to 40 and still others up to 107 days, all without cold-stratification except one number. After one month cold-stratification, seed came up in three days after removal, indicating for some lots, cold-stratification might help. Our usual procedures for raising bulbs in the nursery were followed.

Culture: None of the collections lived for more than three years in the various sites selected.

***Calochortus macrocarpus* Douglas.**

Habitat: Mostly found in volcanic soils of the dry plains and slopes from northern and northeastern California to British Columbia (Canada), and Montana, 4,000 to 6,000 feet.

Propagation: Two numbers were processed, one of which failed to come up and the other did poorly, not living more than two years.

***Calochortus nudus* S. Watson.**

Sierra Star Tulip.

Habitat: Siskiyou County to western El Dorado County, 4,000 to 7,500 feet; growing in damp places and meadows of montane forests.

Propagation: One seed collection failed to germinate, while three numbers of mature grown bulbs were grown in the nursery until ready for planting.

Culture: Only one lot was observed for six years during which time no flowers were produced and the planting gradually deteriorated.

***Calochortus obispoensis* Lemmon.**

Habitat: In the dry rocky canyons of San Luis Obispo County, California.

Propagation: One number of mature bulbs was acquired in 1955. In 1965 two collections of seeds were added but have not attained sufficient age to be judged as to adaptability. The seed damps off readily.

Culture: Set out in December 1955, a few bulbs lingered until 1959. Two or three flowers were observed in 1957.

***Calochortus plummerae* Greene.**

Habitat: Often found in the dry brushy or open spaces in chaparral below 5,000 feet in the area between the Santa Monica Mountains and the San Jacinto Mountains.

Propagation: One collection of seed sown in September 1952 took 43 days to emerge without pretreatment. The material was grown in the nursery until 1954 when it was considered ready for planting.

Culture: This species was native to the botanic garden area but only rarely seen in the very dry soft chaparral. Within a few years, it disappeared apparently not liking the changed cultural conditions. Our own planting was observed doing well for three years but was later reported as being lost to rodents.

***Calochortus splendens* Benth.**

Lilac Mariposa.

Habitat: Most often found on dry slopes in heavy or granitic soils, below 6,500 feet in the Coast Ranges from Colusa County to northern Baja California (Mexico), and Santa Catalina Island.

Propagation: Untreated seeds will come up in periods ranging from 11 to 86 days but on the average 20 to 30 days. One to two months cold-stratification will come up almost immediately or be already up before removal. Best not to cold-stratify.

Culture: While this species was native to the east and north slope of the mesa, and does occasionally appear, the addition of plantings have changed the conditions and the species seldom is seen. Most of our additions from seed have been lost to rodents, but a few appear each year, even though not too successfully.

***Calochortus superbus* J.T. Howell.**

Habitat: Dry open slopes, meadows or wooded places up to 5,000 feet, the mountains of California from Shasta County to San Diego County.

Propagation: While we cold-stratified our seed for one or two months, it is unnecessary. Germination started before removal from cold two or three days later.

Culture: Plantings in 1956 and 1958 were recorded as dead within two years, but bulbs acquired in 1965 have grown very well. This lot was divided into two groups, one planted in rocky granitic loam with considerable humus under a large oak and the other was planted in full sun in the tight mesa clay. The latter group appears to be stronger and developed into a nice colony that flowered well and produced good crops of seed.

***Calochortus venustus* Benth.**

Habitat: Sandy or decomposed granite soils, 1,000 to 8,000 feet, mountains of central California to Los Angeles County.

Propagation: Fourteen collections, three of bulbs, eight of seed from wild, and three seed collections from our cultivated plants. None of the seed was cold-stratified and germination time varied from 12 to 98 days, the longest being taken by cultivated seed. Averaged about 30 days. Excellent germination in all cases except for one failure.

Culture: A few plants survive from a 1951 planting in rocky, granitic loam. A few flowers and some seeds are produced each year from this and subsequent additions. However, the majority of collections have been eradicated by field mice and other rodents.

***Calochortus weedii* Alph. Wood var. *intermedius* Ownbey.**

Habitat: Heavy soils in the hills of Orange County.

Propagation: Untreated seeds germination in 12 to 46 days, usually the former.

Culture: Recorded notes indicate some lots lived for seven years but were eventually eaten by rodents, particularly mice, and birds. No flowering or seeding were reported during that period.

***Calochortus weedii* Alph. Wood var. *vestus* Purdy.** [Ed: *Calochortus fimbriatus* H.P. McDonald. TJM2]

Habitat: Dry chaparral slopes from Monterey County to Ventura County.

Propagation: Three collections were processed. One of mature bulbs, the other two were seed. One lot was cold-stratified for 64 days and germination began four days after removal, while an untreated seed lot took 18 days, indicating that cold-stratification is unnecessary.

Culture: The mature bulbs set out in 1957 have persisted sparingly for the last ten years, producing a few flowers and some seed each season. Growth appears to be normal but the colony does not increase to any degree. Later plantings have been destroyed by rodents.

***Caltha howellii* (Huth) Greene.** [Ed: *Caltha leptosepala* DC. TJM2]

Marsh-Marigold.

Perennial.

Ranunculaceae. Buttercup Family.

Habitat: Marshy and boggy places in the North Coast Ranges and Sierra Nevada to southern Oregon, from 4,500 to 10,500 feet.

Propagation: Four attempts were made in 1953 and 1954 to germinate seed with pretreatment of cold-stratification. All attempts failed.

***Calycadenia multiglandulosa* DC. ssp. *cephalotes* (DC.) Keck.** [Ed: the ssp. is not recognized in TJM2]

Rosin-Weed.

Annual.

Asteraceae. Sunflower Family.

Habitat: The grassy slopes and valleys, below 1,000 feet in the North Coast Ranges from Mendocino County to Napa and Sonoma counties.

Propagation: The seed was sown directly into the rock garden in January 1955. It took 25 days to come up. First flowering was recorded in July, 1955, but the plants all died from root rot fungus, which heavily impregnated the soil during that period. While no seed was recorded as setting, scattered plants were observed each season for three years.

***Calycanthus occidentalis* Hook. & Arn.**

Spice-Bush.

Deciduous Shrub.

Calycanthaceae. Calycanthus Family.

Habitat: Around ponds, along streams and other moist places, below 4,000 feet, North Coast Ranges and the western base of the Sierra Nevada from Shasta to Tulare counties.

Propagation: Untreated seed will sprout within 25 to 30 days when sown in flats or, up to four months if sown in the open ground. Either way, good results are obtained, and no problems should be encountered in raising these plants to planting size. Young plants or rooted branches and mature clumps may be transplanted with ease.

Culture: Our material was grown from seed gathered from in plants established at the old site in 1927. These were used in a number of sites, doing best on semishaded banks. Except for severe sunburn during the hottest periods of the year, all plants grew vigorously, flowered well and produced quantities of seeds. Our oldest plants have spread as much 20 feet and attained heights of five to eight feet in 15 years. In the proper locations, this plant serves as a useful erosion control material.

***Calycoseris parryi* A. Gray.**

Annual.

Asteraceae. Sunflower Family.

Habitat: Common on open desert flats and slopes, up to 6,000 feet; California deserts to Utah and Arizona.

Propagation: Well-drained beds of crushed granite and sand were prepared in the desert garden or the desert sand dunes were used for growing this species. The seed, sown directly in the site, took from one to two months to emerge with varying results.

Culture: Making rank growth up to 12 inches tall with equal or greater spreads, the plants occasionally flowered well and produced viable seeds. More frequently, as the blooming period was reached in late March or in April, the plants were attacked with a crown rot and soon died. However, volunteers were noted over a period of eight years, after which no further record was noted.

***Calycoseris wrightii* A. Gray.**

Annual.

Asteraceae. Sunflower Family.

Habitat: Less common than *C. parryi*, the species is more widely distributed, ranging from the eastern Mojave Desert, along west edge of the Colorado Desert and thence to Utah and western Texas.

Propagation: Of two seed collections made in April, 1958, only one produced a few seedlings from seed sown directly into a garden site of well-drained sandy granite soil. One lot died before producing flowers and a second lot had a few flowers but no seed was produced. Seed

germination took about the same period as *C. parryi*, and flowering occurred in April, 1960. No additional signs have been recorded since that date.

***Calyptridium umbellatum* (Torr.) Greene.**

Pussy Paws.

Annual to Perennial.

Portulacaceae. Purslane Family. [Ed: Montiaceae. Miner's Lettuce Family. TJM2]

Habitat: A locally common species found at elevations of 2,500 to 11,000 feet, mostly on well-drained, gravelly, or sandy slopes and flats, ranging from the San Jacinto Mountains through the Sierra Nevada and Coast Ranges from the Santa Cruz Mountains to British Columbia (Canada); Rocky Mountains; and Baja California (Mexico).

Propagation: When the seed is sown in flats, the seedlings will begin to emerge in nine to twelve days, but in the open ground, it may take up to two months. We frequently followed the latter procedure with good results. Transplanting the seedlings and growing on in the nursery was accomplished with no problems, usually producing 100% of the seedlings.

Culture: Either when the seed was sown in the open or seedlings transplanted, we always placed them in our well-drained, gravelly rock garden, in full sun. Here they quickly established themselves and usually produced flowers within six months from date of sowing the seed, either in the open or in the nursery. Growing vigorously, plants up to 12 inches across made handsome specimens, flowering profusely and producing an abundance of seed. While the plants do not survive for more than a year or two, there are an abundance of seedlings each year to keep the species growing.

***Calystegia macrostegia* (Greene) Brummitt.**

Morning-Glory.

Perennial.

Convolvulaceae. Morning-Glory Family.

Habitat: Brushy flats and canyons of the Channel Islands, California; Guadalupe and San Martin islands, Baja California (Mexico).

Propagation: Seed will sprout in five to ten days, but usually our collections have produced but a few seedlings. No losses were encountered in transplanting the seedlings through to five-inch containers. The same length of time for germination and results were recorded for the **ssp. *cyclostegia* (House) Brummitt.**

Culture: Few of the seedlings became established, and since most of the material has only been out for a matter of two years, complete assessment of our results cannot be made.

***Calystegia soldanella* (L.) R. Br.**

Beach Morning-Glory.

Perennial.

Habitat: Commonly found growing in the Coastal Strand from San Diego County to Washington; South America; Old World.

Propagation: Sown in five-inch pots, the seed will start germinating in 15 days or even up to two months, recorded for our two collections from the wild. Seed sown directly into garden sites will take much longer to germinate.

Culture: Our two plantings made in March, 1966, have developed rapidly in our coastal sand dune garden. Given some protection under small shrubs, the species has spread quickly into surrounding areas, making for a healthy planting. Flowering was noted within three months after setting out in the permanent location. We have not encountered the problems we had at the old location.

***Camassia leichtlinii* (Baker) S. Watson ssp. *suksdorfii* (Greenm.) Gould.**

Camas.

Perennial herb.

Liliaceae. Lily Family. [Ed: Agavaceae. Century Plant Family. TJM2]

Habitat: At elevations of 2,000 to 8,000 feet, in mountain meadows of northern California to British Columbia (Canada).

Propagation: Mature bulbs acquired from the wild were grown in the nursery for a year before setting out. Seed harvested from this collection was sown in September 1952, but failed to germinate. No subsequent collections have been introduced.

Culture: Bulbs were set out October 1952 in a shady, well-drained area that was moist during the winter months. The following April, 1952, flowers were borne and seed developed, but which apparently was not viable. This collection gradually deteriorated until it was written off in 1957.

***Campanula prenanthoides* Durand.** [Ed: *Asyneuma prenanthoides* (Durand) McVaugh. TJM2]

California Harebell.

Perennial.

Campanulaceae. Bellflower Family.

Habitat: Monterey County and Tulare County northward in dry, wooded places in the mountains northward to southern Oregon.

Propagation: Seed may be sown directly into site or in flats, the latter germinating more rapidly. Nursery sown seed has been erratic in germination periods, ranging from 25 days to two-and-a-half months. The best results were recorded for the shorter periods. Transplanting history has been good, with little or no losses recorded. Some of the seedlings appeared to be weak, but this did not appear to have been the result of age as excellent germination occurred from five- and six-year-old seed.

Culture: This short-lived species grows quickly, flowers the first year and produces quantities of seed, which increases the volunteer crop each year. We have mainly used our collections in a semi-shaded portion of the rock garden where drainage is excellent. Even so, mature plants, because of their rank growth, maintain moisture too long underneath and around the crown

causing rotting and a quick demise. It needs to be kept somewhat on the dry side to prolong its life.

***Cardionema ramosissimum* (Weinm.) A. Nelson & J.F. Macbr.**

Perennial herb.

Caryophyllaceae. Pink Family.

Habitat: Sandy coastal strand and bluffs, Washington to Baja California (Mexico), western Mexico, Chile.

Propagation: Seed harvested in July 1950, from established plants at the old site was not sown in the nursery until August 1954. This failed to germinate and another lot was sown in January 1955 directly into a garden site. Forty-eight days later, these emerged, and continued to grow. A 1965 seed collection from the wild, produced seedlings in 12 days when sown in nursery flats. While germination was poor, there was no loss of seedlings and all were grown to planting size.

Culture: This species needs to be kept on the dry side in well-drained, sandy soil. Watering, particularly summer irrigation, will soon rot the plants, hence our results at the old site were much better than here, where established plants have not survived more than five to seven years. They will not withstand any smothering by other plants.

***Carex* L.**

Perennial herbs.

Cyperaceae. Sedge Family.

This is the largest genus of flowering plants in California. Munz & Keck (1959) recognize 144 species, three of which are introduced, 21 that extend beyond North America, and 21 that are endemic to California. We have made no effort to obtain a large collection of this genus as most of the species can soon become difficult to control, quickly spreading by underground rootstocks.

Propagation: By seed or small clumps of roots. The seeds require on the average about 45 days, although some lots came up in 18 days. Since only a few pots of each species was desired, we sowed the seed directly into the container. The following species were handled: ***C. nebrascensis* Dewey.**, ***C. obispoensis* Stacey.** (failed to germinate), ***C. obnupta* L.H. Bailey.**, ***C. pansa* L.H. Bailey.**, ***C. senta* Boott.**, ***C. sitchensis* Prescott.** [Ed: *C. aquatilis* Wahlenb. var. *dives* (T. Holm) Kuk. TJM2], and ***C. viridula* Michx.**

Culture: All of the species above were placed in or beside an intermittent stream on the mesa, where the soil is heavy and either moist or wet all the time. Colonies have become established and some have flourished quite well. Several clumps of ***C. sitchensis***, were grown at the old site from 1937, were moved and established at the edge of a pond. While it became established, at no time has this species really appeared to be happy in the area, or it may be the nature of the species, since it is rare in the wild.

***Carpenteria californica* Torr.**

Tree-Anemone.

Shrub (evergreen).

Saxifragaceae. Saxifrage Family. [Ed: Hydrangeaceae. Hydrangea Family. TJM2]

Habitat: Fresno County, 1,500 to 4,500 feet, on dry granitic ridges and slopes between the San Joaquin and Kings rivers.

Propagation: Seeds, cuttings, and suckers may be used for propagation of this handsome endemic. An open seeding medium is a must, the seed should be sown almost on top of the medium as it is very tiny, and careful attention must be given to watering as the species is highly subject to damp-off fungus. A fungicide, such as Captan, would ensure prevention of this fungus. The average period for germination to start has been ten to 18 days for eight separate lots handled in the nursery since 1950. The tiny seedlings must be handled carefully during the initial stages of potting, but once established, there is no problem in growing on to planting size.

Greenwood tip cuttings treated with Rootone, put under intermittent mist, and with bottom heat rooted 99%, and rooting started in 14 days. New growth, and new growth with semihard base treated with Hormodin #2 and put in a cold frame without bottom heat rooted poorly, and took 22 to 26 days to root. All cuttings were taken in April. Suckers would be treated in a like manner unless they had struck roots before severing from the parent plant. Mature plants can be balled and moved readily with little or no loss.

Culture: *Carpenteria* performs best in semishade, but does well in full sun, usually blooming more profusely in the latter situation. The species appears to grow equally well in heavy clay soil or well-drained granitic loam. An occasional irrigation and light pruning help the appearance of the plants as they tend to become somewhat shabby during the summer months. The only pest that seriously affects the appearance of the plants is aphids, and with the new systemic sprays available, this condition should not hamper the use of this rare plant.

Our oldest collections were moved from the old site where they had been established since 1942. All of the 24 of one collection and 13 of a second number are thriving here. They have attained sizes of six to nine feet tall and six to twelve feet wide, and have continuously borne flowers and seeds. Additional plants raised from seeds and by cuttings have done equally well in all locations. Watering in the heavier, less well-drained soils should be carefully watched. In June 1962, we received from the University of Washington Arboretum, a plant acquired by them from the Sunningdale Nurseries, Windlesham, Surrey, England, which was said to have particularly large and well-formed flowers. The plant was imported in March 1960, cuttings were rooted and we received one of them to grow for assessment and to preserve the clone in case it should be lost in Washington. The specimen was placed in a semishaded spot in clay-loam soil with a considerable amount of oak leaf humus in the soil. The flowering has been sparse and the flowers have not been any better than any one of our own plantings. However, as time passes, it may show to better advantage.

***Cassia armata* S. Watson.** [Ed: *Senna armata* (S. Watson) H.S. Irwin & Barneby. TJM2]

Senna.

Shrub.

Fabaceae. Pea Family.

Habitat: Sandy washes and open flats of the Colorado and Mojave deserts, to Arizona and Nevada, below 3,700 feet.

Propagation: Untreated seed usually was sown in small pots or directly into a site in the garden to avoid disturbing the long tap root as much as possible, since the seedlings are difficult to move. Germination required from three to 15 days, was usually very poor, and growth was slow. Much of the seed has a low percentage of viability. Great care had to be exercised to prevent damping-off, and seed was dusted with a fungicide, mostly a Captan product. Despite our best efforts, we raised comparatively few seedlings to planting size, no matter what planting media was used or how carefully watering was controlled.

Culture: Two plants that had been raised in the desert were acquired 1952. We planted them in our desert garden, where the drainage is excellent, and one plant survived for ten years. Flowering started the sixth year and was never profuse. Capsules formed but no seed was ever produced. The plant had attained a size of 28 inches tall by 25 inches wide before dying. Several other collections failed to develop at all, usually dying within a year, even though some of the seed had been sown directly into the garden site.

***Castanopsis chrysophylla* (Dougl.) A. D.C.** [Ed: *Chrysolepis chrysophylla* (Hook.) Hjelmq. TJM2]

Giant Chinquapin.

Tree (evergreen).

Fagaceae. Beech Family.

Habitat: Growing on the forested slopes near the coast, below 1,500 feet, Mendocino to Del Norte counties, to Washington.

Propagation: Our procedure is to sprout the burs in a mixture of moist peat moss and perlite. Growth begins in 25 to 35 days with maximum results in two to three months. At the proper time, the sprouted burs were transferred to deep seed flats with copper screen or a painting of copper sulphate on the bottom. This latter treatment tends to burn the tip of the long tap roots and produces a more fibrous root system for transplanting. After growing in the deep flats from four to six months, the plants were transferred to gallon-cans. One lot, upon transfer, was kept in a very moist greenhouse room and there were high losses, probably from too much moisture. A second lot of burs from the same collection were raised two years after collecting by the same methods, but holding the burs in cold-stratification for a period of two months. Sprouting time was about the same. After growing in the deep flat for four months, the young plants were transferred to gallon-cans, but not put in humidifying room of the greenhouse. Only two plants were lost. No further trouble was encountered while the plants were in the nursery. One small bareroot specimen was transplanted from the wild and was established in a container before planting in the garden. Eight of ten bareroot plants of ***Castanopsis chrysophylla* var. *minor* (Benth.) A. DC.** [Ed: *Chrysolepis chrysophylla* (Hook.) Hjelmq. var. *minor* (Benth.) Munz. TMJ2] were successfully transplanted from the wild to the garden.

Culture: The growth history of this species here has not been good, due principally to root rot problems. Handsome specimens would develop for period up to five- or six-years-old and then succumb to root rot, either in well-drained or heavy clay soils. One group has dropped from 85 plants to four in five years, but part of the trouble has been the high summer temperatures. Other lots placed in shaded or semishade spots with good drainage gradually have been lost one by one. Eight plants of the **var. *minor***, the golden chinquapin, were planted on the mesa. They grew very well until a severe hot spell during their third year. There was a rapid loss until all were

gone in the eighth year. They attained sizes of three-and-a-half to four-and-a-half feet tall and six to eight feet wide. Some flowers were produced the second year and at least two dozen burrs were counted in the sixth year. The burrs did not develop. All of the dead plants exhibited symptoms of a root rot.

***Castanopsis sempervirens* (Kellogg) Dudley.** [Ed: *Chrysolepis sempervirens* (Kellogg) Hjelmq. TJM2]

Bush Chinquapin.

Shrub (evergreen).

Habitat: On dry rocky slopes and ridges, at elevations of 2,500 to 11,000 feet, one finds this species in the open spaces and montane coniferous forests in the San Jacinto and San Gabriel Mountains, and in the Sierra Nevada from Kern County northward, and in the Coast Ranges from Lake County to southern Oregon.

Propagation: It is not always possible to find good seed of this species, and out of five collections acquired between 1952 and 1958, only one produced any quantity of seedlings. We started the seed in a moist mixture of peat moss and perlite or finely crushed granite, and in one case, we cold-stratified the seed for four months. This procedure did not appear to help, and is not recommended except as a means of holding the seed for a longer period. Germinative capacity, as stated, is usually poor, and our quickest period was 22 days for two lots up to 117 days for one lot, not including the cold-stratified lot. Maximum capacity was reached in periods of two to three months with germination continuing for six months. The tap roots are very long, and proper procedures must be followed in transferring the seedlings to containers. It is best to establish seedlings in deep seed beds or field rows. Some losses occurred after transferring to gallon containers, when the young seedlings rotted easily.

Culture: Of the five collections handled, only two have shown any degree of strength here. One number collected in the Lake Tahoe region at 6,500 feet had 50% alive in ten years and had grown to three-and-a-half feet tall by two-and-a-half to seven-and-a-half feet wide. No flowering or seeding had been recorded in that period. As might be expected, the best stand established has been from a number gathered on the slopes of Mount Baldy, just above us at 8,200 feet in the San Gabriel Mountains. In well-drained, granitic loam with some shade provided by other larger plants, a total of 31 out of 40 have lived for ten years. They are up to four feet tall with spreads to eight feet. The first flowering was recorded in their tenth year. Other plantings have succumbed in the heavier soils or where more irrigation may be applied.

***Castilleja affinis* Hook. & Arn.**

Perennial.

Scrophulariaceae. Figwort Family. [Ed: Orobanchaceae. Broomrape Family. TJM2]

Habitat: Throughout the Coast Ranges on dry wooded and brushy slopes from Napa and Sonoma counties to Baja California (Mexico).

Propagation: Seed from one collection that was sown in a flat produced seedlings in 14 days and maximum amounts in 45 days. Upon transplanting to pots, we sowed seed of *Gilia capitata* Sims ssp. *chamissonis* (Greene) V.E. Grant. in 114 of the pots to determine if this would be beneficial to this semi-parasitic plant. Additional amounts were potted without sowing any *Gilia* seed and

the remaining seedlings were left in the flat. Insofar as we could determine, there was no apparent benefit to the *Castilleja* from the *Gilia*. The ones without the *Gilia* grow every bit as well.

Culture: Except for lacking granitic slopes, the seedlings were planted in a typical situation with all the natural components present. This procedure failed as well as one other locale dissimilar in naturalness but in well-drained sandy loam.

***Castilleja miniata* Hook.**

Perennial.

Habitat: Widely distributed along streams and in wet places below 11,000 feet, California to British Columbia (Canada), and the Rocky Mountains.

Propagation: Seeds sown directly into a garden site came up in 23 days and one plant brought in from the wild did not survive the move.

Culture: The plants from seed sown in a stream bed in 1950 were recorded as being dead six years later. No other information was recorded.

***Caulanthus amplexicaulis* S. Watson.**

Annual.

Brassicaceae. Mustard Family.

Habitat: On loose dry slopes, 5,000 to 8,500 feet, western Mojave Desert, San Bernardino Mountains and San Gabriel Mountains.

Propagation: The seed was sown directly into a garden site on 12-10-63 in the rock garden where germination began in 28 days.

Culture: Seven plants survived to begin flowering in late May, 1964. In July the seed was harvested. This is a rather insignificant annual, and does not make a show.

***Caulanthus coulteri* S. Watson.**

Annual.

Habitat: Dry slopes and valley grasslands below 5,000 feet in the Sierra Nevada foothills from Madera County to northern Los Angeles County.

Propagation: One collection of seed was sown directly into the rock garden where germination occurred in 19 days, but all the seedlings damped off.

***Caulanthus crassicaulis* (Torr.) S. Watson.**

Perennial.

Habitat: Eastern Mojave Desert Mountains, 5,000 to 8,000 feet, dry rocky slopes, uncommon, and to Nevada, Utah, and Wyoming.

Propagation: One seed collection was gathered in 1954. Seed sown in a flat in September took four days to come up. All of the seedlings were transplanted easily with only minor losses. A

second lot in 1956 was sown directly into a garden site in the desert garden where it took 38 days to begin growth.

Culture: None of the plantings survived for more than six months here as conditions are greatly different than in the wild. Probably too wet and cold.

***Caulanthus inflatus* S. Watson.**

Desert Candle.

Annual.

Habitat: Common in very dry open flats and brushy slopes below 5,000 feet, from the Inner Coast Ranges southeastward to the western Mojave Desert.

Propagation: All of our collections of seed were sown directly into a garden site in the desert garden. Germination usually took from 18 to 29 days, often poorly at first. Rains seemed start new seedlings over a period of several years, from the same sowing. If the weather was too cold and moist, many plants were lost from damp-off.

Culture: None of our plants persisted to any degree. The specimens were usually poor and only when dry warm weather conditions were present and seeds had been sown later in the winter did we get best results. Some flowering occurred in April and the seeds were harvested in May.

***Ceanothus* L.**

California-Lilac.

Shrubs and Small Trees.

Rhamnaceae. Buckthorn Family.

The genus *Ceanothus* is comprised of some 50 to 60 species and many varieties. They are all found in temperate North America, with the greatest number being native to California. Munz & Keck (1959) recognize 64 taxa and eight named natural hybrids. There are also, many races, variations, forms, etc. that are considered valid by other authors who have listed and described them. In the past 15 years, we have grown 37 species, 20 varieties, and none of the natural hybrids. During the past fifty years, there has been generated a great interest in the group, due, in part to the beauty and abundance of the flowers and the popularizing and introductions of Theodore Payne.

The flowers are small but showy, ranging in color from white to blue or purplish, sometimes lavender or pinkish, and borne profusely in terminal and lateral panicles or umbel-like cymes. The usually magnificent display, in cultivation, occurring from late winter to early summer has caused this group to become a popular, although sometimes discouraging, garden subject. Besides their beauty of flower, the wide range of growth habits have further enhanced the many uses to which they can be put, such as prostrate groundcovers, small foreground shrubs, medium-sized shrubs, and large background plants of tree-like proportions. Their rapid growth and generally large size prohibits their use in many small gardens, but where mass displays are needed, these plants can be valuable.

Propagation: Propagation is by seed, cuttings, or layering with some species. Seeds are harvested for low elevation species from late May to July. Seeds for species growing at higher elevation are harvested from August to September, depending upon the actual locality. The rather hard and

impermeable seed coat or embryo dormancy makes it necessary to use some form of pretreatment to cause germination. This is done usually by one of several methods, namely: before sowing, soaking the seed for a period of time in water that has been heated to 180° F or near boiling (this is known as the hot water treatment), sowing the seed, then cold-stratifying it for a period of two to three months (or longer, if necessary) at temperatures between 36° F and -40° F or by using the hot water treatment and then cold-stratifying or by burning straw, pine needles, or excelsior on top of soil mix in which seed has been sown. Germination will begin on the average during periods of seven days to three weeks, or in the case of cold-stratification within a short time after removal from the cold. The most generally practiced methods are the hot water treatment and cold-stratifying. The case for burning over flat or seed bed is best exemplified by the mass of seedlings that usually appear after a fire in the hills or mountains where any one of several species of the genus may be naturally growing. The seed appears to germinate best when sown during the winter months. Our practice has been to sow during September, October, and November, although there have been times when seed was sown earlier or later. Cuttings are usually started by taking moderately firm tip wood, three to five inches long, treating with a rooting compound, inserting in a rooting medium (our mix is: one-half perlite, one-half peat moss or variations thereof), putting the cuttings, either in a container or directly inserted into the bench, kept under intermittent mist and in a highly humidified room in the greenhouse (we used the Binks Method of humidification). This procedure is accomplished in April or any months when plant material is ready. We have inserted our majority of material during April, but have gotten good results in almost any month of the year. Rooting will start on the average in three to five weeks, but may take shorter or longer, depending on the species and quality of material. Parent plants grown under lath or other cover are generally the best source of cuttings. The period during rooting has to be carefully observed as some species do not take kindly to intermittent mist. In such cases, we have rooted these successfully in individual pots in a highly humidified room. Fungicides are often useful in preventing damp-off during the rooting period. If water is highly alkaline, a slow-rooting cutting may acquire a coating of lime which will be detrimental for future growth after the cutting has rooted and is removed from the misting compartment. The drying of the stems or killing the leaf nodes will prevent future growth, therefore intermittent application of mist must be applied until cuttings are established in small pots.

Culture: Much has been written about the culture of *Ceanothus*. Some kinds (mostly hybrids) have been raised successfully in moist climates, particularly in England. However, most of the species prefer a drier climate, and well-drained soil or slopes of quick runoff are essential ingredients for more successful culture. The problem of irrigation is one to carefully assess. Unfortunately, the root systems of all species are readily attacked by the various root rot fungi, etc. A general observation may be that water should be supplied at least once a week when first set out from containers and rain has not been recorded. This period can be gradually extended until only a few applications per year or no water is provided. If the soil is heavy or poorly drained, deep but infrequent or no irrigations should be the practice. Plants should not be located in the garden where regular and frequent irrigations are applied, particularly in the summer months as this is the time when root-rot fungi grow best under moist and warm conditions.

Pruning should be limited to pinching back new growth, removing the dead twigs, shaping the plant, etc. Heavy pruning will drastically cut down on the flowering and will take at least two years to recover to normal flowering. Every five to ten years, heavier pruning of some species will cause a renewal of young vigorous growth and is of considerable benefit. This is what takes

place when the stump sprouting species are burned in a forest fire. It is best to limit this practice of severe pruning to the stump sprouting species.

Pests, Insects and Diseases: The usual, commonly known insects, such as aphids, some kinds of mites, mealy bugs, scale, etc. are found on the more popularly grown kinds, however, they are readily controlled by the use of proper sprays or the newer systemic insecticides. The ceanothus stem gall moth (*Periploca ceanothiella*) is commonly found among species of the *Euceanothus* section of the genus. [Ed: Section *Euceanothus* is now known as section *Ceanothus*.]

Infestations of this moth have been particularly severe in our plantings. Considerable research has been done on its life history and control. The moth punctures the new, soft tip growth, lays its eggs, and small larvae hatch and eat the inside the stem, causing an enlargement of the stem. This in turn prohibits normal flowering. Attacks by the moth most often occur during the periods of new growth after flowering and prevention is the best means for controlling the stem galls. The first practice to follow is to irrigate as little as possible, thus preventing new growth to the minimum. Secondly, spray once a month during August, September, and October with Cygon 267, at the rate of four-and-a-half pints per 100 gallons of water. We have found this method the most effective, and while not all stem galls can be eliminated, at least 50 to 75% can be controlled. Among the species of dense growth habit, it became necessary to inspect regularly for the nests of rats and mice. The rats and mice build their nests in the center of the large shrubs and are often difficult to detect until dying branches are noted and inspections shows the rats or mice have stripped the bark of the branches. In places where gophers are prevalent, strong prevention methods should be carried on. All species need protection against rabbits and deer.

In our opinion, the most serious defect that prohibits this genus from becoming a very popular garden subject is the susceptibility to root rot, particularly that classified under the genus *Phytophthora*. Excess moisture applied during the warmer seasons of the year contributes greatly to the advance of this disease, and all species of *Ceanothus* are subject to being killed by it. To avoid this problem, careful horticultural practices must be applied as well as planting the plants in well-drained soils. A contributor to the short life span of most species is the raising of the young plants in containers and poor nursery practices, such as leaving the plant in the container too long, causing a tightly coiled root system, which in turn harbors the root rot fungi. If seeds could be sown in the area where the plant is desired, much longer life would be the result.

Another serious problem we have experienced is a fasciation or proliferation of the new branch growth, making a tight, unhealthy branching system, which in turn spoils the flowering. The cause of this affliction has not been determined, but a virus has been indicated. This problem occurred first in *C. papillosus* var. *roweanus* and later was noted in a number of species, again those in the *Euceanothus* section of the genus. After the second year, other genera were attacked. This condition was prevalent over a period of about five years, but during the past two years (1966 and 1967), there has been considerable improvement and most of the species seemed to have outgrown the problem. While it was at its worst, the plants were miserable looking specimens. One record has been made of *C. glorious* being killed by oak root fungus (*Armillaria mellea*). Two other species have also been suspected as having died from that serious fungus.

Note: Numerous articles on the genus have been published in many noteworthy horticultural publications, such as **Gardeners' Chronicle**, **Journal of the Royal Horticultural Society**, **California Horticultural Society Journal**, and *Sunset's Western Garden Book*. Van Rennselaer & McMinn (1942) and Everett (1957. Pgs: 53-68.) should be consulted for specific information.

Hybrids – As has been stated, it is difficult to raise a pure species from seed when the seed has been collected from plants growing in the vicinity of other species. The work of the bees, which visit the flowering plants in some quantity, make it impossible to get seed of the true species. Hence it is necessary to reproduce plants in our collection by cuttings. However, often in a group of seedlings, an interesting type is found and as a consequence a number of superior types have been introduced to horticulture. While we have selected many kinds, we have not considered any of them worthy of introduction, but they have been of enough interest for us to continue to grow them. The hybrids created by Dr. Malcolm Nobs are listed in the text below after the *Ceanothus gloriosus* entry, after the *Ceanothus gloriosus* var. *porrectus* entry, and after the *Ceanothus rigidus* entry.

Common Name: While there are a few species to which a specific common name has been consistently applied, the term “California-Lilac” has most generally been used. This common appellation will be used here and unless specifically noted otherwise, will not be repeated in the following text.

***Ceanothus arboreus* Greene.**

Shrub or Small Tree.

Habitat: Among the chaparral of Santa Cruz, Santa Rosa, and Santa Catalina islands.

Propagation: Seed harvested from isolated plants at the old site in 1949 produced quantities of seedlings in ten to 15 days when subjected to the hot water treatment for 20 hours. The first lot was sown in November 1950 and the second in September 1957, and equally good results were recorded. A 1965 collection from the wild was subjected to the hot water treatment for 16 hours and then cold-stratified for 38 days, at which time it was noted the seed was already germinating. Therefore, it is unnecessary to cold-stratify. A collection of semihard and hardwood cuttings from wild plants rooted 97% in 76 days when treated with Hormodin #2 and the addition of bottom heat after 60 days. Five years later, tip cuttings were taken from these plants under cultivation, and 90% rooted in 29 days when treated with Rootone but no bottom heat. Seedlings and cuttings, once established, grow rapidly in containers attaining as much as three to four feet in six to eight months.

Culture: During the fifteen year period, there has been a 60% loss of plants which have been situated in rocky decomposed granite loam. Growth has been rapid, plants three to four feet tall when set out, attained sizes of 12 to 15 feet tall and 13 to 25 feet spread. Flowering and seeding started within three years. Young plantings need to be protected from rabbits and other grazing animals. And young plants will not tolerate many degrees of frost, as indicated by heavy losses occurring among two-year-old plants from a sudden and sharp frost in the winter of 1952. In 1962, most of our plantings were noted to have severe branch proliferation, and the specimens in general became weakened and made little growth. This condition gradually improved until those surviving five years later appeared to be quite normal. In our area, this species appears to prefer a slightly shaded position as indicated by our superior specimens in such locations.

***Ceanothus* ‘Bamico’.**

Shrub.

Propagation: Nursery history incomplete, but tip cuttings taken October 1962, rooted 90% in 43 days. There were no losses of rooted cuttings in the nursery.

Culture: We received our original plant in 1962, accompanied by a letter from Mr. Otto Martens, Manager, Deigaard Nurseries, Duarte, California with the following information. "The original plant was planted out among some other *Ceanothus griseus* seedlings by Horace Colby, seven or eight years ago at the Bamico Nursery (same location as the old Rust Nursery), 352 East Glenarm, Pasadena. This one *Ceanothus* distinguished itself by being compact and growing to a height of three to three and one-half feet, with heavy, glossy, large leaves; color (of flowers) medium blue. Coolidge Rare Plant Gardens took cuttings of this plant, considering it outstanding and brought it into trade by the name of *Ceanothus* 'Bamico'. The parent plant subsequently [Ed: became infested] with borers and died." While this unpublished selection has grown well for us, it cannot be considered of outstanding merit when compared with others that have been subsequently introduced.

***Ceanothus* 'Blue Cloud'.**

Large Shrub.

Propagation: Three plants received in containers in 1950. Cuttings were taken in April and July, 1958. The plants were in flower when the first lot of cuttings were taken, new tip growth of side shoots were treated with Rootone, given bottom heat, and were placed under intermittent mist. Only seven out of 20 rooted and four of these died after removal from cutting frame. In July, 20 tip greenwood cuttings were taken and treated with SUPERthrive and Terraclor. Of these 11 rooted but six died apparently from heavy incrustation of lime on leaves and stems after prolonged period taken for rooting, both lots needing 47 and 43 days respectively to begin rooting. During transplanting procedures, all were lost except for five raised to planting size.

Culture: The first three plants were received from the late Louis Lake Edmunds, Danville, California, who stated he had received in 1940 a lot of seedlings of *Ceanothus* which had been propagated by Clarence Quick for Professor Howard E. McMinn, a long time student of the genus. Many of these seedlings were used in his gardens (Edmunds'). Professor McMinn and Mr. Edmunds considered the above to be a cross between *C. spinosus* and *C. impressus*. These three plants thrived and grew into large plants but were not considered to be of outstanding merit. The additional plants were raised to keep the cultivar in existence and to further study it. However, after several years, most of the plants deteriorated to such an extent that further plants have not been raised, although the plants continue to live in the garden.

***Ceanothus* 'Blue Cushion'.**

Low Shrub.

Propagation: Originally received as plants in 1958, three lots of cuttings were taken in 1961, the first in April and two more in October. The plants were in flower in April and 80 side shoots were taken, and treated with CUTstart XX. The cuttings started rooting in 27 days, 46 were potted off. The roots were very long – up to nine inches – in 20 days after initial rooting. Losses during transplanting stages were small. A second lot of 81 cuttings in October, treated with Rootone and soaked in Terraclor rooted in 72 days, the first roots were recorded at 38 days. All were shifted through to gallon-cans and survival was good in the Nursery. Another lot of 40 cuttings taken at the same time, but given no treatment took 41 days to start rooting and only 25% rooted. (Dates cuttings taken: October 23, 1961). No particular problems were encountered in raising the cuttings through nursery.

Culture: This cultivar is another selection of the late Louis Lake Edmunds. Three plants were received in January 1958 and were held in the nursery until December 1958, when they were planted in full sun in the tight clay-loam soil of the mesa. Notes taken May 1962 recorded the plants as being two feet tall and four feet wide with first flowering in April, 1962. While making neat, dark green mounds, the plants are not completely attractive because of a “witches broom” effect of the foliage. One branch appears normal, and has nice blue flowers, while the dense proliferated foliage did not bear flowers or bloomed very sparsely. These plants attracted considerable attention by lay and professionals alike because of the low, mounding and rather clean green of the foliage. Cuttings taken from normal appearing foliage, and which appeared in the plants four years after setting out, produced normal, low spreading, loosely open plants which appeared to flower as expected. Likewise, cuttings grown from the proliferated foliage continued to grow with that type of foliage, and in our opinion were not attractive as well as producing few flowers. The original three plants are doing well in their original site while the cutting grown material, used in several locations has experienced severe mortality, although one planting next to the original plants continues to thrive.

***Ceanothus* × *burtonensis* Van Rensselaer.** [Ed: This is the name for the hybrid between *Ceanothus impressus* and *Ceanothus thyrsiflorus*.]

Large Shrub.

Propagation: Cutting grown material received in January, 1958 from the late Louis Lake Edmunds Danville, California. Additional propagation was not carried on by us.

Culture: Van Rensselaer in ***Ceanothus***, p. 46. 1942, states this entity is a natural hybrid between *C. impressus* and *C. thyrsiflorus*, the original plant from which the above material was taken being found on Burton Mesa, San Luis Obispo County. Van Rensselaer used the name ‘burtonensis’ as a horticultural designation. McMinn, in his technical treatment in the same book makes no mention of it and the name therefore would have no technical validity. This entity grew into large bushes, which bore bright blue flowers with great profuseness during the earlier years but later became infested with ceanothus stem galls and much stem proliferation and had to be removed.

***Ceanothus* ‘Cielito Lindo’.**

Shrub.

Propagation: One plant received in a gallon-can in July, 1955, but apparently root rot had set before we received it as the plant died in the nursery soon after receiving. The plant had been grown from a cutting.

Culture: Among a group of seedlings grown by Mr. Frank Gander, Lakeside, California, this selection appeared and was of such interest that Mr. Gander grew several plants from cuttings. Our notes indicate Mr. Gander thought it to be a probable hybrid between *C. integerrimus* and *C. cyaneus*. There was also the added note that the material had been with Colchicine. He stated the flowers were a very fine blue.

***Ceanothus* ‘Concha’.**

Shrub.

Propagation: Originally received in May 1960, as plants in containers, 70 heal cuttings of side shoots were taken in May, 1961, treated with CUTstart XX and rooted under intermittent mist. Initial rooting started in 25 days and about 55% rooted. Even though shifting to pots began within ten days after initial rooting, clipping the roots was necessary to get them comfortably into the pots. Only minor losses were recorded during the growing on in the nursery.

Culture: Selected and introduced by the Bee Line Nursery, San Dimas, California, we were presented with two cutting grown plants in 1960 to be planted for testing. A probable selection of *C. impressus*, it had much of the qualities of this species, producing an abundance of dark blue flowers, much the same leaves but more upright in growth habit. It is an attractive selection that has performed well with us.

***Ceanothus* ‘Consuelo’.**

Propagation: A cutting grown plant received in February 1959. Five tip cuttings were taken upon receipt of the plant and four rooted in 50 days after treated with Hormodin #2, given intermittent mist, bottom heat, and five extra hours of light in the evenings. Two survived in the nursery for planting.

Culture: A selection of, and introduced by, the Bee Line Nursery, San Dimas, California The original plant, a seedling noted in the Bee Line Nursery, was selected for its unusually deep blue flowers and is a presumed hybrid of *C. impressus* and *C. thyrsiflorus*. It produces an abundance of bright blue flowers and has an upright habit similar to *C. thyrsiflorus* rather than *C. impressus*. Our plants have done well, but appear to be happier in well-drained soils. Stem proliferation and serious infestations of stem gall have marred the growth of this cultivar.

***Ceanothus cordulatus* Kellogg.**

Snow Bush.

Habitat: Open flats and slopes of montane coniferous forests, mostly at elevations of 3,000 to 9,500 feet from Baja California (Mexico), through the San Jacinto Mountains, Sierra Nevada, and North Coast Ranges from Lake County, to Oregon and Nevada. Flowering from May to July.

Propagation: Our records definitely show that seed needs to be cold-stratified for at least four months. There is some indication that seed three years or more old gives better results although this has not been strictly proven. All of our production, usually poor, came through seedlings. We began in January 1955 by sowing a few seed taken from a collection made in 1941. Only hot water treatment prior to sowing was used and from the few seeds we got 12 seedlings, all of which lived to be planted. Between 1951 and 1957, several sowings were made from wild sources. Sown at varying times with or without hot water treatment and cold-stratification, the best results occurred from the hot water treatment for 20 hours plus four months cold-stratification, either sown directly into to flats or putting in a jar with peat or sphagnum and sand, and waiting until seedlings started to emerge before removing from the cold. It is necessary to guard against damp-off when using such treatments. However, on most occasions our results were excellent during the growing stages in the nursery.

Culture: Grown continuously since October 1953, it cannot be said the species is entirely happy at this location. Used in well-drained, semishaded positions, there has been a gradual loss of plants until few remain of the original plantings. The best specimens have been those where soil conditions are somewhat on the drier side and while protected from the hottest sun, the position

is one of openness. Plants ten-years-old or more have attained sizes of one to four feet tall and spreads of 18 inches to 11 feet. Flower and seed production has been poor, not occurring before the seventh year.

***Ceanothus crassifolius* Torr.**

Habitat: Commonly seen on dry flats and slopes below 3,500 feet from Santa Barbara County to Baja California (Mexico). Flowering from January to April.

Propagation: Seed harvested in 1949 from a planting at the old site was sown in November 1950 after 24 hours soaking in hot water treatment. Within ten days, seedlings emerged and full germination had taken place in 30 days. There was a heavy loss during the gallon-can stage in the nursery; this species being quite susceptible to root rot troubles. Not until 1966 did we obtain a collection from the wild, and after 17 hours of hot water treatment plus 38 days of cold-stratification, seed emerged in eight days after removal from cold, and reached maximum germination in 14 days. However, indications are that this species does not need cold-stratification.

Culture: The original planting was made in May 1951, the plants being five to eight inches tall, good condition. During the 15 years, losses have been minimal, a total of 20 are alive from the original 27, and these are 11 to 14 feet tall by 12 to 16 feet spreads. Since the seed was harvested at the old garden site, it has been noted many of the plants are hybrids, perhaps being mixed with *C. cuneatus*.

***Ceanothus crassifolius* Torr. var. *planus* Abrams.** [Ed: the var. is not recognized in TJM2]

Habitat: Similar to species but mainly in Santa Barbara and Ventura counties, intergrading with the species farther south.

Propagation: Seed originally harvested in the wild in 1941 was taken from an herbarium sample and sown in January 1955, being 14-years-old. After 20 hours of hot water treatment, seedlings began emerging in 25 days with a resulting excellent germination within a month. In June 1950, seed was harvested from growing plants at the old site, sown the following October after 24 hours of hot water treatment. Twelve days later seedlings began emerging and only poor germination resulted within 30 days. The previous lot fared much better in the nursery than the second group, heavy losses resulting during the gallon-can stage.

Culture: The history of both of our plantings for this variety has been excellent. Thirty plants, six to 12 inches tall, were set out in November 1955, and in ten years only one plant was reported dead. The plants were in excellent condition, nine to 15½ feet tall and seven to 17 feet wide; fruiting began in the fifth year. The second lot of 21, measured 22 to 44 inches tall, planted in November 1952 were all recorded alive in their 15th year, seven to 15 feet tall and ten to 25 feet wide; flowering and fruiting began during their second year.

***Ceanothus cuneatus* (Hook.) Nutt.**

Buck Brush.

Habitat: One of our most common chaparral plants on dry slopes and alluvial fans below 6,000 feet from Baja California (Mexico), cismontane California to Oregon.

Propagation: Seven collections of seed were handled between 1950 and 1955. Four of these were 14-year-old seed taken from herbarium seed samples, one was from a cultivated collection in the old site and the remainder were direct from the wild. All collections were given the hot water treatment for periods of 20 to 24 hours and seedlings emerged in periods of 12 to 60 days, the quickest being the garden harvested seed lot. The 14-year-old seed ranged from 23 to 47 days while other wild collections generally took longer since they had been most recently collected. One lot of the minor variety #1 (according to McMinn) was raised from seed in ten days with hot water treatment. Also in April, 1958, 30 softwood tip cuttings (taken when the plant was in flower) were given no pretreatment but had bottom heat to 75° F, four hours of extra light, and intermittent mist. Only six rooted and of these three were raised for planting. The other numbers of the species were handled in the nursery without severe losses.

Culture: Generally all collections have done exceedingly well in well-drained, rocky granitic loam, particularly those raised from the 14-year-old seed. In the four collections, nine plants were recorded as dead and eight of these were from one accession that was being grown in a particularly difficult site with exceedingly poor soil conditions. Later collections have not fared as well, but all are growing well despite losses of individual plants. Ten-year-old plants less than a foot tall when planted, ranged from three to 12 feet in height and three to 14 feet spreads. The one number of *C. cuneatus*, minor variety #1 has shown no losses in 15 years and have attained heights of nine to 12½ feet tall by 14 to 20 feet in width. Flowering and seed production started from three to five years on the average with one number taking seven years.

***Ceanothus* hybrid (*C. cuneatus* toward *C. fresnensis*)** [Ed: This plant was later named and introduced by the garden as *Ceanothus* ‘Sierra Snow’.]

Propagation: Seed harvested from a planting at the old garden site was sown September 1950 after 24 hours hot water treatment. Seedlings began emerging in 18 days and fair results obtained. Minor losses occurred in the nursery during the growing stage. Cuttings from a selected plant rooted quite well with and without any pretreatment. Seventy tip cuttings were treated with Rootone and were placed in individual two-inch pots, and 52 rooted. Thirty-four untreated tip cuttings were placed in a seed pan and 32 rooted. Branches that had rooted where they had touched the ground were placed in flats. All of these (cuttings and rooted branches) were kept under intermittent mist in the greenhouse. A total of 80 plants were successfully raised, without problems, in the nursery.

Culture: In 1941, seed was harvested from wild plants that appeared to be hybrids between *C. cuneatus* and *C. fresnensis*, as both entities were growing in the immediate area. Progeny were grown at the old garden site, and before abandoning that site, seed was harvested from this presumed hybrid. A total of 32 were set out in October 1951 in an experimental plot. While there was some variability among the group, they were notable for the magnificence of their white flowers borne in great profusion.

When it became necessary to remove most of this planting in 1958 (these were growing on the mesa in tight clay-loam soil), we took cuttings to preserve the entity. Where it was possible, the original plants were left and these have matured into handsome plants. One of these is surrounded by a planting of a groundcover strawberry and receives a considerable amount of water. No disease or insect problems have been noted and these plants, now 15-years-old, are handsome specimens that bear a profusion of clear white flowers each year.

***Ceanothus cyaneus* Eastw.**

Habitat: Endemic to San Diego County in the chaparral at Lakeside, Ramona, Alpine, and El Capitan.

Propagation: Seed harvested at the old site in July and August, 1949 was sown in November 1950 after 24 hours hot water treatment. First seedlings came up in 12 days. Previous experience indicates that pretreatments are unnecessary for this species. Excellent germination resulted within 30 days. During transplanting stages, particularly the period when growing in gallon-cans before setting out, this species is highly susceptible to root problems and leaf blights in the nursery. (See also Everett, 1957. Pgs: 56-57.)

Culture: Our plantings were all made into well-drained rocky granitic loam areas where the plants would receive little attention. Planted during October and December 1951, the young plants received a serious set-back from a January 1952 freeze which dropped to slightly below 25° F. The plants were defoliated but otherwise not seriously damaged. For the first ten years there were no losses recorded but gradually there has been a gradual weakening of the plants particularly from severe infestation of the stem gall and a high degree of stem and branch proliferation. Within the 15 years, there has been a rapid depletion in numbers of plants.

***Ceanothus cyaneus* 'Cal Poly'.**

This horticultural introduction was presented to the garden in October 1957. It is a selection from a number of seedlings which proved to be of high flower quality with an extended flowering season, with some blossoms occurring most of the year. Unfortunately, our three plants were in the midst of an area which was later changed in character. Two plants, five feet tall and three feet spreads had to be removed and one was left in place. However, it soon succumbed to excessive watering in the area. Notes were taken which recorded that excellent flowering occurred during the latter part of April, 1960, but our plants have not shown the sporadic flowering throughout the year as noted by its sponsors. The plants appeared to be good *C. cyaneus*, but the leafing habit was superior to the species usually maintaining all its leaves throughout the season rather than losing most of them during the summer months. Being further inland could have materially affected the extended flowering quality of the plant, but this sporadic flowering has been noted in all of our cultivated plants.

***Ceanothus dentatus* Torr. & A. Gray.**

Habitat: Sandy and gravelly places below 5,000 feet near the coast from Santa Cruz County to San Luis Obispo County. Flowering from February to June.

Propagation: One seedling was grown from 14-year-old seed after 20 hours hot water treatment, and generally poor results were obtained from wild seed sources and no cuttings from the wild could be rooted. One lot of seed given 16 hours hot water treatment plus 50 days cold-stratification emerged in nine days. No losses were recorded during the nursery stages.

Culture: Wild sources of seed are not reliable as all of our plantings have shown a high degree of variability, many hybrids being noted. Results have been fair in open flat areas of rocky decomposed granite loam. Our plants have been afflicted by severe stem and branch proliferation that has resulted in poor quality plants. Losses have been moderate, averaging about one plant a year. Seven-year-old plants are recorded as one to seven feet tall with spreads of three to 13 feet. Flowering and seeding have not been noted.

***Ceanothus divergens* Parry ssp. *confusus* (J.T. Howell) Abrams.** [Ed: *Ceanothus confusus* J.T. Howell. TJM2]

Habitat: Chaparral, Rincon Ridge, Sonoma County to Bartlett Mountain, Lake County and Mount St. Helena, Napa County. Flowering from February-April.

Propagation: Plants from the wild were successfully transplanted in November 1963. At that same time, thirty hardwood cuttings were taken from the wild and were treated with Rootone, and only four rooted. However, tip cuttings taken in May 1964 from growing plants in the lath house rooted a high percentage without any pretreatment. A collection of seed obtained in 1963 provided a large number of seedlings when given 16 hours hot water treatment plus 22 days of cold-stratification after being sown for a month. Germination started before removal from cold. Excellent results were noted for growing plants in nursery - only minor losses occurred.

Culture: In the four years we have grown this species, the best records are for those protected by high shade and planted in the tight clay-loam soil of the mesa. These have done exceedingly well, spreading out rapidly and making fine bank and ground covers. A group of 75 seedlings were planted in a section of the garden with light sandy rocky granitic loam. Even though these young plants were protected by surrounding high growing shrubs and trees, the planting suffered severe losses, dropping off to only seven plants. There is indication that they needed additional irrigations to get established. Seeding was noted in the third year and plants which were two to nine inches by ten to 20 inches when planted had grown in three years to three to 14 inches tall by one to four-and-a-half feet spread.

***Ceanothus diversifolius* Kellogg.**

Pine Mat.

Habitat: Occasionally flats and draws in heavy forest, 3,000 to 6,000 feet, Greenhorn Mountains, Kern County along west side of Sierra Nevada to Shasta County, Siskiyou County to northern Lake County. Flowering from May to June.

Propagation: Originally collected in the wild in July 1941, a small amount of seed taken from an herbarium seed sample was given 20 hours of hot water treatment, and was then sown on January 11, 1955. It started emerging in 48 days and produced 26 seedlings. All except three seedlings lived to be planted in the garden. This same collection failed to germinate when sown in 1941 and 1944, using the same treatment. While other subsequent seed collections from the wild failed, semihard and hardwood cuttings taken in the wild and layered in flats, produced seven plants from the greenwood material but not from the hardwood. Tip cuttings taken from these plants in the garden in September 1965, rooted 100% with Rootone treatment and each cutting was put in an individual three-inch pot. The foliage of this species rots easily under intermittent mist and therefore mist should not be used. We had no unsatisfactory results in raising the plants in the nursery.

Culture: Our first 23 plants were planted out in December 1955, in sun, semishade, and shaded areas in well-drained rocky granitic loam. Here, with additional summer irrigation, they prospered well, although there was a gradual diminution of numbers until 1961, when three plants, ten to 15 inches tall with six-and-a-half to 11 feet spreads, remained and have become stabilized. Additional cutting grown material was used under a coast live oak tree (*Quercus agrifolia*) where the soil is the tight clay-loam soil of the mesa. Here for the first years the plants grew exceedingly well until the heavy accumulation of oak leaves began to produce fungus,

which caused the leaves and stems of the *Ceanothus* to die-back or die out completely. This type of planting site is not recommended for this or other species of *Ceanothus*. This species grows much taller and more rampant in this climate than in its native habitat, where it makes a beautiful, tight, flat groundcover under the pines, the best usage for this species.

***Ceanothus* 'Far Horizons'.**

Introduced by the Santa Barbara Botanic Garden. The following notation from Dara Emery, Horticulturist, at the above institution states, "A selection grown from a batch of open pollinated seed of *C. x burtonensis*, which according to the *Ceanothus* book is a natural hybrid between *C. impressus* and *C. thyrsiflorus*. This makes the parentage of 'Far Horizons' something less than exact." The flowers are reported to be deep blue and the plant habit is spreading. We received three plants in February 1963 and these were planted in March 1963. We have grown the plants for too short a time to fully assess the value of this introduction for our area. Two remain as of January 1968, when they measured four-and-a-half to five feet tall and ten feet wide. No comments were recorded on flowering.

***Ceanothus foliosus* Parry.**

Low Spreading Shrub.

Habitat: Brushy rocky slopes and dry ridges below 5,000 feet in the Coast Ranges from Humboldt County to Santa Cruz County and the Cuyamaca Mountains in San Diego County.

Propagation: Fourteen-year-old seed taken from two herbarium samples were soaked for 20 hours in a hot water treatment. These began to germinate in 39 and 76 days respectively. Other collections from the wild of fresher seed came up in ten to 19 days and two lots of the Cuyamaca Mountains strain (formerly known as *C. austromontanus* Abrams. [Ed: *Ceanothus foliosus* Parry. TJM2) took 25 and 29 days. Many cuttings were rooted from selected plants. While results varied from zero to 99%, the average with treated cuttings was a little better than 50%. Our experience with cuttings of this species is that they rot easily when placed under intermittent mist. All types of cutting taken in April, May, July, and September produced their best results when put in individual three-inch pots with no mist and rooting compound, 99% rooted while other lots produced zero or up to 52%. All seedlings and cuttings need to be handled with great care during the growing stages in the nursery. We found them extremely susceptible to root rots, particularly in the gallon-can stage. The var. *medius* McMinn. and var. *vineatus* McMinn. are handled in the same manner.

Culture: Numerous plants were set out during the period between 1955 and 1965. Growth was rapid, as much as a ten feet spread in four years and heights of two to four feet. Flowering and seeding occurred in two to three years. Beautiful effects were produced quickly. There were many particularly fine low growing specimens and these were preserved by cuttings. However, in all cases, the species has proved to be quite short-lived here, on the average living not more than five to eight years, and with heavy losses occurring within a year or two. There is some indication that more shade might prove of benefit. The species appears to do equally well and to live just as long in either the very well-drained granitic loam or the tight clay-loam soil. Watering should be applied with care. Var. *medius* and var. *vineatus* had much the same history.

***Ceanothus gloriosus* J.T. Howell.**

Habitat: Sandy places along the coast from Point Reyes Peninsula, Marin County to Mendocino County. Flowering from March to May.

Propagation: Easily produced from seeds or cuttings, we grew many lots by both methods, using cuttings to maintain the true species or preserve selected types. While we used 16 to 24 hot water treatments for all our seeds, it appears to be unnecessary as most lots came up within eight to 20 days and never over 24 days. All seed was sown during the months of September, October, November, December, January, and March. We always had good germination. Cuttings were usually taken from March to May, generally in April and some were in flower. However, excellent results were obtained from tip cuttings taken in July and August. CUTstart XX, SUPERthrive and Terraclor, Rootone, Indole-3-acetic acid at 1:10,000, soaked for six hours, and no treatment were used. The highest percentage rooted when the cuttings were treated with Rootone, however, excellent results were obtained with CUTstart XX, and no treatment. Roots measuring up to nine-and-a-half inches long were recorded for both treated and untreated cuttings. During the transplanting stages, there were occasional severe losses from either damping off or from root rot during the gallon-can stage in the summer months.

Culture: Numerous collections grown from seeds and cuttings have been produced and planted during the period of 1950 to 1965. Very few plants have lived for more than ten years, the majority succumbing within five years, and particularly those planted in sunny, decomposed granite loam locations. While beautiful plants grew for a few years, they were generally extremely short-lived here, but much better than at the old garden site in Orange County. Best survival occurred when used in partial shade and if the soils were the tight clay-loam soil of the mesa or sandy loam of prepared sand dunes. Two interesting selections were made, one a beautiful plant, low and fine foliage, that produced the deepest blue flowers I've ever seen on this species. Another fine plant has clear white flowers, a good albino, and is over ten-years-old growing in a sand dune and mostly in full sun with some shade late in the day. Our recommendations for this species in this area is to plant them under high shade - but not under coast live oaks where there would be a gradual build-up of oak leaves that smother or rot the *Ceanothus*.

***Ceanothus gloriosus* 'Tuttlei'.**

This cultivar was given to us in 1961 by the Deigaard Nurseries, Duarte, California. Apparently this plant was selected from a group of seedlings at the Tuttle Brothers Nursery, formerly in Pasadena. Deigaard Nurseries has been propagating it and asked us for an appraisal. We used the one plant in a section of rock garden where there is a fair amount of shade cast by a large coast live oak tree (*Quercus agrifolia*). It has grown beautifully and has made a fine plant about 18 inches high and a spread of five feet with somewhat arching branches. Flower color is not outstanding and has been sparse during the six years we have grown it. Since it grows in an area that receives irrigation at least every two weeks during the dry season, it has shown no signs of root trouble to date, even though its location is well-drained. Forty-one cutting grown plants were planted on the mesa, but only 14 survived. These plants measured up to one foot tall and had spread from two to three feet wide.

Malcolm Nobs hybrids of *Ceanothus gloriosus* J.T. Howell.

In February 1952, we received from Dr. Malcolm Nobs, of the Carnegie Institution, Stanford, California a number of seed collections of hand pollinated crosses he had made, and which he

wanted tested. Among the several lots were the following crosses he made of *C. gloriosus*, namely, *C. gloriosus* var. *gloriosus* × *C. masonii*, *C. gloriosus* var. *gloriosus* × *C. purpureus*, *C. gloriosus* var. *gloriosus* × *C. rigidus*, and *C. gloriosus* var. *gloriosus* × *C. verrucosus*.

Propagation: All of the seeds were given 24 hours of hot water treatment. They were all sown on February 19, 1952, and first germination started 18, 20, 18, and 23 days respectively. However, in all lots seedlings continued to appear over a period of two to three months and generally was poor as is shown by the following records: 200 seeds sown - 51 potted; from 30 seeds - ten potted; 100 seeds - 19 potted; 50 seeds - 20 potted. None of the seedlings were weak, and all proved to be healthy plants and were raised through the nursery stages without losses. The cross with *C. masonii* proved to be a good one and in March and April, 1956, a total of 114 tip cuttings were taken. They were all pretreated with Rootone. Rooting started 34, 36, 41 days and a total of 77 cuttings were potted.

Culture: All material of the above crosses were used on the mesa in tight clay-loam soil. All grew well and while most of them were not outstanding, one cross with *C. masonii* was propagated for additional plantings. It produced masses of deep purplish blue flowers, had small leaves and struck a nice form with slightly arching branches up six feet tall. The majority of the material was gradually replaced with other material as the space was needed. A few of the plants are still alive, and have grown into very large specimens. Unfortunately, observation records were not carefully maintained for the group.

***Ceanothus gloriosus* J.T. Howell var. *exaltatus* J.T. Howell.**

Habitat: In chaparral or Douglas-fir forests, Bolinas Ridge, Marin County, and Mendocino County.

Propagation: Seed collected in 1941 was sown in January 1955 and produced excellent results when treated with hot water for 20 hours and started germinating in 30 to 37 days. Later collections of fresh seed from cultivated plants took seven to 22 days and one lot from the wild took 78 days, and the resulting seedlings were chlorotic and soon died. That seed collection came from the "pine barrens" area of Mendocino County. Tip cuttings, some plants in flower, were taken in April, May, June, and November; all lots treated with Rootone, rooting began 28 to 33 days later and had excellent root systems. Losses were generally at a minimum, however, in some cases the prominent leaf buds became incrustated with lime from the intermittent misting during rooting and were killed, thereby causing failure to produce new leaves with the resulting death of the cutting.

Culture: Rapidly attaining heights of five to 11 feet and spreads to more than 16 feet, abundant flowering and seeding occurred within two to three years. However, in our area, the plant was short-lived, seldom attaining more than eight years of age. A few specimens have been recorded at ten years and still fewer at twelve years. Handsome specimens with the deepest blue flowers have been preserved by cutting propagation, but it has been difficult to keep them going. Since most of the plantings have been in sun and in an area that receives considerable irrigation, it appears that high shade with less irrigation is the proper culture.

The cultivar, 'Emily Brown' was received in 1958 from the late Louis Lake Edmunds, Danville, California. This is a much lower growing plant more like *C. gloriosus* than var. *exaltatus*, and it has not responded too well here. Cutting grown plants have been distributed rather widely and it is hoped they did better.

***Ceanothus gloriosus* J.T. Howell var. *porrectus* J.T. Howell.**

Habitat: Inverness Ridge and Ledum Swamp, closed-cone pine forests Marin County.

Propagation: Three lots of tip cuttings were processed between 1958 and 1961. Two lots rooted 100% and the third about 71%. Two lots were Rootone treated and one with CUTstart XX. One lot of greenwood taken in September took 53 days to begin rooting. A second lot of semihard tip growth rooted 100% and took 33 days to initiate rooting and the third lot of semihard tip cuttings, made in December 1961, CUTstart XX treated, rooted 100% but took 64 days to root. After 48 days in a seed pan, the cuttings were removed and put in individual three inch pots and rooting began in 16 days. All cuttings were given the same treatment, intermittent mist, fogger, etc. All of the material handled easily in the nursery during the transplanting stages, only minor losses were recorded.

Culture: Three plants, grown from cuttings taken from a selected plant on Mount Vision, Marin County by the late Louis Lake Edmunds, were presented in June, 1950. [Ed: This selection became the cultivar 'Mt. Vision' and is the most commonly encountered form of this taxon in the nursery trade, even though it is often not sold with its cultivar name.] They were held in the nursery until June, 1951, when they were planted in well-drained, decomposed granite loam with some shade during part of the day. Given little attention, and somewhat trampled on, they became fine plants. First flowering was recorded March, 1953, a good blue color and plants were six inches tall and two feet across. In 1959, all plants had grown into a large clump 18 inches tall and six feet across. Cuttings were made after the plants were seven-, eight-, and ten-years-old. They lived for about three more years. Cutting grown material has been used in the tight clay-loam soil of the mesa and in a large planting adjacent to and under pines with decomposed granite loam. Both plantings have done exceptionally well, however, after four years losses from root rot appeared in the planting in the tight clay-loam soil. This planting had received too much water. In five years the group in the pines has lost 18 plants, principally from becoming too dry during high summer temperatures. They have grown to three feet tall and three to ten feet wide. Seeding began the third year.

Malcolm Nobs hybrid of *Ceanothus gloriosus* var. *porrectus* × *Ceanothus rigidus*.

This is another of Dr. Malcolm Nobs hand-pollinated hybrids. Twenty seeds were sown on February 19, 1952 after 24 hours of hot water treatment. Twenty days later seedlings began emerging but only six eventually came up. These were all grown on to be planted in the experimental garden. A note recorded that this was an extremely handsome form, so cuttings were taken in March and April of 1956 when the plant was in bloom. A large portion rooted after Rootone treatment, taking 34 and 40 days to start rooting. However, the best results - 100% - was from cuttings taken after the shrubs were finished flowering in April. A total of 61 plants were produced and planted but unfortunately additional records are not available. One plant is recorded alive and it measures four feet tall and six feet wide. This is a good cross.

***Ceanothus greggii* A. Gray var. *perplexans* (Trel.) Jepson. [Ed: *Ceanothus perplexans* Trel. TJM2]**

Habitat: Dry slopes below 7,000 feet, south face of San Bernardino Mountains to northern Baja California (Mexico). Flowering from March to April.

Propagation: Seeds were collected from a seed herbarium sample that had been collected in the wild in 1941. These seeds were treated to a 20 hour hot water soak. From two sowings only eight seedlings were obtained, taking 25 and 31 days to start germinating. Poor germination was the history of this collection when sown in 1941, 1944, and 1945. The seedlings and young plants were all successfully raised in the nursery. Seed gathered in June, 1949, from cultivated plants at the old site, were sown in November 1950. Excellent germination occurred in three days after the seeds were given 24 hours hot water treatment. It appears this species may not need the pretreatment. These were started at the old site, moved during the two-inch pot stage when many stems were broken. Eventually 67 were transferred to gallon-cans from an original 90 seedlings. A total of 59 plants were planted in the garden.

Culture: The history of this variety has been very good in this location, particularly in the well-drained, dry, rocky, granitic loam. Only two plants have been record as lost in a total planting of 31 plants in ten years. The lot of eight grown from wild seed collection in 1941 have attained heights of four-and-a-half to seven-and-a-half feet and five-and-a-half to 11 feet spread in ten years. The group of 25 plants grown from seeds of cultivated plants growing at the old site, have recorded losses of two plants in 15 years, and heights of ten-and-a-half to 14 feet and spreads of eight to 25½ feet. Some of these have been noted as hybrids.

***Ceanothus gregii* A. Gray var. *vestitus* (Greene) McMinn.** [Ed: *Ceanothus vestitus* Greene. TJM2]

Habitat: Mostly very dry desert slopes, from 3,500 to 7,500 feet; Mono County to Kern, Los Angeles, and San Bernardino counties, west into eastern Santa Barbara and San Luis Obispo counties, to Utah, Arizona. Flowering from May to June.

Propagation: Fair to good germination in 40 days, 1941 wild seed from herbarium seed sample, sown January 1955, 20 hours hot water treatment. One lot gathered from plants growing at the old site came up in 30 days with 20 hours hot water treatment. A high percentage was raised through the nursery.

Culture: Planted in extremely rocky, granitic loam in full sun, two plantings totaling 67 plants have shown a loss of six plants in ten years; heights of three to seven-and-a-half feet and spreads of three to 12 feet. In one area there was a severe reaction to the use of Aminotriazole for weed control. Many of the plants became almost white but no losses are attributed to that cause and all appeared to have recovered within a year. In a second recorded planting, flowering and fruiting began in five years. There was crowding from other more aggressive plantings and conditions were not so favorable and therefore only five plants were counted as missing in ten years.

***Ceanothus griseus* (Trel.) McMinn.** [Ed: *Ceanothus thyrsiflorus* Eschsch. var. *griseus* Trel. TJM2]

Habitat: Coastal mountains at low elevations, Santa Barbara, San Luis Obispo, Monterey, Sonoma, and Mendocino counties.

Propagation: Seed takes nine to 12 days to germinate after 24 hours hot water treatment, wild and cultivated sources, and 14-year-old wild seed took 28 days with 20 hours water treat. A 1963 wild collection with 16 hours hot water treatment germinated in eight days. Soft tip cuttings made in April, treated with Rootone, gave best results, 75% and 99%, taking 37 and 45 days to initiate roots. On December 24, 1954, eight out of 18 semihard tip cuttings took 84 days to root

when treated with Hormodin #2, bottom heat to 75° F and four hours extra light. Likewise 11 with no bottom heat for 59 days then given heat and otherwise same treatment took 84 days and seven rooted. A third lot of 14 had bottom heat but no Hormodin #2 and rooted in 84 days and for a total of ten plants. Apparently, if proper material is used, no pretreatment may be necessary to root this species.

Culture: Over 200 seedlings and about 75 asexually produced plants have been used during the past 15 years. Generally, good results can be reported even though after the ten to 15 year period there was a more rapid deterioration of plants, due in part to location and severe attacks of stem and branch proliferation that occurred in some areas of the garden. The ceanothus stem gall moth attacked all plantings) and hampered the flowering. As there is considerable variation among seedlings, depending on the source of the seed, such that plants grew anywhere from two to four feet tall and eight to 14 feet tall and grew up to 20 feet wide in a matter of ten to 15 years. Flowering and seeding usually occurred within three years. Since there was some variation among the plants, selections were made for testing. Out of this group one selection surpassed all others and was introduced to the nursery trade under the name *Ceanothus griseus* 'Santa Ana', for which see in the following discussions of cultivars.

Ceanothus griseus 'Louis Edmunds'.

This selected variant of the species was named in honor of the late Louis Lake Edmunds, long time native plant specialist in Danville, California. A history and description of the cultivar was published in the **California Horticultural Society Journal** [18(2): 28-30. 1957.]. We received a few plants in 1958. During the first few years, they grew poorly and only two survived. These have now become handsome plants, one of them has spread to nearly 20 feet wide and has grown to about five feet tall. It has glossy, dark green foliage and the flower color is a good deep blue. This cultivar has been noticeably free from the ceanothus stem gall and from stem and branch proliferation. A good plant to be used in the proper site.

Ceanothus griseus 'Santa Ana'.

This cultivar was described in **Lasca Leaves** [11(1): 2-4. 1961.]. It is a selected seedling from a wild collection harvested one-and-one-quarter mile south of Point Arena, in Mendocino County by the late Louis Lake Edmunds, in 1949. Mr. Edmunds' notes stated the plant was small-leaved, and prostrate. We sowed one-eighth ounce of seed in November 1950 that produced over 200 seedlings. Among a group used on the mesa, appeared a plant with very brilliant, deep blue flowers, the finest ever seen by the author. It was noticed by several nurserymen and cuttings were released. Since we did not give it any name, it was designated 'Santa Ana' by Deigaard Nurseries to note it came from our botanic garden. The type plant of *Ceanothus griseus* 'Santa Ana' is about eight feet tall and spreads to 15 feet wide, achieving these dimensions in 15 years. The long, thin, green branchlets are angled, wiry, and with less foliage at the ends than is typical for the species. The foliage is generally smaller than usual and quite sparse on the thin wiry branches of nursery stock. As the plant matures, the foliage becomes dense. For a complete description and additional information, the article in **Lasca Leaves** should be consulted. It has proved to be a reliable and one of the longer-lived plants of this genus, the losses having been minimum and usually not due to any inherent weakness in the plant.

Ceanothus griseus (Trel.) McMinn var. *horizontalis* McMinn. [Ed: *Ceanothus thyrsiflorus* Eschsch. var. *griseus* Trel. TJM2]

Carmel Creeper.

Habitat: Wind swept bluffs at Yankee Point, Monterey County. Flowering from March to May.

Propagation: Four wild collections of seeds were germinated in seven to 15 days after 24 hour hot water treatment. Numerous seedlings were obtained and were raised easily in the nursery. Cuttings usually rooted within 30 days after pre-treated with a root promoting compound. Again, our experience was very good in raising the cuttings through to planting size.

Culture: Our best results were recorded for those grown in the tight clay-loam soil of the mesa rather than in the rocky, decomposed granite loam in full sun on open flat ground. While some of the plants growing on the decomposed granite loam have lived to 15 years, the greatest losses were recorded for these areas. Semishaded banks of the mesa and on the flat top of the mesa produced plants of large dimensions in a few years. Since there were usually considerable differences among the seedlings, the heights varied from one to eight feet and spread out as much as 20 feet. There appears to be no limiting factor as to how far one plant will spread since they root along the bottom side of the stem wherever it touches the ground – as long as nothing serious happens to the parent. Our best planting has been of a selected cutting grown group from a plant not more than 12 inches high. These plants have spread out many feet under a large oak where only filtered shade is provided. Many cuttings have been harvested by wholesale nurseries, as the clone is an exceptionally fine looking plant. [Ed: This plant is likely the selection that has become known as “**Carmel Creeper**” in the California nursery trade.] One section of plants was attacked in 1953 by the flat-headed apple borer. The only action taken was to cut out the branches. There has been some serious infestation of the ceanothus stem gall moth, but only among the most vigorous growers and those with larger and more succulent branch tips.

***Ceanothus griseus* var. *horizontalis* ‘Hurricane Point’.**

An extremely vigorous grower with very large, glossy green leaves, we consider this cultivar the finest of any we have seen, despite the poor color of its flowers. The late Mr. Louis Lake Edmunds selected this clone from among a group growing on Hurricane Point in Monterey County. We received three plants in 1960 and since then have propagated it from cuttings, obtaining 100% rooting in 44 days. Our planting receives some filtered shade from bigleaf maples (*Acer macrophyllum*), western redbud (*Cercis occidentalis*), and Torrey pines (*Pinus torreyana*), and they are growing vigorously in the tight clay-loam soil of the mesa. There have been no problems except when the plants get too dry in summer. The foliage of plants growing in full sun will burn. Presently the planting exceeds 50 feet spread and is not more than 18 to 24 inches in height. Some tall branches have been pruned away, in order to maintain a fine, low, groundcover effect.

***Ceanothus griseus* var. *horizontalis* ‘Yankee Point’.**

This selected clone was introduced by the Saratoga Horticultural Foundation. We received three of their plants in 1960 and planted them in full sun on the mesa. While they have grown well, they have been subject to infestations of ceanothus stem gall moth and from stem and branch proliferation. These plants have grown to four feet tall and have spread from six to ten feet wide. This clone has not been as vigorous as ‘Hurricane Point’ nor are the leaves as large and glossy green. The flower color is a deeper blue. It is said to be longer-lived under similar situations than ‘Hurricane Point’. To date, we have not had this proven.

***Ceanothus impressus* Trel.**

Habitat: At low elevation near the coast, Burton Mesa in Santa Barbara County.

Propagation: Excellent germination of several seed lots with 16 to 24 hours hot water treatment, taking ten to 20 days; no trouble in the nursery. No lots raised from cuttings.

Culture: Included among some horticulturist's lists as one of the ten best native plants in the United States, there is no quarrel with such a statement. However, this can only relate to the beauty of the profuse display of flowers, since the life of the shrub is generally quite short. Our entire experience with this species has been discouraging after about the eighth year, when rapid losses occur. The plant responds rapidly in growth, attaining maximum sizes up to six to eight feet or even more in eight years. One group of volunteer seedlings displayed a marked pinkish tinge to the flowers, and were rather attractive in full flower. A fifty percent decline in numbers of plants was a normal record for this species in ten years. Our plantings have serious infections of stem and branch proliferation, but other species suffered from this to a greater degree.

In August, 1956, we received two plants from the University of Washington Arboretum, in Seattle, which had been tentatively named *Ceanothus* 'Puget Blue'. Mr. Brian Mulligan, Director, stated it was a selected seedling of fine color and form that was observed among a group of plants which had been raised from seed obtained from Lester Rowntree, the noted California native plant specialist. We were asked to determine its identity correctly and to report our impressions. We reported it was *C. impressus*, and was unquestionably a superior plant. It was subsequently described and distributed under the name *Ceanothus impressus* 'Puget Blue'. While it grow well for us in tight clay-loam soil, in full sun for several years, eventually the original plants died, and only cutting produced plants are being grown. This cultivar also suffered from extreme branch proliferation.

Much the same history has been recorded for the **var. *nipomensis* McMinn.**, a larger plant, found only on the Nipomo Mesa in San Luis Obispo County. One of our collections was started from seed harvested at the old site and another was from wild seed stored as an herbarium collection for 14 years. Of this latter collection, only three plants succumbed in ten years, but about 55% died from the garden harvested seed. Growth was good, rapid, and normal. Plants achieved heights of six to 15 feet and spread to widths of ten to 22 feet in ten years. Flowering and seeding began in the third year from seed.

***Ceanothus incanus* Torr. & A. Gray.**

Whitethorn.

Habitat: Redwood and mixed evergreen forests below 3,000 feet, on the open slopes and ridges of the Outer Coast Ranges from Santa Cruz County to Humboldt and Siskiyou counties. Plants usually grow in very dense thickets in cut-over forest areas.

Propagation: One-eighth ounce of seed was sown in January 1960, after 16 hours of the hot water treatment. Seeds were then placed in two months cold-stratification, after which the seed emerged in six days and more than 100 seedlings had germinated in a total of nine days. A chlorotic condition appeared among the seedlings and eventually all of them died. A second lot was sown in April, 1960 after 17 hours hot water treatment. A month later, since no germination had started, the flat was put in cold-stratification until September 19, 1960. In four days seedlings appeared and were all up in ten days. This attempt met with complete success, all of

the seedlings being raised for planting. Thirty-five cuttings of a particularly prostrate plant were taken in September 1963, and were treated with Rootone, and 11 rooted and nine were raised for planting.

Culture: Severe losses occurring in our planting set out in rocky, decomposed granite loam in full sun indicates that this species does not enjoy this environment. However, the plants do seem to prefer our tight clay-loam soil where they have grown exceedingly well. A planting of 60 plants, ten to 20 inches tall when they were set out in November 1961, had dropped to 15 plants six years later. They were two-and-a-half to seven feet tall and seven to 13 feet wide. Heavy seeding was noted during the fourth year. An interesting prostrate plant was noted among this group and additional plants were reproduced of this individual from cuttings. When these were set out on the mesa in tight clay-loam soil and where a small degree of shade was available, none of the cutting-grown plants exhibited any of the prostrate growth habit of the seedling plant. There was no explanation for this phenomenon since the original plant was carefully examined and observed for at least three years and it did not vary in its growth habit.

***Ceanothus insularis* Eastw.** [Ed: *Ceanothus megacarpus* Nutt. var. *insularis* (Eastw.) Munz. TJM2]

Habitat: Dry chaparral covered slopes, Santa Cruz, Santa Rosa, and Santa Catalina islands. Flowering from January to March.

Propagation: Excellent germination occurs in eight to 14 days when seed is given 15 to 24 hours of hot water treatment. Reproduction from cuttings posed a considerable problem for us. The leaf stipules are very prominent, and during the 20 to 44 days it took to initiate rooting (after rooting compounded pretreatments), they would become encrusted with salts from the water used for the misting process. While 60 to 70% rooting occurred, only 11 plants were produced for planting from a total of 212 cuttings taken during the months of February, April, and May in 1959, 1961, 1962, and 1963. Excellent, vigorous roots in quantity were noted on the cuttings and some material lived in gallon-cans for over a year before finally succumbing. We attempted to alleviate this condition by covering the buds with Vaseline but this did not help.

Culture: As with other species in the *Cerastes* group, this species has been a complete success wherever we have used it. Losses have been held to one or two plants over a period of fifteen years. Our only reduction in numbers has come about by the necessity of thinning out plantings that became impenetrable and for needed space. Among our first planting, one plant was observed to have much larger, rounded leaves than the others. It would often be mistaken for a *Cercocarpus* species. We decided to reproduce it by cuttings, the results of which are noted above. However, the few plants we have been able to produce of it have grown exceedingly well on the mesa and are developing into handsome plants with long, arching branches that become loaded with white flowers. Our oldest plants have attained sizes of seven to 15 feet tall with spreads of nine to 20 feet in 15 years. Flower and seed production occurs in the third year.

***Ceanothus integerrimus* Hook. & Arn.**

Deer Brush.

Habitat: Including the poorly defined varieties of this species, this entity may be found between 1,000 and 5,000 feet elevation throughout most of the mountains of California, not including the desert areas, and the **var. *californicus* (Kellogg) G.T. Benson.** [Ed: *Ceanothus integerrimus*

Hook. & Arn. var. *macrothyrsus* (Torr.) G.T. Benson. TJM2] grows as far north as the state of Washington.

Propagation: Through the years 1949 to 1960, we only used the hot water treatment before sowing the seed. While germination rates and results were variable, we generally got good results, even when we sowed seeds that were seven- to 14-year-old. Germination resulted within 13 to 106 days, but averaged for many lots about 20 to 30 days. In 1963, we followed the recommended procedures of hot water plus cold-stratification. One collection of wild seed was given 20 hours hot water treatment plus three months and 25 days of cold-stratification. Excellent germination occurred 15 days after removal and maximum germination was reached shortly thereafter. A second collection was given 17 hours plus 42 days cold-stratification and germination occurred in 12 days and was every bit as good as the longer cold-stratification. In the var. *californicus*, the only lot raised from garden harvested seed took 19 days to come up after 24 hours of hot water treatment. Two lots of wild seed of the var. *puberulus* (Greene) Abrams. [Ed: *Ceanothus integerrimus* Hook. & Arn. var. *macrothyrsus* (Torr.) G.T. Benson. TJM2] gave equally excellent results with 16 hours of hot water treatment and 69 and 30 days of cold-stratification. It took ten and seven days to come up after removal from cold-stratification. It appears that cold-stratification helps produce a larger percentage of seedlings with more uniform germination, however, it is unnecessary in most cases.

Asexual reproduction was far more difficult. Over a period of five years, we made 147 cuttings, some semihard, some new growth, but the best were tip cuttings taken in April. All were pretreated with Rootone and Terraclor, CUTstart XX or just Rootone. Root initiation took 29, 33, 48, and 57 days, and we got a total of 23 rooted cuttings, and only eight were raised to planting size. This species was highly susceptible to fungus troubles when grown under intermittent mist and yet the mist was necessary. One group of 23 were put in individual three-inch pots and three were rooted but were not successfully raised to planting size.

Culture: Generally, the various collections have quite good records. One number raised from 14-year-old seed has only shown a loss of three plants in ten years, while the average loss for most of the plantings have been 50% or better in ten to 15 years. The largest percentage of plants were grown in sun, in a rocky decomposed granite soil. Plant sizes ranged from three to nine feet tall and spread to widths of five to 13 feet. Flower production usually started in three years and flower color has varied from creamy white, light blue, and shades of pink. We have received two seed collections harvested from pink flowering bushes in the wild. One seedling of our first collection has been called '**Apple Blossom**' and it is that selection with which we have had such a difficult time producing from cuttings. A second and more recent number was raised in 1963 and has produced a number of plants that have shown varying shades of pink as well as several very fine blue flowered individuals. As the plants mature, better judgments can be made of the quality of the flower. Young plants need protection against rabbits when first set out – otherwise they can be nibbled severely.

***Ceanothus jepsonii* Greene.**

Musk Brush.

Habitat: Scattered, dry, usually rocky serpentine slopes at low elevations from Marin County to Mendocino County. Flowering from March to April.

Propagation: Hot water treatment for 24 hours was used for two seed collections. While germination was poor in the first lot and good in the second, elapsed time for seedling emergence was 35 days for a wild collection and six days for garden harvested seed. The latter proved to be mostly hybrid plants. One wild seed collection was treated for four minutes in Thiourea, but only two seedlings germinated 39 days later. Other seed lots failed to germinate, likely because the seeds were not good. Handling of seedlings was difficult and only a few (except the hybrid lot) were raised to planting size. Rootone treated cuttings taken in May rooted at a rate of better than 50% after 41 days, however, none of them survived as they dried up after their removal from intermittent mist. Small bare-root plants from the wild were transplanted successfully in November, and all of these plants survived in the garden.

Culture: While the final number of plants successfully brought through the nursery was small, the results in the garden have been good. Two plants set out in April, 1951, in full sun and rocky, decomposed granite loam, have attained sizes of four to five feet tall with spreads of eight to nine feet wide, and were in good condition in their fifteenth year. The group of hybrids, to 13 feet tall and spreading ten to 17 feet wide, has grown equally well. The bare-root seedlings moved successfully in November, 1963, are doing equally well, having started to flower in the third year and are 18 inches to two-and-a-half feet tall and three to four-and-a-half feet wide.

***Ceanothus* ‘Joyce Coulter’.**

In October 1961, we received from the Saratoga Horticultural Foundation two plants of this cultivar for testing. They were planted in the tight clay-loam soil of the mesa and a year later ten cuttings were made, treated with Rootone, and all rooted within 37 days and were successfully raised for additional plantings. In a similar situation, this group has spread out many feet but all plants have grown considerably higher than the described height of under two feet, ours being over four feet. However, all other characteristics are similar and the spring brings forth a lovely display of bright blue flowers. In our area, ceanothus stem gall and severe branch proliferation has damaged the blooming qualities of this hybrid, presumed to be of *C. papillosus* parentage.

***Ceanothus* ‘Julia Phelps’.**

This outstanding plant was introduced to the gardening public in 1951 by the Saratoga Horticultural Foundation. A description may be found in the **California Horticultural Society Journal** [13(1): 20. 1952.]. We received two plants in May 1952, and have continuously produced it from cuttings, which can be easily rooted with rooting compound pretreatments. While we had our best rooting, 100% and 99%, when the cuttings were taken in May and September, we also had excellent results in June. Equally good results were attained in raising the cuttings to planting size in the nursery.

Culture: All of our plantings have been made in full sun on the mesa in tight clay-loam soil. Vigorous growth occurs and a mature plant is realized in three to five years. The original plant was a variant seedling from *C. papillosus* var. *roweanus*, and the progeny are most like this parentage. The brilliant cobalt blue flowers with a tinge of red smother each bush during March and April, creating a most memorable sight. This cultivar creates more excitement among our visitors than any other *Ceanothus*. Irrigation must be watched as the plant easily succumbs to root rot. In heavy soils, it should not receive any additional irrigation after it is established.

***Ceanothus* ‘Junior’.**

A variant found in a group of seedlings of *C. impressus* in the Bee Line Nursery, San Dimas, California. It was selected for abnormal foliage structure, being very much smaller and condensed than the species. We received one plant in 1959.

***Ceanothus lemmonii* Parry.**

Habitat: Open wooded slopes, 1,200 to 3,500 feet, Sierra Nevada foothills Tuolumne and El Dorado counties north, and the Inner North Coast Range from Lake and Yuba counties north, to Humboldt and Shasta counties. Flowering from April to May.

Propagation: Excellent germination occurred in most collections of seed, even for 14-year-old seed, when given 20 to 24 hours hot water treatment. Based upon these observations, cold-stratification appears to be unnecessary. However, seed germination took from 45 to 122 (1 lot for 122 days) days, but two lots cold-stratified either failed or only produced two seedlings, and hot water treatment only for other lots in the same collection produced over 100 seedlings from traces of seed.

Culture: Similar recorded data for longevity as for *C. foliosus*, to which this species appears to be closely related, but somewhat longer-lived in our area in rocky decomposed granite loam in full sun. Seven- to 15-year-old plantings have been reduced 50% or more. Mature growth has been attained in seven to ten years, and ranges from one to four feet tall and spreading two-and-a-half to 14 feet wide. Flowering and seeding occurs within three years.

***Ceanothus* ‘Lester Rowntree’.**

Two plants were received in 1960 from Mr. Louis Lake Edmunds, who said Lester Rowntree originally got the seed from him, grew the resulting seedlings in her garden in Carmel Highlands and because of its beauty, prevailed upon Mr. Edmunds to grow it from cuttings. He named it in her honor. A low spreading plant which Mr. Edmunds suspected had *C. thyrsiflorus* var. *repens* blood in it, failed to live long enough in our area to evaluate it for our area.

***Ceanothus leucodermis* Greene.**

Chaparral Whitethorn.

Habitat: Dry, chaparral covered slopes below 6,000 feet, northern Baja California (Mexico), extending northward through cismontane Southern California, north along the Inner Coast Ranges to Alameda County, and in the Sierra Nevada to El Dorado County. Flowering from April to June.

Propagation: Twenty and 24 hours hot water treatment only and one lot with hot water treatment plus three months cold-stratification started to germinate 15 days after sowing. Three collections from the wild of 14-year-old seed, 20 hours hot water treatment only, started germinating in 34, 53, and 54 days, two collections of garden harvested seed treated with 24 hours hot water germinated in 23 and 28 days; a fourth wild collection of two-year-old seed given 20 hours hot water treatment took 75 days to germinate. A second seed lot was subjected to a 20 hours hot water soak and was then sown, 15 days later the flat was put in cold-stratification for three months. These seeds began germinating eight days after the flat was removed from the cold. However, all of the lots were equal in final results, and all were good. It appears the recommendation of three months of cold-stratification plus hot water treatment is unnecessary but does no harm. It is advantageous to sow seed during summer months, cold-stratify it for three

months and seedlings will emerge soon after removal - cold-stratification has this in its favor. The transplanting processes gave no difficulty and most of the seedlings were raised to proper size for planting. One lot was lost from excessive sulphur fumes during hot weather - sulphur in potting mixture.

Culture: Recorded data over the past 15 years indicates that equally good results have been our experience here as at the old site. This is one of the hardiest of species, not subject to the root problems and other ills of some of the other species. Minor losses have occurred in all collections except for a few being blown over during periods of high winds. Flowering and seeding began in the third year and sizes attained in ten to 15 years have averaged five to 17 feet tall with spreads of ten to 36 feet wide. Plantings have done equally well in the tight clay-loam soil and rocky, decomposed granite loam.

***Ceanothus maritimus* Hoover.**

Habitat: Coastal bluffs of San Luis Obispo County.

Propagation: Seed germinated in 17 days after 20 hours hot water treatment and yielded good results. The remainder of our propagation of this species was done by means of cuttings. Tip cuttings were taken during the months of November, December, January, April, May, June, and August. Both CUTstart XX and Rootone were used for pretreatment and Rootone gave the quickest and highest percentage rooting. There did not seem to be a great difference in success from one month to another. A group of 358 cuttings were taken from plants in nursery containers in the lath house, pretreated with Rootone and a total of 333 were rooted and raised with no difficulty in the nursery. It would be expected this species would root easily since it readily takes root on the ground wherever it is planted.

Culture: Since 1955, when we first acquired seed this species collection from the wild, it has been most successful. Our records indicate that it will accept additional irrigation and does best in our tight clay-loam soil. A planting in full sun in rocky, decomposed granite did best when provided with a covering of artificial shade and after the shade was removed this planting quickly deteriorated. However, when used on the mesa in tight clay-loam soil it has spread over considerable areas, both in shade or sun. It is an extremely prostrate plant, not rising much over four to six inches tall and slowly spreads to several feet, an ideal plant for rocky walls or rock gardens. When grown under heavy shade it will grow taller and more spindly. We have used it in our home demonstration garden where it receives weekly irrigation and there has been no loss from this cause over a period of three years. In our opinion it is the best of our most prostrate groundcovers. In their search for low fuel type plants, the U.S. Forest Service has found it to be very hardy using it in their studies of fire prevention methods and erosion control.

***Ceanothus masonii* McMinn.**

Habitat: On the chaparral covered, rocky, drier portions of Bolinas Ridge in Marin County.

Propagation: Fine germination occurred in ten to 15 days after 24 hours hot water treatment before sowing. A high percentage of tip cuttings pretreated with Rootone rooted in 18 to 22 days, and both seedlings and cutting produced plants were easily raised in the nursery. Also, excellent results occurred in transplanting young seedlings from the wild.

Culture: Except for one group wiped out from the effects of prolonged and extremely hot weather, the results have been very good with this species. In one group of seedlings an

interesting prostrate plant occurred, which was increased by cuttings. This plant was of much interest to the U.S. Forest Service Fire Laboratory such that they used several hundred for testing in various locations. Performance has been rated as good. We have found this prostrate form to be a good plant for rock garden use although it may spread to over ten feet while attaining heights of one foot. Under sterile soil conditions, it remains a tight clinging plant of not over two to three inches tall.

***Ceanothus megacarpus* Nutt.**

Habitat: Santa Barbara County to San Diego County and Santa Catalina Island, below 2,000 feet on the dry chaparral-covered foothills near the coast.

Propagation: Excellent germination occurred in 12 to 20 days after a pretreatment of 20 to 24 hours hot water treatment. Cold-stratification is unnecessary with this species. Since it was unnecessary to raise additional plants, asexual production was not tried. Loss of seedlings during the growing period in gallon-cans was high, but sufficient plants were raised for our purposes.

Culture: Once set out in full sun, rocky, decomposed granite loam or tight clay-loam soil, this species has proved itself equally hardy in this area as it did at the old site. During 15 years, two were recorded lost in a group of 25. Excellent plants eight to 13½ feet tall with spreads of 12 to 14 feet wide had flowered and seeded heavily since their third year. No disease problems have been encountered and no care is provided.

***Ceanothus* × *mendocinensis* McMinn.**

Habitat: Among the cut-over redwood forests of Mendocino and adjacent counties in cohabitation with *C. thyrsiflorus* or *C. velutinus* var. *laevigatus*, never in separate colonies.

Propagation: Soaking for 24 hours in hot water treatment produced seedlings in 12 to 35 days for the three lots of seeds we raised in 1949, 1950, and 1952. While it is known that asexual production is successful, we did not attempt to increase this entity. The seedlings were successfully handled in the nursery with only minor losses being noted before planting.

Culture: No formal records were kept on this presumed hybrid described by McMinn (Van Rensselaer and McMinn 1942, pgs. 266-267). Notes taken from time to time indicate some of our plants lived for at least ten years and were recorded as growing to 12 feet tall and 15 feet across.

***Ceanothus* ‘Mills Glory’.**

A hybrid of *C. glorious* × *C. purpureus* produced by Professor Howard E. McMinn of Mills College. We received one plant in May 1952.

Propagation: In April 1958, 25 tip cuttings were treated with Rootone, inserted in a seed pan, kept under intermittent mist and fogger, plus 75° F bottom heat and four hours of extra light, rooted 98% in 38 days. All were successfully grown in the nursery.

Culture: The one plant received in 1952 was planted on the mesa in tight clay-loam soil and there it thrived for over six years until it became overgrown by other more vigorous shrubs. The cutting produced material grew well on a somewhat shaded bank where it was noted to be in flower several years later.

***Ceanothus* 'Mountain Haze'.**

This hybrid cultivar was introduced by Dr. Walter Lammerts, while he was a professor in the Department of Horticulture at U.C. Los Angeles. The plant was first received by us in 1948. There were 13 plants recorded as doing well in all areas of the garden in 1950. Cuttings taken from one of these plants were rooted with the assistance of Indole-3-acetic acid at 1:50,000 CF, and soaked for 24 hours. Rooting occurred in 33 days but only one was raised to be planted at the Claremont site. It has done exceedingly well here in the tight clay-loam soil, and is still alive and in excellent condition. After 15 years it has grown to about eight feet tall and 15 feet wide. Additional cuttings were taken in April, 1958 when the plant was in flower, and these rooted in 18 days, after pretreatment of Rootone, and placed under intermittent mist and fogging with bottom heat of 75° F, and with four hours of extra light. Transplanting through various sizes of pots to gallon containers was accomplished with only minor losses.

Culture: A popular and worthwhile cultivar of medium size that appears to resist the common diseases that attack this genus.

***Ceanothus oliganthus* Nutt.**

Habitat: Below 4,500 feet on dry brushy slopes; San Luis Obispo County to Los Angeles and western Riverside counties. Flowering from February to April.

Propagation: Satisfactory germination occurred in 27 days after 24 hour soaking in hot water treatment. Raising the seedlings posed to be no difficult problem, although summer watering in containers must be carefully controlled. Fourteen-year-old seed from the wild of **var. *orcuttii* (Parry) Jeps.** took 28 days to emerge after 20 hour hot water treat. The resulting seedlings were raised successfully.

Culture: While only one collection has been raised from garden harvested seed, the planting in full sun in rocky, decomposed granite loam has suffered no severe losses in 15 years. A few runty specimens and two severely damaged by mice stripping off the bark were the only reasons for reducing the original number planted. Beautiful displays each year have been noted and plants have grown ten to 15 feet tall and 11 to 17 feet wide. Flowering and seeding have been recorded since the fourth year. Equally good results have been recorded for the **var. *orcuttii***, there being a total of 29 alive out of a planting of 35 that were originally set out in November 1955. These plants started flowering in the fourth year and have produced crops of seeds since 1960. Ten-year-old plants, growing in rocky, decomposed granite loam, are three to eight feet tall and four to ten feet wide.

***Ceanothus palmeri* Trel.**

Habitat: On the dry slopes of chaparral and yellow pine forests, at elevations of 3,200 to 6,000 feet; mountains of Riverside, Orange, and San Diego counties, and northern Baja California (Mexico). Also found at 400 to 1,500 feet elevation in chaparral and foothill woodland of the Sierra Nevada foothills of Amador and El Dorado counties. Flowering from May to June.

Propagation: One collection of wild harvested seed in 1952, provided sufficient plants from 24 hours hot water treatment, taking 87 days to germinate. A second lot sown four years later produced only a few seedlings after 20 hours hot water treatment. It appears that best germination results with the additional treatment of cold-stratification, but perhaps not as long as three months. No losses occurred during nursery stage growth for the first lot though the second

was all killed by sulphur fumes during a period of extremely high summer temps. A small portion of soil sulphur had been added to the soil mixture.

Culture: No losses have occurred during a period of 15 years. The plants were used in a rocky, decomposed granite loam, in an open, flat area and except for rabbit protection during early stages, these plants have made phenomenal growth. Flowering in late May and early June, these handsome plants make a fine display. Sizes range from six to 12 feet in height and eight to 18 feet in width. The planting has become a solid mass. The planting receives occasional summer irrigation.

***Ceanothus papillosus* Torr. & A. Gray.**

Habitat: From two habits wooded and open slopes, below 3,000 feet, from San Mateo County to San Luis Obispo County. [Ed: Disjunct populations are known from the Santa Ana Mountains in Orange County, and from near Cerro Bola in Baja California, Mexico.] Flowering from April to May.

Propagation: Seed collections from the wild appear to need some cold-stratification plus the hot water treatment, although our results have been somewhat varied. Garden harvested seed did not need cold-stratification. Our first collection was sown in 1955 was a small amount of seed taken from an herbarium seed sample, which was 14-years-old. After 20 hours hot water treatment, first germination was recorded in 32 days. However, a 1958 collection from the wild, sown in October 1958, after 16 hours hot water treatment, sown in flats and after two months was put in cold-stratification for 76 days at which time it was found to have germinated and when it was removed from cold the results were excellent results. Six years later a second lot of same collection was sown, 16 hours hot water treatment and after 69 days put in cold-stratification for 18 days. Seedlings started emerging in six days, but results were not as satisfactory. Two collections of garden harvested seed produced excellent results in ten to 13 days with 20 hours of hot water treatment. We had no occasion to produce this species from cuttings, but this can be done satisfactorily. Good results followed raising the seedlings in the nursery, most of them living through this critical period.

Culture: Despite every effort, there were heavy to severe losses recorded after a six to eight year period. This has been the typical history of this species in our area. Fine plants are produced in a few years, after which there is a rapid decline and each year sees a diminution in numbers. This occurs even with the most careful placement and attention after planting, in any of our soils. While shaded situations were not used extensively, even there plants followed the usual pattern. Aside from being short-lived, this species was subject to severe branch proliferation and ceanothus stem galls. Specimens up to 12 feet tall and with spreads of 20 feet were produced in eight to 12 years. Flowering and seeding usually began during the third and fourth years. It has been reported that young plants one- to two-years-old have withstood temperatures down to 10° F and 14° F without any ill effects. Garden harvested seed and seed from other sources were the source of many hybrid seedlings, which were tested extensively in our experimental plots. While some were noted as being of interest, we only produced through cuttings one selected plant, which did not survive long enough to be thoroughly tested.

***Ceanothus papillosus* Torr. & A. Gray var. *roweanus* McMinn.** [Ed: the var. is not recognized in TJM2]

Habitat: Dry, brush covered slopes; 2,000 to 4,000 feet; San Benito and Monterey counties to the Santa Ana Mountains of Orange County. Flowering from February to June.

Propagation: Seed harvested from our original planting at the old site was sown upon three occasions, November 1950, December 1952, and October 1956. Using the 20 to 24 hour hot water treatment, excellent germination occurred, with germination starting after 13 and 20 day respectively. Only minor losses were recorded during the growing period in the nursery. In 1962, cuttings from selected plants were made in June and September. The lot of 45 taken in June were put in individual three-inch pots, and only received the benefit of high humidity in our greenhouse cutting room - no intermittent mist - (this entity does not relish such treatment). Rooting of these semihard cuttings began in 18 days and 31 rooted. In September the same treatment plus spraying cuttings with Wilt-Pruf, and treating them with Hormex (a root promoting solution). In 14 days rooting started and a total of 32 out of 500 rooted. In August 1963, 34 cuttings were treated with Rootone and were placed in seed pans under intermittent mist and fogger in the greenhouse, and 27 of them rooted in 33 days. Cutting-grown plants were easily grown in the nursery.

Culture: Much the same growth and longevity were recorded for this variety as for the species. Numerous plants were used in a variety of locations because of the handsome deep blue flowers borne in great abundance and they were one of the outstanding early features of the garden in its new location. Unfortunately, there were root-rot problems. This was also the first of all the *Ceanothus* species to be attacked with our severe branch proliferation problem, and there were heavy infestations of the *Ceanothus* stem gall moth. These problems made this variety less desirable as time passed. Again, after about a six to eight year period, deterioration set in and eventually the plants succumbed. Our records indicate losses of 60% to 100% of each of our plantings over the course of 15 years. Heights ranged from three to eight feet and widths of six to 12 feet. Flower and seed production began in three to four years. Two selections were grown by means of cuttings; one a low, compact shrub and the other of taller, open proportions, but both had equally intense deep blue flowers, which made them outstanding examples to display.

***Ceanothus parryi* Trel.**

Habitat: Wooded canyons and slopes below 2,500 feet; outer and middle Coast Ranges from Humboldt to Napa and Sonoma counties. Flowering from April to May.

Propagation: Good germination occurred in a 14-year-old collection of wild seed started germinating in 34 days after 20 hours of hot water treatment. Garden harvested seed to 29 days with 24 hours of hot water treatment. A second collection from the wild in 1954 when soaked for 15 hours hot water treatment, took nearly five months to start germinating. A second lot sown two years later needed the same amount of time after 20 hours hot water treatment. A third lot of seeds were sown six years later, after they had been given a 16 hour hot water soak. They were then given 73 days of cold-stratification. The seeds started germinating ten days after they were removed from the cold, and reached maximum germination 16 days later. It appears that one to two months of cold-stratification yields the best results. A lot sown ten years later given 16 hours hot water treatment plus 12 days cold-stratification after being sown for 69 days produced very poorly, indicating either age or more cold-stratification is needed.

Culture: Our records indicate that for this area, this species does best with some protection from the hot summer sun. Where used in open, rocky, decomposed granite loam, plantings have not

lived more than ten years, the numbers being considerably reduced in a matter of five or six years. In an area with the same soil type but some protection from full sun, losses have been held to about 50%. Greatest size was noted in the heavier clay soils. The beautiful deep blue flowers make this a species to be cultivated more extensively in the most suitable areas. Extensive branch proliferation and stem galls were noted on many specimens. Sizes ranged from four to nine feet tall and spreading from five to 12 feet wide. Flower and seed production were recorded in the third year after planting out.

***Ceanothus prostratus* Benth.**

Mahala Mat.

Habitat: Open flats of pine forests at elevations from 3,000 to 6,500 feet in the Sierra Nevada from Calaveras and Alpine counties north to Modoc County, and west to Siskiyou and Trinity counties, north to Washington. Flowering from April to June.

Propagation: Several seed collections from the wild were sown and each collection was subjected to more than one treatment in an attempt to learn the best method. Strangely, in only one lot did seed given the hot water treatment plus cold-stratification equal in number of seedlings against only hot water treatment. Solely using the hot water treatment, germination began in 56, 34, 82, 30, and 16 days. Seed lots that received both hot water treatment and to cold-stratification periods ranging from 42 days, two-and-three-quarters months, four months, and five-and-a-half months yielded only a few seedlings, though the seedlings germinated more quickly after they had been removed from the cold, an average of 13 days. Since the branches of plants root readily along the undersurface, reproduction by cuttings is much more satisfactory than seed unless there is no other way. Rooted branches inserted in flats or seed pans was one method used for increasing the number of plants; or taking tip cuttings, and treating with a rooting compound. We took cuttings in March, April, May, September, and November and except for one lot, each rooted better than 60%. One lot was untreated and had just as high a percentage of rooting and just as quickly, the usual time being 22, 24, 26, and 38 days to start rooting. Generally, we raised all materials with only minor losses in the nursery.

Culture: The recorded experience of this species has been much more satisfactory in this site than at the old location. While losses have been generally high, fine specimens have developed in our rock garden and adjacent well-drained rocky loam. Observations indicate that better and stronger plants result from using them in high shade rather than in full sun. Even in our tight clay of the mesa, a planting grew exceptionally well until it was necessary to remove a protecting large shrub. Within a year, deterioration from hot sun was noted. Our oldest plants, now 11 years, are four inches to one foot tall and have spread to ten feet wide. Flowering has been sparse and no seeding has been noted. The **var. *occidentalis* McMinn.** was acquired in 1963, we transplanted a few seedlings bare-root, growing them in a large, deep flat in the nursery and, as cutting material developed, we were able to increase the number to 42 plants. An excellent percentage of rooting was obtained, but nearly 50% were lost during the initial stages of nursery growth. This entity was used in the rock garden, placed there in 1964 and 1965, and enough time has not elapsed to judge the results.

***Ceanothus pumilus* Greene.**

Habitat: Dry serpentine flats and slopes from 2,000 to 5,700 feet from Mendocino and Trinity counties to Del Norte and Siskiyou counties to western Oregon. Flowering from April to May.

Propagation: Only bare-root material or a few plants received in containers were our source of plants for the garden. These were grown on in the nursery until of proper size for planting.

Culture: What little material has been available has done poorly and only one plant survived for four years.

***Ceanothus purpureus* Jepson.**

Habitat: Dry rocky hills below 1,800 feet in the Napa Range of Napa County. Flowering from February to April.

Propagation: Three lots of seeds responded very well to 24 hour hot water treatment, and started germinating in ten to 24 days. Asexual reproduction of a selected plant met with poor results during the first attempt. Twenty cuttings were made in April and were treated with Rootone and were placed in the greenhouse with intermittent mist and 75° F bottom heat, and only three rooted. However, five years later, over 90% rooted when they were only treated with Rootone, mist, and the fogger (and no bottom heat). Some difficulty was encountered after rooting, as the stems dried and about 50% were lost during the growing on period.

Culture: A variety of locations were used for growing this attractive species. The majority grow exceedingly well intermingled with other shrubs, under large oaks or in full sun with rocky decomposed granite loam. During the first eight to ten year period of growth, losses were minimal. However, after ten years, there was a rapid dropping out of plants until there were only a few plants alive at the 15 year mark. Sizes attained were 18 inches to seven-and-a-half feet tall with two to 12 feet spreads. Beautiful flowering. In a planting in full sun and rocky decomposed granite loam, one plant was noted to be very compact and in a matter of ten years was only 18 inches tall and 23 inches wide. Additional material of this selection was produced by cuttings. The plants were used in a testing area on the mesa in tight clay-loam soil. Survival has been good, but it has been noted that a section with shade cast by a large oak has been best, indicating some shade and a drier situation is best.

***Ceanothus ramulosus* (Greene) McMinn.** [Ed: *Ceanothus cuneatus* var. *ramulosus* Greene. TJM2]

Habitat: Dry sandy and rocky places below 1,500 feet; Outer Coast Ranges from northern Santa Barbara County to Mendocino County. Flowering from February to April.

Propagation: Several lots of seeds of the species and **var. *fascicularis* McMinn.** [Ed: *C. cuneatus* var. *fascicularis* (McMinn) Hoover. TJM2] were sown from 1950 to 1965 and all began germinating within six to ten days. These seed lots had been treated to either hot water soakings of 16, 18, or 24 hours and/or periods of cold-stratification from one to two months. Two lots of seeds that were gathered from the wild were soaked in hot water for 16 and 18 hours, and were then cold-stratified, and one of the seed lots was also soaked in a Thiourea solution for four minutes, but none of the wild seed collections germinated as well as garden harvested seeds. The best results we had from wild collected seeds was from seven-year-old seeds that were soaked in hot water for 18 hours and then cold-stratified for one month. Growing the seedlings through the nursery period was no problem, most of the lots showing no, or few, losses. A selected plant was reproduced by taking 72 tip cuttings in October, treating with Hormex and put in individual three-inch pots without intermittent mist. Rooting started in 15 days and a total of 62 plants were raised without any problem.

Culture: Both the species and **var. fascicularis** have responded quite satisfactorily in this area. All of our plantings, whether used in rocky, decomposed granite loam or in the tight clay-loam soil of the mesa, grew exceedingly well, and provided fine plants within a few years that were resplendent in masses of deep lavender, pale blue, or whitish flowers. The long, arching stems gracefully carried these masses of flowers, causing much favorable comment. One plant, observed to flower profusely each season, had a more congested inflorescence, reminding one of the butterfly bush (*Buddleia* sp.). Additional plants were grown by cuttings, and these have developed into good looking specimens. Many plants, 15-years-old, have attained sizes of ten to 15 feet tall by ten to 24 feet broad. The larger specimens are those grown in the clay-loam soil. Flowering and seeding began in the third year. Much the same history has been recorded for the **var. fascicularis**.

***Ceanothus* ‘Ray Hartman’.**

See the **California Horticultural Society Journal** [17(4): 145-146. 1956.] for the history and introduction of this cultivar.

Propagation: Several lots of cuttings have been taken in various months of the year: April, May, July, August, and October. All cuttings were treated with a rooting compound, Hormodin #2 (one lot), Rootone (four lots) and SUPERthrive plus Terraclor (one lot). The two best results were one Rootone taken in April and the SUPERthrive plus Terraclor made in July, each rooting 85%, while the remainder were quite low. All rooting started in 32 to 36 days except the one lot made in October which took 83 days. The prolonged periods of rooting posed a problem during the after-potting stages, when the stems would dry up after removal from intermittent mist. However, a large percentage were brought along in the nursery.

Culture: This handsome selection is a presumed hybrid between *C. arboreus* and *C. griseus*, and was first introduced in 1952, and since then we have received several plants. It has performed admirably for us except for one thing. Our plants became severely afflicted with the branch proliferation and ceanothus stem gall moth problems, which caused this plant to present a very poor appearance and to seriously affect its flowering and health. During the last few years, our plants appear to be recovering and perhaps can be expected to continue doing well in this area. All plantings have been made in the tight clay-loam soil of the mesa and none of the specimens have succumbed to any root problems.

***Ceanothus rigidus* Nutt.**

Habitat: Sandy hills and flats of the Monterey Peninsula in Monterey County. Flowering from February to April.

Propagation: Exposure to the hot water treatment for 16 to 24 hours provides excellent germination starting within six to 12 days. One lot, after 16 hours hot water treatment was then cold-stratified for one-and-a-half months, after which seed came up in five days, but this was unnecessary. While we did not do additional testing, the rapidity of germination could indicate that no further treatment is necessary before sowing. Tip cuttings from a selected plant were taken in April, and were pretreated with Rootone and a good percentage rooted after 32 days. However, we had difficulty with the stems drying up after their removal from the misting bench, and losses were high.

Culture: Despite the naturally cool habitat of this plant, it grew well for us and during the past 15 years, losses have been relatively small since most of the plants were used in our very rocky soil in full sun and initially were severely damaged by rabbits. This species has responded equally well in the tight clay-loam soil of the mesa, in full sun and has not been particularly susceptible to root rot problems. Fifteen-year-old specimens measure four to nine feet tall and six to 12 feet wide. Flowering and seeding begins in the third year.

***Ceanothus rigidus* 'Snow Ball'**

Habitat: This clone came from Yankee Point, but albino types are found scattered on the Monterey Peninsula in Monterey County.

Propagation: Reproduced only from cuttings as seedlings exhibit flower color variations from purple, semi-white to pure white. Plants of this cultivar are generally much more compact and rounded than typical *Ceanothus rigidus* specimens. We received three plants in 1950 from the late Louis Lake Edmunds of Danville, California, who had grown his plants from cuttings taken from the original plant on Yankee Point. Mr. E. K. Balls of Carmel Highlands, who knew the original plant, stated it was not more than 18 inches high and spread several feet even though it was entangled in other brushes. In May 1951, we set out our three plants on the mesa in tight clay-loam soil, in full sun. At intervals from 1956 we started many cuttings at various times of the year: February, March, April, and June. Usually very satisfactory amounts were rooted from tip cuttings treated with Rootone and these would regularly take 40 to 45 days to begin rooting. Except for a few lots, most rooted material was handled easily in the nursery.

Culture: Two of the original three planted on the mesa plus many others added since have grown splendidly, developing into large, rounded, very compact plants. The branches tend to point downward and where they touch the ground, rooting soon takes place. The mature plants resemble a large ball and when in full flower during February and March, it has the appearance of a large snowball. In recent years the flowering has been hampered by the sparrows eating all the flower buds, otherwise the plants become completely pure white. See **Pacific Coast Nurseryman** [25(5): 10. 1966.] for a full description of this plant. NOTE: One-year-old plants grown from cuttings presented to Wandalee Thompson on February 15, 1966, and planted on March 12, 1966, began flowering on March 15, 1967, and withstood temperatures down to 10° F in 1966 and to 14° F in 1967 and none were injured, and plants were reported doing very well in August 1967.

Malcolm Nobs hybrid of *Ceanothus rigidus* x *Ceanothus gloriosus* var. *gloriosus*.

Propagation: Twenty F2 seeds of this Dr. Malcolm Nobs controlled cross were soaked for 24 hours of hot water treatment, and were sown on February 19, 1952. Thirty-seven days later one seedling emerged and no more came up. The flat was held for seven months.

Culture: This one plant was set out in an experimental plot and further records are not available.

***Ceanothus* 'Royal Blue'.**

Three cutting-grown plants of this cultivar were received from the late Louis Lake Edmunds of Danville, California, in June 1950. The original plant was selected from a batch of seedlings that were collected and grown from a plant of *C. thyrsiflorus* var. *repens* growing in Edmunds' garden that had apparently crossed with *C. griseus*. The original plants of *C. thyrsiflorus* var.

repens were grown from cuttings taken on Point Reyes in Marin County. Since the presumed cross had parentage of *C. thyrsoiflorus* var. *repens*, this cultivar grew to not more than four feet tall but spread out many feet. In July 1950, nine tip cuttings were made, given no treatment, and five rooted, taking 21 days to initiate roots. They were planted in an experimental plot and within three years produced great trusses of the deepest royal blue flowers the writer has ever seen on a *Ceanothus*. However, after about six years, severe branch proliferation and other troubles beset the plants and they gradually were removed. Also after the first two or three years, they failed to flower as beautifully as they had during their prime.

***Ceanothus* ‘Sierra Blue’.**

Propagation: Excellent, good, and indifferent results were obtained growing this entity by means of cuttings. A test of four lots of cuttings taken in March 1953, produced nine rooted cuttings out of 12 when given no treatment and when treated with Hormodin #2, rooting in 36 and 41 days respectively. While the cuttings treated with Rootone failed completely and those treated with Hormodin #3 resulted in only two rooted cuttings. Later attempts, in April 1966, after more experience, produced 30 rooted cutting out of a total of 35, when they were treated with Rootone. Once rooted, there was little difficulty in growing the plants in the nursery.

Culture: When we abandoned the old site, there were nine living plants, all in excellent condition. Cuttings were taken from them, and three rooted plants were transferred to this site. These plus additional amounts grown from cuttings have continued to grow without any trouble other than severe infestations of the

ceanothus stem gall. Plants have attained heights of over 20 feet and widths of ten to 15 feet. Unless controlled by careful pruning, this cultivar will make an excellent background plant. We cannot remember ever losing a plant from root rot. All of our plants have been grown in our tight clay-loam soil on the mesa in full sun and have received moderate amounts of water.

A group of seedlings were raised from ‘Sierra Blue’ and produced some fine plants with excellent blooms of deep blue flowers - much like *C. cyaneus*. The trusses of flowers were larger and a brighter blue. These plants were large, but not as tall as *C.* ‘Sierra Blue’.

***Ceanothus soreliatus* Hook. & Arn.** [Ed: *Ceanothus oliganthus* var. *soreliatus* (Hook. & Arn.) Hoover. TJM2]

Jim Brush.

Habitat: On the dry slopes of the Coast Ranges below 3,500 feet from Humboldt to Orange and western Riverside counties. Flowering from February to May.

Propagation: Hot water treatment for 20 to 24 hours will start germination in ten to 23 days for seed harvested from cultivated plants, and 31 to 34 days for seed gathered in the wild and when 14-years-old. We did not have any occasion to grow this plant from cuttings, but it is reported that tip cuttings taken in January will root.

Culture: While location in the garden has been of importance, our best record has been from those plants raised from 14-year-old seed collected directly from the wild. Over a period of 12 years, only one plant has been recorded dead for the lot raised from seed that was collected directly from the wild. Plants are eight to 12 feet tall, spreading to eight to 13 feet wide.

Flowering and seeding was not formally recorded until six years after they were planted, but may have occurred earlier.

Progeny grown from seeds collected from our plants growing in the garden at the old site did not come true from seed. These plants have steadily declined in the garden over the past 15 years.

***Ceanothus spinosus* Nutt.**

Red Heart or Greenbark Ceanothus.

Habitat: Mostly below 3,000 feet on the dry, brush covered slopes of coastal mountains from San Luis Obispo County to northern Baja California (Mexico). Flowering from February to May.

Propagation: While hot water treatment has been used for 20 to 24 hours, it appears unnecessary as the seed comes up quickly in eight to ten days, and maximum germination occurs within 30 days. We have had no occasion to attempt growing this species from cuttings, but presume it may be done. Seedlings grow rapidly in the nursery, to as much as three feet tall in six months, and it may be best to sow seed later, such as in December or January if plants have to be held through the summer months in the nursery. Our sowings were made in October and November and we had no problem growing them without losses in the nursery.

Culture: Various reports have indicated that this species is one of the hardier types to grow, and it has been in cultivation for about 75 years. Our records, both at the old site and here, confirm this fact. Losses have been minimal, growth has been rapid and excellent and profuse flowering has occurred within three to five years. Fifteen-year-old plants range in height from six to 12 feet and spread nine to 17 feet wide.

***Ceanothus thyrsiflorus* Eschsch.**

Blue Blossom.

Habitat: Wooded slopes and canyons of the cool coastal Outer Coast Ranges below 2,000 feet from Santa Barbara County to southern Oregon. [Ed: A disjunct population of this species is known from near Erendira in Baja California, Mexico.] Flowering from March to June.

Propagation: Eleven collections of seed, including the **var. *repens* McMinn** [Ed: the var. is not recognized in TMJ2], were sown, several of them more than once, between 1950 and 1965. Hot water treatment from 20 to 24 hours was used in all lots except one, which was soaked in Thiourea for four minutes. Cold-stratification for 20 and 34 days was used on two lots. Germination rated from good to excellent in most lots, even for two collections of 14-year-old seed. The number of days required for seedling emergence was highly variable, even among the same collections of seed. The 14-year-old seed took 26 and 38 days, cultivated and other collections of wild harvested seed ranged from five to 23 days. The two lots receiving cold-stratification emerged in four and nine days after removal from the cold. The **var. *repens*** came up in eight and ten days. Two lots of cuttings rooted in 29 and 42 days, the quickest being treated with CUTstart XX and was of the **var. *repens***. No problems were encountered during the growing-on stages in the nursery. However, seedlings grow rapidly and may be three to four feet tall in gallon-cans before the planting season.

Culture: Until ten-years-old most of our plantings, necessarily planted in full sun, both in rocky decomposed granite and tight clay-loam soil, fared exceedingly well. Beyond that time, there was a rapid decline in both number and condition of plants. Some were severely infected with

the branch proliferation or the ceanothus stem gall. Other plants seemed to age rapidly and eventually succumbed to root rot problems, especially when they received too much summer irrigation. Properly used in coastal regions and requiring little attention, this species can be a useful background or hedging plant.

***Ceanothus tomentosus* Parry.**

Habitat: Scattered on dry slopes below 5,000 feet in the foothills of the Sierra Nevada from Placer to Mariposa counties. Flowering from April to May.

Propagation: Two collections of seed from the Ione area, Amador County were sown after 17 hours hot water treatment. Our first lot took 85 days to emerge and over five months to attain maximum germination, but we obtained a sufficient number of seedlings, which unfortunately, were killed by sulphur fumes during excessively hot weather in May 1957. A second lot, while taking only 29 days, produced only two seedlings. A later collection was treated with a 17-hour hot water soak followed by 77 days of cold-stratification. The seeds began germinating in 16 days and 40 were produced from a very small amount of seed. There was a high mortality during early seedling stage and only 13 were alive for planting out.

Culture: Although only five-years-old, our single planting of this species has done well to date, two being recorded as dead. While they had been chewed by rabbits during early growth, the plants now measure two-and-a-half to five feet tall and three to seven feet wide. Flowering or seeding had not been recorded.

***Ceanothus tomentosus* Parry var. *olivaceus* Jepson.** [Ed: the var. is not recognized in TJM2]

Habitat: Dry brush-covered slopes below 3,500 feet in the mountains and foothills of San Bernardino County to San Diego County and northwestern Baja California (Mexico).

Propagation: Two seed collections harvested from plants growing at the old site were sown after 24 hours hot water treatment. Germination began in 20 to 23 days and was excellent. Losses were moderate during growing-on stages in the nursery.

Culture: As would be expected from seed-grown plants, our collections contained several hybrid types among the group. However, magnificent specimens have grown in our open, full sun, and rocky decomposed granite loam. Each March, beautiful displays of magnificent blues are evident in several portions of the garden. Where specimens were not too crowded, they developed into specimens that are 16 feet tall and 22 feet wide. Oak root fungus (*Armillaria mellea*) has killed several plants in the rock garden area. Flowering and seeding started in the third year.

***Ceanothus velutinus* Douglas.**

Tobacco Brush.

Habitat: Open wooded slopes, 3,500 to 10,000 feet; chaparral and montane coniferous forests, in the Sierra Nevada from Tulare County north to Modoc County and west to Humboldt and Trinity counties; to British Columbia (Canada), South Dakota, and Colorado. Flowering from April to July.

Propagation: Five seed collections from the wild were obtained between 1953 and 1958 and either failed to grow or germinated poorly. Hot water treatments only or with added cold-stratification for varying periods had little effect. One of the best percentages resulted after only

hot water treatment and no cold-stratification. In any case, it was difficult to grow the seedlings in the nursery, most of them succumbing before any size was attained.

Culture: A total of six plants of size were used in appropriate places in the garden, but none survived for more than seven years. Two plants grew to two-and-a-half feet tall and seven feet wide.

***Ceanothus velutinus* Douglas var. *laevigatus* (Hook.) Torr. & A. Gray.** [Ed: the var. is not recognized in TJM2]

Habitat: Woods below 3,000 feet in the Outer Coast Ranges from Marin to Del Norte counties, and north to British Columbia (Canada).

Propagation: Few seedlings were obtained from two collections. As with the species, we had difficulty in producing this variety. We did manage to root a very low percentage of cuttings taken from plants growing in the nursery. These were raised to be fine plants without any trouble and are now growing satisfactorily in the garden in well-drained, rocky, granitic soils with shade cast by large trees.

***Ceanothus verrucosus* Nutt.**

Habitat: In the dry hills of western San Diego County and adjacent northwestern Baja California (Mexico). Flowering from January to April.

Propagation: After the hot water treatment for 24 hours, the seeds began to germinate in ten days. Seeds may not need any treatment. Excellent germination was recorded. There were no problems encountered in raising the seedlings, and there has been no occasion to raise any plants from cuttings.

Culture: This handsome species with its very pure white flowers is one of the best species for all around appearance and usage. Never appearing ragged or shabby, we have never had to concern ourselves about any disease or insect problems. Except for some necessary thinning, and the loss of one two-year-old plant, our records are excellent for this species. Flowering and seeding occurred in two years. After 15 years, our plants measured from eight to 15 feet tall and had spread from 13 to 19 feet wide.

***Celtis douglasii* Planch.** [Ed: *Celtis reticulata* Torr. TJM2]

Western Hackberry.

Tree (deciduous).

Ulmaceae. Elm Family. [Ed: Cannabaceae. Hemp Family. TJM2]

Habitat: Usually at elevations of 2,800 to 5,000 feet, in widely scattered damp places, mountains of eastern San Diego County northward along the edges of desert and desert mountains to eastern Washington, Utah, and Arizona. Flowering from April to May.

Propagation: Sufficient seedlings were acquired when sown in either September or November and subjected to 30 to 90 days cold-stratification. Since many seedlings were obtained in former sowings at the old site without cold-stratification, that treatment appears to be unnecessary. One lot of seed harvested from our cultivated plants came up before removed from cold-stratification in 30 days, while a second collection from the wild provided with 83 days of cold-stratification

came up 13 days after removal from the cold. There was no problem in raising the seedlings while in the nursery.

Culture: About 25 trees to ten feet tall or more and 21-years-old were pruned severely and moved bare-root from the old site and planted in their present location in March 1952. Losses were minimal, and some of the re-established plants were again moved in 1957. These had already attained sizes of eight to ten feet or more. These plantings (originally from the old site) are now 35-years-old and started producing flowers three years after they were moved (1955) and good crops of seed were being produced by 1959. Later plantings of seedlings were made in 1962 and 1964. While these young plants were severely eaten by rabbits, growth has been good, the plants attaining as much as nine feet in height and ten feet in width in five years. All plantings have been made in full sun in rocky decomposed granite loam. Irrigation intervals range from three to six weeks during summer months. In 1959, a severe infestation of black caterpillars nearly denuded our oldest plants but a spraying soon alleviated the condition.

***Centaurium venustum* (A. Gray) B.L. Rob.** [Ed: *Zeltnera venusta* (A. Gray) G. Mans. TJM2]

Canchalagua.

Annual.

Gentianaceae. Gentian Family.

Habitat: Mostly on dry slopes and flats below 2,500 feet in the open spots of chaparral and sage scrub in cismontane Southern California.

Propagation and Culture: This annual, while sporadically local, never really took hold when sown in comparable spots in the garden: dry, flat sandy loam. Seedlings were noted in the spring from time to time over a period of seven years but eventually disappeared.

***Cephalanthus occidentalis* L. var. *californicus* Benth.** [Ed: the var. is not recognized in TJM2]

Buttonwillow.

Shrub.

Rubiaceae. Madder Family.

Habitat: Edges of lakes and streams, below 3,000 feet, Central Valley and bordering ranges north to Siskiyou County, and the western U.S. Flowering from June to September.

Propagation: Untreated seed germinates in 12 to 30 days, the seed harvested from cultivated plants responding more rapidly. Buttonwillow may also be started from cuttings, although we have not done so. Seedlings were raised easily in the nursery.

Culture: Our oldest plants were set out in November 1952 and thrived in a moist stream on the mesa in tight clay-loam soil. However, another planting set out in 1955 did poorly in a low spot in very rocky, decomposed granite loam. Another group of seedlings have responded rapidly in an easily irrigated channel, again in rocky, decomposed granite loam. Specimens as much as 15 feet tall and 15 feet wide were recorded after ten years of growth. Five-year-old plants were six feet tall and eight feet wide. Flowers and seeds were noted two years after planting, and good crops have been produced each year for the past fifteen years. A relatively moist habitat must be maintained for this plant to do best.

***Cerastium arvense* L.** [Ed: *Cerastium arvense* L. ssp. *strictum* Gaudin. TJM2]

Perennial.

Caryophyllaceae. Pink Family.

Habitat: Moist rocky or grassy slopes and cliffs, widely distributed from Monterey County northward, to Alaska, the Atlantic Coast, and Eurasia. Flowering from February to August.

Propagation: One collection germinated in ten days without treatment. No losses occurred in nursery.

Culture: Plants were set out in March 1966, and few plants remained a year later. While widely distributed naturally, our records indicate it might not respond here, where it is not found naturally.

***Cercidium floridum* A. Gray.** [Ed: *Parkinsonia florida* (A. Gray) S. Watson. TJM2]

Blue Palo Verde.

Tree.

Fabaceae. Pea Family.

Habitat: Low sandy places and washes, below 1,200 feet, Colorado Desert; Arizona, Sonora and Baja California (Mexico).

Propagation: As related in our previous work (Everett, 1957. Pgs: 69-70), we followed somewhat the same processes for seed germination at our present location. Seeds were soaked in either hot or cold water up to 24 hours and germinated in four to six days, while untreated seeds may take a few days longer. Except for two lots, all seeds were sown on regular schedules in four-inch pots or gallon-cans. Those sown in flats were readily transplanted. As recorded previously, seed will rot easily and perhaps summer sowings may be best, however, we were always able to raise the required number of plants. Untreated seed sown in 100% sphagnum moss gave quick results but had to be carefully watched for rotting. Once started, a high percentage of the seedlings were raised through the nursery.

Culture: Much the same experience as recorded at the old site has been noted here. Young, unprotected plants are eagerly sought by rabbits, but when the plants are suitably protected, they will quickly grow into fine specimens with few if any losses. Losses typically occurred within the first two or three years. Our oldest plants, set out in 1952 with additions made in 1953 and 1957, have responded exceedingly well in our rocky, decomposed granite loam with occasional summer irrigation. Plants measure six to 24 feet tall and seven to 17 feet wide. They have been producing flowers and seeds since their fifth year, and have developed into handsome specimens. In other areas, flowers and seeds were noted after the second year.

***Cercidium floridum* × *Cercidium microphyllum*.**

Tree.

Propagation: A few seed originally collected in the wild in 1940 were sown in September 1955 after soaking for seven hours in cold water. Seedlings began germinating in four days and all had come up - a total of four - in 22 days. Only one was raised for planting.

Culture: An attempt was made to move seven plants bare-root from the old site, but this procedure failed. The one seedling raised in 1955 was planted in October 1956 and measured 18 inches tall and three feet wide in 1959.

***Cercidium microphyllum* (Torr.) Rose & I.M. Johnst.** [Ed: *Parkinsonia microphylla* Torr. TJM2]

Tree.

Habitat: Below 1,200 feet, gravelly slopes and washes in the Whipple Mountains of eastern San Bernardino County, Arizona, Sonora and Baja California (Mexico).

Propagation: Seed of our original collection from the wild (propagation number 3653) was harvested in July 1940, and was reported in our previous work. This collection was used to produce plants for our present location. Since August 1940, a total of 17 lots have been sown of this collection. At this location, our first sowing was made in August 1951 and our last in June 1957, the latter sowing responded with 90% germination. Our first three lots followed past procedures of sowing two or three seeds in either four-inch pots or gallon-cans, either with or without pretreatment in hot or cold water. From 1956 onward, we sowed seeds in flats and have had excellent results in transplanting. We have continued to follow this procedure. All germinations occurred within four to eight days, no matter what treatment was used, but it was noted that four days was usual when seeds were sown in 100% sphagnum moss. While some seed rotting occurred, it was not as bad as with *C. floridum*. The usual procedures in the nursery followed without undue trouble.

One time, several seeds were sown in gallon-cans in the nursery. In cases when only a single seed had germinated and then was planted out in the garden, it was noted that additional seeds germinated the following winter – almost a year later. Sowing the seed directly into site, with suitable preparation, could be a most satisfactory practice.

Culture: No attempt was made to transplant growing plants from the old site. Our first plantings here were made in October 1951, and December 1952. Severe losses occurred the first winters, seemingly from a stem rot contracted during the unusually wet winter. Otherwise, results have been much better than at the old site. All plants are growing in a rocky, decomposed granite loam and while slow to establish they have done well when settled in. They need similar protection against rodents. Our only losses recorded in later years occurred from fire set by vandals. Our 15-year-old plants range from three to 11 feet tall and from six to ten feet wide. Flowering and seeding started during their fifth year.

***Cercis occidentalis* A. Gray.**

Western Redbud.

Shrub.

Fabaceae. Pea Family.

Habitat: Dry slopes and canyons in the foothills mostly below 3,500 feet, northern central valley and Sierran foothills south to Kern County, desert slopes of the Laguna and Cuyamaca Mountains of San Diego County; to Utah and Arizona. Flowering from February to April.

Propagation: During the fifteen-year period of this report, we grew 18 collections from seed, 15 from the wild, four of which were gathered from white flowering plants, and three from our cultivated plants. Two of the latter were originally from the Laguna-Cuyamaca Mountains in San Diego County. Age of seed ranged from one to three months for most lots, but good results were obtained from seed more than a year- to 15-years-old. While several variations were used to promote germination, we usually got satisfactory results from a 24 hour soaking in hot water prior to sowing. On one occasion straw was burned over the flat but nothing occurred in the subsequent nine months so the seeds were removed and soaked for two days after which they began to germinate in 42 days. Two lots were subject to hot water and 75 days of cold-stratification. Seedlings emerged in 13 days after removal from the cold, and maximum germination occurred in two months. Our experience indicates dropping the seed into nearly boiling water and soaking for 24 hours starts germination within a variable period of 15 to 45 days, usually averaging close to one month. Maximum germination usually had occurred in two to three months. In no case does this represent 100% germination as there will always be many seeds that may take a year or more to break dormancy. A few lots were sown directly into pots or gallon containers, and there several seedlings would appear in each container. Usually there was little difficulty in raising the seedlings to planting size. However, when exposed to excessive amounts of water, such as during wet periods of the year, seedlings are apt to easily succumb to damp-off fungus. Since the species is deciduous, we found it entirely satisfactory to sow the seed in deep seed beds in the lath house, protecting the seed and seedlings from rodents, and letting their root system develop naturally. Transplanting during their dormant period was done with no serious problems.

Four of our collections were harvested from white flowering plants in the wild. Out of numerous seedlings raised and planted in the garden, only three fine specimens were raised. Desirous of increasing our number of plants, we took 30 tip cuttings as an experiment in May and 26 rooted with Rootone treatment and bottom heat. These were grown in nursery bed for a year, after which they were transplanted bare-root during their dormant period. This surprising success has been repeated and additional plants are being raised of selected color specimens of the normal color types.

Culture: The extensive use of this fine large shrub creates quite spectacular splashes of welcome color in various areas of the garden in March. Sporadic periods of flowering appear later in the year. Several quite large shrubs growing at the old site were moved successfully, and many additions have been added from the collections raised during the past fifteen years. A large percentage of the plantings have come through with only minor losses, provided they were early protected from the nibbling rabbits or the crown of the plant was not buried too deeply, particularly in the heavy clay of the mesa. Growth rates have been moderate to slow, depending on the site. Sizes range from five to 15 feet in ten years with usually greater spreads. Initial flowering begins in three to five years and may reach their zenith in ten years, usually the best flower production occurs after a cold winter.

A few pods will be produced after the first flowering, and will increase in number with each year. The pods are quite attractive in reddish hues in some strains while others turn from green to brown, hanging on for several months. Volunteer seedlings appear in quantity after several years. Our albino plants appear to be more upright rather than spreading and make a fine show in March and April, being quite distinctive. In general the species would be most useful on open

hillsides where its full beauty can be appreciated rather than surrounded by other shrubs and trees.

***Cercocarpus betuloides* Nutt.**

Mountain-Mahogany.

Shrub.

Rosaceae. Rose Family.

Habitat: A common shrub of dry slopes and canyons below 6,000 feet in cismontane California to southwestern Oregon and northwestern Baja California (Mexico). Flowering from March to May.

Propagation: Germinates well and promptly without any pretreatment, usually within 15 to 25 days. One lot cold-stratified for three months started emerging before removed from cold. There are indications that seed collected directly from the wild is slower to come up than seed from cultivated plants. There was no problem in raising the seedlings to planting size.

Culture: Excellent results in all areas have been recorded for this hardy species. Young plants must be protected against rabbits, otherwise they will be chewed severely, hampering their growth and strength. Fifteen-year-old plants have grown into handsome specimens up to 12 feet tall and with equal or greater spreads. Flowering and seeding began the second year. Seeds of *C. betuloides* Nutt. var. *multiflorus* Jeps. [Ed: the var. is not recognized in TJM2] were also grown, and these behaved the same as the species.

***Cercocarpus betuloides* Nutt. var. *blancheae* (C.K. Schneid.) Little.**

Habitat: Among the chaparral of Santa Cruz, Santa Rosa, and Santa Catalina islands. Flowering from March to April.

Propagation: Two seed collections from cultivated plants and one from the wild were grown. All were sown without pretreatment and came up from ten to 15 days. One collection from the wild, of poor quality, produced only one seedling while the other garden collected accessions came up abundantly. As with the species, there were no problems encountered in raising the seedlings.

Culture: Much the same data as for the species.

***Cercocarpus intricatus* S. Watson.** [Ed: *Cercocarpus ledifolius* Nutt. var. *intricatus* (S. Watson) M.E. Jones. TJM2]

Habitat: Elevations of 4,000 to 9,000 feet, from the White, Providence, and Clark mountains of California; to Utah and Arizona. Flowers in May.

Propagation: Five seed collections from the White Mountains in Inyo County were handled between 1954 and 1962. One untreated lot came up in 15 days but best results were recorded when pretreated for two to three months in cold-stratification. Seedlings emerged quickly in 15 days after removal from cold. One seed lot, treated with Thiourea, came up poorly, while a second lot of same seed collection that was cold-stratified produced satisfactory results. Records indicate that only minor losses occurred while being grown in the nursery.

Culture: This is a very slow growing species, and the young plants have been slow to take hold in the garden. However, once established, there is no problem. Indications are that it should be

grown in soil with considerable amounts of clay. Our sites have been extremely rocky and with little soil, and as a consequence, the species is slow to become established. Losses have ranged over a period of five to ten years from 20 to 70 percent. Growth has been from a few inches to two-and-a-half feet with equal spreads. No flowers or seeding have been recorded. A handsome little plant once well developed.

***Cercocarpus ledifolius* Nutt.**

Habitat: Dry rocky slopes, 4,000 to 10,500 feet, eastern slopes of the Santa Rosa and San Jacinto mountains through the mountains of the western Mojave Desert, north to Modoc and Siskiyou counties; to eastern Washington, Montana, Colorado, Arizona, and Baja California (Mexico). Flowering from April to May.

Propagation: Six collections of wild seed were sown between 1948 and 1963. Only two collections produced satisfactory quantities of seedlings, the remainder either failed to come up or only a few seedlings emerged. Both of these collections had much more viable seeds. Untreated seed took from 20 to 55 days to germinate; one lot given a 24 hour hot water treatment took 50 days to germinate. Two accessions were cold-stratified, one a jar with moist sphagnum and seedlings had started germinating in 46 days while still under cold-stratification. A second collection had 65 days cold-stratification and started emerging two days after removal from the cold and excellent results were obtained. Apparently the amount of seedlings depends on quality of seed and while cold-stratification may help, it does not appear to be necessary. Excellent results were recorded during growth in nursery containers, with only minor losses.

Culture: All plantings have been made in very rocky, decomposed granite loam in full sun. Exceedingly fine plants have grown in all areas. Ten- to 15-year-old plants range in size from four to seven feet tall and spreading five to 11 feet wide. Flowering and seeding has been slow, seven to ten years is shown on our records.

***Cercocarpus minutiflorus* Abrams.**

Habitat: On the chaparral covered slopes of San Diego County and Baja California (Mexico), at elevations below 3,000 feet. Flowering from March to May.

Propagation: From a planting at the old site, seed was harvested in 1949 and sown in August 1951. Seedlings came up in 13 days with no treatment. A second lot sown eight years later took 15 days, both with excellent results.

Culture: No losses have been recorded for this species, as it is extremely hardy and not subject to any problems. Sizes range from six to 14 feet tall with spreads of eight to 13 feet wide. Flowering and seeding occurred within three years.

***Cercocarpus traskiae* Eastw.**

This species long reported on Santa Catalina Island was rediscovered in 1966-67. A few seeds were found and a later collection was made. Since the discovery has been so recent, results have not yet been recorded, but it is known that seedlings are being grown (March 1968).

***Cereus emoryi* Engelm. [Ed: *Bergerocactus emoryi* (Engelm.) Britton & Rose. TJM2]**

Woody perennial.

Cactaceae. Cactus Family.

Habitat: Dry coastal bluffs and cliffs, Orange County to Baja California (Mexico); Santa Catalina and San Clemente islands.

Propagation: The simplest method is to take cuttings, and to either start them in pots with sandy loam or set them out directly into the garden. We have never attempted growing from seed, but assume it can be done.

Culture: All of our original material collected in 1928, raised at the old site, was moved in September and October, 1951, to their present locations here. While there was some rotting, most of the material took hold and good exhibits of this species may be seen in their proper settings. This material has been handled easily for the past 35 years. Additional numbers were added, one from San Clemente Island in 1962 and another from Santa Catalina Island in 1965. In the latter location, the species was growing abundantly over a wide area. As the plants age, the older stems die, lending an untidy appearance to the plantings. However, these can be removed easily should it seem necessary.

***Cereus giganteus* Engelm.** [Ed: *Carnegiea gigantea* (Engelm.) Britton & Rose. TJM2]

Saguaro.

Tree.

Habitat: Dry, rocky mountains below 1,500 feet in Arizona and very local in the Wipple Mountains near the Colorado River; and to Sonora, Mexico.

Propagation: We have had no experience germinating seed, however, we were able to get a small offshoot in May 1956. Putting it in a pot with a very sandy mixture after drying the cut thoroughly, it had failed to root by February 1957. It was then set outside in its permanent location, where it did not root until after a year had passed.

Culture: A plant, originally obtained from the Arizona side of the Colorado River, in 1929, was grown at the old site, and was moved in September 1951, at which time it was 14 inches tall. It survived the second move (to Claremont), and in its 35th year it had attained a height of 29 inches and spread of nine inches. It was doing very well with protection from a large creosote bush (*Larrea divaricata*).

The offshoot, reported above, was recorded as flowering in July, 1957. At the time, it was noted to be soft and yellowish in color and with no roots, and was noted it probably would not live. However, our latest observation noted it was alive, had produced roots, and was eight inches tall and three-and-a-half inches wide.

***Chaenactis* DC.**

Pincushion Flower.

Annual and Perennial.

Asteraceae. Sunflower Family.

Habitat: Widely distributed in western U.S. and adjacent borders, generally growing dry, gravelly, or sandy soils of deserts and hillsides, at low altitudes.

Propagation: While the seed may be sown in flats and the seedlings transplanted, we sowed all of our seeds of all species directly into the open soil where the plants were to grow. When sown under such conditions, in light soils, germination usually occurs within one to three weeks, depending somewhat on the species.

Culture: Again, depending on the species, results have been poor to excellent. The desert species, particularly those from extremely different habitats than our site, have been the most troublesome. The following species and varieties have been generally successfully grown: *C. artemisiifolia* (Harv. & A. Gray) A. Gray., *C. carphoclinia* A. Gray., *C. fremontii* A. Gray., *C. glabriuscula* DC., *C. glabriuscula* var. *lanosa* (DC.) H.M. Hall., *C. glabriuscula* var. *orcuttiana* (Greene) H.M. Hall., *C. stevioides* Hook. & Arn., *C. suffrutescens* A. Gray., and *C. xantiana* A. Gray. Flowering starts in April or May with seeding about two months later.

***Chaetopappa aurea* (Nutt.) Keck.** [Ed: *Pentachaeta aurea* Nutt. TJM2]

Annual.

Asteraceae. Sunflower Family.

Habitat: Dry open ground and grassy slopes up to 6,000 feet, Los Angeles County to San Diego County and Baja California (Mexico). Flowering from April to July.

Propagation: Two strains collected in San Diego County in 1962 were sown in field rows in clay-loam soil. Both numbers took 31 days to appear, but one collection was vigorous and the other collection was weak. Subsequent sowings indicated one strain was far more vigorous than the other. However, germination periods were about the same, depending somewhat on where they were sown in open ground, seedlings appeared in seven to 45 days. Sandy soil gave best results.

Culture: Fine groupings of this colorful annual produced nice spots of color, beginning in the latter part of March and continuing until seed was harvested in May.

***Chamaebatia australis* (Brandege) Abrams.**

Shrub.

Rosaceae. Rose Family.

Habitat: Dry chaparral covered slopes below 2,200 feet in southern San Diego County and northern Baja California (Mexico). Flowering from November to May.

Propagation: Established plants were received as a gift and therefore this species has not been propagated by us. However, it appears to require the same treatment as *C. foliolosa*.

Culture: Planted on a steep bank in heavy clay-loam soil, our two plants acquired in 1965 grew vigorously, and there is no reason to presume they would not be successfully established.

***Chamaebatia foliolosa* Benth.**

Mountain Misery.

Shrub.

Rosaceae. Rose Family.

Habitat: Spreading over wide areas in open forests at elevations of 2,000 to 7,000 feet, this tenacious plant is found in the mountains from Shasta County to Tulare County. Flowering from May to July.

Propagation: Cold-stratification for periods of two to three months is essential for germination. We tried lesser periods but the results were poor. Seed began germinating while still under cold-stratification in a period of slightly over two months. Seed is generally found to be of poor viability and therefore should be examined carefully before harvesting. We experienced no difficulty in raising all the seedlings that came up in the flat. Note that this species is also easily propagated from root cuttings.

Culture: Three plantings were made, each in a semishaded position under oaks where there was a thick layer of leaf mulch and loose granitic loam. All plants make excellent growth and soon started spreading out by underground rootstocks. No losses were recorded and soon beds 20 feet by 50 feet were recorded. Flowering and seeding began in the third year after setting out in permanent site.

***Chamaebatiaria millefolium* (Torr.) Maxim.**

Fern Bush. Desert Sweet.

Shrub.

Rosaceae. Rose Family.

Habitat: Inhabits dry rocky slopes of the more desert areas at elevations of 3,400 to 10,200 feet, east of the Sierra Nevada and into Oregon, Wyoming, and Arizona. Flowering from June to August.

Propagation: Our first sowing of seed in 1952 was cold-stratified for a period of nearly three months. At the same time, another lot sown and was not cold-stratified. Of several sowings of untreated seed, even though some lots were four-years-old, germination occurred in five to thirteen days, and while cold-stratified seed germinated equally well, this treatment is unnecessary. We had no problem in raising all the seedlings necessary for our uses, healthy, vigorous growth occurring in all lots.

Culture: While some losses were recorded over a period of thirteen years, the results have been generally excellent in all areas. Vigorous plants two to six feet tall and spreading from five to ten feet in ten years were noted in most cases. Flowering and seeding were recorded three to four years after setting out.

***Chamaecyparis lawsoniana* (A. Murray bis) Parl.**

Lawson Cypress. Port Orford Cedar.

Tree (evergreen).

Cupressaceae. Cypress Family.

Natural Range: Moist canyons and slopes of coastal northwestern California and southwestern Oregon below 4,800 feet.

Propagation: Seed and cuttings, particularly the latter for selected types. The percentage of viable seed is usually low. Germination period will range from 15 to 60 days without cold-stratification.

We sowed garden harvested and wild seed, and in both cases, seed that was three- to four-years-old germinated within 15 to 20 days while fresh seed took 40 to 60 days. This would indicate that fresh seed might benefit from cold-stratification. Our experience in rooting cuttings has been limited, but with a SUPERthrive treatment, seven out of 20 cutting rooted in 50 days. As we had no need for further asexual propagation of this species, we did no further work with this method. Seedlings need to be carefully watched for damp-off problems, but we suffered little damage with our seed mixtures, and seedlings grew well and healthily for us.

Culture: Our location in the interior of Southern California is not one where this coastal species would be expected to perform. However, since we did not have the needed moist canyons or deep shade, we planted our specimens in the open in full sun and very rocky granitic loam. When material was available, a thick coating of mulch was scattered over the surrounding soil.

Amazingly, the plants responded quite well, producing handsome specimens as tall as 15 feet and spreads to ten feet. Where space was available, some specimens were located in shadier spots. However, one cannot say they grew any more thriftily. After 15 years, there has been an increase in mortality. A few specimens of selected and named varieties were received from the National Arboretum in Washington, D.C. in 1963. All but two have survived and doing quite well. These are: *C. l.* ‘**Drummondii**’, ‘**Krameri**’ and ‘**Lutea Nana**’.

Uses: Specimen, park and natural forests in the proper locations. While not recommended for interior Southern California, it will grow quite well. This species is often used for lumber. There are many interesting horticultural forms.

Chamaecyparis nootkatensis (D. Don) Spach. [Ed: *Callitropsis nootkatensis* (D. Don) D.P. Little. TJM2]

Alaska-Cedar.

Tree.

Cypress Family.

Natural Range: Rare in northern California in Siskiyou County at about 5,000 feet, more common northward to Alaska.

Propagation: Seed and cuttings. Our only collection was presented to us in 1939 as young seedlings, and since then we received two lots of seeds, neither of which germinated.

Culture: Two plants were grown at the old site until we moved, and at which time they were transferred to five-gallon-cans in February and March 1951. They were severely chewed by rabbits after setting out in April 1951, in a full sun position. Deteriorating in the first position, they were again transferred to a shadier spot where they appeared to begin to take hold. However, after nine years they finally succumbed.

Uses: Primarily a forest tree of great value as a lumber product.

Cheilanthes Sw.

Perennials.

Pteridaceae. Brake Family.

Natural Range: Usually in very dry areas, particularly around the base of rocks. Ours mostly in arid, desert regions up to 9,000 feet, ranging throughout the western and southwestern states and northern Mexico.

Propagation: Transplants from the wild were the only materials we handled. They could be re-established satisfactorily by this method, but needed careful attention to not overwater.

Culture: Three undetermined species and two species were set out in the suitable areas, such as around the base of rocks or in a rock wall. There they all did poorly and were dead within two years. This genus needs the attention of a specialist and a site where, once established, they receive no additional water during their dormant stage during the dry months of the year.

Uses: A specialist item but of interest for rock walls and rock gardens. We used them as part of the flora for our desert garden.

***Chilopsis linearis* (Cav.) Sweet.**

Desert-Willow.

Shrub.

Bignoniaceae. Trumpet-Creeper Family.

Natural Range: Common along washes and watercourses below 5,000 feet, from western Texas through southern Utah to Southern California.

Propagation: Seeds and cuttings. While it has been recommended to use a sandy seeding media, we have used our standard mixture for several collections handled between 1951 and 1964. Germination without any treatment is rapid, usually within five to 20 days. Seedlings must be carefully watched for damp-off, and we encountered considerable losses during the gallon-can stage during the early spring and summer months. This is a case where a dormant species should not be grown until the natural period for leaf growth. There was little trouble during first transplant stages. Cuttings, while rooting readily, either with or without root inducing materials, have usually posed a problem during the shifting from rooting media to other containers. Also, excessive losses occurred during the growing stages in the nursery. Rooting period takes about 35 days.

Culture: Our various plantings have been established successfully, but never with the vigor experienced at the old site where the soil was heavier and more alkaline. Flowering and general appearance of the plants leaves something to be desired. This is not to say they have not done well, for they have. Selected flower color types have been maintained as well as the more commonly observed pale lavender to whitish flowers. They need plenty of water to be adequately maintained.

Uses: Interior region where water is plentiful, this large deciduous shrub can be a useful adjunct to a desert landscape. It is recommended as a useful game cover, erosion control plant in dry regions, and for use in shelter belts. Interesting small trees, pruned to shape are a useful adjunct to the desert home.

***Chimaphila umbellata* (L.) W.P.C. Barton var. *occidentalis* (Rydb.) S.F. Blake.** [Ed: the var. is not recognized in TJM2]

Pipsissewa. Prince's Pine.

Perennial.

Ericaceae. Heath Family.

Natural Range: Inhabits dry or moist shrubby slopes and forest floors, ranging widely as far north as Alaska and east to Michigan.

Propagation: Two seed collections failed to germinate either with or without cold-stratification. As with many of the ericaceous-type plants, many of the seeds are either not viable or they are most difficult to germinate.

Culture: No experience but would probably need a loose, dry granitic soils under forest type conditions. A plant for the specialist.

Uses: Rock gardens or natural woodland plantings.

***Chlorogalum* Kunth.**

Soap Plant. Amole.

Bulbous perennials.

Liliaceae. Lily Family. [Agavaceae. Century Plant Family. TJM2]

Natural Range: The five species and two subspecies range throughout California with one species, *C. pomeridianum*, crossing the border in to Oregon. Usually in dry, heavy soils of slopes and plains, they may be found as narrow endemics or wide ranging species throughout the state, usually below 5,000 feet. Flowering from April to August.

Propagation: Seed may be sown in open ground or started in flats, whichever is most convenient. No pretreatment is necessary. Many lots of seed were sown and germination ranged from 12 to 65 days, there being no accounting for the wide differences in time, even within the same lot. Seed over four-years-old came up as rapidly as freshly collected seed. Sown between August and January, but usually from September to December.

Usually the seedlings were raised in the nursery for two years before planting into the garden site. Dormant bulbs can be readily moved.

Culture: We successfully grew all of the species and varieties, except *C. grandiflorum* Hoover., and it was easily started from seed but disappeared after two years. It could well have been eaten by rodents. The following have been grown from ten to 15 years and are still flourishing in the garden, *C. angustifolium* Kellogg., *C. parviflorum* S. Watson., *C. pomeridianum* (DC.) Kunth., *C. pomeridianum* var. *divaricatum* (Lindl.) Hoover., *C. pomeridianum* var. *minus* Hoover., *C. purpureum* Brandegee, and *C. purpureum* var. *reductum* Hoover., the latter just added to the collection. While there was a reduction from the original number of bulbs put out, once established and not beset by rodents, the colonies have greatly increased in size and strength.

Uses: The plants are a source of food for the California Indians and were also used by California's early settlers. Of interest to the bulb specialist and for those particularly interested in early uses of plants. *C. pomeridianum* has been most commonly used by the Indians as a cooked food and the foliage is put into streams to stupefy fish. The uncooked bulbs can be used to produce a nice lather.

***Chorizanthe* R. Br. ex Benth.**

Annuals.

Polygonaceae. Buckwheat Family.

Natural Range: Generally inhabits dry, sandy flats and slopes throughout California, usually below 5,000 feet. Depending on the species and variety as to specific range and altitude.

Flowering from April to July.

Propagation: The three species and the subspecies that we have grown, all have been sown directly into the garden area where they are desired. Germination is not always excellent, but we have managed to have adequate displays each season. Germination period has ranged from five to 52 days, depending on the site and how frequently irrigation was provided for the newly sown seed. The usual germination period was 20 to 30 days for open sown seed. The involucre bracts are difficult to separate from the seeds, therefore the outside coat has to be broken down before the seeds can start to germinate.

Culture: While we have grown many strains of *C. douglasii* Benth. since 1944, and *C. staticoides* Benth. since 1935 and *C. staticoides* ssp. *chrysacantha* (Goodm.) Munz. [Ed: the ssp. is not recognized in TJM2] since 1958, we failed with *C. membranacea* Benth. It was not recollected. Many ounces of pure seed have been harvested from all of our yearly plantings through the years and often many volunteers have been observed wherever it has been sown.

Uses: Should be included in all wildflower seed collections, particularly *C. douglasii* and *C. staticoides*, which both offer much late spring color and the dried plants can be used attractively in flower arrangements.

***Chrysopsis villosa* (Pursh) Nutt. var. *sessiliflora* (Nutt.) A. Gray.** [Ed: *Heterotheca sessiliflora* (Nutt.) Shinn ssp. *sessiliflora*. TJM2]

Golden-Aster.

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Immediate coastal chaparral and sagebrush slopes from sea level to 5,300 feet, Mendocino County south to Baja California (Mexico).

Propagation: No problem encountered with no pretreatment; germination in five days. Easily raised to planting size.

Culture: Used in our sand dune area where plants grew well but were short-lived in our area; apparently not liking any extra water during summer and desiring cooler atmosphere. Our plants bloomed very well after eight months in the garden.

Uses: Only as a novelty and for botanic garden collections.

***Chrysothamnus* Nutt.**

Rabbit-Brush.

Shrubs or Subshrubs.

Asteraceae. Sunflower Family.

Natural Range: Thirteen species, ten of which are found in California, and range widely over western North America. The largest concentration is found in California at elevations from near sea level to over 10,000 feet. Mainly, they inhabit dry flats and plains, often alkaline soils, and their greatest concentration in California is along the eastern border of the state, where from August through October, they make a most colorful display.

Propagation: While many collections were sown of a large number of species, due to the high percentage of nonviable seed, either a few plants or none resulted. Seventeen accessions failed to germinate from a total of 41 collections from the wild or from the garden. There appears to be “off years” when the seed was not good. While in other years, we had good germination success from most collections. The seeds are short-lived – never surviving more than a year or two. No treatment is necessary and usually seed will germinate within five to ten days. Caution must be exercised to not overwater the seed flats as the seeds may quickly rot. A sandy soil mixture is most suitable for the seed flat, and remove all the chaff, if possible, before sowing the seeds. While growing the young seedlings in containers, overwatering must be avoided during the growing stages in the summer months.

Culture: As stated in our previous report (Everett, 1957. Pgs: 76-79), this widely distributed genus never has attained the perfection it does in the wild. However, it has done much better in this location than at the old site. This we believe is due to the better drained soil, drier atmosphere, and hotter and colder temperatures. After setting out, plants reached their best development in five to eight years and then gradually deteriorated, and a greatly accelerated mortality occurred after the tenth year or even before. We have successfully raised the following: ***C. nauseosus* (Pall.) Britton ssp. *albicaulis* (Nutt.) Hall & Clem.** [Ed: *Ericameria nauseosa* (Pall.) G.L. Nesom & G.I. Baird var. *speciosa* (Nutt.) G.L. Nesom & G.I. Baird. TJM2], ***C. nauseosus* (Pall.) Britton ssp. *bernardinus* (Hall) Hall & Clem.** [Ed: *Ericameria nauseosa* (Pall.) G.L. Nesom & G.I. Baird var. *bernardina* (H.M. Hall) G.L. Nesom & G.I. Baird. TJM2], ***C. nauseosus* (Pall.) Britton ssp. *consimilis* (Greene) Hall & Clem.** [Ed: *Ericameria nauseosa* (Pall.) G.L. Nesom & G.I. Baird var. *oreophila* (A. Nelson) G.L. Nesom & G.I. Baird. TJM2], ***C. nauseosus* (Pall.) Britton ssp. *hololeucus* (A. Gray) Hall & Clem.** [Ed: *Ericameria nauseosa* (Pall.) G.L. Nesom & G.I. Baird var. *hololeuca* (A. Gray) G.L. Nesom & G.I. Baird. TJM2], ***C. nauseosus* (Pall.) Britton ssp. *mohavensis* (Greene) Hall & Clem.** [Ed: *Ericameria nauseosa* (Pall.) G.L. Nesom & G.I. Baird var. *mohavensis* (Greene) G.L. Nesom & G.I. Baird. TJM2], ***C. nauseosus* (Pall.) Britton ssp. *speciosus* (Nutt.) Hall & Clem.** [Ed: *Ericameria nauseosa* (Pall.) G.L. Nesom & G.I. Baird var. *speciosa* (Nutt.) G.L. Nesom & G.I. Baird. TJM2], ***C. parryi* (Gray) Greene ssp. *nevadensis* (A. Gray) Hall & Clem.** [Ed: *Ericameria parryi* (A. Gray) G.L. Nesom & G.I. Baird var. *nevadensis* (A. Gray) G.L. Nesom & G.I. Baird. TJM2], ***C. parryi* (Gray) Greene ssp. *vulcanicus* (Greene) Hall & Clem.** [Ed: *Ericameria parryi* (A. Gray) G.L. Nesom & G.I. Baird var. *vulcanica* (Greene) G.L. Nesom & G.I. Baird. TJM2], ***C. viscidiflorus* (Hook.) Nutt., and *C. viscidiflorus* (Hook.) Nutt. ssp. *pumilus* (Nutt.) Hall & Clem.** [Ed: the ssp. is not recognized in TJM2]. Others were raised but were either short-lived with us or our records were not clear. Growth was rapid and in most cases, flowering and seed production began within one to two years. Depending on the species, they all could be said to have reached maturity within five to eight years and most generally were much larger than in the wild. Our oldest and most successful plantings have been with us for over 15 years.

***Cirsium* Mill.**

Thistle.

Annuals, Biennials, Perennials.

Asteraceae. Sunflower Family.

Natural Range: There are about 200 species that range over the Northern Hemisphere. In California, there are 30 species of which two have been introduced from Europe, the remainder being native from marshy land to high montane habitats. Flowering mostly from June to September.

Propagation: Untreated seed is the usual method for starting this easily germinated genus. Our standard procedure is to sow the seed directly in place as they will come up in two to three weeks, if the soil is reasonably moist. More concentrated moisture will bring them up in a week either in flats or seed rows where moisture may be better controlled. If seedlings were transplanted, we had no problem in raising all of them. Even seedlings dug in the wild were successfully transplanted.

Culture: Since the several species we handled were from different habitats and elevations, it seems best to discuss briefly each species.

***Cirsium andrewsii* (A. Gray) Jepson.** – One collection of five plants was raised from seed; planted March 1963 after which they fared poorly from lack of attention and the destructive efforts of moles.

***Cirsium brevistylum* Cronquist.** – From one collection of seed, only a few seedlings germinated and these later died from root rot.

***Cirsium californicum* A. Gray.** [Ed: *Cirsium occidentale* (Nutt.) Jeps. var. *californicum* (A. Gray) D.J. Keil & C.E. Turner. TJM2] – Successfully grown for several generations beginning in 1950 at this location. Volunteer seedlings were noted spreading into scattered areas.

***Cirsium coulteri* Harvey & A. Gray.** [Ed: *Cirsium occidentale* (Nutt.) Jeps. var. *occidentale*. TJM2] – Two collections sown directly into place failed to become well established over a period of three years, but have not been totally lost to our growing collections.

***Cirsium drummondii* Torr. & A. Gray.** [Ed: *Cirsium scariosum* Nutt. TJM2] – Two collections of this high altitude species were attempted, one from seed and the other by small bare-root seedlings. The latter were brought along successfully in the nursery. Neither collection continued for more than a few months after being set out in the garden.

***Cirsium fontinale* (Greene) Jepson.** – Six seedlings were raised in the nursery but did not appreciate our wet spot location in heavy soils where it was indicated they should do well.

***Cirsium hydrophilum* (Greene) Jepson.** – One number of this brackish water species was sown in the nursery and 14 seedlings were raised. These were placed near the edge of a wet stream bank. They gradually succumbed and were gone within a year.

***Cirsium mohavense* (Greene) Petr.** – Two generations of this inhabitant of moist alkaline places of the Mojave Desert grew poorly until they were all gone within two years.

***Cirsium neomexicanum* A. Gray.** – One collection from the eastern Mojave Desert failed to establish in rocky sandy soil of our desert garden.

***Cirsium occidentale* (Nutt.) Jepson.** – The most successful of the thistles, this fine species has been grown for many years, volunteers repeatedly spreading over large areas but never in overwhelming quantities.

***Cirsium pastoris* J.T. Howell.** [Ed: *Cirsium occidentale* (Nutt.) Jeps. var. *candidissimum* (Greene) J.F. Macbr. TJM2] – Equally as successful as the immediate above in all respects.

***Cirsium proteanum* J.T. Howell.** [Ed: *Cirsium occidentale* (Nutt.) Jeps. var. *venustum* (Greene) Jeps. TJM2] – Two collections of seed, but neither continued for more than a year, principally due to excessive infestations of aphids.

***Cirsium quercetorum* (A. Gray) Jepson.** – While the seeds germinated well, the seedlings were thought to have succumbed from conditions that were too dry.

***Cirsium rhotophilum* S.F. Blake.** – Five numbers of this coastal dune species were raised quite successfully through seedlings stages; either in the nursery or when sown directly in open ground. However, the resulting mature plants did not appreciate our “sand dunes” and therefore beyond two to three years, when some flowered, and the produced seed, this rare endemic failed to respond. A most handsome plant in the young plant stage.

***Clarkia* Pursh.**

Farewell-To-Spring. Summer's Darling.

Annuals.

Onagraceae. Evening-Primrose Family.

Natural Range: About 33 species and numerous subspecies are found in temperate western North America and Chile. California has 31 species and several subspecies widely distributed in coastal, foothill, and mountain habitats, mostly in open woods, grassy slopes, and coastal bluffs and plains, usually below 7,000 feet. Dry, well-drained soils are the typical growing conditions, but not always. Depending on locality and species, flowering occurs between March and August, but is usually from April to June.

Propagation: Untreated seed when broadcasted on site, will germinate in one to two weeks provided the soil is kept properly moist until germination, otherwise, it will take longer. Seeds may also be sown in flats, when even faster germination will occur, and the resulting seedlings raised in small containers until ready to set out in the garden. The latter method may be safer because birds and rodents raise havoc with the young seedlings until they grow to a somewhat mature size. There have been no problems encountered in raising the young seedlings either way, provided proper caution is exercised against damp-off fungus and other extraneous dangers.

Culture: One course that should be pursued in the culture of *Clarkia*, which includes that group long known in horticulture as the godetias, is that the soil should be well-drained, on the sandy side, if possible, and as plants attain maturity, watering should be carefully controlled. Except for occasional attack by certain beetles, our one cause for failure was rotting at the crown of the plant about the time of flower initiation. This crown rot problem was particularly prevalent among the selected horticultural varieties, which we tested on several occasions. The soil should also not be too rich as huge plants will develop all out proportion and some of the daintiness and splendor of this choice plant is lost. Plants observed to be single stemmed and only a few inches tall in the wild may grow under cultivation to five feet tall and produce numerous branches,

thereby making a rather coarse looking planting instead of what might truly be expected under more sterile and controlled conditions.

The following kinds have been raised successfully for many years: *C. amoena* (Lehm.) A. Nelson & J.F. Macbr. ssp. *huntiana* (Jeps.) H. Lewis & M. Lewis., *C. amoena* (Lehm.) A. Nelson & J.F. Macbr. ssp. *whitneyi* (A. Gray) H. Lewis & M. Lewis. (several strains), *C. biloba* (Durand) A. Nelson & J.F. Macbr. (needs well-drained, semi-sterile site), *C. biloba* (Durand) A. Nelson & J.F. Macbr. ssp. *brandegeae* (Jeps.) H. Lewis & M. Lewis., *C. bottae* (Spach) H. Lewis & M. Lewis., *C. concinna* (Fisch. & C.A. Mey.) Greene., *C. cylindrica* (Jeps.) H. Lewis & M. Lewis. (raised abundantly and easily at old site, but poorly here and nearly gone after 30 years; one strain completely lost), *C. davyi* (Jeps.) H. Lewis & M. Lewis., *C. deflexa* (Jeps.) H. Lewis & M. Lewis. [Ed: *Clarkia bottae* (Spach) H. Lewis & M. Lewis. TJM1], *C. delicata* (Abrams) A. Nelson & J.F. Macbr., *C. dudleyana* (Abrams) J.F. Macbr. (another that has not been happy at this location, gradually deteriorating through the years), *C. pulchella* Pursh. [Ed: this species is not native to California.] (one collection failed to germinate), *C. purpurea* (Curtis) A. Nelson & J.F. Macbr. ssp. *quadrivulnera* (Lindl.) H. Lewis & M. Lewis., *C. rhomboidea* Douglas., *C. rubicunda* (Lindl.) H. Lewis & M. Lewis ssp. *rubicunda*., *C. speciosa* H. Lewis & M. Lewis ssp. *speciosa*., *C. speciosa* H. Lewis & M. Lewis ssp. *immaculata* H. Lewis & M. Lewis., *C. unguiculata* Lindl., *C. williamsonii* (Durand & Hilg.) H. Lewis & M. Lewis., and *C. xantiana* A. Gray. (failed after one year).

Uses: The named horticultural strains are valuable as bedding plants, many of them extremely handsome and colorful. The wild seedlings can be used in wildflower mixtures or in some cases as bedding plants, producing quite a long flowering period.

Clematis L.

Virgins-Bower.

Woody Climbers.

Ranunculaceae. Buttercup Family.

Natural Range: *Clematis lasiantha* Nutt. and *Clematis ligusticifolia* Nutt. are quite widely distributed through California, however, *C. ligusticifolia* ranges as far east as the Rocky Mountains and northward to British Columbia (Canada), while *C. lasiantha* is confined to California and Baja California (Mexico). *Clematis pauciflora* Nutt. is found from Southern California to Baja California (Mexico). All are found below 7,000 feet and largely clamber over shrubs and into trees in canyons not far from water. Flowering from March to August.

Propagation: Usually by seed which needs no treatment, although there was some indication that better germination occurred after one to two months cold-stratification. Germination started from four to six weeks without cold-stratification. We encountered no problems in raising the young seedlings in the nursery.

Culture: No collections of *C. pauciflora* had been made during the past 15 years. The results with *C. lasiantha* and *C. ligusticifolia* indicated they did best when grown in heavier soils, perhaps where moisture could be better maintained than in the loose, gravelly soils. In the latter position our losses were heavy until a plant became well-established, after which it grew with abandon. Our best examples were specimens of *C. lasiantha* growing high into oak trees as

much as 30 to 50 feet blooming profusely and setting much seed. Planting of both species were established along fences, where they made colorful displays in spring and early summer.

Uses: California has few good looking vines and while our species of *Clematis* are attractive during the spring months and into seeding, they leave much to be desired in the way of a good looking all-year vine. Infusions of *C. ligusticifolia* are used by Indians to treat colds and sore throats and are said to have been used by the early settlers for the treatment of cuts and sores on horses.

***Cleome* L.**

Annuals.

Capparidaceae. Caper Family. [Ed: Cleomaceae. Spiderflower Family. TJM2]

Natural Range: In California eastern central borders to northeastern California with wider distribution into adjacent states for most species. Largely found in sandy flats below 6,500 feet in sagebrush scrub or pinyon-juniper woodlands. Flowering from May to August.

Propagation: Our seed was usually sown during November, December, or January directly into sandy dune type garden situations where the seedlings would emerge in varying periods from 18 to 55 days. Sown in nursery flats, germination will occur within 13 days. At no time over a period of six or more years did we get more than poor results, usually only a few seedlings appearing. Many of these would die in the course of maturing until only one or two plants were left.

Culture: As stated above, our results have been generally poor with the three species we have planted, namely, *Cleome lutea* Hook. [Ed: *Peritoma lutea* (Hook.) Raf. TJM2], *Cleome platycarpa* Torr. [Ed: *Peritoma platycarpa* (Torr.) H.H. Iltis. TJM2], and *Cleome sparsifolia* S. Watson [Ed: *Carsonia sparsifolia* (S. Watson) Greene. TJM2]. While upon a few occasions plants to two or three feet were raised, mostly the results were discouraging. However, we harvested seed and continued to have plants over a period of six to ten years.

Uses: While there are some fine horticultural strains of other species, our native plants would only be useful for botanic garden collections.

***Cleomella obtusifolia* Torr. & Frem.**

Stinkweed.

Annual.

Capparidaceae. Caper Family. [Ed: Cleomaceae. Spiderflower Family. TJM2]

Natural Range: Alkaline flats, below 4,000 feet; Inyo County to Colorado Desert; Arizona and Nevada. Flowering from April to October.

Propagation: When sown in open ground in sandy granitic soil or sandy loam, germination started in 52 and 56 days for two lots that have been sown. Better results were obtained in the sand dune area.

Culture: Two collections were handled, one in 1952 which did not persist for more than two years and the second in 1960 and 1961, the latter producing a few ounces of seed for future plantings.

Uses: Of interest only to botanic gardens.

***Clintonia andrewsiana* Torr.**

Perennial Herbs.

Liliaceae. Lily Family.

Natural Range: Monterey County to Del Norte County and southwestern Oregon, in shaded damp woods. Flowering from May to July.

Propagation: While it has been reported that no treatment of seed is necessary, we found four to five months cold-stratification is needed to obtain good germination. After the seedlings were pricked out, we had little luck in growing them on and they rotted before reaching any size for planting. One collection of *C. uniflora* (Schult. & Schult. f.) Kunth. failed to germinate.

Culture: No experience, except some rooted plants were brought in but failed to grow when planted out.

Uses: For naturalized wooded areas where cultural conditions are satisfactory.

***Cneoridium dumosum* (Torr. & A. Gray) Baill.**

Bushrue.

Shrub.

Rutaceae. Rue Family.

Natural Range: Frequently seen on the mesas and bluffs of Orange and San Diego counties to Baja California (Mexico), below 2,500 feet. Flowering from November to March.

Propagation: Seed was harvested in 1949 from plants started in 1929 at the old site, and was sown without treatment, except for one lot that was soaked for 24 hours in preheated water. For the several lots sown, germination occurred in 15 to 42 days. Since the results were quite satisfactory we have felt cold-stratification unnecessary, although it might improve germination. We have made no attempts from cuttings since the seedlings are usually true to type, there being nothing else with which to hybridize. Seedlings are easily raised in the nursery.

Culture: Used in a variety of locations and soil types, this hardy shrub performs well under most conditions. It grows as well inland as it does in its natural habitat near the coast, accepting tight clay soils and loose granitic loams. While an overabundance of water in poorly drained soils will kill it, the plant does accept normal amounts of moisture. Not a fast grower, plants 15-years-old attained heights of two to six feet and spread three to nine feet wide growing in loose rocky soils with a minimum of attention. Losses were few. Flowering and fruiting starts within two to three years after planting out.

Uses: This handsome, intricately branched, small-leaved evergreen shrub can be put to several landscape uses. It makes a fine clipped small hedge, a good foreground plant, and a good green covering for hillsides where little attention can be provided. The small, white flowers profusely cover the plant during the height of the blooming season and periodic blooms are seen throughout the year. The small berries are green to red and finally age to brown and are present for a long time. [Ed: Some people will develop contact dermatitis from touching or handling this plant.]

***Coleogyne ramosissima* Torr.**

Blackbush.

Shrub.

Rosaceae. Rose Family.

Natural Range: On dry slopes below 5,000 feet in the Mojave Desert, western Colorado Desert, and eastward to Arizona and Colorado. Flowering from April to June.

Propagation: Three wild collections of seed were sown in August, September, and October. All seed was untreated except for one lot which was cold-stratified, an unnecessary procedure. Seedlings emerged in 12 to 19 days, though mostly in 12 days. The cold-stratified lot took several months to germinate and only two seedlings emerged while very satisfactory germination occurred in all other lots. During the small pot stage, losses were minimal, however, care must be exercised during the gallon-can period as losses can be extreme if watering is not carefully controlled.

Culture: During the early stages of growth, losses usually run high, but as the plants settle in their mortality is small. Plantings six- to ten-years-old have plants 15 inches to three feet tall with spreads of 20 inches to seven feet. Flowering or fruiting were not observed during this period.

Uses: Browse plant and for botanic garden collections.

***Collinsia heterophylla* Graham.**

Chinese Houses.

Annual.

Scrophulariaceae. Figwort Family. [Ed: Plantaginaceae. Plantain Family. TJM2]

Natural Range: Commonly found in shaded places throughout most of cismontane California below 2,500 feet and south into Baja California (Mexico). Flowers from March to June.

Propagation: Sown in the open ground, untreated seed will produce seedlings within 12 to 30 days, depending on the site and amount of available moisture. Sown in flats, seedlings emerged in 12 days. Once established, this species will volunteer readily and gradually spreads into other areas.

Culture: While accepting a moderate amount of sunlight, the species does best under high shade where filtered sunlight can reach the plants. We have successfully grown this plant for many years, and always have good results. While attacked by slugs and birds, our plantings were never severely damaged when proper preventatives were applied. *C. childii* A. Gray. was successfully raised for several season but gradually disappeared when additional seed was not harvested.

Uses: Wildflower mixtures, and as an interesting annual for any semishaded garden. The long flowering period adds a bright spot to the garden.

Note: for above. *C. parviflora* Lindl. was successfully raised but not continued.

Selected color strains were separated for *C. heterophylla* - brighter red lips.

***Collomia grandiflora* Lindl.**

Annual.

Phlox Family.

Natural Range: Dry open and wooded slopes, below 8,000 feet, in many plant communities throughout California, to British Columbia (Canada), and the Rocky Mountains. Flowering from April to July.

Propagation: Untreated seed germinates readily within one to three weeks when broadcast into open ground. Also handled easily when sown in flats and transplanted to containers or open ground.

Culture: We first began raising this attractive annual in 1933 from a collection made in Fresno County. This same collection has been grown for many generations and always with success. However, it appears to be less vigorous in our present location than at the old site, even though we have had splendid stands each year.

Uses: A fine addition to any wildflower mixture and a suitable annual for the garden. The apricot colored flowers are different from the ordinary runs of red and yellows.

***Comarostaphylis diversifolia* (Parry) Greene.**

Summer-Holly.

Shrub.

Ericaceae. Heath Family.

Natural Range: Dry slopes, low elevations, among the chaparral of San Diego County and Baja California (Mexico). The **ssp. *planifolia* (Jeps.) G.D. Wallace.** is found in similar situations but in the Santa Monica Mountains, Santa Inez Mountains, and on Santa Rosa, Santa Cruz and Santa Catalina islands. Flowering from March to June.

Propagation: Untreated seed sown from September to November will produce excellent germination in 32 to 55 days, mostly in 36 days. Seed cold-stratified for three to four months will emerge in four days or will have already started germinating upon removal. Hot water treated seed will come up in 41 days. Since more seedlings were always obtained with untreated seed, it would appear special seed treatments are unnecessary. While occasionally there were more than normal losses during the shifting and growth period in the nursery, our results were usually satisfactory. Plants up to 18 inches tall would be grown in a nine to 11 month period. Asexual production was not attempted simply because it was unnecessary but it is assumed cuttings could be rooted. Balled plants were moved from the old site with excellent results.

Culture: Both the species and the variety have behaved equally well in either tight clay soil or loose rocky granitic loams, in full sun or semishaded positions. While both the species and the variety are coastal or insular plants, their growth this far inland has been quite normal, and with no high percentages of losses. Since only one collection of the species has been made (in 1963), nearly all of our experience has been with the **ssp. *planifolia***. Fine specimens to ten feet tall and spreads of 11 feet wide have developed during the past 15 years. One plant has grown into a splendid small tree. While full sun appears to cause no problems, a better and deeper green develops in the foliage of those specimens grown under semishaded conditions. Flowering and seeding have been recorded from the fifth and sixth years. Half shade, some moisture, and good drainage are best, but not altogether necessary.

Uses: Handsome evergreen specimen and group plantings for large shrub borders. Plants develop slowly and are taller than wide under most conditions. This plant is a good substitute for *Arbutus unedo* L., which it somewhat resembles. Masses of small white urn-shaped flowers are produced in March to May or June with brick red warty fruits similar to madroño [Ed: but are much smaller and are produced in racemes] appearing in late summer, hence the common name: Summer-Holly.

***Condalia lycioides* (A. Gray) Weberb. var. *canescens* (A. Gray) Trel.** [Ed: *Ziziphus obtusifolia* (Torr. & A. Gray) A. Gray var. *canescens* (A. Gray) M.C. Johnst. TJM2]

Shrub.

Rhamnaceae. Buckthorn Family.

Natural Range: Creosote bush scrub, in sandy places below 1,500 feet in the Colorado Desert; to Nevada, Arizona, and south to Sonora and Baja California (Mexico).

Propagation: For seeds harvested from our collection growing at the old site: Untreated seed usually sown in October germinates in 11 to 18 days. After nine years in storage, seeds still germinate fairly well. Cold-stratification was used for one lot and appeared to help, but later sowings indicated that cold-stratification is unnecessary. Seedlings grow slowly, and after shifting to gallon-cans more care must be exercised in growing them through the summer months. Losses may range to 25% or more during this stage. The species, ***C. parryi* (Torr.) Weberb.** [Ed: *Ziziphus parryi* Torr. TJM2], acted in much the same manner.

Culture: Enjoyed by rabbits, our first planting was completely destroyed in early 1952. Thereafter all plantings were caged until they grew to sufficient height and strength to withstand such attention. Even then, there was always some nibbling as indicated by a 15-year old plant that had not grown more than one inch tall, whereas most of the others grew up to five feet tall and had spread up to six feet wide. Grown in a very rocky, decomposed granite loam, their growth has been generally slow. Flowering was noted within five years but fruiting did not occur until the eighth year, and then only on one plant. ***C. parryi*** was gathered in the wild in 1955, in pinyon-juniper woodland. Situated in a rocky, decomposed granite loam in full sun, the original plants suffered from a root rot fungus and heavy losses resulted. However, additional plantings put in later, came along very well and in ten years plants had grown up to six feet tall and spread up to seven feet wide. Flowering and fruiting had not been recorded during that time.

***Coreopsis* L.** [Ed: *Leptosyne* DC. TJM2]

Annuals.

Asteraceae. Sunflower Family.

Note: The perennial, ***C. maritima* (Nutt.) Hook. f.** [Ed: *Leptosyne maritima* (Nutt.) A. Gray. TJM2], and shrub, ***C. gigantea* (Kellogg) Hall.** [Ed: *Leptosyne gigantea* Kellogg. TJM2], are treated separately.

Natural Range: The annual coreopsis are found widely distributed in a variety of habitats, ranging from sandy desert flats to rocky, clay hillsides and valleys, usually below 2,000 feet and ranging over most of California, and flowering in early spring.

Propagation: Generally sown directly on site, where germination occurred under best conditions in one to two weeks, depending on the constancy of moisture. Seedlings must be protected against birds and rodents. Transplanting from flats is equally successful with germination perhaps somewhat quicker.

Culture: During the past fifteen years, we continued to raise a strain of *C. bigelovii* (A. Gray) Hall. [Ed: *Leptosyne bigelovii* (A. Gray) A. Gray. TJM2], first acquired in 1935, as well as several other collections obtained later. *C. californica* (Nutt.) H.K. Sharsm. [Ed: *Leptosyne californica* Nutt. TJM2], *C. calliopsidea* (DC.) A. Gray. [Ed: *Leptosyne calliopsidea* (DC.) A. Gray. TJM2], and *C. douglasii* (DC.) Hall. [Ed: *Leptosyne douglasii* DC. TJM2] were all acquired at various times during the past 15 years. All have been raised more or less successfully, however, we had a constant battle with birds and rodents. One serious condition was the attacks at the crown by a larvae determined to be *Agromyza seniventris* Fallen. Pathogenic organisms would then gain entrance from the larvae injuries, and the host, in most cases, would die from rot from these secondary invasions. The first indication of trouble appears when sudden wilting occurs just as the plant is ready to flower. Recommended control is to apply DDT to the plants and soils about two to three weeks prior to flowering.

Uses: A gay addition to the drier garden and for inclusion with wildflower mixtures.

***Coreopsis gigantea* (Kellogg) Hall.** [Ed: *Leptosyne gigantea* Kellogg. TJM2]

Tree Coreopsis.

Shrub.

Asteraceae. Sunflower Family.

Natural Range: Along the immediate coast from San Luis Obispo County to Los Angeles County, most of the Channel Islands; to Guadalupe Island, Baja California (Mexico). Flowering from March to May.

Propagation: Untreated seed may be sown in flats or open ground. In flats, seedlings emerge in four to six days, while those sown directly into the open ground in the garden will begin germinating in eight to 15 days. We practiced both methods, depending on what usage we needed the plants, particularly if we wished to develop a larger plant before planting it in the garden. When the plants are grown in the nursery, there is no problem during the early shifts but after reaching gallon-can size, there is great danger from root rot and we never did quite find the right combination of moisture and dryness. This plant goes completely dormant during the dry, summer season and since it is unnatural for these plants to be growing during that period, there may be considerable problems in keeping container grown plants through the summer. [Ed: In the summer, it is best not to water them at all, and to grow them in partial shade in hot inland gardens. Note that they may be grown in full sun along the coast.]

Culture: Our first plantings were dug out of the old site and transplanted here in November 1951, where they were situated on a rocky clay-loam soil south-facing slope. There was a gradual diminution of numbers until all were gone six years later. However, experimental plantings were made in a number of locations. Some attained heights of six feet or more and did splendidly for a while. The problem of root rot plagued us and only in one area were we quite successful. Numerous volunteer seedlings appeared and a natural colony of twisted plants, a growth habit that is natural, continued to prosper. Growth is always rapid, plants attaining six or more feet in

two or three years, after which they began to sprawl and twist in all manner of shapes. Flowers the first year, usually from March to May.

Uses: Best along the coast, but an interesting and colorful plant to raise.

***Coreopsis maritima* (Nutt.) Hook. f.** [Ed: *Leptosyne maritima* (Nutt.) A. Gray. TJM2]

Sea-Dahlia.

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Coastal bluffs and dunes, southern San Diego County to northern Baja California (Mexico), and adjacent islands. Flowering from March to May.

Propagation: Sown in the fall months, into the open ground, seedlings will emerge in two to three weeks, however, speedier results occur when sown in flats, taking not more than five or six days. Transplanting is easy and young plants ready to be planted out may be grown in three to four months. When sown in the open, seedlings need to be thoroughly protected against birds and rodents or the planting will soon be destroyed.

Culture: This species never has done as well in our present site as at the old garden. There it thrived in the heavy clay, producing excellent plants and fine flowering. Here it has languished and never seemed completely at ease. While plants existed, they never grew with the abandon we were accustomed to at the old site. A fine cut flower, with two- to three-foot stems and bright yellow flower heads two to three inches across, it could make a fine garden subject under the right conditions. Bright green fern-like foliage.

Uses: Naturalized areas and as a good cut flower.

***Corethrogyne* DC.**

Perennials.

Asteraceae. Sunflower Family.

Natural Range: Depending on species and variety, plants of this genus may be noted scattered in a variety of habitats but most generally on the coastal slope of California and adjacent Channel Islands, usually below 3,500 feet. Flowering prolonged.

Propagation: Untreated seed will emerge in four to eight days. Difficult to raise plants through gallon-can period, but no trouble during smaller size containers. Best to plant out when younger and not hold through summer months.

Culture: While generally the individual plants were not long lived in our area, volunteer plants arose in such quantities that there was no problem in maintaining the planting - particularly in rocky, open soil under dried conditions. The following species and varieties were raised: ***C. californica* DC.** [Ed: *C. filaginifolia* (Hook. & Arn.) Nutt. TJM2], ***C. filaginifolia* (Hook. & Arn.) Nutt.**, ***C. f. var. linifolia* Hall.** [Ed: *C. filaginifolia* (Hook. & Arn.) Nutt. TJM2], ***C. f. var. sessilis* (Greene) Canby.** [Ed: *C. filaginifolia* (Hook. & Arn.) Nutt. TJM2], ***C. f. var. virgata* (Benth.) A. Gray.** [Ed: *C. filaginifolia* (Hook. & Arn.) Nutt. TJM2], ***C. f. var. viscidula* (Greene) Keck.** [Ed: *C. filaginifolia* (Hook. & Arn.) Nutt. TJM2], and ***C. leucophylla* Jeps.** [Ed: *C. filaginifolia* (Hook. & Arn.) Nutt. TJM2].

Uses: Of no particular horticultural interest except for botanic garden collections.

***Cornus glabrata* Benth.**

Brown Dogwood.

Shrub.

Cornaceae. Dogwood Family.

Natural Range: Uncommon in Southern California, this plant ranges through varied habitats, in moist places below 1,500 feet in cismontane California to Oregon.

Propagation: Freshly harvested seed may need no pretreatment, but seed one year or more in age needs two to three months cold-stratification. A four-hour bath in sulfuric acid may assist germination. Our one seed collection was sown one year after harvesting, and was cold-stratified for two months. Germination started 36 days after the seeds were removed from the cold, but then the seeds were given an additional month of cold-stratification. Even then the results were poor. Root suckers are started easily and are a satisfactory propagation method. There is no problem in raising the seedlings in the nursery.

Culture: Our original material came from root suckers taken from the large plantings at the old site. These immediately began spreading in a moist stream bed and after a few years, because of the extremely aggressive habit, the planting was removed. Seedlings were later established in shallow ditch in full sun with very rocky granitic loam. This area was well supplied with water and after ten years, the planting had converged and fine plants six to ten feet tall and spreading 11 to 16 feet wide were recorded. Flowering started in the sixth year was followed by fruiting.

Uses: Erosion control in moist areas; shelter belt; bird food; some ornamental value in the proper location.

***Cornus nuttallii* Audubon.**

Mountain Dogwood.

Shrub or Tree.

Cornaceae. Dogwood Family.

Natural Range: Open wooded areas below 6,000 feet; uncommon in mountains of San Diego County to Los Angeles County, more common in Coast Ranges from Monterey County northward and from the Sierra Nevada north and east to Idaho and British Columbia (Canada). Flowering from April to July.

Propagation: Due to embryo dormancy and a hard pericarp, the seed needs to have three to four months cold-stratification. Prior to cold-stratification, soaking for 24 hours in hot water or for about four hours in sulfuric acid will be helpful. Fresh seed can be sown without treatment and after two months, if no seedlings appear, then cold-stratification is necessary. We raised numerous collections and the best results were from fresh seed put in a jar in the refrigerator and kept there until the seeds began to germinate in three months after which the seed was sown in a flat. Several lots of the cultivar '**Eddiei**' received from other institutions failed to germinate except for one, which produced only a few seedlings. Our chief losses occurred during the growing on period in gallon-cans during the summer months. Root rot was the chief trouble. However, we raised many plants for the garden, even though difficult in this area.

Culture: While we did not have the best sites for this species, we managed to try the plants in a variety of situations. However, none thrived to any degree or for any length of time. However, in each lot, there were always a few plants that could withstand our conditions and survived, developing into plants four to eight feet tall and spreading to six feet wide in ten years.

Flowering occurred sporadically, but the finest display was from a plant that burst into profuse bloom in September after a particularly hot spell of weather when the plant was subject to a high degree of stress. No viable seed has been noted on any surviving plants. The cultivar 'Eddiei' died out in a year and specimen of *C. nuttallii* 'Pilgrim', grafted onto *C. capitata* rootstock, bloomed the first year but failed to survive through winter dormancy.

Uses: A handsome plant for many horticultural uses in suitable locations.

***Cornus occidentalis* (Torr. & A. Gray) Cov.** [Ed: *Cornus sericea* L. ssp. *occidentalis* (Torr. & A. Gray) Fosberg. TJM2]

Shrub.

Natural Range: Moist places, below 8,000 feet; many plant communities in cismontane California from San Diego County north to British Columbia (Canada). Flowering from May to July.

Propagation: Same methods as for *C. nuttallii*, however, usually with poorer results. Hot water treatment for 24 hours produced equally as well as cold-stratification.

Culture: Needs moisture and plenty of space where it can spread out. An established plant at the old site was moved successfully and planted in an open flat in full sun and well-drained soil. This plant, now 25-years-old, has attained a size of ten feet tall and 15 feet wide, and while there has been some deterioration in its condition for the past five years it continues to persist and is in generally good condition. Other later plantings of seedlings were used in several spots but only on the slope of the mesa in clay soil and in shade have they lived. Those used in open flat sunny locations died within a few years, even when supplied with sufficient moisture.

Uses: Wildlife food and cover; large spreading plant for suitable park-like situations.

***Cornus sessilis* Torr.**

Shrub or Small tree.

Natural Range: Northern California mountains along banks of streams at elevations from 500 to 5,000 feet.

Propagation: No experience with seeds but we assume their requirements are the same as for other native dogwoods. Tip cuttings rooted 100% when treated with Rootone and kept under mist. However, probably due to heavy salt encrustation on leaves, they all died after potting.

Culture: Our only experience is with 18 plants moved from the old site. Four survived the move and lived for nearly ten years. One plant, in our records for 25 years, has attained a size of three-and-half feet tall and spread to six-and-half feet wide and is in good condition growing in an open site now provided with a little shade by adjacent trees.

Uses: Much as for other dogwoods.

***Cornus stolonifera* Michx.** [Ed: *Cornus sericea* L. ssp. *sericea*. TJM2]

American Dogwood.

Shrub.

Natural Range: Montane coniferous forests, in moist places below 9,000 feet, mountains of northern California, and widespread to Alaska, New York, Newfoundland (Canada), and Mexico. Flowering from May to July.

Propagation: As for the other dogwoods. Cold-stratification for two to four months.

Culture: With the exception of *C. glabrata*, this is the most successful species of *Cornus* in the garden. Plants spread widely in moist soils on the mesa, and in all garden areas where they are given sufficient irrigation is supplied. In ten years, fine specimens have grown to ten feet tall and have spread from 12 to 15 feet wide. Flowering and seeding noted from the fourth year.

Uses: Wildlife food; landscape plantings, etc.

***Corylus cornuta* Marshall ssp. *californica* (A. DC.) E. Murray.**

Hazelnut.

Shrub.

Betulaceae. Birch Family.

Natural Range: Damp or dry forested slopes and banks below 7,000 feet from central northern California north to British Columbia (Canada). Flowering from January to April.

Propagation: Seed appears to have a dormant embryo and will take several months to germinate regardless of whether pretreatment of seed by cold-stratification is practiced. Three to four months cold-stratification is recommended, but even then complete germination will be sporadic over a period of several months. We tried several methods and always with the same results. Since we lost about 50% of the seedlings in containers before planting, we later sowed the seed in a deep seed bed in the lath house and let the seed germinate at will. After growing in place for a year, or when the plants had grown sufficiently large, we planted them out bare-root when dormant. Satisfactory results were obtained by this method.

Culture: Several plants were moved from the old site and established in the clay soil of the mesa, either on the flat or slopes. Fine specimens eight feet tall and ten feet wide developed and in their tenth year produced a good crop of nuts. Later plantings, of which there were several, were located in the plant community section, in full sun in rocky decomposed granite loan. Of slower growth, they became quite well established without excessive losses. Seeding was noted on these plantings in their ninth year when the plants measured up to eight feet tall and eight feet wide. One planting growing in an area known to be infected with oak root fungus (*Armillaria mellea*) succumbed in its tenth year.

Uses: Wildlife food and human food, basket splints, medicinal, and recommend as an erosion control plant.

***Cowania mexicana* D. Don var. *stansburiana* (Torr.) Jeps. [Ed: *Purshia stansburyana* (Torr.) Henrickson. TJM2]**

Cliffrose.

Shrub.

Rosaceae. Rose Family.

Natural Range: Dry, exposed, rocky situations, such as mesas and canyons in the mountains of the eastern Mojave Desert and White Mountains to southern Utah and Colorado, and to northern Mexico; from 4,000 to 8,000 feet elevation. Flowering from April to July.

Propagation: From several wild collections, we obtained satisfactory results in ten to 21 days after sowing during the fall months in flats. No pretreatment of seed seems necessary, since we consistently got the same results. Numerous attempts were made to root cuttings, but all were failures. Seedlings were grown easily in containers with only minor losses. Suitable sized plants were produced in six to eight months.

Culture: Our results growing this handsome plant have been excellent, doing especially well in the well-drained rocky, decomposed granite loams and kept on the dry side. One planting, used in the tight clay soil of the mesa, never seemed quite satisfactory, flowering sporadically, but never profusely, until a slow deterioration of plants began and they were removed. One plant, presented to us, and used in our desert garden, developed into a beautiful specimen, flowering much more profusely than any other plants of the species, but never producing seed. All of our other plantings began producing flowers and seeds from in their third year. Specimens from one to six feet tall and one to 12 feet wide were grown in ten years.

Uses: Because of conspicuous white, fragrant flowers borne in profusion, feathery seeds, and aromatic foliage, it is a handsome ornamental for dry situations. It is also a fine browse plant.

***Crataegus douglasii* Lindl.**

Western Black Haw.

Shrub or Tree.

Rosaceae. Rose Family.

Natural Range: Near streams and meadows at elevations of 2,500 to 5,500 feet, in the mountains of northern California to British Columbia (Canada) and Michigan. Flowering from May to June.

Propagation: Germination results have been contradictory. Several methods, such as sulfuric acid, hot water, cold-stratification and non-treatment, have been used. Complete failure was recorded for the first two methods. Cold-stratification produced sufficient seedlings, but not good results, in three to five months, with the seedlings often having started to emerge before removal from refrigeration. One collection of garden harvested seed was sown and put in cold-stratification the same day. Five months later, when seedlings appeared while still in the refrigeration, the flat was removed and over 100 were noted from one-eighth ounce of seed. A year later, in July, one-half ounce was sown directly into gallon-cans without any pretreatment. Seedlings began emerging in 20 days and nearly 100% had come up in the following month. Garden harvested seed, sown at the old site, came up in ten days without pretreatment. It appears seed from wild collections may need cold-stratification while that from cultivated plants do not. Subsequent culture in the nursery raised no problems as this plant accepts general procedures very well. One lot was completely lost in gallon-cans when excessively hot weather occurred and sulphur fumes from the soil mix killed the plants.

Culture: Since this plant grows naturally in areas with plenty of moisture, it follows that under cultivation such practice is necessary, even though it will do quite well in substandard moisture

areas. Where we used plants in such places, growth was excellent, though considerable protection was necessary to protect the young plants against rabbits for a few years. Mealy bug and scale had to be guarded against and sporadic attacks of fire blight were noted. Several plants from the old site were moved and established successfully. Plants to 14 feet tall and 11 feet wide were recorded in ten years. Fruit production was noted in the seventh year but may have been earlier.

Uses: Wildlife food plant, browse, and fruit. While well-grown plants are interesting, they cannot be considered highly ornamental.

***Crossosoma bigelovii* S. Watson.**

Shrub.

Crossosomataceae. Crossosoma Family.

Natural Range: Scattered in dry rocky canyons below 3,000 feet in the southern Mojave Desert, and western Colorado Desert, to Arizona, and Sonora and Baja California (Mexico). Flowering from February to April.

Propagation: Seedlings will emerge in ten to 15 days and present no problem until the critical stage in gallon-cans while in the nursery. Extreme care must be exercised in watering during summer months.

Culture: Used in the rockiest sites, this species became fairly well established even though losses were more than 50%. Once established, and not overgrown by other more vigorous plants, it can be expected to live a long time with no care.

Uses: Of interest only to botanic gardens.

***Crossosoma californicum* Nutt.**

Apple-Blossom-Bush.

Shrub.

Crossosomataceae. Crossosoma Family.

Natural Range: Endemic only to the brushy dry slopes and canyons of Santa Catalina and San Clemente islands and on the Palos Verdes Peninsula of Los Angeles County, and Guadalupe Island (Mexico). Flowering from February to May.

Propagation: On an average, untreated seed will germination in ten days. Excellent production, even from seed eight-years-old. As with so many dry land plants, particularly the summer aestivators, losses during the gallon-can stage were high and great care had to be exercised in summer watering. Excessive growth in some lots necessitated some pruning, which seemed to have an ill effect on the plants and appeared to cause a high mortality.

Culture: Unlike the ease with which this species was established and grown at the old site, we have had a difficult time getting plants established in the open, rocky decomposed granite loam. Less trouble has been experienced in the heavier clay soils. After a high percentage died within two to three years, the plants that became firmly rooted in have grown very well and need little attention. Specimens to eight-and-a-half feet tall and 11½ feet wide have developed in 15 years. Flower and seed production began in their third year in best positions.

Uses: While the profuse flowering of apple type blossoms and the soft blue-green foliage during fall and winter is most attractive, the long periods of brown dry foliage cancel it as a useful ornamental. However, in proper positions among native plants for slope coverage, it is excellent as it needs so little care.

***Cryptantha confertiflora* (Greene) Payson.**

Perennial.

Boraginaceae. Borage Family.

Natural Range: Usually in dry rocky places of limestone between 4,000 to 5,000 feet on the eastern slopes of the Sierra Nevada and eastward to the mountains of the Mojave Desert, to Utah and Arizona. Flowering from May to July.

Propagation: May be sown directly into site or in flats. Germinates in flats within ten days, taking a longer period of time when sown directly into site. Seedlings must be watched for damp-off, otherwise no problems were encountered when raising this species to planting size.

Culture: plants need an extremely dry situation, and well-drained soil. However, it has been short-lived for us, as it could well be in the wild. The annual *C. intermedia* (A. Gray) Greene. was raised successfully but not continued.

Uses: Only of interest to botanic gardens.

***Cucurbita foetidissima* Kunth.**

Calabazilla.

Perennial.

Cucurbitaceae. Gourd Family.

Natural Range: Widely distributed in cismontane California and as far east as Nebraska and Texas. Flowering from June to August

Propagation: Untreated seed readily germinates in ten days when sown in flats. The seeds could also be sown directly into the garden. Rotting does occur while raising seedlings in containers, particularly during the gallon-can period.

Culture: Once established, this species is hard to eradicate, gradually developing an enormous root. Hardy in most areas, the plants climb over any plant nearby or spread out over large areas in open spaces.

Uses: Except as food for certain wildlife, of little value.

***Cucurbita palmata* S. Watson.**

Coyote Melon.

Perennial.

Cucurbitaceae. Gourd Family.

Natural Range: Scattered in the deserts and interior portions of Southern California to Arizona and Baja California (Mexico), below 4,000 feet.

Propagation: Untreated seed sown in flats will germinate within ten days. However, seeds sown directly into garden sites, or directly into pots, will germinate more slowly. All these methods were used but in no case did we get excellent germination. Apparently much of the seed is not viable. Care must be exercised when raising the seedlings and young plants in containers in the nursery. We found that it is best to establish this species by directly sowing seeds into the garden.

Culture: Not grown as successfully, except for a few specimens that became well established. Some flowers, fruits, and volunteer seedlings were noted.

***XCupressocypris leylandii* (A.B. Jackson & Dallimore) Dallimore.**

Tree.

Cupressaceae. Cypress Family.

Natural Range: Intergeneric hybrid described as being a spontaneous cross between *Chamaecypris lawsoniana* and *Cupressus macrocarpa*. The history and propagation are described in **The Gardeners' Chronicle** [127(5697): 103. 1950.]. It is said that the cross occurred about 1888. Our two trees were received in October 1947 from The Institute of Forest Genetics in Placerville, California. These were grown from cuttings taken from the Institute's trees, which, in turn, were grown from cuttings taken from trees in Golden Gate Park, San Francisco, California These latter were said to have been asexually reproduced from the original tree in England.

Propagation: Cuttings or grafting, however, the first procedure is generally followed as the cuttings root easily. Our specimens, while producing cones, never had viable seed.

Culture: Our two specimens were 18 inches tall when planted in October, 1947 at the old site. By March, 1951, they had developed into trees eight to ten feet tall. They were balled but these broke and it was then noted the root system was very poor – there were very few roots and they had grown little. Planted immediately in the new site, in sun and tight clay soil of the mesa, the trees were cut back severely. One survived and eventually attained a height of 40 feet in its fifteenth year. Additional trees were grown from cuttings and these rapidly developed into fine, symmetrical specimens. As the specimens grew taller, the branching became very floppy and unsightly. Having a very poor, near-the-surface root system, their heavy bulk made them topple easily during any windstorm. Apparently these trees are susceptible to cypress canker, our trees became so unsightly we discarded them in 1967. Trees of this cross growing in Wisley Garden, in England, and as viewed by this author, in no way resembles the trees we grew. They had much the resemblance of *C. macrocarpa*, were quite wide spreading and very handsome trees. Ours were tall, tightly columnar type trees, very handsome in young stage but gradually becoming quite unsightly as they became older.

***Cupressus* L.** [Ed: *Hesperocypris* Bartel & R.A. Price. TJM2]

Cypress.

Trees.

Cupressaceae. Cypress Family.

Natural Range: The ten species and one subspecies of California cypresses are scattered widely over most of the state. At elevations from ten to 5,000 feet, they usually occupy very dry, rocky slopes, canyons or headlands in the chaparral, foothill woodland, yellow pine forest and closed-cone pine forest plant communities.

Note: Our scientific publication, **Aliso** [1. 1948.], is devoted to a botanical, horticultural and disease treatise of the North American species of cypresses. Additional information has been published by this garden (Everett, 1957. Pgs: 87-89). This present work will summarize and consolidate such information as has been obtained at our Claremont site.

Propagation: While cypresses can be easily rooted and perhaps less readily grafted, our practice has been production from seed. Recommendations have been to sow seed in the fall, allowing one to two months for start of germination and sporadic emergence of seedlings over a period of several months. While some of our lots were handled in this manner, we found two months cold-stratification helpful in getting a greater quantity of seedlings. Further, seed could be sown as late as January or February and still get good results. In nearly all lots, seedlings emerged in five to ten days after removal from cold-stratification. Untreated seed, if sown from September to November may start germination in three weeks to two months, however, seedling emergence is usually very sporadic. If all seed has not germinated by June, watering should be withheld until the following September. No extensive production of the various species was undertaken since we could only handle a few trees of each kind. As we had no experience in transplanting bare-root seedlings for this group, we grew our specimens in cans and planted them out as soon as possible - not over four to six months from seedling stage. At no time did we have any trouble in our nursery procedures with all the species.

The seeds of the California native cypresses have been widely distributed by this garden since our earliest days. Large distributions were made, in particular, to the forestry departments of South Africa, New Zealand, and Australia. Other specific distributions have been made to nearly every continent.

Culture: The California species of cypresses appear to need sterile and dry conditions to be at their best and to be able to survive for any degree of longevity. Naturally growing under such conditions, their very efficient root system produces too large a body, that easily becomes prey for diseases, if provided too rich cultural conditions. Unable to anchor themselves sufficiently, the trees are easily blown over during winter storms, and once the root system is broken, the specimens should be removed. Our methods were to establish them with the minimum of care, and once established leave them alone. As several of the species are highly susceptible to the cypress canker (*Seiridium cardinale*), we initially raised only the most resistant. As a test, we later acquired collections of two of the known susceptible species. Specific information about the species raised the past fifteen years follows.

Uses: Cypresses have been extensively planted in countries that lack forests. They have also been used commonly in horticulture, such as in parks, along avenues, as specimen plants, and as hedges and windbreaks. The Monterey cypress was the most commonly used species for windbreaks for citrus groves until the cypress canker became rampant. A stately tree, it is still used to some degree near the coast in California. The Tecate cypress has proved to be a good clipped hedge and has been used in such manner in California gardens.

Hybrids – Hybrid swarms have been reported wherever more than one species is grown, particularly under cultivation. However, Wolf found no evidence of hybridization among the

wild native stands. As noted above, intergeneric hybrids, too, have been described. In 1953, we received seed from the New Zealand Forest Service through the University of Washington Arboretum. The presumed cross was *Cupressus macrocarpa* × *Chamaecyparis lawsoniana* × *C. macrocarpa*. The resulting eight seedlings were highly variable, following the pattern described in correspondence with the New Zealand Forest Service. Stunted, ill-formed types, normal growth and one specimen exceedingly reminiscent of *Chamaecyparis lawsoniana*. This latter tree alone survived and has developed into a handsome specimen at least forty feet tall. To date, it shows no ill habits or diseases. This deep green foliated plant with the flat sprays of the Lawson cypress (*Chamaecyparis lawsoniana*) is outstanding and if no ill habits become evident it should be a handsome tree for introduction to horticulture. No cones have been produced in the 14 years that we have grown it. Mr. M. H. Bannister, the New Zealand Forest Service botanist does not agree that one of the parents is *Chamaecyparis lawsoniana* suggesting that perhaps *Cupressus lusitanica* Mill. is the other parent. Much research needs to be accomplished to provide clear answers.

Additional collections of presumed hybrids were received from the New Zealand Forest Service. While variation was evident, it never approached the degree of the lot described above. Further, none of these subsequent specimens resembled the very distinctive Lawson cypress type.

***Cupressus bakeri* Jeps.** [Ed: *Hesperocyparis bakeri* (Jeps.) Bartel. TJM2]

Modoc Cypress.

Planted in 1960, this inhabitant of the volcanic areas of Shasta, Plumas and Siskiyou counties has grown well for us in rocky, decomposed granite loam. Seven-year-old trees vary in height from two to 12 feet and spread from one-and-a-half to eight feet wide. No production of cones to date and only minor losses have occurred, principally from rabbit damage in the young stage.

***Cupressus bakeri* Jeps. ssp. *matthewsii* C. B. Wolf.** [Ed: the ssp. is not recognized in TJM2]

Siskiyou Cypress.

Established in 1955, our plantings grew exceedingly well for ten years, having attained heights of 12 to 24 feet and spread from seven to ten feet wide. Staminate cones were recorded from the fifth year but female cones were never produced. While continuing to grow well after the tenth year, several trees became infected with the cypress canker (*Seiridium cardinale*) and eventually had to be removed. To help control this fungus, yearly spraying with Bordeaux mixture (a copper sulphate base spray) was started. While this practice did not completely stop the disease, it did help to control this disease and fewer trees died. This species and subspecies had not been observed to be very susceptible to this fungus in past plantings at the old site. There, handsome specimens developed over a period of years. This species and subspecies appear to require more irrigation for best development. In 1957, we received a report that two to three foot specimens of this subspecies had withstood temperatures down to 23° F below zero and were doing fine, in Rochester, New York.

***Cupressus forbesii* Jeps.** [Ed: *Hesperocyparis forbesii* (Jeps.) Bartel. TJM2]

Tecate Cypress.

Our first collection was grown from seed harvested at the old site from trees over 20-years-old that had been free from cypress canker infection. Our Claremont plantings, first planted in 1951,

grew less favorably. They were easily blown over by winds and were attacked by the cypress canker. Our plants quickly developed large top growth and had an inadequate root system to support the heavy top growth such that the plants were easy prey to even moderate winds during wet weather. One tree was lost to oak root fungus (*Armillaria mellea*). A few specimens became infected with cypress canker and had to be removed. Later, a yearly spraying with Bordeaux mixture seemed to help control this fungus, but not entirely. A second planting, grown from wild harvested seed, and set out in 1959, fared much better and at the end of eight years, no losses had been recorded from any cause. Specimens measured up to 20 feet tall and with spreads up to ten feet wide. No cones had been produced on this latter collection but first cones had been recorded on the earlier group during their eighth year. Seeds of this species have been widely distributed, particularly to the forestry departments of South Africa, Australia, and New Zealand. An interesting comment received in 1953 from the Australian Forestry Department stated that this species was becoming increasingly popular because of its excellent appearance and rate of growth. In trial plots, it had accepted various soil types and is one of the few species that will thrive on their heavy black basaltic clay-loams of the Darling Downs. This species is also useful as a fine hedge plant.

***Cupressus macnabiana* Murr.** [Ed: *Hesperocyparis macnabiana* (A. Murray bis) Bartel. TJM2]
McNab Cypress.

One of the hardiest species, several small collections have been established between 1954 and 1964. All have grown exceedingly well, without any losses recorded. Ten-year-old specimens measured from six to 20 feet tall and spread from six to 14 feet wide. Cones were first recorded during their sixth year of growth and on nearly all trees by the seventh year. To date, this species seem to be immune to cypress canker as no infections have been observed.

***Cupressus macrocarpa* Hartw.** [Ed: *Hesperocyparis macrocarpa* (Hartw.) Bartel. TJM2]
Monterey Cypress.

This species is highly susceptible to the cypress canker and therefore no collections were made of it. However, three plants growing at the old site and produced asexually and thought to be cypress canker resistant by Dr. W. W. Wagener and who studied the cypress canker extensively, were moved and established at this site. All plants grew rapidly, attaining heights of 30 to 37 feet in 15 years. After the tenth year, one tree became infected with cypress canker and later all died. Subsequent studies seem to indicate that these trees were actually Italian Cypress, *Cupressus sempervirens* L.

***Cupressus nevadensis* Abrams.** [Ed: *Hesperocyparis nevadensis* (Abrams) Bartel. TJM2]
Piute Cypress.

Seedlings from a wild collection gathered in 1956 were planted in November 1956, as six inch plants. In ten years, they were 12 to 25 feet tall and five to ten feet wide. A handsome gray cypress, this species has not shown any effects of cypress canker, our only losses (six trees) were the result of high winds. No cones have been produced during this period.

***Cupressus pygmaea* (Lemmon) Sarg.** [Ed: *Hesperocyparis pygmaea* (Lemmon) Bartel. TJM2]
Mendocino Cypress.

While known to be highly susceptible to cypress canker, test plantings were made to record the species behavior in this area. Seed produced plants from a wild stand in Mendocino County were planted in October 1960, as specimens six to 15 inches tall. In seven years they had reached 17 to 23 feet tall and spread from seven to eight feet wide. Over 50% loss was recorded from being blown over during windy rain storms. No cones had been produced during this period.

Stunted trees producing cones were transplanted from the "Pine Barrens" area in Mendocino County and were established in gallon-cans. These were presented to us in 1960. It was a long time before these trees began to make normal growth. And at that time, all of the cones were dropped from the original two-foot height of the trees. In seven years, the two remaining specimens had attained heights of 25 to 29 feet and spread from six to seven feet wide. During that period, one tree had blown over during a windy rainstorm. The remaining two were in good health and to date had not shown any indication of cypress canker.

***Cupressus sargentii* Jeps.** [Ed: *Hesperocyparis sargentii* (Jeps.) Bartel. TJM2]

Sargent Cypress.

Our initial collection was grown from seed harvested at the old site, and were planted in 1951 when they were from 12 to 18 inches tall. Growing in rocky decomposed granite loam, in 15 years they grew to ten to 30 feet tall and were ten to 12 feet wide. The first female cones were recorded in their eighth year of growth. A total of eight trees had been removed during the 15 years, principally from wind damage and runty specimens. A second collection from the wild that was planted in 1961 showed no losses in six years, and fine specimens were developing in a rocky, decomposed granite loam. They were recorded as being seven to 13 feet tall and from four to eight feet wide. There has been no evidence of female cones to date.

***Cupressus stephensonii* C.B. Wolf.** [Ed: *Hesperocyparis stephensonii* (C.B. Wolf) Bartel. TJM2]

Cuyamaca Cypress.

This species was not added to our collection until 1963, when seed from the wild were obtained. Planted in November 1964, the 12 to 20 inch plants had grown in three years to two to six feet tall and were 13 to 30 inches wide. They were in good condition and could be expected to make normal growth.

***Cynoglossum grande* Lehm.**

Western Hound's Tongue.

Perennial.

Boraginaceae. Borage Family.

Natural Range: Dry shaded slopes below 4,000 or 5,000 feet, Coast Range and Sierra Nevada from central California north to Washington. Flowering from March to June.

Propagation: Several lots of seeds were sown directly into a shady site where there was a suitable layer of leaf mold. By this method, germination was recorded within two months. The roots, if dug at the proper season and before breaking dormancy, can be moved readily.

Culture: Two plants, established at the old site in 1941 were balled in March, 1951, put into cans, and the following July were set out in their new site, a shaded bank of clay-loam soil. Here they grew on, flowered feebly each season, and after their 20th year were recorded as being dead. Other collections, established by sowing the seed directly into site, did not fare so well, although flowering specimens were noted after the second and fifth years. Usually, the sites became overgrown by other perennials during the dormant season and the roots would rot.

Uses: Of little value except as botanic garden specimens.

Dalea Juss. [Ed: *Psorothamnus* Rydb. TJM2]

Indigo Bush. Smoke Tree.

Perennials and Shrubs.

Fabaceae. Pea Family.

Natural Range: A commonly seen plant scattered over large areas of our deserts, our ten species and three varieties are found in various habitats, but mainly on dry, rocky slopes or in washes, at elevations below 6,000 feet, but mostly below 2,500 feet. Flowering from February to June.

Propagation: The seed germinates rapidly, in three to seven days without treatment, but usually only a very low percentage is viable. Our greatest difficulty was in being able to grow the seedlings on to planting size. Experimenting with various soil combinations, fungicides, and sowing directly into site, we never accomplished any satisfactory results. Aside from a few seedlings, all of our efforts were fruitless. Sowing in spring directly into pots proved most successful, but usually only one or two seedlings were raised for planting out. Generally, we had much poorer results than at the old site.

Culture: Only a few plants, but mostly none were raised of the following species and varieties:

Dalea arborescens A. Gray. [Ed: *Psorothamnus arborescens* (A. Gray) Barneby. TYM2] – One small plant reported alive two years after planting.

Dalea californica S. Watson. [Ed: *Psorothamnus arborescens* (A. Gray) Barneby var. *simplicifolius* (Parish) Barneby. TJM2] – No results.

Dalea fremontii A. Gray. [Ed: *Psorothamnus fremontii* (A. Gray) Barneby. TJM2] – Best results by sowing directly into pots and planting out as soon as possible, a few were alive two years later.

Dalea fremontii A. Gray var. minutifolia (Parish) L. Benson. [Ed: *Psorothamnus arborescens* (A. Gray) Barneby var. *minutifolius* (Parish) Barneby. TJM2] – None survived in either the nursery or garden.

Dalea fremontii A. Gray var. saundersii (Parish) Munz. [Ed: *Psorothamnus arborescens* (A. Gray) var. *arborescens*. TJM2] – One plant became well established from seed sown directly into a garden site while all other seedlings died in same spot. The plant flowered in its fifth year and was still growing slowly in its 12th year.

Dalea parryi Torr. & A. Gray. [Ed: *Marina parryi* (Torr. & A. Gray) Barneby. TJM2] – A perennial that grew intermittently for us, flowering, producing a few seeds, dying and more volunteers appearing in a year or two, but not observed after the eighth year.

***Dalea polydenia* Torr.** [Ed: *Psorothamnus polydenius* (Torr.) Rydb. TJM2] – No results, seedlings dying soon after appearing.

***Dalea schottii* Torr.** [Ed: *Psorothamnus schottii* (Torr.) Barneby. TJM2] – No results, all seedlings dying.

***Dalea spinosa* A. Gray.** [Ed: *Psorothamnus spinosus* (A. Gray) Barneby – No results, even with tiny seedlings lifted in the wild.

Uses: Nurseries located in the desert areas are more successful in raising plants that can be quite readily established in desert home sites.

***Darlingtonia californica* Torr.**

California Pitcher-Plant. Cobra Lily.

Perennial.

Sarraceniaceae. Pitcher-Plant Family.

Natural Range: This marshy and bog-loving plant is found in scattered locations in Nevada, Plumas, Siskiyou, Trinity, and Del Norte counties; north to southwestern Oregon at elevations of 300 to 6,000 feet. Flowering from April to June.

Propagation: Using a variety of procedures, our three attempts to germinate seeds failed. Seed should be sown on live sphagnum and kept constantly moist.

Culture: In their natural habitat, one may find them at relatively high elevations, indicating they will stand considerable cold. One party reports growing them where there is snow in winter and 90° F to 100° F temperatures in summer. A successful growing medium has been mucky mud, sawdust, peat, and acid fertilizers all covered with water.

Uses: Mainly as an horticultural oddity, interesting for being one of the insectivorous types of plants, and if grown properly can be of considerable interest.

***Datisca glomerata* (C. Presl) Baill.**

Perennial.

Datisceae. Datisca Family.

Natural Range: Scattered locations in dry stream beds and washes in mountains and hills, below 6,500 feet; several plant communities throughout California; Baja California (Mexico).

Flowering from May to July.

Propagation: Our one collection of seed failed to germinate when sown shortly after harvesting and cold-stratified for three months. Year old seed of the same collection and cold-stratified for one-and-a-half months produced a few seedlings, beginning in 36 days. All seedlings were raised in the nursery without trouble.

Culture: Needs low spots, where winter and spring moisture can gather plus some additional irrigation in artificial habitats. Dies down completely in winter.

Uses: Only of interest to botanic gardens.

***Datura discolor* Bernh.**

Annual.

Solanaceae. Nightshade Family.

Natural Range: Low places, alkali sinks, etc. below 1,500 feet; Colorado Desert; Arizona, to Mexico and the West Indies. Flowering from April to October.

Propagation: Collected in 1958, our first seed was sown directly into site, but failed to germinate. A year later seed was sown in nursery, and only three seedlings came up. These subsequently died from damp-off fungus. A third attempt with eight-year-old seed from original collection produced one seedling in 11 days. This was raised and was planted in desert garden.

Culture: Experience with only one plant indicates this species needs an extremely well-drained site and should be kept very dry. Our only plant grew to two feet in a year, flowered and produced seed, and acted much like a biennial or even a perennial in our area.

Uses: Ours only of interest to botanic gardens since it is a perennial when other species in South America are trees. [Ed: These large South American plants have been reclassified into the genus *Brugmansia* Pers.]

Delphinium L.

Larkspur.

Perennials.

Ranunculaceae. Buttercup Family.

Natural Range: Growing in a great range of habitats, the thirty species and several subspecies are widely scattered throughout California and into adjacent states and countries, ranging in elevations from near sea level to over 11,000 feet. Flowering from March to May.

Propagation: Untreated seed, on average, will germination in 14 days, although this varies from lot to lot, seed may emerge in ten to twenty, or even forty days. Some authors recommend cold-stratification for older seed, and while we did use this method for some species, we found it unnecessary even with two- to four-year-old seed. If cold-stratification is resorted to, it should be no longer than a month, as seedlings begin sprouting during the cold treatment. After seedling emergence, which usually was good to excellent, they are grown on in their container (pot or flat) until natural dormancy sets in, around May. Watering is gradually curtailed until the container is dry. The shriveled roots are kept in the container until the following fall when watering is again resumed. After the perennial roots are large enough, they are set out into their permanent site.

Culture: To determine the proper cultural conditions for the thirty species native to California, one should know its local habitat. Except for those inhabiting wet, boggy areas, generally *Delphinium* species may be grown in loose or heavy soils where they may receive a reasonable amount of moisture through the winter and spring months, after which they need to completely dry out and remain undisturbed. Our chief trouble was encountered with rodents or birds digging out the roots. However, in our area, seldom any species live more than two to five years with a maximum of over ten years. To maintain a species, repeated propagations were carried on every two to three years. Flowering and seeding occurred within one to two years from seed. The following spp. and ssp. have been raised during the past 15 years, in the Claremont site:

Delphinium amabile Tides. [Ed: *Delphinium parishii* A. Gray. TJM2] – Several collections grown for about six years.

Delphinium bakeri Ewan – ?

Delphinium californicum Torr. & A. Gray. – Grown for six years.

Delphinium cardinale Hook. – Native to the Botanic Garden and adjacent areas - grows in extremely rocky, dry, brush covered areas. The Dutch breeders have made several hybrids, using this species as one parent.

Delphinium glaucum S. Watson. – Two collections failed to germinate.

Delphinium hesperium A. Gray. – Several lots of garden harvested seed were raised for the past ten years.

Delphinium hutchinsoniae Ewan. – Maintained for nine years and then disappeared.

Delphinium luteum A. Heller. – Produced several lots of seeds for over five years.

Delphinium parishii A. Gray. – Has been well established for 15 years - however, additional plants were added throughout the period to supplement the original planting.

Delphinium parryi A. Gray. – A commonly seen species, it was native to garden area, and supplemented by collections from other localities; plants were short-lived.

Delphinium parryi A. Gray ssp. *blochmaniae* (Greene) H. Lewis & Epling. – This subspecies has been maintained in our plantings for over 25 years, although individuals were comparatively short-lived.

Delphinium uliginosum Curran. – Recorded for five years and disappeared.

Delphinium variegatum Torr. & A. Gray ssp. *apiculatum* (Greene) Ewan. [Ed: the ssp. is not recognized in TJM2] – Has been repropagated several times during the past 15 years.

Uses: Hybridizers have used some species for developing new horticultural varieties; many of the species have fine, deep blue flowers and a well-established colony is very colorful.

***Dendromecon harfordii* Kellogg.**

Island Tree Poppy.

Shrub.

Papaveraceae. Poppy Family.

Natural Range: On the chaparral covered slopes of Santa Cruz and Santa Rosa islands. Flowering from April to July but with some flowers most of year.

Propagation: One collection of a few green seeds that was obtained in 1958 produced four seedlings without the usual burning of straw or pine needles over the seed flat. By taking firm tip cuttings while plant was in flower, we got 95 to 98% rooting in 30 days, and this is the best method for raising plants of this genus. About 90% of the cutting-grown plants were brought through the nursery for supplementing our plantings.

Culture: Recommend well-drained site with some supplementary irrigation or if in a poorly aerated soil, not more than two to three additional irrigations per year. One of our plants was an

exceptional fine specimen, and from which we took all of our cutting material. The writer has had three in his garden for over three years and they were never without some flowers, although finest bloom is from April to June. Weekly irrigations are provided the same as for other garden material, and they have grown moderately and compactly. They have the admiration of everyone who sees them.

Uses: A fine gray-leaved plant which with thoughtful care and proper placement will add a definite interest to the garden. Particularly useful for slopes and banks among other native plants.

***Dendromecon harfordii* Kellogg var. *rharnoides* (Greene) Munz.** [Ed: the var. is not recognized in TJM2]

Shrub.

Natural Range: Brushy slopes of Santa Catalina and San Clemente islands. Flowering from April to July, but some flowers most of year.

Propagation: Burning a heaping pile of pine needles or excelsior on a flat or pot after the seed is sown, will induce germination in 20 to 40 days, usually between 20 to 30 days. While percentage germination is not high, we usually acquired 75 to 100 seedlings from less than one-eighth ounce of seed. We sowed the seed anytime between September and March, preferring late winter or early spring in order to not have the plants too long in the nursery as they grow rapidly. The critical stage in the nursery is during the summer months when watering needs to be applied regularly.

Culture: Having raised this variety for over 15 years on this site, we began to lose plants between the ten to 15 year periods. Handsome, full grown specimens, five to ten feet tall with equal or greater spreads to 12 feet or even 20 feet across were measured during that period. However, without any apparent reason, plants singly would begin to die back and gradually succumb. The soil was a rocky, decomposed granite loam or a tight clay-loam soil, and equal results were obtained in either location. Flowering began in their second or third years with seeding following.

Uses: The same as for the species. Either one is superior to *D. rigida*.

***Dendromecon rigida* Benth.**

Tree Poppy.

Shrub.

Natural Range: Dry, brushy slopes and rocky washes, below 6,000 feet; Coast Ranges from Sonoma County to Baja California (Mexico), and in the Sierra Nevada from Shasta County to Tulare County. Flowering from March to June, or later.

Propagation: Same procedures as for the preceding, but germination is much slower and sporadic, usually taking 40 to 60 days to emerge and one to two months more for completion. One lot of Rootone treated heel cuttings taken in April began to root in 44 days. The same careful nursery procedures should be followed as stated above.

Culture: Much the same cultural requirements as the two preceding. Young plants need protection, if rabbits are present in the area. Not as attractive, becoming quite messy looking during the summer months. This species has a more upright growth habit, and may reach heights

of six to ten feet and spreads from five to 14 feet wide in ten to 15 years. Flowering and seeding begin after the second year.

Uses: As for the two preceding, but not as attractive, the drying leaves in summer making the plant quite messy looking.

***Dentaria californica* Nutt.** [Ed: *Cardamine californica* (Nutt.) Greene. TJM2]

Perennial.

Brassicaceae. Mustard Family.

Natural Range: Shady banks and slopes, below 2,500 feet, through the western slope of California to Baja California (Mexico), and southwestern Oregon. Flowering from February to May.

Propagation: Untreated seed will germinate in ten days and is completed a few days later. There is no problem in raising seedlings through the nursery operation.

Culture: Our results were most unsatisfactory, all plants raised were dead within three months, even when placed in what appeared to be our most suitable sites.

Uses: One of hundreds of species in the mustard family, it is only of interest to botanic gardens.

***Dicentra chrysantha* (Hook. & Arn.) Walp.** [Ed: *Ehrendorferia chrysantha* (Hook. & Arn.) Rylander. TJM2]

Golden Ear-Drops.

Perennial.

Fumariaceae. Fumitory Family. [Ed: Papaveraceae. Poppy Family. TJM2]

Natural Range: Frequently seen in burned areas or disturbed places, below 5,000 feet or occasional to 7,500 feet, Inner Coast Ranges from Mendocino County and Sierra Nevada foothills from Calaveras County to cismontane Southern California and Baja California (Mexico). Flowering from April to September.

Propagation: Since this species occurs most abundantly after a fire, we artificially followed nature by burning pine needles or excelsior over seed flats after they had been sown with untreated seed. The occasional seed lot germinated in 25 to 35 days, however, the average time for the seeds to germinate was two to three months. Seedlings could not be potted before four or five months after sowing of seed. Four- to seven-year-old seed gave equal or better results as fresh seed. Seedlings, for the most part, were handled with a high degree of success during the initial stages. If the plants had to be held over and shifted to gallon-cans, then a greater percentage of losses occurred having to carry them through the summer months which necessitated applying more water.

Culture: An impermanent species, it needs a warm, dry, loose soil position, such as a sunny bank and to be without too much competition from other plants. Even at the best, we seldom maintained a planting for more than five years, but by additional propagation, we have exhibited the species for many years. Flowering and seeding occur within the first year.

Uses: Of interest only to specialist growers and botanic gardens.

***Dicentra ochroleuca* Engelm.** [*Ehrendorferia ochroleuca* (Engelm.) Fukuhara. TJM2], is a species occasionally found in disturbed places below 3,000 feet, from the Santa Ynez and Santa Lucia Mountains to the Santa Ana Mountains has much the same habit as *D. chrysantha*, but is taller and has off-white- to cream-colored flowers. Its cultural history paralleled *D. chrysantha* during the past 15 years.

***Dicentra formosa* (Haw.) Walp.**

Western Bleeding Heart.

Perennial.

Natural Range: Moist, shady locations from sea level to 7,000 feet, central to northern California in the Coast Ranges and Sierra Nevada. Flowering from March to July.

Propagation: Our one seed collection failed to germinate, but bare-root plants brought in from 7,000 feet elevation were readily established.

Culture: Used in a shady, oak leaf covered spot, this species has been maintained and has spread out during the past 15 years. While not as vigorous and healthy as it might be in more suitable climates, it can be said to have been successfully established.

Uses: In place of the cultivar widely sold, it might perform better in those gardens where the commercial form does not thrive. A useful, shade-loving plant.

***Dichondra* J.R. Forst. & G. Forst.**

Perennial.

Convolvulaceae. Morning-Glory Family.

Natural Range. The species are usually found below 1,500 feet, scattered on sandy, dry banks, under brush or trees, mainly near the coast in California.

Propagation: Seed sown in flats will respond in a few days during the warm seasons of the year, but all of our collections were started from roots. The roots, placed in flats, quickly covered the whole flat. Numerous collections were gathered from various sections of the state for testing in our area.

Culture: On the whole, the only species established, and which has barely existed for the past 15 years, is *D. occidentalis* House. Complete protection against rabbits was necessary, as this plant is greatly relished by them. This species did not grow nearly as well as at the old site, where we established a good lawn covering with it. Other species identified, besides several undetermined collections, were: *D. brachypoda* Wooton & Standl. [Ed: This species is not native to California.] and *D. donelliana* Tharp & M.C. Johnst.

Uses: Mainly as a groundcover.

***Dirca occidentalis* A. Gray.**

Western Leatherwood.

Shrub.

Thymelaeaceae. Daphne Family.

Natural Range: Uncommon, moist or wet slopes in rocky soil, below 1,500 feet, the central coastal counties near San Francisco Bay. Flowering from January to March.

Propagation: Since we have never been able to obtain seed, we have attempted cuttings and rooted rootstocks, neither of which was successful.

Culture: Obviously needs a loose, humus filled soil in semishade to shade and with considerable moisture, at least during the winter and spring months. Established plants in gallon-cans, received through more successful friends, failed each time.

Uses. Only for the specialist and botanic garden collections.

***Disporum smithii* (Hook.) Piper.** [Ed: *Prosartes smithii* (Hook.) Utech et al. TJM2]

Fairy Bells.

Perennial.

Liliaceae. Lily Family.

Natural Range: Moist, shaded slopes near the coast, Santa Cruz County north to British Columbia (Canada). Flowering from March to May.

Propagation: Our only collection recently obtained, were rootstocks, which we established in pots in the greenhouse. They flowered in this situation before setting out in the garden. Seed may need cold-stratification. One lot of ***D. hookeri* (Torr.) G. Nicholson.** [Ed: *Prosartes hookeri* Torr. TJM2] produced a few seedlings, using this treatment, but after going dormant, they failed to revive.

Culture: Needs a shady, humus filled soil with moisture during growing period, but should be rather dry during resting season after flowering and seeding. Our collection failed to respond to our culture.

Uses: Interesting for shady gardens, but may be difficult to establish.

***Dithyrea californica* Harv.**

Spectacle Pod.

Annual.

Brassicaceae. Mustard Family.

Natural Range: Common in the sandy patches in the creosote bush scrub, below 1,500 feet; found in both of our deserts from Inyo County, to Nevada, Arizona, and Baja California (Mexico). Flowering from March to May.

Propagation: Our seed was sown directly into site in December, where it took 32 to 35 days to come up. Germination was poor, but ungerminated seed came up quite well with the first rains the following year. This pattern occurred each time we sowed seed, therefore it appears to have an inhibitor, which probably could be removed by soaking in water before sowing. Seedlings rot easily and need the sharpest drainage to survive. However, our climate being colder and wetter during the winter and early spring months is not conducive to raising this species successfully.

Culture: Needs the sharpest sandy drainage and driest climate to survive. While we raised several plants to flowering, they usually rotted and failed to set seed.

Uses: A novelty while in seed, the flat seed pods appearing like “spectacles.”

***Dodecatheon clevelandii* Greene.**

Shooting Star.

Perennial.

Primulaceae. Primrose Family.

Natural Range: Grassy slopes of coastal hills, below 2,000 feet, Los Angeles County to northern Baja California (Mexico). Flowering from January to April.

Propagation: Untreated seed will come up in ten days, usually very thickly. Excellent germination was obtained from four to six-year-old seed. After a few months, the seedlings go dormant and need to be dried off and kept in the flat until regrowth is started the following fall. When seedlings are large enough, they can be shifted in clumps or singly to larger containers, such as four to five inch pots, to be allowed to become stronger plants before setting out. Careful handling is necessary in bringing them out of their dormant period.

Culture: Growing naturally on grassy, open slopes or in open spots among smaller shrubs, this species needs to be used in a similar situation where there is no competition from larger, more invasive plants. Even with our best efforts, for one reason or another, any one collection seldom lived for more than six years. Usually, in the best locations, many seedlings would arise each season, but never enough would live to continue on indefinitely. The **ssp. *insulare* H.J. Thoms.**, only recently acquired, behaved in a similar manner.

Uses: An interesting colorful perennial for the definite location.

***Dodecatheon hendersonii* A. Gray.**

Perennial.

Natural Range: Usually found on shaded slopes, below 4,000 feet, (occasionally higher) from the San Bernardino Mountains through the Coast Ranges and Sierra Nevada, north to British Columbia (Canada). Flowering from February to May.

Propagation: Cold-stratification was used for some lots of seeds, but it is unnecessary as untreated seed will germinate in ten days. We followed the same procedure for raising the seedlings as for *D. clevelandii*.

Culture: Much the same results as for *D. clevelandii* but not quite as successful. Careful placement of plants and attention afterwards to see they do not get overrun by more vigorous plants will insure a longer life. They, too, need to be in a location where they may dry out during their dormant summer season.

Uses: As for *D. clevelandii*.

***Dodecatheon jeffreyi* Van Houtte.**

Perennial.

Natural Range: Wet boggy places at elevations of 2,500 to 11,000 feet, mountains of northern California, north to Alaska and Montana. Flowering from June to August.

Propagation: While it has been reported that no treatment of seed is necessary, we provided one to two months of cold-stratification, and had some degree of success. Since the seedlings did not emerge during the cold period, it probably did no harm. Seedlings need to be kept in a moist condition in pots until planted out in a boggy spot. None of our attempts resulted in any great degree of success, the young plants barely existing for a year or two and then disappearing during their dormant stage.

Uses: An interesting and useful plant for the proper situation.

***Downingia cuspidata* (Greene) Rattan.**

Annual.

Campanulaceae. Bellflower Family.

Natural Range: Vernal pools of wet and drying clay soils, below 1,600 feet; San Diego and western Riverside counties, both coastal and interior mountains of central California and northward. Flowering from March to June.

Propagation: If sown in a flat, it needs to be kept very moist until germination begins in about 18 days, otherwise, the seedlings may take two or more months to emerge. Seed sown at the edge of a vernal pool will also come up thickly in 15 to 25 days. However, for our best results we raised the seedlings in flats, transplanted them into four inch pots and set the plants out when sufficiently strong.

***Downingia concolor* Greene.** and ***Downingia elegans* (Lindl.) Torr.** were raised in a similar manner.

Culture: A duplication of the natural vernal pool concept is necessary, where the water remains through a good portion of the winter and as spring approaches, begins to diminish in depth and gradually dry up. We planted this species at the edge of a depression in clay-loam soil, which produced the necessary artificial habitat. Fine specimens were grown in this manner with flowering starting early in March or even when plants were still in the greenhouse. This species has been grown for several years, but *D. concolor* and *D. elegans* petered out after a few seasons.

Uses. A handsome little annual that can be grown quite satisfactorily in gardens.

***Draperia systyla* (A. Gray) A. Gray.**

Perennial.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Natural Range: Dry slopes in woods, 2,400 to 8,000 feet; central and northern Sierra Nevada. Flowering from May to August.

Propagation: Our only collection of seed was acquired in 1952, sown in 1953 and again in 1954, both times requiring at least two months or more to germinate, and after which there was sporadic emergence for a period of three to four months. Seedlings grew rapidly and were set out from five-inch pots within a few months. About 25% loss occurred while in the nursery.

Culture: Our collections were used in the rock garden, in somewhat shaded well-drained areas. Noxious soil fungi quickly took their toll, and within a year or two, most plants were gone. Flowering and seeding did occur on a few plants.

Uses: Only for interest to botanic gardens.

***Dryopteris arguta* (Kaulf.) Maxon.**

Wood Fern.

Perennial.

Dryopteridaceae. Wood Fern Family.

Natural Range: A common fern on dry loose wooded slopes, mostly below 5,000 feet, cismontane California to Washington, and the Channel Islands.

Propagation: Several collections of rooted plants were acquired and started in nursery containers. This is easily done, and when vigorous enough, they may be planted out. Sowing spores in the proper medium and with specialized care would be the method for producing quantities of seedlings.

Culture: Need a semi-shaded area with plenty of dryish humus filled soil and enough water provided occasionally to keep plants growing vigorously. Our oldest collection was over 15-years-old in the garden, and nice clumps ten to 24 inches tall by one to five feet wide were growing satisfactorily.

Uses: Excellent for naturalizing in dryish wooded areas where only occasional moisture is received.

***Dudleya* Britton & Rose.**

Live-Forever.

Perennials.

Crassulaceae. Stonecrop Family.

Natural Range: The 21 species and numerous varieties range over most of California from near sea level to 7,000 feet. They inhabit rocky places, sea bluffs, headlands, cliffs, steep road-cuts, stony places, etc. where water drains away quickly. Flowering from March to July, depending on species.

Propagation: Easiest method is to start rooted plants or portions of plants in small containers. Seed sown in flats will germinate in five to 15 days without any treatment. The tiny seedlings are difficult to transplant so it may be necessary to take small clumps. We usually sowed seed in August or September to have plants ready for setting out by January or February. There is no problem in raising the seedlings through the nursery.

Culture: Dudleyas require well and quickly drained sites, and for the cismontane species, a little high and light shade for a portion of the day is acceptable. The broad, flat leaved kinds can easily get crown rot if the water is not dissipated quickly from the center of the plant. It is recommended these kinds be planted on slopes or otherwise set to prevent water from accumulating in the center of the plant. Otherwise, this genus is a rugged one, accepting harsh conditions and neglect, if necessary, but will more than repay a little attention. The types,

sometimes classified under the genus *Stylophyllum*, which have roundish leaves, are more amenable to flat surface cultivation. A few plants of *D. hassei*, established at the old site and moved to this location, have multiplied by the thousands. It has been used extensively as a border plant and as a groundcover. While many of our collections have been added during the past 15 years, a large group were transferred from the old site and have become well established here. Some of these collections have now been in cultivation with us since 1932. We have put the various species in three principal sites, the rock garden, the coastal sand dunes and the desert garden. On the whole, most of the kinds became well established. Comments on the taxa follow:

***Dudleya abramsii* Rose.** – One collection maintained for ten years and another added later produced numerous seedlings around parent plants.

***Dudleya abramsii* Rose ssp. *murina* (Eastw.) Moran.** – One collection in 1960 was lost from rot caused by heavy oak leaf coverage.

***Dudleya arizonica* Rose.** – Added in 1960 was placed in desert garden, where only a few remained in 1966.

***Dudleya attenuata* (S. Watson) Moran ssp. *orcuttii* (Rose) Moran.** [Ed: *Dudleya attenuata* (S. Watson) Moran. TJM2] – Two collections established at old site in 1941 were readily moved and re-established. One number had to be shifted to shadier site where vigor soon returned.

***Dudleya caespitosa* (Haw.) Britton & Rose.** – Many collections from various wild locations have been established, and while there has been some diminishing of numbers, collections obtained in 1940 and moved are still recorded in good condition.

***Dudleya candelabrum* Rose.** – First obtained in 1932 on Santa Cruz Island, moved and re-established in this site, this species has shown great strength. Several later collections have been added to augment this number.

***Dudleya cotyledon* (Jacq.) Britton & Rose.** [Ed: most likely *Dudleya farinosa* (Lindl.) Britton & Rose. TJM2] – First obtained in 1949, we have augmented this species by several seed propagations.

***Dudleya cymosa* (Lem.) Britton & Rose.** – Has been short-lived, performing well for five to six years, however, one number has been maintained for 15 years. Easily augmented by seed propagations.

***Dudleya cymosa* (Lem.) Britton & Rose ssp. *minor* (Rose) Moran.** [Ed: *Dudleya lanceolata* (Nutt.) Britton & Rose. TJM2] – Ten to 15 years have been the life span for three collections while others have dwindled away in three to five years, prefers some protection around the base of soft chaparral.

***Dudleya cymosa* (Lem.) Britton & Rose ssp. *ovatifolia* (Britton) Moran.** – Only two small collections, neither of which survived for more than a year.

***Dudleya densiflora* (Rose) Moran.** – Plants originally collected in the San Gabriel Mountains have increased over the years, and we have maintained the species for over 30 years.

***Dudleya eastwoodiae* Rose.** [Ed: *Dudleya farinosa* (Lindl.) Britton & Rose. TJM2] – After struggling along for ten years at the old site, one plant was moved to Claremont where it failed to respond and was written off in 1955.

***Dudleya edulis* (Nutt.) Moran.** – Since 1933, in both sites, this species has done very well, increasing in numbers and producing excellent representations.

***Dudleya elongata* Rose.** [Ed: *Dudleya lanceolata* (Nutt.) Britton & Rose. TJM2] – One collection added in 1955 became overgrown by vigorous annuals and perennials that gradually choked the plants.

***Dudleya farinosa* (Lindl.) Britton & Rose.** – Collections from various localities have been added through the years. Most of them have responded favorably, the oldest collections attaining ages of ten to 15 years in our care.

***Dudleya greenei* Rose.** – Three numbers added since 1958 have responded well and continue to increase numbers.

Dudleya insularis nomen nudum [Ed: this unpublished combination appears to be based on *Stylophyllum insulare* Rose and therefore would be *Dudleya virens* (Rose) Moran ssp. *hassei* (Rose) Moran in TJM2.] – A total of three plants have been maintained since 1962 and are responding.

***Dudleya lanceolata* (Nutt.) Britton & Rose.** – From 1934, many collections have been added and while many plants have died, there are a few that have lived from 20 to 30 years. The chief trouble has been overcrowding and rotting.

***Dudleya laxa* (Lindl.) Britton & Rose.** [Ed: *Dudleya cymosa* (Lem.) Britton & Rose. TJM2] – Two collections failed after three years.

***Dudleya multicaulis* (Rose) Moran.** – None survived for more than two years.

***Dudleya pulverulenta* (Nutt.) Britton & Rose.** Chalk Lettuce. – Has been handled for many years. It is long-lived if planted so that water will not collect and remain in the center of the rosette of large, chalk covered leaves. The side of a steep bank or rockery is excellent with a bit of shade. Plants growing in eight-inch pots have been known to survive for over ten years without any attention, not even watering, fertilizing or change of soil. Our oldest plants were grown from seed sown in 1940.

***Dudleya saxosa* (M.E. Jones) Britton & Rose.** – Used in the desert garden, there has been a gradual loss during the 15 years until only a few plants remain. Perhaps the optimum conditions have not been attained for this desert species.

***Dudleya saxosa* (M.E. Jones) Britton & Rose ssp. *aloides* (Rose) Moran.** – The same history as for the species.

***Dudleya septentrionalis* Rose.** [Ed: *Dudleya farinosa* (Lindl.) Britton & Rose. TJM2] – Only one collection acquired in 1937, reduced to one plant which succumbed in 1955.

***Dudleya stolonifera* Moran.** – One collection acquired in 1955 became smothered by other plants and succumbed in 1958.

***Dudleya traskiae* (Rose) Moran.** – The original collection gathered in 1941 has increased and grown healthily for the past 25 years.

***Dudleya virens* (Rose) Moran.** – Started from a few plants gathered in 1932, this species has increased by the thousands and has been used for groundcover and border plantings - a most successful species.

***Dudleya virens* (Rose) Moran ssp. *skinneri* nomen nudum** [Ed: *Dudleya virens* (Rose) Moran. TJM2. In our records the name *skinneri* was attributed to Moran, but this name was never published. For this RSABG collection, the name referred to a mainland population of *Dudleya virens* (Rose) Moran from Point Vicente on the Palos Verdes peninsula of Los Angeles County.] – One collection gathered in 1955 has increased in numbers and in all ways appears to have settled in nicely.

***Dudleya viscida* (S. Watson) Moran.** – Added in 1936, this species has shown minimal increase and generally maintains itself well. Additional plants to augment our collection have been grown from seed.

***Dyssodia cooperi* A. Gray.** [Ed: *Adenophyllum cooperi* (A. Gray) Strother. TJM2]

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Gravelly washes, open mesas, and slopes, 2,000 to 5,200 feet, California deserts, southern Nevada and northwestern Arizona. Flowering from May to June, and from September to November.

Propagation: Untreated seed of three separate collections failed to germinate.

Culture: Needs a hot, dry, desert-like habitat, probably would not survive in this area.

Uses: Only of interest to botanic gardens.

***Dyssodia thurberi* (Gray) Robinson.** [Ed: *Thymophylla pentachaeta* (DC.) Small var. *belenidium* (DC.) Strother. TJM2]

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Often on limestone, rocky ground, or washes, 3,000 to 5,000 feet, narrow range in mountains of Mojave Desert; to Texas and Mexico. Flowering from April to June.

Propagation: One collection of untreated seed sown in September came up in six days but after a month, all died, but not from damp-off fungus.

Culture and Uses: As for the preceding species.

***Echinocactus acanthodes* Lemaire.** [Ed: *Ferocactus cylindraceus* (Engelm.) Orcutt. TJM2]

Barrel Cactus.

Shrub.

Cactaceae. Cactus Family.

Natural Range: Commonly found in the Mojave and Colorado deserts, inhabiting rocky slopes, walls, and gravelly mesas below 5,000 feet, and to adjacent Arizona and Baja California (Mexico). Flowering from April to May.

Propagation: Untreated seed germinates within four to eight days. Seedlings grow very slowly and may take as long as four to six months before moving to small containers (two-inch pots).

After two to three years, they can be set out in permanent location. If permission can be obtained from the land owner, it is much quicker to transplant plants from the wild. [Ed: This is no longer recommended.]

Culture: Rocky clay slopes or well-drained soil in full sun are best positions for this species that needs little water. Some fertilizing and careful watering will speed up growth but also may result in causing internal rots, to which this species is subject. Several plantings taken from the old site plus additional small lots added in the past 15 years are all surviving and doing well. Our oldest group, originally planted in 1927, were moved and planted at the new site in October 1951, are all alive and range in heights from one foot to 28 inches, and range from eight inches to one foot wide. Other lots have suffered losses from internal rots and vandalism that have reduced their numbers, but are otherwise doing equally well. They produce flowers and seeds each season in quantity. One group of three plants, raised from seed and maintained for 25 years, are now six to nine inches tall and are seven to nine inches across. No flowers have been noted to date.

Uses: Interesting addition to desert landscaped gardens, hobbyists, and botanic gardens.

***Echinocactus johnsonii* Engelm.** [Ed: *Sclerocactus johnsonii* (Engelm.) N.P. Taylor. TJM2]

Hedge-hog Cactus.

Perennial.

Cactaceae. Cactus Family.

Natural Range: Infrequently seen in driest, rockiest slopes where very little rain ever falls, from north of the Kingston Mountains in the Mojave Desert to Utah and Arizona. Flowering from April to May.

Propagation: We have never obtained seeds but assume it will produce seeds as others of this genus. A few specimens from wild were thoroughly dried in the greenhouse before potting in a sandy soil mix. Careful watering with some light feeding brought the plants along until they could be planted out.

Culture: Given the warmest spot against some rocks, our few plants have been maintained for five years with only a few losses from internal rot. It is doubtful if this species will be successfully grown in this climate in the open.

Uses: A very interesting cactus for the specialist.

***Echinocactus polyancistrus* Engelm. & J.M. Bigelow.** [Ed: *Sclerocactus polyancistrus* (Engelm. & J.M. Bigelow) Britton & Rose. TJM2]

Perennial.

Cactaceae. Cactus Family.

Natural Range: Occasionally seen on very dry, rocky or gravelly mesas between 2,000 to 6,000 feet, in the eastern Mojave Desert from Red Rock Canyon to Nevada. Flowering from April to June.

Propagation: No seed germination history, but assumed to emerge without treatment. Only a few plants have been restarted in the nursery after thoroughly drying and potting in a sandy mix with light feeding. Plants were set out in 1962, and most have succumbed to rots.

Uses: Interesting for the cactus specialist.

***Echinocactus polycephalus* Engelm. & J.M. Bigelow.**

Perennial.

Cactaceae. Cactus Family.

Natural Range: Inhabits very rocky slopes from 2,000 to 5,000 feet in the Colorado and Mojave deserts to Utah and Arizona. Flowering from March to May.

Propagation: Several sowings of seeds failed to germinate, therefore we have no recommendations. While difficult, mature plants may be restarted by first drying roots thoroughly, repotted in a sandy mix and given an occasional light feeding after roots start growing.

Culture: As for the preceding species, this one is highly susceptible to internal rots and therefore needs the warmest, best drained spot possible. Even with care, our losses have always been high, even though a few plants have been maintained for ten to 15 years.

Uses: Suitable for the cactus specialist.

***Echinocactus viridescens* Torr. & A. Gray.** [Ed: *Ferocactus viridescens* (Torr. & A. Gray) Britton & Rose. TJM2]

Perennial.

Cactaceae. Cactus Family.

Natural Range: Dry, grassy hills and coastal bluffs of San Diego County to Baja California (Mexico). Flowering from May to June.

Propagation: Untreated seed, harvested from our plants, began emerging in eight days from two lots sown on the same date. One lot, sown in 100% sphagnum moss, produced many more seedlings that were moved from flat to pots within two months while the other took over seven months before seedlings were ready for transplanting. Further, there was a much higher percentage loss of seedlings in the later mix (which was our standard medium). Careful attention during youngest stages is necessary to avoid losses.

Culture: This species may be placed in heavy or well-drained soils, provided there is not an abundance of water. A particularly rugged species, we have maintained several collections for 25 to 35 years without much trouble. Plants that get overgrown by other plants tend to rot. Plants in open locations will thrive with no attention. Never attaining large size, plants in our collections for 35 years are not over 13 inches tall by ten inches wide. Seedlings raised were noted to start flowering in their sixth year, even when not much more than two inches tall.

Uses: Mostly for the specialist and botanic garden collections.

***Echinocereus engelmannii* (Parry ex Engelm.) Lem.**

Hedgehog Cactus.

Perennial.

Cactaceae. Cactus Family.

Natural Range: A common plant on gravelly slopes below 7,200 feet in the deserts of California, Utah, Arizona and to Sonora and Baja California (Mexico). Flowering from April to May.

Propagation: None of our collections were grown from seed, even though we had plenty on hand. It is much easier to collect mature plants from the wild (with the owner's permission), and these are readily re-established in the nursery [Ed: This practice is no longer recommended.] Freshly dug plants should be thoroughly air dried before they are potted up in a sandy mix. An occasional light feeding increases the vigor of the plants.

Culture: Extremely well-drained soils and a warm setting are necessary for best results. This species is highly susceptible to root and internal rots, and needs careful placement for best results. While withstanding moving from the old site, many of our oldest plants were lost from rots after transplanting directly to our new site. Even so, many plants have been in our collections for 25 to 35 years without incurring particularly heavy losses.

Uses: A good subject for desert landscaping, hobbyists, and botanic gardens. The beautiful flowers make it a worthy subject for culture.

***Echinocereus mojavensis* (Engelm. & J.M. Bigelow) Rumpler.**

Mound Cactus.

Perennial.

Natural Range: Rocky slopes from 3,000 to 7,000 feet, in the mountains of the Mojave Desert, to Nevada and Arizona. Flowering from April to June.

Propagation: Seed or restarting mature specimens, the latter method is the only one pursued by us. Specimens treated as for others in the genus.

Culture: Grow this species in rocky, well-drained, warm sites or in pots. Our oldest specimens have been maintained for 20 to 35 years, having been moved twice in the interim. Some losses were incurred from rotting, but on the whole all have done remarkably well. Specimens that are 35-years-old are not more than eight inches tall and up to two feet across.

Uses: Desert garden landscaping, hobbyists, and botanic garden displays in warmer areas.

***Echinocereus munzii* (Parish) L. Benson.** [Ed: *Echinocereus engelmannii* (Parry ex Engelm.) Lem. TJM2]

Perennial

Natural Range: Dry rocky places from 4,500 to 7,000 feet, in the San Bernardino and San Jacinto Mountains, to San Diego County and Baja California (Mexico). Flowering from May to June.

Propagation: Untreated seed began germination in 16 to 20 days when sown in 100% sphagnum moss (one lot was sown in gritty sand). While only a few seedlings were obtained from each lot, the sphagnum media produced the most. Seedlings grow very slowly, taking three to four years to produce sizeable plants for setting out. No particular trouble was encountered during nursery production.

Culture: This higher altitude species has not prospered for us, but at the same time it has been maintained for up to 25 years without unduly high losses. One lot, transferred from the old site in 1951, still has two plants alive from an original 21 set out in 1941 at the old site. These are not

more than five inches tall with spreads of six to eight inches. Another group, acquired in 1950, has recorded no losses and is six to eight inches tall by ten to 12 inches across. Flowering has occurred spasmodically.

Uses: Cactus specialists and botanic gardens.

Encelia Adans.

Shrubs.

Asteraceae. Sunflower Family.

Natural Range: Of the four species and two varieties native to California, all grow in the southern part of the state, three are found in some quantity in the desert ranges, occupying very dry, rocky slopes, mesas, or washes, usually below 5,000 feet, and one is common in the lower coastal foothills. Flowering from February to June.

Propagation: Untreated seed begins to emerge in five to ten days and is usually completed within a month. Since much of the seed may not be viable, seed should be sown rather thickly. Careful handling in the nursery will produce plants large enough for planting in four to six months. Holding over through summer months in the nursery can be disastrous.

Culture: Dry hillsides or well-drained areas with little attention once established. Quantities of seedlings will appear in surrounding areas and while the original plants may not live many years, their presence will always be assured. They are subject to winter freezes if temperatures drop much below 25° F to 28° F. This is particularly true of *E. farinosa* Torr., which in our area puts on new growth during fall and early winter.

Uses: Except for *E. farinosa* (a handsome gray-leaved shrub with bright yellowish flowers), the other species are best for covering background hillsides and for early winter color, the flowering appearing from January or February to the middle of summer. *E. farinosa* needs to be used in the driest spots but with an occasional bit of water. It is particularly handsome along higher altitude desert roads where it is very rocky.

***Ephedra aspera* S. Watson.**

Shrub.

Ephedraceae. Ephedra Family.

Natural Range: Occasionally seen on dry rocky slopes below 5,000 feet in the Mojave and Colorado deserts to Texas and northern Mexico. Flowering from March to April.

Propagation: One seed collection gathered in 1958 was of poor quality and only three seedlings came up. One seed lot that was sown untreated began germinating in 12 days. The second seed lot started to germinate while they were in cold-stratification for two months (this was apparently too long). The three seedlings were raised without trouble.

Culture: Planted in rocky, decomposed granite loam, no losses occurred in eight years. The plants were two to three feet tall and three to six-and-a-half feet across; no flowering or seeding was recorded.

Uses: Botanical collections.

***Ephedra californica* S. Watson.**

Mormon-Tea.

Shrub.

Natural Range: Largely below 3,000 feet in both California deserts, from San Diego County north along Inner Coast Ranges to Merced County; and to Baja California (Mexico). Cones produced from March to April.

Propagation: Our only plants of this species were raised by others, but past experience indicates no treatment is necessary to germinate seeds.

Culture: Dry, rocky, or well-drained loam soils. Found naturally in several plant habitats with varying types of soils. Grown since 1952 at this site, there have been no losses and plants do very well with little care. Our largest plants are up to two feet tall and spread equally wide. No flowering or seeding has been recorded in 15 years.

Uses: As for other species.

***Ephedra nevadensis* S. Watson.**

Shrub.

Natural Range: Commonly found below 4,500 feet on dry slopes and hills, in both California deserts to Owens Valley and to Utah and Arizona. Coning from March to April.

Propagation: Untreated seed will start germinating in six to 14 days, and while one lot was cold-stratified for 43 days, seedlings had started to appear before they were removed from the cold. However, the largest number of seedlings were obtained from this lot. In other lots the seeds appeared to be less viable. No problems were encountered in raising seedlings through the nursery.

Culture: Generally excellent results and normal growth for all lots. Plantings were made in well-drained rocky loam soils. Growth rates appeared to be normal, plants attaining sizes from one to four feet in eight to ten years and spreading to seven feet; flowering and fruiting were recorded their seventh and eighth years.

Uses: As for other species.

***Ephedra trifurca* S. Watson.**

Shrub.

Natural Range: Dry rocky and sandy places below 2,000 feet in Colorado Desert, to western Texas, northern Mexico, and Baja California (Mexico). Coning from March to April.

Propagation: From a minute amount of untreated seed, one seedling appeared in 12 days. It was raised and planted in 1953.

Culture: Situated in our desert garden, this species has continued to grow into a good sized plant. It began flowering during its sixth year, but no fruit has been observed to have been set.

Uses: As for other species.

***Ephedra viridis* Coville.**

Green Ephedra.

Shrub.

Natural Range: From the western edge of the Colorado Desert northward on the eastern slopes of mountains to Lassen County; and to western Colorado, at elevations of 3,000 to 7,500 feet.

Coning from April to June.

Propagation: One collection of garden harvested seed produced only one seedling in several attempts. However, a wild collection of untreated good seed produced a fine group of seedlings germinating within ten days. A large share of these were raised without any trouble and were ready for planting within ten months.

Culture: As for all species, this one does well in most conditions and has prospered well here. Ten-year-old plants were two to five-and-a-half feet tall and were three to nine feet wide. Flowering and seeding began during their fifth year in the garden.

Uses: The nice green foliage and stems of this species makes it an attractive plant for those who wish something different and useful in the landscape. It also is useful for making good Mormon Tea.

***Epilobium angustifolium* L.** [Ed: *Chamerion angustifolium* (L.) Holub ssp. *circumvagum* (Mosquin) Hoch. TJM2]

Fireweed.

Perennial.

Onagraceae. Evening-Primrose Family.

Natural Range: Usually found in fairly moist mountain clearings or disturbed places below 9,000 feet, throughout most of California; to Alaska, the Atlantic Coast, and Eurasia. Flowering from July to September.

Propagation: Untreated seed will germinate in five days. Seed germinated under cold-stratification indicated this procedure is unnecessary. However, seed appears to be short-lived - as two-year-old seed failed to come up when previously it produced abundant seedlings. Plants may be established by digging the underground rootstocks. Seed gathered from our cultivated plants failed to germinate.

Culture: Originally produced at the old site, where it grew vigorously, six clumps were moved to a moist location at our present site, in 1952. These did not take hold and were written off within a year. The same results occurred for another lot of over 100 seedlings. Apparently this species needed a more open soil condition than we provided.

Uses: In the right situations, this species could produce an abundance of color. It also, might become a garden pest as indicated by its abundance throughout its natural range.

***Epilobium watsonii* Barbey var. *franciscanum* (Barbey) Jeps.** [Ed: *Epilobium ciliatum* Raf. ssp. *watsonii* (Barbey) Hoch & P.H. Raven. TJM2]

Perennial.

Natural Range: Low, marshy places, immediate coastal areas from San Luis Obispo County to Del Norte County, and north to Oregon. Flowering from May to August.

Propagation: Untreated seed sown in a vernal pool site in heavy clay soil came up in 13 days, producing an abundance of seedlings. Since there was only enough seed for one sowing, it has not been handled since 1965.

Culture: Needs a moist, marshy-like place. Our sowing was eradicated by slugs, therefore further experience cannot be recorded.

Uses: Only of interest to botanic gardens.

***Epipactis gigantea* Hook.**

Stream Orchid.

Perennial.

Orchidaceae. Orchid Family.

Natural Range: Widely distributed in California in many plant communities, below 7,500 feet, along stream banks and wet, springy places to Baja California (Mexico), British Columbia (Canada), to South Dakota and Texas. Flowering from May to August.

Propagation: Only two attempts were made to germinate seed and both failed. The creeping rootstocks are readily established in pots or may be planted directly into suitable site.

Culture: While always needing a moist situation, it is found naturally in a wide variety of habitats, including moist alkaline clay soils in the desert with sedges, cattails, willows, etc. A 1941 collection, growing poorly at the old site, was dug in March 1951, and was re-established in five-gallon-cans, and were later planted in a moist location at the new site in March, 1952. Here they existed until overrun by a large shrub and were written off in their fifteenth year. Not until plants were found in the San Gabriel Mountains did we successfully establish this interesting orchid. Now, after five years, it grows well and has spread vigorously in a moist streamside location in partial shade.

Uses: Of interest to orchid hobbyists and to botanic gardens.

***Equisetum* L.**

Horsetail. Scouring Rush.

Perennial.

Equisetaceae. Horsetail Family.

Natural Range: Widely distributed in California in many plant communities, mostly below 8,500 feet (*E. arvense* L. to below 10,000 feet), in moist or wet places, along stream banks, marshy places, shallow pools, etc.

Propagation: Usually by division of the creeping rootstocks - and that is the only way that we have propagated the various species. Plants are readily established by this method.

Culture: Not particular as to soils, but need quite wet or moist situations. Our oldest collection, *E. hyemale* L. var. *californicum* Milde. [Ed: *Equisetum hyemale* L. ssp. *affine* (Engelm.) Calder & Roy L. Taylor. TJM2], was originally started in 1940, at the old site, moved to our present location as small clumps in February 1952.

They have all become well established and have spread vigorously. Other species more recently started have been *E. laevigatum* A. Braun. and *E. telmateia* Ehrh. ssp. *braunii* (J. Milde) Hauke.

Uses: Pools, streams banks, marshy areas, roadside ditches. Since they are extremely invasive, they should be used in containers or other preventive methods to curb spreading should be employed.

***Eriastrum* Wooton & Standl.**

Annuals. Perennials.

Polemoniaceae. Phlox Family.

Natural Range: Inhabiting several plant communities, this genus is widely distributed in California and adjoining states, usually at quite an elevation range, from near sea level to 10,000 feet. Typically in sharply drained sands and rocky soils.

Propagation: Seeds of annuals or perennials when sown in flats, will start germinating in five to eight days. When sown directly into a garden site, more time will be required. Attempting to raise perennial seedlings through to the gallon-can stage, severe losses were encountered during the final period. Indications are that if nursery procedure is followed, the plants should be moved out in pots no larger than four-inches in size. Direct seedling of annuals (and perennials) is preferred.

Culture: The species of this genus need dry, sharply drained soils, and are preferably kept on the dry side with regard to moisture. None of our collections survived for more than three to four years, and even then the results were generally poor. Flowers and seeding can be expected the first year during June and July. We grew the following species: *E. densifolium* (Benth.) H. Mason., *E. eremicum* (Jeps.) H. Mason., *E. sapphirinum* (Eastw.) H. Mason., and *E. sparsiflorum* (Eastw.) H. Mason., the latter being native to our area in a very light sandy decomposed granite loam.

Uses: While the small flowers are generally blue and often make fine displays in the wild during June, July, and August, they are only of interest to botanic gardens.

***Erigeron breweri* A. Gray var. *porphyreticus* (M.E. Jones) Cronquist.**

Perennial.

Asteraceae. Sunflower Family

Natural Range: Dry rocky places from 5,000 to 9,500 feet, in the mountains of central eastern California to Nevada. Flowering from May to August.

Propagation: One collection of wild untreated seed was sown over a period of four years, produced only a few seedlings, the best percentage of which was from a sowing made a year after harvesting. One lot was cold-stratified, but there is no advantage to this treatment. Seed appears to be short-lived as a sowing made after the fourth year failed to come up. The germination period was three months for the first sowing made about two and a half months after initial harvesting. After one year, a second lot came up in nine days. While raising the seedlings to four-inch pots there were only minor losses.

Culture: Attempting to duplicate the dry rocky and well-drained slopes of the natural habitat, we used the plants in our rock garden and desert garden. The plants bloomed and seeded freely the first year, growing to eight inches tall and 18 inches across. However, neither planting survived for more than five years.

Uses: Only of interest to botanic gardens.

***Erigeron foliosus* Nutt. var. *blochmaniae* (Greene) H.M. Hall.** [Ed: *Erigeron blochmaniae* Greene. TJM2]

Perennial.

Natural Range: Limited to the sand dunes along coastal San Luis Obispo and northern Santa Barbara counties. Flowering from July to August.

Propagation: Excellent results were obtained from fresh, untreated seed when sown in flats; germination began in six days and was mostly completed within 30 days. Put in three-inch pots, no losses occurred before setting out five months after sowing the seed.

Culture: Since the variety is a coastal sand dune plant, our first planting was made in the sand dune garden in 1963 and was placed in sun, partial-shade, and full shade. About two-thirds died within two years, however, those in shade or partial shade were surviving and in fair to good condition. It was too soon to say if the planting would be successful in this area. Nearer the coast, this variety would undoubtedly be more successful.

Uses: Coastal gardens with warmer temperatures and very sandy soils. A rather vigorous, almost shrubby plant, producing many bluish, daisy-like flowers.

***Erigeron foliosus* Nutt. var. *hartwegii* (Greene) Jeps.**

Perennial.

Natural Range: Sierra foothills and Coast Ranges from central California north to Oregon, mostly below 3,000 feet and usually in open, or brushy, rocky slopes. Flowering from May to August.

Propagation: Except for one collection of garden harvested seed, which took 30 days to germinate, all other lots, both wild and garden harvested, came up within ten to 13 days when sown untreated in flats. Both harvested and wild seed five-years-old failed to germinate. Only minor losses occurred during the seedling stage when they were raised either in four-inch pots or gallon-cans. The smaller pots, rather than gallon-cans, are completely satisfactory since the plants are usually ready for planting out within four to five months.

Culture: Plants set out in the clay soil of the mesa did not survive more than four years. Apparently they needed a drier situation and to be left undisturbed. Plants were noted as flowering and seeding profusely from their first year, enabling the additional harvest of seeds to maintain the variety.

Uses: Could be used on well-drained slopes among native brush for a bit of early summer color. Also of interest to botanic gardens.

***Erigeron glaucus* Ker Gawl.**

Seaside Daisy.

Perennial.

Asteraceae. Sunflower Family

Natural Range: Coastal bluffs, sand hills, and beaches, below 500 feet, the Channel Islands, and from San Luis Obispo County coast north to southwestern Oregon. Flowering from April to August and sporadically through the remainder of year.

Propagation: Numerous collections of untreated seed, both from the wild and garden harvested, germinated readily and well within a period of seven to 13 days. When sown directly into the garden, usually into a sandy-loam soil, a few days longer is required for germination. Through either method, we produced several hundred seedling plants, which required no special effort to bring them to sufficient planting size within a few months, in containers no larger than four-inch pots. Small to medium sized plants are easily re-established, and cuttings root quickly without pretreatment. We rooted 98% of one selected group of untreated tip cuttings in nine days. They had been collected in the wild six days before they were placed in the greenhouse. Seed five- to six-years-old, produced a satisfactory number of seedlings, but many were runty and had to be discarded.

Culture: Flowering and seeding occurred the first year. While individual plants may not have lived any longer at the old site, generally the species grew much better there than at the present Claremont site. Many of our plants here lasted not more than two to three years, although we have records of longevity up to seven or eight years. When these plants are planted in sandy loam or clay soil sites, there seemed to be some improvement in performance when they are grown in partial shade. Under cultivation, the species is apt to become two or three times as large as it does naturally, and consequently with any amount of irrigation, crown or root rots may occur rather quickly. Therefore the species should be used in closer proximity to the coast where little if any irrigation may be needed, once the plants are established.

Uses: Principally nearer the coast, rock garden, well-drained sandy loam, as a border plants or beside path, partial shade further inland.

***Erigeron peregrinus* (Pursh) Greene ssp. *callianthemus* (Greene) Cronquist.** [Ed: *Erigeron glacialis* (Nutt.) A. Nelson var. *glacialis*. TJM2]

Perennial.

Natural Range: Relatively uncommon in high mountains in moist to wet meadows from Tulare County northward, and more widely beyond California. Flowering from July to September.

Propagation: Nine plants transplanted from the wild were established readily in six-inch pots and were later planted out. This represents our only collection, therefore we have no experience with growing this species from seed.

Culture: Placed in a semishaded area in the rock garden, the planting was recorded dead after its third year. Undoubtedly this plant needs a relatively moist meadow situation and a somewhat cooler climate.

Uses: An attractive addition to a proper botanic garden site.

Eriodictyon Benth.

Yerba Santa.

Shrubs.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Natural Range: Very dry, rocky slopes, fans, washes, or ridges in several plant communities usually below 6,000 feet; about eight species are native to the southwestern U.S. and Mexico, with most centered in central and Southern California, though *E. californicum* extends further north into Oregon. Flowering from May to August.

Propagation: Six species, totaling thirteen collections from the wild were handled. Two of these were rooted underground rootstocks and the remainder were seeds. All seed collections were sown from a month or two up to six years after collecting. After sowing during the period between September to December, pine needles or excelsior were burned on top of the flat. For the six species raised, only one failed to germinate; both underground rootstock collections were readily established in six-inch pots. The shortest germination period was 16 days and the longest 51 days, but the average was from three to four weeks with completion from one to three months after first emergence. During the interim period before planting out, we encountered no problems with any of the collections during the seedling stages; most of them quickly becoming plantable within four to six months.

Culture: Since all of the species are notorious invaders, only a few plants of each species were used, and they were planted in the most inhabitable areas available. Even then, they spread out quickly, inhabiting areas considerably beyond their original site. Depending on the species, plantings soon attained heights of three to 11 feet and spreading out of their areas over 100 feet wide. Flowering and seeding started within two to three years. The following species are being successfully grown: *E. angustifolium* Nutt., *E. californicum* (Hook. & Arn.) Torr., *E. crassifolium* Benth., *E. tomentosum* Benth., *E. traskiae* Eastw., and *E. trichocalyx* A. Heller.

Uses: A fine group of plants for erosion control, and plants are very useful in more remote areas. Some species have been harvested for their medicinal properties. Under ideal conditions, some species have lovely, soft gray foliage. Some are highly aromatic plants.

***Eriodictyon angustifolium* Nutt.**

Shrub.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Natural Range: Rocky, dry slopes from 5,000 to 5,500 feet elevation in the New York Mountains in the eastern Mojave Desert; to Utah, Arizona, and Baja California (Mexico). Flowering from June to July.

Propagation: Two dozen rooted underground rootstocks were moved from the wild in May, 1958. Twelve of these were established in six-inch pots and were planted the following November. We have no experience with growing this species from seed.

Culture: Our planting quickly established itself in full sun, rapidly spreading by underground rootstocks in a very rocky, decomposed granite loam, mostly rock rather than soil. Within three years, a plot 50 feet by 50 feet was measured and soon afterward control methods were necessary. The colony was controlled by spraying its outer edges with 2,4-D and Aminotriazole. These treatments had a rather drastic effect, and we nearly lost the planting, however it came back and began spreading out again by its ninth year.

Uses: Erosion control, bank, or roadside plantings.

Eriogonum Michx.

Wild Buckwheat.

Annuals, Perennials, Shrubs.

Buckwheat Family.

Natural Range: A large and mostly western genus of about 150 species of which there are more than 75 species and numerous varieties native to California and adjacent states. Many of them are highly restricted in distribution, naturally occupying very small sites. Depending on the species, they are found at elevations from near sea level to over 12,000 feet. Consistently, they inhabit well-drained dry sites of sandy or rocky soils. One of the species, *E. fasciculatum* and its several varieties, occupies a large share of the low elevations hillsides and mountains, being one of the primary and most abundant plant species throughout the state.

Propagation: Untreated seed for all species when sown in flats will, on the average, begin to emerge within seven days. Occasional lots may take a few days longer, but a high percentage of the many lots we have handled rather consistently began coming up in five or six days. Average time for maximum germination usually occurred within a month. Excellent results, though taking somewhat longer to come up, may be obtained by sowing the seed directly into the garden. This procedure was followed for a large number of lots we sowed, and with all species and varieties. If sown in flats or in outside seed beds, the small seedlings can be easily transferred to containers or used to extend the area of the planting in the garden. We generally found the seedlings moved easily and were established with little trouble. Volunteer seedlings are usually produced in great quantities in most locations. To preserve a prostrate form of *E. fasciculatum* and to provide additional plants of *E. lobbii* (which failed to set viable seed in our area), we rooted an adequate number of plants, attaining at least 90% rooting, with both untreated and treated cuttings. In fact, untreated cuttings rooted just as quickly and with as high a percentage as did treated cuttings.

Culture: While in nature wild buckwheat can be found in quite diverse habitats, they generally are growing in light sandy or sharply drained soils and usually under quite dry conditions, excepting for the higher altitudinal species, which may be covered with snow for considerable periods during the year. While we had excellent results planting many species in heavier soils, their average life span was shorter. In such areas, little or no irrigation should be practiced. However, since quantities of volunteer seedlings come up around the mature plants, one has no problem in maintaining most kinds, particularly those from lower elevation habitats. The cultivated species are mostly from along the California coast.

Ideally, these plants should be planted in full sun, provided with sharp drainage, such as a loose gravelly soil, and once established given little additional irrigation. Some species, such as *E. fasciculatum* and its varieties, are likely to become quite dry and shabby looking during and after the long, hot dry season. Once a month irrigation will keep them brightly green and much more attractive. This also is a protection in high fire hazard areas, since this plant will burn quickly after several months without moisture.

The following kinds with additional notes have been raised during this 15-year period:

***Eriogonum apricum* J.T. Howell.** – A rare and unusual perennial endemic found scattered in the clay hills of Amador County near Ione and Buena Vista. We acquired a total of 14 plants of

which we established seven in small pots. These were later planted in the rock garden, and subsequently a few flowered were noted but it is unknown if viable seed was set. Within a period of two years, all plants were recorded as dead. Since this endemic appears to need exact soil requirements, it would be doubtful if we could establish it here.

***Eriogonum arborescens* Greene.** Tree Buckwheat. – Native only to Santa Cruz, Santa Rosa, and Anacapa islands. This attractive plant has been one of the most successful species grown in the genus. Well-established plants are found in a variety of locations in the garden. Rather moderately slow in growth, this species develops into interesting shapes. When grown under dry conditions they will live for many years. One of the few species of this group that can be recommended as a “bonsai” specimen. Quantities of seedlings come up around the mother plants, soon extending the plantings. Seed may be sown directly into a garden site without going through nursery procedures. In ten years, plants may reach heights of four to five feet and may spread to eight feet wide. Flowering and seeding will start within the second year.

***Eriogonum caespitosum* Nutt.** – While there was no problem in producing an ample quantity of seedlings, and even though special site preparations were made, this high elevation perennial from the dry mountains of eastern California grew poorly. The one 1956 collection of seedlings, and the 1958 plants raised from several resowings, were all recorded as dead within two years.

***Eriogonum cinereum* Benth.** – This Southern California beach and coastal bluff species, is easily established in either sandy loam mounds or heavy clay slopes, both conditions have been equally successful. Plantings on flat ground worked well, too. Numerous volunteer seedlings keep an abundant supply of new plants coming along. However, our earliest original plantings made fifteen years ago are still strong and abundant. They have developed well in full sun, partial shade, or shade, and now measure two to three feet tall and have spread eight to ten feet wide. Flowers and seeds are produced during the second year.

***Eriogonum cinereum* x *Eriogonum giganteum*.** – One adventive seedling appeared in the garden at the old site. Its parentage was deduced. Seed was harvested, and proved viable, and a large quantity of seedlings were grown in 1951. These were used in the new site, and as was to be expected, there was a great variability in the appearance of the seedlings, few resembling the original mother plant. No attempt was made to maintain this natural cross.

***Eriogonum crocatum* A. Davidson.** Conejo Buckwheat. – This buckwheat grows on the northern base of the Santa Monica Mountains in Ventura County, in scattered populations in the general area of the Conejo Grade. This lovely buckwheat has perpetuated itself easily for over 30 years in our garden. Our original collection was obtained in 1937. We have used this species extensively and it has scattered itself around and into a variety of habitats in the garden. The bright clear gray of the foliage, its low growth habit, and the nearly-constant (under cultivation) saffron yellow flowers make it a most attractive plant for use in drier gardens. It is particularly well suited for use in rock gardens.

***Eriogonum dasyanthemum* Torr. & A. Gray.** – This erect annual from the dry slopes of the Inner Coast Ranges from Lake to Amador counties, was produced successfully at the old site. The seed harvested there was sown here four and five years later, but resulted in failure both times. There was no noted indication for such failure.

***Eriogonum davidsonii* Greene.** – A strikingly colorful plant when seen in the wild, this annual was first produced in 1958 by sowing the seed directly into the garden site. It was never as pretty

under cultivation. This, perhaps, was due to the garden's lower elevation and to our soil conditions. Even though the plants performed satisfactorily, and seed was left to naturalize, no seedlings were ever found in subsequent years.

***Eriogonum fasciculatum* Benth.** California Buckwheat. – Covering the dry slopes of the immediate coastal hills from Santa Barbara County to northern Baja California (Mexico), this commonly seen plant with its **var. *foliolosum* (Nutt.) Abrams.**, which has a greater distribution northward to San Benito County and further inland, are two of the most abundant and hardiest of the wild buckwheats. Easily produced by seeds, cuttings, or rooted stems, plantings may be established on hillsides, steep slopes for erosion control or general ground covering. An occasional application of water, keeps it green throughout the hot, dry season when fire hazard is most dangerous. A very low growing form was discovered and brought into cultivation by the late Theodore Payne. We have been growing it for several years on the mesa, in heavy clay, and it has done very well. Produced from cuttings, and by seed, we have selected the best types and now have a rather low, uniform groundcover, growing to not over one foot tall. It must be kept quite dry as it seems to be more sensitive to excess moisture than the true species or variety. We have named it ***E. fasciculatum* 'Theodore Payne'**. The **var. *polifolium* (Benth.) Torr. & A. Gray.**, grayish foliaged and somewhat lower growing, inhabits large desert areas inland from the other varieties and extends into adjacent states. We generally had poorer results germinating the seed of this variety, and consider it to be less adaptable to cultivation. It needs the sharpest drainage and driest spot available in the garden. Once established and growing under proper horticultural conditions, handsome plants with lovely soft gray can be enjoyed.

***Eriogonum giganteum* S. Watson.** St. Catherine's Lace. – This handsome species, a native of Santa Catalina Island (the **var. *compactum* Dunkle.** is from Santa Barbara Island, and the **var. *formosum* K. Brandegee.** is found on San Clemente Island, neither of which have been grown by us), when properly developed has been measured in cultivation to eight feet tall and spreading over ten feet wide when in full flower. A specimen discovered in its native habitat, measured 12 feet tall and four feet wide, and had a trunk diameter of five inches. The inflorescence, standing above the leaves, is a compound, flat-headed cyme composed of numerous small whitish flowers, may measure as much as a foot across. As the flowers age, they turn to varying shades of soft browns. Handsome dry arrangements last for months without any water. Since the dried floral parts become very brittle, such arrangements should not be used when there is much traffic. Plants grow best in dry, well-drained soils, otherwise they can rather rapidly succumb to less than desirable conditions. However, so many volunteer seedlings appear each spring that there is no problem in maintaining this species in the garden.

Eriogonum grande* Greene.** – On the bluffs and cliffs of Santa Cruz, Santa Catalina, Anacapa, and San Clemente islands, this species is quite prevalent. Since 1957 and 1958, we have maintained a suitable number of specimens in our coastal sand dune garden. It did not fare well when grown in heavier soils. A compact form was acquired in 1957 and this plant has continued to live happily in the coastal dune garden. The **var. *rubescens* (Greene) Munz.**, is a more colorful plant, and is found on San Miguel and Santa Cruz islands. This taxon has been perpetuated since 1937 by raising a number of lots of plants in the nursery and from thousands of volunteer seedlings in the garden. There has been a considerable amount of variation noted in subsequent generations of this plant, probably due to natural hybridization. In general, the **var. *rubescens has been maintained easily, although it is somewhat short-lived.

***Eriogonum kennedyi* Porter ex S. Watson var. *austromontanum* Munz & I.M. Johnst.** –

Among the dry, granitic rock slopes among the yellow pines in Big Bear Valley in the San Bernardino Mountains, at about 7,000 feet elevation, dwells this densely matted perennial plant that grows less than four inches tall and spreads into mats measuring several feet across. Small heads of flowers are composed of several tiny, whitish blooms, mounted on thin, wiry stems, rising above the mats by several inches. A 1956 seed collection produced a few seedlings, which were then planted out in the rock garden. These plants have spread many feet across and have produced numerous seedlings, which in turn have increased the display considerably. Dying patches of a mat may cause some concern, but this is normal, and is a condition regularly noted in the wild. An excellent rock garden subject, these soft gray plants creep artistically over and around suitable rock outcroppings.

***Eriogonum latifolium* Sm.** – Along the immediate coast from San Luis Obispo County to Oregon, this commonly found species inhabits sandy places and bluffs in some quantity. We used this species principally in our coastal sand dune garden, but we could never maintain it for any length of time. Here, it is highly susceptible to root and crown rot. Our losses were extremely high, perhaps due to the dense covering of leaves and sprawling stems keeping the soil moist adjacent to stem and crown wet too long. This has been one of the least successful species in our garden.

***Eriogonum lobbii* Torr. & A. Gray.** – In a specially prepared site of crushed granite rocks and loam soil under a large oak tree, one plant grown from a cutting has done nicely for 15 years. Flowering has been sparse, and no viable seed production has been noted, but we have increased our number of plants by cuttings and rooted runners spreading from the base of this high altitude, low spreading plant. Surprisingly, this species, while not overly vigorous, has always been considered to be in good condition. In 15 years, the plant was recorded as being five inches tall and 26 to 42 inches wide.

***Eriogonum nudum* Benth.** – While a 1949 wild seed collection sown four and six years after harvesting failed to germinate, a 1953 wild collection gave us 23 plants. When planted in a very rocky, well-drained slope, they failed to survive for more than five years. Many more seedlings were raised from a collection of the **var. *scapigerum* (Eastw.) Jeps.**, but our ability to maintain it for more than five years also failed. Flowers and seeds were produced by the first lots and those in turn gave us additional plants. None lasted more than five years even when they were grown in several different experimental sites.

***Eriogonum ovalifolium* Nutt.** – While not producing a large number of seedlings, we grew a representative stand of this perennial in our rock garden for about six years. Densely cushioned plants spreading to three inches or more across slowly developed. This species would be an excellent rock garden plant if it could be maintained under most gardening conditions.

***Eriogonum parvifolium* Sm.** – Common on the bluffs and dunes along the coast, this species is found between Monterey County and San Diego County. Easily grown, usually producing quantities of seedlings within a few days of sowing. When grown in inland gardens, it appears to do best in heavier clay soils than in very dry, rocky granitic loams. Vigorous plants grow rapidly to several feet tall in the mesa's clay soil, while plants less bulky were noted in rocky soils. Since in nature it is purely a coastal species that is bathed with cool moist air a large percentage of the time, growing this plant in this far inland garden site with high summer temperatures requires the exercise of more careful horticultural practices. On average specimens lived six to eight years,

and flowered and seeded within the first or second year. The **var. *paynei* (C.B. Wolf ex Munz) Reveal** [Ed: the var. is not recognized in TJM2], an entity from Santa Paula Canyon, Ventura County was grown from the original collections made in 1939 and 1953. The history of this variety paralleled that of the species.

***Eriogonum saxatile* S. Watson.** – We began producing this perennial species from a wild collection made in 1954. The lovely silvery-gray low rounded plants flowered by the second year in our rock garden and additional lots were sown both in the nursery and directly into the garden site. While short-lived for us, we produced enough plants to keep it going for over ten years. After blooming the second year, there was a decline in the vigor of the plants. An excellent rock garden subject under proper conditions.

***Eriogonum umbellatum* Torr.** – Four plants were lifted and moved in February 1951 from the old garden site. Three survived and were planted in August 1951, in a semishaded spot with a high percentage of humus mixed with crushed granite. One of these has survived and is now 18-years-old. In good condition, its height is six inches and its spread is 15 inches. It flowers sparsely each year, but it produces little or no seed. The **var. *polyanthum* (Benth.) M.E. Jones** has been grown more frequently. We obtained two wild collections of seed in 1952 from which several subsequent lots of seed have been gathered. Fine displays of the bright yellow flowers appear atop short stems above this low growing plant. Plants grown in the rock garden provide a high degree of interest. An excellent rock garden plant, but this species needs very sharp drainage and little irrigation.

***Eriogonum ursinum* S. Watson.** – This very prostrate perennial species makes a fine rock garden plant. We have successfully grown it since 1959. The plants, not more than an inch or two high, spread out over a foot across. The inflorescences are borne on rather weak stems in our area and tend to fall over thereby losing some of its neat appearance. Several lots of seed have been harvested, and many additional plants have been planted in the rock garden.

***Eriogonum wrightii* Benth. var. *trachygonum* (Benth.) Jeps.** – This perennial subshrub was produced from two wild collections of seed acquired in 1952 and 1953. Many of the seeds germinated and we planted out many seedlings in sunny, dry, well-drained, rocky soils, such as the rock garden and adjacent filled, rocky areas. Here this entity has flourished under neglect, a condition best for a large share of the wild buckwheats. Additional plants have been produced by directly sowing garden harvested seed into the same areas. While not an overly attractive variety, it can be considered a very hardy one, doing well under extreme conditions as well as liking a bit of coddling.

***Eriophyllum confertiflorum* (DC.) A. Gray.**

Golden Yarrow.

Shrub.

Asteraceae. Sunflower Family.

Natural Range: This brightly-flowered herbaceous subshrub is widely distributed throughout most of California from sea level to 8,000 feet, and inhabiting open spaces on brushy slopes and is consistently found growing in loose, well-drained soils. Flowering from April to August.

Propagation: Fresh, untreated seed sown in flats consistently germinates in seven to ten days. Seed three- or more-years-old took 20 to 30 days and produced many runty, unusable seedlings.

This fact held true in the same lot of seed gathered from the wild. Some caution must be taken in transplanting the seedlings, as they are easily susceptible to damp-off fungi. We never grew them into larger than three- or four-inch pots before planting them out into the garden, and we experienced only minor losses growing these plants in the nursery.

Culture: If planted in a sunny, well-drained light soil – a condition this plant appreciates most – patches of bright, yellow flowers, borne in abundance, may be had in the late spring and early summer. Losses will be great should they be grown in other than a dry, well-drained location. In richer, heavier soils, the plants become leggy, fall over, and are much less attractive. In proper locations, new seedlings appear each season, and are always welcome since the species is comparatively short-lived, particularly under cultivation.

Uses: Sunny, open hill slope spaces among low brush; desert-like gardens.

***Eriophyllum lanatum* (Pursh) J. Forbes.**

Herbaceous perennial.

Asteraceae. Sunflower Family.

Natural Range: The species and its eleven California varieties, are far ranging throughout the state and reach into several bordering states north, south, and eastward, from sea level to over 10,000 feet, in dry, loose soils among low brush. Flowering from April to August.

Propagation: Several varieties, numbering many lots of seeds, both from wild and cultivated plants, consistently germination in ten to 13 days, with a few coming up a few days earlier and a few days later. Again, caution needs to be used in raising the seedlings to planting size. It is unnecessary to move them into larger sized containers than four- to five-inch pots. The seedlings will be ready to set out in a matter of three or four months. The following varieties have been handled the past fifteen years:

***Eriophyllum lanatum* var. *arachnoideum* (Fisch. & Ave-Lall.) Jeps.** – Grown from an original seed collection gathered in 1941.

***Eriophyllum lanatum* var. *grandiflorum* (A. Gray) Jeps.** – ?

***Eriophyllum lanatum* var. *integrifolium* (Hook.) Smiley.** – ?

***Eriophyllum lanatum* var. *monoense* (Rydb.) Jeps.** [Ed: *Eriophyllum lanatum* var. *integrifolium* (Hook.) Smiley. TJM2] – This one seed sown directly into desert garden, but the few seedlings did not survive very long.

Uses: As suggested for *E. confertiflorum*.

***Eriophyllum nevinii* A. Gray.** [Ed: *Constancea nevinii* (A. Gray) B.G. Baldwin. TJM2]

Shrubby Perennial.

Asteraceae. Sunflower Family.

Natural Range: On the rocky coastal bluffs of Santa Catalina and San Clemente islands. Flowering from April to August.

Propagation: Initial germination of untreated seed sown in flats occurred in eight to 14 days, the sowings having been made during months of August to November. No trouble was encountered

during the first stages after transplanting the seedlings. If the plants are to be kept in the nursery for longer periods, it will be necessary to shift them into gallon-cans. These larger plants can be difficult to maintain during the summer months, when a larger percentage are lost since more irrigation was required during that period. Seven out of eight cuttings brought from the wild, treated with Rootone, rooted in 12 days when inserted in April 1962. Four of these survived for use in the garden.

Culture: Since this species is usually found growing on steep coastal cliffs, they should be provided with sharp drainage in cultivation and given little, if any, water during the summer months, when the plants are naturally dormant. Inland, a little protection from the hot sun is welcome. In winter, where temperatures might drop much below 30° F, additional protection must be provided. In such areas, it is generally best to wait to plant this species until spring. Under cultivation, this species may reach from four to five feet tall and may spread as much as four feet wide. It has not been very long-lived for us, the oldest surviving for ten years

Uses: The large, flat head of bright yellow flowers in contrast to the interesting, finely cut gray foliage, makes this an attractive shrubby perennial in the garden. Useful on drying slopes mixed in with soft chaparral.

***Eriophyllum staechadifolium* Lag. var. *artemisiaefolium* (Less.) Macbr.** [Ed: the var. is not recognized in TJM2]

Shrubby Perennial.

Natural Range: Grows in fields along the shore, near the coast, from the Channel Islands, Santa Barbara County north to Coos Bay, Oregon. Flowering from March to August.

Propagation: Untreated seed will come up in six or seven days when sown in flats. We had no trouble with raising the seedlings, although care must be exercised in their irrigation.

Culture: Plants must be kept on the dryish side, particularly if planted in less well-drained areas. Plants will accept a wide range of soils and conditions, but needs little water once established. Inland it is short-lived, but if handled as an annual or short-lived perennial, very bright scenes may be produced on sandy hillsides.

Uses: Only as a component in a mixture in soft chaparral covered slopes and hillsides nearer the coast.

***Eriophyllum wallacei* (A. Gray) A. Gray.**

Annual.

Natural Range: In sandy and rocky washes, fans, and mesas of both our deserts from Mono County to San Diego County, and to Utah, Arizona, Baja California (Mexico). Flowering from March to May.

Propagation: Our seed is always sown directly into a specially prepared site: a mound of sandy loam and crushed granite. Using this practice, we have produced creditable stands of this lovely, prostrate annual with its very bright yellow heads of flowers covering the plant most completely. Never attaining more than two inches high, the plants spread out to several inches wide. In the deserts, the sandy open spaces may be sheets of yellow with this attractive annual. We experienced some difficulty in establishing a cultivated strain of seed, but eventually we

harvested enough to be able to have a reasonably good showing each season. Wet, cold winters are very deleterious to its health.

Uses: Only for the inland, warmer areas where suitable desert-like sites are present.

***Eryngium articulatum* Hook.**

Bee-Thistle.

Perennial.

Apiaceae. Carrot Family.

Natural Range: Usually found in wet places below 400 feet from the lower San Joaquin Valley to Trinity, Siskiyou and Modoc counties; and to Idaho. Flowering from May to September.

Propagation: Seed was harvested from cultivated plants at the old garden site in 1950, and was subsequently sown untreated in September 1953. These seeds germinated in ten days and produced over 50 seedlings from a trace of seed. All but two were raised to gallon-cans for planting the following April.

Culture: Two sites were chosen, one in the heavy clay soil of the mesa and the other in a sand dune area where they were kept moist. In neither site did the plants prosper and all were all gone within two years. Even plants adjacent to a wet stream area failed to respond. Our results were not as satisfactory as at the old site in adobe clay.

Uses: Only for botanic garden collections.

***Erysimum* L.**

Wallflower.

Annuals, Biennials, Perennials.

Brassicaceae. Mustard Family.

Natural Range: Of the 11 species and five varieties native to California, most of them are endemic to the state. They grow in a variety of habitats: sand dunes, coastal bluffs, rocky plateaus, etc., ranging in elevation from sea level to 12,000 feet. Flowering from February to May, and later at higher elevations.

Propagation: Untreated seed sown directly into open garden sites came up in 15 to 30 days, while those sown in flats emerged in five to seven days. We always had excellent germination and there was no problem in raising the seedlings in the nursery, in three- to five-inch pots. Initially we sowed the seed directly into garden sites, but the resulting plants were more difficult to bring to maturity. We found it more satisfactory, and quicker, to produce plants in the nursery where all conditions could be controlled.

Culture: The species and varieties that we raised appeared to grow better in light sandy loam soils and are best kept on dry side (they will not tolerate excessive moisture). While some were planted in the tighter clay of the mesa, they did not perform well. None of the kinds we handled lived more than two to three years with an occasional individual living to five years. In the best locations, volunteer seedlings could be counted on to keep the species going. These plants are best handled as annuals or short-lived perennials. First flowering and fruiting of all the taxa listed

below was recorded in their first year. The following kinds have been raised during the past 15 years:

Erysimum capitatum (Hook.) Greene. – Most extensively grown for several seasons.

Erysimum capitatum var. *angustatum* (Greene) Rossbach. [Ed: the var. is not recognized in TJM2] – Grown continuously since 1947.

Erysimum capitatum var. *bealianum* (Jeps.) Rossbach. [Ed: the var. is not recognized in TJM2] – Used in desert garden where it was observed for ten years.

Erysimum concinnum Eastw. – Failed to germinate.

Erysimum menziesii (Hook.) Wettst. – Our records are incomplete, but the plants failed to survive for more than a year.

Erysimum suffrutescens (Abrams) Rossbach var. *grandifolium* Rossbach [Ed: the var. is not recognized in TJM2] – Has been raised over a period of ten years.

Uses: A border plant or useful as an annual or rock garden plant, or in plantings on open slopes.

Erythronium L.

Adder's-Tongue. Fawn-Lily.

Perennial.

Liliaceae. Lily Family.

Natural Range: Twelve species are native to California in shaded areas with considerable humus, mostly in northern California from 700 to 8,000 feet in elevation. Depending on species, flowering from March to August.

Propagation: Seeds were gathered in the wild in October 1954 and were sown on three occasions. Each time the seeds were cold-stratified, the first time in a glass jar with sand. The second and third times, each a year apart, the seeds were sown directly into flats. The period of cold-stratification for each lot was 65, 87, and 115 days respectively. In each lot, germination had occurred sometime before their removal from the cold. Since this is the only method we used, it is unknown whether cold-stratification is needed, but in any case, we recommend a shorter period of 45 to 60 days. When the seedlings were sufficiently large, small clumps were removed from the flat and put in six-inch pots. However, our results were failures, as there was a gradual rotting of the tiny bulblets. *E. grandiflorum* Pursh var. *pallidum* H. St. John [Ed: the var. is not recognized in TJM2] took two years to germinate, and that was only after two periods of cold-stratification and in sphagnum moss.

Culture: It is doubtful that these plants can be raised satisfactorily in this area. In any case, partial shade or full shade plus a fairly moist rich, porous soil with a high percentage of leafmold is indicated. One collection was raised for two years after which it failed to appear.

Uses: Woodland situations, rock gardens, beside pools or streams.

Eschscholzia Cham.

California Poppy.

Annuals, Perennials.

Papaveraceae. Poppy Family.

Natural Range: Throughout a large part of California, the eight or ten species plus several subspecies are usually observed growing in grasslands, open spaces, on brushy hillsides, and desert flats and rocky benches, at elevations from near sea level to 8,000 feet, depending on species and location. Flowering in March, April, May, or June, and with *E. californica* Cham. continuing as long as September.

Propagation: Since the species are difficult to transplant, the usual method for germinating the seed is to broadcast it directly into the selected site, usually in the fall months. In areas where frost and snow prohibit this procedure, sowing can be delayed to the earliest time in the spring. Both annuals and perennials will germinate within 15 to 20 days, provided adequate and constant moisture is present in the soil. Seeded areas need to be protected since birds will devour the seed or freshly germinated seedlings. To preclude undue rotting of young plants, thinning should be practiced if the area gets more than usual moisture. Except for the perennial, *E. californica* Cham. and its many forms, the annuals are best sown in sandy or light loamy soils with good drainage.

Culture: Little needs to be said about growing the perennial, *E. californica* Cham. and its several forms which have been treated botanically as varieties by many botanists. It has been grown the world over and will naturalize in many kinds of habitats. Quantities of volunteer seedlings are usually produced and gradually spread over large sections of country. Often flowering under cultivated conditions may be observed through most of the year, particularly if the spent blooms and plants are cut back after the initial flowering period in the spring. Many striking flower and color types have been produced over the years by commercial seed growers. We have grown several of these and consider them to be of great interest to the gardener, as judged by the constant comment by our visitors.

The annuals, of which there are several species, are little known in cultivation, except perhaps, *E. lobbii*. Ranging in color from clear yellow to yellow orange, with tiny- to medium-sized flowers, they are an interesting group useful for rock gardens, small, intense plantings in well-drained areas. We find they do best in sandy loam or sharply drained rock gardens. They are quite susceptible to crown rot and therefore need this type of situation in the garden. The desert annual species have been most difficult. In fact, we cannot say we have attained any degree of success in growing them. The following annuals have been grown:

Eschscholzia caespitosa Benth. – Sown and enjoyed yearly since 1933, a long-flowering species but reaching its zenith in April and May.

Eschscholzia caespitosa Benth. ssp. *kernensis* Munz. [Ed: *Eschscholzia lemmonii* Greene ssp. *kernensis* (Munz) C. Clark. TJM2] – This distinct type from the Tejon Ranch in Kern County was grown much more successfully at the old site than in our present site. It appears to need a little heavier soil, and some other conditions which we could never ascertain. We have maintained it since 1935. The flowers are a much deeper color and are larger-flowered than *E. caespitosa*.

Eschscholzia glyptosperma Greene. – Several attempts with this desert species have been unsuccessful, usually a few sickly plants will grow and bear a few flowers. Mostly, they do not survive through our colder wetter winters.

Eschscholzia lobbii **Greene.** – Most successfully handled in our rock garden, where it produced colorful vistas among the rocks. Even there, great care had to be exercised that they did not succumb to crown rot.

Eschscholzia minutiflora **S. Watson.** – One collection from the Mojave Desert failed to come up.

Eschscholzia parishii **Greene.** – This desert species did a little better for us, one collection volunteering each season for seven years. While the plants were never strong, they produced a good show of flowers. Other collections of the same species failed or were not happy here.

Eschscholzia ramosa (**Greene**) **Greene.** – Two collections gathered in 1962 on San Clemente Island have not responded very well. Sown in rows to increase seed supply, they have done poorly in the tight clay soil, indicating the site needs to be changed for better results.

Uses: Roadsides, open fields, wild areas, colorful displays in difficult spots.

Euchnide urens (**A. Gray**) **Parry.**

Rock-Nettle.

Shrub.

Loasaceae. Loasa Family.

Natural Range: Dry rocky places from 2,000 to 4,500 feet, from the Death Valley region and eastern desert mountains to Utah, Arizona, and Baja California (Mexico). Flowering from April to June.

Propagation: Even though untreated seed started emerging in ten to 15 days, very few seedlings appeared, indicating that the seed has a low percentage viability. One lot of six-year-old seed produced four seedlings while another collection of fresh seed and a much larger quantity of seed gave only one plant. These were raised through the nursery but plants never grew strongly.

Culture: Used in the rockiest and driest spot in the desert garden, the young plants failed to survive more than a year.

Euonymus occidentalis **Torr.**

Western Burning Bush.

Shrub.

Celastraceae. Staff-Tree Family.

Natural Range: Damp wooded banks and canyons, below 5,200 feet from Monterey County to Siskiyou County; and to Washington. Flowering from April to June.

Propagation: We have not grown this species from seed. However, it has been suggested that three months of cold-stratification may be helpful. Germination of seed of the **var. parishii** (**Trel.**) **Jeps.**, indicates otherwise. Our material came from small dug plants. After being grown at the old site for seven years, 11 plants were dug and placed in five-gallon-cans that were later moved to the Claremont site. (See Everett, 1957. Pg: 108.)

Culture: Needs moist, acid conditions and partial to full shade, depending on the site. Since shade and the proper site were not available at the time we moved our plants from the old

garden, we had to place them in full sun, in rocky, decomposed granite loam. Here they gradually died until all were gone within ten years.

***Euonymus occidentalis* Nutt. var. *parishii* (Trel.) Jepson.**

Shrub.

Natural Range: Seen occasionally canyons in the San Jacinto, Cuyamaca, and Palomar Mountains of Riverside and San Diego counties at 4,500 to 6,500 feet.

Propagation: One collection of seeds and cuttings were gathered from the wild in September, 1955. Two days later, one lot of seed sown and put under cold-stratification for a period of 78 days. The second lot was untreated, and 24 days later it started coming up. The cold-stratified lot started coming up 19 days after its removal from the cold. Both lots of equal amounts of seed produced almost the same number of seedlings, although the untreated lot had a few more. A second later collection was cold-stratified and all but one seed came up after 32 days. At least for very fresh seed, the indication is that for this variety, cold-stratification is unnecessary. Two additional attempts two years later failed to germinate, indicating that the seed is short-lived. At the same time as the seed was collected, rooted runners and semihard cuttings were gathered. All of the runners and all the untreated cuttings were rooted, the latter taking 37 days to start rooting. No seedlings or rooted cuttings were lost until after going into gallon-cans and growing in the lath house. They became severely infested with red spider mites and mealy bug. Constant application of spray materials was necessary and there was some loss of plants.

Culture: While the plants were provided with the best location possible, there was generally rapid loss of plants until all were gone except for about three plants which still remain alive, having made slow growth in a partially shaded spot with much humus and rocky soil. No flowering or seeding has been observed in the ten years we have grown them.

Uses: Botanic garden collections.

***Eupatorium occidentale* Hook.** [Ed: *Ageratina occidentalis* (Hook.) R.M. King & H. Rob. TJM2]

Perennial.

Asteraceae. Sunflower Family.

Natural Range: At base of granite boulders at elevations of 4,000 to 12,000 feet, in the mountains of northern California, to Washington, Idaho, and Utah. Flowering from July to September.

Propagation: Initial germination of untreated seed started in 11 days, but maximum germination occurred in about four months. Seedling loss in the nursery was minimal and none died after placement in gallon-cans.

Culture: Plants were planted one year after the seed was sown. This species grew well in a sunny, decomposed granite loam for about one year. Moles began invading the area, causing unusual disturbance of the roots that resulted in high plant mortality until all were recorded as lost within four years. Other collections failed to survive for more than a year or two, even when unattended by the ubiquitous moles.

***Euphorbia misera* Benth.**

Shrub.

Euphorbiaceae. Spurge Family.

Natural Range: Scattered on coastal bluffs of Orange and San Diego counties, western Colorado Desert, and Santa Catalina Island. Flowering from January to August, but also intermittently throughout the year.

Propagation: Untreated seed sown in a flat will come up in five to seven days. However, since the seed is difficult to harvest and perhaps due to poor viability, few seedlings can be obtained at any one time. There is no problem in raising the seedlings to planting size, since at no time did we incur any losses in the nursery. Taking cuttings from wild plants, our results were a complete failure. But at least 95% rooted when tip cuttings were taken from side shoots of plants in gallon-cans in the nursery. These were handled in the usual manner and without any rooting compound. Cuttings were taken in June and July.

Culture: Only two plants have survived winter frosts, all being killed the first season after planting. Only those that were fully protected by other plants survived. Therefore this species cannot be grown in areas where temperatures may fall below 28° F until they have become well established. It is an interesting plant useful in coastal bluff gardens where it easily withstands the buffeting of winds and the effects of the salty atmosphere. It may be considered long-lived and needing no attention in the proper areas.

***Eurotia lanata* (Pursh) Moq.** [Ed: *Krascheninnikovia lanata* (Pursh) A. Meeuse & A. Smit. TJM2]

Winter Fat.

Shrub.

Chenopodiaceae. Goosefoot Family.

Natural Range: This important browse plant is a common inhabitant of sandy flats and rocky mesas at elevations above 2,000 feet, from the Mojave Desert north along the eastern base of the Sierra Nevada, to Washington, the Rocky Mountains, Texas, and Sonora, Mexico. Flowering from March to June.

Propagation: Every lot of untreated seed of three collections from the wild came up in two days. Complete germination was rapid, but the germinative capacity of the seed is poor. There was little trouble in raising the seedlings through the four-inch pot size, but great care had to be exercised in growing the plants through the gallon-can size during the summer months. We always managed to raise at least 50% and had an adequate amount ready for the field.

Culture: This plant needs well-drained, sunny, dry areas. Usually there has been a 25 to 50% loss during the first five years, after which the plants seemed to take hold and losses were comparatively small. Ten-year-old plants ranged in height from two to three feet and spread to seven feet. Flowering and seeding began from the second to fifth years.

***Eustoma exaltatum* (L.) G. Don.**

Catchfly Gentian.

Perennial.

Gentianaceae. Gentian Family.

Natural Range: Seen occasionally along the Santa Ana River in Orange and San Bernardino counties, and in the deserts below 1,500 feet; to Florida, to the West Indies, Mexico, Baja California (Mexico). Flowers at any time of the year.

Propagation: We have sown seed in flats and directly into garden sites. Untreated seed will germination in 15 days in flats while it may take 30 to 60 days under best conditions in the garden. Since the seed is very small, great quantities of seedlings can be had from only a tiny pinch of seed. We experienced no trouble in raising the seedlings to planting size.

Culture: Judging from our experience with this species at the old site, it needs a moist, sandy loam. While we had a presentable display here, they were very poor specimens and lived a short time. It should be considered an annual under cultivation. We did not have as good results in our present site, and what seed was produced was of no value as it failed to germinate in successive sowings.

***Fallugia paradoxa* (D. Don) Torr.**

Apache Plume.

Shrub.

Rosaceae. Rose Family.

Natural Range: Occurs in a variety of dry rocky soils in the mountains of the eastern Mojave Desert, to southern Nevada, southwestern Colorado, western Texas and south into Mexico. Flowering from May to August.

Propagation: Untreated fresh seed will germinate within four to ten days. We tried cold-stratification on several occasions, and while we got results, it was much slower and unnecessary. One lot treated with Thiourea failed to respond any quicker. Two lots were sown in open ground, but results were slower and less satisfactory. Prior to shifting the seedlings to gallon-cans, we suffered only minor losses. Carrying the young plants through the summer months in the lath house was difficult and losses were high. Either the seed should be sown early – say August or September – to produce the plants quickly so they may be planted in the garden before the summer months, or to carefully keep the plants on the dry side during that period. That is a difficult procedure.

Culture: Probably from conditions already established in gallon-cans, we had trouble preventing a high mortality during the first three years in the garden. When planted in rocky, decomposed granite loam, the young plants were slow to start. However, once established, the plantings progressed rapidly and no further losses were sustained. Flowering and seeding began in the third or fourth year; after ten years of growth, the plants ranged in size from two to seven feet tall and spreading from ten to 16 feet wide. The plants are most attractive during their initial seeding stage. Apache plume has been used horticulturally since at least 1877, and in some areas has proved to be useful for erosion control and as a stock forage plant: both for wild and domesticated animals. During the hot summer months, little foliage is evident on the plant when it is grown under the driest conditions, but add a little water and the plant's appearance will improve dramatically.

***Forestiera neomexicana* A. Gray.** [Ed: *Forestiera pubescens* Nutt. TJM2]

Desert Olive.

Shrub.

Oleaceae. Olive Family.

Natural Range: Ranging as far east as Texas, we find this deciduous shrub in scattered dry locations below 6,700 feet in California. Flowering from March to April.

Propagation: Untreated seed sown in July came up in 16 days and experienced maximum germination in a month. Over 500 seedlings were grown from five-eighths ounce of seed. We encountered no problems handling the seedlings in the nursery. Also in July, 50 seeds were embryo cultured, the embryos were put in a nutrient solution commonly used for such procedures. Within two days, growth started and we got 31 out of the 50. However, 13 were so poor they were not potted. All 18 of the remainder survived, and grew along as well as the other lot of seedlings. While we never started any plants from cuttings, in 1950 we received, four staminate plants that had been grown from cuttings. We never had any occasion to follow this procedure.

Culture: All of our plants were set out in full sun in decomposed granite loam. The oldest planting of four staminate plants was set out in May 1951, and had attained sizes of eight to nine feet tall and ten to 12 feet spreads in 15 years. No flowers had been observed to that date. A group of 75 plants were set out in November 1956, and ranged in height from 18 inches to ten feet with spreads of 18 inches to 11 feet in ten years. Neither flowers nor seeds had been recorded in ten years. During the first two years, plant losses were high, but after that no losses occurred during the following eight years. While generally observed in dry areas, this plant will accept a considerable amount of water and will be the better for it. Because of its habit of spreading by underground roots, it can be assumed to be possibly useful for erosion control.

***Fouquieria splendens* Engelm.**

Ocotillo.

Shrub.

Fouquieriaceae. Ocotillo Family.

Natural Range: This unique shrub is commonly seen in both our deserts, mainly below 2,700 feet in the rocky washes but fingering up the very dry slopes; it also grows eastward to Texas and Mexico. Flowering from March to July.

Propagation: Commonly started by cuttings 12 inches in length, or longer sections of the stem, and either placing them in containers or directly into the garden site. Rooting may not occur for several months or even a year or more. In desert communities, one may observe living fences started in this manner. Even well-established plants may be moved with a good percentage of survival. We moved three collections ranging in age from 12- to 23-years-old with good results. Several lots of untreated seed, harvested from our own plants, came up in four, ten, or 12 days, the latter two collections were sown in December and January while the four day interval was recorded for July and September sowings. The seedlings develop slowly and it is difficult to raise a satisfactory percentage to planting size. Out of one lot of 155 originally potted, we managed to set out a total of 60. Other seed lots proved equally difficult. Additional experimentation needs to be carried out.

Culture: Our oldest plants, those moved from the old site, are now 40-years-old and have developed into splendid specimens over ten feet tall and 15 feet wide. These plants flower and set seed rather abundantly each year. Additional irrigation, which they accept readily without any harm, brings out new foliage and occasionally additional flowers. The seedling losses have been high, but those that remain have not grown more than a foot tall in about ten years. In desert areas this plant can be used for screening, impenetrable hedges or as a “character plant” to be silhouetted against a wall.

Fragaria L.

Strawberry.

Perennials.

Rosaceae. Rose Family.

Natural Range: Four species are found in California, occupying individual areas, but usually in shady, damp, mountainous habitats, except for the sand strawberry found along our coastline from Santa Barbara County north to Alaska and to Hawaii and South America. Flowering from March to August.

Propagation: All of our species have been grown from runners collected in the wild, and none of them posed any problems, readily establishing in pots or flats. A few lots were grown from seed for hybridizing purposes and genetic studies. The fruit was crushed and the seed sown immediately. Seedlings began emerging within seven to ten days. If the seed is allowed to dry, it is very difficult to break dormancy and germination is extremely slow.

Culture: A number of collections were grown from material gathered in the wild or from plantings at the old site. Most of them have grown well, spreading into adjacent areas. Some withered during hot spells. Our oldest collection is one of *F. californica* Cham. & Schltl. (*F. vesca* L. ssp. *californica* (Cham. & Schltl.) Staudt) [Ed: *Fragaria vesca* L. TJM2], originally started at the old site in 1927. It has grown vigorously, spreading widely by runners and from volunteer seedlings. It needs full shade in our climate, and even then will show the effects of hot weather. It comes back quickly at the onset of cooler temperatures. It is a native of well shaded and cooler and damper areas throughout the mountain sections of California. Commonly known as wood strawberry; from low elevations nearer coast to higher elevations farther inland – up to 7,000 feet. Subject to mildew under oak trees – as are most of the wild strawberries. Withstands summer watering – never becomes matted to any degree – fine ground cover plant, making nice green carpet. Two pentaploid hybrids (*Fragaria californica* x *Fragaria chiloensis*) have been grown for study purposes and observation. These were acquired through Dr. Bringhurst, of the University of California at Davis.

***F. chiloensis* (L.) Mill. (*F. chiloensis* (L.) Mill. ssp. *pacifica* Staudt).** Beach Strawberry. – Recent studies of this species by Staudt refer our western North American coastal plants to a subspecies of the species. Our plant is referred to that entity found along the coast from Santa Barbara County, California northward to Alaska. The entity from the western coast of South America (from Peru to Patagonia) was the first cultured and used in producing the commercial strawberry. The species is grown extensively among the coastal natives of South America. While this species has become a common plant for groundcover usage, it does best nearer the coast and in sandy loam soils and with some irrigation. Inland, shadier spots should be used, although we have used it in full sun but without any degree of success. It can be used in heavy soils, and

while it grows well, may not last as long and is subject to more trouble. A type with large, glossy leaves and flowers on shorter scapes is found at Oso Flaco, in San Luis Obispo County and is superior in attractiveness. In an attempt to produce a hardier groundcover, Dr. Lee W. Lenz, Director of this garden, crossed several commercial varieties with *F. chiloensis*. Numerous clones were studied for several years and eventually **Hybrid Ornamental Strawberry #25** was introduced to the trade. It found immediate success and has been used extensively, particularly in the San Joaquin Valley and in Texas. But it, too, become subject to the many problems that beset the cultivated strawberry. It produces poorly colored fruit which have much of the delicious wild taste and are avidly sought by birds. Using a power mower in January takes off the long stemmed leaves, which often turn reddish in cool weather, and permits the flowers, which are borne on very short scapes, to be seen more readily. This also freshens the look of the groundcover. We have grown this clone and another for nearly 20 years.

***F. crinita* Rydb.** [Ed: *Fragaria vesca* L. TJM2] – One collection has been grown since 1941 and another since 1959. This entity may be a hybrid with *F. chiloensis* x *F. californica*. It has not responded as well in this area, although it has done better here in Claremont than at the old site.

***F. polypetala* Rydb. (*F. virginiana* L. ssp. *platypetala* Staudt).** [Ed: *Fragaria virginiana* Duchesne. TJM2] – This entity is found in the Coast Ranges and the Sierra Nevada, at elevations from 4,000 to 10,500 feet in very damp, shaded spots. Used in full shade, this species made little progress with us and after maintaining the collections for seven years, they were then written off as not being successful here.

***Frasera parryi* Torr.**

Perennial.

Gentianaceae. Gentian family.

Natural Range: Frequently seen on dry, open flats of rocky clay or decomposed granite clays, between 1,500 and 6,000 feet in cismontane Southern California, and to Arizona and Baja California (Mexico). Flowering from April to July.

Propagation: Untreated seed sown within a month of harvesting in the wild, started germination in eight days with a maximum reached in one month when sown in September. Seed from this same collection sown four years later took 23 days to germinate but had maximum germination within a month when sown in October. After four years, no seed germinated even though tried upon several occasions. Untreated seed sown four months after harvesting from cultivated plants, took 13 days to come up, and a little over a month for maximum results. A sowing the following year, and twice afterwards, failed to produce any seedlings from this same collection. In all cases, excellent results were obtained from those lots that responded. Bringing the seedlings along in the nursery to planting out size proved to be difficult. Out of 200 seedlings only 75 survived to planting out into the garden – the seedlings rotting easily during initial stages.

Culture: Planting our material in as suitable a site as possible, our plants responded well the first season, flowering and producing seed. Their life span was that of a biennial, most of them failing to respond after the second season.

***Frasera speciosa* Griseb.**

Biennial or Perennial.

Natural Range: In dryish or dampish places at elevations from 5,000 to 9,000 feet in the mountains of central and northern California and northward to Washington and east to the Rocky Mountains.

Propagation: Cold-stratified in a jar with moist sphagnum moss for 76 days at which time about 75 of the seeds had sprouted. The sprouted material was sown in a flat and in another 17 days maximum germination was recorded. Fine germination resulted and almost 99% were raised to the four-inch pot stage, and nine months later a high percentage were transferred to six-inch pots. Another seven months of growth in nursery was needed for the plants to develop into large enough plants to be planted out.

Culture: Plants were placed in a semishaded, clay-loam soil situation where they failed to establish. Notations on its growth were not recorded.

***Fraxinus anomala* S. Watson.**

Dwarf Ash.

Shrub or Small Tree.

Oleaceae. Olive Family.

Natural Range: Dry canyons and gulches of the mountains of the eastern Mojave Desert from 3,000 to 11,000 feet elevation, and to Colorado, and Texas. Flowering from April to May.

Propagation: We have been unable to acquire seed since our original collection in 1940. After several attempts, we produced four seedlings. Germination time was 166 days. Cold-stratification might have lowered that period. They were grown and planted at the old site. The four plants were transplanted in March 1951, to gallon and five gallon-cans.

Culture: Held in containers for over two months, the four plants were set out at the present site, in full sun and very rocky decomposed granite loam, in May 1951. In their twentieth year, they had attained heights of three to seven-and-a-half feet tall and 21 inches to six feet across. To that date, they had not produced flowers or fruit, and were in fair to good condition.

***Fraxinus dipetala* Hook. & Arn.**

Flowering Ash or Foothill Ash.

Shrub or Small Tree.

Natural Range: Usually seen on the dry brushy north-facing slopes in the foothills of much of California and Baja California (Mexico), at elevations below 3,500 feet. Flowering from April to May.

Propagation: Two to five lots were sown from each of five seed collections, one of which was from trees growing at the old site. Seeds were sown in September and October. All but one lot were sown in flats and about half were untreated and the remainder were cold-stratified for periods of three to four months. One lot was sown in a seed bed in the lath house. This is the recommended procedure. Germination rates varied from 29 days for one lot (unusual) to 118 days for the untreated seed. Cold-stratified seed received three to four months of cold treatment and took from 15 to 32 days to come up after removal. The lot sown in an outside seed bed took 88 days to germinate and had the best germination. Only two lots produced good germination, the seed is generally has a low percentage of viability. Seedlings removed from the flats are

subject to some losses until well established. It is best to raise the seedlings in outside seed beds, thin them if necessary, and plant dormant stock a year later. With this method, there is no impairment of the root system and the stock is generally more robust and grows better after planting.

Culture: There is a great difference in vigor between those plantings in the heavy clay-loam soil of the mesa and those planted in the very rock decomposed granite loam. In the latter, growth was slow and losses were much higher. Plantings in the clay-loam soil of the mesa grew into fine specimens and were many times the size of the former. Fifteen-year-old plantings in the clay-loam soil were 12 to 19 feet tall and 14 to 25 feet wide with flowering and seeding starting in the fifth year. Those of the same age used in rocky decomposed granite loam were two to seven feet tall and 14 inches to six feet wide and none had been observed in flower. The smallest specimens had been chewed by rabbits. This species is an attractive, deciduous plant that can be trained as a small tree. In the rock sites, the leaves burned readily in late summer whereas they remained in fair condition in the clay-loam soil. The plant has been suggested for erosion control in those areas of more moisture. The species will accept general garden culture and in the spring is covered with large panicles of white flowers, being showier than other *Fraxinus* species as it has petals. Quantities of seeds are produced and can be a nuisance. Plants are best planted on north slopes amongst other native shrubs.

***Fraxinus latifolia* Benth.**

Oregon Ash.

Tree.

Natural Range: A streamside tree below 5,000 feet in the canyons of the western base of the Sierra Nevada and the Cascades from Kern County to Modoc County and in the Coast Ranges from Santa Clara County north to British Columbia (Canada). Flowering from March to May.

Propagation: Seed was sown untreated and cold-stratified, and while the latter produced the best results, the untreated seed, one lot of which was from cultivated trees at the old site, came up in 22 to 50 days. These were all sown in September and October. Two wild collections sown in January were cold-stratified for 78 days and seedlings began emerging in nine and 14 days. All were sown in flats. However, we recommend sowing in deep outside seed beds, as producing the plants there and lifting them during the following winter season (preferably in February, when the plants are dormant), and planting them into their permanent garden location. While we experienced no difficulty in raising the seedlings in the nursery in containers, the root systems produced under such conditions are not the best for long-term success as they are often coiled.

Culture: This species appears to grow equally well in very rocky loam soils and clay-loam soils. Most of our plantings were made in the former and handsome specimens, 22 to 25 feet tall and 21 to 26 feet broad were recorded in 15 years. Flowers and seeding began in the seventh year. This species makes a handsome tree of rapid growth, accepting any quantity of water. The young foliage is attacked severely by aphids. We removed a number of these trees, but otherwise our losses were minor and the trees were easy to grow.

***Fraxinus velutina* Torr. var. *coriacea* (S. Watson) Rehder.** [Ed: the var. is not recognized in TJM2]

Tree.

Natural Range: Usually a streamside tree in canyons below 5,000 feet, from northern Los Angeles County to San Diego County, and in the desert north to Inyo County, and to Nevada and Baja California (Mexico).

Propagation: A wild collection of seed from Inyo County was sown on four different occasions without cold-stratification, November two times, October one time, and January one time. Seedlings began emerging in 54, 47, 38, and 76 days, in flats, and the overall results were poor. A collection of seed from cultivated plants at the old site, took 31 days to germinate and yielded excellent results. However, it is recommended to sow the seed in an outside seed bed, produce the plants there and lift them when they are dormant (preferably in February, or just before the buds begin to break), and then plant them in their permanent location.

Culture: This entity grows very well in our rocky decomposed granite soils. Our Inyo County collection grew into handsome specimens in 15 years, reaching 18 to 27 feet tall and 14 to 26 feet wide. Flowering and seeding began in their sixth year. The young foliage was never as readily attacked by the aphids as in other collections. In fact, none were observed for several years. Also, the foliage of the Inyo collection remained in better condition, particularly during the hottest days during the latter part of the summer, when the other collections and species showed browning and dropping of leaves.

***Fremontodendron* ‘California Glory’.**

Shrub.

Sterculiaceae. Cacao Family. [Ed: Malvaceae. Mallow Family. TJM2]

Distribution and Notes: A presumed hybrid of *F. californicum* and *F. mexicanum*, first discovered and raised at Rancho Santa Ana Botanic Garden. It was first described in **Lasca Leaves** [12(1): 2-4. 1962.], the publication of the Los Angeles State and County Arboretum in Arcadia. Rooted material has been distributed to various nurseries and botanic gardens since that date. The source of the seed from which this presumed hybrid was derived was from a plant growing at the old site and thought to be *F. californicum*. Careful investigation points to a lot of seed collected from plants in the late Theodore Payne’s Nursery, on Los Feliz Boulevard, in Los Angeles. The original lot of seed could have been of hybrid origin.

Propagation: The original seed was given the hot water treatment for 24 hours then sown in a flat. First seedlings emerged in 30 days with maximum results in two-and-a-half months. Of the 65 original seedlings potted, there remained 39 to be planted in the garden, indicating very careful handling of seedlings is needed. After it was decided to introduce a clone to the gardening world, we began experimenting with asexual production. Originally, we got about 30% rooting but as we gained more experience, we could get 60 to 80% rooting, particularly by taking the cuttings between May and July, treating them with Rootone compound, and inserting them in a rooting media of perlite and peat moss, with or without bottom heat, and using as little intermittent mist as possible. In fact, cuttings put in individual three-inch pots with no mist rooted best (these still had high humidity from a fogger). Even with closest attention, there is some loss after their removal from the cutting bench, but we found them to be a lot less trouble when inserted in individual pots.

Culture: The original group of seedlings were set out in three separate areas on the mesa (tight clay-loam soil). In two of the plantings all plants succumbed within five years, as they received too much water and the soil conditions were not to their liking. The third group prospered and

only one plant from this planting was lost within a ten year period. This group received some irrigation, but generally an effort was made to keep these plants from getting water directly around the base of the plants. After one of these plants was selected to become the clonal plant for our introduction of *F. 'California Glory'*, we greatly increased the number of plants in the immediate and adjacent areas, all grown from cuttings. A clonal plant set out in September 1953, had attained a height of 18 feet tall and had an equal spread. In April and early May, the mass of flowers creates a magnificent site.

Selecting one of the plants in this group, Dr. Lee W. Lenz in 1956 crossed it with *F. mexicanum*. Two plants were produced, and they were planted in 1957 or 1958 at the north end of the mesa. Two huge specimens have developed and were measured in 1967 at 22 and 23 feet tall with spreads of 40½ and 44 feet. They have the general appearance of *F. mexicanum* but the great quantities of flowers produced indicate *F. californicum* heritage.

***Fremontodendron californicum* (Torr.) Coville.**

California Slippery-Elm. Fremontia. Flannel Bush.

Shrub.

Sterculiaceae. Cacao Family. [Ed: Malvaceae. Mallow Family. TJM2]

Natural Range: Mostly found on granitic slopes from 3,000 to 6,000 feet in elevation, along the western base of the Sierra Nevada from southern Shasta County to Kern County through the mountains to San Diego County, and to Arizona. Flowering mostly from May to June.

Propagation: Numerous collections of seed from various wild localities and from our own cultivated plants were grown. One number taken from a 23-year-old seed sample in the herbarium was given 15 hours of hot water treatment before sowing and took 15 days to begin germination. Eight seedlings were grown, all having germinated in 31 days. Seed collections harvested from these plants six years later, after given 17 hours of hot water treatment, started emerging in 13 and 22 and 29 days with fair results. Collections from the wild given 24 hours hot water treatment took much longer at 55, 58, and 77 days. Other seed from cultivated plant sources in our garden took 18 and 35 days with 24 hours hot water treatment. Maximum germination usually took two to three months.

Other recommendations have indicated two to three months of cold-stratification is helpful. We never followed this procedure, but it should be investigated, to get quicker maximum germination. Raising the seedlings through the nursery never posed any serious problems, losses were never greater than six plants at the most. While we never tried cuttings, it is to be assumed they can be rooted but are probably difficult.

Culture: The largest percentage of our plantings are set out in well-drained granitic loam, however, many plants grew equally well in the tighter clay-loam soil. Over a period of 15 years, our losses were very low, usually not losing more than two to six plants. There was a great amount of variation among our various collections (this group needs thorough taxonomic study). Sizes show considerable variation, ranging from heights of four to 12 feet or 12 to 18 feet and with spreads of seven to 17 feet or 19 to 25 feet wide. There was a great variety of leaf-types, some being very small, other large, glossy, and somewhat cupped. Plants within collections and between other collections showed considerable differences in size of flowers, time of flowering and color of flowers. Flowering and seeding usually started in the third years, sometimes in two

years. On the whole we experienced few problems with growing this species, it is generally much hardier than any of the other subspecies or species.

One collection of purchased seed was raised of the **ssp. *crassifolia***. It took 21 days to germinate and a total of 11 were planted in May 1951. A number of these were rapidly lost such that there were only four remaining after three years. They had grown to be 15 to 20 feet tall and spread from 19 to 21 feet wide. In their 15th year three remained alive, and measured 13 to 18 feet tall and were 16 to 22 feet across. Flowering and seeding began in their second year.

***F. californicum* (Torr.) Coville ssp. *decumbens* (R.M. Lloyd) Munz.** [Ed: *Fremontodendron decumbens* R.M. Lloyd. TJM2]

Natural Range: El Dorado County, growing in rocky red clay at 2,000 feet elevation. Flowering from April to May.

Propagation: After given the hot water treatment, two small lots of seed gave very sporadic germination over a period of three to four months with the first seedlings emerging in 19 and 43 days. Seedlings from a cross between this subspecies and **ssp. *napensis*** took 94 days to come up, but continued to emerge one at a time over an additional two months. We had no trouble in raising the seedlings in the nursery. We failed to root two lots of cuttings brought in from the wild.

Culture: In both rocky soils and clay-loam soils, this subspecies has performed well during the three years we have been growing it. Flowering began in their second year, but they did not produce the red flowers that have been described for this subspecies. The flowers were more an orange red, a condition also observed in some specimens of ***F. californicum***. The plants are decumbent in growth habit, specimens three-years-old measured 19 inches to four feet tall and spread from three-and-a-half to eight-and-a-half feet wide. In a test plot, similar growth has been measured. The flowers are not clearly visible, being hidden to a considerable degree by the foliage. The flowers are also small. This is an interesting plant that is relatively new to science and horticulture.

***Fremontodendron californicum* (Torr.) Coville ssp. *napensis* (Eastw.) Munz.** [Ed: the ssp. is not recognized in TJM2]

Shrub.

Natural Range: Chaparral covered slopes, from about 1,500 to 1,800 feet elevation in Napa, Lake, and Yolo counties. Flowering in May.

Propagation: Four collections of seed (three from cultivated plants and one from the wild), were given a pretreatment of hot water for periods of 15, 16, 17, and 24 hours. Seedlings first germinated in 19, 20, 28, and eight days. About 15 to 25% losses occurred while they were being grown in the nursery. Cuttings were taken from a nearly red flowered plant, but these failed to root.

Culture: This subspecies is generally found in highly serpentine areas, and perhaps due to this habitat, we suffered a high percentage of losses in all of our plantings in extremely well-drained areas. No matter the kind of treatment, they rapidly succumbed until one-third to 95% were dead in five to ten years. These plants ranged in size from three to 11 feet tall and spread from three to 16 feet wide. Six plants received from the late Theodore Payne in 1948 were planted at the old

site and were later transplanted to five-gallon-cans in February 1951. Four of these lived and were planted at the Claremont site in May 1951. Two died during the first year, but the remaining two flourished and in the 15th year were seven feet tall and were 12 to 14 feet across. In the 20th year, one remained and was noted in good condition. It measured eight feet tall and 16 feet across. Some specimens have reddish flowers.

***Fremontodendron mexicanum* A. Davidson.**

Mexican Flannel Bush.

Shrub.

Natural Range: Dry, brushy canyons at about 1,500 feet, southern San Diego County to Baja California (Mexico). Flowering from March to June with sporadic flowers throughout the year.

Propagation: We have sown six lots of seeds during the past 15 years, all were given the hot water treatment for periods of 16, 17, and 24 hours. In prior years at the old site we followed the practice of sowing two to three seeds directly into small pots, based on the theory that the seedlings are difficult to transplant. We abandoned that procedure for sowing the seeds into flats after the pretreatment. Sowings were made in August, October, November, and January. They occurred when two- to three-year-old seed was given 24 hours hot water treatment. Careful handling of transplanted seedlings is necessary to insure maximum production. They are readily susceptible to damp-off fungus.

Culture: This species has been in the nursery trade for many years. Growth is rapid and consequently the plants attain maturity early and many gardeners are disappointed by their early demise. Providing more than minimum irrigation is a further cause of death as the root system is readily attacked by root rotting soil fungi. All of our plantings are made in extremely well-drained rocky soils. Even with the best attention, there is a gradual decrease in number over a period of 15 years. Flowering and seeding begin the second year. Fifteen-year-old plants have attained sizes of 12 to 18 feet tall and spread from 15 to 22 feet across. Since growth is so rapid the first few years, plants must be protected by other shrubs or supported by other means as their bulk makes them easy prey to moderate or high velocity winds.

***Fritillaria* L.**

Fritillary.

Perennials.

Liliaceae. Lily Family.

Natural Range: Sixteen species and one variety are recognized as growing in California out of a possible 100 species found in the North Temperate Zone. Our native species are usually found growing in heavy clays, granitic, or serpentine soils, at elevations of 500 to 10,500 feet. Only two species range farther south than Kern and Ventura counties. Flowering from February to July.

Propagation: Eleven lots of seeds representing two undetermined collections and five species out of a possible eight were all cold-stratified for periods of one to three-and-a-half months. Usually when these were removed from the cold, the seedlings were already appearing in abundance. In a few cases, the seedlings appeared within a few days after removal. However, there is information

that indicates the cold-stratification period is unnecessary. Except for the failure of one collection, our results were excellent with regard to germination. After the seedlings grow for a few months, they begin to enter a period of dormancy. We transferred small clumps of the plants into pots and rested them in cold-stratification. Removing them in September or October, the young plants would sprout again and grow to stronger plants. This process was carried out for two seasons, at which time the plants were considered strong enough for outside planting.

Culture: The following species were set out in semishaded areas with clay-loam soil, rocky granitic loam, or in a covering of humus over rock loam: *F. agrestis* Greene., *F. atropurpurea* Nutt., *F. biflora* Lindl., *F. lanceolata* Pursh. [Ed: *F. affinis* (Schult. & Schult. f.) Sealy. TJM2], *F. liliacea* Lindl., *F. pinetorum* Davidson., *F. pudica* (Pursh) Spreng., and *F. recurva* Benth. The only species surviving for more than a few years has been *F. agrestis*. Planted in heavy clay-loam soil, a few bulbs have survived for ten years. The first flowering and seeding occurred in their seventh year from seed. On the whole, it can be said that we need to do more studying to find the most suitable species for our area and how to grow them.

***Galium* L.**

Bedstraw. Cleavers.

Annuals and perennials.

Rubiaceae. Madder Family.

Natural Range: The 38 species and many varieties are widely distributed in California, in a variety of habitats and elevations. Flowering from March to September.

Propagation: Untreated seed produced an acceptable number of seedlings. Fresh seed of *G. angustifolium* A. Gray harvested at low elevation produced abundant seedlings in nine days, while year-old seed of *G. pubens* A. Gray [Ed: *Galium bolanderi* A. Gray TJM2] from 7,500 feet took 57 days to emerge. Only two seedlings were lost in producing the plants in the nursery. One bare-root plant of *G. parishii* from the wild was easily established in a gallon-can.

Culture: Bedstraw is a group of plants usually found in close proximity or supported by other brushy plants or inhabiting cracks and crannies among the rocks; always growing in well-drained soil and in close competition with surrounding shrubbery. They need complete neglect and probably because our plants receive some attention they are not particularly long-lived. Flowers and fruits have been recorded within a few months of planting for the species raised. Crown rotting is the most notable cause for losses. A life expectancy of five to eight years may be expected.

***Galvezia speciosa* (Nutt.) A. Gray.** [Ed: *Gambelia speciosa* Nutt. TJM2]

Bush-Snapdragon.

Shrub.

Scrophulariaceae. Figwort Family. [Ed: Plantaginaceae. Plantain Family. TJM2]

Natural Range: In the soft scrub of rocky canyons on Santa Catalina and San Clemente islands, and to Guadalupe Island (Mexico). Flowering from February to May, but with some sporadic flowers throughout the year.

Propagation: Plants are readily produced from seed or by cuttings. Seeds sown untreated will start to germinate in an average of two weeks time, though an occasional seed lot may take longer. Cuttings from either wild or cultivated plants have initiated roots in nine to 24 days, and usually are 100% successful. The only problem we had raising the seedlings or cuttings was when we pruned a group in gallon-cans to keep their growth in bounds. Gradually, the leaves and the stems began dying back until nearly the entire lot was lost. We never did this practice again.

Culture: Planting some of our original collections in full sun in Claremont, we soon found that this species will not tolerate such conditions this far inland. Luxuriant growth in full shade indicated this was the situation the plants preferred. Under such conditions, flowering is sparse and the plant tends to become leggy and clamber over the surrounding shrubbery. We found this to be not a particularly long-lived plant, so we found it necessary to set out replacements from time to time. Nearer the coast, this is a floriferous plant when it is grown in full sun or in semishade. For us, it is used as an excellent steep bank cover, offering very satisfactory protection against erosion.

***Garrya buxifolia* A. Gray.**

Shrub.

Garryaceae. Silk Tassel Family.

Natural Range: Northwestern California to southwestern Oregon on rocky slopes at elevations of 1,500 to 4,600 feet. Flowering from February to April.

Propagation: A few seeds acquired in 1962 were cold-stratified for 64 days, after which two seedlings emerged in 15 days. A month later the flat was again put in cold-stratification for 27 days. After removal, much better germination resulted, giving us a total of 30 seedlings. None died in the nursery and all grew to planting-out size within one year.

Culture: Plantings were grown in two locations, one in a well-drained site on the north edge of a large oak, and the other on a rocky clay bank. In five years the plantings were all gone except for three plants measuring six to ten inches tall with spreads of eight to 20 inches. None could be said to be in good condition. This species needs more study to establish it satisfactorily here.

***Garrya congdonii* Eastw.**

Shrub.

Garryaceae. Silk Tassel Family.

Natural Range: Dry canyons and ridges, below 2,750 feet, largely on serpentine, northern central California. Flowering from February to April.

Propagation: Fresh, untreated seed from the wild took 70 days to come up, producing seven seedlings. A second lot was cold-stratified for four months and then took 74 days to produce one seedling. Seed harvested from cultivated plants were cold-stratified for 95 days, at which time nearly all the seedlings were up upon removal from the cold. All of the seedlings were raised in the nursery without loss.

Culture: Our original planting of six specimens did poorly in the rocky site selected for them and all were recorded dead within four years. A second planting of two set out in 1958 have grown very well, producing seed within four years and attaining heights of six to nine feet and spreads

of eight to 12 feet in eight years. Seedlings produced from these two plants are thriving in another site of rocky, decomposed granite loam. It is noted they were fruiting heavily in their fifth year and only five out of the original 35 which contained a few weak plants had died. They were three to eight-and-a-half feet tall and two to nine-and-a-half feet wide and in good condition.

***Garrya elliptica* Lindl.**

Silk Tassel Bush.

Shrub.

Natural Range: Native in the coastal mountains below 2,000 feet from Ventura County to southwestern Oregon, and Santa Cruz Island. Flowering from December to March.

Propagation: Seedlings from two wild collections of untreated seed began emerging in 53 and 106 days respectively. A third collection of wild seed was given 68 days of cold-stratification after which seedlings came up in 22 days. Only minor losses of seedlings occurred in the nursery. Good quality semihard tip cuttings from the wild or taken from nursery stock gave us 65 to 90 % rooting. Root initiation took 24 and 27 days for Rootone treated material. A miscellaneous group of poor quality material gave us about two percent rooting in 55 days, pretreated with CUTstart XXX. These cuttings were taken from special selections in the wild.

Culture: In our area, this species grows best in a semishade area in rocky clay-loam soil or if in full sun, in clay-loam soil. A large group of plants was placed in very rocky soil in full sun and while the losses were low over a ten year period, they needed a considerable amount of irrigation. Another group set out in another rocky location in full sun but receiving much less water did poorly and losses have been high; the best plants were in a low spot with a more silty loam soil. Since this species is a vigorous grower, it seldom flowers much before the fifth year and may not set fruits until several years later. It appears the male plants flower first. Plants attained sizes of six to ten feet tall and seven to 15 feet wide in ten years. The general appearance of plants is much better in a semishaded area. In this species the yellowish male catkins are the longer than those of female flowers. These plants are dioecious – there are separate male and female plants.

The selection ‘**James Roof**’ has been grown very successfully in full sun in the heavy clay-loam soil of the mesa. It has been reported this selection produces flower tassels up to ten inches long. While our plants of this cultivar are only five to six years old, they have never produced such lengthy tassels. Ours are only five to six inches long, an average length for plants of this species in our garden.

***Garrya flavescens* S. Watson var. *pallida* (Eastw.) Bacig. ex Ewan.** [Ed: the var. is not recognized in TJM2]

Shrub.

Natural Range: On the dry slopes of the Coast Ranges from 3,000 to 8,000 feet, from San Diego County north to Alameda County, and in the Sierra Nevada in Tulare, Fresno and Inyo counties, and in the mountains of the eastern Mojave Desert. Flowering from February to April.

Propagation: Two lots of seeds harvested from our own plants at the old site were untreated and germinated in 42 days with maximum results within two months. Only minor losses occurred during growth in the nursery.

Culture: An extremely well behaved species in our area, we lost only one plant in 15 years. Flowering seeding noted first in the fifth year. In 15 years, the plants were four to 11 feet tall and six to 13 feet wide, in excellent condition.

***Garrya fremontii* Torr.**

Fremont Silk Tassel.

Shrub.

Natural Range: Mostly below 7,500 feet on dry, brushy slopes, Sierra Nevada and Cascade Range to Modoc County, Coast Ranges to Monterey County, mountains of Orange and San Diego counties; to Washington. Flowering from January to April.

Propagation: Twenty seven lots of seeds were sown from seven wild collections between 1951 and 1961. One collection tested five times in six years failed completely. Five lots were given a two hour pretreatment in sulphuric acid and all failed to germinate. The remaining 17 lots were cold-stratified for varying lengths of time, sown untreated or sown untreated with later periods of cold-stratification. Clear cut recommendations on best treatment could not be ascertained. In some collections untreated seed lots came up in 50 to 58 days, others took longer with only a few appearing and after cold-stratification a greater number came up. Then again the same collections subjected to three to five months cold-stratification produced only a few seedlings while other lots untreated in the same collection gave good results. It would seem the best recommendation is to sow and after a period of sixty days, put flat under cold-stratification. After one or two months, examinations of flats should be made as seedlings might be appearing. Generally good results were experienced in raising the seedlings through the nursery with only minor losses except under some unforeseen condition. Seed five-years-old or more failed on every occasion.

Culture: Generally this species has not performed as well here as it did at the old site. In the open, full sun, gravelly soils, losses have been high. It appears they, as with the other species, prefer a clay-like soil and some protection from the full sun, even though their wild habitat would indicate otherwise. It is a handsome plant when at its best and makes a fine background with its brighter green leaves. Ten-year-old plants varied greatly in size, each collection being different. Generally they were four to eight feet tall and five to ten feet across; flowering and seeding occurred in four to seven years and in one collection none in ten years.

***Garrya veatchii* Kellogg.**

Shrub.

Natural Range: Dry, bushy slopes below 7,000 feet, San Luis Obispo County to Baja California (Mexico). Flowering from February to April.

Propagation: No pretreatment of seed is necessary as we had fair to excellent germination within 28 to 30 days from seed harvested from cultivated or wild plants. Only minor losses occurred while raising young plants in the nursery.

Culture: This species, once established, has grown exceedingly well in this location. Two plantings in very rocky, decomposed granite loam suffered minor losses, but on the whole have been in excellent condition. Flowering and seeding began the third year from seed. Growth is rapid, and ten to 15-year-old plants were five to 11 feet tall and four to 11 feet broad.

***Gaultheria shallon* Pursh.**

Salal.

Shrub.

Ericaceae. Heath Family.

Natural Range: Commonly seen below 2,500 feet, in woods and brushy places of the coastal mountains from Santa Barbara County north to British Columbia (Canada). Flowering from April to July.

Propagation: Numerous lots of seeds were sown from three collections harvested in the garden and from nine collections gathered in the wild. Some lots were cold-stratified for periods of one to three months and others were untreated. Fresh seed of good quality germinated in 26 to 58 days for untreated seed, the average being 27 days. Cold-stratified seed took almost as long although a few lots came up in 18 to 25 days. Cold-stratification is unnecessary unless it is desirable to sow seed in summer. The older the seed, the longer the period for germination. Among many of the lots, there were an unusually larger number of weak seedlings, although losses were minimal during potting until after reaching the gallon-can stage. During the hotter parts of the summer months, losses were excessive, usually from root fungus trouble. On several occasions, we encountered much trouble with mealy bug around the crown and roots during this period. Other collections appeared to be stronger, grew well and produced nice plants. There seemed to be some correlation with older seed but not always. For a few plants, and stock plants are available, it is simpler to propagate the underground rooted runners from established plants.

Culture: Since this species naturally inhabits the shadier woody areas, usually with a thick carpeting of humus, it is necessary to provide like conditions for best results. In our area, it is mandatory to grow in deepest shade with thick humus, although the latter condition can be foregone if drainage and moisture is good in loose loamy soils. Grown in a highly impregnated peat moss area in a home garden, this species grew with great abandon. However, it was subject to black and brown scale to a high degree. Our garden plantings were less successful, there being a high mortality, although usually a few plants of each group would establish and gradually grow into good sized clumps several feet across. This is the "lemon leaves" of the florist trade and is a useful filler for the rhododendron or azalea garden or other acid shady areas. It is a good bank cover. Flowering and seeding occur from the second to fourth year. The fruit a dark purplish huckleberry type, edible and much loved by birds.

***Gayophytum* A. Juss.**

Annuals.

Onagraceae. Evening-Primrose Family.

Natural Range: Eight species and several subspecies are commonly seen on dry flats, slopes, or ridges above 3,000 feet through most of California and spreading into adjacent states; and South America. Flowering from June to August.

Propagation: Seed sown directly into our rock garden came up in 14 days and volunteers seedlings reappeared for several years.

Culture: Original seed sown in the rock garden, which had a covering of crushed granite rock stood up to our conditions and continued to spread and prosper for many years. Our collections consisted of *G. heterozygum* H. Lewis & Szweyk. and *G. diffusum* Torr. & A. Gray. ssp. *parviflorum* H. Lewis & Szweyk.

***Gentiana* L.**

Gentian.

Annuals or Perennials.

Gentianaceae. Gentian Family.

Natural Range: Most commonly seen in wet or dry meadows, boggy places, the 12 species seen in California are found at elevations usually above 2,500 feet. There are two species found in drier situations at lower elevations. Flowering from July to September, depending on species and altitude.

Propagation: Bare-root plants are easily transferred and started in containers. Seed needs to be cold-stratified up to 90 days. For us, *G. calycosa* Griseb. took 16 days to germinate after 86 days of cold-stratification. *G. sceptrum* Griseb. had 120 days without cold-stratification and no germination, then after 53 days of cold-stratification, the seedlings began emerging in 26 days. Both lots produced a fine quantity of seedlings and only minor losses occurred in the nursery.

Culture: Set out in specially prepared areas and kept very moist, neither of the above species lived more than three to five years, doing very poorly and only flowering occasionally. Probably not a genus that can be raised satisfactorily in this area and at this altitude.

***Geraea canescens* Torr. & A. Gray.**

Desert Sunflower.

Annual.

Asteraceae. Sunflower Family.

Natural Range: A colorful component of the sandy desert floors at elevations up to 3,000 feet in both California deserts; to Utah, Arizona, and to Sonora and Baja California (Mexico).

Flowering from February to May and from October to November.

Propagation: Erratic germination occurred in two collections from garden harvested seed and eight from the wild. Seed sown directly into site took anywhere from 15 to 60 days to germinate. We sowed all lots of seeds in sandy gravelly or sand dune areas. The sandier soil was best but none were satisfactory. The seedlings succumbed easily to wet cold weather. Seed sown in April produced a few flowering plants and seed.

Culture: Best grown in very sandy desert-type soils. Our experience indicates this species is unhappy in areas with other than desert conditions as our winter weather is too wet and cold. Flowering occurred in April and only from two collections were we able to harvest a small quantity of seed. Some volunteer seedlings were noted from time to time but no collection survived more than five years.

***Geraea viscida* (A. Gray) S.F. Blake.**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: At elevations of 2,000 to 4,000 feet, on the open dry hillsides of southeastern San Diego County and adjacent Baja California (Mexico). Flowering from May to June.

Propagation: Untreated seed from the wild was sown in late December directly into our desert garden, germinated in 41 days. Seed harvested from these plants was sown in early November and took 12 and 17 days to germinate in another garden site with more loam mixed in with the rocks. Another two lots of garden harvested seed was sown untreated in flats and took four days to germinate when sown in October, and a year later took ten days when sown in early January. In any case, there was a slowing down of germination after the first year and much quicker results are obtained by sowing seed in flats. In all lots, we suffered heavy losses during the seedling stage, both indoors and outside.

Culture: This is a plant that needs little or no attention and once established and it seems to persist for many years. We have a planting that is still doing well after 15 years. The species is never very attractive but manages to flower intermittently through the year. Initial flowering starts within six months after germination and seed production soon follows. Eight-year-old plants are 15 inches tall and are one to two feet across. Initially the plants were severely chewed by rabbits.

Gilia Ruiz & Pav.

Gilia.

Annuals.

Phlox Family.

Natural Range: A genus of about 50 species of which 37 species and many subspecies are listed for California and adjacent areas. They inhabit many types of sites from sea level to 10,000 feet, but are mostly found below 8,000 feet. Dry sandier soils are favored. Depending on species, flowering from March to July or September.

Propagation and Culture: Untreated seed is usually broadcast directly into site. Depending on species and conditions, germination usually occurs in one to two weeks. However, germination time may be shorter or longer. If sown in flats, only a few days may be required and seedlings are easily transplanted directly into the garden or into pots. As a rule, seeds that were harvested from the wild took longer to germinate. Desert species were much more difficult to grow in our area – they were harder to germinate and grow due to our colder and wetter winters. Late sowings often worked better for these species.

Plants grew equally well in heavy or light soils, though usually more vigorous in clay. Birds, rabbits, and slugs ate seedlings and plants in the garden. The following notes record the history of the various species raised. Many were acquired through the intense studies of Dr. Verne Grant, authority on the genus.

***Gilia achilleaefolia* Benth.** – One strain purchased from the late Theodore Payne in 1932 has been raised continuously since that date and always with excellent results. Sown in field rows or

broadcast, equally good effects were produced with flowering occurring in late March or early April. Four additional collections from the wild were used, but none equaled the results we experienced with the Payne seed strain.

***Gilia aliquanta* A.D. Grant & V.E. Grant.** – Neither of two collections from the western desert mountain slopes fared well in our environment, growing poorly and fading out within two years.

***Gilia angelensis* V.E. Grant.** – Started from experimental plants, several collections have shown little strength here, growing moderately well but not with any degree of strength.

***Gilia australis* (H. Mason & A.D. Grant) V.E. Grant & A.D. Grant.** [Ed: *Saltugilia australis* (H. Mason & A.D. Grant) L.A. Johnson. TJM2] – One collection of experimental plants acquired in 1952. When these were planted in March they flowered well in May and the seed was left to naturalize. The species was gone within four years.

***Gilia brecciarum* M.E. Jones ssp. *neglecta* A.D. Grant & V.E. Grant.** – Initially acquired in 1950, this entity from the mountains of western Mojave Desert in Inyo and Kern counties has established quite well and has been used each season for the past ten years. Flowering starts in February or March and germination takes from seven to 20 days, depending on site and soil conditions.

***Gilia cana* (M.E. Jones) A. Heller ssp. *bernardina* A.D. Grant & V.E. Grant.** – From the northern desert slopes of the San Bernardino Mountains, this species has been grown sporadically for the past 12 years. Some collections failed while others produced sufficient seed to continue the strain. Requiring 12 days to germinate in flats, seedlings did not emerge from seed sown in the garden until 57 days while another took only six days. Apparently hybridizes with *G. latiflora*. The ssp. *triceps* (Brand) A.D. Grant & V.E. Grant., likewise from desert mountain areas, was not established due to severe attacks by birds and rabbits, causing failure to set seed for the only collection received.

***Gilia capitata* Sims ssp. *capitata*.** – An easily established species and grown for many years, always producing quantities of seed to continue its cultivation.

***Gilia capitata* Sims ssp. *chamissonis* (Greene) V.E. Grant.** – An exceptionally fine strain acquired in 1939 has been used successfully in numerous situations, always with a high degree of success. Flowers in April.

***Gilia capitata* Sims ssp. *staminea* (Greene) V.E. Grant.** – Originally acquired in 1937, this entity has been equally successful here as well as the old site, growing happily in many situations. It, too, produces an abundance of flowers and seeds, starting in April and being harvested in June.

***Gilia caruifolia* Abrams.** [Ed: *Saltugilia caruifolia* (Abrams) L.A. Johnson. TJM2] – While grown sporadically for several years from seed acquired in 1952, this inhabitant of the open areas on brushy slopes and woods of San Diego County and northern Baja California (Mexico), it has not been entirely satisfactory. Germination has been slow from wild seed, requiring one to three months to emerge. Seed from cultivated plants required much less time, 12 to 25 days.

***Gilia clivorum* (Jeps.) V.E. Grant.** – Only attempted once from a few plants acquired from experimental project. Did not establish.

***Gilia eremica* (Jeps.) T.T. Craig.** [Ed: *Eriastrum eremicum* (Jeps.) H. Mason. TJM2] – A desert species which failed to germinate.

***Gilia exilis* (A. Gray) Abrams.** [Ed: *Gilia ochroleuca* M.E. Jones ssp. *exilis* (A. Gray) A.D. Grant & V.E. Grant. TJM2] – From collections acquired in 1952 and 1962, this species has been successfully established and continues to produce nice stands of flowers and good quantities of seeds.

***Gilia gilioides* (Benth.) Greene.** [Ed: *Allophyllum gilioides* (Benth.) A.D. Grant & V.E. Grant. TJM2] – Successfully grown for one year from experimental study plants, but not continued. The record indicated strong plants were observed. The same results were recorded for the ssp. ***volcanica* (Brand.) H. Mason & A.D. Grant.** [Ed: the ssp. is not recognized in TJM2].

***Gilia interior* (H. Mason & A.D. Grant) A.D. Grant.** – This species was grown from experimental plants. These were allowed to naturalize, but were gone in two years.

***Gilia latiflora* (A. Gray.) A. Gray.** – Several collections of seed from wild and cultivated sources were grown in our desert garden area, where we had excellent drainage and sandy soils. This attractive desert species, when not mutilated by rabbits or killed by fungus attacks, behaved very well, producing nice displays of color. The number of days for germination was erratic. Always sown untreated into site, as many as 79 days or as few as 14 days was required. Seed from cultivated plants usually came up in two to three weeks. We had the best rate of germination after rains, and volunteer seedlings were noted in the garden for many years. Flowering occurred in late March or through April and seeds were harvested in April or May.

***Gilia latifolia* S. Watson.** [Ed: *Aliciella latifolia* (S. Watson) J.M. Porter. TJM2]– This common desert annual failed to respond on two attempts to establish it.

***Gilia leptalea* (A. Gray) Greene.** [Ed: *Navarretia leptalea* (A. Gray) L.A. Johnson. TJM2]– Failed to germinate.

***Gilia leptantha* Parish.** – Found at the 5,000 to 7,500 feet level in the San Bernardino Mountains, an original collection of seed in 1954 initially failed to naturalize but after a second attempt, seedlings were noted each season for several years, however, there was a gradual weakening of the colony until all disappeared in 1960. The ssp. ***purpusii* (Milliken) A.D. Grant.** has settled in much better and has made good displays each season since 1955 in the desert garden. Usually excellent germination after early rains.

***Gilia modocensis* Eastw.** – Harvested in the wild in 1955, untreated seed was broadcast into site in December 1955. One collection took 48 days and the second took 20 days, and neither germinated in abundance. Flowering in April, the seed was allowed to drop for naturalizing. Later recorded notes indicated both collections had disappeared within a three year period.

***Gilia nevinii* A. Gray.** – Acquired in 1962 from a collection on San Clemente Island, untreated seed took 48 days for initial germination when sown in a field test plot in clay-loam soil. Flowering in March, a nice quantity of seed was produced for harvesting in April. Recorded notes assessed this species as “unattractive”.

***Gilia ochroleuca* M.E. Jones ssp. *bizonata* A.D. Grant & V.E. Grant.** – Four-year-old seed from the wild was sown untreated into site. It required 65 days for seedlings to appear and only poor results were obtained. Flowering in early May, enough seed was produced to permit naturalizing. And while plants flowered well, records indicate it had disappeared within three years.

***Gilia sinuata* Benth.** – A few experimental plants acquired in 1951 produced enough seed to insure a second crop. Recorded notes state the plants grew strongly and well, but the species had disappeared within two years.

***Gilia splendens* H. Mason & A.D. Grant.** [Ed: *Saltugilia splendens* (H. Mason & A.D. Grant) L.A. Johnson. TJM2] – Produced over a period of seven years, this species behaved indifferently in our area, either when sown in heavy clay-loam soil or sandy loam. The germination period required 13 to 25 days with a few lots taking longer. Flowering occurred in May and only small quantities of seed was harvested or left to naturalize.

***Gilia stellata* A. Heller.** – This species was noted for over seven years growing each season as volunteers in our desert sand dune area. The original lot was collected in 1952 and was first sown in 1955. It required 20 days to germinate. Flowering occurred in April and seed was left to naturalize species.

***Gilia tenuiflora* Benth.** – Largely found in the hills bordering the Salinas Valley, this species has been grown since 1951. The germination period may be from seven to 15 days, with the flowering period in April. Often the seed was allowed to drop thereby producing annual stands which would last for several years if not disturbed or overgrown by other more vigorous plants.

***Gilia tricolor* Benth.** Bird's-Eye Gilia. – This species has been grown successfully for over 30 years, both at old site and here. Plants are indifferent to soil types. It is a very satisfactory annual to grow. Seed germinates quickly, ordinarily within seven to ten days, and abundantly. Fine displays result from broadcasting seed over large areas. We have grown the same strain acquired in the Tejon Canyon, Kern County in 1935. Other collections have been tested but none found to be superior to our strain.

***Glehnia leiocarpa* Math.** [Ed: *Glehnia littoralis* Miq. ssp. *leiocarpa* (Mathias) Hulten. TJM2]

Perennial.

Apiaceae. Carrot Family.

Natural Range: From the Coastal Strand of Mendocino County to Alaska. Flowering from May to June.

Propagation: Fresh, untreated seed sown in flats will germination in 20 to 30 days. We sowed three lots of the same collection. The first was sown in September and came up in 21 days, the second was sown in November and took 29 days, while the third lot was sown directly into site and failed to come up. Potting took place from a month to three months after emerging. The soil in the flats was dumped in two outside locations. Within a month or two, numerous seedlings were observed in both locations. Those seedlings were potted off and came along nicely in the nursery with no losses.

Culture: Placed in artificial sand dunes, none to the young plants survived through the following winter and were thought to have succumbed to frost. While our conditions are dissimilar to its native habitat, this species certainly grows in colder areas. Our conditions could well have prevailed.

***Glyptopleura setulosa* A. Gray.**

Annual.

Asteraceae. Sunflower Family.

Natural Range: Locally common on sandy flats at elevations of 2,000 to 3,500 feet, in the western Mojave Desert from Inyo County to southern Utah and northwestern Arizona. Flowering from April to May.

Propagation: Sowing directly into specially prepared sites in our desert garden, the germination period was 29 to 47 days. We experienced poor germination, yielding only a few seedlings, and many succumbed during winter months. Sowing seeds in early spring did not appear to help. Attacked by birds.

Culture: While we produced a few flowering plants, this species languished under our conditions and was never happy with us. An occasional nice specimen grew, but on the whole they were generally poor.

***Grayia spinosa* (Hook.) Moq.**

Hop-Sage.

Shrub.

Chenopodiaceae. Goosefoot Family.

Natural Range: A common component of mesas and sandy flats, from 2,500 to 7,500 feet, Mojave Desert to Lassen and Siskiyou counties; to eastern Washington, Wyoming, and Arizona. Flowering from March to June.

Propagation: After we began using chopped sphagnum moss for a top covering on our flats, germination for untreated seed took only two to five days with maximum results in a month. Prior seeding media without the sphagnum moss required 16 to 20 days. One lot soaked for 24 hours in cold water came up in 13 days. While results were generally good, some collections produced far more seedlings than others. Occasional attacks of damp-off fungus had to be guarded against, otherwise a high percentage of the seedlings potted off were raised through the nursery.

Culture: An original planting of 50 plants was made at the old site. In September 1951, 21 plants were lifted bare-root, transferred to Claremont and planted. A total of six survived and in 15th year were recorded in good condition, two-and-a-half to four-and-a-half feet tall, and spread two-and-a-half to five-and-a-half feet wide. None of them had been recorded as flowering. Later plantings of several other collections suffered high mortality in the first years but once they had settled in, losses were minimal. Moles lifting young plants and other causes resulted in high mortality. Other groups measured one-and-a-half to five-and-a-half feet tall and two-and-a-half to nine feet wide. Young plants were chewed severely by rabbits caused set-backs for many specimens. Seed production began during fifth year for some collections, others were up to 15-years-old before producing seed.

***Grindelia* Willd.**

Gum-Plant.

Annual, Biennial, Perennial.

Asteraceae. Sunflower Family.

Natural Range: Eleven species and four subspecies are seen in California. Over 50% inhabit a variety of habitats either along the immediate coastal environment or not far removed inland. A few species are seen in the general San Joaquin Valley area and adjacent Sierra Nevada foothills. Flowering from May to October.

Propagation: Untreated seed of several species and many lots sown in flats will invariably sprout in three to five days, usually in three days, even with five- to eight-year-old seed. Eight-year-old seed sown directly into site required 41 days to germinate. Tip cuttings taken in October in the wild, untreated and inserted six days after collection began rooting eight days later and 100% rooted. A high percentage of seedlings and cuttings were raised without any difficulty in the nursery.

Culture: Newly grown stock in the nursery needs to be well protected when planted out. Rabbits consider this plant a choice morsel, but they will seldom, if ever, bother volunteer plants or the original plantings after they have become toughened. The several species are content with most soil types, growing vigorously in sandy or heavy soils. Volunteer seedlings are usually abundant, and while the various species are not long-lived, seldom living over eight years, their continuance is insured. After about the third year, when they become quite attractive, making bright yellow displays, there is a gradually dropping off of vigor and plants. Flowering begins the first or second season. The following kinds have been raised with some degree of success: *G. camporum* Greene., *G. x latifolia* Kellogg. [Ed: *G. stricta* DC. var. *platyphylla* (Greene) M.A. Lane. TJM1], *G. robusta* Nutt. [Ed: *G. camporum* Greene var. *bracteosa* (J. Howell) M.A. Lane and *G. camporum* Greene var. *camporum*. TJM1], *G. stricta* DC. ssp. *blakei* (Steyerm.) Keck. [Ed: *G. stricta* DC. var. *stricta*. TJM1], and *G. stricta* DC. ssp. *venulosa* (Jeps.) Keck. [Ed: *G. stricta* DC. var. *platyphylla* (Greene) M.A. Lane. TJM1], the latter having been continuously raised since 1937, when it was established at the old site.

***Gutierrezia californica* (DC.) Torr. & A. Gray.**

Matchweed.

Shrub.

Asteraceae. Sunflower Family.

Natural Range: Dry hills and plains, mostly below 1,000 feet, valleys of central California and cismontane Southern California; to southern Arizona and Chihuahua (Mexico). Flowering from May to October.

Propagation: Untreated seed will start sprouting in seven to nine days if sown in flats. One lot sown in hard clay took 48 days to germinate in a garden site. One collection was raised through the nursery with no plant loss, while a second collection gave trouble, losing all but one.

Culture: Planted in rocky, decomposed granite loam, this species has grown well for over ten years with a little over 50% loss. After establishment, no watering was applied after the second year. Plants developed into three to five feet tall specimens with spreads of four to nine feet. Flowering often started in the nursery the first year, but was noted consistently by the second season.

***Gutierrezia microcephala* (DC.) A. Gray.**

Shrub.

Asteraceae. Sunflower Family.

Natural Range: Open desert, up to 7,000 feet, Mojave Desert, east to Colorado, Texas, and northern Mexico.

Propagation: Untreated seed in flats will germinate in eight to 16 days, while if it is sown into a garden site it may take as long as 42 days. One lot of seedlings was raised without trouble, and another with 50% loss of seedlings. Watering during the summer months needs to be carefully controlled.

Culture: Fifteen seedlings were acquired in 1953 and after they became established in pots, they were planted in a sunny, open spot with considerable sandy overlay on granitic loam. While not many of the original plants are living, numerous seedlings have sprouted, spreading the planting to a considerably larger size with well over 100 plants; all are doing well. Other plantings have behaved equally well. Flowering and seeding started the first or second year. Plants two to three feet tall and to three-and-a-half feet wide developed in a period of ten years.

***Habenaria unalascensis* (Spreng.) S. Watson** [Ed: *Piperia unalascensis* (Spreng.) Rydb. TJM2]

Rein Orchid.

Perennial.

Orchidaceae. Orchid Family.

Natural Range: Undisturbed, dry or moist flats or slopes, below 8,000 feet, Baja California (Mexico), to Alaska; Alberta (Canada); Utah. Flowering from April to August.

Propagation: One seed collection each of this species and ***H. elegans* (Lindl.) Bolander**. [Ed: *Piperia elegans* (Lindl.) Rydb. TJM2], when sown in flats, failed to respond. The small fleshy roots of ***H. sparsiflora* S. Watson**. [Ed: *Platanthera sparsiflora* (S. Watson) Schltr. TJM2] and this species were moved and planted directly into site.

Culture: The above species was native to a small part of the garden, as well as to close by areas. This species needs to be left undisturbed, as once we began clearing and gardening in the area, even though we were most careful not to disturb the native plants in any way, it was only a matter of a few years and they had completely disappeared. Another planting of roots moved from another close by area, survived, but poorly, for nearly five years.

***Haplopappus* Cass.**

Perennials, Shrubs.

Asteraceae. Sunflower Family.

Natural Range: A genus of some 150 species, all American, but chiefly seen in western United States, Mexico, and Chile. Of this number about 39 species and many subspecies are found throughout California in a wide variety of habitats, ranging in elevation from near sea level to over 10,000 feet. Mostly flowering from June to September, but some are earlier and some are later.

Propagation: None of the seed needs to be pretreated before sowing, either in flats or in outside seed beds. 34 lots seed from both wild and cultivated collections were sown during the 15 year

period. This comprised the below listed species and subspecies. The average germination period was eight days with large percentage in two to five days. Sowing directly into site required 32 days. Germination on the whole was good to excellent if the seeds were fresh (not more than a few months old). Seed more than two-years-old usually failed to germinate and certainly none germinated after four or five years. This pattern followed consistently for all species sown. Generally, our production of seedlings was good to excellent with an occasional lot suffering through heavy losses in the nursery - usually during the summer growing months. Asexual production was attempted only once. Ten semihard tip cuttings of *H. canus*, taken directly in the wild in May were pretreated with CUTstart XX, and rooted 100%. Initial rooting started in 16 days, and all plants were raised and planted.

Culture: Since the majority of the species are found naturally growing in dry, rocky habitats on slopes, mesas, and sandy flats, it follows that similar situations should be provided in cultivation. While the largest percentage of our plants were used in sharply drained situations, those planted in clay-loam soil grew equally well provided greater care was exercised in providing moisture. In fact, in the latter situation they needed no extra attention. Our results in growing this genus both here and at the old site have been quite similar. Average lifespan under our cultivation is six to ten years with greater or lesser periods for some species. Losses during the first six years were usually minimal with a gradual increase to the tenth year, after which there is a rapid decrease in numbers. In several instances many volunteer seedlings sprung up around the originals and help perpetuate the entity. Horticulturally, there would appear to be little interest in the genus, however, during our late summer and fall months, particularly along our more desert-like roadsides, very colorful bright yellow patches are observed which create interesting vistas for miles along our highways. A very useful scenic attribute during this very dry part of our year. Flowering under cultivation usually starts within the first or second year. Our feeling is that the colors never seem quite as bright and showy as in the wild, and our plants fail to create quite the effects as noted in nature. Overall, the plants are generally grayish in appearance. The following kinds with notes are listed below:

***Haplopappus acaulis* (Nutt.) A. Gray.** [Ed: *Stenotus acaulis* (Nutt.) Nutt. TJM2] – Two wild collections, one of which failed to germinate. Seed of the second, collected at an altitude of over 7,000 feet in Alpine County, developed into a small colony in a very rocky soil. Notes were recorded for over five years and at which time the plants remained small and had not flowered.

***Haplopappus acradenius* (Greene) S.F. Blake.** [Ed: *Isocoma acradenia* (Greene) Greene. TJM2] – Two wild collections and one from cultivated plants were grown; one wild collection failed to germinate. This desert species is found below 3,000 feet elevation and grew well and quickly but deteriorated rapidly after first five years. Plantings were recorded dead within six to eight years. Some damage was noted from winter frost when temperatures dropped to 25° F. (Most of our desert species start growing in early winter here in Claremont, and the tender new growth can be killed by frost.) Flowering and seeding began the second year and plants developed into specimens two to four feet tall with spreading three to eight feet wide. All of our three wild collections of the **ssp. *eremophilus* (Greene) H.M. Hall** [Ed: *Isocoma acradenia* (Greene) Greene var. *eremophila* (Greene) G. Nesom. TJM2] failed to germinate.

***Haplopappus apargioides* A. Gray.** [Ed: *Pyrrocoma apargioides* (A. Gray) Greene. TJM2]– This alpine species from an altitude of 12,000 feet responded quickly but was only recently acquired and has not been grown sufficiently to test its reliability here.

***Haplopappus arborescens* (A. Gray) Hall.** [Ed: *Ericameria arborescens* (A. Gray) Greene. TJM2] Golden Fleece. – This wide ranging, stout shrub is mostly found in the dry foothills of cismontane California. It responded exceedingly well to our conditions and only between the tenth and 15th year period were serious losses recorded. Ten-year-old plants attained heights of up to ten-and-a-half feet tall and had spreads of eight to 12 feet wide. Flowering and seeding were noted the second year.

***Haplopappus bloomeri* A. Gray.** [Ed: *Ericameria bloomeri* (A. Gray) J.F. Macbr. TJM2] – A low, compact shrub usually seen on flats or slopes near coniferous woods at elevations of 3,500 to 9,000 feet. Our three wild collections came from altitudes of 4,500 and 9,500 feet. Germination was poor or failed completely. The best response was from one collection that grew well but lived only to its ninth year. Sizes attained were eight to ten inches tall and eight to 22 inches across. Flowering and seeding were noted in the second year.

***Haplopappus canus* (A. Gray) S.F. Blake.** [Ed: *Hazardia cana* (A. Gray) Greene. TJM2] – This coastal bluff insular plant is one of the longer lived species in our area. Seeds harvested from an original 1932 planting at the old site provided our source for starting anew in this area. Situated on a north slope of hard clay, the species has done well although suffering from time to time from death caused by sudden winter freezes when temperatures dropped to 25° F or even lower. This happened with other later collections soon after setting out and losses were high. Plants protected by nearby large shrubs survived and have developed into fine specimens eight feet tall and eight feet wide. Other collections have reached 15 years of age and are three to five-and-a-half feet tall and five-and-a-half to 11 feet wide. Flowering and seeding started either in the first or second year, often a few months after germination.

***Haplopappus cooperi* (A. Gray) H.M. Hall.** [Ed: *Ericameria cooperi* (A. Gray) H.M. Hall. TJM2] – This common plant of the desert areas at elevations of 2,500 to 5,700 feet was started in 1959. Severe seedling losses in the nursery occurred, but in the seven years of growth, the history has been normal although general condition of the plants is relatively poor. Our best specimens have attained sizes of three feet by six feet. Flowering and seeding commence in the second year.

***Haplopappus cuneatus* A. Gray.** [Ed: *Ericameria cuneata* (A. Gray) McClatchie. TJM2] – A few specimens were maintained in good condition for a period of ten years or more. Naturally found on cliffs, slopes, and among crevices of granitic boulders on the drier portions of many of our mountain slopes, 2,500 to 9,000 feet, we suffered high mortality the first few years. After that, a few plants survived. Plants flowered from the second year and produced some seed. Sizes ranged from one to two-and-a-half feet tall by 15 inches to five feet wide.

***Haplopappus ericoides* (Less.) Hook. & Arn.** [Ed: *Ericameria ericoides* (Less.) Jeps. TJM2] – The seed of several collections of this coastal sand dune species failed to germinate. From two collections, we grew excellent stands of plants, one of which rapidly expired until a surviving two plants have been maintained for several years and are now over ten-years-old, three to three-and-a-half feet tall and eight to 11 feet across. The second collection was more than 50% destroyed by road reconstruction, but the remainders have survived with minor losses, being two to three-and-a-half feet tall and two to five feet across. These plants flowered in their second year. The **ssp. *blakei* C.B. Wolf** [Ed: the ssp. is not recognized in TJM2] has been relatively short-lived and only raised once and only recently.

***Haplopappus linearifolius* DC.** [Ed: *Ericameria linearifolia* (DC.) Urbatsch & Wussow. TJM2] – An inhabitant of the inner arid slopes and borders of deserts below 6,000 feet, this species has performed quite well in our area, being grown well for over ten years with only average losses. Specimens eight- to ten-years-old were two to five feet tall and three to eight feet across. Flowering and seeding began during the second year.

***Haplopappus parishii* (Greene) S.F. Blake.** [Ed: *Ericameria parishii* (Greene) H.M. Hall. TJM2] – This Southern California species observed locally on outwash fans and exposed hillsides below 6,000 feet, grew rapidly into large shrubs often seven to nine feet tall with equal spreads. As with the other species, losses were rapid until only a few specimens remained, and these would survive for eight to ten years. They need quite dry and loose soils of a somewhat loamy nature.

***Haplopappus pinifolius* Gray.** [Ed: *Ericameria pinifolia* (A. Gray) H.M. Hall. TJM2] – An inhabitant of the dry slopes of cismontane Southern California, we failed to germinate the seeds of our lone collection.

***Haplopappus propinquus* Blake.** [Ed: *Ericameria brachylepis* (A. Gray) H.M. Hall. TJM2] – Likewise failed to germinate.

***Haplopappus squarrosus* Hook. & Arn.** [Ed: *Hazardia squarrosa* (Hook. & Arn.) Greene. TJM2] – Found on coastal bluffs, in montane canyons and ridges of central California below elevations of 2,200 feet. Our two collections of this species have grown extremely well having suffered only relatively small losses and have produced excellent plants and abundant volunteers in the immediate vicinity. Specimens average three to six feet tall and six to 15 feet wide. Flower and seed production start the first year. One seed collection of the **ssp. *grindeloides* (DC.) Keck** [Ed: *Hazardia squarrosa* (Hook. & Arn.) Greene var. *grindeloides* (DC.) W. Clark. TJM2] failed to germinate, and the second, while producing few seedlings, has been grown in good condition for over three years with small losses.

***Haplopappus venetus* (Kunth) S.F. Blake ssp. *oxyphyllus* (Greene) H.M. Hall.** [Ed: *Isocoma menziesii* (Hook. & Arn.) G. Nesom var. *menziesii*. TJM2] – This species grew so vigorously in heavy clay soil and produced so many volunteer seedlings, that it became necessary to thin the planting in the second year. Three-year-old plants were three to six feet tall and four to ten feet wide. The **var. *sedoides* (Greene) Munz** [Ed: *Isocoma menziesii* (Hook. & Arn.) G. Nesom var. *sedoides* (Greene) G. Nesom. TJM2] was only recently obtained, but numerous seedlings were easily raised and planted. However, there are no recently recorded notes.

***Haplopappus venetus* (Kunth) S.F. Blake ssp. *vernonioides* (Nutt.) H.M. Hall.** [Ed: *Isocoma menziesii* (Hook. & Arn.) G. Nesom var. *vernonioides* (Nutt.) G. Nesom. TJM2] – An abundant component of the coastal strand and adjacent coastal valleys and headlands below 1,000 feet in the southern portions of the state less abundant above Santa Barbara County. One collection suffered no losses after the seventh year and plants ten-years-old had attained sizes of two to four feet tall and were two-and-a-half to ten feet wide. The other numbers failed completely after their fourth year, having been weak plants and chewed severely by rabbits.

***Helenium bigelovii* A. Gray.**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Common in moist meadowy places and elevations depending on locations throughout the state. Flowering from June to August.

Propagation: No problems were encountered when using one- to three-year-old seeds, as these germinated within six to 17 days without any pretreatment. There was no trouble with raising the seedlings.

Culture: While we planted this species in the closest approximation to its native habitat that we could, it cannot be considered to have been a success. Some plants survived for several years, and we often grew fine flowering specimens, but even our moist spots were not the same as a mountain meadow. In one area, volunteer seedlings were noted. It was considered a short-lived perennial for us.

***Helenium hoopesii* A. Gray.** [Ed: *Hymenoxys hoopesii* (A. Gray) Bierner. TJM2]

Perennial.

Asteraceae. Sunflower Family.

Natural Range: A high elevation component of meadows, streamsides, and wet slopes in the Sierra Nevada and Warner Mountains of California. Flowering from July to September.

Propagation: One- to two-year-old seed, cold-stratified or untreated, responded in five days. Wild or cultivated seed four- to five-year-old, untreated germinated in ten days and produced few seedlings. We had excellent results handling the seedlings and young plants in the nursery.

Culture: Surprisingly, this high montane species performed relatively well for us, particularly when used in a shady portion of our rock garden. In heavier, wet soils, losses were high, mostly from crown rot. While our plants were not of the quality observed in its native habitat, quite nice flowering specimens were produced. From these, several collections of seed were harvested over a period of several years. A gay bright flower, this plant could be successfully used, and is used, in moister garden climates.

***Helianthemum* Mill.**

Rock-Rose.

***Helianthemum scoparium* Nutt.**

Perennial.

Cistaceae. Rock-Rose Family.

Natural Range: Near the coast on sandy flats and slopes from Santa Barbara County to Mendocino County, and from Santa Cruz and Santa Rosa islands. Flowering from March to June.

Propagation: Several collections of seed harvested from cultivated plants in the garden were grown from our original wild collection dating back to 1942. Excellent germination occurred within six to ten days from untreated seed. No losses of seedlings was recorded during growth in the nursery.

Culture: Used in sandy, dune-like situations, this neat, mounded species grew into nice specimens. These were exhibited over a period of several years, even though individual

specimens seldom lived more than four to eight years. Volunteers and easily produced seedlings kept the species in our collection.

***Helianthemum scoparium* Nutt. var. *aldersonii* (Greene) Munz.** [Ed: the var. is not recognized in TJM2]

Woody Perennial.

Natural Range: Observed in open dry sandy or rocky situations below 5,000 feet, usually among chaparral in the interior parts of Southern California. Flowering from March to July.

Propagation: Seedlings from untreated wild or cultivated seed will emerge in five to ten days, usually averaging seven days. Most seed lots produced quantities of plants that could be grown in the nursery quite readily.

Culture: While generally considered relatively short-lived for us, we were never without specimens, either from volunteer seedlings or from easily produced plants grown in the nursery. Some of our oldest specimens were recorded at eight years being 12 to 18 inches tall and 16 to 30 inches across. Flowering and seeding began the first year, even with seedlings growing in the nursery. This is likely true for the straight species, too. A rather straggly plant which at times can be quite attractive and usually invokes interest among visitors.

***Helianthus annuus* L. ssp. *jaegeri* (Heiser) Heiser.** [Ed: the ssp. is not recognized in TJM2]

Annual.

Asteraceae. Sunflower Family.

Natural Range: Seen in wet alkaline areas of the eastern central California and into western Nevada. Flowering from July to October.

Propagation: One collection of seed, untreated, responded in six days and all the seedlings were successfully raised and planted out.

Culture: Over a period of seven years, a small colony was maintained, some of the plants were noted to be volunteers. After using them in a rocky portion of our desert garden, they finally disappeared. Flowering was noted the first year and apparently good seed was produced. Our garden situation is completely different from its native habitat.

***Helianthus californicus* DC.**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: A species of boggy meadows, moist streambanks, and moist ground at low elevations, observed scattered throughout a large portion of California. Flowering from June to October

Propagation: We never raised this species from seed, as our material was produced from plants moved from the old site in 1951. This species is easily increased from the underground roots, so that there is little necessity for raising plants from seed. Dormant bare-roots were shifted from our old site.

Culture: Used in two places, both moist stream sites, fine colonies grew for a period of eight to ten years after which, for some unknown reason, the plantings deteriorated and gradually disappeared. While a very tall, straggly plant, the abundance of large bright yellow clusters of flowers makes it an attractive natural streamside plant.

***Helianthus gracilenthus* A. Gray.**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Loose soil on dry hillsides at elevations from 200 to 6,000 feet; mostly from the outer Coast Ranges from Contra Costa County to northern Baja California (Mexico). Flowering from May to October.

Propagation: Our plants were grown from seed, untreated material germinated in 15 to 25 days. Clumps of plants may be divided and restarted in containers. Our percentage germination was mostly poor to fair, but losses in nursery were minimal, and the young plants were raised quite easily.

Culture: Planted in a number of garden locations, this sunflower was the most successfully grown. Except for setbacks during early years of growth from frosts, several good stands spread into adjacent areas. Ten- to fifteen-year-old clumps were two to four feet tall and three to ten feet wide. Flower and seed production began the second year.

***Helianthus petiolaris* Nutt.**

Annual.

Natural Range: A weedy inhabitant of waste places, rare in Southern California; extending east to Missouri, Texas, and Saskatchewan (Canada). May-September.

Propagation: One wild collection of seed, started in 1952, took 16 days to germinate but did so rather sporadically. All the young plants were successfully raised in the nursery.

Culture: Our few seedlings were planted in a sterile soil situation in the desert garden, where seedlings continued to appear for over ten years. It did not spread to any extent, being easily kept within a small area. Plants flowered well and new seedlings appeared each season. The original planting was nearly killed by frost.

***Hemizonia clementina* Brandegee.** [Ed: *Deinandra clementina* (Brandegee) B.L. Baldwin. TJM2]

Shrub.

Asteraceae. Sunflower Family.

Natural Range: Grows in heavy soils on Anacapa, Santa Barbara, San Nicholas, Santa Catalina, and San Clemente islands. Flowering from May to August.

Propagation: Untreated seeds will germinate in eight days. Unnecessarily, we cold-stratified several lots for periods of two to four weeks and seed sprouted within a few days or had already started germinating before their removal from cold. A high percentage of seedlings were raised in the nursery for planting out. One original collection of seedlings from the wild were

established in cans and gave us our initial start of the species, as they produced seed their first year.

Culture: Our chief difficulty with this species was its tenderness to frost, which caused most of our losses. Protected plants survived and developed into good specimens 12 to 18 inches tall and 16 to 29 inches broad within a year or two. A recorded note says the juvenile foliage is coarse while the mature foliage is fine.

***Hemizonia corymbosa* (DC.) Torr. & A. Gray.** [Ed: *Deinandra corymbosa* (DC.) B.G. Baldwin. TJM2]

Annual.

Natural Range: Along the immediate coast from Mendocino County to Monterey County, at elevations under 500 feet. Flowering from May to October.

Propagation: Untreated seed sown in a flat will germinate in three days. Seeds sown directly into our garden site (of sandy or clay-loam soil), took an average of seven to 15 days, and sometimes shorter or longer periods, depending on how well rains or irrigation were timed.

Culture: Except for one initial lot, all plantings were sown directly into site in either well-drained sandy loam or in the clay-loam soil of the mesa. In any situation, this species always responded very well, producing excellent colorful vistas with an abundance of flowers placed compactly on rounded bushes. Flowering began in May and seed harvesting began in July. Once established in an area, volunteer seedlings could be counted on from year to year. Several generations were raised from an original 1958 wild collection.

***Hemizonia fasciculata* (DC.) Torr. & A. Gray.** [Ed: *Deinandra fasciculata* (DC.) Greene. TJM2]

Annual.

Natural Range: An abundant spring annual on sandy plains under 1,000 feet; San Luis Obispo County southward to Baja California (Mexico). Flowering from May to September.

Propagation: Sown directly into sandy loam areas in the garden, germination occurred in one to two weeks, depending on weather and frequency of irrigations.

Culture: This species is native to open sandy areas in the garden. As would be expected it was grown successfully and has been established in new areas.

***Hemizonia paniculata* A. Gray.** [Ed: *Deinandra paniculata* (A. Gray) Davidson & Moxley. TJM2]

Annual.

Natural Range: Dry hills and mesas, at low elevations, from western Riverside County to Baja California (Mexico). Flowering from May to November.

Propagation: Initially, seeds were started in nursery flats, and germination required four days. We had excellent results. When seeds were sown directly in sandy garden spots, they required ten to 27 days to germinate.

Culture: While grown successfully, the species was discontinued as it was not considered to be an attractive species.

***Hemizonia ramosissima* Benth.** [Ed: *Deinandra fasciculata* (DC.) Greene. TJM2]

Annual.

Propagation: Seeds sown in nursery flats germinated in four days. When sown in the garden, seeds germinated in 41 days and 11 to 15 days.

Culture: Sandy loam and heavy clay-loam soils were equally successful for growing this species. Many young plants were destroyed by birds. We considered it unattractive and stopped growing it.

***Heracleum lanatum* Michx.** [Ed: *Heracleum maximum* W. Bartram. TJM2]

Cow-Parsnip.

Perennial.

Apiaceae. Carrot Family.

Natural Range: Growing in moist, semishaded places below 9,000 feet, this plant is widely distributed through much of the country into Alaska and the Atlantic Coast. Flowering from April to July.

Propagation: Sown in January, and after 78 days cold-stratification, seedlings emerged in ten days. However, untreated seed sown in September and November required only 22 and 36 days. In three lots sown, germination was poor, but none of the seedlings were lost in the transplanting and growing process in the nursery.

Culture: Planted at the edge of a moist stream course in heavy clay soil, a few plants became established and flowered, attaining normal size. It took about three years for the plants to flower.

***Hesperocallis undulata* A. Gray.**

Desert Lily.

Perennial.

Liliaceae. Lily Family. [Ed: Agavaceae. Century Plant Family. TJM2]

Natural Range: Locally common on dry sandy flats and gentle slopes below 2,500 feet; from the Mojave and Colorado Deserts to western Arizona. Flowering from March to May.

Propagation: Four collections of seeds that were divided into several lots responded in eight to 12 days when sown in seed flats. Seed sown directly in a sand dune location, took 35 and 63 days to germinate, the latter producing excellent germination. When sown in flats, the seedlings were gradually dried off in April or May and watering was resumed the following September. This procedure continued until bulbs grew large enough to set out. Losses during this process were high. Sown directly into site, much the same process was attempted but seedlings usually failed within two years, sometimes caused by problems with excessive ants.

Culture: This species has never been successfully raised by us, no matter how hard we tried. Certainly it is a beautiful species to have if it could be raised successfully.

***Heteromeles arbutifolia* (Lindl.) M. Roem.**

Toyon. California Holly.

Shrub.

Rosaceae. Rose Family.

Natural Range: A common component of the brushy hillsides and canyons below 4,000 feet through the mountains of Southern California north to Mendocino County, and Sierra Nevada foothills from Shasta County to Tulare County.

Propagation: Seeding, cuttings, and grafting are methods used for reproduction of this useful species. Cold-stratification of seed unnecessary as untreated seed will germinate in eight to 15 days, even four-year-old seed came up in 12 days. One lot of seed germinated in three days however, it, too, averaged 12 to 15 days. While most lots of seedlings can be raised without excessive losses, occasional problems arise from damp-off and precautions are needed to guard the seedlings from this pathogen. Only one collection of cuttings were raised from an outstanding plant of the **var. *macrocarpa* (Munz) Munz.** [Ed: the var. is not recognized in TJM2]. The cuttings were taken in late July and were treated with Rootone, and took 37 days to start rooting. About 80% rooted and were successfully grown on. Since this variety is preferred for horticultural purposes, one large commercial grower grafts it on to the root of another species. Other growers feel this practice is unnecessary.

Culture: Having raised hundreds of plants of the species and the **var. *macrocarpa*,** nothing but success has attended our efforts with this handsome and beloved plant. Entwined in the early history of our state, this useful species is well known to horticulture and little needs to be said about it. This species grows into a large plant, so plenty of room needs to be allotted for its best growth. It is not too choosy about soils, though it will not accept highly alkaline situations. Flowering and fruiting may be expected in the third to fifth year, depending on the actual garden site and the rapidity of vegetative growth. Our plants registered growth in ten years of ten to 15 feet tall with spreads of 11 to 21 feet. Other groups did not achieve this size but all were of good dimensions. Needing little attention, this plant may be used in a variety of situations but is most handsome on a hillside where the copious amounts of berries may be viewed best during the months prior to and after the Christmas season. The large berries and huge clusters of the **var. *macrocarpa*,** found on Santa Catalina and San Clemente islands has become a favorite horticultural plant. Our experience indicates it is not relished by the birds until the later part of the season when they come through in hordes in later March or April.

***Heuchera brevistaminea* Wiggins.**

Perennial.

Saxifragaceae. Saxifrage Family.

Natural Range: Dry rocky outcrops in the Laguna Mountains of San Diego County, at 5,000 to 6,000 feet. Flowering from May to July.

Propagation: No experience from seed. Our collection grew from receipt of a potted plant.

Culture: Placed in our rock garden, in semishade, this plant has performed very well in three years since we received it. It has flowered but not profusely. It has gradually spread into a fine specimen. Excellent for the rock garden.

***Heuchera maxima* Greene.**

Island Alum-Root.

Perennial.

Saxifrage Family.

Natural Range: Canyon walls and cliffs of the Santa Cruz, Santa Rosa, and Anacapa islands.
Flowering from February to April.

Propagation: Easily started from divisions, lifting established plants, rooting branches, or sowing untreated seed in a flat. Seeds germinate in 24 to 30 days, and the seedlings are easily raised in containers to plantable size within a few months.

Culture: Our plantings were all started from seed acquired in 1938. In 1951, suitable sized plants were moved from the old site and were planted on a shady bank under large oak trees. Here they grew rapidly, spreading in a short time to over two feet across. Additional hundreds of plants were raised from seed and were established in other suitable garden locations. Specimens exposed to the hot summer sun burned easily, but through a large portion of the year, they did well in rather open spots, flowering far more profusely in these places. The heavy growth of large rounded leaves is a fine hiding place for snails and slugs, requiring frequent eradicating treatments. Sporadic flowering occurred through much of the year but was most abundant from March through May. The long stems are covered with an abundance of creamy white flowers and make fine fillers for bouquets. This species was used a great deal in hybridizing in an effort to produce a superior coral bell for horticulture. See *Heuchera* 'Santa Ana Cardinal'.

***Heuchera micrantha* Lindl. var. *erubescens* (A. Br. & Bouche) Rosend.** [Ed: the var. is not recognized in TJM2]

Perennial.

Natural Range: Moist humus and rocky banks from 2,500 to 7,000 feet, in the Sierra Nevada from Tulare County north to Siskiyou County. Flowering from May to July.

Propagation: Untreated seed sown in flats germinated in 15-25-45 days, emerging in less time for older seed but without yielding such good results. There is no problem raising the seedlings to planting out stage. Divisions, cuttings, and transplants are equally successful modes of propagation. This also holds true for the **var. *pacifica* Rosend., Butt. And Lak.** [Ed: the var. is not recognized in TJM2].

Culture: Used in partial to full shade areas in rock garden, banks, and flat areas, these varieties grew exceedingly well. The **var. *pacifica***, was started at the old site in 1942, and was later transferred to the new site. Of these, all except one plant grew and have developed into clumps one foot tall and four to nine feet across. Abundant flowers and seeds are produced each year. A useful plant for the shady wild garden as well as for more cultivated spots.

***Heuchera ovalifolia* Nutt.** [Ed: *Heuchera cylindrica* Douglas. TJM2]

Perennial.

Natural Range: Among volcanic rocks, etc., in rather dry situations, from 4,000 to 8,000 feet elevation in the mountains of eastern Modoc and Siskiyou counties to Washington and Nevada. Flowering from June to August.

Propagation: Untreated seed from the wild sown in flats takes 21 to 38 days for germination to take place, while seed from cultivated plants consistently came up in 16 to 19 days. We experienced excellent results in raising the plants in the nursery.

Culture: These plants needed a shade in our area and performed best in the rock garden. The removal of a large, shade tree exposed a large planting to full sun in the rock garden. Within a few months the entire planting had died. Some specimens planted in the heavy clay of the mesa failed to survive for more than a few years and did not perform well there. These plants need shade and sharp drainage found in our rock garden. Other later plantings have persisted well when they are grown in proper conditions.

***Heuchera parishii* Rydb.**

Perennial.

Natural Range: Rocky places, 5,000 to 9,000 feet, in the San Bernardino Mountains. Flowering from July to August.

Propagation: Two plants, removed from the wild and presented to the garden in 1963, were easily established in pots until they were ready for planting. We have no experience with growing this species from seed.

Culture: Two years after placing the plants in a shady spot in the rock garden, a report noted the two plants were doing very well, flowering and making nice clumps.

***Heuchera rubescens* Torr. var. *alpicola* Jeps.** [Ed: the var. is not recognized in TJM2]

Perennial.

Natural Range: Dry rocky places, from 6,000 to 12,000 feet, in the central eastern California mountains to Nevada. Flowering from May to July.

Propagation: Untreated seed required 79 days to germination and only two seedlings came up. These were raised and planted. Perhaps cold-stratification would have served a good purpose.

Culture: The plants were planted in 1957 in the rock garden, we have no subsequent record as to its growth here.

***Heuchera rubescens* Torr. var. *glandulosa* Kellogg.** [Ed: the var. is not recognized in TJM2]

Natural Range: Dry slopes and screes from 6,000 to 12,000 feet elevations largely from Placer and Plumas counties.

Propagation: Untreated seed in flats required 27 to 32 days for germination. Four-year-old seeds gave the best results, however only one collection was successful. No problems were encountered while raising these seedlings. Three lots sown from the sixth to the ninth year failed to respond.

Culture: While losses were considerable in the rock garden, good specimens four inches tall and four inches wide were recorded on several occasions. These plants flowered well and appeared to respond to our site conditions. The last record in 1959 indicated that the plants were deteriorating but had been doing well – these plants were originally planted in 1953 and 1955.

***Heuchera* ‘Santa Ana Cardinal’**

Notes: This outstanding hybrid is the result of a cross between *H. sanguinea* Engelm. and *H. maxima*. It was introduced into the commercial nursery trade in 1962 by Deiggard Nurseries. Several years of hybridizing by Dr. Lee W. Lenz, Director of this botanic garden, and the production of several hundreds of clones, resulted in the introduction of this fine plant into commercial production. It is an unusually vigorous, free-flowering clone, producing as many as a hundred flower spikes on clumps three to four feet across. The leaves are large and rounded similar to *H. maxima* and with its vigor, while the flowers are a vibrant rose red with as many as 50 to 100 on a stout spike two feet tall.

Propagation: Only by asexual production. The branches of mature plants are separated from the main stalk, cleanly cut and all leaves but the top are removed. Put into individual small pots, kept in a greenhouse, rooting begins within a few weeks. Plantable material should be ready in six months.

Culture: Light, high shade appears to be best. Our plantings have done equally well in loose or tight clay. Flower production occurs over a period of several months, and these are followed by intermittent blooms through the year in mild climates.

***Hibiscus californicus* Kellogg.** [Ed: *Hibiscus lasiocarpus* Cav. var. *occidentalis* (Torr.) A Gray]

Perennial.

Malvaceae. Mallow Family.

Natural Range: Moist banks and freshwater marshes of the lower Sacramento and San Joaquin rivers in central California. Flowering from August to September.

Propagation: Initial germination for untreated seed from wild or cultivated collections was five to eight days, however, total germination was sporadic and lasted for a period of four to five months. One lot was pre-soaked for two hours in a 2.6% solution of sodium hypochlorite, and took 38 days for first germination but total germination occurred within 30 additional days, rather than four to five months. The seedlings proved to be easily raised to planting size.

Culture: Planted in a pond or in a wet stream bed, this water-loving plant grew quite well, producing large creamy white flowers with a deep crimson center after the second or third year. Viable seed was harvested the second year from seed. Each winter season, the plant died back and was not seen until the following spring. There was a gradual spreading of the root crown and additional stalks arose each year, increasing the size of the clump.

***Hibiscus denudatus* Benth.**

Perennial.

Natural Range: Rocky slopes and canyons below 2,500 feet, in the creosote bush scrub of the Colorado Desert, east to Texas. Flowering from February to May.

Propagation: One collection from the wild of untreated seed came up in four days, but only a few seedlings emerged. One other collection failed to germinate. All of our seedlings died in the nursery. One plant acquired was grown to planting size.

Culture: Our one plant, set out in September 1952, was killed by frost the first winter, a condition which often happens with some of our desert plants.

***Hilaria rigida* (Thurb.) Scribn.**

Galleta Grass.

Perennial.

Poaceae. Grass Family.

Natural Range: A common plant in sandier places below 4,000 feet, in both deserts, to Utah, Arizona; Sonora (Mexico). Flowering from February to June.

Propagation: We have never grown this species from seed, only by transplanting clumps and re-establishing them in pots before replanting them in the garden. This process was followed in transferring established plantings at the old site for replanting here in Claremont. Two large clumps were moved in five-gallon-cans in February 1951.

Culture: Two clumps from the old site were replanted in September 1951 and only one survived. It is growing in a rocky sandy situation, it is well established, although making little growth. Having grown the clumps for 25 years (first acquired in 1941) the one remaining clump now measures three feet tall and three feet wide.

***Hoffmannseggia densiflora* Benth.** [Ed: *Hoffmannseggia glauca* (Ortega) Eifert. TJM2]

Shrub.

Fabaceae. Pea Family.

Natural Range: Alkaline soils, below 2,600 feet from the Mojave and Colorado deserts and cismontane California; to Texas and Mexico. Flowering from April to June.

Propagation: Wild collections of untreated seed started to germinate in five days, when sown in either in either flats or pots. Germination ranged from poor to good. About 25% loss occurred during the transplanting stages in the nursery, which led us to sow the seeds directly into individual pots. Care must be exercised since these seedlings rot easily in cans.

Culture: Set out in a sandy rocky area, underground rootstocks were soon sent out in all directions. In 15 years, plants were eight inches tall and had made clumps to six feet wide. While generally in good condition, there appeared to be a weakening over time, and the underground rootstocks seemed to be less vigorous. Flowering occurred the first season in the nursery, but during the third year in the garden. This species needs little or no attention, but should be grown in well-drained loose soil.

***Hoffmannseggia microphylla* Torr.**

Shrub.

Fabaceae. Pea Family.

Natural Range: Common in canyons and washes below 4,000 feet, in the Colorado Desert; Arizona; Sonora and Baja California (Mexico). Flowering from March to May.

Propagation: Germination occurs in five days for untreated seed from the wild. Our best results occurred when the seeds were sown in late February or March and sowing several seeds (for to six) into gallon-cans with a very sandy soil mix. We raised a little better than 50% of the

seedlings. Results from sowing seed in October was poor, with only three seedlings being successfully raised, the remainder were killed by damp-off fungus.

Culture: All of our plants were killed from frost within the first three years of planting out. This species is sensitive to temperatures below 28° F.

***Holacantha emoryi* A. Gray.** [Ed: *Castela emoryi* (A. Gray) Moran & Felger. TJM2]

Crucifixion Thorn.

Shrub.

Simarubaceae. Quassia Family.

Natural Range: Occasionally seen in gravelly places and dry plains of the southern Mojave Desert, the Colorado Desert; and to Arizona, and Sonora (Mexico). Flowering from June to July.

Propagation: Seven lots of seeds were sown from a harvested collection gathered in the old site from plants planted in 1929. Since germination was erratic and rather poor, we experimented with several methods, principally untreated, cold-stratified, and soaking in Thiourea for four minutes. A wild collection of untreated seeds started to germinate in 15 days. Over a period of eight years we sowed seeds collected from plants in the garden, and those that were sown untreated began germinating in 22, 59, and 14 days. Another lot of garden collected seeds were treated with Thiourea and began germinating in 42 days. Two more lots of garden collected seeds were cold-stratified for three months and these began germinating in 38 and 14 days after they were removed from the cold. While sufficient seedlings for our purposes germinated, the results could not be considered better than poor to fair. After transferring the seedlings to pots, there were comparatively small losses until after shifting to the gallon-can stage for the summer. Mortality was generally severe, either from damp-off or a fungus that started at the tips of plants and gradually worked down the stems to the root system.

Culture: Used in our rockiest areas, this hardy plant grew vigorously with little loss or attention after establishment. Seed production did not start until the eighth year while the first flowers were noted in the sixth year. Fifteen-year-old plants had attained heights of two-and-a-half to five feet tall and spread two to seven feet across. While they can survive on little or no additional water, we found they progressed better if given an occasional irrigation, once or twice every two or three months during the summer months.

***Holocarpha macradenia* (DC.) Greene.**

Tarweed.

Annual.

Asteraceae. Sunflower Family.

Natural Range: Rare; growing in colonies on heavy soil of grassy flats near the coast in Marin, Alameda, and Santa Cruz counties. Flowering from June to October.

Propagation: Untreated seed sown in the garden takes nine to 12 days to appear. Starting from a poor original showing of four plants, we quickly produced several generations the following years.

Culture: Sown in both heavy clay and light sandy loam, attractive displays were produced each year, although heavy protection from birds was necessary. Flowering began in June and continued for two to three months after which seed was harvested from late August to September. This species is apt to grow too leggy and spindly when grown under rich soil conditions – and in such cases it is unattractive.

***Holodiscus discolor* (Pursh) Maxim. var. *franciscanus* (Rydb.) Jeps.** [Ed: the var. is not recognized in TJM2]

Cream Bush. Ocean Spray.

Shrub.

Rosaceae. Rose Family.

Natural Range: On brushy and rocky slopes and woods, below 4,000 feet, through California from Orange County to southern Oregon. Flowering from May to July.

Propagation: Seed was harvested from plants at the old site and when untreated produced seedlings in 14, 21, and eight days, the latter being a fresher seed collection. A wild collection was cold-stratified for 84 days, however seedlings had appeared before they were removed from the cold. The total germination occurred within a few days after removal. Prior sowings indicate good seed will give satisfactory results without cold-stratification. Unusual specimens may be propagated by layering or by taking greenwood cuttings, but we did not do this. We have had excellent experience raising seedlings in the nursery and growing them on into gallon-cans. These plants were then planted out in the garden within a year.

Culture: Used in several locations, the best plants were grown in light shaded areas in clay soils. Once established in the open, rocky sites, and even though initial losses were relatively high, the plantings were noted to be in fair to good condition. Flowering and seeding began the third year and sizes ranged from three to eight feet tall and were five to 11 feet across for ten- and 15-year-old specimens. Relished by rabbits, the young plantings were severely chewed, causing a considerable weakening of their vigor. We found it necessary to protect all plantings from the start and until they were at least three-years-old. A well grown specimen produces an attractive display of large clusters of creamy-white flowers, gradually aging to tannish colors. Pruning helps preserve the quality appearance of this plant. A group of five plants were transferred from the old site in five-gallon-cans. Since the new site offered no protection and was rather severe for this material, all except one died within three years. The remaining specimen was recorded dead in the 15th year.

***Holodiscus microphyllus* Rydb.** [Ed: *Holodiscus discolor* (Pursh) Maxim. var. *microphyllus* (Rydb.) Jeps. TJM2]

Shrub.

Rosaceae. Rose Family.

Natural Range: An inhabitant of the higher portions of mountains of the eastern and desert sections of California, between 5,000 to 11,000 feet and ranging into Colorado and Arizona. Flowering from June to August.

Propagation: We grew two wild collections of seed. Untreated and sown in December, the first collection produced fair results with germination occurring in 34 days. Subsequent sowings the following six years failed completely, even though some lots were cold-stratified. A later wild collection of fresh seed was cold-stratified for 50 days with germination starting in seven days and maximum germination in a month. Additional material sown four years later failed to respond. Our history indicates only fresh seed will grow, the following years failing completely. While no effort was made, cuttings may be rooted. Good results were obtained in raising the seedlings through the nursery, there were only minor losses.

Culture: Gathered from two different plant communities in the wild, our first collection was placed in open sandy loam with an underlay of rock. This area grew fine specimens of other plants which afforded some protection for this species. Slightly over two-thirds succumbed in ten years but the remaining plants were in fair to good condition, and measured 14 inches to three-and-a-half feet tall and one to four-and-a-half feet wide. Discontinuing basin irrigation and working around the plants helped them to become increasingly better specimens. No flowering had been recorded to date. Some rabbit damage was noted. A second later collection from the sage brush scrub plant community was placed in a very rocky, open site and losses were relatively severe during their nine years in the garden. They grew 14 inches to three-and-a-half feet tall and spread from 14 inches to four feet wide. No flowering has been noted. The **var. *glabrescens* (Greenm.) Ley.** [Ed: *Holodiscus discolor* (Pursh) Maxim. var. *glabrescens* (Greenm.) Jeps. TJM2] was grown under much the same conditions and failed within three years.

***Horkelia cuneata* Lindl.**

Perennial.

Rosaceae. Rose Family.

Natural Range: Open sandy fields and in woods near the coast, from San Francisco to San Diego County. Flowering from April to September.

Propagation: By seeds or dividing young plants. Our material came from established plants moved from the old site and re-establishing them in containers until they were ready for planting out.

Culture: Since this species naturally grows throughout the present garden site, the plants from the old site were situated in an open area with full sun and rocky soil. They grew well, developing into plants eight to 12 inches tall and 15 inches across. They were noted to have been lost in their 20th year due to being overrun by large adjacent shrubs.

***Horkelia frondosa* (Greene) Rydb.** [Ed: *Horkelia californica* Cham. & Schltl. var. *frondosa* (Greene) Ertter & Reveal. TJM2]

Perennial.

Natural Range: In the dry hills near the coast, below 1,000 feet, Sonoma to Monterey counties. Flowering from May to September.

Propagation: One wild collection of fresh, untreated seed required 11 days to germinate, and maximum germination took 21 days. We encountered no problems in growing the seedlings which were ready for planting out in five months.

Culture: Plants were planted in two areas, the young plants took off rapidly in semishaded conditions with well-drained sandy rocky soil. Within a few weeks, flowering plants were noted and since then the clumps have developed into almost solid colonies.

***Horkelia tenuiloba* (Torr.) A. Gray.**

Perennial.

Natural Range: Sandy or silty meadows, below 1,800 feet, in the Outer Coast Ranges, from Sonoma, Marin and San Luis Obispo counties. Flowering from April to July.

Propagation: Plants and cuttings were collected and were easily established. Of the cuttings, 21 out of 23 rooted in 25 days with no treatment. However, the stems were noted as rooting under large mats of plants growing in very sandy soil.

Culture: Placed in a sand dune area, the plants progressed nicely and became well established in a short period of time.

***Horsfordia newberryi* (S. Watson) A. Gray.**

Shrub or woody perennial.

Malvaceae. Mallow Family.

Natural Range: Dry rocky places, below 2,500 feet, western Colorado Desert; to Arizona; Sonora and Baja California (Mexico). Flowering from March to April, and November to December.

Propagation: From plants that had been growing in the cactus garden at the old site, seed was harvested for sowing at the new site. Sown untreated in late August and early September, seedlings emerged in seven days, but germination was poor. Carefully handled in the nursery, only a few seedlings were lost before they were planted out in the garden. Adjacent to the nursery where the discarded flats of soil was dumped, a seedling came up and later produced seed. This lot, while somewhat better in results, suffered from high mortality in the nursery after shifting into gallon-cans and our attempts to grow them through the summer in this situation. It appears better to start seed later, produce suitable sized plants in four- or five-inch pots and to plant them out before summer arrives.

Culture: Set out in several situations, this desert plant did not survive our winters, being easily killed with temperatures under 28° F to 30° F. Where sheltered by buildings or trees, the species might be maintained, although it does not appreciate wet, cold winters - even without freezing temperatures.

***Hulsea heterochroma* A. Gray.**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Infrequently found in forest openings or chaparral from 3,000 to 8,000 feet, through much of California; and into Nevada. Flowering from June to August.

Propagation: Untreated seed from wild collections began germinating in eight days when directly sown into the garden, and in 23 and 34 days when sown in the nursery. The seedlings have been raised in the nursery without any trouble.

Culture: Our original plantings were choked out by more vigorous weedy material and our second collection is too recent to make any meaningful observations.

***Hulsea callicarpa* (H.M. Hall) S. Watson ex Rydb.** [Ed: *Hulsea vestita* A. Gray ssp. *callicarpa* (H.M. Hall) Wilken. TJM2]

Perennial.

Natural Range: Infrequently seen on open dry stony slopes or meadow borders from 4,000 to 10,000 feet, mountains of interior Southern California. Flowering from May to August.

Propagation: We experienced very poor results from two collections of wild seed sown untreated in September and October. Seed germinated in 18 and 65 days for each of two lots of one collection, and 39 days for the second collection plus two failures. Our results would indicate either very poor seed (seems most likely) or that these seeds need cold-stratification (and this could be true as this is a high altitude species). All seedlings were successfully raised through the nursery.

Culture: Planted in our rock garden, all plants collapsed from crown rot when coming into their prime growth.

***Hydrocotyle ranunculoides* L. f.**

March Pennywort.

Perennial.

Apiaceae. Carrot Family. [Ed: Araliaceae. Ginseng Family. TJM2]

Natural Range: Widely distributed in ponds and slow-moving streams throughout cismontane California; to Washington, Pennsylvania, to South America, and to southern Europe. Flowering from March to August.

Propagation: The simplest propagation method is to gather rooted plants and place them directly into the garden site.

Culture: This species needs a wet area, shallow standing water, or a slow-moving stream. We placed our plants, originally harvested along a desert river, in a depression of our man-made stream. Here the plants have prospered, spreading abundantly in the shallow pool-like situation. Dying out in the winter, if too cold, it comes to life the following spring, continuing its regular cycle. One plant of *H. umbellata* L. was brought in but never became established.

***Hymenoclea salsola* Torr. & A. Gray.** [Ed: *Ambrosia salsola* (Torr. & A. Gray) Strother & B.G. Baldwin. TJM2]

Shrub.

Asteraceae. Sunflower Family.

Natural Range: A dryland plant common to most of the western desert areas, below sea level to 5,000 feet, often in alkaline soils. Flowering from March to June.

Propagation: Excellent germination may be obtained in three to five days from untreated wild seed. Our chief difficulty was in raising the seedlings after they were shifted to gallon-cans and

grown through the summer. Even sowing seed in March failed to accomplish any control over the plants rotting in cans.

Culture: Since this is a xerophytic plant accustomed to sharp drainage, or extremely hot and dry conditions, we used our plants in such garden situations. Generally, this species handled our garden conditions well, except for one severe loss during a sharp winter drop of temperature down to 23° F a year after their initial planting. Once established, our plantings have continued to do as well as can be expected under the differences in conditions. Ten-year-old plants average two to four feet tall and spread four to nine feet across. Flowering or seeding was not recorded in ten years, but may have occurred.

***Hymenopappus filifolius* Hook. var. *lugens* (Greene) Jeps.**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: The higher dry slopes from 4,000 to 7,500 feet of desert facing mountains in Southern California, to New Mexico, Utah, and Baja California (Mexico). Flowering from June to August.

Propagation: When sown directly into a garden site in dry, rocky, sandy, granitic loam in our desert garden, seedlings appeared in 33 days, and several nice rosettes four inches across became well established. Flowering occurred the next year and was recorded on several occasions. Recorded notes indicate that a gradual decline took place and the plants were noted to have disappeared in four years.

***Hymenoxys acaulis* (Pursh) Parker var. *arizonica* (Greene) Parker. [Ed: *Tetraneris acaulis* (Pursh) Greene var. *arizonica* (Greene) K.F. Parker. TJM2]**

Perennial.

Asteraceae. Sunflower Family.

Natural Range: Mountains of the eastern Mojave Desert, largely on rocky limestone ridges and flats from 4,000 to 8,000 feet; to Colorado. Flowering from April to June.

Propagation: Originally started from a wild collection of seed gathered in 1940, all subsequent propagations have been from our cultivated plants. Untreated seed will provide good germination within five to ten days (usually in six to eight days). Seedlings are easily handled with only minor losses. Large clumps of established plants may be lifted and divided, or small seedlings are transplanted readily. This latter process was used in transferring plants from the old site and for bringing in seedlings from the wild. Many of the plants, 11-years-old, were dug and moved bare-root with good success, and were replanted directly into the garden without being grown in pots. Seed has been sown directly into garden sites with some degree of success but some lots were destroyed by birds.

Culture: Used in our desert garden, some plantings have been established both from transplanted stock and from new propagations both of seedlings raised in the nursery and or sown directly into the garden. Although our plants were planted in extremely well-drained positions, and have established reasonably well, they have not matched the quality of the plants that were raised at the old site. These plants never seem to be as vigorous, although they have flowered, produced

seed, and volunteer seedlings have been noted from time to time. Clumps over 15 inches across were produced at the old site in eight years while presently they seldom acquire more than six to eight inches across and flower rather sparingly. The opposite condition would be anticipated since the soils here are better drained and the climate warmer in summer but colder in winter. The species *H. cooperi* (A. Gray) Cockerell. was obtained in 1964, and seedlings were produced in late 1965 and planted out in March 1966. Enough time had not elapsed to evaluate this species in our area.

Hypericum L.

St. John's Wort.

Annual or Perennial.

Hypericaceae. St. John's Wort Family.

Natural Range: The three native species are usually seen at variable altitudes, depending on species. Two inhabit moist to wet meadows, stream banks, etc. while the third is found on dry, brushy slopes. One species, the Klamath weed (*Hypericum perforatum* L. ssp. *perforatum*), introduced from Europe, has become a serious weed pest. Flowering from May to September.

Propagation: All collections except one were brought in as rooted plants, and established in pots or flats. *H. concinnum* Benth. germinated readily in ten to 18 days and raising seedlings was no problem. Volunteer seedlings of one species, *H. anagalloides* Cham. & Schldl. Tinker's Penny, were noted in the garden.

Culture: All three native species, *H. anagalloides*, *H. concinnum*, and *H. formosum* Kunth var. *scouleri* (Hook.) J.M. Coult. [Ed: *Hypericum scouleri* Hook. TJM2], were all placed in proper sites, but none were very long-lived, most receding from the scene in three to five years, even though growing and flowering normally. They were all highly subject to rabbit damage, which often caused a considerable weakening of the plants.

Hyptis emoryi Torr.

Desert-Lavender.

Shrub.

Lamiaceae. Mint Family.

Natural Range: A common plant in the washes and canyons, below 3,000 feet, in the southern Mojave Desert and Colorado Desert, to Arizona, Sonora and Baja California (Mexico). Flowering from January to May.

Propagation: Seedlings emerge in four to seven days from untreated seed, either from wild or cultivated plant sources. There was some indication that very fresh seed might need an after-ripening period before sowing. One lot took over two months to germinate when it was planted immediately after harvesting, but the same collection sown a year later produced fine germination within a few days. Extreme care must be exercised in raising the seedlings as they are highly subject to damp-off and root rots. The latter condition was a particular concern during the growing stage in gallon-cans during the summer months. Several procedures were followed but none helped – although we did find that watering the plants as little as possible (though

enough to sustain good growth) during the summer was beneficial. We found that either too little or too much moisture was a sure path to failure.

Culture: Always used in well-drained sites, plants would grow readily and with fair survival rates. Plants are highly subject to frost damage, any temperature under 28° F would cause high mortality and it was this factor that depleted the number in our plantings. Once some degree of maturity was reached, the species acquired some degree of frost tolerance, although it was touched each season. With soft gray foliage with very light blue flowers, this erect shrub can make a handsome background if carefully pruned and groomed. A fair degree of water tolerance is evident once this plant is settled in.

***Iliamna bakeri* (Jeps.) Wiggins.**

Perennial.

Malvaceae. Mallow Family.

Natural Range: Volcanic loam and lava beds, from 3,000 to 6,000 feet in Siskiyou, Modoc, and Shasta counties, to southern Oregon. Flowering from July to August.

Propagation: One wild collection of seed, untreated, germinated in eight to 18 days when sown upon three occasions over a period of three years. Only a few seedlings came up each time, but only two seedlings were ever lost in the nursery.

Culture: We were unable to provide the more exacting conditions necessary for this species, so we planted them in our rock garden in a very sandy granitic loam soil. The plants were severely chewed by rabbits, and the wide habitat difference caused the plantings to die within a period of two years. One specimen grew to three feet tall and three feet wide. Flowering occurred within one year but no seed was harvested. Crown rot and root rot killed a few plants while accidental weed spray caused the death of a few others.

***Ipomopsis* Michx.**

Annuals, Perennials.

Polemoniaceae. Phlox Family.

Natural Range: The several species inhabit dry, rocky slopes or ridges and open spaces over a wide range of California but mostly toward the drier desert slopes, usually from 3,000 to over 10,000 feet elevation. Flowering from March to July.

Propagation: The species are usually grown from seed but several of our collections were acquired through studies of the genus by Dr. Grant. Our specimens of ***I. aggregata* (Pursh) V.E. Grant.** and ***I. congesta* (Hook.) V.E. Grant.** were all brought in as plants.

Culture: Used in our rock garden, ***I. aggregata*** and ***I. congesta*** lived not more than three years, but produced numerous volunteer seedlings that have kept these species in our collection for over a period of ten years. These seedlings have spread out into a wider area of the garden.

***Iris* L.**

Perennials.

Iridaceae. Iris Family.

Natural Range: Consult Munz & Keck (1959) for specific distribution and habitat information for each of the 17 *Iris* taxa native to California. The majority of our taxa inhabit the more northerly counties of California; only one, *I. missouriensis* appears to be on the eastern side of the Sierra Nevada, and only one species, *I. missouriensis*, and one subspecies, *I. hartwegii* ssp. *australis*, occur farther south than Kern and Santa Barbara counties. None are found on the Channel Islands. Flowering from March to June, but mostly from May to June.

Propagation: Over 100 lots of seeds were sown (Note: some seeds were purchased from all over, such as New Zealand, etc.) in the past 15 years, principally for the hybridizing work carried on by Dr. Lee W. Lenz, who has studied the Pacific Coast Iris for the past 20 years and continues to carry on such work at the garden. Many fine hybrids have been raised in a great variety of color combinations, (thus enabling us to plant large areas of colorful displays, principally from March through May). A large percentage of these collections were raised from seed. Checking the germination data, there was such a great variation that one cannot say that the seed germinates in any specific time. However, the greatest number began germinating in 30 to 60 days with maximum germination occurring over a period of two to three months. The following is a review of our experience with the following species, no cold-stratification or other treatments were used unless indicated; the numbers listed below are the number of days for the first seeds to germinate:

***Iris bracteata* S. Watson.** – 56 and 63 days were required for seed from the wild to germinate.

***Iris douglasiana* Herb.** – All wild or cultivated collections and purchased seed from both wild and cultivated sources, mostly germinated in the 40 to 50 days, but the occasional lot taking over one year after three months cold-stratification or soaking in water for 17 hours. Other lots took 60 to 80 days to germinate. One seed lot (over seven-years-old) germinated well. Many seeds from cultivated sources and horticultural types (cultivars) were grown.

***Iris fernaldii* R.C. Foster.** – 26 and 39 days were required for germination, but our results were poor.

***Iris hartwegii* Baker.** – 109 and 134 days were required for germination, cold-stratification may have helped produce better germination.

***Iris hartwegii* Baker. ssp. *australis* (Parish) L.W. Lenz.** – 25 and 27 days were required for germination, two lots were cold-stratified (one for five months and the other for 89 days) and both germinated 11 days after their removal from the cold, these two lots yielded a higher percentage of seedlings.

***Iris hartwegii* Baker ssp. *columbiana* L.W. Lenz.** – 73 days were required for germination.

***Iris innominata* L.F. Hend.** – Many collections were processed, a large number with only a few seeds and were from both wild and cultivated sources, there were also many color selections; 40 to 60 days were required for germination, with many germinating at 54 days. Another group took 11 months, and another 60 to 90 days; none of these seed lots were cold-stratified, all were sown in six-inch pots.

***Iris longipetala* Herb.** – Untreated wild and cultivated seed begin to germinate in 32 to 66 days; three lots were cold-stratified for 82 to 130 days and these began germinating 12 and 21 days after they were removed from the cold; one lot was cold-stratified for one year and yielded poor germination. Some seed lots were as much as eight-years-old.

***Iris macrosiphon* Torr.** – For untreated seed from cultivated sources, 32 to 51 days were required for germination; seeds from wild sources germinated in 37 and 45 days.

***Iris missouriensis* Nutt.** – For wild untreated seed, 34 to 51 days were required for germination, and another untreated lot took 117 days to start germination. Seeds that had been cold-stratified for 84 to 138 days began germinating in 9, 6, and 24 days after they had been removed from the cold. Cold-stratification of the seeds gives better germination and a quicker time period to reach maximum germination. Cold-stratification should probably be used for this species. Untreated seed generally yielded poor results but these seed collections may not have been good.

***Iris munzii* R.C. Foster.** – Untreated cultivated seeds took 27 and 28 days to germinate, while untreated wild seed collections took 21 and 24 days to germinate. One lot was cold-stratified for 90 days and started to germinate 21 days after removal from cold. Cold-stratification is unnecessary. We considered our results with this species to be fair to good.

***Iris purdyi* Eastw.** – Untreated cultivated seed germinated in 35, 50, 58, 56, and 130 days, but only one of these lots had good germination. One lot was treated with cold-stratified for nine months and began germination 72 days after it was removed from the cold.

Iris purdyi* × *Iris tenuissima – 49 days were required for germination, and our results were poor.

***Iris tenuissima* Dykes ssp. *purdyformis* L.W. Lenz.** – untreated seeds germinated in 69 days, after which the flat was subjected to 29 days of cold-stratification, after removal from the cold only three additional seedlings germinated.

***Iris thompsonii* R.C. Foster.** – One lot took 180 days to germinate.

Except for an occasional lot, raising the seedlings posed no special problems, few seedlings were lost between initial pottings into three- to four-inch pots to the final setting out stage from six-inch pots. Since our native *Iris* root systems were not greatly hampered when grown in six-inch pots, these were the usual container size we used, although we also grew many hundreds of *Iris* plants in gallon-cans.

Many collections of wild plants were brought into the garden bare-root by the staff for experimental work as well as for the growing for the collection. Several hundred accessions were acquired. Experimental work proved that it is best not to move our native iris until new root initiation – usually in October or November – although it was often necessary to dig specimens in May or June. Established clumps in the garden should not be divided until examination of root system showed new roots to be approximately one to two inches long. Following this procedure almost complete success can be guaranteed. Otherwise losses will be excessive.

Culture: The most commonly cultivated native iris, such as *I. douglasiana*, *I. longipetala* and *I. innominata*, can be planted in full sun near the coast but inland they should have high shade. While all of our experimental growing grounds were in full sun with a tight clay-loam soil, and in such situations the irises grew vigorously, our recommendation is that generally they would appear healthier and with better all-year appearance when grown where they received some degree of shade from mid-day onward. Too deep a shade results in few flowers and lanky ungainly plants. While the more vigorous species survived and expanded under our coast live oak trees (*Quercus agrifolia*), the higher elevation and less vigorous species succumbed to rots caused by the smothering effect of the oak leaves from these large trees. Irises appear to be more suitably grown under pines in well-drained decomposed granite loam. In any case, this group of irises lend themselves more appropriately to naturalizing, although some of the hybrids are find

garden subjects for producing mass displays of color. Cutting for arrangements and decorative uses, the flowers should be taken when they are in full bud or only partially open. This procedure will make the bouquet last longer especially for those species producing more than one bud per stem. It is good to have a partially opened flower with several full buds.

Some of species may require, and most will accept, some summer watering though others prefer to be left alone. However, an occasional irrigation does no harm to any of the species. The maximum display begins in late March and if the weather remains cool will continue for several weeks. Hot weather quickly eliminates the blossoms. The most common pest to attack our species is the red spider mite. Occasionally mealy bug infestations are a problem. Slugs or snails will eat the flowers and foliage. Burying the crown (the leading end of the rhizome) too deeply, or allowing the buildup of excessive dead leaves and debris to bury the plants will result in crown or root rot, particularly when the plants are grown in heavier soils. All in all we grew the hardiest types relative to our interior conditions exceedingly well and used them extensively in all display areas. The following kinds with notes were grown during the past 15 years:

***Iris bracteata* S. Watson.** – Four collections from the wild were grown. Two were used for experimental studies and two were planted in a semishaded location with rocky clay. Heavy oak leaf drop and vigorous growing perennials smothered both collections, one after ten years and the second after five years. Flowering began during the third year from seed. The established clumps measured two feet by two feet.

***Iris chrysophylla* Howell.** – Four collections were used in *Iris* studies by Dr. Lenz. There are no horticultural records for this species.

***Iris douglasiana* Herb.** – Cultivation of the Douglas iris is as easy and satisfactory as most of the well-known garden varieties. Slopes or flat areas are equally satisfactory locations, preferably where they can be left to naturalize and will be left undisturbed for a few years. Eventually, when flower production decreases, the clumps should be divided in the manner stated above. There are several named cultivars offered by *Iris* specialists. These have been augmented by the fine introductions developed by Dr. Lenz at this garden. Many clumps were divided and moved from the old site to provide a quick start at our new locations. A very high percentage survived and have spread out in fine groups. To augment our collections many additional accessions have been added.

***Iris fernaldii* R.C. Foster.** – Three collections were acquired from the Petrified Forest area in Sonoma County. Two of these were used for experimental work, but some of each collection were planted in semishaded areas. One accession grew into a clump 15 inches by 37 inches and has been in good condition for 15 years. Flowering began the second year from seed.

***Iris hartwegii* Baker.** – Twelve collections acquired, both of seed and plants, mostly the latter, from dry wooded slopes of the western Sierra Nevada of central California. Five to eight years was the typical life span for this species in our area. The most serious problem was that the plantings got lost under spreading vigorous shrubs and perennials, or they were too deeply covered by oak leaves. Otherwise they flowered (but rather weakly) and upon occasion were noted to be growing vigorously. One collection of the **ssp. *australis* (Parish) L.W. Lenz.** from the higher portions of the mountains in Southern California that was collected bare-root has been established for over 15 years and measures six inches to one foot tall and spread into clumps that were two-and-a-half feet across. Flowering started four years after acquisition. The two collections of **ssp. *columbiana* L.W. Lenz.**, one of seeds and one of plants, were acquired in

1957, and were used by Dr. Lenz in his hybridizing studies. The *ssp. pinetorum* (Eastw.) L.W. Lenz. was never raised successfully here in Claremont, though three collections, one seed and two of plants were collected by Dr. Lenz for his work.

***Iris innominata* L.F. Hend.** – The highly variable flower colors, ranging from deep golden yellow to clear yellow, with or without veining, to lavender and deep purple, makes this species a valuable parent for hybridizing. As a consequence 59 collections of seeds and plants, the majority being seeds, were gathered and grown in our experimental garden. The most interesting specimens were used in breeding work. Many splendid hybrids were created from the various crosses, particularly with *I. douglasiana*. Over the ensuing years, these hybrids have won many awards in various *Iris* shows. This interesting species inhabits the sunny or partly shaded slopes in Del Norte County to southwestern Oregon. In its native habitat it is found in a great variety of color forms, many of which have been selected and introduced to the *Iris* fancier in various parts of the world, particularly into New Zealand.

***Iris longipetala* Herb.** – Our original collections were acquired in 1943 from natural coastal stands in San Mateo County, and in 1947 from Monterey County. These collections were lifted, divided, and transferred from the old site to their present location, in 1951. Since then several accessions, raised from seed gathered from these collections, have been added to selected semishaded, moist sites throughout the garden, where they have performed very well. Each season these stiffly erect plants produce quantities of flowers with lilac-purple veining on a lighter background. Large clumps over 20-years-old have spread out to several feet across.

***Iris macrosiphon* Torr.** – This species is found in foothills on grassy or wooded slopes below 3,000 feet in the Sierra Nevada and Inner Coast Ranges, in central California. These plants have deep golden-yellow, cream, pale lavender, or deep blue-purple flowers. It has been relatively successfully since we first raised them in 1947 and 1948. Several collections of established plants and seedlings in containers were transferred from the old site and were successfully established in semishaded, well-drained areas. Some collections succumbed to too heavy accumulations of oak leaves that subsequently caused crown rot. However, while this species was not as vigorous a grower as others, it has done well here. Fifteen collections were acquired for both experimental studies and for the garden's collections. While several colonies died after ten years, there are others which have spread over 25 feet across and are still strong, healthy plants.

***Iris missouriensis* Nutt.** – This moisture loving species, which has a very wide natural distribution, was not successfully established until we could provide adequate moisture. While only a few seedlings were ever raised at one time in the nursery due to poor germination, we managed to successfully establish several colonies in the constant moisture of our stream bed. Here they have gradually increased to where the species can be safely said to be well established for many years to come. A total of 19 collections, both seeds and plants, were acquired over a period of 15 years, and were used for garden plantings and in the experimental *Iris* studies.

***Iris munzii* R.C. Foster.** – This narrow endemic species from Tulare County has not thrived as well as might be expected in this site. Plantings that were established shortly before abandoning the old site thrived and flowered very well. Although the plants appeared to be healthy and established, there was gradual dwindling of plants until several colonies were in poor condition after ten years. It appears that we had not found the proper conditions to successfully grow this species for more than ten years. Its natural habitat is in the shade, often quite dense, of pines and

oaks, and around the base of large granite boulders in the Sierra Nevada. The pale lavender to blue-violet flowers have made this species a valuable parent in work toward producing a good blue-flowered cultivar.

***Iris purdyi* Eastw.** – Seven collections of seeds and plants were obtained and most of them were used for experimental studies. Of these several collections, only one was maintained for over ten years in the garden, after which it died from a smothering layer of dry oak leaves that caused the plants to rot. There are no records available on other more recent introductions of this species.

***Iris tenax* Lindl. ssp. *klamathensis* L.W. Lenz.** – One seed collection failed to germinate, and one of plants was used in experimental studies. None were used in the garden.

***Iris tenuissima* Dykes.** – Ten collections were grown mostly for experimental work, but those used in the garden never established, usually dying within two to three years. The same can be reported for our one collection of the **ssp. *purdyiformis* (R.C. Foster) L.W. Lenz.**

***Isomeris arborea* Nutt.** [Ed: *Peritoma arborea* (Nutt.) H.H. Iltis

Bladderpod.

Shrub.

Capparidaceae. Caper Family. [Ed: Cleomaceae. Spiderflower Family. TJM2]

Natural Range: Dry washes, or sub-alkaline areas from the coast to both deserts, essentially in Southern California. Our records include a number of varieties that often mingle with the species or are closely adjacent. Flowers are produced during most of the year, especially on cultivated plants.

Propagation: Untreated seed of the species and the varieties will germinate in four to eight days, although the **var. *globosa* Cov.** [Ed: *var. globosa* (Cov.) H.H. Iltis. TJM2] averaged 14 to 18 days. Transplanting seedlings, either from flats or from the wild is no problem.

Culture: A very useful, hardy plant for out-of-the-way places or on dry hillsides. Needing little care, once established, it thrives in most situations, even accepting some additional irrigation. Handsome specimens may be grown in less than four to six years and a little added attention keeps them in good spirits. A useful plant for sunny locations, it produces an abundance of flowers starting in January. Whole hillsides may become bathed in yellow and are noticeable from some distance. Sporadic flowering and fruiting, the large pods are inflated and make a loud “pop” when pressed, occur through the year. Besides the species we grew all of these: **var. *angustata* Parish.** [Ed: *var. angustata* (Parish) H.H. Iltis. TJM2], **var. *globosa*,** and **var. *insularis* Jeps.** [Ed: the var. is not recognized in TJM2]. Ten-year-old specimens attained heights of four to ten feet and spreads five to 13 feet wide. Flowering and seeding began the first or second year from seed, and many volunteer seedlings were noted. We found that spraying with a petroleum weed control spray was detrimental to the plants. Within a week or two, the plants were nearly denuded of their leaves. The oil fumes quickly caused the leaves to shrivel and drop off. This practice had to be discontinued around these plantings, no matter how dilute the spray solution. It was particularly serious if warm days followed spraying. The State Highway Department has found this plant to be highly successful and desirable as a median strip planting in the freeways of San Bernardino County.

***Iva hayesiana* A. Gray.**

Woody Perennial.

Asteraceae. Sunflower Family.

Natural Range: Alkaline places, below 1,000 feet; southern San Diego County, and Baja California (Mexico). Flowering from August to September.

Propagation: Young bare-root plants were brought from the wild in 1962. These became easily established, and provided cutting material for additional plants. Without any treatment, root initiation started in 12 days, and 99% of the cuttings rooted. All of the plants were raised through the nursery.

Culture: Used in a well-drained, granitic loam situation, excellent growth occurred and in five years plants were one to three feet tall and spread two to seven feet across. There is no problem raising this plant in most any situation, even though it naturally inhabits highly alkaline areas.

***Jepsonia parryi* (Torr.) Small.**

Perennial.

Saxifragaceae. Saxifrage Family.

Natural Range: Moist shaded banks, southwestern San Bernardino County to San Diego County, and Baja California (Mexico). Included also: ***J. heterandra* Eastw.** from central Sierra Nevada foothills and ***J. malvifolia* (Greene) Small.** from the Channel Islands. Flowering mostly from October to December.

Propagation: Only roots dug on Guadalupe Island were grown. Seeds of ***J. heterandra*** germinated in 17 days with no treatment. Both roots and seedlings, upon going dormant, were kept in cold-stratification for several months. When these were removed in September they began sprouting. All forms were difficult to handle until it is understood that they must have a long rest period of complete dryness and dormancy. Careful watering brings them to life after a few weeks.

Culture: A few roots were kept alive for two or three years where they were under complete protection of a wire screen to protect them from becoming lost. Coming to life during the winter months, after flowering in fall, they go completely dormant for several months and must not have any moisture, otherwise they soon rot.

***Juglans californica* S. Watson.**

Southern California Black Walnut.

Tree.

Juglandaceae. Walnut Family.

Natural Range: Locally common, below 2,500 feet, in foothills and mountains from Santa Lucia Mountains of Monterey County to the Santa Ana Mountains of Orange County. Flowering from April to May.

Propagation: Nuts sown in deep flats, seeds beds, or flats, and kept lightly moist (to prohibit rotting), will start germinating in 40 days with completion in two to three months. They are best grown in deep beds or field rows, when they can be transplanted bare-root after going dormant the following year. Before growing in large cans, the long tap root should be clipped to produce

a more fibrous root system, and help prevent coiling of roots. The oak-leaved form, *J. californica* var. *quercina* Babcock was continued from the old site, but only a few trees of this type were grown.

Culture: There is no problem in raising this easily established walnut. Only one plant was lost in 15 years, the others attained sizes of five to 26 feet tall and spread five to 35 feet wide. The first nuts were produced in three-and-a-half years from seed grown specimens. This tree appears to prefer heavier soils over very rocky types. The largest specimens are hybrid trees crossed with *J. regia* L., and exceedingly vigorous. Subject to oak root fungus (*Armillaria mellea*).

***Juglans hindsii* R.E. Sm.**

Northern California Black Walnut.

Tree.

Juglandaceae. Walnut Family.

Natural Range: Central Northern California near Indian campsites.

Propagation: Same as for *J. californica*. Root stocks are used in grafting for commercial production of nuts.

Culture: A very vigorous and hardy tree, posing no growth problems in this area. Trees eight- to ten-years-old ranged in height from six to 28 feet and spread from 20 to 25 feet wide. Nuts were first produced in their fifth year.

***Juncus* L.**

Rush. Wire-Grass.

Annual or Perennial.

Juncaceae. Rush Family.

Natural Range: Widely distributed as a genus, there are approximately 50 species and many varieties found in California. These are found in a wide variety of habitats, though most grow in low, wet spots, at the edges of ponds, etc. flowering from May to August, depending on species.

Propagation: Seed or by division of creeping rootstocks. Untreated seed produced good germination in 14 to 37 days, although most germinated in about three weeks. There was no problem raising the young seedlings in the nursery.

Culture: The following kinds were established in a stream bed or at edges of ponds: *J. acutus* L. var. *sphaerocarpus* Engelm. [Ed: *J. acutus* L. ssp. *leopoldii* (Parl.) Snogerup. TJM2], *J. ensifolius* Wikstr., *J. falcatus* E. Mey., *J. lesueurii* Bol. [Ed: *J. lescurii* Bol. is the corrected spelling for this name TJM2], *J. nevadensis* S. Watson., and *J. patens* E. Mey. Some became so boisterous that many of them had to be removed and all needed some control.

***Juniperus californica* Carr.**

California Juniper.

Arborescent Shrub.

Cupressaceae. Cypress Family.

Natural Range: Essentially below 5,000 feet in the interior parts of California, and at the edges of deserts from Tehama County to southern Nevada and northwestern Arizona, and south to Guadalupe and Cedros islands in Baja California (Mexico). Flowering from January to March.

Propagation: There is no clear cut recommended process for the propagation of this species by seed. We have followed this protocol: One-and-one quarter ounces of seeds were sown in a flat and pine needles were burned over the flat. The first seedlings emerged in 85 days and a total of 55 seedlings were potted after four months from seeding. Juniper seed is notoriously lacking in viability, various methods have been suggested to break dormancy, but our experience indicates burning straw, pine needles, excelsior, or other material is helpful. A second seed lot was sown at the same date but was soaked for two hours in sulphuric acid. After two months there was no germination, so pine needles were burned on flat, but still no seedlings ever came up. Seedlings are easily raised in the nursery. New plants may also be started by cuttings, but we have had no experience with this procedure for this species.

Culture: Two plants, 26 and 29 inches tall, were dug and moved from old site. One survived and in its 20th year measures 11½ feet tall and spread to seven-and-a-half feet wide. No seed production has been noted on the plant. Seed-grown plants that germinated in 1949 were planted in May 1951 at our present site, in very rocky granitic loam, and have grown extremely well without any losses. Sizes attained in 15 years range from nine to 15 feet tall and from eight to 15 feet wide. Seeds were first produced from these plants during their ninth year.

***Juniperus communis* L. var. *saxatilis* Pall.**

Dwarf Juniper.

Shrub.

Cupressaceae. Cypress Family.

Natural Range: Craggy and wooded slopes from 6,400 to 11,000 feet, in the Sierra Nevada from Mono Pass to Mount Shasta; and from sea level to 5,000 feet in Del Norte and Siskiyou counties, north to Alaska, and to Greenland and Eurasia.

Propagation: Our only experience is with cuttings. Tip, heel, or side shoot cuttings taken in April and treated with Hormodin #2 or Rootone, were generally successfully rooted at about 75% over a period of four to six months. For one lot containing heel and side shoot cuttings, the latter rooted quicker. There was no particular problem in raising the cutting-grown plants. Losses were minimal.

Culture: There are several races of this entity and a search should be made for the most desirable types. Our original material came from the Tioga Pass region and the original three plants attained sizes of several feet across and provided much additional cutting material. These and later collections were used in our rock garden in partial shade where they thrived. Ten- to fifteen-year-old plants were never more than 18 inches tall and four-and-a-half feet across. Losses were minor during the establishment stage, even when the young plants were dug and moved on one or two occasions.

***Juniperus occidentalis* Hook.**

Western Juniper.

Tree.

Cupressaceae. Cypress Family.

Natural Range: One of the most picturesque of trees, attaining an estimated 3,000 years of age or more, and inhabiting the mountain peaks and valleys at elevations of 3,000 to 10,500 feet from the San Bernardino Mountains north through the Sierra Nevada and Yolly Bolly Mountains, to Washington, Nevada, and Idaho.

Propagation: As with other *Juniperus* species, seed is often of poor quality. Our practice was to sow seeds in fall, cold-stratify them for three to five months, burn excelsior on flat, re-cold-stratify them for another three to six months. At intermediate stages in this process, a few seedlings were potted off, but the main bulk of seedlings from those seed lots of good quality appeared after the second cold-stratification. On the whole, maximum germination occurred after 12 months. Except for a 1957 collection from the San Bernardino Mountains, none of several collections of seed produced more than a few seedlings. Examination usually showed the seed was no good. Once germinated, there was no problem in raising the seedlings in the nursery. Seedlings from a Lassen County collection had only two cotyledons and were green while the one from the San Bernardino Mountains usually had three cotyledons and the backside would turn a reddish-brown. Plants more than several-years-old were dug in the wild and transplanted without any trouble, even when only a small portion of the roots was left on the plants.

Culture: Two plants, two to three feet tall, at the old site were transferred to five-gallon-cans in March 1951. Eleven days later, they were set out in the new garden site in Claremont. Both plants thrived, and measured 16 to 20 feet tall and spread seven to nine feet wide in their 20th year. No seed production had been recorded for them. Three groups were raised from seed and were set out in the garden in 1954, 1955, and 1958. These grew remarkably well with losses of only a few runty specimens that were removed or dug out for thinning purposes. Seedlings six inches tall when first planted out in the garden, measured four to 13 feet tall and four to seven feet across in their tenth year. Seed production was noted on a few trees in their ninth and tenth years. An altogether handsome and hardy tree.

***Juniperus osteosperma* (Torr.) Little.**

Utah Juniper.

Tree.

Natural Range: Growing on dry slopes and flats at elevations of 4,800 to 8,500 feet, this hardy juniper is found in the eastern Mojave Desert to Mono County; to southwestern Idaho, southwestern Wyoming, and western New Mexico.

Propagation: No seed propagation during past 15 years; plants all moved from the old site.

Culture: A 16-year-old specimen balled, moved and transplanted from old site on March 14, 1951. This specimen never showed any signs of having been moved. It was six-and-a-half feet tall when it was transplanted, and measurements taken in its 30th year noted the plant being ten feet tall and 14 feet wide. Seeds had been reported since 1945. Forty-two plants, one to six-and-a-half feet tall, were balled, moved and planted at the Claremont site on March 14, 1951. Burlap was tacked to three posts that surrounded each plant until the re-established. A few of the plants had been severely chewed by rabbits at the old site and had the same treatment at the new site. A total of seven succumbed the first year, after which no losses were registered. This was the

second move for these plants, the first being in January 1941 when dug in the wild. An extremely tough tree, specimens were measured in their 25th year in the garden, at five to 16½ feet tall and were from four to 11 feet wide; male cones were first noted in the 14th year and the first seed-cones were noted in the 19th and 20th years. Altogether a very hardy and successfully grown species for our area.

***Jussiaea repens* L. var. *peplodes* (Kunth) Griseb.** [Ed: *Ludwigia peploides* (Kunth) P.H. Raven ssp. *peplodes*. TJM2] [Ed: Note that this taxon is now considered not native to California according to TJM2.]

Perennial.

Onagraceae. Evening-Primrose Family.

Natural Range: Pools and slow streams below 2,000 feet in cismontane Southern California north through the Great Valley and the intermediate ranges, to Oregon, and South America. Flowering from May to October.

Propagation: The easiest method to produce new plants is by division of rooted stems. There is little need for any formal procedure. Gathered specimens and plant them directly into site.

Culture: Planted in a large pool, this plant soon invaded every area and had to constantly controlled to stop it from over-running other plants. This plant could become a pest under certain conditions.

***Kalmia polifolia* Wangenh. var. *microphylla* (Hook.) Rehr.** [Ed: the var. is not recognized in TJM2]

Western Laurel.

Shrub.

Ericaceae. Heath Family.

Natural Range: Boggy places and wet meadows from 7,000 to 12,000 feet, in the Sierra Nevada from Tulare County northward, and in the Coast Ranges from Humboldt County north to Alaska. Flowering from June to August.

Propagation: Usually by seeds or cuttings, but none of our efforts were successful. Several lots of seeds failed to germinate even though recommended procedures were followed. Seed was apparently not viable. A few plants were obtained in the wild and were grown reasonably well in pots in the greenhouse.

Culture: While this species was grown and flowered in pots in the greenhouse, four plants, when set out in a specially prepared bed adjacent to the rock garden and in shade failed to respond. While some flowering occurred the first season, the plants were recorded dead after their second year.

***Langloisia matthewsii* (A. Gray) Greene.** [Ed: *Loeseliastrum matthewsii* (A. Gray) Timbrook. TJM2]

Annual.

Polemoniaceae. Phlox Family.

Natural Range: Often seen in great masses on the sandy desert mesas or flats, below 5,000 feet in both deserts from Imperial to Mono County, Nevada, and Sonora (Mexico). Flowering from April to June.

Propagation: We grew six wild collections and one seed collection from cultivated plants. Seeds were sown directly into the site of other sand dune or desert garden species. Sometimes these areas had specially prepared soil conditions, and produced seedlings in varying time periods, ranging from 16 to 70 days, but averaging 30 to 40 days. Seed sown in periods from November to March. Germination was usually poor but we always managed to grow a few specimens. Flowering in the garden occurred in April or May, depending when seed was sown.

Culture: This species needs very open, sandy, or gritty soils, preferably in desert environments. Our wet and often cold winters caused rotting or poor growth and very little could be said about the health of the materials. And due to the small size of the plants, certainly no one would ever suspect the species was being grown here unless they were specifically pointed out. Much of the same history was recorded for *L. schottii* [Ed: *Loeseliastrum schottii* (Torr.) Timbrook. TJM2] and *L. setossima* (Torr. & A. Gray) Greene.

***Larrea tridentata* (DC.) Coville.**

Creosote Bush.

Shrub.

Caltrop Family

Natural Range: The dominant shrub of the deserts of our southwestern states, from below sea level to 5,000 feet, and to Mexico. Flowering from April to May.

Propagation: Untreated seed sown at any time of the year will germinate in an average of four to ten days. Germination varies from poor to excellent as there seems to be a great difference in the quality of the seed from year to year. Seed viability is maintained for several years. We found that rubbing the outside "fuzz" off the seed before sowing seemed to produce better results, although many lots were sown without such treatment. Young seedlings are troubled greatly by damp-off, better results were obtained by using Morton Soil Drench. Damp-off is the most serious problem in raising seedling through the nursery. Seedlings develop long roots in a short time, it was necessary to move the seedlings through the smaller containers as quickly as possible. This brought a tiny seedling to the gallon-can size, which had to be carefully monitored. Year old seedlings in cans would not be more than three to six inches tall with some variation in spread from six to eight inches. Once through the seedling stage, the young plants were very hardy.

Culture: This species is quite content with a variety of soils, even relishing the more solid clays (grows better in them - faster) but they appeared to like our very rocky granitic loams and soon grew to some size. Seedlings three to six inches tall when set out have been measured at 11 feet tall and five to 12 feet across in ten years. Other groups, of same age or older, have not made such growth but on the whole, all plantings have thrived with comparatively small losses considering all circumstances. Additional irrigations keep the plants healthier and bushier in growth habit. First flowering and seeding occurs in three to five years. Young seedlings must be protected from rabbits. We now have handsome specimens in many appropriate parts of the

garden. Several specimens were moved successfully from the old site, and have attained ages of 20 to 25 years from seed and measure eight to ten feet tall and have equal or greater spreads.

***Lasthenia glabrata* Lindl.** [Ed: all other plants now known as *Lasthenia* are found alphabetically in the genus *Baeria* **F. & M.**]

Annual.

Asteraceae. Sunflower Family.

Natural Range. Typically found in large colonies in low spots and alkaline flats, usually growing in heavy soils, central valley, Coast Ranges, and through Southern California. Flowering from March to May.

Propagation: Sown directly into site, usually in clay soils, germination takes six to 14 days, depending on moisture in soils. Usually sown from October through December.

Culture: As stated above, when sown into garden sites, care must be exercised in the control of birds, weevils, cutworms, etc. otherwise the young seedlings can be easily destroyed. Fine displays were produced each year, flowering starting in February or March and lasting for a month or so. Seeds are eagerly sought by birds, particularly the wild canaries. Best sown in low spots, etc. that retain moisture that is suitable for subsequent quick growth.

***Lathyrus laetiflorus* Greene ssp. *alefeldii* (T.G. White) Brads.** [Ed: *Lathyrus vestitus* Nutt. var. *alefeldii* (T.G. White) Isely. TJM2]

Perennial.

Fabaceae. Pea Family.

Natural Range: Chaparral areas of western Riverside County south to Baja California (Mexico); Santa Catalina Island. Flowering from April to June.

Propagation: Seeds were soaked for 17 to 24 hours in hot water treatment, and then sown in individual five-inch pots in one lot, while other lots were sown in flats. Germination required 13 to 21 days, the longer soaking produced quicker germination. All of our seeds were collected from plants in our garden, grown from an original collection in 1941. Seeds can be stored for at least seven years with no adverse effect. We had no problem in raising seedlings in pots before setting them out in the garden. Plants cannot be easily held in cans through the summer. It proved unnecessary to sow the seeds directly into individual pots as we had excellent results in transplanting seedlings from flats to pots.

Culture: As with past experiences, we could not maintain this species for more than two to three years, during which time it would grow rapidly to several feet over shrubs or on a fence. Flowers and seeds were produced in during the first or second year, and if the crop was not eaten by rodents, we could maintain the variety with additional plantings. All *Lathyrus* species need to be kept dry after their flowering period, otherwise they rot easily. Plants are subject to heavy infestations of aphids.

***Lathyrus laetiflorus* Greene ssp. *barbarae* (T.G. White) Hitchc.** [Ed: *Lathyrus vestitus* Nutt. var. *vestitus*. TJM2]

Perennial.

Natural Range: Coastal Southern California in chaparral or coastal sage scrub. Channel Islands.

Propagation: Seeds were subjected to hot water treatment for 15 to 24 hours, and then sown in flats or containers. When sown in containers germination took 14 days, while those sown in flats germinated in five to ten days. When seeds were sown directly into a garden site, they took 41 days to germinate but grew well.

Culture: Used adjacent to fences or to clamber over shrubs, we continued to experience difficulty in maintaining this variety. Plants required two to three years to flower and seed and by that time many had succumbed from having been eaten by mice or rabbits, or by having moles disturb the plant's root system causing it to dry out and die. Once a plant becomes well established, it may last for several years. This entity has been grown continuously since April, 1927, and descends from the garden's first accessioned collection (#1) gathered by the founder of the garden, Mrs. E. A. Bryant.

***Lathyrus littoralis* (Nutt.) Walp.**

Perennial.

Natural Range: Coastal strand from Monterey County to British Columbia (Canada). Flowering from April to July.

Propagation: Seeds were treated to hot or cold water treatments, and the two seed lots required 21 and 37 days to germinate. The first collection was sown untreated and after the first potting of nine seedlings, the remaining seeds were soaked in cold water overnight which then started germination quickly. We experienced no problem with raising seedlings in the nursery.

Culture: Used in sand dune garden in shade, plants were chewed to ground by rabbits, and while some made feeble attempts to start from base, they eventually died within a few months. Our first collection was acquired in 1958, and second in 1965. This latter collection was just started before the end of this reporting period, so there is no further information.

***Lathyrus splendens* Kellogg.**

Pride of California, Campo Pea.

Perennial.

Natural Range: Dry slopes, below 3,500 feet, from eastern San Diego County near the Mexican border. Flowering from April to June.

Propagation: We experimented with both seeds and cuttings, the latter being new tip growth taken in December. Sowing seeds after hot or cold water treatments for 15 to 24 hours produced seedlings in flats, pots, or gallon-cans in seven to 14 days. Many seeds were sown directly into open sites beside fences without previous treatment. Germination began in 40 to 50 days, and was usually good. This is a good method to properly establish these plants. Plants must be guarded from predation from slugs, aphids, snails, birds, and rabbits - particularly when seeds are sown directly into a garden site or after planting young specimens.

Culture: Usually planted along fences in clay or rocky soils, few plants lived more than five years. Only one specimen in a spot where it received no attention survived for over ten years. An abundance of flowers on beautiful bushes were established in two to three years but unless extreme caution was exercised to prevent summer irrigation, the plants gradually succumbed to

root rots. Even under the most rigorous care, this condition prevailed. Therefore this beautiful example of our native plants was not particularly long-lived under our conditions.

***Lathyrus vestitus* Nutt. spp. *bolanderi* (S. Watson) C.L. Hitchc.** [Ed: *Lathyrus vestitus* Nutt. var. *ochropetalus* (Piper) Isely. in part, and *Lathyrus vestitus* Nutt. var. *vestitus*. in part]

Perennial.

Natural Range: Scrambling over the brushy, wooded slopes from San Francisco Bay to southwestern Oregon this subspecies may be found flowering from April- June.

Propagation: Seeds were soaked for 17 hours in hot water, and were then usually sown directly into four-inch pots. Seeds typically germinated in 13 to 24 days, the latter time was for fresh seed from wild, and the shorter time was for seed collected from our cultivated plants. We experienced no problem in transplanting seedlings, and usually accomplished this task with not more than one or two seedlings perishing.

Culture: Planted around a large shrub, several of the original plants have grown vigorously in rocky, clay soil. Each year, the plants spread out by underground roots into adjacent areas. Our original plantings were made in February 1954, and this handsome group grows vigorously each year. Several garden collections of seed have been harvested since the plantings' second year, and subsequent plants were added to other areas of the garden where the plants are established and around large shrubs.

***Lavatera assurgentiflora* Kellogg.** [Ed: *Malva assurgentiflora* (Kellogg) M.F. Ray. TJM2]

Malva Rosa.

Shrub.

Malvaceae. Mallow Family.

Natural Range: Among the coastal sage scrub of the Channel Islands, this plant is widely cultivated and has escaped along coastal mainland California. Flowering from March to November.

Propagation: Untreated fresh seed harvested from cultivated plants will germinate in four to six days, however, older seed required up to 20 days. The percentage of germination usually was poor to fair and is quite sporadic over a period of two to three months. Other times, seedlings emerged quickly and with good results. Untreated cuttings taken in June rooted at a rate of 95%, and took 32 days to start rooting. Cuttings taken earlier (in March) yielded poor results. A variegated selection was acquired, but only cuttings without variegated leaves rooted, while those with variegated leaves succumbed. There was no problem in raising seedlings or cuttings in the nursery.

Culture: Growth was rapid, with plants attaining several feet within a year. Eight- to ten-year-old plants grew to sizes of seven to 11 feet tall and spread from 11 to 14 feet wide. First flowering and seeding took place in the second year. Our chief losses of plants were caused by frost and severe girdling by field mice and rats, both of whom relish the bark of this plant. This tender coastal plant, while not killed completely, suffers severely each winter this far inland, otherwise it grows with great vigor, soon making fine specimens. Where somewhat protected, there is not much concern with frost. This species is useful for providing quick hedges or other protection,

screening, etc. Needing little attention, it grows quickly, providing a useful, but short-lived shrub. It has been used to some degree by vegetable growers in windy valleys, etc. Plants may be sheared to keep them especially dense. Some flowers may be produced the first year, and plants generally flower for most of year, but bloom most heavily from April to August.

***Layia* Hook & Arn.**

Tidy Tips.

Annuals.

Asteraceae. Sunflower Family.

Natural Range: One of our showiest wildflowers, the 16 species and four subspecies are all found in California and only two extend beyond the state's borders. Often produces great masses of flowers in early spring. One finds the various species in diverse habitats throughout the state, from the coast to the desert and usually at low elevations. Most are found growing in sandy or clay soils in grasslands on slopes and valleys. Flowering from March to April.

Propagation: Seed is best sown directly into site, and depending on soil temperature and moisture conditions, seedlings should appear in eight to 15 days. Occasionally this may take a shorter or longer period. Seed should not be sown deeply, in fact, it should be sown just under the soil surface. Seedlings may need protection against birds, weevils, cutworms, and other destructive insects and animals. Birds, chewing insects, and slugs gave us the most trouble. Seeds may be sown in wide variety of soils, and plants perform well under most conditions, though they are best when grown in full sun.

Culture: A very useful and colorful annual of easy culture. Tidy tips flowers range in color from white, yellow, creamy-yellow with white tips, and are about two-inches across. Plants grow eight to 18 inches tall. In wild a single stem is often produced, but under cultivation they are much more vigorous, producing plants with many branches and a single plant may spread to a foot wide. Abundant seed is produced which scatters around and may be left for subsequent annual displays – as long as the seed bed remains dry during the summer months. The following species and subspecies have been raised successfully and for many generations here at the garden: *L. chrysanthemoides* (DC.) A. Gray., *L. glandulosa* (Hook.) Hook. & Arn., *L. heterotricha* (DC.) Hook. & Arn. (at the old site, we raised a strain that had a very distinctive apple fragrance to the foliage, but we lost the strain and have never reacquired it), *L. pentachaeta* A. Gray ssp. *albida* D.D. Keck. (raised almost yearly since 1937), *L. platyglossa* (Fisch. & C.A. Mey.) A. Gray., and *L. platyglossa* (Fisch. & C.A. Mey.) A. Gray ssp. *campestris* D.D. Keck. [Ed: the ssp. is not recognized in TJM2] (raised almost yearly since 1935).

***Ledum glandulosum* Nutt. ssp *columbianum* (Piper) C.L. Hitchc.** [Ed: *Rhododendron columbianum* (Piper) Harmaja. TJM2]

Labrador-Tea.

Shrub.

Ericaceae. Heath Family.

Natural Range: Wet or boggy places near the coast, from Monterey County to Washington. Flowering from May to June.

Propagation: We only propagated this species from seed and had successful germination with and without cold-stratification. One collection did not seem to need cold-stratification, and a second collection failed to germinate until it was cold-stratified for three months after which seedlings appeared in 31 days. Seedlings are tiny and grow slowly but we experienced good results in the nursery through smaller sized pots and for one lot fine results in gallon-cans, however, there were some losses during this late nursery stage.

Culture: We always planted this species in semishaded or shady spots with a good supply of humus on top of well-drained soils. Some plants responded fairly well in these conditions. Others over a period of seven to eight years the plants gradually deteriorated. Part of this was due to loss of shade and to oak root fungus (*Armillaria mellea*). Flowering began during the second and third year from seed. This plant may never be completely at home in this inland area, although they probably would respond better to more attention to their growing conditions.

***Lepechinia calycina* (Benth) Munz.**

Pitcher Sage.

Shrub.

Lamiaceae. Mint Family.

Natural Range: Open brushy slopes, below 3,000 feet; Coast Ranges from Ventura to Lake counties, Sierra foothills from Mariposa to Butte counties. Flowering from April to June.

Propagation: The best results were obtained using a hot water treatment for 15 to 20 hours with year-old seed, resulting in excellent germination in eight to ten days. Testing several lots without hot water treatment provided poor results and required ten to 30 days for germination. Some wild lots sown fresh (directly after harvesting) took between 63 to 77 days to germinate. Eight-year-old seed gave excellent germination. Cold-stratification did not improve germination. Moderately small losses of seedlings were recorded in nursery procedures.

Culture: While a number of lots were set out in open, sunny locations with rocky, decomposed granite loam, the life of this species was comparatively short here. There was a large and rapid loss of plants until there were only a few left at the tenth year. Growth seemed normal and was rapid, plants attained heights of four to six feet tall and spread four to ten feet wide. Flowering was usually noted during the second or third year. Plants growing in the light shade of larger nearby shrubs often lived longer, and those mixed in with other plantings and growing in soil with some clay and rock appeared to survive better.

***Lepechinia ganderi* Epling.**

Shrub.

Natural Range: On the dry brushy slopes of Otay and San Miguel Mountains, San Diego County. Flowering from June to July.

Propagation: Untreated seed from a cultivated plant took 22 days to sprout and produced a good supply of seedlings from a very small quantity of seed. These were raised with only small losses before setting out.

New tip growth cuttings with a semi-hard base were taken in March, inserted untreated, and under mist, rooted at a rate of 100% with the first roots noted in 28 days. About 35% were lost during growing stages in nursery.

Culture: Planted among large shrubs that provided some protection, this species deteriorated rapidly and seed grown plants were completely gone in eight years, having reached heights of three to five-and-a-half feet tall and spread three to seven feet wide. While flowering occurred during and after the third year, no seed was produced. Plants produced from cuttings exhibited much the same history and from a total of 55 planted, there were nine alive in the eighth year, and these ranged in size from eight inches to five feet tall and 15 inches to 12 feet across. These plants were noted to be in poor to fairly good condition at that time.

***Lepidium flavum* Torr.**

Annual.

Brassicaceae. Mustard Family.

Natural Range: A common plant noted in desert washes and semi-alkaline flats, below 4,300 feet, from Inyo to Imperial counties, to Nevada, Baja California (Mexico). Flowering from March to May.

Propagation: Over a period of four years, one collection of seed from the wild was sown directly into our garden site. Under these conditions, germination required 22 to 39 and 81 days. The length of germination time seemed to be determined by soil and moisture conditions.

Culture: Sown in the desert garden or in the desert sand dunes, this annual grew weakly here, producing a few small plants and flowers with some seed. Flowering occurred in March and was generally poor although one lot made a fair display in the desert sand dunes.

***Lepidium fremontii* S. Watson.**

Desert Alyssum.

Perennial.

Brassicaceae. Mustard Family.

Natural Range: Common in rocky and sandy places, below 5,000 feet, deserts from Inyo County to northern Riverside County, to Utah and Arizona. Flowering from March to May.

Propagation: Several collections of wild, untreated seed that were sown in flats gave excellent response in three to six days. Damp-off fungus needed to be guarded against although some lots were raised with only minor losses of seedlings before setting out.

Culture: Planted in dry spots in the desert garden and plant community section, with highly drained soils, the life of this species here was comparatively short usually not over four to seven years. Flowering was noted the first year, even in the nursery before planting out. Several handsome, small plants were grown and if these could have been handled with any degree of success, they would have made a useful small border plant much like the cultivated *Iberis*.

***Lepidospartum squamatum* (A. Gray) A. Gray.**

Shrub.

Asteraceae. Sunflower Family.

Natural Range: Commonly seen in gravelly places and the drier washes of cismontane central California to Baja California (Mexico); in both deserts. Flowering from August to October.

Propagation: Underground runners and by seed; the untreated seed will start germinating in seven days, but is short-lived and must be sown within the first year. Every planting of older seed failed to germinate. The species *L. latisquamum* **S. Watson.** also takes the same amount of time and treatment. While raising the young plants of the latter species in the lath house, nest building birds chewed off all the stems and all of the plants were destroyed. While care in raising the seedlings must be followed, we had little trouble in raising sufficient plants.

Culture: Always found in rocky and open, gravelly spots, such as washes and flats, the species is very hardy, although not one especially attractive for horticulture. It could serve as a useful erosion control once established on loose hillsides.

While for this species there was considerable loss in 15 years, *L. latisquamum*, grew abundantly in other parts of the garden. These plants ranged in size from two to four feet tall and spread three to six feet wide. While flowering of *L. squamatum* was not observed in our garden for 15 years, previously reported history indicates it will flower in one to two years from seed.

Leptodactylon californicum **H.& A.** [Ed: *Linanthus californicus* (Hook. & Arn.) J.M. Porter & L.A. Johnson. TJM2]

Prickly-Phlox.

Polemoniaceae. Phlox Family.

Natural Range: Dry slopes and banks, below 5,000 feet; San Luis Obispo County to western San Gabriel Mountains, and Santa Ana Mountains. Flowering from March to June. The **ssp. glandulosum (Eastw.) Mason**, is found at a little lower elevation, 3,000 feet on very dry banks, and cuts, in the San Gabriel, San Bernardino, and Santa Ana Mountains.

Propagation: Seeds and cuttings, the former untreated, began germinating in seven to 16 days, while Rootone-treated tip cuttings taken in December or March rooted at rates of 90 to 95%. Generally, only minor losses occurred raising either seedlings or rooted cuttings. However, care must be exercised in watering procedures while in large containers (larger than five-inch pots.). Most plants were set out from five-inch containers or smaller. And most plants were usually dead within six months. Cuttings root along the stem rather than at the base. Cutting taken in June rooted poorly and losses afterward were heavier.

Culture: Steep banks, loose gravelly, or sandy well-drained soils are appreciated most by these plants. Plants rapidly attain flowering size, usually within a year from seed, and large masses produce an array of color. The flowers are outstanding in brilliance, and range from a rose or rose-lavender, while sometimes a pure white-flowering plant emerges. The latter were easily produced by cuttings. While not long-lived, many seedlings are produced each year thus adding to the abundance of plants and enlarging these areas of color. *L. californicum*, in our experience, is a much taller and less bushy plant than the **ssp. glandulosum (Eastw.) H. Mason.**, which spreads to several feet across in cultivation. The species grows on stouter stems with a more upright habit. The species and subspecies are both fine plants for quick color in an undesirable habitat. Plants are unattractive in the summer months, when they go quite dormant and the leaves and stems are brown, but very handsome in spring with the great abundance of flowers. The **ssp.**

glandulosum has been raised continuously from an original collection obtained in 1932 and was brought to our Claremont site from the Orange County site.

***Leptodactylon pungens* (Torr.) Rydb. ssp. *hookeri* (Dougl.) Wherry.** [Ed: *Linanthus pungens* (Torr.) J.M. Porter & L.A. Johnson. TJM2] [Ed: the ssp. is not recognized in TJM2]

Northeastern California. Only two seedlings were raised. These came up in eight days, and survived to be planted in the rock garden. One plant was recorded flowering during its first year, but there are no later records.

***Lessingia leptoclada* A. Gray.**

Annual.

Asteraceae. Sunflower Family.

Natural Range: In abundance on open, dry ground, from 1,000 to 6,200 feet in the Sierra Nevada, El Dorado County to Kern County. Flowering from July to October.

Propagation: Sown directly into our garden site, either in clay-loam soil or sandy loam, germination occurred in nine to 25 days, depending on the moisture condition of the soil. Results were usually poor, with few seedlings appearing, however, once started, there was little trouble in producing flowering plants.

Culture: A plant from the dry section of our state, we had only fair success in producing flowering and seeding plants. After a period of six years, our collection petered out and was lost. No abundant amounts of volunteer seedlings were ever noted and little seed was produced.

***Leucocrium montanum* A. Gray.**

Sandy-Lily.

Perennial.

Liliaceae. Lily Family. [Ed: Agavaceae. Century Plant Family. TJM2]

Natural Range: Sandy loam meadows and flats, from 4,000 to 5,000 feet; northwestern California to Oregon and Nebraska. Flowering from April to May.

Propagation: A clump of roots was collected in sandy soil at 5,000 feet elevation in Modoc County in 1950. These were put in a flat with loam and peat moss, and the roots developed into a solid mass. The material was kept slightly moist at all times until planted in a selected site in the garden.

Culture: Planted in a sandy, gravelly site, the root system developed strongly, but there was little evidence of strength in the leaf and flowering stems. After two years, we discovered mice had eaten all the succulent roots, thus ending our endeavors to establish this species in our area. Additional plants were never seen in subsequent journeys to the area.

***Lewisia* Pursh.**

Perennials.

Portulacaceae. Purslane Family. [Ed: Montiaceae. Miner's Lettuce Family. TJM2]

Natural Range: About 18 species of which 13 species and five varieties or subspecies are recognized in California. Plants occur at altitudes of 500 to over 12,000 feet. Plants grow mostly on cliffs, rocky, gravelly places, moist or wet (at least in winter and spring), and generally northward from the southern end of Sierra Nevada (Tulare and Fresno counties). Some species grow in the Coast Ranges and only two species and one variety are found in the San Bernardino Mountains. Flowering from April to September, depending on species and altitude.

Propagation: Our collections were mostly of small numbers of roots, which may be restarted easily in pots, and in fact, are best grown in pots outside of their native areas, at least when brought to this clime. A few collections of seeds were given 30 days of cold-stratification but appeared not to need it, as seedlings had started before removal from the cold. We had excellent experience in growing the seedlings, losing a few of one species and none of another.

Culture: While we attempted to provide as close a proximity to their natural conditions as possible, the plants fared from fair to poor when once planted outside. In the greenhouse, we raised all collections quite easily in pots. Plants started growth in the fall months, and we kept them in vigorous growth until after seeding, after which they were allowed to dry out (depending on species and natural habitat). Flower and seed production was normal under such conditions. Planted in the garden, in the rock garden or in conditions as similar to that as possible, there was a gradual diminution of numbers. Some losses were caused by rot, others from ants and other causes. Life span here was from three to eight years, some seedlings were produced and an occasional beautiful specimen was grown. The following kinds were collected and grown: *L. cantelovii* J.T. Howell., *L. cotyledon* (S. Watson) B.L. Rob. var. *heckneri* (C.V. Morton) Munz., *L. cotyledon* (S. Watson) B.L. Rob. var. *howellii* (S. Watson) Jeps., *L. nevadensis* (A. Gray) B.L. Rob., *L. rediviva* Pursh. Bitterroot., and *L. rediviva* Pursh var. *minor* (Rydb.) Munz.

Lilium L.

Lily.

Perennials.

Liliaceae. Lily Family.

Natural Range: A large genus of about 100 species, of which 13 species and four varieties are found in California, all except two species and two varieties are found north of Santa Barbara County and Kern County (at the southern end of the Sierra Nevada), none are found in our deserts. Some species grow at elevations up to 10,500 feet but most are found below 7,000 feet and some grow at or near the coast. Soils range from dry, rocky, and gravelly types to wet, boggy, and moist soils with much humus. Flowering from May to August or September, but usually from June to July.

Propagation: Division of offsets, bulbils, scales, or by seeds. Except for those collections started by bulbs (more or less mature), all of our material numbering 12 species and three varieties was grown from seed. Seeds were sown in both standard depth and deep flats, or in outside seed beds. Sown in a loose, sandy loam and humus, the bulk of the seed was cold-stratified from two to six months prior to germination. The average was two to four months, and proved to be generally enough time. Some lots were sown without cold-stratification, but these lots usually took five or more months to start germination. Most seed began germination after three months of cold-stratification. However, there seemed to be no set pattern, and one raising our native lilies from

seeds should start out with at least three months cold-stratification, remove them from the cold, and if there is no germination within a month, re-cold-stratify. Most of our lots began germinating while in cold-stratification and no harm seems to occur if such was the case. Seed was sown in flats, of either standard depth or deep, seed beds, or pots. However, we found standard or deep flats quite satisfactory. Many lots of seed were put first in jars with either moist sphagnum or sand or a combination of both. When germination was noted, the seed was removed and sown in flats. Seed was sown anytime from July to January, but mostly in October, November, or January. The theory that lily seed placed in a jar with moist sphagnum and set in a window for 90 days to receive the sun was tested and failed with each of several species. The seeds, then placed in cold-stratification for 90 days all showed germination at the end of the period. *L. humboldtii* var. *ocellatum* was sown successfully directly into a site with a heavy overlay of humus formed by oak leaves. Seed germination occurred within 64 days without any pretreatment. Seedlings growing near the edge of a large tree where plenty of light was available, grew to be the sturdiest. Once seedlings in flats are growing, the moisture content of the soil must be kept quite even, special care must be taken to not keep the soil too wet. Even after the growing season, and the seedlings show signs of browning off, the small bulblets must be kept just moist enough to keep them plump. If they are allowed to get completely dry, they will rot upon resumption of watering. If the lots were not too large after the first season, small clumps of the bulblets were taken from the flats and placed in six-inch pots, where they were allowed to mature for about two years. Often some of the more vigorous seedlings flowered before setting out. Bulbs, offsets, and bulbils were raised in some quantity and were placed in pots and were carefully tended for a year or two until they were sufficiently well-established to plant out in the garden.

Culture: Upon the completion of studies on the genus *Lilium* by a former graduate student, the garden collections were increased by many species and interesting collections. Many of these collections as well as our own were kept in good condition for several years, but gradually the majority disappeared, either from disease or from disturbance by rodents. While many accessions were kept alive for as long as six to eight years, the only really successful kind here was and is, *L. humboldtii* var. *ocellatum*. Our native lilies seem to appreciate a slightly moist, well-drained, humus-filled soil with high, light shade, particularly in our area. Too heavy shade, makes them grow spindly and flower poorly. Protection or carefully guarding against rodent predation is a must, and generally we suffered few losses from this direction. Losses were principally attributed to improper handling or rotting of bulbs, the latter being the greatest problem. Those species growing naturally in wet or boggy spots, when provided such conditions here often would not prosper, as for example *L. pardalinum*. This species only occasionally developed into healthy stands when placed in a wet stream bed. Even then the colonies did not live more than a half dozen years. We found that placement in ordinary garden growing conditions with additional water was often more successful.

The following species and varieties have been grown during the past 15 years:

Lilium bolanderi S. Watson. – One seed collection in July 1955, produced one plant; even after repeated treatments of cold-stratification. This one bulb was planted out in January 1958. It was reported as dead in May 1959, having never shown any growth.

Lilium columbianum Leichtlin. Columbia or Oregon Lily. – Two collections, one of seed, and one bulb and scales, were both made in October 1953. Good germination resulted from the seeds, and the bulb was re-started successfully. The following year in June, several flowers were

produced from the bulb while it was in a pot in the nursery. Both collections were planted out in the garden in October 1955. A report on May 29, 1956, stated that four plants flowering with one or two blooms on each 18-inch stem. In May 1959, it was reported that the planting was gone, and that its loss was thought to have been caused by rot due to a very heavy accumulation of fallen oak leaves.

***Lilium humboldtii* Duch.** Humboldt Lily. – One collection of seed, and one of bulbs, were set out in 1956 and 1958. Both failed after two years. Another seed lot was started in 1964, and small plants were set out in the garden in 1966. These seem to be growing well, but it is too soon to tell.

***Lilium humboldtii* Duch. var. *ocellatum* Kellogg.** [Ed: *Lilium humboldtii* Duch. ssp. *ocellatum* (Kellogg) Thorne. TJM2] – Our Southern California form of the Humboldt lily has been the most successful of all the lilies we have raised. Seed started in 1936 at the old site, produced many bulbs of which many were still alive when we moved to our present location. These were moved in 1951 and were planted under some large live oak trees (*Quercus agrifolia*). In these locations, there was a heavy duff of humus underlain with rocky clay. Here, and in several other similar situations, thousands of plants have been grown the past 15 years. Literally thousands of volunteer seedlings have come up and this led to the idea of sowing our seeds directly into different sites in the garden. This procedure has proved to be remarkably successful. There seems to be no doubt that other species from similar habitats could be handled in this manner. We have recorded flowering plants within four years when seeds are sown directly into the site. This period of time in flowering holds true for most of this species when grown from seed. Plants from mature bulbs begin to show above ground in March, sometimes earlier, and full flowering occurs in June. Insects, rots, and other troubles cause a periodic rise and fall in the population of this very successful lily.

***Lilium kelleyanum* Lemmon.** – Six seed collections and five bulbs have been grown. All except two seed collection were successfully grown, but none survived for more than eight years. A few flowers and seeds were produced (two collections of seeds were harvested), but one could not report this plant as very well grown.

***Lilium kelloggii* Purdy.** – Three seed lots were collected in 1955, all of which produced large amounts of seedlings. Plants were set out in the garden in 1956 and 1957, and all were reported gone by 1959.

***Lilium maritimum* Kellogg.** Coast Lily. – One seed lot and a few bulbs were acquired in 1955. These gave us our start of this interesting lily. We had excellent seed germination. However, our conditions do not appear to be to the liking of this northerner, and none survived over four years. Bulbs grown in pots were successfully flowered, but no seed was produced.

***Lilium pardalinum* Kellogg.** Leopard Lily. – Eleven collections of seeds and three of bulbs gave us numerous plants to experiment with, but while many collections flowered and produced seeds, it was necessary to keep replenishing the collection. Most of our plants were raised from harvesting seed from our existing plants. Even though this species is usually found in quite wet localities, it did best for us when not kept too wet. One fine clump lived for several years in a wet stream bed of heavy clay, but rotted after five to six years. Flowering occurred within three years, and many clumps lived for eight years. One of the forms, referred to as **var. *fragrans* Purdy** [Ed: the var. is not recognized in TJM2] was grown for about four years during which time it flowered well but gradually decreased in vigor and eventually expired. A presumed

hybrid of this species with *L. humboldtii* and *L. parvum* was grown for a few years, but many were destroyed by skunks or other rodents. No degree of success was achieved.

***Lilium parryi* S. Watson.** Lemon Lily. – Starting in September 1949, four bulbs were raised from seed. In 1952, they were planted in garden and all flowered in their fourth year. After their sixth year, they began to lose strength and all were gone in the ninth year. From another lot of seeds, several hundred seedlings were raised, and these were planted into the garden during their second year. The third year, one flowered, but there was a quick deterioration of the planting until all were recorded dead in the seventh year. Handsome specimens were raised in pots from some bulbs acquired in 1956. These produced huge flowers and a good quantity of seed, which was grown in 1957. Seeds planted in 1961, failed to grow and were not seen shortly thereafter. There seems to be deterioration in strength after the mature bulbs flower. A few specimens were raised and flowered of the **var. *kessleri* Davids.** [Ed: the var. is not recognized in TJM2] but these were lost shortly after flowering and seed production. A few additional seedlings were raised, but failed to mature.

***Lilium parvum* Kellogg.** Alpine Lily. – We grew a total of seven collections: one lot of bulbs, four lots of wild seed, and two lots of seed collected from our cultivated plants. Of the hundreds of seedlings raised, many failed to survive, but we had good plantings for several years. Flowering occurred within the third and fourth years, but as with other species, there was a decline after flowering. Our oldest plantings attained an age of seven years.

***Lilium rubescens* S. Watson.** Chaparral Lily. Redwood Lily. – We grew two small collections of bulbs, and one collection of seed from which only five bulbs were grown. We had this species in cultivation for four to five years, after which it dwindled away.

***Lilium vollmeri* Eastw.** [Ed: *Lilium pardalinum* Kellogg ssp. *vollmeri* (Eastw.) M.W. Skinner. TJM2] – Of three seed collections gathered in 1955, one produced over 300 seedlings but the other two failed completely. The plants were raised for two years in the nursery, and were set out in the garden in 1957. Two years later they were recorded as gone.

***Lilium washingtonianum* Kellogg.** Washington Lily. – Seeds and a few bulbs were raised easily in nursery, but after planting out and flowering, they slowly deteriorated over a period of seven years. Seed harvested from our flowering plants produced a fine quantity of seedlings, but no better success was attained with them. The same kind of history was recorded for the **var. *minus* Purdy.** [Ed: the var. is not recognized in TJM2], the Shasta Lily. The **var. *purpurascens* Stearn.** [Ed: ssp. *purpurascens* (Stearn) M.W. Skinner. TJM2] was raised too recently (from seed) to determine its ability to survive in our area.

***Lilium wigginsii* Beane & Vollmer.** [Ed: *Lilium pardalinum* Kellogg ssp. *wigginsii* (Beane & Vollmer) M.W. Skinner. TJM2] – A seed collection acquired in 1955 from Siskiyou County produced a fine group of seedlings. However, there were considerable losses while growing the plants in nursery. Approximately 40 plants were set out in 1957, and all were recorded lost in 1959.

***Limnanthes douglasii* R. Br.**

Meadow Foam.

Annual.

Limnanthaceae. False Mermaid Family.

Natural Range: Moist places, such as vernal pools and seepages, usually growing in heavy soils, below 3,000 feet in the Coast Ranges, from San Benito County to Southwestern Oregon. Flowering from March to May.

Propagation: Untreated seed when sown in flats, will germinate in an average of six to eight days. Sown in a moist garden site, our records indicate that the seeds will germinate in eight days. Excellent results have been obtained. From an initial few plants in 1964, thousands of seedlings now appear each year.

Culture: This species, **ssp. rosea (Benth.) C.T. Mason.**, and **ssp. sulphurea (C.T. Mason) C.T. Mason.** have all been raised successfully. Planted at the edge of an artificial vernal pool, or at the edge of a stream, they have responded with vigor. Presently, scattered volunteers are appearing where the clay soils are not quite as moist. When grown in full sun or under high light shade, all of these plants make excellent garden subjects. Their brilliant yellow flowers are borne in abundance, as are the lighter shades of the flowers of the varieties. A slightly moist condition needs to be maintained during the growing season for best results.

***Linanthus* Benth.**

Annuals, Perennials.

Polemoniaceae. Phlox Family.

Natural Range: A large, widely distributed genus in California consisting of some 34 species and many subspecies, many of which are very attractive. Commonly occupying well-drained, open, gravelly sites, the various species may be observed in a wide range of elevations. Flowering from March to July, depending on the species.

Propagation: Except for experimental studies, all of our collections have been sown directly into sites in the garden. Germination periods under such conditions vary considerably, but on the average seedlings may be expected within one to two weeks, and perhaps sooner if the soil is kept at an even moisture content.

Culture: While most species prefer an open, sandier soil or a well-drained gravelly soil, we had excellent results with most some species, particularly ***L. grandiflorus***, in the heavy clay of the mesa. Sunny positions and the above soils, should bring success for the majority of species. The following kinds have been raised at this site:

***Linanthus androsaceus* (Benth.) Greene.** [Ed: *Leptosiphon androsaceus* Benth. TJM2] – First sown in a field row on the mesa and again in the rock garden, this species from the dry decomposed granite slopes of Monterey County performed well, producing ample supplies of seeds, but was not considered very attractive. Flowering began in March.

***Linanthus aureus* (Nutt.) Greene.** [Ed: *Leptosiphon aureus* (Nutt.) E. Vilm. TJM2] – From sandy flats at elevations of 3,000 feet and above in the hills of the Mojave Desert, two collections were raised fairly well for several seasons. Special sites were prepared and in those areas volunteers were noted for several seasons, but they gradually disappeared. Flowering started in the middle of March.

***Linanthus ciliatus* (Benth.) Greene.** [Ed: *Leptosiphon ciliatus* (Benth.) Jeps. TJM2] – A collection of seed was obtained in 1949 from a dry, meadow-like area in the forests of Trinity County. This collection has been maintained in our rock garden from then on. While not a

particularly showy plant, it keeps coming back each season without much trouble. Flowering started in April.

***Linanthus dianthiflorus* (Benth.) Greene.** Ground-pink. – This species was native to our garden site, in the very sandy areas, but gradually disappeared upon the advent of more activity in those areas. A delightful annual with varying shades of light to deep pink flowers, we have cultivated it most successfully in our rock garden. Selected colors types were maintained until the mixing became impossible to separate. Flowering began in February, March, or April, depending upon when the seeds were sown.

***Linanthus dichotomus* Benth.** Evening Snow. – The common name is most appropriate as the white flowers of this species “unroll” in the evening and remain open until about mid-morning, depending on the light intensity (note that they stay open on cloudy days in cultivation). Several generations from a collection obtained in 1956 from Kern County, have been raised successfully in our rock garden area. Flowering begins in March.

***Linanthus grandiflorus* (Benth.) Greene.** [Ed: *Leptosiphon grandiflorus* Benth. TJM2] – Several selected strains of this fine and easily grown species have been grown for many years. Starting in 1932 with a strain purchased from Theodore Payne, this and several collections of our own have been continuously raised each season. A fine, pure white-flowered plant was selected in 1948 and has been the progenitor of displays of pure white flowers every year since. These abundant seedlings grow up to two to two-and-a-half feet tall and eventually create a wonderful mass of pure white flowers. Customarily, the flowers are pinkish-lavender to lavender. Guard plantings against birds and rabbits in the seedling stage! Flowering begins in April or May, depending on when the seed is sown. This species is principally from the Coast Ranges.

***Linanthus montanus* (Greene) Greene.** [Ed: *Leptosiphon montanus* (Greene) J.M. Porter & L.A. Johnson. TJM2] Mustang-Clover. – A Sierra Nevada species growing at 1,000 to 5,000 feet elevation. We have continuously grown this species since an original seed collection made in June 1933. This is always an easily grown species, and is appreciated by everyone who knows it. We have especially appreciated its value as a good display subject. Favoring drier and well-drained situations, it performs well in this site, although when it was first introduced to our new site, it behaved erratically. Seed and seedlings must be protected against birds for any sort of display. Flowering begins in April and lasts through May. A lovely, pink-flowered form has been selected for additional study and propagation.

***Linanthus nuttallii* (A. Gray) Milliken.** [Ed: *Leptosiphon nuttallii* (A. Gray) J.M. Porter & L.A. Johnson. TJM2] – An attempt was made to transplant seedlings from the wild (from Westgard Pass, Inyo County, at 10,000 feet elevation) but only one plant survived. Planted in our rock garden, it gradually weakened and was lost within the year. The **ssp. *floribundus* (A. Gray) Munz.** [Ed: *Leptosiphon floribundus* (A. Gray) J.M. Porter & L.A. Johnson. TJM2] was raised from seed acquired from cultivated plants. Although only recently acquired, they started strongly, flowered the first season, and seed has been gathered for additional propagation. It appears to be getting well acclimated.

***Linanthus parryae* (A. Gray) Greene.** – This species was recently acquired, and appears to be adapting to cultivation in the rock garden. Flowering began in April, but no seed was harvested as we are waiting to see if it will voluntarily naturalize.

***Linnaea borealis* L. var. *longiflora* Torr.**

American Twin Flower.

Perennial.

Caprifoliaceae. Honeysuckle Family. [Ed: Linnaeaceae. Twin Flower Family. TJM2]

Natural Range: Creeping among the undergrowth in dense woods, from elevations of 400 to 8,000 feet, northern California to Idaho and Alaska. Flowering from June to August.

Propagation: Our experience is limited to rooted plants and stems that may be transplanted and restarted in the nursery quite readily. Undoubtedly seed would germinate readily. Our plants grew vigorously in the nursery in flats and pots.

Culture: This species prefers a damp woodland-like situation to perform well. Our plants developed nicely until they succumbed from being overgrown by larger and more vigorous plants. In our dry climate, we would question its ability to do well. However, we would not write it off. This plant makes a nice, creeping plant of interesting habit.

***Linum perenne* L. ssp. *lewisii* (Pursh) Hult.** [Ed: *Linum lewisii* Pursh var. *lewisii*. TJM2]

Blue Flax.

Perennial.

Linaceae. Flax Family.

Natural Range: Widely distributed throughout California at elevations of 4,000 to 11,000 feet, inhabiting many plants communities and growing on dry slopes and ridges. Flowering from May to September.

Propagation: Untreated seed will germinate in seven days when sown in a nursery flat, but will require two to three weeks if broadcasted into open ground. The latter procedure was followed by us in nearly all of our plantings. Seeds germinate abundantly and within a year many hundreds of volunteers seedlings arise in all areas, but this species seems to prefer an open, somewhat rocky, well-drained situation. It was noted that the seedlings produce an unusually long tap root.

Culture: As this species seems to require an open, full sun situation, we grew most of our plants in the rock garden where they prospered exceedingly well. In shade or on dark days, the flowers remain closed, but on bright sunny days, the delightful blue shade of the flowers produced on thin, branching stems, creates a light, pleasing picture. Seed is dropped abundantly, and many volunteer plants arise in the area. Individual plants are short-lived, and are almost handled as annuals. Flowers appear over a period of several months, but usually peak in May and June.

***Lippia wrightii* Gray.** [Ed: *Aloysia wrightii* (Torr.) Abrams. TJM2]

Shrub.

Verbenaceae. Vervain Family.

Natural Range: Very dry, rocky places, from 3,200 to 5,000 feet elevation, from the mountains of the Mojave Desert, to Texas, and northern Mexico. Flowering in spring and fall.

Propagation: Untreated fresh seed will germination in seven to 11 days when they are sown in a nursery flat. Seed appears to be short-lived as seven-year-old seed failed to germinate. Plants,

even old ones, can be transplanted easily. Cuttings were taken from wild plants in January 1941. These cuttings were stuck untreated, some with bottom heat and some without bottom heat, in a cutting flat. A total of 29 rooted: 26 with bottom heat, three without bottom heat. (See Everett, 1957. Pg: 134.)

Culture: This species needs an open, sunny situation with well-drained soils, preferably on the rocky side. Our collection started from one plant dug in the Clark Mountains of the eastern Mojave Desert, in January 1941. This specimen was planted in the old site in May, 1941, and it grew very well there. An additional four plants, grown from cuttings, were added in 1946. These attained heights of one to three-and-a-half feet tall and spread four-and-a-half feet wide before they were transplanted into five-gallon-cans in February 1951 for the move to the new garden site. Four plants survived the move and were planted in May 1951 at the new garden site in Claremont. All are alive, and at the age of 25-years-old have attained heights of 19 inches to three feet and have spread from two-and-a-half to five-and-a-half feet wide. Seed has been harvested and grown for two additional garden plantings, and all of these plants are progressing nicely. These additional plantings are four- and 15-years-old. Young plants need protection from rabbits as many of ours were chewed consistently until they were fully protected.

***Lithocarpus densiflorus* (Hook. & Arn.) Rehder.** [Ed: *Notholithocarpus densiflorus* (Hook. & Arn.) Manos et al. TJM2]

Tanbark-Oak.

Tree.

Fagaceae. Beech Family.

Natural Range: Wooded slopes below 4,500 feet, from the Coast Ranges of Ventura County to Del Norte County; and into southwestern Oregon. Flowering from June to October.

Propagation: By seeds, cuttings, and grafting. The acorns are usually sown untreated, in the fall, but germination may be held back by putting them in a flat and holding them under cold-stratification at a temperature just above freezing. The soil medium may be peat moss, sphagnum, or a suitable light mixture that is kept moderately moist. Too much moisture will cause the acorns to rot. They may also be sown in deep outside seed beds or field rows. In the later practice, the seeds should be well protected against rodents. It has been our practice to sow the acorns in flats and carefully keep the sprouting medium constantly but only moderately damp. In more recent years, the seeded flats were put in standard cold-stratification for about three months. Upon removal from the cold in the first part of January, they were placed in the greenhouse where they began sprouting in 28 days. Our first collection of one pound, 12 ounces (116) acorns was sown on September 27, 1951. In 73 days sprouting began and continued for another two months. The roots appear several weeks before the leaves show above ground. By the time the leaves appear, the roots have attained considerable length. Potting should be restricted to deep, narrow containers, but if this is not possible, the roots may be clipped, a procedure which will produce a more fibrous root system. A few lots of sprouted acorns were put directly into cans, but generally with poor results. Our latest practice was to plant the rooted acorns in a deep bed in the lath house and let them grow to size. They were then dug and some were soaked (as a test) for 15 minutes in Hormex at a rate of 150 drops to three gallon water. We could not determine if this treatment did any appreciable good or harm. Potted seedlings often suffered severe losses from acorn rotting, rodent predation, or other diseases. An occasional

collection seemed to be more vigorous, and there was little difficulty in producing a fine lot of strong plants.

Tip cuttings, taken in November, treated with Rootone, and put in a seed pan in a soil mix of peat moss and perlite, kept under mist and fogger, produced roots in 56 days on 13 of the original 15 cuttings. Only one of these cutting-grown plants died in the nursery, and this stock was used for grafting experiments.

The following procedures were used for grafting as reported by Mr. N.F. Lolonis, horticulturist at the garden. Use container grown stock that is from one- to two-years-old. Bring these rootstock plants into greenhouse in late January and fertilize them. Make grafts from mid-February to early March. Cleft or whip and tongue grafts may be used. Selection of proper scion wood is most important. It is best to use one or preferably two-year-old wood; never use last season's growth. A portion of the wood where one season's growth ends and the next season's begins is best for scions. Small buds in this area are most reliable. It is best to remove all the leaves from the scion wood. Tie the unions with budding rubber and seal with Tree Seal. Put grafts in cutting room, preferably under mist, and remove as soon as scions start new growth, which is in about three weeks after grafting. Remove rubber bands a few weeks after scions take hold and begin to grow.

Culture: While there may be some questions about the primary cause (or causes) of our initial heavy losses after planting, it appears that this species did not take to our very rocky, open soils. In all lots where plants were planted both in the clay-loam soil of the mesa and the rocky area off the mesa, the survival was far better on the mesa, the rate there was almost 100%, whereas off the mesa it ranged from complete loss down to 50% in a few years. Three plants from an original collection set out at the old site in 1936 were balled in March 1951, and were replanted at the Claremont site. Two died the first season and one tree, now 30-years-old, has grown to 16 feet tall and has spread to ten feet wide. It was 40 inches tall when set out in 1951, in its present site. No acorns have been reported on this tree. Other plantings, beginning with those planted in 1952, have grown to nearly ten feet tall and eight feet wide; flowering was first recorded in 1962, after a period of ten years of growth. One very vigorous strain has attained heights up to 11 feet in seven years, and these first flowered in their seventh year. All plants on the mesa have made much better growth, and are notably taller, broader, and are fully branched to the ground. One particularly vigorous and beautiful specimen has outgrown all others. This tree was part of our original 1952 planting and it shot up a beautiful single trunk that is now over 30 feet tall, it has produced acorns, and it has very large leaves on branches that exhibit a somewhat drooping habit. This is the specimen which we have studied for possible introduction into horticulture and have been experimentally grafting for additional plants. One feature which may provide reason against such introduction is the peculiar odor of the female flowers. It is an odor often offensive to many people, particularly when there are many trees in bloom. The species is a handsome and worthy of more usage, as long as the odor is not too objectionable. This tree is extremely hardy when once established, and there are many other locales where it could grow with even more vigor.

***Lithocarpus densiflorus* (Hook. & Arn.) Rehder var. *echinoides* (R. Br. ter) Abrams.** [Ed: *Notholithocarpus densiflorus* (Hook. & Arn.) Manos et al. var. *echinoides* (R. Br. ter) Manos et al. TJM2]

Shrub.

Natural Range: Dry slopes and flats from 2,000 to 8,000 feet in elevation; it is found from central northern California to southern Oregon. Flowering from June to August.

Propagation: Two collections of acorns were gathered in 1954 and were germinated in moist sphagnum. Sprouting began in 91 days with the maximum number reached in three-and-a-half months. When the acorns had sprouted sufficiently, two or three young plants were potted up in each gallon-can. Only minor losses occurred in the nursery, and a fine group of seedlings were planted.

Culture: As with the species, this shrub variety performed much better in the silty clay of the mesa when compared to those growing in the very rocky, granitic loam. Young plants were severely nibbled by rabbits and had to be protected by caging. In the rocky soil, at least 90% were lost in ten years, and the surviving plants averaged two to three feet tall and a little broader. First flowering began in their eighth year, but no acorns have been recorded. On the mesa, the plants were considerably larger. Losses here, while high, were not as severe as it was for those planted in the rocky soils. Because of over-crowding, a number of these plants had to be removed. While the yellowish-green foliage is not as attractive as a deep green, this evergreen shrub is a useful, hardy shrub of comparatively slow growth.

***Lithophragma* (Nutt.) Torr. & A. Gray.**

Woodland-Star.

Perennials.

Saxifragaceae. Saxifrage Family.

Natural Range: A wide ranging group over much of California (particularly the two species under consideration). Mostly cismontane California at a variety of elevations. Flowering from March to June.

Propagation: Ours specimens were obtained by transplanting a few plants from the wild. These were restarted under fogging conditions in the greenhouse's cutting room in pots. During their dormancy period, plants were moved into cold-stratification where they were held until the following fall.

Culture: *L. affine* A. Gray. and *L. heterophyllum* (Hook. & Arn.) Torr. & A. Gray. were native to our area in cool, shaded banks, but we added out-of-county collections which remained for several seasons, but since they are rather insignificant, they were overlooked and lost.

***Lobelia cardinalis* L. ssp. *graminea* (Lam.) McVaugh.** [Ed: *Lobelia cardinalis* L. var. *pseudosplendens* McVaugh. TJM2]

Scarlet Lobelia.

Perennial.

Campanulaceae. Bellflower Family.

Natural Range: Occasionally seen in boggy places in some parts of Southern California in Los Angeles, San Bernardino, and San Diego counties, ranging east into Texas, and south to Panama (Central America). Flowering from August to October.

Propagation: Untreated seed will germinate in 17 to 22 days, however, we used cold-stratification for some lots for from two to three months, but germination was not any more rapid except when held longer in cold. We had excellent results transplanting and growing the seedlings in nursery.

Culture: Planted along stream, the plants grew exceedingly well for two or three seasons, flowered beautifully, and produced some seed. However, no volunteer seedlings were ever observed. After the second or third season, there was a rapid decline and few plants lived for over five to six years.

***Lobelia dunnii* Greene var. *serrata* (A. Gray) McVaugh.**

Perennial.

Natural Range: Occasionally found in moist seepages or canyons, in cismontane California from Monterey County to northern Baja California (Mexico). Flowering from July to September.

Propagation: Our two plants were presented growing in containers, but undoubtedly could be started easily from seed or by dividing the plants. The plants grew very well in the greenhouse, flowering most of the time.

Culture: We recently set out plants beside a running stream, they were initially observed growing very well, and should become established in this shady site.

***Lomatium mohavense* (J.M. Coult. & Rose) J.M. Coult. & Rose.**

Perennial.

Apiaceae. Carrot Family.

Natural Range: A fairly abundant plant on dry plains, from 2,000 to 6,000 feet in elevation, from the Mojave and Colorado deserts of California, extending into western Nevada. Flowering from April to May.

Propagation: Untreated or cold-stratified seeds sprouted in 48 days for every lot raised. Seed was sown in August or September to get as long a growing period as possible, since the plants go dormant through the summer months. This habit makes it difficult to produce many plants since many will rot in the nursery unless watering is completely stopped. About 50% of our seedlings were lost in this manner.

Culture: Set out in sandy, gravelly loam, many of the plants died within two to three years and no specific records were made of their progress.

***Lonicera conjugialis* Kellogg.**

Shrub.

Caprifoliaceae. Honeysuckle Family.

Natural Range: Wooded slopes from 4,000 to 10,200 feet in elevation, in the Sierra Nevada from Tulare County northward, and from western California to Washington and western Nevada. Flowering from June to July.

Propagation: Our plants were grown from untreated seed sown in December, and these took 63 days to sprout. Germination rates were exceedingly poor for our one collection and yielded only

five seedlings. Of these, only two were successfully raised for planting and these were poor specimens.

Culture: Placed on an oak-shaded bank, the history is unknown since nothing was recorded, therefore it is suspected the plants succumbed shortly after planting. Other specimens that had been given to us also failed to survive in the nursery.

***Lonicera hispidula* Lindl. (Torr. & A. Gray) var. *vacillans* A. Gray.**

California Honeysuckle.

Shrub.

Natural Range: Near streams and on wooded slopes, below 2,500 feet, from northern and central California south to western Riverside County, rare in Southern California; north to Oregon. Flowering from April to July.

Propagation: Our six collections were all generated from seed collected in the wild; four lots germinated, two failed. All six lots were sown untreated in July, September, October, and November. Germination occurred in 39 to 46 days, however one lot of four-year-old seeds germinated in 12 days. Four lots were cold-stratified for 30 to 38 days. Of these, two failed completely and the other two took 12 and 26 days after removal from cold to germinate. Cold-stratification in no way helped germination and appears unnecessary, although it does no harm. One lot was sown directly into gallon-cans, but required nearly five months to germinate. If the weather turned excessively hot, losses in gallon-cans were high, otherwise we generally experienced good results while raising the seedlings.

Culture: Wherever our plants were afforded plenty of shade protection, such as on the clay banks of the mesa shaded by oaks, they grew rampantly. Where used in the plant communities section of the garden, they needed complete shade to grow best – and even then losses were relatively high over a ten year period (losses were often more than 50 to 60% of the planting). However, this is to be expected for a relatively cool climate plant that scrambles over heavily wooded slopes. One distressing fact each spring was the exceedingly heavy infestations of aphids, which could be controlled much better with the advent of systemic insecticides. The clusters of orange-reddish berries are most attractive hanging down from large shrubs over which the plant has scrambled. Planted on flat ground, plants attained one to two feet in height, but spread out over ten feet. Flowering and fruiting was consistent beginning in the second and third year.

***Lonicera interrupta* Benth.**

Chaparral Honeysuckle.

Shrub.

Natural Range: Mostly in chaparral on dry slopes, from 1,000 to 6,000 feet elevation, both ranges of interior California to the San Bernardino Mountains. Flowering from May to July.

Propagation: Two lots of untreated seed were sown in October and December (both were from same wild collection of seed) and these germinated in 34 and 40 days with maximum results one to two months later. Germination was good and results in the nursery were fine, and no losses were recorded.

Culture: While over 50% of the plants were lost during a ten year period, on the whole the species has done well, especially where the plants are somewhat protected from full sun. This species needs the shade of shrubs to protect its roots and where ample shade is cast the plants respond adequately. Ten-year-old plants showed growth to five feet tall (when not scrambling over plants) and spread to 11 feet wide. Both flowering and fruiting were recorded for these plants in their second year.

***Lonicera involucrata* (Richardson) Spreng.**

Twinberry.

Shrub.

Natural Range: Moist places, from 6,000 to 10,000 feet elevation, and below 1,000 feet nearer the coast, from the central California coast ranges and the Sierra Nevada, from Santa Barbara and Tulare counties north to Alaska; Quebec (Canada), and Mexico. Flowering from March to April.

Propagation: Produced by seed, cuttings, divisions, and transplants. Untreated seed will germinate in 30 to 40 days, but some of ours took longer, even up to five months. Seeds treated with three months of cold-stratification germinated from 16 to 20 days after they were removed from the cold. Results have been somewhat erratic. No cuttings were gathered during this period, but they can be readily rooted by taking cuttings of new growth in February or March. Usually there is little trouble is encountered in raising the seedlings.

Culture: Since all of our collections were made in the coastal regions of northern California, our plants have done best when they were planted in semi-shaded positions with plenty of moisture. However, fine specimens are growing in full sun as long as they are provided with enough moisture. Being a deciduous, vigorous shrub, it is good practice to cut the older stems back to ground to permit new, vigorous shoots to arise. Flowers and the interesting black fruits, surrounded by a bright red collar, are borne along the stem and a bush of new growth with big, bright green leaves creates a handsome bush. We transplanted plants from the old site in April, 1951. Two failed to survive, and after the fifteenth year, two more succumbed. But 20 years later, three transplanted shrubs growing in full sun remained and measured two to five-and-a-half feet tall and had spread from three-and-a-half-feet to seven feet wide. Ten-year-old plantings in better locations are four to six-and-a-half feet tall and have spread five to ten feet wide. Flowering and fruiting were first recorded during their third year of growth. Many plants have been grown on the mesa where they have performed adequately, but none appear to have been as happy here as at the old site, probably because of the drier climate.

***Lonicera subspicata* Hook. & Arn.**

Moronel.

Shrub.

Natural Range: A chaparral plant from the dry slopes near Santa Barbara, below 3,000 feet. Flowering from June to July.

Propagation: One collection of seed was gathered from plants growing at the old site. These started germinating in 25 days and all those potted were raised in the nursery.

Culture: Growing this Southern California species has been very simple and we have experienced good results. Nearly all plants that have been set out in the garden are alive and growing vigorously. Fifteen-year-old specimens range in height from three to seven feet and spread up to 12 feet wide. Flowering and fruiting were recorded in their second year. The **var. *denudata* Rehder**. has been grown equally well, in four years specimens have attained heights of one to four-and-a-half feet and have spread from one-and-a-half to ten feet wide. First flowering and fruiting were recorded during their second year.

***Lotus* L.**

Bird's Foot Trefoil.

Annuals, Perennials.

Fabaceae. Pea Family.

Natural Range: A very large and wide ranging genus. In California, species may be seen in nearly all parts of the state, mostly at elevations below 8,000 feet, but some grow at elevations as high as 10,500 feet. All types of habitats and plant communities are represented in this catholic genus. In California there are 36 species and many varieties. Flowering usually from March through July, but often later when growing at higher altitudes.

Propagation: Seeds of all species and varieties collected have been sown untreated, and averaged four to seven days to germinate. ***L. crassifolius*** and ***L. oblongifolius* var. *nevadensis*** took much longer – as much as three months. One lot of ***L. crassifolius*** was cold-stratified for three months and the seeds germinated a few days after their removal from the cold, and there was an improved rate of germination. Most of the collections were handled with ease in the nursery.

Culture: Generally the various species prefer well-drained soils that were kept on the dry side, as too much moisture usually caused rotting, but again this was dependent on the species. Many grew exceedingly well in the clay soil of the mesa. They were all subject to rabbit and rodent damage, particular the ***L. scoparius*** group and similar species. On the whole the various species raised were rather short-lived for us. Flowering and seeding occurred in the first year. Notes on the species and varieties that were raised follows:

***Lotus argophyllus* (A. Gray) Greene var. *ornithopus* (Greene) Ottley.** [Ed: *Acmispon argophyllus* (A. Gray) Brouillet var. *argenteus* (Dunkle) Brouillet. TJM2]– Originally acquired in 1941, several lots of seeds have been raised or sown in place in the garden. These plants had a short life span, about three to five years is average. Losses from rabbits and frost were typical, but were followed by many seedlings in the immediate area.

***Lotus benthamii* Greene.** [Ed: *Acmispon cytisoides* (Benth.) Brouillet. TJM2] – This coastal species has survived for over seven years from the production of volunteer seedlings, however, a few specimens remain from the original planting. They get burned in the hot summer months.

***Lotus crassifolius* (Benth.) Greene.** [Ed: *Hosackia crassifolia* Benth. TJM2] – This large woody perennial has not been raised successfully, as the seedlings always die in the nursery, or the seed fails to germinate.

***Lotus hamatus* Greene.** [Ed: *Acmispon micranthus* (Torr. & A. Gray) Brouillet. TJM2] – Our first seed collection was acquired in 1965, but on the basis of present observation, this species is behaving normally and will have much the same history as the others.

***Lotus oblongifolius* (Benth) Greene var. *nevadensis* (A. Gray) Munz.** [Ed: *Hosackia oblongifolia* Benth. var. *oblongifolia*. TJM2] – Recorded as being flower the second year from seed, but no other history is noted. It is assumed that all the plants lived only a short time.

***Lotus rigidus* (Benth.) Greene.** [Ed: *Acmispon rigidus* (Benth.) Brouillet. TJM2] – A few plants were set out in 1952 and flowered shortly thereafter. However, no further history was recorded, so the plants were assumed to have died within a few years.

***Lotus scoparius* (Torr. & A. Gray) Ottley.** [Ed: *Acmispon glaber* (Vogel) Brouillet. TJM2] – This common woody perennial and its varieties grow throughout most of this region. Several generations of seedlings have been raised. This species is beloved by rabbits, and therefore it is difficult to keep a planting going until the plants have attained some age. The following varieties and subspecies were also raised, all with some degree of success, but again needing complete protection from the rabbits until they attained mature size and even then they were attacked: **var. *brevialatus* Ottley** [Ed: *A.g.* var. *brevialatus* (Ottley) Brouillet. TJM2], **var. *dendroideus* (Greene) Ottley** [Ed: *A. dendroideus* (Greene) Brouillet var. *dendroideus*. TJM2] , and **var. *traskiae* (Noddin) P.H. Raven** [Ed: *A. dendroideus* (Greene) Brouillet var. *traskiae* (Abrams) Brouillet. TJM2].

***Ludwigia natans* Elliott var. *stipitata* Fern. & Griscom.** [Ed: *Ludwigia repens* J.R. Forst. TJM2]

Perennial.

Onagraceae. Evening-Primrose Family.

Natural Range: Marshy ponds and streams, below 5,000 feet elevation in the San Bernardino Mountains. Flowering from July to September.

Propagation: Easily grown from seed, but our plants were brought in as rooted runners.

Culture: Needs wet conditions and ours grow well under such conditions. Unless controlled, this plant may become too rampant.

***Lupinus* L.**

Lupine.

Annuals, Perennials, Shrubs.

Fabaceae. Pea Family.

Natural Range: The more than 80 species and 60 varieties or subspecies of this large genus are well-distributed in most parts of California from one border to the other, embracing a wide variety of habitats from the seashore to near arctic conditions on the highest mountains.

Flowering from January to August.

Propagation: Annuals, perennials, and even shrubs, the seed may be sown directly in the garden site. Germination takes from two to four weeks. All of our annuals, many perennials, and some shrubs have been grown in this manner. Also, many volunteers were observed within the groups of perennials and shrubs. A large majority of perennials and shrubs were started in the nursery by giving them a hot water treatment – from 17 to 24 hours – after which the majority germinated in four to six days. However, an occasional collection germinated in a longer or shorter time.

Generally seedlings grew quickly and we scheduled them to be planted in the garden within four

to six months after sowing seed. Since the losses were high when we held the young plants through the summer months in gallon-cans in the nursery, we endeavored to have them planted from four- to five-inch pots. (Note: There are several species of annual lupines that have soft-shelled seeds and a high percentage of germination may be expected, but there is another group with only a small percentage that are soft-shelled (*L. succulentus*) and only about 10% of the untreated seed will come up the first season. This is equally true of the perennials and shrubs. All lupines benefit from hot water treatment. The perennials may be propagated through divisions as well as by seed.

Culture: Our lupines are not too particular as to soil, but on the whole it should be well-drained and open, except for those species that naturally inhabit wet, swampy places, and even then the soil is usually gritty. In heavier soils, watering must be controlled and kept to a minimum during the dry months. Root and stem rots easily kill those species naturally inclined to dry situations.

Annuals should be protected against snails, slugs, rodents, rabbits, and birds until they are of sufficient size to maintain themselves. We have had many fine stands ruined overnight from the attacks of any one of the aforementioned groups. This also holds true for the perennials and shrubs, when they are sown directly in a garden site. The shrubs were always protected by cages when they were first planted and remained so until they grew too large for their cages. It proved best to raise the shrubs in the nursery to ward off these attacks. The annuals, particularly the *L. densiflorus* group and its close relatives, were subject to attacks from the vegetable weevil (*Listroderes cosbiroctris*). It bores into the hollow stem and eventually caused the plants to collapse, usually when they are on the verge of blooming. This situation made it difficult to obtain adequate quantities of seed for resowing the following season. However, once determined, the problem can be controlled by spraying in advance of the attacks.

Generally the perennials and shrubby species were comparatively short-lived, that is they survived between three to five years or five to ten years depending on site and other factors. Since the plantings could be renewed quickly, there was no great problem in maintaining the most suitable types, which for our area were these from the drier habitats. Flowering primarily from March to May, with seed production following closely. The flowers bloom from the bottom of the spike to the top, correspondingly the seeds also ripen from the bottom to the top of the spike.

The following notes pertain to the individual species:

***Lupinus abramsii* C. P. Smith.** [Ed: *Lupinus albifrons* Benth. var. *abramsii* (C.P. Smith) Hoover. TJM2] – A narrow endemic from the Santa Lucia Mountains of Monterey County, this shrubby perennial was added to our collection in 1955. During its first three years growing in the tight clay soil of the mesa, it produced handsome displays in the late spring. However, within five years there was a gradual decline, and supplementary collections of seed were necessary to maintain the species. A group grown in very rocky soil has been maintained for ten years, though many of these are volunteers and display hybrid characteristics.

***Lupinus albicaulis* Dougl. ex Hook.** – Although we added this species to the collection in 1952, and two collections were raised, neither were successful and both collections were noted as dead within their first year.

***Lupinus albifrons* Benth.** – An original collection of seed from Santa Catalina Island in 1932 has provided many generations of plants for the garden. And an additional number of collections

from various parts of California have been added. Always successfully grown, this shrub has provided masses of bright blue flowers in the early spring and many specimens attaining heights of five to eight feet tall. One of the most useful and successfully grown of this large genus.

***Lupinus albifrons* Benth. var. *douglasii* (Agardh.) C. P. Smith.** – Acquired in 1960, this variety has performed well, flowering and producing an abundance of seed for larger additions to other sections of the garden.

***Lupinus albifrons* var. *eminens* (Greene) C. P. Smith.** [Ed: the var. is not recognized in TJM2] – While maintained from an original collection obtained in 1941, this variety has not been quite as hardy for us, although we have easily maintained it from several collections of cultivated seed.

***Lupinus andersonii* S. Watson.** – Similar to *L. albicaulis*, our experience was likewise much the same, all three collections having succumbed within a year.

***Lupinus arboreus* Sims.** – Thirteen wild collections of seeds, and two from cultivated plants, failed in our area. While there was no problem in getting plants to mature, very few lived for more than a year. Further, never were the flowers as brilliant a yellow as those seen in the wild. Ours were only a washed out semblance of yellow or were a dirty whitish tone. Raised either in the nursery or sown directly in the garden, the plants always grew rapidly but were never happy in our area.

***Lupinus argenteus* Pursh.** – One collection acquired in 1952 produced a few plants, but no record was made as to the results and is assumed to have failed shortly.

***Lupinus benthamii* A. Heller.** – Several generations of seed strains, originally gathered in various locations of this species range, have been grown successfully. The **var. *opimus* C.P. Smith.** [Ed: the var. is not recognized in TJM2] has been grown since an original collection was gathered in 1935. Seeds are easily started, but our chief trouble has been with insects and rots, both of which can be contained if preventive action is taken soon enough.

***Lupinus breweri* A. Gray.** – Recently acquired, the three seeds produced one plant on which no information was recorded.

***Lupinus chamissonis* Eschsch.** – Added in 1963, this lovely shrub was started successfully but since this report covers only two years of its life, it cannot be stated as to its longevity here. It is assumed to be much like the others judging from past experience.

***Lupinus citrinus* Kellogg.** – This annual from the Sierra foothills was acquired in 1951 but no information was recorded.

***Lupinus confertus* Kellogg.** [Ed: *Lupinus lepidus* Lindl. var. *confertus* (Kellogg) C.P. Smith. TJM2] – Seed from this beautiful, and in some places abundant, perennial was collected from nine locations and two subsequent seed harvests were made in the garden during a period of ten years. While they flowered and produced small quantities of seed and volunteers for several years, it cannot be said to have adjusted well to our garden. It was used mostly in our rock garden area and seemed to be its best there.

***Lupinus densiflorus* Benth.** [Ed: *Lupinus microcarpus* Sims var. *densiflorus* (Benth.) Jeps. TJM2] – This, and its several varieties, is most often found in open fields or hillsides growing in loose dry soils, and plants grow best in gardens that have similar conditions. Plants are highly subject to rots and the attacks of the vegetable weevil, we had many discouraging experiences, particularly with the latter problem. However, some of the varieties, most notable a strain of the

var. aureus from near Davis [Ed: since named ‘**Ed Gedling**’], produced good displays among the wide variety of annuals raised. They are particularly good mixed in with other similarly vigorous growers. The species was added to our collections in 1949 with several wild collections acquired later. Two strains of the **var. aureus** [Ed: *Lupinus microcarpus* Sims var. *densiflorus* (Benth.) Jeps. TJM2] were presented by the late Theodore Payne never proved to be as deep a yellow as the strain collection along the railroad tracks west of Davis [Ed: ‘**Ed Gedling**’]. This is a bright, deep yellow and makes a most attractive planting. From a collection made in 1933, many generations of the **var. lacteus** [Ed: *Lupinus microcarpus* Sims var. *densiflorus* (Benth.) Jeps. TJM2] have been growing as well as from several later numbers collections from a wide selection of locations. The **var. palustris** [Ed: *Lupinus microcarpus* Sims var. *microcarpus*. TJM2] was only recently added and first notes indicate heavy losses from damping off in field rows.

***Lupinus duranii* Eastw.** – This species from the volcanic sands of Mono County, produces masses of deep blue-lavender to red-purple flowers in its native habitat. It has failed miserably for us. After two years languishing in our nearest type habitat, it was lost during the winter months.

***Lupinus excubitus* M.E. Jones.** – As might be expected, this hardy shrub successfully established itself in our area and was a valuable adjunct to our spring color displays. This and its **var. hallii** (Abrams) **C.P. Smith.** have been a part of our collections for many years. The species being added in 1949 and the **var. hallii** in 1933. A particularly handsome pure white flowered strain was added in 1947, and while there is some variation in color among a large group of seedlings, the majority comes true to color.

***Lupinus formosus* Greene.** – As would be expected, this woody perennial species, native to our area, formed handsome plants adjacent to the garden. However, while several collections from other habitats were added, they failed within a short time. Only **var. bridgesii** **Greene** [Ed: the var. is not recognized in TJM2], produced seed for several harvestings.

***Lupinus hirsutissimus* Benth.** – This robust annual with its very stiff, sharp hairs is of little horticultural interest but was raised on several occasions with a small modicum of success. Since this species grew naturally in the garden, we did little to increase its abundance. Appreciating dry, open soils, it languishes under more opulent conditions.

***Lupinus holmgrenianus* C.P. Smith.** – A collection from the Last Chance Mountains in eastern Inyo County was germinated and the plants were successfully raised in the nursery. However, after setting them out in the garden, they failed within two years and produced no flowers. The plants rotted during our wet winter months.

***Lupinus latifolius* Agardh.** – This common tall perennial of the shady and moist woods and thickets, has been established with one collection out of several and in only one small area of the garden that is partially shaded by a large oak, receives more moisture, and has very porous soil. Several other collections of the species and **var. parishii** **C. P. Smith.** all failed within a short time after setting out, no matter where they were planted. These plants die down to their roots each year, and make handsome plants during their growing season from early spring to summer. However, the amount and color of flowers is not outstanding.

***Lupinus longifolius* (S. Watson) Abrams.** – Mainly a coastal Southern California species, this vigorously growing, tall, erect plant, has been used successfully for many years. Our chief

problem with this handsome species was the easy breakage of the branches, most often splitting down the center and leaving an unhappy aspect. Otherwise, for quick display, and ease of handling, it was a useful plant. A number of selected color strains were introduced, but when grown under uniform conditions in the same location, they mostly resolved into much the same kinds of colors noted in the species.

***Lupinus magnificus* M.E. Jones.** – Only a few plants were raised but no data was recorded.

***Lupinus meionanthus* A. Gray.** [Ed: *Lupinus argenteus* Pursh var. *meionanthus* (A. Gray) Barneby. TJM2] – One seedling was raised, but it was recorded dead within a year.

***Lupinus milo-bakeri* C.P. Smith.** – A few seeds were recently acquired and produced 15 plants which were set out in 1968. Further records are not available.

***Lupinus nanus* Benth.** – We have had much better results in this location with this popular annual than at the old site. Various strains from a wide variety of locations in the state have been raised. Some have been selected as outstanding, such as the ‘Piedras Blancas’ strain from San Luis Obispo County. Almost completely prostrate, this vigorously growing strain has very attractive blue and white flowers and has produced excellent displays for us. Our records indicate a constant battle against weeds, weevils, rabbits, and birds! ***L. nanus* Benth. ssp. *menkeræ* (C.P. Smith) D. Dunn.** [Ed: the ssp. is not recognized in TJM2] has been continued intermittently since 1935, but has never been successful.

***Lupinus odoratus* A. Heller.** – Several collections of seeds have been sown in the desert garden. These germinated abundantly but have never withstood our climatic conditions. On the whole, we experienced very indifferent results.

***Lupinus palmeri* S. Watson.** [Ed: *Lupinus argenteus* Pursh var. *palmeri* (S. Watson) Barneby. TJM2] – An inhabitant of dry desert mountains, several seed lots were raised, but losses through the winter months due to our natural (wetter) conditions prohibited us from raising this plant with any degree of success. While a few plants were flowered, none lived for more than a year or two.

***Lupinus peirsonii* H. Mason.** – We were given seedlings and seed of this lovely, rare perennial. None of the seedlings survived, but after the second try, untreated seed germinated with rather well. Hot water treatment failed to produce any seedlings, while the untreated seed came up very well within three days. All were raised, and used in the rock garden. For the first six to eight months, the planting appeared as if it would make the grade. However, gradually the plants succumbed to root rot and within a year all were gone. Apparently this species needs the sharp drainage of granitic soils and less summer moisture – even though ours only received an occasional watering.

***Lupinus polyphyllus* Lindl.** – Easily raised from seed, our conditions are not conducive to establishing this northern coastal species. Provided the best conditions possible, a few plants grew for more than a year or two, much like *L. arboreus* and *L. latifolius*.

***Lupinus rivularis* Lindl.** – A few plants from one seed collection sown on the mesa became mature-sized plants within a year, produced a few flowers, and proceeded to acquire root rot.

***Lupinus sparsiflorus* Benth.** – This annual was native to the Claremont garden site, however, we acquired a fine collection of seed in 1962 which provided us with the best results we had ever

had with this species. As the seed became older, we had less success – although additional amounts of seed were harvested from our stock.

***Lupinus stiversii* Kellogg.** – This gay annual lupine with its bright yellow banner and wings of rose-pink or purple, created very colorful spots among the annuals. Raised successfully from a collection of a few seeds presented to us in 1948, we have successfully cultivated this annual, gradually adding to our supply of seed more extensively each season. Like the other annuals, it has been prey to the various troubles which beset this group, such as rots, rodents, weevils, etc.

***Lupinus subvexus* C.P. Smith.** [Ed: *Lupinus microcarpus* Sims var. *microcarpus*. TJM2] – This species needs a dry, open, sandy condition to grow best and wherever we could provide it with these conditions it was most successful. But it, too, had the many problems that attack the fistulous (hollow-stemmed) annuals, particularly root rots and vegetable weevils, our two worst enemies. We grew several strains (collections from different areas), but the one most continuously grown was gathered along the Tule River, in Tulare County in 1933. Other collections have been grown from time to time, and at least ten collections have been raised.

***Lupinus succulentus* K. Koch.** – This species appears to particularly favor adobe clay soils and is seldom seen in other situations. While only occasionally are abundant stands observed in the wild, under cultivation this species has been more than reluctant to provide colorful stands, which at its best, are truly fine. We even had less success in growing suitable displays with it here than at the old site, where we had adobe clay soil. Rabbits particularly relished the young plants and only by complete site protection could we get any sort of results. Various studies carried out at the old site are reported in detail in Everett (1957. Pgs: 140-141).

***Lupinus tidestromii* Greene.** – A coastal strand species from the Monterey Peninsula, we attempted to establish this perennial in our sand dunes but without luck. Seed was sown directly into the dunes and produced seedlings over a period of several years, but all plants succumbed before maturity.

***Lupinus variicolor* Steud.** – The recorded data on this coastal species was similar to many of the preceding notes, short-lived, root rots, and rodents. However, it quickly produced mature plants, which were not nearly as attractive here as those seen in the cooling breezes of their coastal environment.

***Lycium andersonii* A. Gray.**

Shrub.

Nightshade Family.

Natural Range: On dry stony hillsides and mesas, below 6,000 feet, occasional in cismontane Southern California, deserts, to Utah and New Mexico, and Mexico. Flowering from March to May.

Propagation: It is difficult to obtain suitable seed from this species. Only once (in 1952), and after three failed attempts over the course of four years, was a viable seed collection harvested. Untreated seed germinated in 11, 13, and 24 days. While some losses were encountered in the nursery, on the whole a high percentage were successfully raised (there were no losses for the first two lots, and 21 were lost from the third lot). Asexual production was not attempted.

Culture: Naturally growing in very rocky situations, we planted our specimens in a flat, open area with perfect drainage. Protection from rabbits was mandatory. Over a period of 15 years there was a gradual loss in numbers, the plants ranging from poor to good condition. During this time frame, the best specimens attained heights of two-and-a-half feet and spread to four-and-a-half feet wide. The first flowering (of only a few plants) was recorded during their sixth year, but the main planting never attained that degree of health.

***Lycium cooperi* A. Gray.**

Peach Thorn.

Shrub.

Solanaceae. Nightshade Family.

Natural Range: Rocky mesas and hillsides, below 5,000 feet elevation, in deserts and parts of central California; to Utah and Arizona. Flowering from March to May.

Propagation: Untreated seed germinates in seven to 16 days. Several lots were cold-stratified but without any appreciable results. There were no problems while raising the seedlings in the nursery.

Culture: Provided a rocky situation, this species did even less well than *L. andersonii* and certainly not as well as specimens at the old site. Moles rooting through the young seedlings caused high mortality, and later nice-sized specimens were weakened by frost and subsequently by severe infestations of blister mites. Over a period of ten years, there was a severe drop off in numbers until only a few specimens remained. These attained heights of three to five-and-a-half feet and spreads of six to six-and-a-half feet wide. Seed and flowering were never recorded, if this occurred, which is doubtful.

***Lycium fremontii* A. Gray.**

Shrub.

Solanaceae. Nightshade Family.

Natural Range: Near Mecca in southeastern California, and to Arizona, Sonora and Baja California (Mexico). Flowering from March to April.

Propagation: Untreated seed will germinate within seven days. We experienced no losses while raising the seedlings in our nursery.

Culture: Only four plants were grown, of which one has grown exceptionally well in the desert garden. In ten years it had grown to six feet tall and spread to eight feet across, but it had not yet produced any seed.

***Lyonothamnus floribundus* A. Gray.**

Island Ironwood.

Tree.

Rosaceae. Rose Family.

Natural Range: The species inhabits the heads of dry canyons on Santa Catalina Island, while the **var. *aspleniifolius* Greene** [Ed: *L. f. ssp. aspleniifolius* (Greene) P.H. Raven. TJM2] grows in similar habitats on San Clemente, Santa Rosa, and Santa Cruz islands. Flowering from June to July.

Propagation: The average germination time for untreated seed from wild or cultivated trees is 14 days. Some lots germinated as quickly as five days, while others took as long as 26 days. One wild collection of the **var. *aspleniifolius*** failed to germinate when first sown in January. A second lot sown two months later and cold-stratified for 45 days produced excellent results with the seedlings appearing in three days after removal from the cold, and with maximum results in 20 days. Untreated seed required one to two months to produce maximum results. It appears that cold-stratification is helpful although not necessary. Seed is very fine and should be sown as near to the surface of the soil as possible. Since both entities were so easy to raise from seed, and there was no particular reason to select a particular individual, we did little work with cuttings. One lot of 19 tip cuttings taken in December and treated with Rootone, required 90 days to start rooting and only four were successful. Roots appeared above the cut and were very long. Only a little callusing was observed.

Raising the seedlings was no problem, however close attention to the watering schedule was necessary until the seedlings were well established. By the end of eight to ten months, we had two to three foot tall young trees ready to plant out.

Hybrids between the two varieties were noted from seeds that were collected in the garden. There was considerable mortality in these batches of hybrid seedlings as many of them were weak.

Culture: There was some question in our minds as to whether this genus could be raised successfully this far inland. However, our fears were unfounded as handsome specimens developed within a few years. The species, *L. floribundus*, is not as strong a growing tree, and as it is much less attractive, there is little reason to raise it. While *L. f. var. aspleniifolius*, with its handsome, fern-like leaves, made splendid, strong growth and over a period of 15 years little or no trouble was experienced in our area. Setting out plants along a boulevard adjacent to the garden, taught us the secret of raising this entity. It needs little water and well-drained soils, though the latter condition is not as essential as the amount of moisture applied after establishing the plant. Our practice, once determined, was to irrigate only once or twice through the long, dry periods and let the winter rains provide the rest. Some chlorosis appeared in a few specimens of the species, even in the best drained areas. We never observed this condition in the variety. Four specimens of the variety, four to six feet tall were balled and moved from the old site in March 1951. In 15 years these had developed into specimens 18 to 30 feet tall and 13 to 22 feet wide. New plantings from seed-grown specimens measured up to 40 feet tall and had spreads up to 20 feet wide. The species was a much narrower tree, ranging in width to 12 feet but approximately the same height. Flowering and seedling started in six to eight years. The flowers heads vary in size from several inches up to 18 inches across, and are flat and composed of hundreds of tiny, whitish flowers which impart a most peculiar odor but are not offensive as it is unnoticed unless smelled at very close range. After flowering, the large heads turn brown and do not drop for about a year, which leaves a very untidy appearance and is the chief fault of this otherwise lovely tree. Since it is an insular plant, there is little argument that it would grow easier closer to a coastal environment. Oak root fungus (*Armillaria mellea*) infected ground will soon takes its toll,

although our trees planted in such an area were not infected until they were over ten-years-old. Aphids proved a nuisance but did not do enough damage to seriously affect the trees.

***Lysichiton americanum* Hult. & H. St. John.**

Yellow Skunk-Cabbage.

Perennial.

Arum Family.

Natural Range: Near the coast in swamps or wet woods, northern coastal California to Alaska, and Montana. Flowering from April to June.

Propagation: Excellent germination was obtained from untreated seed within 17 days, and maximum results were achieved within a month. The seed flat, with an ample covering of sphagnum moss, was kept under our mist system in our greenhouse “cutting” room the entire time, so it was kept constantly moist. Seedlings were collected at the same as the seed. These seedlings were grown in containers and we did not lose any of them in the nursery.

Culture: Planted in and beside a stream, many of them started off well, although there were losses in the group. Since this species was only recently planted in the garden, a sufficient amount of time had not elapsed to judge the success of this plant in our area.

***Machaeranthera* Nees.**

Annuals, Biennials, Perennials.

Asteraceae. Sunflower Family.

Natural Range: Except for one species, our plants are all from the very dry desert regions of Southern California. Flowering from March to May.

Propagation: Seeds were sown untreated in August or September, but two lots were planted in December. Germination occurred in three to five days, and was finished within a month. We seldom raised these plants in nursery beyond the four- to five-inch pot size, as they were difficult to bring through the summer season in gallon-cans. However, we were successful in growing these plants to gallon sized containers on a few occasions. In general, seeds sown in August or September yielded plants that were ready for setting out in March to May.

Culture: Needing well-drained, dryish soils, we used all of our plants in the desert garden, rock garden, or in other similar situations. Growth was rapid, and flowering usually began within a few months after planting and good seed crops were produced. Volunteer seedling crops were noted for several species, however, none of the species that we handled survived for more than two to three years, as they died mainly from root rot fungus problems, even when irrigation was withheld. The following entities were either grown from seed or brought in as seedlings, grown on in nursery and then set out:

***Machaeranthera canescens* (Pursh) A. Gray.** [Ed: *Dieteria canescens* (Pursh) Nutt. TJM2] – We grew one seedling collected in the wild and one seed collection, the latter being used in rock garden and a few on mesa. None lived longer than five years, but these plants produced numerous seedlings which were observed for several additional years.

***Machaeranthera cognata* (H.M. Hall) Cronq. & Keck.** [Ed: *Xylorhiza cognata* (H.M. Hall) T.J. Watson. TJM2] – One seedling presented to us failed within a year.

***Machaeranthera shastensis* A. Gray.** [Ed: *Dieteria canescens* (Pursh) Nutt. var. *shastensis* (A. Gray) D.R. Morgan & R.L. Hartm. TJM2] – Several seed lots were raised over a period of five years, the last lot failed to germinate. Plants were set out in 1953, 1954, and 1955. These plantings flowered and produced many self-sown seedlings but none of the individual plants lived for more than two to three years.

***Machaeranthera tephrodes* (A. Gray) Greene.** [Ed: *Dieteria canescens* (Pursh) Nutt. var. *canescens*. TJM2] – Three wild collections of seeds were grown, as well as one from our cultivated plants. Plants were placed in our most suitable sites. Growing rapidly, these plants grew to be three to four feet tall and flowered within a few months after planting. But, as with all of these species, they were short-lived.

***Machaeranthera tortifolia* (Torr. & A. Gray) Cronq. & Keck.** [Ed: *Xylorhiza tortifolia* (Torr. & A. Gray) Greene. TJM2] Mojave Aster. – This is the most attractive species of the group, but it is likewise quite difficult to maintain. Our history with it was no different from the preceding species. The first two to three years, the plants became nice specimens and flowered well. They produced some seeds, but on the whole they seldom lived beyond two to three years with maximum lifespan of five years.

***Madia* Molina**

Tarweed.

Annuals, Perennials.

Sunflower Family.

Natural Range: Distributed over most of California and adjacent areas, principally in xerophytic habitats, but also in mesophytic sites at varying altitudes. Flowering from May to July.

Propagation: Sown either in flats or directly into the garden, untreated seed will germinate in seven to 25 days, depending on the species and conditions. Seedlings are easily raised in the nursery.

Culture: Depending on the species, either a very dry placement or a moderately moist condition will suffice. At the old site, the annuals were raised with considerable ease, however, in the present area, while they grow and flower well, they have not naturalized. This may be due, in part, to the fact that the various species are generally unattractive, and efforts have not been made to preserve them. The flowers are colorful and gay, but they close when the sun is not out and the plants are sticky and unattractive to the eye.

The following species and subspecies were raised:

***Madia bolanderi* (a. Gray) A. Gray.** [Ed: *Kyhosia bolanderi* (A. Gray) B.G. Baldwin. TJM2]– There are no recorded notes on this perennial, but they are assumed to have died within a year.

***Madia elegans* D. Don.** – Sown in open ground in the garden, volunteer seedlings appeared for several years after which it disappeared.

***Madia elegans* D. Don. ssp. *densifolia* (Greene) Keck.** [Ed: the ssp. is not recognized in TJM2]– Our strain originated near Mokelumne Hill, in Calaveras County and had been grown

continuously at the garden since 1933, It gradually disappeared after a few years at the new site, principally because of extremely weedy conditions prevalent in the area where it was grown and young seedlings were destroyed in the processes of weed control. Other later collections of the same subspecies failed to establish successfully.

***Madia sativa* Molina** – We harvested seeds from Santa Catalina Island where it was a prevalent species. It was successfully grown in seed rows, but was considered unattractive and was discarded.

***Mahonia* Nutt. (See *Berberis* species)**

***Malacothamnus* Greene.**

Shrubs.

Malvaceae. Mallow Family.

Propagation: Untreated seeds germinate in seven to 21 days, and the seedlings are easily raised in the nursery. Excess watering can be troublesome, and must be carefully controlled. All species have a natural tendency to spread by underground rootstocks and therefore plants can be started simply by removing these rootstocks. Four rooted pieces from the wild of ***M. clementinus*** were started in cans, and later provided cutting material, which was taken in June. Treated with CUTstart and Captan, about 75% of the cuttings were successfully were rooted. Rooting was initiated in 16 days. Other species have not been tried. Seed of ***M. aboriginum*** from a wild collection that had been in storage for 14 years germinated well in eight days.

Culture: The 18 species and three varieties native to California (out of a total of about 20 species native to southwestern North America) are generally inhabitants of very rocky hillsides, where the soil is usually loose and moderately heavy so consequently these plants need very little attention in cultivation. Altitudinal range is typically below 3,500 feet except for two species which may be found up to 8,000 feet. On the whole, our results have been good, however, a large majority of the plantings were badly disfigured by a severe proliferation or fasciation of stems. This condition, seldom seen in the wild, attacked all of our plantings in the garden and made them very unsightly in appearance. We were never able to determine the cause of this condition. The following species were raised.:

***Malacothamnus aboriginum* (B.L. Rob.) Greene.** – Started from seed harvested from the original planting at the old site, this species has made a fine display in very rocky, decomposed granite soil. Two plants, moved into gallon-cans from the old site were re-established here and have grown seven feet tall and spread eight to ten feet wide and are now in their 25th year. Flowering usually begins during their second year from seed.

***Malacothamnus clementinus* (Munz & I.M. Johnst.) Kearney.** – We started our plants from cuttings in 1963, and plants were planted out in the garden in 1962 and 1963 on a gentle north-facing slope in tight clay-loam soil. These plants developed rapidly and began flowering during their first year. Although there has been some mortality, the planting was noted to be in good condition having reached two to five-and-a-half feet tall and spreading from three to five-and-a-half feet wide. Seeds were harvested in 1964 to grow additional plants.

***Malacothamnus densiflorus* (S. Watson) Greene.** – Grown from garden harvested seed that produced only a few seedlings, this species, at the end of ten years, had been reduced to one

plant that was characterized as being in poor shape. It measured four feet tall and seven feet wide, and was severely infected with stem proliferation. Flowering and seeding began during their second year of growth. The **var. viscidus (Abrams) Kearney**. has been more extensively grown, but it, too, has suffered from this problem of severe stem proliferation, and as a consequence, most of the plantings were in poor shape.

***Malacothamnus fasciculatus* (Torr. & A. Gray) Greene var. laxiflorus (A. Gray) Kearney.** [Ed: the var. is not recognized in TJM2] – Native to the adobe clay hills of the old site, this variety has been successfully grown without severe losses, although it is attacked by severe stem proliferation. This proliferation has a decidedly weakening effect, and is detrimental to the appearance of the plant. In general, these plants do not look good, except during the flowering season. Ten-year-old specimens reached 11 feet in height and had spread up to 15 feet wide.

***Malacothamnus fasciculatus* (Torr & A. Gray) Greene var. nuttallii (Abrams) Kearney.** – This variety has a highly invasive root system, and needs to be controlled in a garden situation – or at least that is our conclusion based upon our planting on a gentle north facing slope in tight clay-loam soil. Yearly notes from the fourth year onward indicate spreading by root suckers and in tenth year our notes state: “spreading widely.” At that time, plants were noted as six to 12 feet tall and had spread four to 11 feet wide. Flowering and seeding began during their second year of growth, if not the first.

***Malacothamnus fremontii* (A. Gray) Greene.** – A species of the foothills of the ranges encircling both sides of the San Joaquin Valley, it was started at this site from garden harvested seed from the old site, which was originally introduced there in 1931. Set out in a very dry, rocky situation, there was rapid depletion of plants until only two remained. These have developed into good specimens, four to five feet tall and spreading six feet wide. They receive no attention.

***Malacothamnus marruboides* (Durand & Hilg.) Greene.** – Found at elevations of 1,500 to 7,000 feet, our original collection was brought to the old site in 1941, where it grew vigorously. Seed harvested from these individuals produced sufficient plants to give us a good start here. These new plantings have been grown on a very dry, rocky flat and, in their 15th year, measure six to ten feet tall and spread eight to 13 feet wide. Highly invasive, the root suckers have spread out widely over a considerable area.

***Malacothamnus niveus* (Eastw.) Kearney.** [Ed: *Malacothamnus jonesii* (Munz) Kearney. TJM2] – A chaparral plants from San Luis Obispo County, all of our established plants that were growing at the old site since 1943 were dug up and put into containers. These were replanted in the new site in June, 1951, where they were severely eaten by rabbits which caused their early demise. Seed harvested from the plantings at the old site failed to germinate.

***Malacothamnus palmeri* (S. Watson) Greene.** – Rooted suckers of plants growing in the wild were dug and established on a gentle north slope of the mesa in tight clay-loam soil. One loss was recorded during their first year, and the remaining three developed quickly and began spreading over a wide area. Records from their tenth year of growth measured them at heights of eight-and-a-half to 11 feet tall and spreads of seven to nine feet wide, and the cautionary comment: “spreading widely.”

***Malacothrix californica* DC.**

Annual.

Asteraceae. Sunflower Family.

Propagation and Culture: We have dealt with two collections of this species, one from the western edge of the Mojave Desert which failed, and one from San Luis Obispo County (found in the open rolling hills of valley grasslands and growing in a sandy loam soil) that has struggled, but has not altogether failed. Beset by weevil and rabbit troubles, enough plants have been raised to continue its existence for the past five years, and each generation proves more successful. Sown in the sand dune area, with rabbit protection and weevil spraying, these plants have provided quite a good show in April. Seeds are harvested a month or two later.

***Malacothrix coulteri* Gray.**

Annual.

Propagation and Culture: Scattered through cismontane and desert Southern California and wandering further afield, this dry soil plant was only attempted once and resulted in failure. Seeds were sown in our driest, sandiest area, and germination failed on several occasions. Twice, a few plants grew but only once did a few plants flower in April – but no viable seed was produced.

***Malacothrix glabrata* (D.C. Eaton) A. Gray.**

Desert-dandelion.

Annual.

Propagation and Culture: In good wildflower seasons, this typical annual of the deserts and inner valleys of Southern California, will be seen in great abundance, growing in the very sandy areas. While never outstanding in our area, we produced some nice displays each season. Seed was sown directly in the garden, and seedlings appeared within a period of 45 days. Flowering occurred in April and seeds were harvested within the next month. Several generations and collections from various sites were raised. Many volunteers were noted through the years.

***Malacothrix saxatilis* (Nutt.) Torr. & A. Gray var. *arachnoidea* (E.A. McGregor) E.W. Williams.**

Propagation and Culture: This perennial, endemic to the rocky clay banks of Carmel Valley in Monterey County, was started easily in a seed flat in the nursery, germinating in eight days. Due to damp-off, most of the seedlings were lost and only a few were planted in the garden. Another seed lot was sown directly into the garden and germinated in 35 days, but soon died. None of the plantings, set out in well-drained positions, lasted more than a year.

***Malus fusca* (Raf.) C.K. Schneid.**

Oregon Crab Apple.

Shrub.

Rosaceae. Rose Family.

Natural Range: From very damp to wet environments along the northern California Coast to Alaska.

Propagation: Initial germination of untreated seeds required 50 to 90 days, while five months of cold-stratification produced 100% germination, therefore the latter is recommended. While we had no problem raising the seedlings, infestations of mealy bug must be watched for. While not practiced, grafting and cuttings or root cuttings could be used for selected material.

Culture: It follows that this species should be grown in a cool moist area here in Southern California. So it is no surprise to report that our best specimens grew under such conditions. When they were grown in an open, flat, very rocky site, and given a moderate amount of water, they became highly infested with mealy bug and required considerable attention. Even under the best conditions, this area is too hot and dry for this species. Specimens one-half to one foot tall when planted grew to be two to nine-and-a-half feet tall and spread two to nine feet wide in ten years. They were severely attacked by rabbits and mealy bug each season. They produced brilliant foliage colors in late fall or early winter when temperatures were cool enough and moist air conditions prevailed.

***Malvastrum parryi* Greene.** [Ed: *Eremalche parryi* (Greene) Greene. TJM2]

Annual.

Malvaceae. Mallow Family.

Natural Range: Plants in the wild are seen on dry flats and hills largely in the San Joaquin Valley.

Propagation: Sown directly into a sandy loam site in the garden, good germination may be expected in nine to 14 days.

Culture: We have successfully raised many generations of this annual since 1935, when we first introduced this species into the old site and later brought it with us to Claremont. In this location, it maintained itself satisfactorily each season from volunteers. Seeds were initially sown in the driest open spots in the garden.

***Malvastrum rotundifolium* A. Gray.** [Ed: *Eremalche rotundifolia* (A. Gray) Greene. TJM2]

Desert Fivespot.

Annual.

Propagation and Culture: Several experimental methods were used to produce this lovely small annual. Sown directly into specially prepared sites of sandy loam and crushed rock, germination took about two months. If sown in the fall, the winter moisture killed the plants, so we tried sowing the seeds in March. This method proved much more successful and plants were flowered and produced seed. Seed that was cold-stratified for two months came up in six days, and the seedlings were potted up and were planted out late spring. (The seeds were sown directly into two-inch pots, and were treated with Morton Soil Drench). A nice lot of plants were produced in the nursery and were later planted out in the garden where they flowered, but many were lost from damp-off. Another seed lot was sown in two-inch pots, and these germinated in four days without any cold-stratification. This species appears to not need cold treatment. Under our conditions, this species can only be raised under the most carefully prepared and treated soil with ideal conditions, and this is not a surprise as it a denizen of the very dry desert washes.

***Mammillaria* Haw.**

Pincushion Cactus. Fishhook Cactus.

Perennial.

Cactaceae. Cactus Family.

Propagation: Since most of our material was collected as plants, we have had little experience growing from seed. For the several lots of seeds that were sown, no treatment was required and seedlings appeared in nine to 13 days or failed completely. While cold-stratification was tried, there seemed to be no advantage to this method. The damp-off fungal problem should be carefully guarded against, but otherwise we had quite satisfactory results in growing these plants from seed, even though it is a very slow process. Plants moved from the wild were carefully cleaned, and all broken roots were removed. The plants were then set in a flat in the greenhouse to dry and thoroughly heal. Subsequently, they were planted in a sandy mixture in clay pots. Using this method, we had no trouble re-establishing the plants.

Culture: All of the known Californian species and varieties were grown – as well as many unidentified collections. Plants that were placed in our most suitable sites in the desert garden, often in specially prepared beds consisting of sandy loam and crushed rock several inches deep, generally yielded fair results. The two chief obstacles were ants and internal rot, the latter often caused by the ants. While the ant problem was controlled by applying powdered Chlordane, the internal rot was often too far along before control measures could be used. Gardeners must realize that these plants come from very dry, rocky, or stony slopes in the deserts, except for the single species native to the immediate coastal bluffs of San Diego County and northwestern Baja California (Mexico). Flowering occurs mostly from April to June, and is followed by colorful reddish fruits filled with black seeds. The genus is one of the most interesting classes of cacti. Observation on the species grown follows:

***Mammillaria alversonii* (J. Coult.) H. Zeissold.** [Ed: *Coryphantha alversonii* (J.M. Coult.) Orcutt. TJM2] Foxtail Cactus. – One plant failed upon being moved from old site, but in a later collection of three plants, one has grown very well for 15 years and is seven inches tall and four inches wide. It first bloomed during its sixth year after planting.

***Mammillaria arizonica* Engelm.** [Ed: *Coryphantha chlorantha* (Engelm.) Britton & Rose. TJM2] – Out of eighteen plants introduced to the garden in 1952, two good looking plants remained 15 years later and measure three inches tall and five to six inches across. Seed was harvested in 1957 and additional seedlings were grown. Several offsets were produced on each plant. The main cause of our losses was from ants.

***Mammillaria desertii* Engelm.** [Ed: *Coryphantha chlorantha* (Engelm.) Britton & Rose. TJM2]– A collection introduced to the old site was moved in 1951 and for many years all had survived, but in their twentieth year, only one was recorded alive and in good condition. This individual measured four inches tall and three inches wide. The production of offshoots was noted and flowering and seeds were produced from time to time. Seedlings were raised from several garden collections of seeds, and these plants were used to increase the collections. Ten additional accessions, four of which were raised from seeds produced by mature plants in our collections, were added over time.

***Mammillaria dioica* K. Brandegee.** – One specimen of this coastal bluff species was moved in 1951 from the old garden site to Claremont. At that time, the specimen measured five inches tall. It prospered here for 15 years, after which it was noted to have been stricken with internal rot. By

that time, it measured seven inches tall and ten inches across. Another collection acquired in 1963 from the wild was doing nicely in a sand dune location. The **var. *incerta* (Parish) Munz.** [Ed: the var. is not recognized in TJM2], from the rocky canyons and walls of western Colorado Desert mountains was established in the garden from four different collections of plants from the wild. The oldest was measured at nine inches tall and 11 inches wide when it was 15-years-old. Flowering was noted during their third year after acquisition.

***Mammillaria tetrancistra* Engelm.** – A few plants from six wild collections were established in the garden. From these cultivated plants, three lots of seeds were collected and sown. However, we experienced little success in growing them. The introduced plants showed some losses but were generally growing as well as the group as a whole.

***Meconella linearis* (Benth.) A. Nelson & J.F. Macbr.** [Ed: *Hesperomecon linearis* (Benth.) Greene. TJM2]

Annual.

Papaveraceae. Poppy Family.

Propagation and Culture: A collection of this diminutive, slender stemmed annual, from Atascadero in San Luis Obispo County was originally started at the old site in 1949. It was continued here with great success. Sown in several locations, it grew best in the rock garden or sand dune areas, where volunteer seedlings were noted from year to year. Our principal trouble was from birds and slugs, otherwise, excellent stands were raised each season.

***Menodora spinescens* A. Gray.**

Shrub.

Oleaceae. Olive Family.

Propagation: Untreated, fresh seed will germinate in five days, with maximum results in 30 days. All of our seedlings were raised without any losses from the one collection we acquired in 1952.

Culture: This dry mesa and slope inhabitant requires little attention, but in reality has grown poorly for us. The 25 plants set out in October 1953 measured four to six inches tall. Only two poor specimens were alive ten years later, and these plants were only five to eight inches tall and had spread four to eight inches wide. The whole lot was dead by their 15th year.

***Mentzelia* L.**

Blazing-Star.

Annual, Biennial, Perennial.

Loasa Family.

Propagation: Our records are highly variable with regard to the amount of time required for germination, and this depends somewhat on the species and the conditions. Overall, seedlings may appear in ten to 60 days. Usually some seedlings have germinated in two to three weeks. Of all the species we handled ***M. lindleyi*** is most uniform and quickest to germinate. All of our collections of several species were sown directly into sites in the garden, depending from whence they came. Ants, damp-off fungi, root rots, and birds need to be guarded against.

Culture: Generally our collections were acquired from desert or very dry areas, and most of the species relish loose, open ground on the dry side. The following kinds were acquired and raised with some degree of success, and many of them have been established over many years.

***Mentzelia albicaulis* (Hook.) Torr. & A. Gray.** – Annual, essentially from the desert, only grown from one collection in 1953. Seedlings noted for several years but these never grew with any vigor.

***Mentzelia gracilenta* Torr. & A. Gray.** – This annual from low altitudes in the South Coast Ranges grows in dry open rocky places. We acquired seeds in 1965, but the species has not become established.

***Mentzelia involucreta* S. Watson.** – Annual, deserts below 4,500 feet. We grew four collections and have satisfactorily established this species at the garden. One lot of seed was cold-stratified and this resulted in much better germination. However, all of the seedlings died when they were transplanting into the garden.

***Mentzelia laevicaulis* (Hook.) Torr. & A. Gray.** Evening-Star. – Biennial. Opening in the late afternoon, the fresh plants are handsome and the beautiful creamy, yellow flowers are indeed choice. However, as the plants age, they become ragged in appearance, and even though the flowering period is very long, they are best placed in the background. We still continue with an original strain acquired in 1931 from Lytle Creek in the San Gabriel Mountains. Seedlings appear at odd times of the year, and flowering may occur during any season, although mostly between June and October.

***Mentzelia lindleyi* Torr. & A. Gray.** Blazing-Star. – Annual. We have continued with the same seed strain that we originally received from the late Theodore Payne in 1932. It is difficult to record how many generations of this fine annual we have raised, but we have almost continuously grown this showy annual since 1932. For several seasons here, it appeared to be not quite as vigorous as those previously grown in the heavy clay adobe soils at the garden's former location. However, as the seasons progressed, we often had fine stands and very colorful displays from this splendid strain, which originally came from England.

***Mentzelia multiflora* (Nutt.) A. Gray.** [Ed: *Mentzelia longiloba* J. Darl. TJM2] – Perennial, short-lived under cultivation or more often an annual. First acquired in 1947, several generations have been more or less successfully been raised from time to time. Damp-off fungal problems have hindered good displays of this species.

***Mentzelia nitens* Greene.** – Annual. Sown in 1956, in the desert sand dunes, only a few plants appeared and flowered in April. It doubtfully set seed, and was not further observed.

***Mentzelia pectinata* Kellogg.** – Annual. First grown in 1950, several generations have been raised subsequently, but never in any quantity. Disease problems, rabbits, and rodents proved a hindrance to the successful cultivation of this species.

***Mentzelia tricuspis* A. Gray.** – Annual. From desert regions. We failed with our first direct sowing of seeds in the garden. Seed that was cold-stratified yielded several seedlings that were later planted out. These plants flowered in 1962, but were not recorded after that date.

***Mesembryanthemum chilense* Mol.** [Ed: *Carpobrotus chilense* (Mol.) N.E. Br.]

Sea-Fig.

Perennial.

Aizoaceae. Iceplant Family.

Propagation: Excellent and quick results were obtained from untreated seeds. Germination started in nine days and we had maximum results after periods of 20 to 30 days. Cuttings root readily whether they are in containers or set directly in place in the garden.

Culture: While naturally found along the seashore, this species is hardy inland where temperatures do not drop much below 25° F. Ours plants were grown in sand dunes, but may be planted on banks, etc. and are not particular about soils. This plant is not the best choice for covering slopes if these have a steep angle as when they become heavy with moisture they often pull down unstable soils. Several presumed hybrids, probably with *M. edule*, were also satisfactorily grown.

[Ed: Most botanists now consider this plant a native of South Africa, and not native to California. This plant is a major weed that usurps our native coastal ecosystems.]

***Microseris lindleyi* (DC.) A. Gray.** [Ed: *Uropappus lindleyi* (DC.) Nutt. TJM2]

Annual.

Asteraceae. Sunflower Family.

Propagation and Culture: Seed of this widely distributed annual was acquired in 1952 from collections made in the Mojave Desert. It was first sown in our desert sand dunes, in 1955. There, excellent germination occurred in 20 days. Flowering occurred for this and later plantings in late April, and seed was harvested in late May. Until 1961, ample seedlings were noted each season, but they all disappeared after that date.

Mimulus L.

Monkey-Flower.

Annuals, Perennials, Shrubs.

Scrophulariaceae. Figwort Family. [Ed: Phrymaceae. Lopseed Family. TJM2]

This report includes those shrubs often separated into a separate genus, *Diplacus*, and most of the data pertains to this group. The genus *Mimulus* is a large one in California, encompassing some 77 species plus many subspecies that are found in widely distinct natural habitats. It is a most colorful genus as well as being an interesting one. Particularly among the shrubs, there is ready hybridization, and bringing naturally widely separated species together in a garden often results in some excellent seedlings with horticultural possibilities.

Propagation: One of the easiest groups to raise from either seed or cuttings, this genus is one of the simplest to grow. Seed germinates rapidly, in a matter of one to three weeks, with an average of two weeks. Seed must be sown very shallowly on an open soil mix, preferably with sphagnum to retard any damp-off fungus, which can otherwise cause problems. Once pricked out the seed flat, the tiny seedlings grow rapidly, usually with little or no losses. Seed may also be sown directly into a garden site, but germination will be slower. Again, it depends on the species involved and the site. Around established plantings, one usually observes quantities of volunteer seedlings, and this fact simplifies the maintenance of the groups. We have taken cuttings at all seasons of the year, even when the plants are in flower, and there seems to be no particular

difficulty. Perhaps there is a better percentage of rooting in April, but we have had excellent results whenever the cutting material is right. Usually firm tip cuttings from new growth are best and may be treated with a rooting compound or not. Bottom heat (or none) does not seem to matter a great deal and when a choice hybrid is discovered, this ease of rooting is a real asset. The annuals may be sown directly in place in their required habitat – which is mostly determined by soil moisture conditions.

Culture: A large number of the most useful annuals and perennials in this genus will prefer moist garden conditions, but this is not critical as will be discussed in some of the species entries below. The shrubby types should have good drainage, and are best grown on either a slope or in soil with good drainage. Ours were usually short-lived when grown in the flat, heavy soils on the mesa but always produced quantities of seedlings, except in the case of a few species. Generally the shrubs require a minimum of water, one or two irrigations in the summer, and none in the winter. They can be pruned to maintain a better appearance and more continuous bloom, which all this group may do under cultivation. Occasional spraying may be required to control aphids and other insects. Plants raised either from seed or cuttings will start flowering within a few months. The following notes may be of some interest:

Hybrids – Innumerable hybrids have been produced by artificial and natural means. Several were carried in our experimental garden plots for a number of years, but in each case (except for one selection), they gradually dwindled away. One particular presumed natural cross was observed clambering over an adjacent shrub. It flowered almost continually throughout the year and additional plants were raised. It has proved excellent in cultivation, producing masses of reddish-orange flowers and withstanding ordinary garden cultivation, where it receives almost weekly irrigations on a sandy loam slope.

***Mimulus aridus* (Abrams) Grant.** [Ed: *Mimulus aurantiacus* Curtis var. *aridus* (Abrams) D.M. Thomps. TJM2]– A local species found in hot, dry, rocky places of southeastern San Diego County and adjacent Baja California (Mexico). This handsome, compact little subshrub has not performed very well for us, despite providing carefully selected sites. Raised from seeds that had been in storage for 13 years, we restarted our plantings here in 1961 as well as from harvested seed at the old site and sown in 1952. Our plantings did not live more than the usual three to five years, but grew vigorously and produced an abundance of flowers and seeds within the first year.

***Mimulus aurantiacus* Curtis.** – Most abundant in the Coast Ranges from Santa Barbara County to Del Norte County and also observed in the central Sierra Nevada foothills, six collections of this species have been raised and planted in quantities throughout the garden. Annually recorded data indicates that while there is a gradual diminution of numbers through the years, it is rather long-lived and will persist for many years. Plants over ten-years-old are typically two to three feet tall and spread to over five feet wide. Plants produce flowers and seeds starting in their first year.

***Mimulus bicolor* Benth.** – Seeds harvested at 4,800 feet from a moist, gritty bank in Calaveras County, were the basis of our only collection. Plants fared poorly and had disappeared in two years.

***Mimulus bifidus* Pennell.** [Ed: *Mimulus aurantiacus* Curtis var. *grandiflorus* (Lindl. & Paxton) D.M. Thomps. TJM2] – While generally short-lived for us, particularly when they were planted on the mesa in clay-loam soil, the several wild collections of this subshrub, usually found in dry, granitic roadside cuts and loose adjacent areas, has grown and flowered abundantly for us. It is

one of the most handsome and floriferous of the group and should be grown to a greater degree. The **ssp. fasciculatus Pennell**. [Ed: the ssp. is not recognized in TJM2] is found in rocky outcrops and loose roadside habitats in the Santa Lucia Mountains of Monterey County. It was acquired in 1953 and several lots were raised, but they only lived a few years. Many appeared to be hybrids, and for several years added a colorful spot to the spring flowering season.

Mimulus bigelovii (A. Gray) A. Gray. – This is a common desert annual from sandy washes and canyons below 6,500 feet. We had indifferent results with this species in our desert garden from two seed collections gathered in 1958. While a few seedlings appeared and flowered, no additional seed was harvested and the species, as well as the **var. cuspidatus A.L. Grant**, was written off in two years.

Mimulus brevipes Benth. – This handsome annual species is native to cismontane Southern California, and was native to our Claremont garden site in areas with dry, loose soils. It is easily raised by sowing seed directly into sites with very open soil that can be kept on the dry side. It is a handsome species with its gay profusion of bright yellow flowers.

Mimulus cardinalis Benth. – This moisture loving perennial has been in continuous cultivation since its addition in 1952, when we placed our first plants in a moist stream bed. Plants have scattered into many situations in the garden, including some areas that are not at all moist. It is an easily maintained source of almost year-around color. In its most favored locations, it will develop into plants that are several feet tall that are in almost continuous bloom. But, as the plants age they become straggly and need to be cut back. Plants spread by root shoots.

Mimulus clevelandii Brandegee. – This rather transitory [Ed: short-lived] species is found between 3,000 to 6,000 feet elevation from the Santa Ana Mountains south to southern San Diego County. Plants for our garden were produced from four wild collections: one of rooted suckers, one of cuttings, and two from seeds that were harvested from the wild. Numerous seed lots were sown, but in no case did we get many seedlings, the highest number of successfully germinated seeds was obtained from seeds that were three-years-old. This species appears to be transitional between the shrubby types and the perennials. It spreads out by underground rootstocks although the stems will get quite woody with age. We needed to propagate additional specimens regularly as our plants needed to be replaced every two or three years. In other words, individual plants were short lived here, but it makes a very lovely flowering plant with its hundreds of bright yellow flowers. In the garden and in the wild, these plants make quite a sight, particularly on freshly burned areas or in cleared firebreaks.

Mimulus flemingii Munz. [Ed: *Mimulus aurantiacus* Curtis var. *parviflorus* (Greene) D.M. Thomp. TJM2]– The seed of this insular species was gathered on Santa Cruz Island in 1958. In order to get sufficient true-to-type plants, it was necessary to grow several lots since the first lot was mostly hybrids. Later, cutting grown material was added to our collection, and the species has been maintained since that date. While not a strong grower for us, it has behaved normally and is a useful plant for our collection – especially due to its brighter brick-red flowers.

Mimulus guttatus DC. ssp. litoralis Pennell. [Ed: the ssp. is not recognized in TJM2] – While only one small collection of this species was grown, this subspecies also from the wet places along the coast has literally spread itself over a wide area in the garden, be it wet or dry. Since the soil is a clay-loam, plants seem to prosper in either wet or dry areas, provided some additional irrigation is provided. It has almost become a weed in some areas, and requires some control. However, its bright yellow flowers are a most welcome addition to the spring scene.

***Mimulus laciniatus* A. Gray.** – While grow easily in the greenhouse, plants introduced to damp areas of the garden fared well until overgrown by more vigorous plants. It was then dropped from our collection.

***Mimulus lewisii* Pursh.** – This widespread perennial from wet areas at elevations of 4,000 to 10,000 feet was introduced briefly to our garden collection from 1950 to 1958. While splendid stands grew and flowered in our artificial stream bed, they faded away in a few years, even though efforts were made to re-establish them.

***Mimulus longiflorus* (Nutt) Grant.** [Ed: *Mimulus aurantiacus* Curtis var. *pubescens* (Torr.) D.M. Thomps. TJM2] – This plant is mostly commonly seen species in Southern California. The species, along with **var. *rutilus* A.L. Grant.** [Ed: the var. is not recognized in TJM2] and **ssp. *calycinus* (Eastw.) Munz.** [Ed: the ssp. is not recognized in TJM2], have been grown extensively and successfully in our garden. Not only have the original plants lived much longer than its other *Diplacus* relatives (some individual have lived up to 15 years), they each have produced quantities of volunteer seedlings within the garden. Each year these plants provide an almost continuous succession of bloom. Several fine hybrids have been added to our collection, and many of these are presumed crosses between the species and the **var. *rutilus*.**

***Mimulus moschatus* Lindl.** Musk Flower. – This species was among several perennial taxa that were introduced to our garden plantings in 1953, as a result of the garden's experimental taxonomic work. While it was grown successfully in the greenhouse, we could not maintain it for very long in the garden.

***Mimulus nasutus* Greene.** [Ed: *Mimulus guttatus* DC. TJM2] – This species is widely distributed in the west, and it grows in gravelly spots throughout California. This annual was raised with as much ease as *M. guttatus*, and from several collections it has spread abundantly along our stream, providing very bright yellow vistas through long periods of spring and into early summer.

***Mimulus puniceus* (Nutt.) Steudel.** [Ed: *Mimulus aurantiacus* Curtis var. *puniceus* (Nutt.) D.M. Thomp. TJM2] – Native to the southern coastal portions of Southern California and Santa Catalina Island. We have grown this interesting red-flowered plant for many years, although it has not prospered as well inland as it did at the old site. Numerous hybrids with *M. longiflorus* have been noted from time to time but none of these were considered to be of outstanding merit.

***Mimulus tilingii* Regel.** – Another annual from higher elevation wet areas in the mountains of central and Southern California. One collection produced abundant seedlings but all disappeared after the young plants were planted out in a moist location in our stream.

***Mirabilis bigelovii* A. Gray.** [Ed: *Mirabilis laevis* (Benth.) Curran var. *villosa* (Kellogg) Spellenb. TJM2]

Perennial.

Four-O'clock Family.

Propagation: Untreated seed germinated in three to six days, but not at a high percentage. In each of the two seed lots raised, we lost two seedlings while they were growing in the lath house. Not all of the seedlings were raised up to gallon-cans – some plants were set out in the garden from four-inch pots.

Culture: A typical plant from our rocky canyons in the deserts below 7,000 feet elevation. This species, and the **var. *aspera* (Greene) Munz.** [Ed: the var. is not recognized in TJM2], were provided with much the same sort of conditions as they experience in the wild, except for the extreme temperature range. Our collections suffered most during periods of frost, and were killed in a matter of four to eight years. Flowering and seeding occurred in their second year. The oldest plants had attained heights up to one foot tall and had spread up to five feet wide.

***Mirabilis froebellii* (Behr.) Greene.** [Ed: *Mirabilis multiflora* (Torr.) A. Gray. TJM2]

Perennial.

Four-O'Clock Family.

Natural Range: This species is essentially from dry desert habitats, in rocky places below 6,500 feet.

Propagation: Untreated seeds germinate in four to eight days, and when sown directly into a site in the garden, they germinate in about 20 days. We experienced low percentage germination rates, but this was not a problem as we only required a few plants for the garden. There was no problem with raising the seedlings in the nursery, most lots coming through at 100%. Roots may be successfully dug and transplanted when they are dormant in the winter.

Culture: These plants will respond well when grown in heavy, light, or rocky soils, and once established the plants will spread to form large clumps. Some of our ten-year-old clumps measure over ten feet across. This species goes completely dormant in the winter. First flowering and seeding occur within their second year. This is a long-lived species that positively responds to some irrigation and other good horticultural practices.

***Mitella trifida* Graham.** [Ed: *Ozomelis trifida* (Graham) Rydb. TJM2]

Bishop's-Caps.

Perennial.

Saxifragaceae. Saxifrage Family.

Propagation: One collection of three-year-old untreated seed required 40 days for initial germination and about two-and-a-half months for maximum results. We had no problems with raising the seedlings through to gallon-can size, and these were ready for planting in the garden within one year. Undoubtedly the plant can be easily divided as it produces long rootstocks.

Culture: An inhabitant of partly shaded slopes of the woods in the northern portions of the state and into British Columbia and Alberta (Canada), we provided a humus covered planting area in the shade. Unfortunately there are no further recorded notes, but it is known that the plants flowered. This planting was much disturbed by moles, and all the plants had died within a year or two.

***Mohavea* A. Gray.**

Annuals.

Scrophulariaceae. Figwort Family.

Propagation and Culture: These species may need some pretreatment before sowing the seed. Our results were extremely poor, and we produced only a few seedlings from several collections of both species, *M. breviflora* Cov. and *M. confertiflora* (A. DC.) A. Heller. Seeds were sown in flats, as well as directly into our sand dunes, and sandy rocky areas of perfect drainage. Most failed to germinate. On one occasion two seedlings were found a year after sowing, while others germinated in 30 to 60 days. None of these plants survived for more than a few weeks. While these species are commonly seen in the desert growing in dry, gravelly, or sandy washes, they did not respond to our care.

***Monardella cinerea* Abrams.** [Ed: *Monardella australis* Abrams ssp. *cinerea* (Abrams) A.C. Sanders & Elvin. TJM2]

Perennial.

Lamiaceae. Mint Family.

Natural Range: This species is from the rocky slopes of the eastern San Gabriel Mountains at 6,000 to 10,000 feet elevation.

Propagation: Three lots of untreated seed were sown a year apart, and all germinated equally well in eight to 15 days. In 1963, one seed lot that was grown from cultivated plants germinated in five days and yielded many plants for the garden. We experienced no problems while raising the seedlings through to four-inch pots, at which size they were ready to be planted in the garden.

Culture: We planted this dwarf perennial in our rock garden, where it grew quite satisfactorily. Flowering and seeding were recorded during their second year of growth.

***Monardella crista* Elmer.** [Ed: *Monardella undulata* Benth. ssp. *crispata* (Elmer) Elvin & A.C. Sanders. TJM2]

Perennial.

Propagation: Untreated seed that was harvested from plants in cultivation at the old site germinated in eight days. When seed was sown directly into a garden site, seedlings were observed after 39 days. There was no trouble with raising the seedlings in the nursery.

Culture: This strictly sand dune plant from the coastline of Santa Barbara and San Luis Obispo counties was planted in our sand dunes. The seedlings raised in pots did not grow well, and were gone within a year. But, the seed lot that was sown directly into the dune site produced a few plants that grew up to 18 inches tall and spread up to three feet wide. These plants flowered during their first year, but did not produce any seed. Our records indicate that one plant lived for four years.

***Monardella exilis* (A. Gray) Greene.**

Annual.

Propagation and Culture: Five-year-old garden harvested seed from an original collection gathered in 1937 was sown in January in the rock garden. Germination took 26 days and the overall rate was poor. Flowering started in April, but seeds were not harvested. Self-sown seedlings were observed the following year, but never after that. The species has not been recollected.

***Monardella hypoleuca* A. Gray.**

Perennial.

Natural Range: Found growing on slopes in loose soils in the mountains from Santa Barbara to Orange counties below 4,500 feet. Flowering from July through September.

Propagation: Untreated seed from the wild was sown in September and germinated in five days. All of the seedlings were successfully raised up to three-inch pots and these were planted out in the garden during the following March. Since these plants have creeping rootstocks, it is assumed to be easily raised through digging and dividing such material. Two seed lots harvested from cultivated specimens of **ssp. lanata (Abrams) Munz.** germinated in seven to 11 days and generated many plants.

Culture: This species was introduced to our collection in 1964. There has not been time to fully assess the results, but it was growing nicely the year after it was out in March 1965. Flowering was observed the first year. The **ssp. lanata** has been grown at both garden sites, the original collection from near Descanso in San Diego County has been grown since 1934. A large clump at the old site was dug in February 1951 and split into 24 clumps that were re-established in gallon-cans. These plants were set out in Claremont in August 1951 in a slightly shaded very dry slope with oak leaf humus. There they were maintained until sometime after 1960. In 1965 they were reported dead. They may have received too much summer irrigation in this site.

***Monardella lanceolata* A. Gray.** [Ed: *Monardella breweri* ssp. *lanceolata* (A. Gray) A.C. Sanders & Elvin. TJM2]

Mustang Mint.

Annual.

Lamiaceae. Mint Family.

Propagation: Sown directly into a garden site, either in sandy loam or heavy clay soils, excellent germination may be expected in two to three weeks, if the soil is kept at a constantly moist.

Culture: Both sandy loams and clay soils appear to be acceptable to this easily grown and striking annual. Flowering occurs in late May or early June and will continue until the seeds are harvested in late June or July. Our plants produced an abundance of seed on every occasion we grew them. We have continued growing only one seed strain, originally collected near Bradshaw Camp in Madera County in 1933. There has never been any indication of hybridity.

***Monardella linoides* A. Gray.**

Perennial.

Natural Range: This plant is found growing on dry slopes of desert and bordering mountain ranges at elevations from 3,000 to 9,500 feet.

Propagation: Untreated seed germinates in seven to 20 days. Most often seeds that are two- to three-years-old germinate quicker than ten-year-old seeds, but germination is usually fair to good in any case. Seedlings are easily raised in the nursery, our losses totaling not more than one plant per lot. Plants are readily moved and increased by transplanting and careful division of the plants.

Culture: In our garden, this plant prefers dry situations and requires little attention. Four plants of a group originally planted at the old site in July 1935 were transplanted into containers in February 1951. These were then re-planted in Claremont in August 1951 in a rocky, decomposed granite loam soil in full sun. In their 35th year, three were alive and were in good condition. These plants had grown from two to two-and-a-half feet tall and had spread from four to eight feet wide. The **ssp. oblonga (Greene) Abrams.** from the dry mountain slopes in Kern and Ventura counties at elevations of 3,000 to 7,000 feet was not successfully established in the garden from the one collection that we acquired in 1956. There was quick deterioration of the seed and only the fresh first seed lot germinated well, but most of the seedlings succumbed in the nursery. The survivors were recorded lost within two years. Two plants of the **ssp. viminea (Greene) Abrams.** [Ed: *Monardella viminea* Greene. TJM2], were originally acquired in 1937, and were grown successfully at the old site. These plants were transplanted into containers in February 1951, and were replanted in Claremont in August 1951. They responded well for a few years, but were recorded as lost in their 20th year. However, seedlings from this collection were established in a rocky, granitic loam site and, at ten-years-old, measure from one to two-and-a-half feet tall and have spread from 14 inches to seven feet wide. First flowering and seeding were noted during their second year of growth.

***Monardella macrantha* A. Gray.**

Perennial.

Propagation: Untreated seed of several lots that were from one- to four-years-old, germinated in nine to 15 days. Minor losses of seedlings occurred during transplanting procedures. Untreated tip cuttings, taken in July from plants growing in containers in the lath house, started rooting in 17 days and 60% were successful. Plants may be readily divided, and the rooted stems may be successfully started in small pots, a procedure we followed on several occasions.

Culture: This handsome small, somewhat creeping plant bears an abundance of bright scarlet flowers that are bunched together in showy heads. Following our observations of its growing conditions in its natural habitat, we determined that it needs filtered sunlight and a loose, open soil that is rich with humus. In cultivation, plantings seem to need rejuvenation after five to ten years. We have done this by digging up the plants, dividing them, and restarting them in small pots. Excellent stands have been grown from the original single plant brought from the old site in 1951. In its 25th year, it was recorded dead, but its seedlings had been started from which we established handsome stands on a gentle slope with light, open humus filled soil. Succumbing easily to overwatering, this practice must be watched carefully, although some watering is appreciated.

***Monardella nana* A. Gray ssp. arida (H.M. Hall) Abrams.** [Ed: the ssp. is not recognized by TJM2]

Perennial.

Natural Range: This species is found in pinyon-juniper woodlands, at elevations of 4,000 to 5,000 feet.

Propagation: One seed lot of harvested from cultivated plants germinated in 16 days. A few of these plants died in the gallon-can stage in the nursery, but our losses were not excessive. Plants are readily divided and transplanted.

Culture: This species needs well-drained soils. Our plant was originally started at the old site in 1941, and the one surviving specimen was transplanted in February 1951 into a container. In August 1951 it was replanted into a selected site with well-drained granitic loam and filtered shade. It grew well for several years, but was eventually recorded dead in its 20th year. Seedlings had been grown from seed harvested from this plant, and these were planted out in 1953. No record of their growth was recorded. One plant of **ssp. leptosiphon (Torr.) Abrams.** [Ed: the ssp. is not recognized in TJM2] was set out in 1951. It grew to five inches tall and spread to five feet across in seven years. Meanwhile, two lots of seeds were harvested and additional seedlings were produced, and these are growing in several different garden locations. Seed of **ssp. tenuiflora (S. Watson) Abrams.** [Ed: the ssp. is not recognized in TJM2] was collected in August 1952. Suitable quantities of seedlings were grown and were planted out in January and October 1953. Flowering and seeding were recorded during their second year of growth, and the planting remains in good health.

***Monardella odoratissima* Benth. ssp. pallida (A. Heller) Epling.**

Perennial.

Natural Range: From high elevations in the Sierra Nevada and adjacent northward ranges. Our collection was gathered at 9,500 feet.

Propagation: Untreated seed sown in September and October germinated in 14 and 12 days. The latter were grown from five-year-old seeds, and surprisingly this yielded the best germination rate. Four months cold-stratification resulted in germination in just four days after removal from the cold, but the number of seedlings was only slightly better than the first seed lot that had produced four seedlings in 14 days. All seedlings were raised successfully through the nursery into four-inch pots, however one entire lot was destroyed by mice.

Culture: Plants were set out in our rock garden, where they were observed in good condition for many years.

***Monardella* × *subglabra* (Hoover) Hardham.** [Ed: *Monardella purpurea* Howell × *Monardella villosa* Benth. ssp. *villosa*. TJM1]

Perennial.

Propagation: Untreated seed sown in November germinated in seven days and generated many seedlings. Except for a few weak seedlings that were discarded, all the others were successfully raised into five-inch pots without any losses. As this species is rhizomatous, it is assumed that it would respond well to dividing.

Culture: Our plants were set out on the mesa in March 1966, and it is too early for this report to make an assessment of this species ability to adapt to cultivation.

***Monardella undulata* Benth.**

Annual.

Propagation and Culture: A small collection of seed was gathered near the sand dunes south of Oceano in San Luis Obispo County. Seeds were sown directly into our sand dunes and germinated in 28 days. Few seedlings were produced, but a few plants grew to flowering size and

began blooming in late May. Little seed was produced and the collection was not observed in succeeding years.

***Monardella villosa* Benth. ssp. *neglecta* (Greene) Epling.** [Ed: *Monardella purpurea* Howell. TJM2]

Perennial.

Propagation. Several lots of untreated seed were sown from a collection gathered in 1958 on Mount Tamalpais in Marin County. Germination started in five to 13 days, and an abundance of seedlings were produced. There was no problem in raising them quickly through the four- or five-inch pot stage.

Culture: Set out in the rock garden and other dry locations, many of the plants persisted for several years, but usually succumbed to root rots. However, they could be replenished easily as there were no problems with propagation efforts.

***Monardella villosa* Benth. var. *obispoensis* Hoover (Jeps.) Jokerst.**

Perennial.

Propagation: No seed collections were raised, but tip cuttings from a plant growing in a container in the nursery rooted 99% without any pretreatment. It took 14 days to initiate rooting. All of the rooted plants were successfully grown in the nursery to their planting out size: five-inch pots.

Culture: First acquired as a single plant in 1949, this plant was transplanted into a five-gallon container in April 1951 for transfer to our present Claremont site in August 1951. There it continued to live until its 14th year when it was recorded dead. Garden harvested seeds failed to germinate. Another collection of rooted plants from the wild provided cuttings for additional plantings and they were alive three years later in a dry, rocky granitic loam. Flowering and seeding occurred during their second year.

***Monardella villosa* Benth ssp. *sheltonii* (Torr.) Epling.** [Ed: *Monardella sheltonii* Torr. TJM2]

Perennial.

Propagation: Untreated seed requires six to 15 days for germination. Rootone treated tip cuttings started rooting in 15 days and 100% of the cuttings were successfully rooted and grown. We experienced no problem while growing either seedlings or rooted cuttings in the nursery.

Culture: We extensively planted this species since 1940, both at our old site and later here in Claremont. This plant has been successfully grown in both heavy clay soils as well as in the lighter granitic loams. Flowering and seeding occur during the first or second year of growth.

***Monardella viridis* Jeps.**

Perennial.

Propagation: Rooted plants from wild were successfully established in pots and were later planted in the garden.

Culture: Brought in from Mount St. Helena in Sonoma County, a few plants were set out in a rocky, well-drained site, but since this collection was only recently acquired, notes have not been recorded on its success or failure.

***Monolopia lanceolata* Nutt.**

Annual.

Asteraceae. Sunflower Family.

Propagation: When seed is sown directly into a garden site, germination may be expected in ten to 20 days, depending upon the site and moisture conditions. Seeds sown in flats will germinate more quickly.

Culture: All of our plantings have been in the clay soil of the mesa where excellent results were obtained. However, vigorous efforts to ward off the birds must be sustained as they love the sprouting seedlings and small plants. Flowering started from the middle of February to early March and the seeds were harvested in late March or early April. We have grown two seed strains, one from Kern County and the other from Los Angeles County.

***Monoptilon* Torr. & A. Gray.**

Desert Star.

Annuals.

Asteraceae. Sunflower Family.

Culture: When untreated seeds of *M. bellidiforme* Torr. & A. Gray. and *M. bellioides* (A. Gray) H.M. Hall. were sown directly into garden sites they failed to germinate in every instance.

***Muilla maritima* (Torr.) S. Watson.**

Muilla.

Perennial.

Amaryllidaceae. Amaryllis Family. [Ed: Themidaceae. Brodiaea Family. TJM2]

Propagation: Untreated seed germinated in 13 days when sown in August. After the seedlings went dormant by the following June, small clumps of corms were transferred to pots. They subsequently reappeared in the early fall months.

Culture: Our plants were started from seed harvested from plants naturally growing within the garden site, and our planting was placed in a similar situation. Records indicate that the first flowers appeared in their fifth season of growth. Numerous collections have been added for experimental studies in connection with genus *Brodiaea*.

***Munzothamnus blairii* (Munz & I.M. Johnst.) P.H. Raven.**

Shrub.

Asteraceae. Sunflower Family.

Natural Range: Endemic to canyon walls of San Clement Island.

Propagation: A small quantity of untreated seed sown in January 1959 germinated in 20 days. After the seedlings were transplanted into small pots, only eight of 20 seedlings survived. Cuttings with a semihard base were gathered in the wild in 1962 and were treated with Rootone

powder. Root initiation started in 42 days and 51% of the cuttings rooted. Subsequently only one of these plants died in the nursery.

Culture: This species was short-lived with us, principally succumbing to frost. It appears to be highly sensitive to cold. All collections were gone within a year.

Myosurus L.

Mouse-Tail.

Annuals.

Ranunculaceae. Buttercup Family.

Propagation: Out of several species sown for experimental studies, only two collections produced seedlings: *M. minimus L. var. filiformis Greene* [Ed: the var. is not recognized in TJM2] and *M. minimus L. ssp. montanus G.R. Campbell*. [Ed: *Myosurus apetalus* C. Gay. var. *montanus* (G.R. Campbell) Whittm. TJM2] Untreated seed germinated in seven and 12 days, when sown in September and December.

Culture: Our plants were raised for taxonomic studies. Mature and flowering specimens were produced in pots successfully. These small vernal pool species are of little horticultural value.

Myrica californica Cham. & Schldl. [Ed: *Morella californica* (Cham. & Schldl.) Wilbur. TJM2]

Western Wax-Myrtle.

Shrub.

Myricaceae. Wax Myrtle Family.

Propagation: We tried a number of experiments. Untreated seeds germinated in 96 and 83 days. Seeds that were soaked in hot water for 17 hours germinated in 81 days. Seeds that were soaked in sulphuric acid for two-and-a-half hours germinated in 99 days. Seed flats that had pine needles burned on top of the soil-seed mix germinated in 101 days. Seed flats that had excelsior burned on top of the soil-seed mix and were then placed in cold-stratification for two months germinated in ten days after their removal from the cold – this method was the most successful by far, and produced many seedlings. Each of the other experiments produced nearly identical numbers of seedlings. Seeds that were two- to three-years-old completely failed to germinate. Seed must be fresh and in any case will take two to three months to germinate. The seed flat should be kept quite moist at all times. We experienced no loss of seedlings while growing them in the nursery.

Cuttings: Tip cuttings taken in November were treated with Rootone and rooted at rates less than 50 % and took eight months to do so. Untreated cuttings taken in May took 71 days to initiate roots, and the results were poor. Soft greenwood tip cuttings taken in June and treated with Rootone took 27 days to root and yielded a success rate of 45%. Our losses of cutting grown plants in the nursery were rather high.

Culture: Since this species inhabits moist canyons and slopes along our coast and north to Washington, it has done best for us when it has been grown in our heavier soils where adequate moisture is available. Plantings grown in full sun in rocky, granitic loams suffered high initial losses, but once established they were indeed hardy but needed heavy irrigation to do best. Two plants were dug up from the old garden site in March 1951 and were planted in five-gallon-cans.

Four more were dug up and balled. All six plants were replanted in Claremont in April 1951. Only one has survived, and it is now in its 20th year and measures six feet tall and nine feet wide – it is growing in full sun. Other plantings have reached their tenth and 15th year. First flowering and seeding is noted after three to five years of growth.

Our best plants are growing on the mesa where they have reached heights of 12 to 15 feet. Some of these plants are growing near a stream, while others have been used as a formal clipped hedge on the north side of a building. Still others have been trained as single-trunked, small trees and these are now handsome specimens. Excessive watering in tight clay soils will cause the roots to rot.

***Myrica hartwegii* S. Watson.**

Sierra Sweet-Bay.

Shrub.

Myricaceae. Wax-Myrtle Family.

Propagation: Two collections of seed failed to germinate. Semi-hard cuttings taken in May and treated Rootone initiated roots in 30 days and we experienced a 75% success rate.

Culture: Our plants were placed in two different shaded garden locations. Neither spot was suitable for this species, and none of the plants survived for more than three years.

***Najas marina* L.**

Annual.

Water-Nymph Family.

Propagation and Culture: Harvested plants from the wild were placed directly into a pool where they survived for a while. Two years later, no surviving plants could be observed and there were no subsequent volunteer seedlings.

***Nama demissum* A. Gray.**

Annual.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Propagation and Culture: Sown directly into a site in the desert garden, this infrequently seen annual from dry slopes and flats of our deserts, did poorly with us. Only a few prostrate plants appeared and flowered in March, but these did not produce seed. The same history was recorded for *N. depressum* A. Gray.

***Nama lobbii* A. Gray.** [Ed: *Eriodictyon lobbii* (A. Gray) Greene. TJM2]

Perennial.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Propagation: Seed of two wild collections failed to geminate. Only two plants were established by moving small rooted sections from the wild.

Culture: These plants were planted in the rock garden, but they failed to survive. This plant apparently needs a dry sandy granitic soil at higher elevations

***Nama rothrockii* A. Gray.**

Perennial.

Propagation: Several attempts were made to germinate seed but only two had any success. In one case we were able to grow one seedling, and in another case we grew three seedlings after the seeds had been treated to five to six months of cold-stratification. All of these seedlings were raised with no losses, and plants were set out in 1957 and 1959.

Culture: Placed in the rock garden in a very dry, sandy granitic loam, none of the plants survived for more than two years.

***Nemacaulis denudata* Nutt.**

Annual.

Polygonaceae. Buckwheat Family.

Propagation: In 1955, one collection of seedlings was obtained from the wild. These seedlings were successfully grown in pots before planting in 1955.

Culture: Set out in a flat area of sandy granitic loam, these plants came into flower in late April. There are no further records.

***Nemophila maculata* Lindl.**

Fivespot.

Annual.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Natural Range: Moist flats or slopes along the western base of the Sierra Nevada from Plumas County to Kern County. Flowering from March to May.

Propagation and Culture: Untreated seed sown in field rows, flats, or directly into a garden site will germinate in 12 to 30 days, depending on the soil type and moisture. Seeds require constant moisture until they have germinated, afterwards less frequent irrigations may be applied. When the soil is too rich and moist the plants will grow leggy, produce fewer flowers, and are less attractive. Plants prefer light high shade when grown in hot inland gardens or full sun when grown near the coast. This species has been grown in our collection since its initial collection in 1933. Many generations have been sown and the plants produce an abundance of flowers each spring. More recently, complete protection of emerging seedlings has been necessary to save them from being eaten by birds. An attractive almost blue corolla without the spots has been separated from our plantings and gradually refined by selection of deepest colors. Many visitors find this most attractive. (Note: Seed over ten-years-old will produce as many plants as fresh seed.)

***Nemophila menziesii* Hook. & Arn.**

Baby Blue-Eyes.

Annual.

Propagation and Culture: A long-time favorite in cultivation, we successfully introduced a local seed collection to our plantings in 1948 and have continued its cultivation yearly since then. We grow it under the same conditions as the above (*N. maculata*) and use it as a contrasting plant. Flowering in February, March, or April, depending somewhat on the time of sowing and the moisture content of soil. Seeds germinate in 12 to 20 days, averaging 12-15 days.

***Nicotiana bigelovii* (Torr.) S. Watson.** [Ed: *Nicotiana quadrivalvis* Pursh. TJM2]

Annual.

Solanaceae. Nightshade Family.

Propagation: Seedlings from untreated seed sown directly in our rock garden and clay mesa soil emerged in 35 days with good results. The **var. wallacei A. Gray** [Ed: the var. is not recognized in TJM2] required 48 days to germinate in a sandy loam site.

Culture: Used in a variety of locations, plants grew well, flowered in late April, and a few seedlings were noted each year for a number of years, after which it disappeared. Not highly attractive for cultivation.

***Nolina bigelovii* (Torr.) S. Watson.**

Perennial.

Agavaceae. Agave Family. [Ed: Ruscaceae. Butcher's-Broom Family. TJM2]

Propagation: Seedlings from untreated seed sown in flats, pots, and seed beds have germinated in 12 days. Maximum germination was reached in a month or less. Seedlings were transplanted into containers and were easily grown to plantable sizes within 12 months. Alternatively, the seedlings they may be grown in a seed bed until a sufficiently strong root system has developed, after which they can be planted out bare-root. In either case, losses will be minimal. Five year or older seed will provide excellent results.

Culture. Planted on flat ground in full sun, in a decomposed granite loam soil, all of our plants have grown exceedingly well after an initial loss of about 10%. In ten years plants our plants measured 18 inches to four feet tall and 33 inches to seven-and-a-half feet wide. Flowering and seeding began with one plant in its seventh year with a gradual increase in numbers each succeeding season. Four plants at the old site were moved bare-root and were replanted in September 1951. Two of these survived and in thirtieth year measured five feet tall and seven-and-a-half feet across. One of these plants produced a flower stem that reached 15 feet high in 1960, this was the plant's first flowering and it was 28-years-old.

***Nolina interrata* Gentry.**

Perennial.

Culture: Our one specimen, the result of transplanting two plants from the old site, and one of which subsequently died after 12 years in this location, has developed into a specimen measuring three feet tall and seven feet across. Both plants flowered each season starting in 1949 and the remaining specimen is in its twentieth year. Since both plants are male, no seeds were produced. No further wild collections have been added.

***Nolina parryi* S. Watson.**

Perennial.

Propagation: *N. parryi*: Untreated seed, harvested from cultivated plants, and sown in September germinated in 21 days. There were no problems with raising the seedlings in the nursery. *N. parryi* ssp. *wolfii* Munz. [Ed: the ssp. is not recognized in TJM2], our wild collections of seed germinated in 29 to 36 days. One collection was subjected to three months of cold-stratification and yielded the best results. However, the others germinated well without cold-stratification. Seedlings need to be protected against damp-off, but otherwise are easily grown once they are past this critical stage. Seedlings may also be produced in seed beds, allowed to grow into strong plants, and then set out bare-root into the garden with minimum losses.

Culture: Preferring a rocky, well-drained site, our plantings were used in such a situation. However, it is known they will grow very well in heavy clay as long as these are not too wet. After ten years of growth, our plants of *N. parryi* measured two to five feet tall and two-and-a-half to five feet wide. The first flowers were noted during their seventh year, but no seeds were produced. *N. parryi* ssp. *wolfii* is a magnificent plant, wild specimens have been measured up to 16 feet tall, with a trunk diameter of three feet. The leaves are often five feet long, making a single plant over 12 feet in diameter. Flower stalks are often 12 feet long, and are six inches in diameter, with the flowering portion about six feet long and 42 inches across. In September and December 1951, a total of eight plants were removed from our old site and planted in the desert garden. There were gradual losses until three remained after the third year. These specimens have grown to huge proportions, but have never flowered and are now in their 30th year. Another planting, raised from seed and set out in 1953, started flowering in March and continued into April of their 15th year. These plants are three to five feet tall with spreads of four to nine feet. Their flowering stalks measured about six to eight feet. Ten-year-old plants have equaled or bettered this size but have not flowered. Losses have been minimal and occurred only during first year or two.

***Nuphar polysepalum* Engelm.**

Yellow Pond-Lily.

Perennial.

Nymphaeaceae. Waterlily Family.

Propagation: Seed must not be allowed to dry – otherwise it will take a long time to germinate. Plants are most easily propagated by root divisions. Our present planting was grown from roots dug from a pond.

Culture: This plant requires a large pond or very wet area, but does best with water at least 12 to 18 inches deep or deeper. Our plants soon spread over a large area, and specimens were dug and planted in additional areas. When cultivated in a small area, the planting will need to be thinned out every three to four years or so. In our area, plants were severely attacked by aphids and were cut down by frost each winter. Observed in many localities in California as well as to Alaska, South Dakota, and Colorado. Plants typically flower from April through September, but are in bloom even longer here.

***Oenothera avita* (W. Klein) W. Klein.** [Ed: *Oenothera californica* (S. Watson) S. Watson ssp. *avita* W. Klein. TJM2]

Perennial.

Onagraceae. Evening-Primrose Family.

Propagation: Easily propagated from untreated seed sown directly into the garden site, requiring perhaps 30 days to germinate, but the time will depend on the actual site and soil conditions.

Culture: Spreading by underground rootstocks, this species from the eastern deserts of California and found growing in very loose, sandy areas, readily spreads over a wide area, much like ***Oenothera californica*** and may need to be kept under control, an often difficult task. The **ssp. *eurekaensis* (Munz & Roos) W. Klein.** [Ed: *Oenothera californica* (S. Watson) S. Watson ssp. *eurekaensis* (Munz & Roos) W. Klein. TJM2] germinated in a seed flat in 23 days, and when sown into garden site in 20 days. These plants were grown in our sand dunes where they were both easy and successful. They spread quickly over the sand dunes.

***Oenothera bistora* Nutt. var. *veitchiana* Hook.** [Ed: *Camissoniopsis bistorta* (Torr. & A. Gray) W.L. Wagner & Hoch. TJM2]

Onagraceae. Evening-Primrose Family.

Propagation: Sown directly into a garden site, the seeds germinated in 20 days under the best conditions.

Culture: Sandy, rocky, dry sites, are preferred. This species is native to our area and came up in abundance in the desert garden to such a degree that it needed to be weeded out in some areas.

***Oenothera brevipes* A. Gray.** [Ed: *Chylismia brevipes* (A. Gray) Small. TJM2]

Annual.

Propagation: Sown directly into a garden site, the seeds germinated in 14 to 20 days. We achieved scattered to good germination, with many seedlings appearing over the course of several years. For best results, seeds probably should be soaked in water before they are sown.

Culture: Many wild collections were sown, though none remained for more than two to five years. Each collection gradually disappeared, but continuing to produce a few seedlings, particularly in the desert garden and desert sand dune areas, where all of our plantings were made. Plants flowered in April and the seeds were gathered a month later.

***Oenothera caespitosa* Nutt. var. *marginata* (Hook. & Arn.) Munz.** [Ed: *Oenothera caespitosa* Nutt. ssp. *marginata* (Hook. & Arn.) Munz. TJM2]

Perennial.

Propagation: Sown in flats, untreated seed will germinate in seven to ten days, but our general practice consisted of sowing the seeds directly into a garden site and these required 20 to 40 days for germination. Abundant seedling production occurred naturally in all sites in the desert garden, where this species was exclusively used.

Culture: Plants require a well-drained sandy rocky situation with only spring moisture. Our plants were not long-lived, but abundant volunteer production never found us short of plants of

this attractive, low growing perennial. With its large white flowers appearing in April, attractive displays typically lasted for a period of several months. We have grown this form from original collections made in 1939 and 1948.

***Oenothera californica* (S. Watson) S. Watson.**

Perennial.

Propagation: Untreated seed germinates in 12 to 14 days when it is sown in a seed flat. Seeds sown directly into a garden site take longer.

Culture: This species is found in widely scattered locations in loose, sandy places in cismontane Southern California and at the western edges of our deserts below 8,000 feet elevation. This easily grown species can become a pest if it is not kept under strict control. This plant will quickly spread by underground rootstocks, it can spread widely in a few seasons. Flowers and seeds are produced abundantly in their first season. This species makes an excellent ground cover for waste areas due to its fine display of large white flowers.

***Oenothera campestris* Greene ssp. *parishii* (Abrams) Munz. [Ed: *Camissonia campestris* (Greene) P.H. Raven ssp. *campestris*. TJM2]**

Annual.

Propagation: When sown directly into garden sites, sporadic, poor germination occurred from ten to 81 days, but usually tended toward the longer time span.

Culture: While a few poor seedlings matured and flowered, only one produced enough seed to harvest and that resulting seed failed to germinate. Plants flower in April. This species is found in sandy dry places in the drier regions principally in Southern California.

***Oenothera cardiophylla* Torr. [Ed: *Chylismia cardiophylla* (Torr.) Small. TJM2]**

Annual.

Propagation: Sown directly into a site in our desert garden, the original seed collection required nearly five months to germinate, and even then our results were poor. This time frame may have been shortened considerably if we had soaked the seeds in water prior to sowing.

Culture: This desert species is found in dry sandy mesas and canyons, and was only acquired twice. One collection failed to germinate, and the other failed to reproduce after flowering well.

***Oenothera cheiranthifolia* Spreng. [Ed: *Camissoniopsis cheiranthifolia* (Spreng.) W.L. Wagner & Hoch. TJM2]**

Perennial.

Propagation: Sown directly into a garden site in sandy loam soil, germination occurred in 12 to 25 days under the best conditions, but may take considerably longer if moisture is sporadic. Some seeds up to 11 years germinated.

Culture: This species is found along the coast from Santa Barbara County northward. Over the years, several collections were raised but were often discarded as they were not particularly attractive and they performed poorly – even though flowering and seeding were recorded during

their first season. Flowers are small and unattractive. We also grew **var. nitida (Greene) Munz** with much same history.

***Oenothera cheiranthifolia* Spreng. var. *suffruticosa* S. Watson.** [Ed: *Camissoniopsis cheiranthifolia* (Spreng.) W.L. Wagner & Hoch ssp. *suffruticosa* (S. Watson) W.L. Wagner & Hoch.

Perennial.

Propagation: Untreated seed was sown directly into a garden site and took 12 to 21 days to germinate, depending on moisture conditions in the soil.

Culture: This Southern California coastal variety performed much better than the species, although it never performed as well for us this far inland as compared to those that we grew at the old site in heavy clay soil. We planted this species in our current garden's coastal sand dunes, and volunteer seedlings were regularly noted and kept this variety in constant cultivation. Flowering typically occurred six months after germination. This is a much more attractive plant than the species as it has silver-gray foliage, and larger flowers.

***Oenothera claviformis* Torr. & Frem.** [Ed: *Chylismia claviformis* (Torr. & Frem.) A. Heller. TJM2]

Annual.

Propagation: Untreated seed generally yielded poor results when sown directly into a garden site, taking 26 to 60 days to germinate. Seeds subjected to cold-stratification for two months produced better results in the number of seedlings (germinating in seven days), but these were difficult to raise in the nursery. Generally, we experienced poor results with this species.

Culture: Planted in our desert garden in the most suitable sites, this species, and its **var. *aurantiaca* S. Watson.** [Ed: ssp. *aurantiaca* (Munz) W.L. Wagner & Hoch. TJM2] and **var. *peirsonii* Munz.** [Ed: ssp. *peirsonii* (Munz) W.L. Wagner & Hoch. TJM2], all performed poorly. A few plants produced flowers from March to May, but most usually succumbed during the wetter parts of the winter before they bloomed.

***Oenothera deltoides* Torr. & Frem.**

Annual.

Propagation: When sown directly into a garden site, we usually experienced poor germination in three to four weeks. The plants were never very strong. The **var. *cognata* (Jeps.) Munz.** [Ed: ssp. *cognata* (Jeps.) W.M. Klein. TJM2], and **var. *howellii* Munz.** [Ed: ssp. *howellii* (Munz) W.M. Klein. TJM2] performed much better but usually required two to three weeks to germinate.

Culture: The species, a common plant of the sandy deserts, was much less successful with us than the **var. *cognata*** and **var. *howellii***, both of which have long been raised from our original collections made in 1933 and 1947 respectively. Flowering occurred from April through to June and volunteers were noted over a long period. The two varieties were highly successful and provided an abundance of large white flowers on cloudy days and in early mornings. [Ed: This species and its two varieties typically open in the evening and fade during the heat of the morning. They may remain open during daylight hours on cloudy days.]

***Oenothera hookeri* Torr. & A. Gray.** [Ed: *Oenothera elata* Kunth ssp. *hookeri* (Torr. & A. Gray) W. Dietr. & W.L. Wagner. TJM2]

Biennial or Perennial.

Propagation: If sown in seed flats, the species and ssp. [Ed: no ssp. were listed] require six to ten days for excellent germination. But, when they are sown directly into a garden site, a few more days may be required for germination (and the germination rate will be just as good). Volunteer seedlings arise in great abundance and are scattered over a wide area in short time.

Culture: While normally found in moist situations in nature, this species and ssp. [Ed: no ssp. were listed] are seen spreading widely over much of our state. One of the easiest of plants to raise, the main concern is to keep it in bounds as seedling production is abundant. Plants flower over a very long period from May to September. Individual plants can become quite unkempt in appearance as flowering proceeds. Individual flowers open at night and close in the sunshine the following morning.

***Oenothera multijuga* S. Watson. var. *parviflora* Munz.** [Ed: *Chylismia walkeri* A. Nelson ssp. *tortilis* (Jeps.) W.L. Wagner & Hoch. TJM2]

Annual.

Propagation: Seeds sown directly into a garden site or cold-stratified were not successful. None survived to flower, most died from damp-off or other causes when they were young. This desert plant comes from rocky washes of canyons, etc.

***Oenothera primiveris* A. Gray.**

Annual.

Propagation: Seeds were difficult to germinate, and appeared to require long periods of time (perhaps to overcome germination inhibitors). Whether the seeds were sown directly into a garden site, treated or untreated, none performed well. Seeds soaked in water did equally poorly, but yielded our best results. These required 32 to 46 days to germinate. In a garden site where we had sown seeds in 1951, three fine specimens appeared in 1963, growing into the most normal plants we had ever raised of this difficult desert species. Seeds were sown in granitic sites in the desert garden, sand dunes, and rock garden, the latter site being the site where most seedlings appeared, but over the course of several years these seedlings never developed normally. Many seed collections were tested and several failed completely. Even mature plants must be guarded against damp-off or crown rot fungi. Most of our plants failed to set seed. This is a beautiful plant if can be raised properly. It has large, bright yellow flowers. Flowers appear from late March to April.

***Oenothera refracta* S. Watson.** [Ed: *Eremothera refracta* (S. Watson) W.L. Wagner & Hoch. TJM2]

Annual.

Propagation: We were unable to germinate this desert annual unless the seeds were cold-stratified for two months. Even then only one seedling appeared in each of our two collections sown. Cold-stratification apparently acted as method of removing inhibitors but as only one

seedling appeared in each, perhaps seeds of this species require additional treatment. Both seedlings died in nursery.

***Olneya tesota* A. Gray.**

Desert Ironwood.

Tree.

Fabaceae. Pea Family.

Propagation: While we used hot water treatment in some lots, it is unnecessary as untreated seed, even several-years-old, will germinate in five to 12 days. When the seeds are placed between wet blotters or pads, 100% germinate in three to five days. It may be necessary to fumigate seed to prevent weevils and other seed eating insects. The seeds rot easily and while we used several fungicidal treatments before sowing the seed and treating the growing media, the results were most often disappointing. Transplanting was the most difficult stage, and nearly always the seedlings succumbed. Sowing the seeds in mid- or late-spring seems necessary to avoid the cold, wet winter months. Also, sowing the seeds directly into gallon containers (to avoid transplanting small seedlings) was helpful, but there again, not every time. Probably the safest procedure would be to plant the seeds in a dry atmosphere in sterilized soil in a deep seed bed since the plant puts down an extremely long tap root almost immediately. We tried moving seedlings from a desert wash and though only cotyledons and the first set of primary leaves were present, the roots were nearly a foot long. We managed to save two out of 44 seedlings dug. Lack of experience in transplanting older specimens has not provided us with the knowledge as to whether this latter method would be successful, but certainly our other experiences suggest this procedure.

Culture: Since this species is a desert wash inhabitant, it follows that the tap root quickly sent down is accessing water deep underground. Therefore it would seem like a good idea to provide the young plants with a similar situation, but plants raised in containers preclude this possibility, so the next best thing is to give the young plants adequate irrigation. We did manage to have several survive. Those that became well established, while growing slowing, will probably continue to thrive for a long time. Our two oldest specimens are now 15-years-old and are from the same collection raised in the desert and presented to us in 1952. These specimens were four to ten-and-a-half feet tall, and three-and-a-half to 13½ feet wide. So far, neither had flowered. Other specimens are ten-years-old and measured one to seven feet tall, and one to seven feet across. None of these plants have bloomed.

***Onychium densum* Brackenr.** [Ed: *Aspidotis densa* (Brackenr.) Lellinger.

Dense Lace Fern.

Perennial.

Pteridaceae. Brake Family.

Propagation: Our only experience with this species is with mature plants. These are readily transplanted and re-established in containers before setting them out in the garden.

Culture: Our plants were planted in our rock garden. Two collections have been established and seem to be holding their own. These plants have only been in our collections for a few years, so their performance cannot be fully evaluated.

***Opuntia* Mill.**

Prickly-Pear. Cholla.

Shrub.

Cactaceae. Cactus Family.

The genus *Opuntia*, in California, consists of some 20 species and perhaps 15 varieties or subspecies. We have representatives of all taxa reported in Munz & Keck (1959), and in other recent studies. The history of this group in our present site is pretty much a continuation of the facts reported for the old garden location. We have continued to raise these plants by successfully transplanting all of the clones from the former site to our new site in Claremont. We have raised none of these species from seed. All of our plants have been grown by rooting cuttings of pads or sections of stems from mature specimens. These plants are very simple to propagate and grow, and we have seldom encountered any problems. (See Everett, 1957. Pgs: 154-158.)

Propagation: Seeds or cuttings. Cuttings of pads, sections of stems, or young rooted plants, were accessioned and then were washed thoroughly, treated with fungicide, laid out in a flat, and put in greenhouse or screenhouse until their cut surfaces were dried and healed. These cuttings were then inserted into pots or other containers in a sandy loam mixture. There usually was no problem in rooting and growing these plants. Seeds will germinate in a few weeks or less, and ordinary seeding soil mixtures are sufficient in most cases. Seed soil mixes should be well-drained and dry quickly on top. Some care will be necessary to prohibit damp-off problems.

Culture: All of our species are hardy and require little attention. When they are planted in well-drained, rocky, or other dry situations, they need little attention except for control of rodents (rats in particular), various kinds of aphids, and mealy bugs that attack some species of the flat lobed types. Scale, too, may need to be controlled. At the old site, the cholla or round-stemmed types, were subject to a discoloring black smut, but this condition, while noticeable to a degree, is not as serious as at the old location, which was nearer the coast, and subject to moister air. The following notes indicate the degree of success we have been able to grow our native *Opuntia* species:

***Opuntia acanthocarpa* Engelm. & Bigel. var. *coloradensis* L.D. Benson.** [Ed: *Cylindropuntia acanthocarpa* (Engelm. & Bigel.) Kunth var. *coloradensis* (L.D. Benson) Pinkava. TJM2]

Buckhorn Cholla. – Two groups were pruned severely and moved from old site, and only one of these died. The remainder are all alive, in their 30th and 35th year. Plants are noted as being in good condition, and measure three to six feet tall, and two to seven-and-a-half feet wide. Two collections from 1957 and 1958 are all alive and are in good condition and measure one to three-and-a-half feet tall, and two to six feet across. Five collections of several plants each of the **ssp. *ganderi* C.B. Wolf.** [Ed: *Cylindropuntia ganderi* (C.B. Wolf) Rebman & Pinkava. TJM2] were moved in September 1951. All survived and are growing vigorously in several locations. These plants measure two to five feet tall, and five to 12 feet across. All were in their 25th year. A collection acquired in 1958 was doing very well, measuring 14 inches to three feet tall, and from

one to three feet across. This collection was grown from rooted cuttings, and three were lost during their first season, but after that time there has been no mortality.

***Opuntia basilaris* Engelm. & Bigel.** Beaver Tail. – Out of ten collections set out, nine were noted as growing very well. Only one had been moved from the old site and was in its 20th year with clumps up to one foot tall and three-and-a-half to five feet across. While all of our collections progressed very well and flowered and fruited heavily each spring, this species (and several other lobe-type *Opuntia*) was attacked after the third or fourth year with a lobe rot. Every few seasons, the plants were removed, the dead portions cut out, and the lobes rooted in place. Often this rot was severest where more water collected in the winter. Fungicidal sprays were used, but were not very effective. This condition prevailed with the following varieties, all of which were raised with some abundance.

***Opuntia basilaris* Engelm. & Bigel. var. *brachyclada* (Griffiths) Munz.** – We have grown this taxon since 1927, and had a small number of plants prior to our move in 1951. Only one clump was moved bare-root to our Claremont garden in September 1951. This plant survives in poor condition and measures eight inches tall and is 14 inches wide.

***Opuntia basilaris* Engelm. & Bigel. var. *ramosa* Parish.** [Ed: the var. is not recognized in TJM2] – This is probably the best known form of the species. Several collections were moved from the old site bare-root, and were replanted in October 1951. These have spread into large colonies that measure several feet across, and are now in their 35th year with us. This is an exceedingly colorful plant, particularly one collection that has rosy-purplish lobes and is strikingly beautiful at any time of the year.

***Opuntia basilaris* Engelm. & Bigel. var. *treleasii* (Coult.) Toumey.** – Our first collection of this rare plant was acquired in 1932. It was transplanted to our Claremont site and divided in September 1951, and all of plants have done well. A second collection was added in 1959, and has done equally well. These clumps measure ten to 16 inches tall, and three to five feet across, while the oldest plants (now in their 35th year) have spread into clumps up to 22 feet across.

***Opuntia basilaris* Engelm. & Bigel. var. *whitneyana* (Baxter) Marshall & Bock.** [Ed: the var. is not recognized in TJM2] – Planted directly into site, one collection acquired in April, 1955, immediately responded and has since developed into one clump that measures one foot tall, and three to five feet across. Seeds were harvested from this plant in August 1958, and were sown in October 1959. Germination began in five days, with maximum results in less than one month. The seedling plants were planted in December 1961, and except for incidental losses, they have grown exceedingly well. In five years of growth, these plants now measure six to 15 inches tall, and eight inches to three feet wide. Flowering began in their third year of growth. A peculiar hybrid was noted in this collection and this warrants further observation.

***Opuntia bigelovii* Engelm.** [Ed: *Cylindropuntia bigelovii* (Engelm.) Knuth. TJM2] Teddy-Bear Cholla. Ball Cholla. – Two accessions (a total of 28 plants) were transplanted bare-root from the old site to our Claremont site in September 1951. Half of these, now in their 35th year, have survived. Additional collections of cuttings and/or bare-root plants have been added. This species has never been as satisfactory in growth as one sees it in its native habitat, where it is often the dominant plant for miles. Rotting joints and a general lack of vigor have been its history with us.

***Opuntia chlorotica* Engelm. & Bigel.** Pancake-Pear. – One accession was moved from our old site in October 1951. This planting has gradually diminished until only two plants in poor

condition were alive in their 25th year. However, two other collections acquired in 1958 and 1959 as cuttings, have progressed nicely and in seven years have attained heights of one to three feet and have spread two to six feet wide. The first flowers were recorded when the plants were six-years-old.

***Opuntia echinocarpa* Engelm. & Bigel.** [Ed: *Cylindropuntia echinocarpa* Engelm. & Bigel. Knuth. TJM2] Silver or Golden Cholla. – Three accessions were transplanted bare-root in September and October 1951 from the old site to our Claremont site with the loss of only one plant. These plants reestablished themselves vigorously, and measured two to three feet tall, and had spread from three-and-a-half to ten feet wide in their 30th year. Nine additional collections have been added to the garden, seven of small bare-root plants and two from cuttings. No losses have occurred and all are growing vigorously and are in good condition. Three collections of the **var. *parkeri* Coult.** [Ed: *Cylindropuntia californica* (Torr. & A. Gray) Knuth var. *parkeri* (Coult.) Pinkava. TJM2] were transplanted bare-root and two were in their 25th and 30th year, and all had survived the transplanting. The oldest collection was found missing during the scheduled inventory and assessment for their 30th year, after having lived in good condition for the previous 25 years. There is no plausible answer for its demise.

***Opuntia erinacea* Engelm & Bigel.** [Ed: *Opuntia polyacantha* Haw. var. *erinaceae* (Engelm. & Bigel.) Parfitt. TJM2] Old Man. Prickly-Pear. – Five accessions were transplanted in September 1951 from the old site to our Claremont site. All have done exceedingly well, spreading over many feet. One collection is now in its 38th year, while others were in their 27th and 30th years. Three more collections were added since 1953, and all have been equally successful. These newer collections have developed into large clumps measuring several feet across.

***Opuntia erinacea* Engelm & Bigel. var. *ursina* (A. Weber) Parish.** [Ed: *Opuntia polyacantha* Haw. var. *erinaceae* (Engelm. & Bigel.) Parfitt. TJM2] Grizzly Bear Cactus. – Collections originally acquired in 1928, 1936, 1937, and 1949 were transplanted in September 1951 and all successfully reestablished at our Claremont site. Three additional accessions have been added to our collection of this variety. This is an interesting plant with its long, whitish, flexible, and threadlike spines that well illustrate its common name.

***Opuntia erinacea* Engelm & Bigel. var. *xanthostemma* (K. Schum.) L. Benson.** [Ed: *Opuntia polyacantha* Haw. var. *erinaceae* (Engelm. & Bigel.) Parfitt. TJM2] – Four accessions, now in their 27th year, were all transplanted from the old site to their present locations at our Claremont site in September 1951. Clumps from six to 12 feet across have since developed, and all are in excellent condition. Three additional collections have made and these have established easily and have performed well since 1959.

***Opuntia* x *fosbergii* C.B. Wolf.** [Ed: *Cylindropuntia* x *fosbergii* (C.B. Wolf) Rebman et al. TJM2] – Three collections of this presumed hybrid between *O. bigelovii* and *O. echinocarpa* from alluvial fans and open desert flats of eastern San Diego County, were transplanted from the old site to our Claremont site in October 1951. These plants are now in their 28th year, and all are doing very well. One subsequent collection from 1957 has grown very well. The initial cuttings were only a few inches long and they have now grown into plants that measure three feet tall and are two-and-a-half feet wide.

***Opuntia fragilis* (Nutt.) Haw.** Pygmy Tuna. – In February 1951, four plants were lifted and were re-established in pots. These specimens were planted in August 1951 in one location where they prospered for a time. After the rock garden was constructed, they seemed more suitable for

that location so they were transplanted again and placed there in a semishaded position. The plants grew even better and began spreading. But, upon the demise of a shading large shrub, they were again transplanted to a built up mound. This species, in our location, does best in a light shaded position that receives occasional irrigation. Gradually creeping out, in its 20th year, we had a clump that measured three feet by four feet, and the plants measured only two to four inches high.

***Opuntia littoralis* (Engelm.) Cockerell.** Prickly-Pear. Tuna. – This is one of the most common platyopuntias found on the cismontane slopes of Southern California. We have had native populations of this species on both our old site and our Claremont site. However, we have other accessions from typical locations and now have six accessions growing in the garden. Our earliest collections were moved from the old garden site to our Claremont site. The oldest of these plants have now been in our living collection for 25 and 35 years.

***Opuntia occidentalis* Engelm. & Bigel. var. *megacarpa* (Griffiths) Munz.** [Ed: *Opuntia* × *occidentalis* Engelm. & Bigel. TJM2] – Three accessions were transplanted from the old site to our Claremont site in October 1951. All survived and have developed into clumps that measure up to 30 feet across. The oldest of these plants have now been in our living collection for 25 and 35 years.

***Opuntia littoralis* (Engelm.) Cockerell var. *piercei* (Fosberg) L. Benson & Walkington.** [Ed: *Opuntia phaeacantha* Engelm. TJM2] – Four accessions were transplanted from the old site to our Claremont site, and all have re-established themselves very well. They have grown into large clumps and are one of the most colorful cacti in the garden during their flowering period from late April into May. These plants are now in their 25th and 35th years with us, and have always proved to be a good addition to the garden.

***Opuntia littoralis* (Engelm.) Cockerell var. *vaseyi* (Coulter) L. Benson & Walkington.** [Ed: *Opuntia* × *vaseyi* (Coulter.) Britton & Rose. TJM2] – Two accessions, originally collected in 1938 and now in their 25th year, were transplanted to our Claremont site and have likewise grown exceedingly well. This is also a useful and colorful variety of this well-known group.

***Opuntia mojavensis* Engelm. & Bigel.** [Ed: *Opuntia phaeacantha* Engelm. TJM2] – Two accessions were transplanted from the old site to our Claremont site in October 1951. These were planted directly into the garden, and quickly became well established. They are now in their 25th and 30th years in our collection, and have developed into colonies that measure one to three feet tall, and have spread to over 11 feet wide. Two additional accessions were added, one in 1958 and the other in 1961, and both of these are in good condition, and have grown into clumps measuring three to six feet across, and up to one to two feet tall.

***Opuntia* × *munzii* C.B. Wolf.** [Ed: *Cylindropuntia munzii* (C.B. Wolf) Backeb. TJM2] – This presumed hybrid of *O. bigelovii* and *O. acanthocarpa*, is a vigorous, tall growing plant, attaining heights of up to ten feet. Two collections were transplanted from the old site to our Claremont site, and these plants were readily re-established in various locations. Now, in their 25th year (raised from seed) and 35th year, they continue to grow strongly. An additional collection of cuttings (joints) was gathered in 1957 and they are now measure six to seven-and-a-half feet tall and are three to four feet wide. These plants were a mere three to 12 inches tall when they were planted in the garden in November 1958.

***Opuntia oricola* Philbrick.** – One accession was transplanted from the old site to our Claremont site in October 1951. This collection was originally acquired in 1936, has continued with good growth and no loss of plants. Clumps had grown up to 15 feet across when the plants were in their 30th year.

***Opuntia parishii* Orcutt.** [Ed: *Grusonia parishii* (Orcutt) Pinkava. TJM2] Devils' Cactus. – We have grown four accessions of this species, including one that was transplanted from the old site in October 1951 and was planted directly into our new Claremont site. This collection is now in its 30th year with us and always has been a good grower. A creeping type, the plants are rather inconspicuous in the wild or in cultivation. They spread slowly, and even though our transplanted specimens are in their 30th year, these now measure four to nine inches tall and form clumps ten to 18 inches across. Our most recent collection, acquired in 1957, has grown somewhat better, and is already four to seven inches tall and has spread eight to 17 inches wide in their tenth year of growth.

***Opuntia parryi* Engelm.** [Ed: *Cylindropuntia californica* (Torr. & A. Gray) Knuth var. *parkeri* (Coul.) Pinkava. TJM2] Valley Cholla. – Four collections were transplanted directly from the old site to our Claremont site in October 1951. These plants have re-established very well and are now in their 25th year. They range in size from two-and-a-half to six-and-a-half feet tall and have spread from four to 12 feet wide. Two additional accessions were collected in 1957 and have likewise grown well, having attained heights of two to four feet and have spread from three-and-a-half to seven feet wide in nine years. These plants were six to 16 inches tall when they were originally planted out in 1958.

***Opuntia prolifera* Engelm.** [Ed: *Cylindropuntia prolifera* (Engelm.) Knuth. TJM2] – As our specimens of this species at the old site were much too large to transplant, we gathered two collections of large branches and these were planted directly into our new Claremont site. These large “cuttings” took off without any trouble, and all survived and grew into plants that now measure three to four-and-a-half feet tall and spread from one to three feet wide. Since the fruits will grow directly into plants with all the characteristics of the parents, the clumps are usually surrounded with many small plants which need to be controlled, as they will otherwise develop into thickets.

***Opuntia ramosissima* Engelm.** [Ed: *Cylindropuntia ramosissima* (Engelm.) Knuth. TJM2] Pencil Cactus. – Two collections were transplanted from the old site to our new Claremont site. All were re-established without any losses and are now in their 38th year with us. We later added one new accession in 1957. This unusual species develops slowly and while appearing in good condition with us, it never appears to be as “natural” as in the wild. Many small branches have a tendency to die back and our plants need cleaning up on occasion.

***Opuntia serpentina* Engelm.** [Ed: *Cylindropuntia californica* (Torr. & A. Gray) Knuth var. *californica*. TJM2] – Found near the city of San Diego in the surrounding dry hills, this semi-prostrate species was transplanted successfully from the old site to our new Claremont site in October 1951. We now have specimens ranging in height from one to two feet and that have spread up to three to six feet wide. These plants are now in their 32nd year. A specimen of a presumed hybrid between this species and *O. prolifera* was acquired by the garden in 1940, and this was also transplanted to our new Claremont site in September 1951. In addition to moving the original plant, forty cuttings were also taken and were planted in the same new area. Soon large clumps developed that we had to vigorously control. This accession is now in its 25th year

(14 years here at the new Claremont site), and has formed a large clump measuring three feet tall and ten to 20 feet across was recorded. It has all the vigor of a hybrid and displays characteristics of both presumed parents.

***Orthocarpus purpurascens* Benth.** [Ed: *Castilleja exserta* (A. Heller) Chuang & Heckard. TJM2]

Owl's-Clover.

Annual.

Scrophulariaceae. Figwort Family. [Ed: Orobanchaceae. Broomrape Family. TJM2]

Propagation and Culture: Untreated seeds that are sown directly into the garden, come up sporadically, at times abundantly or poorly, requiring anywhere from ten days to two to three months to germinate. One essential requirement is to sow other annuals, such as *Gilia* spp. *Layia*, *Baeria* spp. or annual lupines, preferably *Lupinus nanus* that one often finds growing with owl's clover in the wild. This is to satisfy the semi-parasitic requirements of this species. While open, sandy loam or granitic loam soils seem to be preferred, we have had excellent stands in our heavy clay-loam soil. We have also grown the desert type (**var. *ornatus* Jeps.** [Ed: *Castilleja exserta* (A. Heller) Chuang & Heckard ssp. *venusta* (A. Heller) Chuang & Heckard. TJM2]) in our desert garden, and while it has never performed robustly for us, we have managed to have few plants each season for the past several years. This showy annual required two to three months to germinate. Flowering began in the latter part of March or early April, mostly the latter. The **var. *pallidus* Keck.** [Ed: *Castilleja exserta* (A. Heller) Chuang & Heckard ssp. *exserta*. TJM2] has been cultivated in our collection since 1935. It has had much the same history in the garden as the species, providing occasional fine stands and flowering in early April. (On several occasions, vast numbers of seedlings germinated, and there were so many of them that they overwhelmed their host plants and essentially starved them and subsequently they starved, too.) Several wild collections of each of the types listed above were raised. Seeds that had been stored over five to eight years maintained good viability. Seed sown often germinate at a much higher rate in their second year after sowing, indicating that there is perhaps some sort of chemical inhibitor that must be overcome.

***Oryzopsis hymenoides* (Roem. & Schult.) Ricker.** [Ed: *Stipa hymenoides* Roem & Schult. TJM2]

Indian Ricegrass.

Perennial.

Poaceae. Grass Family.

Propagation: Two collections of small clumps of plants were grown in pots before they were planted out in the garden. While we did not encounter any particular problems, some care must be exercised with watering these plants while they are growing in containers. One collection of untreated seed started germinating in twelve days after it was planted in a nursery flat. When treated to 60 days of cold-stratification the seeds began to germinate about four days before their removal from the cold, and germination was completed about ten days later. Two to three seedlings were transplanted into each of five-inch pot, and all of them developed into plantable

size within a year. One collection of seed of *O. kingii* (Bol.) Beal. [Ed: *Stipa kingii* Bol. TJM2] failed to germinate.

Culture: Our specimens were planted in our desert sand dunes area, and while not all have survived, many have become well established, flowering and seeding each year. However, none of the plants have attained the usual vigor and size of plants in the wild, which may, of course, be many-years-old.

***Osmaronia cerasiformis* (Hook & Arn.) Greene.** [Ed: *Oemleria cerasiformis* (Hook. & Arn.) J.W. Landon. TJM2]

Oso Berry.

Shrub.

Rosaceae. Rose Family.

Propagation: Untreated seed or seed soaked for 15 to 24 hours in hot water may germinate in 40 to 60 days. When the seeds are treated to cold-stratification for two to two-and-a-half months, they will germinate shortly before they are removed from the cold or within a few days after they have been removed from the cold. The germination rate is usually poor, our best result was 48 seedlings from one-quarter ounce of seed. Seedlings are easily raised in the nursery and are ready for planting out within a year. We have not grown this species from cuttings.

Culture: We have planted specimens in several garden sites, but the best results were obtained from a planting on a semishaded bank of clay-loam soil. At this location, they developed into large shrubs over eight feet tall and 15 feet wide in a matter of ten years. Nine plants were transplanted (balled and burlrapped) from the old site in March 1951. These plants were replanted early in April 1951, in a rocky, open site in full sun. Four of these plants died over the course of ten years, but five of these plants survived and are now 25-years-old in our collection. These plants measure three-and-a-half to seven-and-a-half feet tall, and have spread from three-and-a-half to nine-and-a-half feet wide. These plants were one to four-and-a-half feet tall when there were transplanted in 1951. Other more recent seed collections have been raised in the past ten years, but these plants have not fared very well when they were planted in the open rocky granitic flat land in either sun or semishaded conditions. There has been a rapid initial loss after which those well-established remain and become suitable specimens. Under our best conditions, the first fruits are produced in their third year, and after six years when grown in less desirable sites.

***Oxalis oregana* Nutt.**

Redwood-Sorrel.

Perennial.

Oxalidaceae. Oxalis Family.

Propagation: Our two accessions, both of plants collected directly from the wild, were easily established in containers before they were planted out.

Culture: One accession was planted under a large oak tree, and initially grew into clumps two to four feet across, but all were gone after five to six years probably due to the heavy accumulation of oak leaves and the drier location. Another accession was established under a large oak but

with better moisture conditions and less leaf debris. These plants have performed splendidly, spreading out until recent observation indicated that they were well established.

***Paeonia californica* Nutt.**

Wild Peony.

Perennial.

Paeoniaceae. Peony Family.

Propagation: We have made only two collections and both were sown directly into the garden. It took about three months for one collection to germinate and over two months for the second. Both were successfully established in the garden. Seeds may benefit from cold-stratification before they are sown in flats.

Culture: This species is found from Monterey to San Diego counties, inhabiting open spots in brushy areas below 4,000 feet. It grows in early spring. When it is emerging and in bud, one expects to see beautiful, large flowers against the interesting foliage. But one is disappointed by the poorly formed flowers with small, deep blackish-red petals. The plants go completely dormant in early summer, shortly after the seeds have been dispersed. These plants need well-drained areas, although they do grow in heavier soils where there is no standing water. This species is native to several sections of the present garden site.

***Palafoxia linearis* (Cav.) Lag.** [Ed: *Palafoxia arida* B.L. Turner & M.I. Morris var. *arida*. TJM2]

Spanish Needles.

Annual.

Asteraceae. Sunflower Family.

Propagation and Culture: One seed lot collected from cultivated plants failed to germinate, while a second collection that was five-years-old germinated in 23 days. A previous sowing in heavier clay soil germinated in 13 days. This species is quite frost tender, so seeds were sown later in winter or early spring, but even then many seedlings were killed by cold. On the whole, this species is slower to germinate in our sandy, rocky soils. A few plants produced flowers in June and July and seeds were then harvested in August. We did not continue growing this desert annual as it has little attraction.

***Parvisedum pumilum* (Benth.) Clausen.** [Ed: *Sedella pumila* (Benth.) Britton & Rose. TJM2]

Annual.

Crassulaceae. Stonecrop Family.

Propagation: Sown in a flat, untreated seeds germinated in 15 days. The seedlings were transferred to and grown in three-inch pots without any trouble.

Culture: This diminutive annual inhabits rocky and vernal pool areas below 4,000 feet. Since the plants began to deteriorate before we could plant them in the garden, they were discarded. This species is best grown in natural sites where it can be sown directly in place.

Pellaea Link.

Cliff-Brake.

Perennials.

Pteridaceae. Brake Family. Fern Family.

Propagation: Several collections of various species were dug in the wild and were re-established satisfactorily in pots in the greenhouse. There they were studied for some time by a graduate student after which some collections were planted in the garden.

Culture: We used these xerophytic ferns in a rock wall and in the rock garden, where two species have been established for ten years and 15 years. On the whole, these ferns have been difficult to properly establish. They appear to need a semishaded site with winter rains for moisture and little or no irrigation in the summer, a period when they naturally go dormant. Since our plants were planted in areas that received a minimum summer watering, those that became well established suffered from this culture. These plants seem to want little or no attention, other than to be sure to site them so that water drains away from their roots and the center of the plants. The following information relates to following species:

Pellaea andromedifolia (Kaulf.) Fee. Coffee Fern. – Four collections were made and only two became established, including one that has grown quite well in a rock wall for ten years. Another collection was established in the rock garden, but has only been there for two years.

Pellaea bridgesii Hook. – This species from higher elevations in montane areas grew poorly for us for three years and died after being buried by too thick a layer of oak leaves.

Pellaea mucronata (D.C. Eaton) D.C. Eaton. Bird's Foot Fern. – Seven collections were established in the rock wall and in the rock garden. One record indicates good growth for one plant for a period of 15 years. Other collections were reported doing well, although they have only been planted for a comparatively short period. The **var. *californica (Lemmon) Munz & I.M. Johnst.*** was transplanted from its location at the old site in February 1950 and was re-established in a seven-inch pot. It was replanted at our Claremont site in August 1951. In this location, two plants have survived for 15 years and now measure 12 to 14 inches tall, and have spread 14 inches to two feet wide. Both plants are noted to be in good condition.

Peltiphyllum peltatum (Torr.) Engl. [Ed: *Darmera peltata* (Benth.) Voss. TJM2]

Perennial.

Saxifragaceae. Saxifrage Family.

Propagation: Ours specimens were started from plants that were received in March of 1961. Seeds that were harvested from these plants failed to germinate. However, their viability was not tested. These seeds had been cold-stratified for two-and-a-half months.

Culture: Large clumps have developed in a wet stream bed and beside a pool where there is constant moisture. They completely die down in winter, but each year have produced new, and vigorous foliage and flowers. They need plenty of water to grow well and to produce flowers and seeds. Clumps to several feet across have developed in the three years we have had them.

Penstemon Schmidel.

Beard Tongue.

Perennials and Shrubs.

Scrophulariaceae. Figwort Family

The figwort family includes many colorful genera, and one of the largest of these is the beard tongues. On several occasions this writer has written papers on the many native *Penstemon* species of California. The most extensive of these was published under the title, *The California Penstemons* [*Aliso* 2(2): 155-198. 1958.]. (See also Everett, 1957. Pgs: 160-166.) Throughout the horticultural publications of the world, one finds much information on this large and colorful genus. In the United States, a particularly useful work is the **Bulletin of the American Penstemon Society**, which deals comprehensively with the propagation and culture of the genus in all parts of the United States, in particular, but addresses these issues for other parts of the world, too. Of botanical interest, one study by Richard Straw [*Brittonia* 19(3): 203-204. 1967.] has proposed the genus *Keckiella* and shifted the following species to that entity: *K. rothrockii* (Gray) Straw and ssp. *jacintensis* (Abrams) Keck; *K. breviflora* (Lindl.) Straw and ssp. *glabrisepala* (Keck) Straw; *K. lemmonii* (Gray) Straw; *K. antirrhinoides* (Benth.) Straw and ssp. *microphylla* (Gray) Straw; *K. cordifolia* (Benth.) Straw; *K. corymbosa* (Benth.) Straw; *K. ternata* (Torr.) Straw and ssp. *septentrionalis* (Munz & I.M. Johnst.) Straw. [Ed: See also *Brittonia* [18(1): 87-88. 1966.] for the discussion about why these plants were being separated from *Penstemon* and were proposed as a “new” genus *Keckia*, (which was invalid as it had already been used for another group of plants) so our plants were moved to the new genus *Keckiella* in the 1967 reference listed above.] However, this work will continue to follow the studies of Dr. David D. Keck and as published in Munz & Keck (1959).

The genus *Penstemon* includes some 230 species, mostly from western North America, one species from eastern Asia. [Ed: This Asian plant was separated from the genus *Penstemon* in 1970 and has been placed in a genus of its own as *Pennellianthus frutescens* (Lamb.) Crosswhite.] Several species are of horticultural importance. Munz & Keck (1959) list 82 taxa : 58 species, 24 subspecies, and one hybrid (*P. x parishii*), along with notations of other probable hybrids in nature. During the 15-year period of this report, we have attempted to grow 37 species, 19 subspecies, five hybrids, two horticultural varieties, and one forma (*P. laetus forma albus* Everett).

Propagation: Our experience concurs with earlier studies regarding the ease with which many penstemons are raised from seeds or cuttings. Untreated seeds sown in the fall generally sprout within one to two weeks, although maximum germination may require up to two months. Usually, we found in our well aerated soil mixture, germination was quick and good if the seed was of good quality. (Note: Most failures were from seeds that had been stored for five or more years.) Some seed collections were simply no good. The following seed lots either failed completely or produced only one or two seedlings: *P. breviflorus*, *P. caesioides*, and *P. azureus*. Some seed lots failed one time, and yet were successful in their second sowing. Cuttings, most often treated with one of several of rooting chemicals, rooted in periods ranging from ten to 20 days, or sometimes longer. Generally we had no problem raising either seedlings or cuttings, and they would be ready for planting by early or late spring. Seldom were they raised in containers that were larger than five-inch square plastic pots. Only the shrubby types might be transferred to gallon-cans, and often then there would be high mortality during the summer months.

Culture: Much has been written about the culture of these lovely, but often short-lived, plants. Penstemons are highly susceptible to root rots, and must be provided with the best drained spot possible. Mounds, composed of rocky soils that are located in warm locations are highly recommended. Even under the best conditions, trouble will be encountered usually after their third year of growth. Some of the higher mountain species or those from wetter climes or habitats, should be given high shade and moderate dosages of moisture when they are grown in hot inland conditions such as at our Claremont site. However, most perennial species grew well for periods of three to five years before it was necessary to renew the plantings. The shrub species could be depended upon to last for many years, again depending on the species and the actual growing conditions. The following data indicates to what degree we were successful in handling the many kinds of penstemons that we attempted to grow at our Claremont site. It is difficult to state whether or not they were more or less successfully grown here than at the old site. Some species, such as *P. heterophyllus* ssp. *australis*, grew less well than at the old site, and we had similar experiences with some of the shrub species. On the other hand, the higher elevation species and those from more completely different habitats, settled in to the site conditions in Claremont much better than at the old site.

Hybrids – One of the notable crosses was *P. antirrhinoides* x *P. cordifolius*. Our seed was produced by a controlled cross with the seed parent being *P. antirrhinoides*. The result was a somewhat upright plant, that grew from three to four feet tall, had a somewhat decumbent growth habit, and was partially to fully deciduous from the summer until fall. Flowers were borne in abundance and were about the size and shape of *P. antirrhinoides* but with a reddish lip. A superior individual with a greater amount of red coloring was produced easily by taking semihard side shoot cuttings in late April and treating them with CUTstart XX. These cuttings rooted in 13 days, and while 76 were potted, all of the cuttings had calloused and likely would have rooted. While the individual plants were not long-lived, we have had adequate plantings of this hybrid for the past 15 years. Excellent seedling production occurred on every occasion sown over a period of ten years.

Another hybrid often seen in the wild is the cross known as *P. x parishii*. Seedlings raised from such a collection often produce *P. x bryantae*, a handsome hybrid first seen and described from specimens at our old site. Our one collection produced only a few seedlings from two sowings, and none proved to be of any value. None exhibited the characteristics of *P. x bryantae*, and were not particularly interesting.

A third hybrid first observed in the garden, in 1962, was propagated from seed to determine its parentage. The plant was found growing among *P. eatonii*, and was a very sturdy, upright plant with much the appearance and upright growth habit of that species, but it produced bright rose to lavender flowers. The seed quality from that collection was good, and over 1,500 seedlings were raised from a trace amount of seed. At maturity, many of the progeny exhibited characteristics of *P. eatonii* and/or *P. spectabilis*, which grew in quantity nearby. One plant which seemed worth propagating was reproduced from tip cuttings taken in November and treated with Rootone. Within ten days rooting started and 99% were potted up. Within two years all of these plants were reported dead.

Penstemon albomarginatus M.E. Jones. – We collected seeds from plants growing in the deep sand near Lavic, in the southern Mojave Desert. This is an interesting but different species to grow. Only one seedling germinated in a loose, deep soil, but after a few months it had withered away.

***Penstemon anguineus* Eastw.** – The underground creeping rootstock of this species made it possible to easily reestablish it in pots in October, when seed was not available. Placed in shady portion of the rock garden, the plants thrived for several seasons, although diminishing in number due to root rot. Seeds were harvested on several occasions, but these did not grow well and in a matter of six years, all of our plants had disappeared. Here in Claremont, this species needs full shade and even then the leaves had a burned appearance in the hot summer months. Flower color was a poor washed-out blue-violet.

***Penstemon antirrhinoides* Benth.** [Ed: *Keckiella antirrhinoides* (Benth.) Straw. TJM2] Yellow Beard Tongue. – While there was no problem establishing this shrubby species, and many plants were 15-years-old, it never seemed to quite attain the vigor and lushness as it did when growing in the clay soil at the old site. We placed these plants among other shrubs in full sun, and in decomposed granite loam. After ten years, these plants measured three to five feet tall and had spread from three to seven feet across. The **ssp. *microphyllus* A. Gray.** [Ed: var. *microphyllus* (A. Gray) N.H. Holmgren. TJM2], found growing in very rocky places below 5,000 feet at the western edge of the Colorado Desert and in the southern and eastern Mojave Desert, was less readily established. These plants produced few seedlings, and the plantings diminished slowly over a period of seven years, after which they were reported gone. Our largest plants attained heights of two feet and had spread up to three feet wide. First flowers were noted in their third year of growth, but the blooms were sparse.

***Penstemon azureus* Benth.** – This dry slope species from central California to southwestern Oregon, and its **ssp. *angustissimus* A. Gray.** fared less well here at our Claremont site than at the old site. Our plants were set out in several locations, they grew much better in the areas of the mesa clay-loam soils that could be kept quite dry. In sandier or rockier locations, the plants failed to perform well, and were very short-lived. Most of the plants grew well for a three to four year period after which the dwindled away.

***Penstemon breviflorus* Lindl.** [Ed: *Keckiella breviflora* (Lindl.) Straw. TJM2] – Six wild collections of this shrubby species from widely separated areas were grown. This species inhabits very dry rocky slopes, and we endeavored to duplicate such growing conditions here in the garden. While losses were kept to a minimum, they were gradual – and over a period of ten years their numbers were greatly diminished. Although the plants were considerably damaged by rabbits, normal sized plants were recorded, and measured up to four feet tall and had spread up to seven feet wide. First flowering and seeding were noted in their first or second year.

***Penstemon bridgesii* A. Gray.** [Ed: *Penstemon rostriflorus* Kellogg. TJM2] – A mountain species, ranging up to 10,500 feet in elevation, we had little success trying to grow this species in our collection. Plants grew best in well-drained granitic loam soils, but we failed to maintain them for any length of time. Often producing fine strands of color in its native habitats, it exhibited only a small degree of this potential in the garden, although it occasionally performed very well.

***Penstemon caesius* A. Gray.** – Three plants that were collected in the wild were readily re-established in containers. Our notes indicate that the plants send down roots from the stems as the plant grows. These plants were presented to us in October, and were planted out the following March in the rocky granitic loam under a pine tree. Unfortunately no records indicate how the plants grew as they were set out in 1965 and not enough time had elapsed.

***Penstemon centranthifolius* Benth.** Scarlet Bugler. – Preferring sandy or porous rocky soils, this well-known species has been grown by gardeners worldwide since 1836. While our success has always been good, the species has not performed as well at this site as it did at the former site. We have maintained the species in our collection, but they never seem to be quite as vigorous or floriferous as we had been accustomed to seeing. Except for over watering in less well-drained soils, there is little else that needs to be said about its horticultural requirements.

***Penstemon clevelandii* A. Gray var. *connatus* Munz & I.M. Johnst.** – Found in the arid canyons of the western edge of the Colorado Desert in Riverside County, this entity was grown from seed harvested from the original collection that was gathered in the wild in 1938. Some of our plantings were successfully grown for six years, but generally four years is about the average life span for this species in cultivation. Additional seeds harvested from our own plants showed considerable hybridization and until new material could be introduced, the plants were gradually discarded. Because of this hybridization, and a lack of new seed collections from the wild, we have not yet introduced this species to our collection here in Claremont.

***Penstemon confusus* M.E. Jones ssp. *patens* (M.E. Jones) Keck.** [Ed: *Penstemon patens* (M.E. Jones) N.H. Holmgren. TJM2] – Two collections were gathered in the White Mountains of Inyo County at 7,200 feet elevation in July 1956. One collection was of seeds and the other was a few plants. Over a period of two years, several sowings were made of the seeds and only seven seedlings were obtained, and of these only four were successfully raised and planted out in the garden. Likewise, five plants were successfully transplanted from the wild. All the plants were placed in our rock garden, where indifferent growth was noted over a period of six to seven years – at which time it was noted that the plants were gone. This species is rather restricted in area to very dry hills and canyons surrounding Owens Valley in Inyo and Mono counties, and as this is such a different environment from the garden, it is not difficult to understand our lack of results.

***Penstemon cordifolius* Benth.** [Ed: *Keckiella cordifolia* (Benth.) Straw. TJM2] Honeysuckle Penstemon. – Commonly seen clambering over the brush on the hillside slopes of the coastal mountains of Southern California, the honeysuckle-like dull scarlet flowers create generous splashes of color. The species is native to the oak shaded banks of our mesa and only in that and similar locations did it perform well in this region. When plants were set out in open exposures in the rocky granitic loams, they burned up and were difficult to establish. Plantings around the bases of large shrubs that provided some shade and structure that the long scandent stems could hang from, could be established with some degree of success. This species appears to appreciate the heavier clay soils of the mesa and grows best there.

***Penstemon corymbosus* Benth.** [Ed: *Keckiella corymbosa* (A. DC.) Straw. TJM2] – Surprisingly, this wholly northern California species, with its main center of distribution in the redwood belt, has performed extremely well for us in this hot interior climate. Our plantings produced abundant seedlings, such that we were able to establish several colonies. Our most successful planting was in a shady portion of the rock garden. Quantities of volunteer seedlings had to be eradicated, otherwise the whole area would have been covered thus forcing out many other kinds of plants. Some plantings have been recorded for over a ten year period in shady but drier situation and with more competition from large, surrounding shrubs and trees. Plants in this location grew up to 18 inches tall and had spread up to three feet wide. The first flowering and seeding were noted in their second year. Rabbits chewed on these plants to a high degree.

***Penstemon davidsonii* Greene.** – This diminutive alpine plant, found among rocky outcrops and in crevices at elevations from 9,000 to 12,000 feet, was collected on four occasions, three in 1952, and one in 1966. The latter failed to germinate. Of the former, two were seeds collections that produced a few plants after cold-stratification. The third collection was two small plants, which were planted in pots in the nursery and were later planted out in the garden. Since overhanging oak trees provided the deepest shade in our rock garden, we used them in such situations. The plantings had a good start and were growing into nice clumps up to a foot across, but they succumbed in their third year from being crowded out by larger more vigorous plants and the heavy layer of fallen oak leaves. The large volume of old oak leaves caused these small penstemons to rot and the plants soon died. However, it would be doubtful if this high mountain species could be established for any length of time in this location.

***Penstemon deustus* Lindl.** – In early day of horticulture, this species was called “Parched Penstemon,” referring to the original habitat description as being found “on scorched, rocky plains, in the interior.” Coming from such a dry, sterile condition, the plant makes a rather neat mound. However, if grown in shadier and richer soils, it becomes lax and unattractive. A profuse bloomer, it is unfortunate that the flowers are small, and an off shade of white to yellow. Introduced by us at the old site, we have continued with several new collections as well as new plantings that were grown from seeds gathered from our older collections. Some plants have reached eight to ten years in age, but generally they have shown a tendency to die out in five to seven years. When planted in our rock garden and adjacent dry areas, they have survived as part of our collection for nearly 15 years. Plants are produced in quantity by seeds or divisions of the spreading crown of the plant. One seed collection of **ssp. *heterander* (Torr. & A. Gray) Penn. & Keck** [Ed: var. *pedicellatus* M.E. Jones. TJM2] was grown in 1952, and the young plants were set out in January 1955. All of these plants were reported dead in 1963.

***Penstemon eatonii* A. Gray.** – Both the species and the **ssp. *undosus* (M.E. Jones) Keck** [Ed: var. *undosus* M.E. Jones. TJM2] have been part of our living collection for many years. Not until 1952 was the species itself added, but the subspecies was grown for many years at the old site. Both have done well for us, even though these are comparatively short-lived plants. We have brought in several new collections from the wild, and have increased our displays with many additional plants grown from garden harvested seed. One garden hybrid was noted (and is discussed at the beginning of this *Penstemon* section).

Penstemon floridus* Brandegee.** – An inhabitant of the arid, rocky canyons and washes of Mono and Inyo counties, at elevations of 6,000 to 8,000 feet, this species and its **ssp. *austinii* Eastw.** [Ed: var. *austinii* (Eastw.) N.H. Holmgren. TJM2] (named in honor of Mary Austin, author of **Land of Little Water**) were readily grown from seed and raised to maturity. First flowering was noted within a two year period. Nevertheless, this is a short-lived plant here in Claremont. Further, it hybridized readily with ***P. spectabilis and other similar penstemons, such that seed collected from cultivated plants could not be depended upon to produce the desired species. In our desert garden, we introduced several colonies, some of which persisted for several years but on the whole our plants were short-lived. However, we felt recompensed with its floriferousness and rapid growth.

***Penstemon fruticiformis* Cov.** – We continued to grow this species from seed harvested at the old site, where the species was grown with some degree of success. While plants grew well here, they somehow became lost in our overall efforts to produce a botanic garden and never attained much success here. After six to eight years, all of our plants had disappeared. This species is

easily grown from seed. Like many of our penstemons, this species comes from an arid region at 3,000 to 6,000 feet elevation, in mountains of Inyo County.

***Penstemon gracilentus* A. Gray.** – Two collections of seeds failed to germinate, and one collection of two small plants failed a short time after they were introduced to the garden.

***Penstemon grinellii* Eastw.** – Confined to the dry, granitic slopes and ridges of the San Gabriel Mountains to the Santa Rosa Mountains in Riverside County, this compact species is endowed with flowers much like *P. palmeri*, however, it has never attained popularity of the latter species in cultivation. It has always performed well for us, growing thriftily under high shade under pines and at the edges of oaks. Preferring such situations, it has been a good plant for us in, and adjacent to, our rock garden. Again, as with so many of the species of this genus, plants are relatively short-lived, but we have had some plants reach ages up to eight- or even ten-years-old. Volunteer seedlings were noted in abundance, and again hybrids were noted apparently crossed with *P. spectabilis*. The **ssp. *scrophularioides* (M.E. Jones) Munz** [Ed: var. *scrophularioides* (M.E. Jones) N.H. Holmgren. TJM2] , was started from a collection of seed harvested at the old site plus an additional seed collection gathered from the wild in 1956. Quantities of seedlings were raised and one collection was recorded as growing for seven years, although the majority disappeared in four to five years. Highly susceptible to root rots, this species survived only the driest conditions.

***Penstemon heterodoxus* A. Gray.** – While the germination rate was generally poor, those that did germinate, grew surprisingly well not only for this species but for the **ssp. *cephalophorus* (Greene) Keck**. [Ed: var. *cephalophorus* (Greene) N.H. Holmgren. TJM2] Seed collections from both wild and cultivated plants performed poorly, but collections of plants were maintained for periods up to seven years in the rock garden (an ideal plant for such situations) and in other parts of the garden. Flowering and seeding were recorded. This species is from high elevations in the mountains where it grows on sloping granitic soils and in mountain meadows. It is a very attractive plant when grown properly.

Penstemon heterophyllus* Lindl.** – One of the most important cultivated *Penstemon* species, this along with its **ssp. *australis* (Munz & I.M. Johnst.) Keck** [Ed: var. *australis* Munz & I.M. Johnst. TJM2] and **ssp. *purdyi* Keck** [Ed: var. *purdyi* (Keck) McMinn. TJM2], were grown extensively every year. However, the most successful and the most desirable was **ssp. *purdyi. Again, plants were very short-lived, but produced quantities of volunteer seedlings, so that there was no problem in maintaining the various botanical entities. The abundant deep steel blue flowers of **ssp. *purdyi*** make it an attractive garden asset, but it must be grown in dry situations. Much has been written in horticultural literature about this species and its various horticultural forms, and because of the colorful effects obtained from the floriferous plants, any shortcomings are quickly forgiven.

***Penstemon incertus* Brandegee.** – Results inconsistent, including seed germination as well as plant growth. While several plantings of this arid land species grew thriftily for a few years and produced an abundance of color and seeds, they quickly deteriorated. We grew our best display of this species in a very well-drained area that received more than the usual amount of water. This planting, in a well-protected, sunny, warm area against a building, grew exceedingly well until it was overpowered by large shrubs.

***Penstemon labrosus* (A. Gray) Hook f.** – This species inhabits coniferous forests in the mountains. We introduced it to our Claremont site in 1956 and again in 1959. The plants were

still growing after seven years in the rock garden, and had produced flowers and seeds for several years. Under our conditions, the flower color was not so strong and the stems were very lax, particularly on those plants growing in partial shade.

***Penstemon laetus* A. Gray.** – This is another popular species in cultivation. We continued to propagate plants from our collections at the old site, and we introduced new collections from several different localities in the wild. All were grown successfully, and fine displays of color were produced over the years. The **forma *albus* Everett**, grown for many years at the old site, gradually disappeared, although a few plants were to be seen here and there. The **ssp.**

***leptosepalus* (A. Gray) Keck** [Ed: var. *leptosepalus* A. Gray. TJM2] was a great success in our rock garden. While it is a taller growing plant, it fit well into the scene and became naturalized, producing each numerous seedlings each year that spread out in the area. The **ssp. *saggitatus* Keck** [Ed: var. *saggitatus* (Keck) McMinn. TJM2] was first introduced to our collection in 1952. While not all of our collections of this species were successful, records indicate one accession was successfully growing in the rock garden for periods of at least eight years. Seeds were harvested in July 1963 from plantings that were made in January 1955.

***Penstemon nemerosus* (Lindl) Trautv.** [Ed: *Nothochelone nemorosa* (Lindl.) Straw. TJM2] – One collection of seed of this shade and moisture desiring species was gathered in October 1954. Our first attempt to germinate untreated seeds failed. For our second attempt, the seeds were cold-stratified for nearly six months and a nice crop of seedlings were grown. These plants were planted in our rock garden. Notes for this planting reveal that only two plants were alive three years later, and these had flowering stalks that were 18 inches high. These plants apparently died not long afterwards. Subsequent attempts to germinate seeds failed.

***Penstemon neotericus* Keck.** – Seeds of this open pine woods species from central northern California were first gathered in 1952. A small collection of plants was also gathered in October 1952. These two collections of seeds and small plants were grown and established in our rock garden, where they performed quite well. Subsequently, we harvested two collections of seeds from our plantings, and both produced a fine quantity of seedlings. These were growing in the rock garden, in a sunny position in 1965.

***Penstemon newberryi* A. Gray.** Mountain Pride. – This fine rock garden species has been known to cultivation since about 1872. Always a popular species, we have made numerous attempts to get it established in our collection. But this has been a difficult task as noted by our numerous collections: six seed collections from the wild, four seed collections from our garden-grown plants, and two collections of rooted cuttings of a noteworthy plant that was grown from one of our wild collections. Cuttings were readily rooted with Rootone treatment, and were taken in both May and October. We experienced ongoing problems with germinating the seeds: three seed collections were divided up into ten different lots and all failed to germinate, even with cold-stratification for varying periods between two and six months. One seed collection gathered in September 1958, along the north fork of the Feather River in Plumas County, produced a single seedling. It grew to be a vigorous plant from which we gathered over 100 cuttings and several lots of seeds. This plant seemed to prefer partial shade, and it developed into a specimen 12 inches tall and 18 inches across, and was alive in 1966. It was, by far, the best plant we ever grew of this species, which in general was very short-lived for us. It had clean, dark green leathery leaves and the flowers were a reddish-purple, not the best color form we have seen, but good. In our area, the colors fade somewhat from what one sees in their natural habitat. A seed collection from near the Stanford Experiment Station at Saddlebag Lake in Tuolumne County

was determined, by Dr. Jens Clausen, to be a hybrid between *P. newberryi* and *P. davidsonii*. This collection was sown five years after it was collected, and failed to germinate.

***Penstemon oreocharis* Greene.** [Ed: *Penstemon rydbergii* A. Nelson var. *oreocharis* (Greene) N.H. Holmgren. TJM2] – Surprisingly, this species has been one of our most successful introductions in the genus *Penstemon*. Seeds were sown and cold-stratified in September 1952 from a collection gathered earlier that same month in Plumas County, and the results were poor. Another sample of this seed collection was sown again in September 1954, and we had excellent germination from untreated seeds. The plants became well-established in a low portion of the rock garden where additional water could be supplied. Soon afterward, the plants spread out from their basal rosettes and began flowering and producing seedlings. Several collections of seeds were gathered from these plants and in subsequent years many were planted beside a stream on the mesa. Here they performed in a most excellent manner, producing fine patches of color, quantities of seeds, and many volunteer seedlings. Established specimens could be readily transplanted and this practice was followed to some extent. This species is highly recommended for the rock garden or other areas where some water is available for extra irrigations. This plant is normally found in damp to wet mountain meadows which may become dry during the latter part of the season. Elevations range from 4,600 to 8,000 feet from the central Sierra Nevada to Washington and Idaho.

***Penstemon palmeri* A. Gray.** – Termed “a most noble plant” by some horticulturists and attempted by a great many *Penstemon* enthusiasts over the world. Our final conclusion is that this demanding species should be left for those who can most closely duplicate its natural habitat and demanding culture. A very warm, dry climate and absolutely perfect drainage are two of the essential ingredients. Even then this biennial or perennial species will be relatively short-lived, seldom lasting more than three, four, or more rarely six years. But once attaining maturity in a proper site, and where it can be observed at close hand, it truly is a fine plant. The slightly fragrant flowers arrange themselves mostly on one side of the four to six feet tall stems. The flowers are whitish suffused with light to deep pink or lilac. Seed gathered from plants adjacent to other *Penstemon* species, such as *P. spectabilis*, often produces a high percentage of hybrids. Occasionally, such hybrids are valuable for propagation, but the percentage is small and generally poor types are seen.

***Penstemon pseudospectabilis* M.E. Jones.** – Our first seed collection of this species was received in October 1964. Sown a year later, it was first cold-stratified, although this was probably unnecessary, and an excellent crop of seedlings was grown. These plants were set out in March 1966, so it is too early for any observations to be recorded. However, one entire planting was recorded as being dead during its first year in the garden – a very unsatisfactory beginning.

***Penstemon rattanii* A. Gray ssp. *klei* (Greene) A. Gray.** – This species from the Santa Cruz Mountains, was added to our collections in 1964 from a fine crop of seedlings raised the previous season. These plants were planted in our rock garden under a large pine tree. Their growth was vigorous and seemed to be a good omen for success. Flowering and seeding were noted a year later, but subsequent losses were severe. Under more natural circumstances, this entity, and the species itself, might prove to be useful in areas closer to the coast.

***Penstemon scapoides* Keck.** – We made three collections: two of seeds and one of plants. We attempted to grow them in 1951 and 1956. Both lots of seeds failed to germinate, and only three

plants were successfully grown and planted out. There are no further records to indicate their history in the garden.

***Penstemon speciosus* Lindl.** – One of the earliest species of this genus to be introduced to horticulture from David Douglas' collection, this lovely penstemon has been sought and grown ever since. As with the many other species of the genus, this one is difficult, but is probably more amenable to some forms of culture. Our results, while much better than at the old site, have not been considered highly successful. Seeds were gathered from five- and seven-year-old plants in the garden in order to grow additional plants for the garden. Flower color has never been as deep a blue as those seen in the wild, but a number of healthy plants have been grown and maintained. One collection of the **ssp. *kennedyi* (Nelson) Keck.** [Ed: the ssp. is not recognized in TJM2] was introduced in 1953 but lasted only a few years after flowering satisfactorily.

***Penstemon spectabilis* A. Gray.** – One of our most common local plants, this species comes up in great quantities all over the garden. Again, this species is a comparatively short-lived, even under natural conditions. However, such great quantities of volunteer seedlings are produced each season, that we have no problem maintaining a suitable display of this fine and colorful plant. In local areas of Southern California whole hillsides of dry granitic soils become a mass of purplish haze from late spring displays. A fine albino form has been separated and produced by cuttings. [Ed: This has happened a number of times over the years at the garden as albino forms pop up on a regular basis in the garden. One of these was named and introduced in 2001 as 'Snow Dragon'.]

Penstemon ternatus* A. Gray.** [Ed: *Keckiella ternata* (A. Gray) Straw. TJM2] – Our cultivation of this species started from a seed collection gathered in San Diego County in 1929. Over the years, we have harvested seeds from these plants to produce all the necessary plants for our collection. This species has a straggly growth habit that ranges in height up to five feet or more, typically clambering over adjacent shrubs. It prefers a similar garden situation to those favored by ***P. cordifolius: a high semi-shaded position. While appearing to grow best in rocky clay soils, it has also grown strongly in an open, flat sunny location in rocky, decomposed granite loam. As adjacent shrubs have grown larger, affording more shade and protection, the plants have shown better growth. The same conditions hold true for the **ssp. *septentrionalis* (Munz & I.M. Johnst.) Keck.** [Ed: var. *septentrionalis* (Munz & I.M. Johnst.) N.H. Holmgren. TJM2]. Plants up to 15-years-old are observed growing in a most healthy manner in several locations in our present site.

***Penstemon thurberi* Torr.** – Used in our desert garden, this attractive southern desert species has fared better than many of our other desert penstemons. While not growing strongly, it has been one of the species that has survived in our area for many years. Occasionally, seed collections were harvested from the garden and seedlings were grown to replenish our colonies. It seems that we always had plants that were several-years-old.

***Penstemon utahensis* Eastw.** – This species was reintroduced into the garden from new wild seed collections in 1952, and by several collections of seeds that were harvested from plants over four-years-old in the garden. We have kept this small penstemon as one of the interesting features of our desert garden since that date. Repeated notes indicate these plants grew normally and strongly in our area. But, as with various other species, plants began weakening after four to six years of age and the plantings needed replenishing. Counter to previous experience, we usually received abundant seedlings from most of our sowings, but care must be used in starting the seedlings in pots. Once established, there was little trouble.

***Peraphyllum ramosissimum* Nutt.**

Desert Apple.

Shrub.

Rosaceae. Rose Family.

Propagation: Bailey (1927. Page 2546) says propagation is by seeds and layering and grafting, the latter on to *Amelanchier* or *Crataegus*, as these are noted as being closely allied to the *Peraphyllum*. Without previous experience, we cold-stratified seed for two months prior to sowing. First germination occurred in 16 days later but was sporadic over a period of two months and yielded 15 plants. An attempt a year later soaked the seeds for 15 hours in hot water and produced only three seedlings. After potting the first lot, the remaining seeds were tested and were found to be rotten inside. Fourteen of the 18 seedlings were successfully raised in the nursery and were planted in the garden. This is a very slow growing plant, we planted them out six months after they were potted up. When the plants were planted in the garden, they were noted as having a strong root system but very little top growth. Perhaps four to six months of cold-stratification might yield better germination rates.

Culture: Growing in a sage brush scrub community in open country at 4,800 feet elevation, we gave our plants a well-drained, sunny position in open ground. The young plants were one to two inches tall when set out, and after ten years the remaining three plants measured eight to 30 inches tall, seven to 28 inches wide, and were noted in fair to poor condition. It is believed that these plants would have responded better if they had been planted in a heavier soil, such as rocky clay, but on a well-drained slope. Our records show no flowering or fruiting to last record date, and it is doubtful if they would for many years as evidenced by information provided by Bailey (1927). Only one plant was still alive in 1973.

***Perityle emoryi* Torr.**

Annual.

Asteraceae. Sunflower Family.

An inhabitant of very dry, desert-like habitats in Southern California and adjacent states, this annual was successfully raised for two seasons but was subject to freezing and could not be continued in this area. One plant became almost shrub-like and continued to grow for two seasons although it was badly setback by frost.

***Petalonyx thurberi* A. Gray.**

Sandpaper Plant.

Shrub.

Loasaceae. Loasa Family.

We received two plants growing in containers, and we planted them out in our desert garden in September 1952. Three years later they were recorded as being dead. There is no other information. This species is a frequently seen shrub in dry sandy places of our deserts and eastward.

***Petasites palmatus* (Aiton) A. Gray.** [Ed: *Petasites frigidus* (L.) Fr. var. *palmatus* (Aiton) Cronquist. TJM2]

Western Coltsfoot.

Perennial.

Asteraceae. Sunflower Family.

This deep shade loving plant from the heavily wooded areas of coastal northern California and northward, was transferred from our old site, where one plant was transplanted and re-established in a gallon-can. This plant was then replanted at the edge of a stream bed, where it did not successfully take hold. This plant was recorded as flowering once (and for the first time, for us) in this new site. We did not have seeds to try to regrow this species again until 1966.

***Peucephyllum schottii* A. Gray.**

Pygmy-Cedar.

Shrub.

Asteraceae. Sunflower Family.

Propagation: Untreated seed germinates in six to 12 days. Damp-off prevention measures must be strictly followed during the seedling stage. Our results were good when the seedlings were carefully handled. Out of a possible 68 seedlings that were potted, 26 were subsequently planted in the garden.

Culture: Found in the driest, rocky, cliff-like exposures in desert canyons, this attractive plant needs the most specialized attention to raise it. Out of a possible 26 plants that were planted, only one survived to grow into a handsome small plant that flowered profusely in its third year. This specimen measured 15 inches tall and was 18 inches across, and appeared to be established. However, in its fifth year, it was noted as being dead. Other seedlings failed to establish.

***Phacelia* Juss.**

Annuals and perennials.

Waterleaf family.

A New World genus, mostly of western North America, of some 200 species, it is widely distributed in a large part of California. Here we find some 87 species and several subspecies or varieties. While we have only raised a small portion of the species native to our state, we have gathered and grown most of the valuable horticultural species. Generally, the phacelias are not popular, as they have two serious objectionable qualities. First, some people that handle the plants are subject to a severe allergic reaction or dermatitis similar to poison-oak, and second is the bad stain one gets on hands or clothing from incidental contact with many (but not all) of these plants. The flowers on the most desirable species are generally some shade of blue or purple and do indeed provide colorful displays in the proper setting. The showy annual species generally perform best when grown in dry, open soil and on hillsides. The desert species usually have the most brilliantly colored flowers, but are, on the other hand, generally more difficult to raise. Quite sandy, warm situations are best. We raised them most efficiently in a narrow, well-drained area on the south side of a metal building.

Propagation: Seeds of perennials may be sown in flats, and for the most species this is the best method. Ten to twelve days are required for good germination. The annuals were all sown directly into a garden site and depending on moisture conditions of the soil, seedlings may appear in a week or after several weeks. Desert species were generally slower to germinate than our long established coastal species. The following is specific data for each species:

***Phacelia bolanderi* A. Gray.** – This perennial from the immediate north coastal environs, was first acquired by the garden in 1934. In 1947, one plant was discovered alive and was transplanted into a five-gallon container, where it grew vigorously. This plant was later planted in a north semishaded slope with much oak leaf humus. It thrived and from this lone plant, volunteer seedlings appeared in a wide selection of sites. In some areas, the abundant plants have needed thinning. Not a particularly attractive species, the flowers being a faded blue, it nevertheless has adapted itself most successfully to our environs.

***Phacelia brachyloba* (Benth.) A. Gray.** – This species was grown most successfully at the old site in adobe clay soil. It was introduced to our new site from a new collection gathered in 1952, but it never became established. Unrecognized, it was hoed out in a heavily weeded area. Since that time, this species has not been recollected, but it can safely be said it would have grown well here in the garden.

***Phacelia calthifolia* Brand.** – Gathered in 1958, along a road to Trona in Inyo County, this high desert species was flowered once in the rock garden after failing to grow in our desert garden. The plants were unhealthy looking and feeble, flowering poorly, and not setting any seed.

***Phacelia campanularia* A. Gray.** – The large, deep blue corolla of this lovely desert species makes it one of our favorites. Standing upright to two feet tall when at its best, the plant is indeed a lovely specimen. Needing the warmest and best drained spots, we were most successful in growing it against a metal-covered building facing south where the plants received the full winter and spring sun all day. Other successful sowings were in the desert sand dune area, where, while only scattered plants were observed, they made nice specimens. Numerous seed collections were made through the years to maintain the species.

***Phacelia ciliata* Benth.** – Essentially a species of the foothills of the Central Valley and southward, we have successfully grown it since the 1935. Our original collection was from the heavy clay soils of Lockwood Valley in Ventura County. This collection has always performed well in our heavy soils, although it does equally well in the lighter soils.

***Phacelia crenulata* S. Watson.** – This common desert annual is found in dry washes and open places mostly below 3,000 feet, from northward of Twenty-nine Palms and northeastward. This species appears to have an inhibitor which prevents easy germination. We tried soaking seeds in water and cold-stratification, but these treatments seem to have little effect. Observation of sowings in our desert sand dunes indicates that heavy germination a year or two after sowing may be expected. However, wet and colder winters seemed to prevent good stands and notes indicate that most of the plants and flowers were poor, although they were noted in these areas for several years. Two seed collections of the **var. *ambigua* (M.E. Jones) J.F. Macbr.** failed, producing only one small seedling from several sowings.

***Phacelia divaricata* (Benth.) A. Gray var. *congdonii* (Greene) Munz.** [Ed: *Phacelia congdonii* Greene. TJM2] – This is another easily grown annual species that was originally acquired from Tejon Canyon in Kern County in 1935. We have continued to successfully grow and propagate

this species here. Our plantings are particularly successful in the rock garden, where each year it volunteers in some abundance. Flowering in March, the seeds are harvested in May or June.

***Phacelia floribunda* Greene.** – This annual is found growing in sheltered places on San Clemente, Santa Barbara, and Guadalupe islands. Our two collections came from San Clemente Island in 1962. One failed to germinate, and the second from which only a few seedlings appeared, was killed by our frosts.

***Phacelia fremontii* Torr.** – Principally seen growing on sandy or clay slopes and flats of both of our deserts, this species, as with other desert species, appears to have a germination inhibitor and usually only sporadic or poor germination occurs in the first season. As with so many of our desert-type annuals, either the seasons were too wet and cold or for other reasons, they failed to grow as well as in their native habitat. However, we managed to grow good displays on several occasions. A note indicates a sowing made in 1958, when only a few scattered plants appeared, had germinated and was flowering well three years later.

***Phacelia grandiflora* (Benth.) A. Gray.** – This species appears most abundantly after fires and otherwise is only occasionally seen in open and disturbed places. While its main distribution is from Santa Barbara County southward to northern Baja California (Mexico), and inland as far as Claremont, it was very difficult to get it to grow here, only sporadically did they grow into a normal sized bush. At its best, this species is attractive, but in our area it did poorly and could not be considered for any sort of display.

***Phacelia lyonii* A. Gray.** – Another insular species, inhabiting the coastal sage scrub areas of San Clemente and Santa Catalina islands, we sowed seed in our rock garden in 1959. During weeding operations, workmen unfamiliar with the seedlings, weeded them all out.

***Phacelia minor* (Harv.) F. Zimm.** Wild Canterbury-Bell. – Seen in abundance for a long period each spring in the garden, this species is native to the area in the more sandy and rocky sections off the mesa. It was so abundant here that it was almost classed as a weed and had to be controlled to some degree. However, it is a prolific and abundant producer of large patches of color in our Southern California hills, particularly after a fire. Whole hillsides are observed completely covered with the deep purplish flowers of this species.

***Phacelia parryi* Torr.** – This is another species seen in abundance after fires in the hills of Southern California from Monterey County to northern Baja California (Mexico), and at the western edge of the Colorado Desert. The flowers of this species are deep purple. It has always been a strong part of our spring scene. The last few years there appears to be a weakening of the seed since our strain has come down through the years from our first and only source, the Theodore Payne Seed Company. We purchased seed from him in 1932. [Ed: Everett states that this collection has “a bright, lighter blue flower” so it may not have been correctly identified.]

***Phacelia tanacetifolia* Benth.** – This common species of the central portions of the state and south to Baja California (Mexico), has always been a very simple plant to grow. In fact, in our first years here, it was necessary to take drastic control measures to keep it from overgrowing other less vigorous annuals in nearby areas. As time has gone on, there has been a lessening of its vigor here, and it is seen less abundantly in the annual spring plantings.

***Phacelia vallis-mortae* J.W. Voss.** – This is another difficult desert species. We had little luck in trying to establish it, as very few seeds germinated. These seedlings promptly died.

***Phacelia viscida* (Lindl.) Torr.** – This species is from sandy coastal areas from Monterey County to San Diego County, and the Channel Islands. We have had this species in our collections since we first purchased seed from Theodore Payne in 1932. We continue to grow this species in a highly successful manner.

***Philadelphus lewisii* Pursh. ssp. *californicus* (Benth.) Munz.** [Ed: the ssp. is not recognized in TJM2]

Mock-Orange.

Shrub.

Saxifragaceae. Saxifrage Family. [Ed: Hydrangeaceae. Hydrangea Family. TJM2]

Propagation: Untreated seeds germinate in 11 to 21 days. We experienced no problem with handling and growing the seedlings. Softwood cuttings, untreated but placed under mist, rooted at a rate of 99% with initial rooting in 18 days. There were no problems with growing the cuttings onward.

Culture: In our area, this plant does best in either well or poorly drained soils as long as they are provided with some shade and plenty of water. From our plantings at the old site, we potted up two plants that were replanted here at our Claremont site on July 27, 1951, on a north facing, semishaded slope. These plants were provided with plenty of water and grew vigorously. They attained heights up to ten feet tall and provided us with plenty of propagative material. Additional lots of seedlings were raised and the plants were used in other sections of the garden. Additional collections of seed from the wild were gathered and several plantings are growing very well in several appropriate plant communities. Those planted in full sun must receive plenty of water to do their best. Losses have been small and plants that are 15-years-old now measure four to eight feet tall and seven to 12 feet wide. Flower and seed production began in their second year. This information is the Sierran form that is found from Tulare County to Humboldt, Siskiyou and Trinity counties. Plants flower from May to July.

***Philadelphus lewisii* Pursh. ssp. *gordonianus* (Lindl.) Munz.** [Ed: the ssp. is not recognized in TJM2]

Propagation: Similar to the foregoing entry, untreated seeds germinate in nine to 12 days. We have no experience with growing this taxon from cuttings, but presume that it would be just as easy. Seeds appear to be short-lived, as subsequent sowings a year later failed completely. We had this experience more than once.

Culture: This is the North Coast Range form, seen in the mountains from Lake and Mendocino counties to Del Norte and Siskiyou counties. Since acquiring seed in 1930 and 1941, we have successfully grown this taxon at the old site and in our present Claremont location. From these two collections made in Siskiyou County, we have harvested several collections of seeds from the garden for additional plantings. We transplanted six plants in February 1950 into five-gallon-cans and kept them in these containers until they were replanted at the Claremont site in April 1951. All survived until after the 15th year, and in the 20th year there were still five good plants measuring from six to nine feet tall, and from eight to 12 feet across. The plants were pruned back quite severely when they were transplanted into the five-gallon-cans. This taxon needs similar horticultural conditions as the above.

***Philadelphus microphyllus* A. Gray ssp. *pumilus* (Rydb.) Hitch.** [Ed: the ssp. is not recognized in TJM2]

Shrub.

Propagation: Seeds that were cold-stratified for three months failed to germinate. Five small bare-root plants reestablished in gallon-cans without difficulty. One of these flowered after six months later in the nursery.

Culture: An endemic of the San Jacinto and Santa Rosa Mountains of Riverside County at elevations between 7,000 and 8,500 feet, we found this small plant growing among the large granite boulders at the upper edge of the yellow pine forest. To observe it more closely, we established the plants in a rocky granitic area where they settled in, but not without gradual losses. The first year, one poor specimen died. After that, the four remaining plants did well and flowered but produced no seeds, for the next four years. At the age of ten years, only one plant survived in fair conditions and measured 15 inches tall and 22 inches across.

***Phlox douglasii* Hook. ssp. *rigida* (Benth.) Wherry.** [Ed: the ssp. is not recognized in TJM2]

Perennial.

Polemoniaceae. Phlox Family.

Propagation: Our only attempt to grow this plant was a collection of five bare-root plants, two of which survived transplanting.

Culture: The plants were set out in our rock garden, where they failed to establish and were gone within the first year.

***Phlox stansburyi* (Torr.) A. Heller.**

Perennial.

Propagation: Untreated seeds sown in flat germinated in 21 days, and seeds sown directly into a garden site in the rock garden also required 21 days. Another seed lot required 68 days in a flat to germinate, and only one seedling was produced. Seeds are apparently of poor quality. There was no problem raising seedlings as 100% of them grew to planting out size.

Culture: Plants were planted in our rock garden, where we had little success with them. All were gone within a period of two years. These plantings included two collections of the **var. *brevifolia* (A. Gray) E.E. Nelson.**

***Physalis crassifolia* Benth.**

Ground-cherry.

Perennial.

Solanaceae. Nightshade Family.

Propagation: Untreated seed germinated in ten days and yielded excellent results. We experienced no loss of seedlings.

Culture: Plants were planted out in the desert sand dunes, where they grew vigorously for a short period of time. All succumbed to root rot during the winter months.

***Physaria chambersii* Rollins.**

Perennial.

Brassicaceae. Mustard Family.

Propagation: Seeds were sown directly into garden sites, and in flats, began germinating in 19 days. We experienced minor losses of seedlings in the nursery.

Culture: Plants were planted in the desert garden and in the rock garden. While the plants flowered and produced some seeds during their first year, they succumbed rapidly from root rot and could not be maintained for any length of time.

***Physocarpus capitatus* (Pursh) Kuntze.**

Ninebark.

Shrub.

Rosaceae. Rose Family.

Propagation: Seeds that were cold-stratified for three months germinated in 16 days. In May, tip cuttings rooted at a rate of 100% when placed under mist and with four additional hours of artificial light. It took 17 days to initiate rooting. We experienced no problems raising seedling or cutting grown plants.

Culture: This species is essentially a plant of moist banks and north slopes. Our original planting at our Claremont site were made in April 1951 from two plants that were transferred from the old site. These plants died after two years, since we had to place them in full sun and we were not able to supply them with enough water. Later collections grown from seeds were properly placed near a stream and in a shady spot, and in this location they grew exceedingly well. Fifteen-year-old plants had attained heights from four to six feet, and had spread from five to nine feet wide. The first flowers and seeds were produced in their second year of growth.

***Picea breweriana* S. Watson.**

Weeping Spruce.

Tree.

Pinaceae. Pine Family.

Propagation: One lot of seed was sown after 109 days of cold-stratification began to germinate after 12 days and reached its maximum after 30 days. While we experienced minor losses during the small seedling stage, there was a 100% loss during the gallon-can stage in the nursery. The most recent sowings were made in a deep seed bed and the results are too recent to be incorporated in this report.

Culture: No plants of this species have been successfully raised at this location, and it is doubtful that any can be established here.

***Picea engelmannii* Engelm.**

Engelmann Spruce.

Tree.

Propagation: We have no experience growing this species from seed. Three seedlings were received in gallon-cans.

Culture: Our plants were planted on an east facing, shaded slope in clay-loam soil. All three specimens have done quite well, and now measure over six feet tall and are apparently quite well established. They were planted in April 1958.

***Picea sitchensis* (Bong.) Carr.**

Sitka Spruce.

Tree.

Propagation: Fresh, untreated seed was sown one month after harvesting, and began germinating in 18 days. Another seed collection, sown in a seed bed in the lath house in January, took 58 days to germinate. Several lots seeds were cold-stratified for periods of 109 days and these began to germinate 12 days after their removal from the cold. Generally, it is noted that this species does not require cold-stratification, although there is no harm done by employing this procedure. Seedlings from the wild, or from seed beds, will transplant readily with only minor losses. We suffered no high mortality among the seedlings during transferring stages, but did have occasional trouble with fungus (probably *Rhizoctonia*) killing the tips while the young plants were growing in gallon-cans. This problem eventually affected the entire plant, and they died. Growth is rapid when they are growing in nursery cans or seed beds, and plants over a foot tall can be raised in a year. If proper after care is provided, bare-root seedlings may be set out and a better root system is produced, although the latter is more fibrous. We have no experience with grafted and cutting-grown plants.

Culture: It goes without saying that this species should have shade and considerable moisture in our area, since the species naturally inhabits a narrow coastal strip in northern California and although broader northward, it still is classified as an essentially coastal species from Alaska southward. Surprisingly it does remarkably well in full sun here, since it was necessary for us to plant it in such a location to be a part of the north coastal coniferous forest plant community. Extremely dense and round in growth habit, they nevertheless grow quite well and only an occasional planting has succumbed. The majority of our plants have taken hold quite well. We experienced a heavy loss of year-old trees during a period of extreme heat when temperatures reached 115° F. On the other hand, 12 specimens, two-and-a-half feet to six-and-a-half feet tall were balled on March 29, 1951 and were moved from the old site to the Claremont site where they were planted on April 3, 1951, in full sun in a very rocky, granitic loam. Over the next five years, five trees died, but there are still seven remaining. These plants are now in their 25th year of growth and are noted as being in good condition, measuring six-and-a-half to nine-and-a-half feet tall and are eight-and-a-half to ten-and-a-half feet across. To date, no cones have been set. It has been stated that this species may set cones after 35 years. Other plantings at the garden in a little better soil and position have developed into nice specimens up to 11½ feet tall (in six years), and are seven-and-a-half feet across. Visitors have always admired our more accessible specimens, particularly during the period in the spring when they bring forth the bright green new growth which makes a strong contrast with the older grayish foliage.

***Pickeringia montana* Nutt.**

Chaparral-Pea.

Shrub.

Fabaceae. Pea Family.

Propagation: Since we have never been fortunate to find seed of this plant, our only means of starting it has been through finding rooted underground stems, which are more prevalent after a fire. An attempt with cuttings failed, but our second collection of portions of rooted stems provided us with three growing plants from nine original portions. Subsequent attempts to root cuttings have failed.

Culture: Planted in a slightly shaded portion of the mesa, the three plants have grown very well in the clay-loam soil and are now considered to be well established. Flowering, but no seed production, was noted during their second year. As noted earlier, this species rarely sets seeds.

Pinus L.

Pine.

Trees, rarely shrubs.

Pinaceae. Pine Family.

Among all the trees of the world, the pines occupy a position of great importance, an importance which has come down through civilization. Occupying a prominent portion of the land surface of the Northern Hemisphere, the some 80 species which are found from the Arctic areas to warmer climates, are an integral part of our daily lives. Generally of frugal tastes, they inhabit those portions of our land which would not produce adequate quantities of food. Lovers of plenty of light we find them occupying our mountains, open seashores, and higher desert peaks. California, rich with an abundant flora, has at least 20 species of this important group of trees within its borders. We have been able to procure and grow all of them, some with much less success than others, particularly the slow growing, high mountain species, which have given us considerable trouble. However, most of them have adapted to our situation and are developing into an important part of the scene, occupying a considerable area.

While pines can be produced by grafting and cuttings, they generally are started from seed. Except for a few collections of seedlings, all of our material has been grown from seeds. In general, we started our seeds without any pretreatment or we used cold-stratification for varying amounts of time, usually from one to three months. Often for something to do during a slack period in the nursery, we sowed the seeds in flats during the summer months and without providing moisture, we set the flats in cold-stratification. During the last few years, after 1960, we preferred to sow seeds in deep seed beds in the lath house, where they were allowed to grow to proper size and moved out bare-root directly to the garden. Following this procedure, plants with excellent root systems were raised. Many of our earlier plantings had come out of gallon-cans, and despite our careful practices, some plants had badly coiled roots. While we experimented with some of the so-called hormone fluids during the transplanting procedures, we never were convinced of their value and later discarded their use as our records indicated no more losses without their usage than with them. Since each species had different needs and generated different results, we will discuss our procedures separately under each species.

Pinus albicaulis Engelm.

Whitebark Pine.

Tree.

Propagation: One seed collection was sown in a flat in October 1961 and was cold-stratified for 78 days. After their removal from the cold, the seeds were resown in a deep box in the lath house. The first seedlings appeared 28 days after their removal from cold-stratification, and germination continued sporadically for six months when 11 seedlings were potted up into gallon-cans. A year and a half later, the remaining nine were planted in the garden.

Culture: The nine small seedlings of this subalpine forest species, usually found at elevations of 8,000 to 12,000 feet, were planted in our rock garden. Two years later in 1965, only four were alive but these were noted to be in good condition. It would seem doubtful that this species would survive here. For a bonsai specialist, the slow growth of this species would be ideal.

***Pinus aristata* Engelm.** [Ed: *Pinus longaeva* D.K. Bailey. TJM2]

Bristlecone Pine.

Tree.

Propagation: Three seed collections were made between 1954 and 1962. Excellent germination started within seven to ten days, and maximum germination was reached within a month. Minor losses occurred when the seedlings were transferred to three-inch pots. Greater losses were experienced when the plants were shifted into gallon containers. Because losses in the garden were so high from gallon-cans, over 100 of the 1962 seedlings were transplanted from the seed flat to a deep seed bed in the lath house. But, since we had never employed this tactic before, and to insure that we had enough plants for our needs, over 100 were also planted in three-inch pots (and these were later transplanted into gallon-cans. Two months after transplanting the seedlings into the deep seed bin, 37 plants were removed for shifting to gallon-cans. These seedlings did not have the expected long tap root, but instead had many fibrous roots at the base of the stem. Seedlings grow very slowly and should be left in growing bins until they are four to six inches tall.

Culture: This species has been most difficult to establish here in Claremont. Four lots of seedlings grown from three different seed collections failed completely within periods of three to five years, and they were planted in several kinds of situations. Realizing we were experiencing the same results as with plantings of *P. monophylla* and *P. quadrifolia*, we switched to raising the seedlings in deep seed beds and transplanting the seedlings bare-root from them or using plants in cans that had been started in the beds. Not until then did we get good results, and even in these instances losses occurred in the group from gallon-cans. Instead of planting specimens two to three inches tall from gallon cans, we waited until they were four to nine inches tall. When planted out into the garden, these bare-root plants had moist peat moss placed around their roots. Later it was discovered that Hoof and Horn fertilizer greatly increased their growth rate and appearance. Three-year-old specimens range in height from three inches to one foot, and has spread from three to seven inches wide. Being of extremely slow growth in our arid climate, both here and in its natural habitat, there is every indication that this species should thrive exceedingly well along coastal California and in the eastern part of the country, judging from information garnered from publications and word of mouth of the excellent results experienced in eastern arboretums. In Southern California, this species is probably best as a pot plant, and it should be an excellent species for bonsai culture.

***Pinus attenuata* Lemmon.**

Knobcone Pine.

Tree.

Propagation: We grew four seed collections from wild and one from cultivated trees at our old site. The seeds collected from our cultivated trees germinated in 15 days, while wild seed collections required 21, 32, 28, and 69 days to germinate. All of these seeds were untreated and sown in flats. There was no problem in raising any of the seedlings in containers. Plants one to two feet tall were ready in a year for planting.

Culture: This is an extremely durable species. All of our plantings have adapted well to either the very rocky soils or the tight clay-loam soils. Except for an occasional planting, little trouble was encountered. In our earliest planting, three specimens acquired a tip die-back each year in late spring. Investigations by several scientists failed to discover a reason for this. These specimens were eventually removed and an examination of all parts of the trees failed to produce any cause. Three other specimens died from an unknown cause that had the appearance of *Verticillium* wilt. Occasional groups of seedlings had some runty specimens, which after a few years were removed as being undesirable. Ten- to fifteen-year-old collections had grown to heights ranging from five to 25 feet, and widths of five to 32 feet. First seed cones were produced from the fourth to the ninth years, the earliest were on trees started from seeds harvested from our cultivated trees at the old site. Other collections from the wild began to produce seed cones in their sixth, seventh, and ninth years.

***Pinus x attenuradiata* Stockw. & Right.**

Tree.

Propagation: We received five bare-root seedlings, four to six inches tall were received from U.S. Forest Service on February 12, 1954. All were planted and grown in gallon-cans before planting nine months later.

Culture: The plants were planted in a group on the mesa in tight clay-loam soil. They grew rapidly and in six years these specimens measured 15 feet tall and 20 feet wide, and were producing their first cones. In following years, large quantities of cones were produced. At 15 years of age, the trees were about 35 feet tall and had spread to 30 feet wide. Due to their rapid growth, some of the trees were partially blown over during a rain storm that was accompanied by wind. One specimen had succumbed to root rot as the soil was poorly drained. This hybrid is a much more durable plant than its parent *P. radiata*. This hybrid should be used in inland landscapes and gardens in place of the Monterey pine, with which we have had so much trouble.

***Pinus contorta* Loudon.**

Beach Pine. Shore Pine.

Tree.

Propagation: Four collections of seed, including one of the **var. *bolanderi* (Parl.) Vasey**. [Ed: ssp. *bolanderi* (Parl.) Critchf. TJM2] from the pine barrens of Mendocino County, were grown. All seeds were sown untreated in flats or in deep seed beds in the lath house. Those seed lots sown in flats that were placed in the greenhouse germinated in 14 to 21 days, while those sown

in seed beds in the lath house germinated in 53 to 72 days. Date of sowings for the seed flats were November 1953 and October 1962, while those in the outside seed beds were sown January 1960. Copper screens were used on the bottom of the flats and seed beds in an attempt to produce fibrous root systems. The seedlings raised in the seed beds were transferred directly to gallon-cans for further growth before they were planted in the garden (since we had no experience on how well they would grow from direct bare-root planting). Later, we found the survival percentage of bare-root seedlings was excellent. We noted the average height of seedling was four inches while the root system was 11 inches long, but was well developed with fibrous roots. No losses were recorded during the transplanting stages, from either the flats or the deep seed beds.

Culture: Before leaving the old site, four plants were balled and transferred to the new Claremont location on March 28, 1951. These plants were planted on April 3, 1951 and only one survived to mark its 25th year. This specimen measured 12 feet tall, and 15 feet wide, and immature cones were noted. The first immature cones were noted five years earlier, but they did not set seeds. Additional collections have been raised since 1953, and some have become established. However, losses have been rather high, as much as 50 to 75% of those planted in our open rocky granitic loam soils, while those planted in the clay-loam soil of the mesa have experienced only minor losses, indicating that the species has a preference for the latter soils. Further notes show that those plants planted out bare-root have fared better than those from the gallon-cans. The first plants in the garden that began producing cones started in six years, though this was not typical. Plants ranged in heights from 16 inches to eight feet at ten years of age, and had spread from three to nine feet wide. This species is an excellent small pine for the garden or for container culture.

***Pinus coulteri* D. Don.**

Coulter Pine.

Propagation: Three seed collections were raised; one from the wild in San Bernardino County, one from the wild in Riverside County, and the third was harvested from cultivated trees at our old site and were separated into four lots. All seeds were sown untreated. Those collected from the trees in cultivation were sown between 1949 and 1955 and started to germinate in 75, 108, 100, and 23 (these were the oldest seeds) days. The first lot gave us the most seedlings, and the third was directly sown in place in the garden. The collections of wild seeds germinated in 141 days (and these were poor), while 1958 seed sown in October 1961 germinated in 42 days and produced over 100 seedlings from one-and-a-half ounces of seed. An additional collection of 18 bare-root seedlings were all successfully raised in containers. Generally, seedlings were simple to grow and maintain in the nursery, and only minor losses occurred in the several lots sown. Within a year the seedlings were five to 13 inches tall. Excellent results were obtained by transplanting bare-root seedlings to deep seed beds from flats, in most cases few or no losses were noted.

Culture: One of our hardiest pines, no problems were encountered raising this species in our garden. Magnificent specimens grew in our Claremont site in very rocky, decomposed granite loam in full sun. After 15 years of growth, these plants measured ten to 25 feet tall and were 13 to 23 feet across. Handsome specimens are also growing equally well on the mesa in tight clay-loam soil. This handsome, relatively slower-growing gray pine will endure much hardship. While it is reported that many specimens in the mountains surrounding the Los Angeles basin

have been killed by smog, we have never encountered any damage to our specimens up to the present time. It is my own feeling that the forest trees were suffering a great deal from drought as this pine does prefer some extra watering for best growth. Fruiting cones were noted on one tree in its sixth and seventh years in two different plantings. This species is an excellent choice for dry hillsides and for the high desert. It is too large for small gardens, and has enormous cones.

***Pinus flexilis* E. James.**

Limber Pine.

Propagation: Altitude appears to have little effect on the germination of this species as our several collections started coming up in ten, 15, 21, and 48 days. Overall production was low, and testing indicated that many of seeds were not viable. A long period for maximum production as not necessary as most of seedlings germinated within a month. Culture of the seedlings was not difficult, although greater losses were suffered during the gallon-can stage in the nursery. The most recent seedlings were raised in 1963, and these were put in deep seed beds where they developed into much better specimens before they were transplanted bare-root into the garden.

Culture: This higher elevation species did not fare too well with us, as most of our plants died in four to six years. Again, it was believed that better success would have been obtained with bare-root material.

***Pinus jeffreyi* Grev. & Balf.**

Jeffrey Pine.

Propagation: Two wild collections of seeds were started in the fall of 1952, in 1956, and in 1957. Two additional seed lots were sown from the earlier collection, and our results were exceedingly poor. The first seed lot was better but not good. Untreated seed germinated in 14 days for fresh seed, 36 days (and one seedling) from the lot sown in 1956, and two seedlings germinated in 16 days in 1957. The other collection required 62 days to germinate, but this was the best result that we had with fresh seed. Cold-stratification of the seeds is believed to be unnecessary, but may be beneficial for some lots.

Culture: This hardy pine of the yellow pine belt has grown exceedingly well at our Claremont site. In March 1951, 11 plants that were growing on a north slope in adobe clay at our old site were transplanted into five-gallon-cans and seven-inch pots. Some of these specimens were in poor condition, and some of the others that were transplanted dried out, but all were successfully grown in the five-gallon-cans. These specimens were planted on April 2, 1951, and measured 15 to 22 inches tall and all were noted as being in good condition. Only one of these plants subsequently failed, and it was planted in very rocky, decomposed granite loam in full sun. In their 20th year, they have been measured at two to 11½ feet tall, and three to ten feet across. Even at this age, no female cones have been produced. Seedlings raised here in Claremont have been planted in several locations. Over a period of ten years, there has been a loss of eight plants in our decomposed granite loam, while none have perished in the clay-loam of the mesa. In fact, some ten-year-old seedlings were balled and moved to another site on the mesa and all survived. This transplanting operation was done in February 1963, and the plants were three to five-and-a-half-feet tall. Other plantings have shown excellent progress. This is an excellent species for bonsai culture and is rather handsome in youth. Plants have a moderate growth rate, depending on actual conditions.

***Pinus jeffreyi* × (*Pinus jeffreyi* × *Pinus coulteri*).**

Hybrid Pine.

Crossed at the Institute of Forest Genetics in Placerville, California, one specimen in a five-gallon-can was presented to us by the U.S. Forest Service in July 1948. It was transferred as a balled plant to present the site on mesa, in April 1951. It was 25 inches tall. In its 15th year, it was measured at 12½ feet tall, and ten-and-a-half feet across, with a nine-inch diameter trunk. No cones had been produced to date but the specimen was very healthy and in excellent condition.

***Pinus lambertiana* Douglas.**

Sugar Pine.

Propagation: Our results indicate cold-stratification would have yielded better results, since germination of our untreated seeds were generally poor and slow. Fresh, untreated seed sown in 1952 began to germinate in 18 days, but germination was sporadic over a period of two months. Another collection took 99 days to germinate, and a 1954 collection took 83 days to begin germination. While sufficient seedlings for our needs were obtained, our results would not be commercially viable. Generally we had good luck in transplanting seedlings to containers, but again it is recommended that, when possible, the seedlings should be grown in a deep seed bed and transplanted in to a garden site bare-root. A few seedlings collected from the wild were successfully raised in containers.

Culture: The world's tallest pine, this species grows slowly in youth and once well-established begins to increase growth rate. This species should result in excellent specimen trees for specific plantings. While our success was attained with some degree of loss over a period of ten or more years, we felt happy to be able to grow sugar pines more or less successfully here. At ten years of age, some of our specimens measured only five inches tall and seven inches across. These specimens were growing in very rocky decomposed granite loam. Other specimens that were planted in better sites had grown up to four feet tall. In another location, two fine specimens succumbed to oak root fungus (*Armillaria mellea*) in their 11th year. Two plants that were six-years-old and growing well on the mesa were transplanted to the rock garden, where one died and the other developed into a fine specimen and was growing vigorously in its eighth year.

***Pinus monophylla* Torr. & Frem.**

One-leaved Pinyon.

Propagation: Two collections of seeds were sown untreated, and germination started between 36 and 73 days. Germination took place on a sporadic basis over a period of two to four months. Overall, we experienced poor germination rates, and cold-stratification is recommended for this species. We recommend growing this species in deep seed beds as the seedlings produce a very long tap root that is difficult to put into a small pot where it makes a wound up root system. Generally, we had good results while raising seedlings in small containers, but we lost over 50% of one group while they were in gallon-cans.

Culture: An important food source (seeds) for native peoples, this very hardy, slow-growing pine is from the mountains bordering the deserts in southeastern California, and Baja California (Mexico), and Arizona. It has not been a problem to grow once the young plants were

established. Raising the plants in containers has proved to be a problem as we had high initial losses once these were set out in the garden. Transplanted trees from the old site were handled most successfully. Eight plants that were five-years-old and measuring from seven to 17 inches tall were transplanted from the old site in March 1951 and were planted at our Claremont site on March 12, 1951. At the same time 14 trees that were 19-years-old and measuring 26 inches to eight-and-a-half-feet tall, were balled and planted on March 12, 1951. These were the first plantings made at our new Claremont site. Of the eight plants that were five-years-old, four died the first year, but none have died since and these trees are now in their 20th year and measure five to ten-and-a-half-feet tall, and three-and-a-half to seven-and-a-half feet across. No cones have been observed to date in this collection. Of the 14 trees that were 19-years-old, four died during their first year. Ten are still alive and are now 35-years-old and in excellent condition. These measure ten-and-a-half to 15 feet tall and are nine to 14 feet across. During their 30th year, it is noted that two of these trees were loaded with cones and two years earlier, cones were first found on one tree. In both instances, seeds were collected and later sown - one in 1952 and the other 1954. We experienced a 99% loss, and it is recommended that further seedlings be raised in deep seed beds and transplanted bare-root into the garden. These recent plantings are closely adjacent to the group of older transplanted trees from the old site.

***Pinus monticola* D. Don.**

Western White Pine. Silver Pine.

Propagation: Between 1952 and 1958, three seed collections were sown, and two of these were untreated. These lots required 104 and 31 days to germinate. Subsequent seed collections were cold-stratified for periods of four and six months. Germination had begun before the seeds were removed from the six-month period of cold treatment, and was rapid after removal. The four-month cold treated seeds began to germinate ten days after they were removed from the cold, and the last germinated 24 days after that. The percentage of seeds that germinated was much greater in the lots that were subjected to cold-stratification. Losses were minimal in the initial stages of transplanting, but nearly a third died in the gallon-can stage. We recommend sowing the seeds in a deep bed and planting out bare-root plants that have developed a strong root system.

Culture: This high elevation pine has been a disappointment here. Plants do somewhat better in the clay soil of the mesa. Those planted in our rocky, decomposed granite loam soil died out within a four to six year period, and none of them had grown more than a few inches high.

***Pinus monticola* x *Pinus strobus*.**

Hybrid Pine.

We received one plant in 1948 from the U.S. Forest Service, and it is the result of a cross made at the Institute of Forest Genetics in Placerville, California. The plant was one foot tall at the time. In late March 1951, it was balled and moved from the old site. It measured 18 inches tall and 19 inches wide. It grew exceedingly well and in its 15th year was measured at nine feet tall and ten feet wide. It began producing cones in its eighth year and each year the number of cones increased. However, none of the cones had viable seed. In about its 18th year it died of some unknown reason. This tree was planted on the mesa in tight clay-loam soil. It had developed into a fine ornamental-type conifer and we were most disappointed to lose it.

***Pinus muricata* D. Don.**

Bishop Pine.

Propagation: Six collections of seed sown, including one from cultivated plants at the old site. Pretreatment was unnecessary as the untreated seeds started to germinate in 17 days when sown in flats. Coincidentally, it took the exact same number of days for the seeds to germinate after they had been subjected to cold-stratification for three months. Three different seed collections were sown in outside seed beds and all of them took 53 days to germinate. While only minor losses occurred raising the seedlings in containers, their growth was rapid and resulted in coiled root systems. Our most recent sowings have been in deep seed beds in the lath house, where initial germination rates were slower but results excellent. Specimens 14 months old were six to ten inches tall on the average. Specimens of similar age in gallon-cans were usually taller, measuring from one to two-and-a-half feet tall, but again, their root systems were badly coiled. This is one of California's closed-cone pines. The cones open and release their seeds only after fires or extremely hot temperatures.

Culture: Occupying much the same geographic area as the coast redwood, but in more sterile soils. This species occupies an area from Santa Barbara County to Mendocino County where in the latter location tiny cone producing trees are noted in great quantities in the "pine barrens". For us, this species was rapid in growth both in bulk and height. Because of their compromised coiled root systems (the result of being raised in gallon-cans), their roots did not reach deeply enough into the rocky granite loam soil or the clay-loam soil, and the plants failed to establish themselves. As a consequence, many trees were blown over in winter storms and had to be removed. Otherwise, this species was entirely successful. Trees 15-years-old has attained heights of 18 to 25 feet. One specimen growing in the clay-loam soil of the mesa had attained a height of 28 feet in ten years. However, ten-year-old specimens averaged seven to 21 feet tall and were five to fifteen feet wide. Starting in 1960, all additional plantings were of bare-root plants, some were treated with a pre-soaking for 15 minutes in a Hormex solution or SUPERthrive solution (each 150 drops to three gallons of water). Control plantings of untreated specimens were also planted. Our results indicated that in most cases untreated plants fared as well or better than the treated plants, and neither product seemed to have any advantage over the other. Therefore later plantings were set out untreated. Trees six-years-old had attained heights seven to 24 feet and had spread from seven to 16 feet wide. In each planting hole, two to three bare-root plants were planted, and when it could be determined which individual was growing best, the others were removed. Cones were first noted in all of our plantings when the plants had reached four to six years of age. New growth (candles) stretching from one to two feet or more, created a most interesting effect each spring before they cast great quantities of pollen. Perhaps this is a hardier and better all-around pine for our area than the Monterey pine (*Pinus radiata*).

***Pinus murrayana* Grev. & Balf.** [Ed: *Pinus contorta* Loudon ssp. *murrayana* (Grev. & Balf.) Critchf. TJM2]

Lodgepole Pine. Tamarack Pine.

Propagation: Between 1952 and 1960, four seed collections totaling five lots of seeds were sown untreated. The first was collected from Tuolumne County at 6,250 elevation and germinated in 77 days. A Siskiyou collection from 3,500 feet germinated in 24 days. A Los Angeles County collection from the San Gabriel Mountains at 8,700 feet elevation began to germinate in eight days. Another Tuolumne County collection from 8,000 feet elevation, took 12 days to germinate, while a second lot of the same number sown in a deep seed bed took 58 days to germinate. The

San Gabriel Mountains strain was by far the best, but all collections germinated at good rates. We had excellent experience while raising the seedlings in containers, even though seedlings that were three-and-a-half inches tall had roots that were 1½ inches long when they were transferred to gallon-cans. Since these collections were highly valuable to us, we did not experiment with bare-root planting, although a seedling brought in with another collection was grown successfully.

Culture: Our garden experience has not been as successful as our nursery experience. Over a period of ten years, our losses have averaged at least 50% or more. We feel that our rocky, granitic loam soil is not to the liking of this species, and while plants growing in the clay soil of the mesa appear to grow better, they are growing very slowly. In the plant community section of the garden, ten-year-old plants range in heights from five to 30 inches with spreads of ten to 30 inches.

***Pinus ponderosa* Lawson & C. Lawson.**

Yellow Pine.

Propagation: During this period, we only grew one collection of untreated seeds in a nursery flat in 1952. First germination occurred in 80 days, and only two seedlings were lost while they were growing in the nursery.

Culture: This species is doing surprisingly well in our area, the records for this planting show only one loss in ten years. At this age, the plants measure from ten inches to four-and-a-half feet tall and are 11 inches to four feet wide. This planting is growing in rocky, decomposed granite loam in full sun. A few plants were set out on the mesa in clay-loam soil and these are doing well have not grown into good specimens.

***Pinus ponderosa* × *Pinus apachea*.**

Hybrid Pine.

Received from the U.S. Forest Service in July, 1948, this hybrid produced at the Institute of Forest Genetics in Placerville, California. This plant was originally set out at the old site in December 1948. There, it had grown to three feet tall and three feet wide. We then balled it and replanted it on the mesa at our Claremont location on March 28, 1951. In its 15th year, it measured 17 feet high and 20 feet across and had a trunk diameter of 14 inches. Seed producing cones have not yet appeared. This tree has proven to be an excellent specimen and is an interesting hybrid.

***Pinus ponderosa* × *Pinus ponderosa* var. *scopulorum*.**

Hybrid Pine.

Presented through the courtesy of the U.S. Forest Service, this hybrid was produced at the Institute of Forest Genetics in Placerville, California. We received the five-gallon plant in July, 1948. It was planted at the old site in adobe clay on December 6, 1948. We balled it in April 1951, and transplanted it on April 11, 1951 to the mesa, adjacent to other hybrid pine specimens. In its 15th year it measured 15 feet tall and 12 feet wide and had a trunk diameter of eight inches. In 1954, it was noted as having a sprawling growth habit. No seed cones have been produced to date.

***Pinus quadrifolia* Sudw.**

Four-leaved Pinyon.

Propagation: After several unsuccessful attempts to harvest seed from the nearest wild population during September and October, we visited the site, by chance, in August and found an abundance of seeds. Thereafter we made each seed collecting visit in August and were always successful in harvesting seeds. A 1953 seed collection was divided into four lots and each was sown in nursery flats on four different occasions. The first lot had poor results: most of the seed rotted, but a few germinated in 82 days. Four months later, a second untreated lot was sown, and these germinated in 29 days. The third lot was sown a year later and the seeds germinated in 24 days and produced the most seedlings by far. The fourth attempt, sown two years later, failed completely. The seedling roots were so long (up to 15 inches) that we resorted to clipping them off to facilitate potting. The procedure was not harmful and our losses were very low. A 1959 seed collection was sown in a deep seed bed in the lath house, and this procedure yielded the best results by far. Using this method, initial germination began in 47 days and maximum germination occurred in four months. Over 300 seedlings were grown from seven and three-quarters ounces of seed. For safety we root clipped 118 of them, and potted them up into gallon-cans. Over 150 of the seedlings were bare-rooted, soaked for 15 minutes in a Hormex solution (150 drops to three gallons of water), and were then directly transplanted into the garden.

Culture: This handsome four-needled pinyon is seen in scattered locations at elevations of 2,500 to 5,500 feet along the western edge of the Colorado Desert and southward to Baja California, Mexico. In cultivation, it develops into a handsome, compact tree with a slow rate of growth. A planting of this species that was set out in solid sandstone at the old garden site had many fine specimens living when we moved to our present Claremont location. Ten of these specimens, measuring two-and-a-half to seven feet tall were balled (most of the rootballs broke because of the loose nature of the sandstone soil - even though it had been thoroughly watered prior to the moving operation) and transplanted in their present Claremont site on March 13, 1951. These were the second plantings made at our new Claremont location. None of these transplanted specimens died, although two runty specimens were removed in the 32nd year. These trees, now 35-years-old, measured 13 to 18 feet tall and were ten to 16 feet across. The first note of immature cones was recorded in June 1958, when the plants were 26-years-old, but no seeds were produced. Even though immature cones were noted two years later, no mature seed-bearing cones were produced.

***Pinus radiata* D. Don.**

Monterey Pine.

Propagation: We made a total of seven seed collections, five from wild populations and two from cultivated trees at our old site. In addition, bare-root seedlings and cuttings have been raised of this species. The fastest initial germination period was ten days from a seed collection made at Cambria in San Luis Obispo County and sown in a deep nursery flat. Several other seed lots germinated in 13 days in standard flats, while others took 11, 14, 18, and 29 days, the latter were seeds collected from cultivated trees. The longest period for successful germination was 31 days, and these were seeds that were sown outside. The bulk of the seedlings were raised in the nursery in cans, but after 1960 they were grown in seed beds. There was no problem raising the seedlings, and specimens two to three feet tall were produced within a year from seeds.

Cuttings were taken in November from an especially fine specimen, and were treated with Rootone powder, and about 60% rooted. The cuttings started showing evidence of rooting at 65 days.

Culture: This handsome, fast growing pine, is extensively used in many parts of the world for both lumber products and horticultural purposes. It develops rapidly (too rapidly) in our interior area, and therefore has a very short life. We have used it extensively in this garden, and have many wonderful specimens that have grown from 40 to 50 feet tall. In one particular area, some have been lost to oak root fungus (*Armillaria mellea*), while others have been blown over during winter storms since they develop such a great bulk so rapidly that the top portion overgrows its little root system (this attribute is further aggravated by raising the young plants in cans where they become rootbound, as is the case with the bulk of our specimens that were grown during our early days here). Others have died from an undetermined cause, which the scientists have dubbed "Virus X" or have assigned "smog" as the culprit. Whatever the cause, we have experienced a disheartening loss of young trees, as most specimens are not over 15-years-old but have attained heights up to 40 feet or greater and have equal spreads. We believe soil conditions in certain areas of the garden may be part of the cause, as some areas have had comparatively small losses while in others, after the tenth year, there is a slow decline in the health of the tree with needles shortening, change in color, and after two to three years the tree is dead. Production of mature, seed-bearing cones has been recorded as starting when the trees are in their seventh, eighth, ninth, and tenth year of growth.

***Pinus remorata* H. Mason.** [Ed: *Pinus muricata* D. Don. TJM2]

Santa Cruz Island Pine.

Propagation: We grew four different seed collections of this species, two were from cultivated specimens at our old site, and two were from wild stands on Santa Cruz Island. Untreated garden collected seeds sown in nursery flats germinated in 12 and 14 days, while untreated wild collected seeds sown in deep seed beds outside germinated in 53 days. Seedlings were easily raised in the nursery. Those that were grown in the deep seed beds and planted bare-root performed especially well.

Culture: Our results have been good and are much the same as for *P. muricata*, a species from which this is hardly distinguishable. Cone production starts at two to four years (mostly the latter). Bare-root seedlings have developed into specimens measuring 11 to 24 feet tall and ten to 24 feet wide. However, the plants do not appear dense or bulky, as they tend to produce long open branches especially when they are young. This "candle" period of growth is particularly interesting, since these range from two to five feet in length in a single season.

***Pinus sabiniana* D. Don.**

Foothill Pine. Grey Pine.

Propagation: Three lots of seeds that were collected from cultivated trees at our old site were sown untreated in nursery flats. These seeds germinated in 43, 35, and 54 days, and the last seedlings germinated before four months had elapsed. A lot of 20 seeds that were sown in a deep seed bed germinated in 104 days, and only seven seedlings appeared. These were subsequently planted bare-root into the garden. No problems were encountered while raising the first batches

of seedlings. Viability testing was conducted by Dr. Lenz in 1952: of 52 seeds, 31 were empty, seven were broken, 14 were excised, and 11 grew.

Culture: This highly ornamental pine has been little used in horticulture. Its great hardiness, open architectural structures, and rapid growth rate make it a tree to be used more in dry hills as a statuesque background. Plants will easily grow in most soils, and has much in its favor. In late March 1951, we balled 14 small trees growing at the old site. These measured from 14 inches to three-and-a-half feet tall. Some of the smallest specimens were planted in five-gallon-cans. The plants were transplanted on March 29, 1951, and all survived. These specimens are now 20-years-old and measure 23 to 37 feet tall, and have spread 14 to 25 feet wide. These trees are growing in rocky clay soils that seem to be highly to their liking. The first seed-bearing cones appeared in June 1957, during their 11th year of growth. Additional seedlings were planted in April 1951. These specimens were grown in containers and measured from one to one-and-a-half feet tall. All lived and developed into splendid specimens measuring from ten to 30 feet tall, and have spread from six to 24 feet wide in their 15th year of growth. The first two trees of this planting produced seed-bearing cones during their fourth year of growth. All other plantings in our garden have had the same record: no plants have been lost, and handsome specimens have developed.

***Pinus torreyana* Carriere.**

Torrey Pine.

Propagation: We collected seeds from Torrey Pines State Park and these were sown untreated in a nursery flat, one month after they were harvested. This collection germinated in 26 days. Later, the ungerminated seeds were moved into pots where they germinated within a month. A second lot of seeds that were two-years-old were sown at a rate of three seeds per gallon-can. These seeds began to germinate at 33 days, and the last one germinated after four months. A third lot of seeds that were nine-years-old were soaked for four minutes in Thiourea and started to germinate in 38 days, and the last one germinated after two months. A fourth lot of seeds that were 14-years-old were cold-stratified for 34 days and were then sown in a deep seed bed in the nursery. These began germinating in 41 days, and the last one germinated in three months. The actual amount of seedlings was pretty much the same for all of these seed lots. The Thiourea soak had no effect and the 14-year-old seeds, and these produced as many seedlings as the nine- and two-year old seeds. However, we did experience the best germination rate with fresh seeds. Seedlings have a very long tap root, which either needs to be clipped or the seedling planted as bare-root material, a process that was very successful for us.

Seeds collected from the Santa Rosa Island population were sown on two occasions, and took 24 and 26 days to germinate, reaching the maximum amount in two months. Our most recent seed lot from the Island consisted of very few seeds that were sown in a deep seed bed in the nursery. These began to germinate in 80 days, and the last one germinated over four months later.

Culture: Of all the pines that we grew at the old site, this species is the only one that has survived after we vacated the site. When we last viewed the old site, these specimens were in splendid condition. They had not received any care or additional water since 1948. At that time, they were 22-years-old and were crowded. At least ten years later, they were in excellent condition.

Here at our Claremont site, some of our plantings in very rocky soils have suffered considerable losses in their early years, due mainly to moles working around their roots, and to some

extremely hot weather during their first summers. Once established, there have been no further losses, and fine specimens have developed. During the early stages of growth, those planted in the rocky soils were spindly and weak with little branching and foliage. After their tenth year, they began to develop into normal appearing trees.

The Santa Rosa Island plants reacted differently, both in the rocky and clay soils. These specimens developed quickly, and they grew most vigorously. While there may not be technical differences between these two plant populations, they certainly have a great difference in appearance. The island form has very heavy branches that reach out many feet from the base of the trunk to the top and are thickly covered with extremely long needles. The Torrey Pines population has thinner, shorter branching, and the trees are very sparse near the base. The difference in appearance is considerable when they are grown in the same soils here in the garden, where plantings have been made of both types in the very rocky granitic loam soil, as well as in the tight clay-loam soil of the mesa. In their 15th year, our Torrey Pines population has specimens ranging from 23 to 43 feet tall, and spreads from 11 to 23 feet wide. Many of these trees are producing cones. Our records for the Santa Rosa Island population show that our ten-year-old trees measure six-and-a-half to 28 feet tall, and have spread from five to 20 feet wide. The smallest tree was a runty specimen, and we have noted many such plants among all of the species of pines that we have grown.

***Pityrogramma triangularis* (Kaulf.) Maxon.** [Ed: *Pentagramma triangularis* (Kaulf.) Yatsk. et al. TJM2]

Goldenback Fern.

Perennial.

Pteridaceae. Brake Family.

Propagation: We grew thirty collections of plants of this species, one of the **var. *maxonii* Weath.** [Ed: ssp. *maxonii* (Weath.) Yatsk. et al. TJM2], and five of the silverback fern **var. *viscosa* (D.C. Eaton) Weath.** [Ed: ssp. *viscosa* (D.C. Eaton) Yatsk. et al. TJM2], were successfully established in pots in the greenhouse for technical studies being carried on by one of the graduate students.

Culture: After the completion of technical studies, the plants were turned over to the garden and planted in either a dry rock wall or in the rock garden. In both locations, several accessions became established and have been growing well for several years. They need some shade and well-drained sites such as rock walls where no amount of water will stand. A rest period is needed during the summer, when the plants go into a semi-dormancy. During this time, the plants should receive little or no water. In pots, they need a little water to keep them from drying out completely. In nature, the roots are usually protected by large rocks, etc.

***Platanus racemosa* Nutt.**

California Sycamore.

Tree.

Platanaceae. Sycamore Family.

Propagation: Untreated seed sown in flats germinates in ten to 15 days. Young seedlings will need protection from damp-off fungus. However, our recommended method is to sow seeds in a deep seed bed outside. The seedlings are then allowed to grow until the following February when they are transplanted bare-root into the garden just before they are expected to come out of their winter dormancy. In colder areas, adjustments to this schedule would have to be made. In any event, fine specimens have also been raised in pots and other containers. Cuttings taken in the wild in November were cold-stratified until the following February. They were removed from the cold and placed in a cold frame with bottom heat, about 70% rooted in a few days.

Culture: Since the natural habitat of this species is along streams and arroyos, which may be seasonally dry (but where the tree roots can tap into subsurface moisture). This tree can be used in areas that are seasonally inundated. Here, at our new Claremont site, there are several wild specimens of California sycamore along old natural stream beds and drainages. Good sized specimens, measuring from ten to 15 feet tall, were transplanted bare-root from the old site, where we had many growing in field rows. These bare-root trees were planted extensively around the main buildings at the new site. There were also mature specimens native to our Claremont site. We only added specimens that were necessary to complete our plantings. Seedlings set out in April 1951 measured from one to two feet tall. These specimens, now in their 15th year, measure from 19 to 40 feet tall and have spread from 20 to 25 feet across, and none have died. The first fruits were noted during their third year of growth. Other plantings have done equally well. However, the tree's susceptibility to anthracnose blight, white fly, red spider mite, and other pests makes this tree of questionable value in a home garden. This is a highly messy tree, but many still prefer to grow it because of its picturesque growth habit (caused by dieback of young branches as a result of anthracnose blight in the early spring or late winter). We have used all of the known sprays to control of anthracnose, and while of some help at times, it may be safely said that it is hardly worth the cost.

***Platystemon californicus* Benth.**

Cream Cups.

Annual.

Papaveraceae. Poppy Family.

Propagation and Culture: Beginning with our original wild collection of seeds that were gathered near the San Fernando Mission, Los Angeles County, in 1935, we have grown this strain continuously, and it has done as well with us here in Claremont as in our old site. Plants grow particularly rank on our simulated sand dunes, and have spread into adjacent areas. Seeds are sown in the fall months, and germination may be expected in 20 to 30 days, if the moisture content of the soil is normal. A form with yellow petals (**var. *crinitus* Greene**. [Ed: the var. is not recognized in TJM2]), was added to our collection in 1962, and for the past four years it has done quite well when it is completely protected from birds.

***Pluchea purpurascens* (Sw.) DC.** [Ed: *Pluchea odorata* (L.) Cass. var. *odorata*. TJM2]

Saltmarsh-Fleabane.

Annual, Perennial.

Asteraceae. Sunflower Family.

Culture: This species produces a high percentage of non-viable seeds. From one collection of seeds gathered from the wild, we were able to grow just three seedlings, and these were from a seed lot that had been subjected to cold-stratification for two months – a procedure that we feel should be unnecessary for this species. The seedlings were raised in containers without trouble. A later collection of two seedlings were also successfully grown in containers in the nursery.

Culture: Our plants were planted on a stream bank and at the edge of a pool. All thrived for a period and disappeared. Flowering was noted but no seed was produced. In some habitats, this species may act as a perennial.

***Pluchea sericea* (Nutt.) Cov.**

Arrowweed.

Shrub.

Asteraceae. Sunflower Family.

Propagation: Our single seed collection failed to germinate. A collection of cuttings of new side shoots was treated with Rootone and rooted at a rate of about 90%. These cuttings were taken while the plants were in flower at the edge of the Colorado River. The cuttings probably would have rooted equally well without the Rootone.

Culture: Knowing that this species will spread rampantly by underground roots running out in all directions, we planted our material in the least desirable spot we could find. When we provided sufficient moisture for good growth, we soon found that drastic methods must be used to control the spread of this plant. When it began raising the nearby blacktopped road, we treated all sprouts with a 2,4-D solution. This controlled the suckering in the blacktop pavement. However, when too much was applied it killed a few plants – but never enough to spoil the planting.

***Poa nevadensis* Scribner.** [Ed: *Poa secunda* J. Presl ssp. *secunda*. TJM2]

Nevada Bluegrass.

Perennial.

Poaceae. Grass Family.

Propagation: One small bunch brought to us was started in a pot.

Culture: Originally found in a moist, rocky canyon at 4,300 feet, we planted our specimen in a rocky stream bed where we could provide it with sufficient moisture. In this location, the plant has grown well and has spread.

***Polemonium carneum* A. Gray.**

Jacob's Ladder.

Perennial.

Polemoniaceae. Phlox Family.

Propagation: Our several lots of seeds were cold-stratified but this is, apparently, unnecessary. Germination started in 28 days – before the flats were removed from cold-stratification. Abundant volunteer seedlings were noted in the garden. Seedlings were easily raised.

Culture: Our plants were planted in semi-shaded areas, under oaks, in the rock garden, and in other suitable spots. This lovely small, short-lived perennial was a very useful addition to our displays of spring-flowering flora. As an added bonus, our plants continued to intermittently flower for the remainder of the year.

***Polygonum paronychia* Cham. & Schltl.**

Woody perennial.

Polygonaceae. Buckwheat Family.

Propagation: Untreated seeds begin to germinate in 12 to 21 days. All seedlings were successfully raised in small pots.

Culture: This coastal shore species, an inhabitant of the highly sandy areas, was planted in our sand dune area where many became established and are growing well three to five years after they were planted in 1963.

***Polypodium californicum* Kaulf.**

Perennial.

Polypodiaceae. Polypody Family.

Propagation: Plants were readily transplanted from the wild and were reestablished in nursery containers.

Culture: Plants were later planted in a semishaded area under scrub oaks in a loose, humus rich soil. These plants readily adapted and spread into a larger area and were doing nicely in their tenth year.

***Polypodium scolieri* Hook & Grev.**

Leather-Leaf Fern.

Perennial.

Propagation: A few plants were collected and these grew very well in a flat in the greenhouse.

Culture: Our plants were planted in the shade of a large tree on a small stream bank, and appeared to be doing all right in our dry atmosphere. The large tree had to be removed, and the sunnier conditions plus crowding from adjacent plants caused the demise of the planting within a year. This will probably be a difficult entity to establish satisfactorily in our area since it normally grows in moist, boggy areas on rotten logs, etc. and where climate conditions are very moist.

***Polystichum munitum* (Kaulf.) C. Presl.**

Sword Fern.

Perennial.

Dryopteridaceae. Wood Fern Family.

Propagation: We collected plants that were then readily established in containers in the greenhouse.

Culture: We planted our plants along a stream bank under a large tree. This planting developed into a fine bed, producing large enough clumps to permit divisions that we planted in other sections of the garden. We incorporated a considerable amount of peat moss and other humus in to the soil at the planting site, and the area is kept almost constantly moist.

***Populus fremontii* S. Watson.**

Fremont Cottonwood.

Tree.

Salicaceae. Willow Family.

Propagation: Two lots of cuttings were taken from trees at our old site. The first group was collected on February 18, 1950 and consisted of 32 semihard to hardwood cuttings, six inches long, one-quarter to one-half inch diameter, with obvious buds. The cut ends were dipped in Fermate, and two cuttings were placed into each gallon-can. Rooting started in 13 days and a total of 13 rooted. Lot 2. The second group was collected on August 15, 1950 and consisted of 30 semihard to hardwood cuttings with fully expanded leaves, six inches long, one-quarter to three-quarters inch diameter. The cut ends were dipped in Fermate, and were placed in pots. Rooting started 13 days and 24 were potted up into gallon-cans. A few of each lot died in lath house, but a total of 29 were planted out. These plants grew from 16 to 27 inches tall within a year. One lot 26 cuttings was put in seed pan and were cold-stratified for two-and-a-half months, after which there were placed in a cold frame with bottom heat (75° F), and 22 rooted. Three of these later died while in the lath house.

Culture: We planted these specimens in the most suitable place that we had at the time – in a flat, open area with very rocky soil. After 15 years, two had died and the remaining plants had grown from nine to 20 feet tall, and had spread from 11 to 21 feet across. At that time, the plants were noted in fair to poor condition. While as much water as possible was provided, this area was not the most suitable. These trees are attacked by fungus and beetles, causing considerable die-back and rotting branches. Additional plants that were planted in rocky clay soil measured 25 feet tall and 25 feet wide and were in excellent condition at 15 years of age.

***Populus fremontii* S. Watson. var. *arizonica* (Sarg.) Jeps.** [Ed: the var. is not recognized in TJM2]

Tree.

Propagation: We followed the same procedure as for the species (listed above). Material was collected on March 13, 1952 and consisted of a total of 40 semi-hardwood cuttings. Approximately 50% rooted in 28 days. A large branch five feet long was stuck in a five-gallon-can and it rooted.

Culture: Two small trees, measuring ten feet tall, were moved bare-root from our old site on March 5, 1952, and were planted adjacent to a stream on the mesa, in clay-loam soil. Here they developed into handsome specimens, but in the intervening years, their root systems were not strong enough to withstand winter storms and they were blown over and had to be removed. Other plantings in a rocky site have grown very well – better than the species – and in their 15th year measured from 18 to 25 feet tall, and had spreads from 15 to 28 feet wide. Flowers were first noted in the third year of growth.

***Populus fremontii* S. Watson. var. *macdougalii* (Rose) Jeps.** [Ed: the var. is not recognized in TJM2]

Tree.

Propagation: Semi-hardwood cuttings were taken in February and were put in gallon-cans and 95% rooted. Cuttings from trees at old site. March 13, 1952 – semihard to hardwood, six to eight inch, one-quarter to one-half inch diameter, Fermate, cuttings to gallon-cans – wood very poor – all died but one. Wild, semihard, Rootone, 17 days, seed pan, mist. Only two survived in the nursery after the plants were shifted to gallon-cans.

Culture: One tree, 18 feet tall, moved from old site in March, 1952. Severe hot spell had serious effect on tree, planted adjacent to stream in clay-loam soil. Thought to have died, removed, found new growth coming from roots, replaced and tree grew on for several years. A planting in decomposed granite loam has done very well with minimum irrigation. Specimens 20 to 45 feet tall and 15 to 23 spread, and only one died the first year, is the record in 15 years. Other material added in more recent years has not fared as well, having been killed by severe attacks of borers, etc.

***Populus tremuloides* Michx.**

Quaking Aspen.

Tree.

Propagation: We have made various attempts to root cuttings, but all have failed: treating with rooting compounds, cold-stratification, soaking in water. Pieces of runner sections were put in flats and given bottom heat, but to no avail. Finally, small rooted suckers were started in gallon-cans. About half of the rooted sucker plants continued to grow.

Culture: While we cannot say that our plantings have been highly successful in the sense that they are as good as seen in the wild, we are pleased that we have been able to maintain them. At 12 years of age, our plants have expanded by suckering and now measure up to six-and-a-half feet tall and have spread up to six feet wide. These specimens were planted at edge of a pond, in a low depression, and the tight clay of the mesa. High summer temperatures burn the leaves, but all in all we are happy to have representatives of the species growing in the garden, and they should be here for a good many years to come.

***Populus trichocarpa* Hook.**

Black Cottonwood.

Tree.

Propagation: Material was gathered from trees at our old site in February 1950 and consisted of 38 cuttings. The cut ends were dipped in Fermate and two cuttings were placed into each gallon-can. Rooting started in 12 days, and 95% rooted. In October 1958 semi-hardwood to hardwood cuttings were gathered from the wild on Santa Cruz Island. These were potted up and were cold-stratified for 80 days. They were then placed under intermittent mist, bottom heat, and extra light. All of these cuttings rooted. We did the same treatments for a collection of rooted suckers but did no cold-stratification. We experienced better rooting success when the material was cold-

stratified. There were some losses throughout the process, but very few once the plants were growing in the nursery.

Culture: This tree is found along streamsides in the mountains where it vigorously spreads by rooting suckers. Care must be exercised in the use of this species in a garden. In cold mountain canyons, it produces great splashes of fall color and in such locations there is no trouble. However, in areas where there is not sufficient room, it should not be used or there must be diligent efforts made to eradicate all of the suckers. We did not plant large quantities of this species, and where we did plant them, we managed to limit the amount of moisture they received. Even then we had 15-year-old specimens measuring from ten to 25 feet tall, and spreading from 12 to 30 feet wide. Being a hardy species, able to withstand severe conditions, it grew with some degree of success in hard, dry, and rocky situations found at our Claremont site.

***Populus trichocarpa* Hook. var. *ingrata* (Jeps.) Parish.** [Ed: the var. is not recognized in TJM2]

Propagation: Tip cuttings from side shoots that were taken in February and were treated with CUTstart XX resulted in 90% rooting after 48 days. A few losses were experienced later while the plants were growing in the nursery. For us, this is an easily propagated species.

Culture: This has been a difficult variety to satisfy here in Claremont, since it is ordinarily found in creek beds at elevations over 6,000 feet. We moved three plants from the old site in March 1951. These trees were reestablished here at our new site where they grew quite well for several years. As there were signs of deterioration in 1962, cutting were taken the following February. These rooted very well, and we were able to increase our number of specimens by some 27 plants. Needing lots of water and perhaps a colder climate, it just survives with us. The specimens that were moved from our old site were all dead by their 20th and 25th years, but cutting-grown plants from one collection is now three-years-old and are doing fairly well. These young plants measure from five inches to three feet tall, and have spread from six inches to two-and-a-half feet across.

***Porophyllum gracile* Benth.**

Perennial.

Asteraceae. Sunflower Family.

Propagation: Two lots of untreated seed began to germinate in six to eight days. While nearly all of the first lot died in the nursery, there were only two lost from the second lot raised a year later.

Culture: Coming from the Mojave Desert, we planted them in our desert garden. Those planted in October were mostly killed by winter frosts. It was difficult to ascertain if the roots were alive without digging them out, but since none returned, it was assumed they had been killed by frosts.

***Potentilla egedei* Wormsk. var. *grandis* (Rydb.) J.T. Howell.** [Ed: *Potentilla anserine* L. ssp. *pacifica* (J.T. Howell) Rousi. TJM2]

Perennial.

Propagation: Plants that had been growing at the old site since 1938 from a collection from Dry Lagoon in Humboldt County, were transplanted to our new Claremont site in February 1952 where they were planted in a stream bed.

Culture: Needing wet areas, this coastal strand and salt marsh plant was reestablished in a stream on the mesa. Soon the plants spread out and became necessary to control. Going dormant each winter, it would vigorously renew itself each spring and was a fine stream bed plant as long as it had plenty of water.

***Potentilla glandulosa* Lindl.** [Ed: *Drymocallis glandulosa* (Lindl.) Rydb. TJM2]

Perennial.

Propagation: A 1953 seed collection only produced one seedling which was grown and planted out in 1954. Subsequently, seed was harvested from it and from it we built our collection. Initial germination required ten days and there was no problem in raising the seedlings in three-inch pots from which they were set out.

Culture: Raised in the rock garden, in semishade, seed was not harvested until eight years later although it produced some in the first year. It was about one foot tall in its first year. It is found in dryish to moist situations from northern coastal California to British Columbia (Canada).

***Potentilla gracilis* Hook. ssp. *nuttallii* (Lehm.) Keck.** [Ed: *Potentilla gracilis* Hook. var. *fastigiata* (Nutt.) S. Watson. TJM2]

Cinquefoil.

Perennial.

Propagation: Our first seed lot was sown in 1955 and was cold-stratified for nearly four months after which the seedlings emerged in 11 days. Subsequent seed propagations were without cold-stratification and seedlings appeared in four and 11 days, but not in such abundant numbers as the first lot. There were no problems with raising the seedlings in the nursery.

Culture: Used as decorative material in selected spots on the mesa, this entity remained with us for several years, although it was necessary to replenish these plantings at intervals. The bright yellow flowers on slender stems were a welcome addition to our displays.

***Prosopis glandulosa* Torr. var. *torreyana* (L. Benson) M. C. Johnst.**

Mesquite.

Shrub or Tree.

Fabaceae. Pea Family.

Propagation: Seeds were harvested from plants growing at the old site were sown untreated directly into pots and gallon-cans. Germination started in three to 16 days, with the quickest response coming from seeds that were eight-years-old. The percentage of germinating seeds varied from 95% to 100%. Since the tap root is very long, the plants are best grown in a deep seed bed and then transplanted bare-root into the garden when they are dormant. In any event, we had no problems raising the seedlings.

Culture: Preferring a deep soil where the tap root can penetrate some distance for moisture, our planting were not happy when they were planted in our very shallow, rocky soil. When they were irrigated heavily, there were high losses. In other locations, where better soil conditions prevailed, they made fine specimens, but their growth habit is more shrub-like than treelike.

The so-called “**Reese Hybrid**” did extremely well when grown in the clay soil of the mesa. Specimens planted in the poorest situation are now 15-years-old and measure five-and-a-half to ten-and-a-half feet tall, and have spread from eight to 13 feet across. Seeds were first produced in the sixth year.

***Prosopis pubescens* Benth.**

Screw Bean. Tornillo.

Shrub or Tree.

Fabaceae. Pea Family.

Propagation: Seeds harvested from plants growing at the old site were sown on four different occasions, two in August 1951, October 1956, and July 1957. The last generated the best result. Seeds of the first lot were sown untreated in gallon-cans and started to germinate in 14 days. The second lot was soaked for 24 hours in hot water and germinated in three days in a seed-flat with better results than the first lot. The third lot was sown in a seed-flat and the seeds were received no treatment and the results were very poor. The fourth seed lot was sown untreated in gallon-cans and started to germinate in 20 days and nearly 100% had germinated in a month. We lost about 40% of the plants while they were growing in the nursery. We expect that the best results will be had by sowing the seeds in a deep seed bed and then transplanting them bare-root into the garden.

Culture: Situated in a better soil, the first lot of 21 plants showed only a loss of three plants during a period of 15 years. These plants measured five-and-a-half to 11½ feet tall, and had spread from six to 12 feet across. The first seeds were produced from this planting during their eighth year of growth. A secondary planting in the same area completely failed. Specimens grown in the desert garden have performed as well as the first planting.

***Prunella vulgaris* L. ssp. *lanceolata* (Barton) Hult.** [Ed: *Prunella vulgaris* L. var. *lanceolata* (Barton) Fernald. TJM2]

Selfheal.

Perennial.

Lamiaceae. Mint Family.

Propagation: Untreated seeds were sown in flats and germinated in seven to 12 days. Seeds sown directly into a garden site germinated in 14 days. Except for one seed lot, the seedlings were grown without excessive losses.

Culture: This species prefers a woody atmosphere and a loose, humus-filed soil where it can spread easily by runners. We have perpetuated a collection first acquired in 1937, and continue to grow it rather successfully. However, we must reinforce our planting with new lots of plants from time to time. Flower and seed production start during their first year of growth. A useful plant for shady, woody areas that may be moderately irrigated.

***Prunus andersonii* A. Gray.**

Desert Peach.

Shrub.

Rosaceae. Rose Family.

Propagation: Between 1953 and 1965, we grew one cultivated and seven wild collections of seeds of this species. Untreated seeds began germinating in 16 to 19 days, but it will take two to three months before all of the seedlings appear. We tried cold-stratification of periods of one to three months. In all cases, seeds were either starting to germinate, or had germinated, by the time they were removed from the cold-stratification. One month of cold-stratification appears to be best, as we had excellent germination within five to ten days after the seeds were removed from the cold. After germinating, the seedlings were transplanted into four- or five-inch pots, and then were later moved into gallon-cans. While generally the plants grew well in the nursery, we did sometimes suffer some losses in the gallon-can stage. Note: Some of the seeds were provided by the USDA station in Fresno for testing and observation. Some of these were noted as having green fruits while others have red fruits.

Culture: All plantings were made in essentially the same garden area: in an open, flat, rocky, decomposed granite loam soil in full sun. Garden performance varied for the various collections, some experienced high mortality during the first few years, while others experienced only moderate losses. However, once the plants settled in, there were no further losses. An excellent representation of the species have been growing for over a period of ten years. Plantings ranged in age from seven to 12 years, and measured from three to ten feet tall, and spread from four to 14 feet wide. Flowering and fruiting began in their third year of growth. Plants needed protection against rabbits who chewed them severely when young. Some of the plants produced very deep pink flowers. Since we had been unable to root cuttings of these specimens, we gathered and grew a large number of seeds from these plants, and planted the seedlings in rows on the mesa. As flowering began, each plant was observed, and those with poor flower color were eradicated.

***Prunus emarginata* (Douglas) Eaton.**

Bitter Cherry.

Shrub.

Propagation: We grew five wild collections of seeds. All were cold-stratified for periods of three to eight months, the longer period produced the most seedlings. Seeds that were a year-old were cold-stratified for three to four months, after which they were then removed from the cold and all of the seeds that had germinated were potted up. The seed flat was then returned to cold-stratification and the same process was followed for periods up to a year, after which the seed flat was discarded. Many plants were successfully grown from this process. Subsequent losses of plants growing in the nursery were moderate.

Culture: All but one of our plantings suffered complete losses after periods of seven to ten years. Even when the plants were provided with shade and better soil conditions, they failed to thrive. It appears that our area is unsuitable for growing this species. From our observations, this species would probably grow better in our area in heavier soils - a condition that one of our plantings had, and these did grow well. Some plantings spread out widely by underground suckers, and some were measured at five feet in height, but no flowering was ever observed.

***Prunus fasciculata* (Torr.) A. Gray.**

Desert Almond.

Shrub.

Propagation: One seed collection from cultivated plants was sown untreated on October 4, 1949, and germination started in eight days, and was finished in 13 days. We experienced excellent results, and even after a few discards and a few losses in the nursery, we still had 99 specimens to plant in the garden. Two collections of **var. punctata Jeps.** were cold-stratified for 30 days and began germinating in nine days and resulted in almost 100% germination – though we had only a few seeds.

Culture: Used in the desert garden and plant community area, both plantings excelled in growth in their respective areas, both in well-drained, rocky situations. In the desert garden, the plants had usurped so much area, that 15 had to be removed. They were eight feet tall and spread ten feet wide. In the Joshua tree woodland area, losses were excessive the first year from rabbit damage and from being in a rocky location. Subsequently, in 15 years, only four were removed. Plants had attained heights up to nine feet tall and spread from three to 15 feet wide. Flowering and fruiting were recorded in their fourth year of growth. Both green and red fruited seed collections of the **var. punctata Jeps.** were presented to the garden by the USDA for testing. These were planted in rocky clay, and they failed to grow as well as might be expected. Only four remained in fair condition from one collection, while the other accession was written off in the third season.

***Prunus fremontii* S. Watson.**

Desert Apricot.

Shrub or Small Tree.

Propagation: Seeds were harvested in 1949 from plants at the old site. These were sown untreated in October 1949, and seedlings began germinating in nine days. Germination was completed in 12 days, and the results were excellent. A letter from Dr. Robert Jones, of the USDA, Crops Research Division, in Fresno, California, stated, “The outstanding feature of these observations (growing seedling of *Prunus* spp. in greenhouse) is that *P. fremontii* does not damp-off under conditions in which other desert species do. For this reason, I believe hybrids of this species might be valuable for this area where *Phytophthora* and other soil fungi create root stocks problems.” Pollen from our plants was sent to the USDA on two occasions: in February of 1960 and 1961.

Culture: Except for crown rot problems caused by overhead irrigation and which was held in abeyance by discontinuing the procedure, we experienced little trouble in growing this species. Handsome specimens growing up to 15 feet tall and to 18 feet across were growing in several locations. On one or two occasions, our plantings had to be thinned to permit the development of stronger plants. Flowering and fruiting began in the first and second year, and plants bloomed profusely in January and February every year after that. Large crops of seeds were produced.

***Prunus ilicifolia* (Hook & Arn.) D. Dietr.**

Holly-Leaved Cherry. Islay.

Shrub.

Propagation: Untreated seeds sown in flats will begin to germinate in 24 to 37 days. Fresh seed is preferable. When the seeds were sown in October, we had excellent results in two months. There

were no problems with growing the seedlings and young plants on in the nursery. However, for best results, it is recommended that the seeds are sown directly in place so that their long tap roots are not damaged as such plants get a better start.

Culture: This species will not tolerate tight clay soils that may receive some extra moisture. Our experience with this species in heavy soils has been poor, while in open well-drained or rocky soils it does exceedingly well. Losses have been minimal or none in some plantings. Beautiful specimens seven to 16 feet tall and ten to 19 feet across have developed with minimum care in 15 years. Flowering and fruiting began in their second or third year of growth. If this specie is grown in the vicinity of *P. lyonii*, resulting seedlings from either parent could include hybrids. This species has been used extensively in the various college campuses close by as clipped hedges with excellent results. Plants are highly resistant to oak root fungus (*Armillaria mellea*), but are readily attacked by white fly. Some plantings in some areas have acquired a serious virus, but our plantings have not been affected. A peculiar malformed situation arose, but after three or four years it disappeared.

Prunus ilicifolia* × *Prunus lyonii

Prunus hybrid.

Shrub or Tree.

Propagation: Seeds were harvested from a known hybrid of fine stature growing at the old site. 140 untreated seeds were sown in a flat in October 1949. Seedlings began to germinate in 26 days and 100% were recorded a month later. Over 100 seedlings were canned, and used in various locations at the new site.

Culture: Used for beautification, handsome specimens, both shrub and tree forms, grew beautifully. Developing into handsome evergreen specimens, we used them extensively for beautification. Some plants grew into rather slender trees 40 feet tall, and were thickly covered with dark green leaves much like *P. lyonii*. Other specimens resembled *P. ilicifolia* and were shrub-like in dimensions and growth habit.

***Prunus lyonii* (Eastw.) Sarg.** [Ed: *Prunus ilicifolia* (Hook. & Arn.) D. Dietr. ssp. *lyonii* (Eastw.) P.H. Raven. TJM2]

Catalina Cherry.

Tree or Shrub.

Propagation: Untreated seed, either from cultivated or wild plants, have been germinated in gallon-cans and flats. The time required for initial germination is usually about three weeks. When seeds were germinated in sphagnum, the resulting seedlings were transferred to gallon containers and were later transplanted into two-gallon and five-gallon containers. However, we feel that the best procedure is to sow the seeds in place, but such sowings must be protected from rodents. This species is one of the easiest California native plants to raise.

Culture: This species is widely used in horticulture, and there is little problem in growing this insular species. It is a handsome evergreen plant of tree-like proportions, often attaining heights of 40 feet, we have used it extensively in both tight clays and well-drained rocky soils. In either location the species has performed beautifully. Flowering and fruiting will start after three to five

years of growth. Plantings should not be made in traffic areas as the fruit drop is heavy and objectionable.

***Prunus subcordata* Benth.**

Sierra Plum.

Shrub.

Propagation: Four wild and two cultivated seed collections were sown. Our records indicate germination is erratic. Seeds need two to three months of cold-stratification after which sprouted seeds are removed and potted up. The rest of the ungerminated seeds are then returned to cold-stratification for another two to three months. The process is repeated until all potential seeds have germinated. Our records indicate that it may take nearly a year before all seeds have germinated. Once the seedlings had been established in containers, we had only minor losses in the nursery.

Culture: Plants were planted in several garden locations, but were mostly used in semishade and in well-drained soils. These plants, once established, have performed quite well. A plant started at the old site nursery was transferred in a five-gallon-can and was planted in an open, hot location in May 1951. In its 15th year of growth, and after a fungus attack that girdled and killed the stems, the plant is now five-and-a-half-feet tall and four-and-a-half-feet wide. Other plantings in better situations have developed into fine specimens and are spreading into large clumps. These are up to seven feet tall and are equally wide after ten years of growth. Fruits were first produced in their sixth year, with flowering starting in their fourth year. Since then excellent crops of seedlings have been raised each year and these have been used to enlarge the plantings.

***Prunus virginiana* L. var. *demissa* (Nutt.) Torr.**

Western Choke Cherry.

Shrub.

Propagation: Two wild collections of seeds were each divided into two lots of equal weight. Lot one was cold-stratified in moist sand in a jar for 100 days. Lot two was soaked for 30 minutes in sulfuric acid, washed thoroughly, and was cold-stratified in a jar with moist sand for 100 days. This same treatment was repeated for the second collection. The only difference between the two treatments was that there were more seedlings in each lot that had the sulfuric acid treatment prior to cold-stratification. In any case, the germination rate overall was excellent. There were no problems raising the seedlings.

Culture: These plants were used in many locations, and the numerous seedlings immediately took hold. In due time many plants had to be removed as they were rapidly spreading underground with such vigor that they encroached on other plantings. This is a much different history than reported at the former garden location, where plantings did not live for more than seven years and were extremely poor. Flowering was first recorded in May-June, 1955, during their fourth year after planting. At 15 years of age, our specimens averaged seven to 15 feet tall and were eight to 12 feet across.

***Pseudotsuga macrocarpa* (Vasey) Mayr.**

Big-cone Spruce. Southern California Douglas-Fir.

Tree.

Pinaceae. Pine Family.

Propagation: Untreated seed germinated in 19 to 30 days, but two to three months of cold-stratification might improve the germination percentage as there is some dormancy present in the embryos of some seeds in each lot. Probably 30 days of cold-stratification would help. However, the percentage of viable seed is usually not high.

Culture: Excellent growth has occurred in each of our several plantings, regardless of situation. When planted on the mesa in tight clay soil or in very rocky, decomposed granite loam, they have responded happily to their situations. In late March 1951, eight 19-year-old plants measuring from three-and-a-half to six feet tall were balled, and two ten-year-old plants measuring 13 to 33 inches tall, were transplanted into five-gallon-cans. The balled plants were planted three days later in an open, flat, rocky, decomposed granite loam. Two plants died within two years but the remaining six are still alive in their 35th year and measure ten-and-a-half to 22 feet tall and are ten to 16 feet across. No cones have been produced. The second lot of two trees in five-gallon-cans was planted in April 1951 in a similar situation and they are in 25th year and measure 11 to 21 feet tall and are 13 to 19 feet wide. No cones have been recorded for this planting. A group of seedlings planted in a better situation, but surrounded by large pine trees, have developed into specimens measuring 18 to 25 feet tall and 12 to 15 wide after 15 years of growth. No cones have been recorded. Specimens growing in the mesa clay have responded even more vigorously and while not much taller, they have greater widths. Commercial Christmas tree growers have looked on this species with some favor as a possible tree to grow for the trade. It is a very handsome tree, particularly beautiful when the new, light green spring growth covers the trees. One tree, growing in an infested area of oak root fungus (*Armillaria mellea*), has been attacked by this fungus but has not been killed as counter measures were taken to prevent further spread of the disease.

***Pseudotsuga menziesii* (Mirb.) Franco.**

Douglas-Fir.

Tree.

Pinaceae. Pine Family.

Propagation: Untreated seed from five diverse localities were sown in flats and began to germinate in nine, 15, 29, and 52 days. When sown untreated in an outside seed bed, the seeds began germinating in 58 days. Since germination was generally poor to fair, cold-stratification should have been followed since there is some embryo dormancy in each lot of seed. The best results were obtained using our outside seed bed. Two collections of bare-root seedlings were readily established in gallon-cans and there were no problems raising the seedlings from flats. The seedlings in the seed bed were transplanted bare-root directly to a site in the garden.

Culture: While losses have been 50% or higher, those plants that settled in have done exceptionally well. In this area, they develop into closely branched and thick, rounded specimens, almost as broad as tall. However, this is not always true as other groups have the normal appearance of the species. In late March 1951, five 19 years-old trees, measuring four-and-a-half to seven feet tall, were balled and two ten-year-old plants, measuring 45 inches tall were put in five-gallon-cans. The balled material was planted three days later and all have lived

and are now beautiful trees in their 35th year, measuring 16 to 22 feet tall and 13 to 19 feet wide. No cones have been produced. One of the plants in the five-gallon-cans died, but the remaining specimen is in its 25th year and measures eight feet tall and eight-and-a-half feet wide, and is in good condition. Bare-root seedlings established in gallon-cans and planted in 1954, when they were eight to 16 inches tall, have been lost at a rate of 50% but have shown no losses for most recent ten years. Their last recorded measurements were three to five-and-a-half feet tall with four to seven feet spreads. The most normal appearing trees are those raised in a deep seed bed that were planted bare-root in the garden. At that time, these plants measured six inches to two feet tall, and now at six years of age, they measure 32 inches to ten-and-a-half feet tall and two-and-a-half to 11 feet wide. Losses were also considerably less in this planting, indicating bare-root planting is to be preferred where possible.

***Psilostrophe cooperi* (A. Gray) Greene.**

Paperflower.

Subshrub.

Asteraceae. Sunflower Family.

Propagation: Untreated seed will germinate in four to seven days when sown in flats, and will begin germinating in 20 days when directly sown into garden sites. While germination is usually rapid, the results are generally poor as there is a high percentage of non-viable seed. Care in handling seedlings must be exercised, but we had 100% of our transplants survive.

Culture: A desert plant, we used our scanty material in the desert garden, in a rocky sandy soil. While good results were obtained, we were unable to maintain the species and it gradually disappeared.

***Psoralea castorea* S. Watson.** [Ed: *Pediomelum castoreum* (S. Watson) Rydb. TJM2]

Perennial.

Fabaceae. Pea Family.

Propagation: Scarified seed was sown in a nursery flat and started to germinate in three days and all had germinated within another two weeks. We had only a very small amount of seed, and only 13 seedlings were potted up. Of these, 12 survived and were planted in the garden.

Culture: Planted in January 1953, in the desert garden, it was recorded they all died during their first year, due, it was surmised, to overhead irrigation.

***Psoralea macrostachya* DC.** [Ed: *Hoita macrostachya* (DC.) Rydb. TJM2]

Perennial.

Propagation: Untreated seed germinated in seven days in sown in a nursery flat. Volunteers readily appear around the garden planting. No problems were encountered while raising seedlings in the nursery.

Culture: When planted in rocky clay soils, this species has grown very well. Abundant seedlings are noted in the vicinity of each plant. Each winter, the plant dies completely to the ground and new vigorous growth appears each spring from an enlarged crown. Flowering and seeding were recorded during the first year. When night temperatures fell below 27° F, the vegetative stems of

the plants were severely frozen, but fresh new stems emerge from the base in late winter or spring.

***Ptelea crenulata* Greene.**

Hop Tree.

Shrub.

Rutaceae. Rue Family.

Propagation: After many discouraging attempts to get a reasonable response from our wild and cultivated seed sources, and after using a variety of methods, we finally got a good response by subjecting the seed to intermittent periods of cold-stratification. Much of the seed is non-viable, but the best results were obtained by subjecting the seeds to three to five months of cold-stratification. The last seedlings we raised were cold-stratified, then were removed from the cold for a period of one month, and were then cold-stratified again. These seeds were initially sown in March and the greatest germination occurred in August after two periods of cold-stratification. We grew over 120 seedlings from this small amount of seed. Generally good results were obtained raising the seedlings.

Culture: Planted in rocky clay soil, all of our plantings have grown with a fair degree of success. Six plants were raised in five-gallon-cans at the old site were planted in April 1951. Five are alive, and measure two-and-a-half to eight-and-a-half feet tall and have spread from three to 11 feet wide. Some of the plants were severely chewed by rabbits during their early stages of growth. Subsequent plantings suffered from being killed by frosts during their early stages of growth. After the plants were established, there were no further losses, and these ten-year-old plants have attained heights of four to eight-and-a-half feet tall and have spread from four to 12 feet wide. All plantings flowered and started producing seeds in their second year.

***Pteridium aquilinum* (L.) Kuhn var. *lanuginosum* (Bong.) Fern.** [Ed: *Pteridium aquilinum* (L.) Kuhn var. *pubescens* Underw. TJM2]

Bracken.

Perennial.

Dennstaedtiaceae. Bracken Family.

Propagation: A few pieces or roots that came in with other material were started in containers.

Culture: Surprisingly, this aggressive fern failed to establish. Provided a spot similar to its known habitats, it failed to establish and was recorded gone after its fifth year.

***Purshia glandulosa* Curran.** [Ed: *Purshia tridentata* (Pursh) DC. var. *glandulosa* (Curran) M.E. Jones. TJM2]

Antelope Bush.

Shrub.

Rosaceae. Rose Family.

Propagation: Untreated seed from a wild collection germinated poorly in 18 days. A second lot was sown directly into a garden site but did not germinate. A third lot, the seed a year-older, was

cold-stratified for two months, and was removed from the cold when the seeds began to germinate. Another collection received from the California Forest and Range Experiment Station, was treated with a three percent solution of Thiourea for five minutes and were sown in February 1958. Sixteen days later 48 had germinated, and after 31 days another 46 had germinated for a total of 94 seedlings out of 200 seeds sown. A third lot sown in October 1958 germinated in five days with additional seedlings appearing for a one month period. We also soaked a seed lot in Thiourea for ten minutes and then subjected them to cold-stratification for a bit over two months. These seedlings germinated quickly, in five days, and last one germinated in 11 days – excellent results. Some losses occurred in the nursery but generally losses were minor with only one lot suffering heavily from a fungal attack while in gallon-cans.

Culture: Used primarily in our sagebrush scrub plant community planting, and in the desert garden, all plantings settled in nicely with only minor losses. In several plantings, ranging from two to ten years in age, plants ranged in size from one foot tall and wide for the youngest, and to six feet tall and eight feet wide for the oldest. First flowering and seeding were recorded in the third year of growth.

***Purshia tridentata* (Pursh) DC.**

Antelope Bitterbrush.

Shrub.

Rosaceae. Rose Family.

Propagation: While untreated seed germinated in nine to 25 days, overall results are not as good as those that have been treated with Thiourea. We would recommend the use of the latter, but if it is not available, then subject the seeds to one to two months of cold-stratification. Seedlings have been no problem to raise in the nursery. Propagation by layering is also possible.

Culture: Planted in essentially the same areas as *P. glandulosa*, our results with this species have been even better. Fifteen-year-old plants range from three to five-and-a-half feet tall and have spread from nine to 12 feet wide. Our nine-year-old plants had reached heights of two-and-a-half to six-and-a-half feet tall and had spread from four-and-a-half to nine feet wide. Seed production started after three to five years.

***Quercus* L.**

Oak.

Trees and shrubs.

Beech Family.

The genus *Quercus* is represented in California by at least 16 recognized species, five varieties or subspecies, numerous other geographic races, and many hybrids, of which several have been described in the literature. This number included the three species of black oaks and the remaining species of white oaks. We are presently growing all of the recognized botanical entities, but not all of the many so-called racial varieties which may, or may not, be recognized by all oak authorities. We are following the interpretation of this genus as it is delineated in Munz & Keck (1959).

Propagation: Oaks are usually propagated by sowing the seeds (acorns) soon after harvesting in the fall. Grafting, layering, and rooting cuttings are used to perpetuate selected horticultural types or to preserve the true species, since hybridization occurs widely among the oaks.

The collections represented here were harvested from late September through early December, but most generally during October. Upon receipt at the nursery, the acorns were cleaned and put in open boxes where they remained in an open room until all of the weevils had emerged from the acorns they had infested. All perforated acorns were removed as they invariably rot after sowing. Any well-drained seeding media can be used but we preferred sowing the acorns in any one of the following mixtures: peat moss and sand, peat moss and finely ground granitic sand, or of sphagnum or peat moss and perlite. This last named mixture came to be our standard mixture. The mixture should be kept only moist enough to initiate and maintain germination. If the acorns become too wet, they will readily rot. Should one desire to hold the acorns for a period time before desiring germination, they should be kept in near freezing temperatures in the seeding mixture. This will delay germination by two to three months. Acorns may also be sown in field rows, deep outside seed flats or deep flats. Rodent and bird protection is necessary unless grown in a rodent and bird proof area. Root emergence averages two to three weeks, but this can vary quite widely, depending on the species. Usually a long tap root is produced quickly and several weeks later the leaves appear above the media. Since our usual method was to start the acorns in flats, we transplanted to a deep seed bin or even to gallon-cans before the roots got too long. If we put the sprouted acorns in containers, we found that clipping the roots did not seem to hinder growth and usually made a more fibrous root system. If we had plenty of acorns, we placed two to three sprouted acorns in each container and later removed all except the most vigorous plant. However, we preferred to start our plants off in deep growing bins, where they were allowed to develop as naturally as possible before planting bare-root. Since copper screening could not be purchased, we either sprayed the bottom of the bin with a copper sulphate solution or sprinkled copper sulphate crystals on the bottom. When the tips of the tap root reached the bottom, they would be burned slightly and thereafter develop a nice fibrous root system, which was more satisfactory for bare-root planting. At other times, the sprouted acorns were planted directly into their garden site, where the holes had been prepared in advance. Several acorns were put in each hole and a light covering of wood shavings or sawdust was used to help conserve moisture and to keep the top soil from sealing over, thus permitting the stem to easily emerge. Each hole was then surrounded by a wire cage to prohibit rodents and birds from destroying the tender stem. This method was quite successful and permitted the roots to grow in an unhampered manner, thus eventually producing a sturdier specimen. Growing oaks in cans is not recommended but upon occasions it is necessary. Efforts should be made to prevent coiling or balling of the root system and therefore the seedlings need to be planted as soon as possible or moved on to larger containers. When sprouted acorns were put in cans before the emergence of the leaves, we often suffered more than the usual losses from a collar rot which attacked the stems near the surface of the soil. The use of a fungicide helped prevent this condition. We further discovered we had the best results by planting the seedlings directly into open areas of the garden when the seedlings were two to three inches tall. Apparently, by this time, the tender stems had hardened enough to offset the attacks of any fungus.

Culture: California oaks, in general, may be said to do their best in rich, well-drained soils, and usually on hill and mountain slopes where the soils are of a heavier quality. In past days of California, outstanding groves of some species of oaks inhabited the richer valley floors but as population and agricultural activities have increased, the oaks are no longer a conspicuous part of

the landscape. Our records tend to show that oaks do best in heavier, but well-drained richer soils. However, we have raised many fine specimens in the very rocky granitic loam off the mesa. The following is a cultural record of all the species and varieties raised at this site in the past 15 years:

***Quercus agrifolia* Nee.**

California or Coast Live Oak.

Tree.

When a new garden site was under consideration, one of the prime considerations in our final choice was the many fine specimens of coast live oak. Many of the trees reached heights of 50 to 75 feet and had equal or greater spreads. Since our site is known as Indian Hill Mesa, one can readily imagine the gatherings that took place under their shade among the Tongva people before the advent of the white man. These oaks primarily grew on the east side of the mesa and made fine habitats for many of our collections of shade loving plants. One finds a rich native flora growing in the shade of oak trees.

In addition, we grew five collections for other areas of the garden between 1950 and 1960. Root emergence began in 58, 28, 49, 26 and 30 days, the latter after two months of cold-stratification. A stem or collar rot caused serious losses after transfer of seedlings to cans for some collections. A ten-year collection growing in clay-loam soil had heights of six to 15 feet and spreads of nine to 13 feet, but no acorns have been produced. Other collections planted in rocky, decomposed granite loam had heights of five to 15 feet and spreads of five to 15 feet and had not produced acorns either. A 1961 planting of bare-root stock first soaked in Hormex, a so-called root promoting solution, suffered severe losses the first year, only one plant survived out of 54 one-year-old plants measuring 18 to 32 inches tall. Although the site is particularly inhospitable, the remaining plant has grown in six years to six-and-a-half feet by six-and-a-half feet and has made a splendid specimen. A specimen with particularly large leaves and about three feet tall growing in a five-gallon-can was received in 1960 and planted as specimen in front of the administration building. In the heavy clay-loam soil, it has developed into a splendid specimen over ten feet tall with an equal spread. However, the large leaves have disappeared and while generally larger, they are about half the size than when it was first received. The most serious factors to consider in using this species is its susceptibility to oak root fungus (*Armillaria mellea*), the oak twig girdler (*Agrilus angelicus*), and witch's broom the latter a powdery mildew that attacks the young growth that can be quite prevalent in some seasons. We suffered little damage from the latter until the seasons of 1965-68, when severe infestations occurred. There is little that can be done about it. Spraying with fungicides may even spread it. Minor infestations can be pruned out. We have one small area where oak root fungus (*Armillaria mellea*) is prevalent and as a consequence we have lost some old, mature trees and many plants during the past fifteen years - prior to our knowledge the disease was present in the soil. Plantings made in other areas have not been affected. Until the oak twig girdler population built up to where they were seriously affecting to health of all our old trees, we did little to control it, an almost impossible task. However, with the help of commercial arborists and a clean-up program, much has been done to control this beetle, which in its larvae stage girdles the tip of the branches and dying branch tips appear all over the tree, making them unsightly.

***Quercus agrifolia* Nee var. *oxyadenia* (Torr.) J.T. Howell.**

Tree.

An inhabitant of the mountains of interior cismontane Riverside and San Diego counties to Baja California (Mexico), this variety differs from the species in having densely hairy leaves, mostly beneath. It is an especially handsome tree and great stands will be found in the designated locations. In addition to one collection moved from the old site, we grew another accession. The acorns sprouted in 30 days and no problems occurred raising the seedlings in containers. Six plants of the latter collection were set out in 1953 and in their tenth year there were no recorded losses and the plants had attained sizes of seven-and-a-half to 18½ feet tall and seven to 15 feet wide, all growing in clay-loam soil. A collection of 13 plants, seven-years-old, growing at the old site were moved from the old site in March 1951. Seven were bare-rooted and six were balled. Records on five have been recorded and in their twentieth year, two were alive and measured 13 to 17 feet tall and 14 to 18 feet wide and were in good condition. They are growing in clay-loam soil and to date (1964) had not produced acorns. Others in the same collection were used in another location, a very rocky site, but had grown equally well.

Three specimens, thought to be the result of a natural cross between *Q. agrifolia* and *Q. kelloggii*, were presented to the garden in 1956 and were used as specimen plants in the parking lot. All three were alive in 1966 and while they were of hybrid parentage, little more could be told about them. The probable cross could well be correct as they have slowly developed and appear to have traits of both probable parents.

***Quercus chrysolepis* Liebm.**

Canyon Oak. Maul Oak.

Tree.

Extending from Oregon to Baja California (Mexico), this handsome, evergreen oak is commonly seen throughout California in canyons and on moist slopes below 6,500 feet and even into the higher elevations of some of our desert ranges. We moved two collections successfully from the old site and have raised nine additional accessions, three of which were considered to be the **forma *hansenii* Jeps.** [Ed: the forma is not recognized in TJM2]. Root emergence for the nine collections was recorded as follows: 43, 67, 42, 80, 52, 40, 48, and two months of cold-stratification plus 20 days. One collection was not recorded. Generally good results were had in the nursery. Two collections, one of the **forma *hansenii***, died out in seven years while all others have made good progress. Fifteen-year-old collections range in height from three-and-a-half to 12 feet with spreads of four-and-a-half to 13 feet. Ten year specimens range in height from three to 15 feet tall by four to 12 feet wide. The last collection was set out in 1961 and these were bare-root seedlings measuring three to 32 inches tall, and were first soaked in solutions of Hormex (50%) and SUPERthrive (50%). These seedlings were planted in very rocky locations, and nearly all survived. After the third year the excess plants were removed from each basin (two seedlings had been planted in each basin). Later the planting was reduced to 16 plants, and these measured 17 inches to seven feet tall and one to seven feet broad. No acorn production was recorded for any of these collections.

In March, 1951, two collections growing at the old site were moved to five-gallon-cans in order to move them to the new site. One accession of three plants was seven-years-old, and the other was a single plant that was five-years-old. In May, 1951, all were planted in very rocky, decomposed granite loam in full sun. One of each of the two accessions survived, and in their

twentieth year were respectively measured at 11½ feet tall and 15 feet wide, and 17 feet tall and 14 feet wide, and neither had produced acorns.

***Quercus douglasii* Hook. & Arn.**

Blue Oak.

Tree.

Six collections were grown between 1951 and 1959. Root emergence started in 33, 21, 28, 22 and 23 days and an accession given two months cold-stratification in a plastic bag had roots starting before removal from cold. Survival in garden has been generally good but growth is slow. Losses occurred early, before the roots had an opportunity to penetrate the soil and were mainly caused by moles burrowing among the roots, causing excess drying of root area and from rabbit damage. A 15-year-old planting measured 18 inches to five feet tall and 21 inches to 11 feet wide; no acorns were produced. Ten-year-old plants measured six inches to four-and-a-half feet tall and one to six feet wide. The smallest had been chewed by rabbits.

A total of 15 bare-root trees that were 21-years-old, and measured three to nine feet tall and three to five feet wide were bare-rooted at the old site during their dormant period, in January 1952. Nine died the first year from lack of sufficient attention, but the remaining six are now in their 35th year and have developed into fine specimens measuring from 14 to 17 feet tall, and 14 to 17 feet across. One tree developed a fair crop of acorns in its 29th year and since then additional trees have produced small crops of acorns.

***Quercus dumosa* Nutt.** [Ed: *Quercus berberidifolia* Liebm. TJM2] [Ed: All of these accessions that were successfully grown in the nursery and were planted out in the garden during this time period were *Quercus berberidifolia*. Acorns were germinated of at least one *Quercus dumosa* accession, but none of them survived.]

Scrub Oak.

Shrub.

This variable evergreen species is principally a common constituent of the chaparral and foothill woodland plant communities below 5,000 feet from northern Baja California (Mexico), through cismontane Southern California and northward through the western side of Sierra Nevada and North Coast Ranges. We grew nine collections successfully, starting acorns in our regular mixtures and recording root emergence on 16, 14, 14, 22, 25, 44 and 14 days, and two accessions were started in plastic bags in cold-stratification. Long tap roots are quickly produced and transplanting began within ten days after the initial roots were noted. Tests were run on clipping of roots and with controls of non-clipped roots, there appeared to be no hindrance of growth and a much better root system was the result (for the clipped root specimens). Seedlings were planted from 1952 to 1963, and growth rates were highly variable resulting in sizes of three inches to seven feet tall and five inches to eight feet wide. After ten years, no acorns were produced. Losses were minor or none at all and a variety of sites, mostly rocky, decomposed granite loam, were used. Later plantings of bare-root plants appeared to grow more rapidly and in six years sizes ranged from four inches to four-and-a-half feet tall and seven inches to six feet wide.

***Quercus dunnii* Kellogg.** [Ed: *Quercus palmeri* (Engelm.) Engelm. TJM2]

Palmer Oak.

Shrub

Principally seen along the western edge of the Colorado Desert from the San Jacinto Mountains to northern Baja California (Mexico), two isolated locations are known in San Bernardino County and San Luis Obispo County. Plants are usually found from 3,000 to 5,000 feet elevations in very dry areas. Our two collections, one gathered in 1952 and the other from San Luis Obispo County in 1965, have performed exceedingly well here. At the old site, their performance was very poor. Acorns started sprouting in 16 and 30 days, the latter were from the San Luis Obispo County location. Our original collection was planted in a flat, rocky location and three plants started bearing acorns in their eighth year, and 13 plants produced acorns in their ninth year. In their tenth year, they measured 20 inches to nine feet tall and 21 inches to ten-and-a-half feet wide. After removal of a runty specimen, only two others were recorded lost out of 40 planted. The 1965 collection showed no losses in two years.

***Quercus durata* Jeps.**

Leather Oak.

Shrub.

Found almost exclusively on serpentine outcrops from central to northern California, we gathered two collections in Lake County (1953) and Tehama County (1954). In order, they started roots in 32 and 25 days, and both collections did not suffer from root clipping, a necessary procedure with this species. No problems were encountered when raising them in containers, and surprisingly they have grown much better than expected in our rocky, granitic loam. Some of these plants have been disturbed by moles and chewing by rabbits, and these pests have been the principal causes for our losses over a period of ten years. Plants ranged in size from eight inches to six feet tall and from one to seven-and-a-half feet across. No acorns have been produced.

***Quercus engelmannii* Greene.**

Engelmann Oak.

Tree.

We grew this Southern California species from two collections, one gathered in 1952 and the other in 1957. The first from the Pasadena region sprouted in 43 days. The San Diego collection, gathered in 1957, was sprouted and the acorns were planted directly into the garden site, several acorns to the hole, into which peat moss was added. Of the eight planted in 1953, six remain, and measure 14½ to 20 feet tall and ten to 15 feet across, after ten years of growth. One specimen was lost in an attempt to transplant it in its seventh year. The second collection was sown directly into the garden site into 30 basins. This was done in early November and most of the acorns had not yet sprouted leaves, a fact that we feel caused excessive losses during the winter months from rotting stems. However, in their tenth year, 15 trees, measuring four-and-a-half to 20 feet tall and four-and-a-half to 17 feet wide were recorded. One, in its fourth year, was moved successfully bare-root during its dormancy. Flowering was noted for the first planting in its ninth year, but no acorns developed.

***Quercus x ganderi* C. B. Wolf (*Quercus agrifolia* var. *oxyadenia* x *Quercus kelloggii*)**

Gander Oak.

Tree.

This hybrid was described by Dr. Carl B. Wolf, former botanist at Rancho Santa Ana Botanic Garden in **Proceedings of the California Academy of Sciences** [25(5): 177-188. 1944.]. The handsome type specimen of this tree stands just as vigorously as when first discovered, and it is a beautiful specimen that is worthy of preservation. It will probably remain in its native location so long as no road widening occurs, as it is close beside the main highway. Acorns are produced in such meager quantities that it is hard to find more than one or two each year. When grown from acorns, specimens seldom show the leaf characters of the parent, a natural expectation.

Therefore, while we have attempted on several occasions to gather acorns, we have only found two or three at widely separated visits. To preserve the true plant, cuttings need to be rooted, or scions grafted, a procedure we were never able to follow. One specimen, while not the true plant was moved from the old site, and it now is growing on the mesa and has attained a height of 21 feet and a spread of 12 feet in its twentieth year. A few acorns were gathered from an eight-year-old tree growing at the old nursery site, but these exhibited none of the desired parental characteristics and were later discarded, though one was kept and developed into a tree five feet tall and eight feet wide before it too was discarded.

***Quercus garryana* Hook.**

Oregon Oak.

Tree.

An inhabitant of wooded slopes, 1,000 to 5,000 feet elevation from the Santa Cruz Mountains north to British Columbia (Canada). This species reaches its finest development in Oregon and Washington and adjacent areas. Seven collections were gathered and raised between 1951 and 1959. All germinated readily, requiring 33, 33, 16, 18, and 21 days. One lot was cold-stratified in a plastic bag for two months and then required 37 days to germinate, and another lot was started in a flat and were then sowed in an outside seed bed. A very long tap root is quickly produced, and clipping it to permit growing in gallon-cans did not hinder growth or cause any losses. Five lots were raised in containers, and two were set out bare-root after treatment with Hormex and SUPERthrive solutions. Neither of these treatments could be said to help in growth or cutting down losses. Three collections were planted from containers in an area set aside for plants of the northern oak woodland community and grew very poorly with losses being 98 to 100%. In other plant communities, while losses were generally high, 30 to 40% over a ten year period, the surviving plants gradually became established. Growth rates were relatively slow, but were best in clay-loam soil. A 15-year-old collection planted from cans in clay-loam soil measured two to 12 feet tall and three to eight feet wide. Ten year plants in rocky, granitic loam from cans measured six inches to three feet tall (the smallest in all cases having been nibbled by rabbits) and six inches to three-and-a-half feet across. Two collections that were six-years-old that had been planted bare-root into rocky, granitic loam measured four inches to five feet tall and eight inches to six-and-a-half feet wide. One collection of the **var. breweri** failed to survive.

***Quercus garryana* Hook. var. *semota* Jeps.**

Shrub.

Found from the dry western slopes of the Sierra Nevada between 2,500 and 5,000 feet from Plumas County to the Liebre Mountains in northern Los Angeles County, the bright golden yellow acorns of this variety often makes these conspicuous plants. A 1952 collection started germination in 28 days. A second collection in 1959 was put in a plastic bag and cold-stratified until roots had appeared. These were then placed in a deep seed bed and allowed to grow there until they were ready for bare planting a year later. Prior to transplanting 50% of the seedlings were soaked in a Hormex solution and 50% in SUPERthrive. There appeared to be no advantage over controls, but this method of bare-root planting was successful as there has been only a loss of two plants in six years. Heights range from four to 22 inches and spreads from eight inches to four feet. The 1953 planting in very rocky poor soil ranged in heights from three inches to three-and-a-half feet and spreading from three inches to four-and-a-half feet wide. About 65% were lost, some losses were caused by moles in the early years. Plantings on the mesa of this same collection have grown exceedingly well, measuring four to six feet tall and five to eight feet across.

***Quercus x grandidentata* Ewan.**

Tree.

Discussed in Munz & Keck (1959) under the heading of *Q. engelmannii*, this presumed hybrid of *Q. engelmannii* x *Q. lobata* or other parentage, has been maintained by us from acorns originally gathered for a study of the complex by students in the Pomona College botany department. Specimens were growing at the old site (Everett, 1957. Pg: 181) and four of these were moved into five-gallon and one-gallon-cans for transfer to our Claremont site. One survived and in its fifteenth year was measured at nine feet tall and eight feet wide, and was noted as being in good condition. No acorns have been produced.

***Quercus kelloggii* Newb.**

California Black Oak.

Tree.

A difficult species for us to establish, this black oak is commonly found at elevations of 1,000 to 5,000 feet in the hills and mountains throughout most of California and into Oregon. The acorn germination period was generally longer and plant growth slower. Acorns sown in the period from 1949 to 1957, required 28 (this collection from San Bernardino Mountains) 98, 100, 67, and 86 days for root emergence to start. In an attempt to offset high initial plant losses, sprouting acorns were sown directly into the garden site. Leaf emergence began in a period of four to six months. In a period of ten years, 50% died. They measured seven to 22 inches tall and nine to 22 inches across, but the garden area was rather sterile. A 1959 collection was cold-stratified for two months in a plastic bag and 35 days after removal root growth appeared after being sown in a deep outside seed bed. The seedlings were allowed to grow there for a year, and they were subsequently planted bare-root after soaking equal quantities in Hormex and SUPERthrive solutions. While the garden situation was much better, although very rocky, granitic loam, there was about a 60% loss in six years. However, the plants ranged in heights of 14 inches to seven feet and spreads from 14 inches to four-and-a-half feet. Fifteen-year-old plants were measured at six inches to nine feet tall and nine inches to eight feet wide. Ten-year-old specimens measured six inches to three-and-a-half feet tall and three inches to four feet across. Conditions ranged from poor to good, and no acorns were produced. Some lots were all consistently slow in growth

while others varied from a few inches to several feet. In March, 1951, ten plants growing at the old site were moved to various sized containers and transferred to the Claremont site. These were planted in May, 1951, and only one has survived in the rocky, decomposed granite loam. In its twentieth year, it measured nine-and-a-half feet tall and six feet wide and had produced no acorns.

***Quercus lobata* Nee.**

Valley Oak. Roble.

Tree (deciduous).

This stately tree, said to be our largest American oak, is found entirely in California, growing in the rich valley loams or on the more sterile hillsides at elevations below 3,500 feet, from Los Angeles County (a few near San Marino) northward through the Coast Ranges, the Great Valley and neighboring hills to Shasta and Trinity counties. Magnificent specimens may be observed in several locations in central California growing in the richer and deeper soils of the valleys. Probably the most famous is the "Sir Joseph Hooker Oak", near Chico, California. Because of its ability to withstand severe drought [Ed: this attribute is due to the fact that most of these trees have roots that reach and exploit the underground water table], sterile soils, as well as seasonal flooding [Ed: in winter only] and a moister and richer environment, this beautiful oak should be put to greater use in our parks and along our highways. We have grown it successfully at this site as well as the old location. Trees make rapid growth in the best situations, but also are very hardy under adverse moisture and soil conditions. Root emergence from acorns began in 21, 30, 21 days or two months cold-stratification plus 24, and 31 days, the cold-stratification apparently holding them in dormancy. If sprouted acorns are put in containers, it is best to clip the long tap root, this procedure having no detrimental effect on their growth. Otherwise, it is best to plant seedlings bare-root during their dormancy period – in our area, usually January or February. Several specimens were transplanted bare-root from the old site in March, 1951. Initial losses were high due to our inability to irrigate the plants sufficiently after transplanting. The remaining trees, planted in our granitic loam, and measured in their twentieth year had developed into specimens seven to 15 feet tall and with spreads of ten to 19 feet. No acorns have been produced. Specimens in other more favorable soil conditions, developed into trees 25 to 35 feet tall. Ten-year-old specimens averaged two to ten feet tall and up to eight-and-a-half feet across. Six-year-old plants planted from bare-root stock in similar locations measured eight inches to seven-and-a-half feet tall with equal spreads. The loss percentage was either none or one to two percent.

***Quercus macdonaldii* Greene.**

Tree (deciduous).

Beside the Middle Ranch Canyon road, on Santa Catalina Island, grows a very large tree of this species, measuring about 50 feet tall and 60 feet wide, and it was from this specimen that we gathered acorns in September 1960. Because the quality of the acorns was poor and there had been so many acorn weevils, they were dusted with the fungicide Terraclor before cold-stratification in moist sphagnum in a plastic bag for 24 days. As there was no germination during that time, we then sowed the acorns in seed flats after which germination started in 31 days. The bottom of a seed bed was divided, one side was treated with a copper sulfate solution and the other with copper sulfate crystals. The seedlings were placed in the bed and allowed to grow there until they were ready for transplanting. Examination of the root systems indicated the

copper sulfate crystals were more effective in producing a very fibrous root system. The plants were then transferred to one-gallon-cans for a long enough period to establish root systems. After planting in rocky, decomposed granite loam, it was soon noted there was a great variation in growth rate, habit of plants and the leaves. In the sixth year, all off-types were removed, and the planting was greatly reduced in numbers, as the area had been purposely over-planted. While a small percentage of losses had occurred prior to thinning, this collection was reduced to 13 plants that measured three to eight-and-a-half feet tall and three to six feet wide.

***Quercus x morehus* Kellogg.**

Oracle Oak.

Tree (evergreen).

Scattered throughout the range of *Q. kelloggii* and *Q. wislizeni*, one finds an occasional tree (or trees) growing among mixed stands of both presumed parents. Only one collection of a few acorns was gathered, and they required 31 days to start germination. Since they were highly variable, only six were planted on the mesa. Planted in clumps, in 15 years they have developed into a group eight to ten feet tall with an equal to greater spread.

***Quercus x munzii* Tucker. (*Quercus lobata* Nee x *Quercus turbinella* spp. *californica* Tucker).**

Tree (evergreen).

[For original description, see: **Madroño** 19(7): 256-266. 1968.]

At Live Oak Tank in Joshua Tree National Monument, there is a 30 foot tall, symmetrical evergreen tree. It has long been a source of conjecture and disagreement among botanists as to its origin and parentage. In 1947, a collection of acorns was acquired from this tree, and we raised over 200 seedlings for a study in an attempt to determine its true origin. It was tentatively thought *Q. kelloggii* might be one parent as well as the common scrub oak found there. Three of these plants were moved to containers in 1951, but to date only one has survived, a plant now twenty-years-old, growing in a very rocky, sterile soil area. It measured eight feet tall and five feet wide in 1967. In 1956, we were presented with another collection of acorns and over 100 acorns were germinated. Presently 11, out of the 25 that were planted, have survived with no losses in nine years. They measured from seven inches to seven feet tall and from six to seven-and-a-half feet wide, and all, particularly with regard to the leaves, were highly variable in character. They most resembled the *Q. turbinella* ssp. *californica* [Ed: *Quercus john-tuckeri* Nixon & C.H. Mull. TJM2] parent.

***Quercus sadleriana* R. Br. ter.**

Deer Oak.

Shrub (evergreen).

In the northernmost counties of California and southwestern Oregon, this interesting oak inhabits the dry ridges and slopes, commonly at elevations of 3,100 to 5,000 feet. We are growing only one collection that was gathered in 1954. Two methods were used in starting the acorns. The first lot was put in a seed flat of moist sphagnum and required 96 days to germinate, with 80% of the acorns germinating. The second lot was put in a jar with moist sphagnum, and was cold-stratified

for 113 days, at which time many had already sprouted. Several (two to three) sprouted acorns were planted in gallon-cans, however, high mortality occurred during the nursery growing stage, from a rotting of the young sprouts. A total of 54 were planted in the garden, of which in their tenth year only five were alive, growing on the mesa, in clay-loam soil, under a large maple tree. They measured from three to 20 inches tall and from six to 30 inches wide. Three were noted in good condition, and two were poor. This species will probably not grow strongly in this location.

***Quercus tomentella* Engelm.**

Island Oak.

Tree (evergreen).

For years, we had made several attempts to find acorns of this insular species. In 1963 we acquired one acorn from Santa Catalina Island which required 37 days to germinate. In 1966, we received ten acorns from Santa Cruz Island, and in the same year, we received four small lots of acorns gathered from various canyons of Santa Catalina Island. One seed collection failed, while all of the others were nearly 100% good. These were planted directly into the garden site when their stems were two to three inches tall and most of them were doing well at last report.

***Quercus turbinella* Greene ssp. *californica* Tucker.** [Ed: *Quercus john-tuckeri* Nixon & C.H. Mull. TJM2]

Shrub (evergreen).

An inhabitant of the dry slopes, at elevations of 3,000 to 6,500 feet, it ranges from the western edge of the Mojave Desert, west and north to the Inner South Coast Ranges to San Benito County. Highly variable from hybridization with *Quercus dumosa* [Ed: *Quercus berberidifolia*] and other oak species, it may also be seen along the western edge of the Colorado Desert. In 1966, five collections were obtained through the courtesy of the Santa Barbara Botanic Garden and Dr. C. H. Muller, an oak specialist. All of these collections started germinating in 16 days, and 11 days later they were planted directly into a garden site. Excellent results have recorded, as all seedlings have survived and are making good growth. Two collections planted at the old site in 1946 and 1947 were moved in March, 1951 for transfer to our Claremont location. Five plants of each collection were put in six- and seven-inch pots and five-gallon-cans. In May, 1951 they were planted in rocky granite and in their twentieth year, four of one collection, and one of the other collection, were alive. Sizes for the first collection ranged from four-and-a-half to eight feet tall and were from seven to ten feet wide (they were from six to 28 inches tall when they were planted in 1951), and for the second collection (the one plant), it was four feet tall and six feet wide (it was 15 inches tall when it was planted in 1951). Acorns have not been produced.

***Quercus vaccinifolia* Kellogg.**

Huckleberry Oak.

Shrub (evergreen).

This low-spreading, rather handsome evergreen shrub is found at elevations of 3,000 to 10,000 feet, growing among rocks and on dry ridges and slopes, in the Sierra Nevada from Fresno County northward into Oregon. In 1952 we gathered three collections of acorns, with one additional collection made in 1954. Germination started in 68, 92, 38 and 33 days. All of the

collections of sprouting acorns were planted in cans and during the period before planting in the garden, from one-third to one-half died in the nursery from stem rot. Inventory has been maintained of three of the collections that were all planted in rocky, granitic loam. In their tenth year, these measured: ten inches to three-and-a-half feet tall and 20 inches to seven feet wide; nine to 18 inches tall and four to three feet wide; and five inches to three-and-a-half feet tall and 11 inches to six feet wide. Most of the smallest plants had been nibbled at one time or another by rabbits, after which wire cages were installed to protect the plants.

***Quercus wislizeni* A. DC.**

Interior Live Oak.

Tree (evergreen).

Many handsome specimens are seen in the valleys and slopes below 5,000 feet in the Inner Coast Ranges and lower slopes of the Sierra Nevada from Ventura to Shasta and Siskiyou counties. We have grown three collections, one each in 1952, 1953, and 1966. These required 42 and 48 days for germination, no data was recorded for the 1966 collection. The 1952 and 1953 collections were started in cans and the acorns of the 1966 collection were sown directly into the garden site. Over their first ten years of growth, four plants were lost of the 1952 collection, and two of the 1953 collection had died. For the 1966 collection, a total of five basins were planted, but those in four of them rotted during their first year. After ten years of growth, the 1950s collections measured from six inches to 11½ feet in height and five inches to 15½ feet in spread. There was a great deal of variation in each lot. Only two individuals of the 1952 collection appear to be normal trees.

An additional two collections from 1960 were cold-stratified in plastic bags for two months. One group had not sprouted, but did so 37 days later after they had been planted in a deep seed bed in lath house for several months. In February 1961, when they were partially deciduous, they were bare-rooted, and soaked in a Hormex solution (150 drops in three-gallons of water) for 15 minutes. Then, three seedlings were planted per basin in rocky-loam soil in the garden. In their sixth year, all were alive and measured three to 11 feet tall and were two-and-a-half to 12 feet wide.

Many scraggly, shrubby types appeared in all collections of this species, suggesting that they were hybrids, or that the species is unstable.

***Quercus wislizeni* A. DC. var. *frutescens* Engelm.**

Shrub (evergreen)

A strong component of chaparral community but found in other adjacent communities, this shrubby form of the species is found in the mountains of Southern California northward to Lake and Shasta counties, and sparingly in the Sierra Nevada. It is also present on Santa Cruz Island. In a period of ten years we harvested eight collections of acorns which pretty much represent a cross section of the habitats in which it is found. These acorns germinated in 52, 28, 36, 44, 46, and 46 days. One collection was cold-stratified in a plastic bag for two months, and since they had not germinated, they were then sown in a deep seed bed where they emerged after 23 days. All collections except last two were grown in cans in lath house, the others were planted bare-root after growing for a year in the seed bed. Plants were grown in many sections of the garden, and relatively good results have been recorded at six, ten, and 15 years of growth. After the

initial starting period of one to three years, losses have been almost nil. Fifteen-year-old plants ranged in height from two to 13 feet and had spread from three to 13 feet wide. Ten-year-old plants measured from eight inches to 14 feet tall and have spreads from nine inches to 15 feet wide. Six-year-old plants ranged in height from six inches to 12½ feet and spread from eight inches to nine feet wide. No acorns had been produced by any of the plants.

***Rafinesquia neomexicana* A. Gray.**

Annual.

Sunflower Family.

Commonly associated with shrubs, which it uses for support and shade, this desert plant may be found growing in both of our deserts, east to Utah and Texas. It flowers from February to May. Three wild seed collections were gathered in 1952, 1958, and 1963. Seeds were directly sown into the garden's sandy, granitic soils of our desert garden in November and December, where they developed into rather normal-sized plants. Flowering began in April and seeds were harvested in May. Seeds germinated in 12 to 15 days, and on the whole performance was good. For each collection volunteers were noted two years after initial planting, but each collection dwindled until none remained. Therefore, it became necessary to replenish this species with additional collections of seeds from the wild.

***Ranunculus californicus* Benth.**

Perennial.

Ranunculaceae. Buttercup Family.

Principally found in the Coast Ranges throughout California, in vernal moist areas, below 3,000 feet.

Propagation: Seeds were cold-stratified for 30 to 35 days, and germination started during the period of cold-stratification or shortly thereafter. It is doubtful if cold-stratification is necessary. Seeds were sown in November and January, and maximum germination was recorded within a few days after initial germination. Seedlings were moved to three- to five-inch pots for growing on until they went dormant (usually occurred in June). The dormant plants can easily be held in pots under semi-dry conditions. One seed lot was put in refrigerator for holding, but started growing within a month. Usually plants have grown large enough, particularly if they were started in November (or even earlier), for planting out in the garden in late March or early April. This was a much more satisfactory procedure rather than holding them in the nursery for a year.

Culture: Our three collections gathered in 1961 (one) and 1965 (two), were planted in several areas on the mesa, where they created a fine display through April and May. Additional lots of seeds were harvested for future use. Plants are best grown in an area where they can be kept moist during the spring months, and allowed to dry out during their dormant period after June. The stems die down completely, therefore notes should be taken as to the position of the dormant plants in one's garden.

***Ranunculus occidentalis* Nutt. var. *eisenii* (Kellogg) A. Gray.** [Ed: the var. is not recognized in TJM2]

Perennial.

Propagation: While the results from direct sowing into a garden site can be good, the maximum number of seedlings are produced by sowing the seeds in flats. Not more than 14 to 16 days elapse before the seedlings emerge, and within another week or two, all of them have germinated. Sowing the seeds in October or November will produce plants ready for transplanting from four- to five-inch pots into the garden in March or April. Seed viability deteriorates rather rapidly, therefore fresh seed is necessary for best results.

Culture: Beginning in 1939, at the old site, fine stands were raised in the heavy adobe clay. Seed was gathered, in 1950, and was sown directly into the Claremont site's clay-loam on the mesa. This is a particular hard clay, and the results were poor but plants persisted and developed into fine specimens from which additional seed was gathered in 1955. More plants were added, but through the years, they have gradually disappeared, and only a few were left in 1966. Flowering begins in their first year of growth, usually from March to April, and seed may be harvested soon thereafter.

Rhamnus L.

Buckthorn. Cascara.

Shrubs and Small Trees (deciduous and evergreen).

Rhamnaceae. Buckthorn Family.

This genus is composed of both evergreen and deciduous shrubs - some tree-like - with five species and eleven subspecies listed for California. Distribution in the state is widespread, usually in the drier habitats of canyons and slopes, although two species, ***R. alnifolia*** and ***R. purshiana***, require moist to swampy conditions. The majority of species are found in the 2,000 to 5,000 foot altitudinal range, although some taxa range to elevations up to 7,500 feet and others to nearly sea level. Depending on their altitudinal range, their flowering period ranges from March to August, but most flower between April and June. [Ed: in the genus *Frangula* flowers are perfect, while in the genus *Rhamnus* the flowers are typically unisexual (rarely perfect).] The most attractive asset of these species is the gradual color changes of the berrylike fruits, from green through a bright yellowish-red, to deep red, and then black. The fruits are greatly sought after by birds, particularly wild pigeons.

We have successfully established four of the five species, and seven of the eleven subspecies, listed for California. We have not had material to try of the remaining entities. Generally, there has been no problem growing any of the taxa attempted, and all have become well-established in the garden, with only minor losses.

***Rhamnus californica* Eschsch.** [Ed: *Frangula californica* (Eschsch.) A. Gray. TJM2]

Coffeeberry.

Shrub (evergreen).

Propagation: Four wild collections of untreated seeds germinated in 27, 29, 28, and 42 days, the latter having many variable runty seedlings. A fifth collection was sown and after 28 days was cold-stratified for 39 days, at which time germination had started. Maximum results were recorded usually around two months after initial germination. The best results were recorded for the lot of cold-stratified seeds, although we produced enough plants for our needs in all cases. Cold-stratification probably increases germination. Sowing and growing the plants in an outside

seed bed is a good method, as it allows the cold winter temperatures to act as the cold-stratifying agent. Transplanting seedlings and growing them in containers until they were ready for planting posed no problem. They were ready for planting out in the garden within a period of one year.

An unusually large-leaved specimen was growing naturally within the garden area. Thirty-five greenwood cuttings of semihard side shoots were taken in June, dipped in solutions of Terraclor and Isotox, and treated with CUTstart XX. Only one rooted, and it required 36 days for root initiation.

Culture: A total of 98 plants were planted in full sun in various sections and soils of the garden. These plants were either four-, seven-, or ten-years-old, and at this point, our records showed a total of 90 live plants that ranged in size from two to 14 feet tall, and from two to 26 feet wide. Flowering and fruiting started when the plants were from two to three-years-old.

Several specimens of the horticultural form, *R. californica* 'Seaview' were raised for display purposes. This is a fine selection, and while it did grow to heights of four to six feet and spread from eight to 12 feet wide, the compact growth and the wonderful display of fruits make it an ideal shrub for banks and other areas where space can be provided. One collection of seedlings of 'Seaview' were raised but only one showed a tendency for semi-prostrate growth. These seedlings were highly variable and most were runty and of little value.

***Rhamnus californica* Eschsch. ssp. *crassifolia* (Jeps.) C.B. Wolf.** [Ed: *Frangula californica* (Eschsch.) A. Gray ssp. *crassifolia* (Jeps.) Kartez & Gandhi. TJM2]

Shrub (evergreen).

This chaparral taxon is from dry slopes and canyons below 2,500 feet in elevation in the interior North Coast Ranges from Trinity to Napa and Lake counties.

Propagation: Two collections of seeds were harvested from plants growing at the old garden site, and were sown in three lots. For the first lot, two to three seeds were sown in four-inch pots, and they began to germinate in 45 days. Lots two and three were sown in flats and took 27 and 42 days to germinate. Good results occurred in the first lot, but results for the two lots sown in flats were poor (but all lots produced enough plants). A wild collection of seeds required 59 days to germinate and the results were similarly poor. Cold-stratification may have been of benefit. No problems were encountered while raising the seedlings in the nursery. One group of 45 side shoot cuttings were taken in September, 1963, and were treated with Rootone. These started rooting in 32 days, and resulted in 29 rooted cuttings of which 14 were planted. The principal cause of losses in these plants was the incorporation of a slow release (Agriform) fertilizer in the initial potting mix, a practice that is not recommended.

Culture: This is the best of the gray-leaved coffeeberries, often having beautiful, soft gray leaves four to five inches long and two to three inches broad. The leaves have a very silky feeling to the touch. However, to maintain plants that are true to type, it is necessary to produce them from cuttings as there usually is considerable variation in seedling grown stock.

The garden history of this subspecies is very similar to that of the species. Seven plants died out of the total 43 that were planted. The oldest group is 15-years-old, and ranged in height from eight to 13 feet and had spread from 12 to 32 feet wide. Ten-year-old specimens were 19 inches to five-and-a-half feet tall and were two-and-a-half feet wide. Flowering and fruiting occurred the second year of growth.

***Rhamnus californica* Eschsch. ssp. *occidentalis* (Howell ex Greene) C.B Wolf.** [Ed: *Frangula californica* (Eschsch.) A. Gray ssp. *occidentalis* (Howell ex Greene) Kartez & Gandhi. TJM2]

Shrub (evergreen).

Propagation: Seeds were harvested from a collection of this taxon growing at the old site and were sown, untreated, in four-inch pots. Germination began in 49 days, and reached maximum at about four months. Another collection from the same cultivated plants began germination in 20 days and had reached maximum germination in two months, indicated that sowing the seeds in flats resulted in quicker germination. A wild collection of untreated seed began to germinate in 28 days, and produced a nice crop of seedlings, however, a second seed lot of this same collection sown two years later produced only one seedling and it took 71 days to germinate. Seedlings losses were generally higher in the nursery for this subspecies.

Semihard cuttings with fruit on them were taken in October 1959, and were treated with Rootone. These cuttings initiated roots in 37 days, with 98% success rate. However, all but one died during the transplanting and growing processes in the nursery.

Culture: This writer considers this subspecies to be one of the best horticultural subjects of the native flora for its deep green leaves, compact and low growth habit, and its splendid display of berries over multiple seasons. Nearly dwarf forms have been noted with berries covering almost the whole plant. Since this is a plant from the moister north to northwest section of the state, its appearance in our hot inland garden is best when it is grown under high shade or in semi-shaded situations. However, we also have successful plantings growing in full sun in well-drained rocky granitic loam soil. Plants growing in the tighter mesa soil grew well for a few years, and then gradually faded out. While some deterioration was recorded for a planting growing in full sun after ten years, the plants measured 21 inches to six-and-a-half feet tall and were two-and-a-half to 14 feet wide, and only one specimen had died. Flowering and fruiting began in their second year. Each spring the planting required spraying as it was heavily infested with aphids that had a decided negative effect.

***Rhamnus californica* Eschsch. ssp. *tomentella* (Benth.) C.B. Wolf.** [Ed: *Frangula californica* (Eschsch.) A. Gray ssp. *tomentella* (Benth.) Kartesz & Gandhi. TJM2]

Shrub (evergreen).

A grayish-leaved evergreen shrub inhabiting dry slopes below 3,000 feet elevation, in chaparral and foothill woodland plant communities. This taxon ranges from Trinity and Siskiyou counties southward in the Inner Coast Ranges and Sierra Nevada to Baja California (Mexico).

Propagation: Four seed collections were sown untreated, three collections were from wild populations and one was from cultivated plants in the garden. Germination started at 28, 60, and 40 days for the wild material, and at 21 days for the seeds from the cultivated plants. The number of seedlings produced was poor for all of the collections, but no problems were encountered while raising them in the nursery. Only one plant died from the two collections that germinated most quickly, while plants from the two collections that took the longest period to germinate suffered the greatest losses over their first ten years of growth. Losses in these two groups were 50% and 52%. The 15-year-old collection suffered no losses and measured six-and-a-half to 11 feet tall and were 13 to 18 feet wide. Flowering and fruiting began in their second season. The three ten-year-old collections from the wild ranged in heights from two to eight-and-a-half feet

and had spreads of two-and-a-half to 14 feet. Flowering and fruiting in all lots began the second season. Heavy infestations of aphids were noted each spring for all collections of this taxon.

***Rhamnus crocea* Nutt.**

Buckthorn. Redberry.

Shrubs (evergreen).

Propagation: Three collections of seeds were gathered from cultivated plants in the garden, and were divided into four seed lots, and were sown untreated. Germination started in 16, 19, and 14 days. The remaining seed lot was sown four years later and germination started in 18 days.

Minor to no losses of plants were noted during transplanting of seedlings and young plants from two-, four-, and five-inch pots, but when the plants reached gallon containers greater losses were recorded.

Culture: Our Claremont site supported many fine native specimens of this valuable species. However, it was necessary to raise additional plants for ornamental use in other parts of the site, as well as to have one planting for which recorded data was kept. As would be expected for a site native, excellent growth and results were recorded over a period of eight years. Heights ranged from three to six-and-a-half feet and the plants had spread from three-and-a-half to 12½ feet wide. Flowering and fruiting was recorded in the third year of growth. As this species is unisexual, not all plants will produce fruits, and there is a noted difference between male and female plants. Growing especially well on dry, rocky hillsides and in other similar situations, it has proven to a valuable plant for hedges, specimen plantings, and general garden purposes. When it is grown in the heaviest soils, water can be kept to a minimum, and the plants will thrive.

***Rhamnus crocea* Nutt. ssp. *ilicifolia* (Kellogg) C. B. Wolf. [Ed: *Rhamnus ilicifolia* Kellogg. TJM2]**

Shrub (evergreen).

Propagation: Seeds were collected from cultivated plants and were sown untreated. Germination started in 18 days. A collection of seeds from the wild germinated poorly in 74 days, while subsequent lots of this same seed collection were sown two years later and germinated very well in 26, 25, and 28 days. An additional collection from a population of wild plants was cold-stratified for 103 days and had started to germinate before they were removed from cold-stratification. Another collection of seeds from cultivated plants that were originally from the Providence Mountains in the Mojave Desert, failed to germinate after cold-stratification on two occasions. All seed lots, except for those collected from our cultivated plants at the old site, produced many weak and runty seedlings that were either discarded or died in the nursery. The cold-stratified collection had attained maximum germination within ten days after removal from cold-stratification, while untreated seeds usually took another month after initial germination.

Culture: This large, evergreen shrub, is found mainly below 5,000 feet elevation in the chaparral belt, and is found from Siskiyou County southward to Baja California (Mexico). The plants have generally grown well for us, but their performance has been variable.

The collection grown from seeds harvested at the old site has recorded only three losses in 15 years, and the plants measure from 19 inches to nine-and-a-half feet tall and are two to 13 feet wide.

The several wild seed collections gathered from widely separated areas in California produced a large percentage of runty, weak seedlings and recorded losses were equally high in the garden – though moles, working through the loose, rocky soils, as well as some unsatisfactory soil conditions significantly contributed to losses of young plants. Once the plants were well established, losses were minimal. A ten-year-old collection recorded a 50% loss and the plants measured four to ten feet tall and five to 12 feet wide. Two collections showed 90% or higher losses in seven years with the remaining plants measuring from four-and-a-half to seven-and-a-half feet tall and five to nine feet wide. A four-year-old collection showed about 30% loss and measures from one to six feet tall and from 20 inches to eight-and-a-half feet wide. Flowering and fruiting occurred in the fourth and fifth years in all collections.

A 15-year-old collection from the Providence Mountains in the Mojave Desert had no losses, but the plants remained low and small, measuring about two feet tall and four to five feet wide. Although an accurate record was not kept, the first seeds were harvested from these plants when they were nine-years-old. These plants have very spiny leaves and very stiff branching.

***Rhamnus crocea* Nutt. ssp. *pirifolia* (Greene) C. B. Wolf.** [Ed: *Rhamnus pirifolia* Greene. TJM2]

Propagation: Two-year-old seeds that had been harvested from plants at the old site germinated in 20 days, while a wild collection from Santa Cruz Island, germinated in 18 days. Both collections reached maximum germination in 15 to 30 days. Seedling losses were minor in the nursery, but a third of them from the wild collection were discarded as they were runts. Seedlings were ready for planting in the garden within a year. Plants were also easily grown from cuttings.

Culture: This tree-like insular evergreen is a handsome plant, particularly during its fruiting period when quantities of brilliant red fruits are borne in heavy clusters on the female plants.

At the old site, severe fasciation or “witches broom” was reported as attacking most of the plants, causing an unsightly distortion of the leaves, and some seedlings appeared to carry this trait into subsequent generations. (See Wolf (1938, page 48) for an early report of this condition.) The source of this problem (fungal, virus, insect, etc.) was never determined, and it was with some anxiety that we watched our new plantings in Claremont. Not until after the tenth year, in one planting on the mesa, was this same pathology observed. The affected plants had been grown from seed harvested from a Santa Catalina Island collection growing at the old site. Our collections grown from Santa Cruz Island seeds did not exhibit this pathology.

Some of our plantings, growing in very rocky soils, have grown quite well and in their 15th year measure from six to 12 feet tall and from six to 14 feet wide. Seven-year-old plants measure from six to 11 feet tall and are six to 12 feet wide. Flowering and fruiting was first recorded in the second and fourth years. Losses ranged from 30 to 50%, but were mainly caused by rodents and moles. Evidence of hybridization was visually noted in our plantings from both wild and cultivated seed sources.

***Rhamnus purshiana* DC.** [Ed: *Frangula purshiana* (DC.) J.G. Cooper. TJM2]

Cascara Sagrada.

Shrub or Small Tree (deciduous).

Propagation: Four seeds were collected in Humboldt County, and were sown without treatment. Two seeds germinated in 67 days. Five years later, seeds were harvested from these two seedlings and were divided into two lots. These seeds were sown without treatment, a year apart, and germinated in 14 and 27 days. More plants were produced from the first sowing, though there were plenty of seedlings produced from both lots. The seedlings varied considerably, with many from both lots appearing puny, stunted, and of very uneven growth. An all-purpose fertilizer was applied, and while it made quite a difference in the growth of the weak stock, none showed the vigor of those that appeared to be normal for this species. Subsequent observations indicated that many of the seedlings were hybrids. Aside from this issue, we experienced little difficulty while raising the seedlings.

Culture: In 1954, the first two plants raised were planted out in the garden on the mesa in tight clay-loam soil, in a somewhat protected location on the east side by large oak trees (*Quercus agrifolia*). Growing on the edge of a large depression where plenty of water could be supplied, they grew rapidly into shrubs 12 to 18 feet tall with equal or greater spreads. In August 1958, seeds were harvested from the two plants. The resulting seedlings showed evidence of hybridization, probably with *Rhamnus californica* and two of its subspecies that were planted nearby. These hybrid seedlings were evergreen, partially evergreen, or deciduous, the latter most resembling the female parent. There was a high mortality among these plants, some of them were weaklings and others succumbed to root rots – an unusual situation for a moisture loving species. Except for the two original plants, our subsequent plantings cannot be said to be entirely successful. The truer-to-type plants do the best. Fruiting occurred in the third year, and eight-year-old plants measured seven-and-a-half to 14 feet tall and were six to 16 feet across.

***Rhamnus rubra* Greene.** [Ed: *Frangula rubra* (Greene) Grubov. TJM2]

Mountain Pigeonberry.

Shrub (deciduous).

Propagation: Between 1952 and 1963, five seed collections were made – four from wild sources and one from cultivated plants in the garden. All seeds were sown untreated except for the one from the cultivated plants. The wild collections germinated in 33 days (results: poor), 34 days (results: poor), 22 days (results: fair), and 23 days (results: good). The seeds from the cultivated plants were cold-stratified for 63 days and germinated 12 days later (results: excellent). Only minor losses were recorded while the plants were grown in the nursery.

Culture: This species naturally inhabits drier slopes and forests at elevations of 4,000 to 7,000 feet in the Sierra Nevada and Cascade Range from Siskiyou County to Calaveras County. Plants grown in our well-drained, rocky, granitic loam, prospered in most instances except when they received too much water. (In a mass planting of this species, a portion of the group received considerably more irrigation than their neighbors, and most of the irrigated plants succumbed while the others grew happily. In another area, a group received only minor irrigation and grew thriftily until there was notable decline in the plants in their eighth year – when they had received additional overhead irrigation applied to adjacent plantings.)

Ten-year-old plantings ranged in heights from two to nine feet and had spread from three-and-a-half to 12½ feet wide. Flowering and fruiting started in the second or third year.

***Rhamnus rubra* Greene ssp. *obtussisima* (Greene) C. B. Wolf.** [Ed: *Frangula rubra* (Greene) Grubov ssp. *obtusissima* (Greene) Kartesz & Gandhi. TJM2]

Propagation: We made two collections of seeds from the wild in 1952. Both were sown (untreated), and germination began in 21 days (results: poor) and 34 days (results: poor). Maximum germination was recorded a month or more later. A second sowing of these seed collections five years later failed to germinate. Only minor losses were recorded while the plants were grown in the nursery.

Culture: This subspecies, like the species itself, naturally grows in very dry situations at elevations of 2,000 to 7,000 feet in the Sierra Nevada and Cascade Range from Tuolumne County to Shasta County. Our experience growing these plants has been relatively good for the first ten years, with minimal losses. However, during their tenth year, recorded losses were much higher, even though there was no change in horticultural procedures. At ten years of age, the plants measured from two-and-a-half to seven-and-a-half feet tall and from four to 12 feet wide. Flowering and fruiting started in their second and third years.

***Rhamnus rubra* Greene ssp. *yosemitana* C. B. Wolf.** [Ed: *Frangula rubra* (Greene) Grubov ssp. *yosemitana* (C.B. Wolf) Kartesz & Gandhi. TJM2]

Shrub (deciduous).

Propagation: In 1952, one seed collection from the wild was sown (untreated) and germinated in 45 days with sporadic seedlings emerging over a much longer period. As a result, cold-stratification is recommended for this subspecies. There was no difficulty with raising the seedlings in the nursery.

Culture: We find this subspecies growing in arid forests and sagebrush scrub of the Sierra Nevada at elevations ranging from 4,000 to 6,500 feet, from Mono County to Tuolumne and Mariposa counties. In 1949 and 1950, we received a total of five plants from the late Louis Lake Edmunds. Both collections had been grown from seed originally harvested from plants in the Mono County region. However, two of the plants were grown from seeds gathered from plants growing in the East Bay Regional Parks Botanic Garden in Tilden Park that had originally been grown from the Mono County seeds. These plants are alive, but are nearly evergreen when they should be deciduous. The others, also show evidence of hybridization since they are only partially deciduous.

Our own plants grown from seeds from the wild are deciduous and have grown exceedingly well here. Only one plant was recorded dead in ten years. These plants measured from seven to 13 feet tall and were eight to 16½ feet wide. Flowering and fruiting started in the second year. This has been our most successful subspecies grown here of the ***Rhamnus rubra*** [Ed: *Frangula rubra*] group.

***Rhododendron macrophyllum* G. Don.**

California Rose-Bay.

Shrub (evergreen).

Ericaceae. Heath Family.

Propagation: Fresh untreated seed (one month old) will germinate in 25 to 30 days with good to excellent results. Two- and three-year-old seed collections were sown and germinated after 40 and 45 days and results were poor. Germination percentage drops off rapidly when the seeds are from two- to three-years-old, and older seeds failed entirely.

Cold-stratification was used for three collections (and multiple seed lots) but the results were generally poor, with only one collection considered successful. Cold-stratification periods were 53, 20, 79, and 68 days. After removal from the cold, germination began in 79, 23, and seven days and for only the latter was the germination rate considered excellent. Maximum germination in all lots took about one to two months, but in most cases was a little over 30 days.

Seeds need to be sown very shallowly (sprinkled on top of sphagnum moss and then lightly worked in) and the soil mix should be kept rather moist. Placing these seed flats in the cutting room of our greenhouse provided a good environment for seed germination. Seedlings are tiny and must be watched carefully for any signs of "damp-off." Initial growth is slow, and the first transplanting into two-inch pots was done at least three to four months after germination. A light feeding during the period of time that the seedlings remain in flats is beneficial and will hasten seedling growth. After the initial potting phase, we experienced little difficulty in raising the seedlings to planting size within one year. Losses were very low.

One lot of 12 greenwood tip cuttings was taken in July, and was treated with CUTstart XXX. Only one cutting rooted, and it required 112 days to start rooting. The plant was raised successfully in the nursery, and was later planted in the garden.

Culture: It cannot be said that we have been too successful with this fine native from the cool, coastal forests from central California northward to British Columbia (Canada). We have planted several hundred plants in the garden, but no accurate yearly records were recorded. Plants were planted in a wide variety of garden conditions in an attempt to find the proper growing areas to demonstrate their usefulness as an ornamental in Southern California. Several specimens were noted to have flowered within two years of planting. The most satisfactory garden location appears to be under established oaks, and in such locations we have plants that have survived for five to ten years. These plants require moisture throughout the year, deep humus soil, and excellent drainage.

***Rhododendron occidentale* (Torr. & A. Gray) A. Gray.**

Western Azalea.

Shrub (deciduous).

Propagation: During a period of 12 years we sowed nine lots of seeds from five wild collections. The seeds are quite small and require shallow sowing. All lots except one were cold-stratified for periods of 35, 45 and 81 days, and subsequently germinated in 15, 18, 21, 29, 31, and 25 days respectively. The untreated collection required 55 days to germinate. Cold-stratification is probably unnecessary, but clearly does no harm. Good to excellent results were obtained for all seed lots sown within one month to two years from their date of collection. Seeds that were three-years-old germinated poorly, and those that were four- or more-years-old were complete failures. Two seed collections that were sown soon after harvesting failed or produced only a few seedlings, while these same seed collections sown a year later gave excellent results. Maximum germination came within one to two months after initial germination. We experienced no serious

problems while raising the seedlings in the nursery. Losses were small in comparison to the many plants successfully grown.

Considerable experimental work was carried on to determine the best method for propagating selected individuals from cuttings. As we found out, the principal difficulty was getting a full cycle of growth after rooting – before the plant goes dormant. If dormancy occurs before a full growth cycle, losses will be extremely high. In June, cuttings of new tip growth were treated with Rootone, and 100% of them rooted, with root initiation starting after 31 days. After three months, all 46 plants were growing vigorously in gallon-cans. However, these plants had not completed their growth cycle before they went dormant, and 29 died in the ensuing months.

A year later 50 cuttings were taken and were treated in same manner, and 37 rooted. All subsequently died as a result of an untimely application of a fertilizer solution that was too strong.

A third group of 15 semi-hardwood cuttings was taken in December and were treated with Rootone, and were put in a plastic bag and kept refrigerated at 38° F until the first of April when they were stuck in a cutting flat. Nine cuttings rooted by June. Four survived and were grown through to two-gallon-cans at which time they were planted out in the garden.

In June, while the selected shrub in flower, a fourth group of 35 tip cuttings were taken and were treated with Rootone and planted in three-inch pots. A total of 30 rooted, but only 15 lived to be shifted to gallon-cans, and only five reached two-gallon containers.

In August, 25 tip cuttings were taken from plants growing in the lath house, and were treated with Rootone. After 35 days, 21 were potted up into three-inch pots. A month later, these plants were shifted into five-inch pots, and five months later (March of following year) all were alive and were transplanted into gallon-cans. The five-inch pots were kept in the cutting room of the greenhouse, and after the plants were shifted into gallon-cans they were grown in the greenhouse.

From later information, it appears the best procedure for this species is to root the cuttings but do not transplant them until after a full growth cycle has been completed (after the first dormancy). Prior to dormancy, periodic light foliar feeding should be done. Our last record (as shown above) appears to have been the most satisfactory (taking the cuttings in August from plants growing in the lath house).

Culture: This lovely species usually is found in scattered locations along stream banks and moist seeps at elevations below 7,000 feet throughout the mountains of California and northward into Oregon. We have grown this species far more successfully than *R. macrophyllum*. While losses in some areas have been high, many plants have lived for over 15 years. We have planted specimens in many situations, and have found that they will accept quite a bit of sun, heavy soils, and moderately dry conditions – although they appreciate shadier and more humus-rich soils with good drainage. Some plants (both seed and cutting grown) were very precocious in the blooming, flowering during their first year in the nursery. Several plants have been recorded as starting to flower during their second year. The fragrance of the flowers is quite noticeable on sunny days for quite a distance from the plant. Our specimens grew up to five feet or more in ten years.

One particularly fine plant produced flowers with deep yellow center markings. This specimen was the basis for our extensive work with cuttings.

Rhus* ‘Claremont’** (aka: ***Rhus* hybrid** presumed parentage: ***Rhus integrifolia* × *Rhus ovata).

Shrub (evergreen).

Propagation: Asexual production only. In August of 1963, 40 tip cuttings were taken and were treated with Rootone and were placed in a seed pan in the greenhouse. Root initiation started in 37 days, but only nine rooted and three of these died during their one-and-a-half years while in the greenhouse and lath house. In July 1964, a second lot of five cuttings were taken and treated with Rootone and were planted in individual three-inch pots and given the usual greenhouse conditions. Root initiation started in 46 days, and only two rooted but neither was lost during their one-and-a-half years in the nursery.

Culture: The parent of the above cutting grown material was one of a group of seedlings raised from seed gathered from a native ***R. integrifolia*** plant growing at the old garden site. There seems to be no question as to parentage as there are many characteristics from both of the presumed parents. The hybrid is a large, rangy but handsome evergreen shrub which in 15 years had been measured at least 17 feet tall and 25 feet wide. The plant’s long, arching branches were covered with leaves that are larger than either parent, and are greener and shinier than ***R. integrifolia***. Many handsome bouquets were taken from the plant as the cut material lasts a long time. The flower clusters tend to be much larger than either parent, and are a lovely pinkish white, and are quite pink-red in bud. They generally are at the end of the long, graceful branches and flower in February and March. The cutting grown plants, when last observed were quickly developing into fine specimens. (This plant was subsequently designated ‘Claremont’ in the 1970s, but it was not officially released with that name until 1993.)

***Rhus ovata* × *Rhus integrifolia*.**

Rhus hybrid.

Shrub (evergreen).

Propagation: In October 1959, 65 semihard cuttings were taken and were treated with Rootone, 37 were planted in individual three-inch pots, and 28 were planted in a seed pan. First roots were noted in 73 days, and only six rooted and all were those in the three-inch pots. All were successfully raised in the nursery.

In May 1960, three lots of cuttings were collected. Lot one consisted of 40 tip and side shoot cuttings that were treated with Rootone, and were planted in seed pans in the greenhouse. Root initiation began in 38 days, with the dark red roots appearing only at the base of the cuttings. These roots were noted as being very brittle and were easily broken, though only five rooted cuttings died in potting transfers. Lots two and three, respectively, totaled 32 and 36 leaf bud cuttings. Lot two was treated with CUTstart plus Captan (a fungicide), and lot three was treated with only Captan powder, both lots were planted in seed pans and were provided usual greenhouse conditions. All of these cuttings had rotted in a two month period.

Culture: Presently no records have been made of the success of any of the plantings of this clone. However, casual observations indicate that they were progressing nicely. Three plants were sent to California City, a very difficult desert environment in Kern County.

***Rhus integrifolia* (Nutt.) Rothr.**

Lemonadeberry.

Shrub (evergreen).

Sumac Family

Propagation: One seed collection was given a hot water treatment for 24 hours, and began germinating in 31 days reaching maximum germination in one-and-a-half months. One lot of untreated seed started germinating in 26 days but took over four months to attain maximum germination results, and the overall results were considered poor. However, a second untreated lot of the same collection sown four years later germinated in 12 days and reached maximum germination a little over one month later, and results were recorded as good.

A sixteen hour soak in sulphuric acid followed by a thorough washing before sowing germinated in ten days with maximum germination at 18 days, and results were excellent. All seeds were sown about a month after harvesting, except for the one lot of four-year-old seeds. While the hot water and sulphuric acid treatments both produced good to excellent results, it appears the latter is best. The seedlings were easily raised in the nursery.

Culture: Native to Southern California coastal lowlands and Baja California (Mexico), extensive propagation was unnecessary as there were many plants already growing within the Claremont garden site. A few were added to existing plantings and others were used for ornamental purposes, particularly where coverage was needed in difficult situations. While this species prospers on an occasional deep irrigation, once established it will continue to grow without any irrigation. It also can be espaliered, clipped to handsome hedges, or allowed to take over difficult garden areas. A 15-year-old planting ranged in heights from two to 17 feet and spread from five to 25 feet wide (the largest was a hybrid that is discussed immediately below). Ten year specimens ranged in heights from two to nine feet and spread from two to 12 feet wide. Flowering and fruiting records were not recorded but were known to have occurred within five years. An unusually small-leaved, prostrate specimen was presented to the garden in 1961. It originally had been raised in the City of San Diego's municipal nursery, where it was noted. It was raised for over two years in another location, then it was transplanted into a five-gallon-can and given to us. After new growth was well underway in the greenhouse, and the plant had been hardened off in the lath house, it was planted on the mesa in full sun and clay-loam soil adjacent to a large native specimen. For five years it made little growth and gradually lost strength, until it eventually died in its sixth year.

***Rhus laurina* Nutt.** [Ed: *Malosma laurina* (Nutt.) Abrams. TJM2]

Laurel Sumac.

Shrub (evergreen).

Propagation: Untreated seed will start germination in 18 to 21 days and will reach maximum germination in one to two months. Since we needed only a few plants, we only raised two lots from one collection of seed. The first attempt was from seeds that were harvested one year before they were sown, and the second lot was sown nine years later. The second sowing produced much better results. Hot water treatment (that has been recommended by others), might have produced better results. There was no loss of seedlings grown from the first lot of fresher seeds, but we lost almost 50% of the seedlings from the older seeds. The later seedlings were a much weaker lot.

Culture: This plant is a component of the Southern California coastal sage belt, and there were several large specimens naturally growing within the Claremont site's boundaries. It is an extremely useful plant where very difficult growing conditions are present, but it does require warmer winter temperatures, usually not much below 28° F. It is a good indicator plant for sites that are favorable for citrus cultivation. Since we needed only a few plants, we made no effort to use all of the plants that we grew. Because we do have temperatures that drop to 25° F or below, young plants that were set out in the fall were weakened by winter frosts and losses were high until the plants were well established. While the species grows much more rapidly in richer soils, in our rather rocky loam, six- and seven-year-old plants were four to seven feet tall and had spread from seven to ten feet wide. Flowering and fruiting was first observed in their sixth year.

***Rhus ovata* S. Watson.**

Sugar Bush.

Shrub (evergreen).

Propagation: Four collections of seeds were harvested from plants growing at the old site and at our new Claremont location were sown on ten occasions. Seeds harvested from plants at the old site were given hot water treatments for 24 hours and one lot was untreated. Excellent results were obtained for both lots given 24 hour hot water treatment, but four-year-old untreated seeds yielded poor results. Hot water treated seed lots required nine and 15 days to start germination, while the untreated seeds took 12 days to start germination. Six lots were sown of seeds harvested from plants set out in our Claremont site. These seeds were given the hot water treatment for 15 hours and germination started in nine days but the results were poor, maximum germination was reached in three months. Thiourea treated seed failed to germination after four months. An untreated three-eighths ounce of seeds took 27 days to start germination, and produced only three seedlings. Another collection was cold-stratified for 82 days and started germinating 11 days after removal from the cold, but the results were poor. A second sowing after 93 days of cold-stratification had seedlings already germinating before removal from the cold, but the results were poor. A third sowing after a three-and-a-half hour soaking in sulphuric acid produced many more seedlings. These began germinating in 18 days and reached maximum germination one month later. A fourth sowing after a three hour soaking in sulfuric acid was very poor for four-year-old seeds sown in March. These began germinating in 13 days, but these older seeds may have benefited from a longer acid soaking. Whatever treatment is followed, it appears the seeds need longer acid or hot water treatments for best results. Up to six hours acid soaking has been recommended (but the optimal time period needs further experimentation), and a 24 hour hot water treatment should be used. The quality of seed has an effect, too. Seeds produced here in Claremont did not seem to be as good as those that were harvested at the old site. Except for discarding runty seedlings and some minor losses there was no particular difficulty in raising the young plants in the nursery.

Culture: This excellent hardy shrub is generally seen in the chaparral belts of Southern California, and while not growing naturally in the Claremont site, it adapted readily. Plants were used in a variety of situations, and developed into handsome plants within a few years. Losses were generally minor. Most of the plantings were used for coverage and ornamental effects. There was considerable variation in the plants, indicating some hybridity as will be noted. Measurements were kept on one group of plants for 15 years, and at that age were recorded at

heights from six to 12 feet and spreads from 12 to 24 feet (the largest was a hybrid plant, that was later removed).

***Rhus trilobata* Nutt. var. *anisophylla* (Greene) Jeps.** [Ed: *Rhus aromatica* Aiton. TJM2]

Basket Bush.

Shrub (deciduous).

Propagation: One wild collection of seed was gathered in May 1952. These seeds were sown the following October, untreated, and began germinating in six days, and reached maximum germination in two months – though the results were noted as poor. Two years later a second untreated lot of the same seed collection began germinating in three days and reached maximum germination in 22 days. Though these results were better than the earlier effort, the results were still poor. Eight years later, the third lot of the same seed collection was cold-stratified for 80 days and germination started ten days after removal from the cold, and reached maximum germination in 18 days, but these results were not as good as the second lot. In each of the three lots, only one-eighth ounce of seed was used and, respectively, 30, 37, and 27 seedlings were potted. While enough plants were produced for our purposes, germination was not considered good. Perhaps, as has been suggested, soaking the seeds in sulfuric acid for one to three hours plus cold-stratification would have increased the number of seedlings greatly. Apparently, storage for at least eight years does not affect seed viability. There was no problem raising the seedlings in the nursery and all were ready for planting within a year.

Culture: This variety is from the mountains of the Mojave and northern Colorado deserts. After the plants are established, they grow very satisfactorily for us, although initial losses were high. Their location in the garden was very rocky and the plants needed more initial attention to properly get started. Ten-year-old plants ranged in height from a few inches to over seven-and-a-half feet tall and had spread up to 14 feet wide. Neither the production of flowers or fruits was recorded. The **var. *malacophylla* (Greene) Munz** [Ed: the var. is not recognized in TJM2] grew naturally in the Claremont site.

***Rhus trilobata* Nutt. var. *quinata* Jeps.** [Ed: *Rhus aromatica* Aiton. TJM2]

Shrub (deciduous).

Propagation: One collection of seeds harvested from plants growing at the old site were soaked for 24 hours in hot water, and provided excellent results. Germination started in 17 days, and maximum germination was recorded in 47 days. There were no problems with raising the seedlings in the nursery. Subsequently, a seed collection was made from this planting in the garden. These seeds were sown after hot water treatment or were sown after cold-stratification, but regardless of treatment only two or three seedlings were produced from each test. Between 1954 and 1960, several lots of three wild seed collections were sown. All but one were cold-stratified for periods of three to four months. One collection failed completely and the others produced more than a few seedlings. The one untreated lot produced as many seedlings as those that were cold-stratified, but the untreated lot began germination in 11 days. Another wild collection was given hot water treatment followed by cold-stratification, but yielded no improvement in germination. The seedlings were raised in the nursery with no problems.

Culture: This is primarily a variety from the Coastal Ranges, and they generally grew exceedingly well for us. Our first group, raised from cultivated seed, had no losses over a 15 year

period, except for those lost during an attempt to transplant some plants that were being crowded by pine trees. These transplants died, but the remaining plants grew into large clumps with heights of six-and-a-half feet and spreads up to 15 to 20 feet wide. Flowering and fruiting occurred in the second year. Additional plantings of wild collections were used in difficult areas and quickly established themselves with few initial losses. Seven-year-old plants ranged in height from two to five feet and had spreads of two to 13 feet. Young plants were often attacked by rabbits, which hampered their growth and necessitated caging of the plants.

***Ribes amarum* McClatchie.**

Bitter Gooseberry.

Shrub (deciduous).

Saxifragaceae. Saxifrage Family. [Ed: Grossulariaceae. Gooseberry Family. TJM2]

Propagation: Only one collection was grown, and these were from seeds that were gathered from cultivated plants at the old site. The untreated seeds were sown fresh and began to germinate in 44 days. A second lot of these same seeds were sown untreated two years later, and began to germinate in 81 days. A third lot of these same seeds were sown seven years later. These were cold-stratified for 90 days and failed to germinate. Fresh, untreated seed will give good to excellent germination. Minor losses of seedlings and young plants occurred during their time in the nursery.

Culture: Found in wooded, semishaded canyons below 5,000 feet from central California southward, this species fared poorly with us, principally because it was located in full sun with very rocky, decomposed granite loam that is somewhat on the sterile side. Even though losses were high, 15-year-old plants were measured at four to five feet tall and were from six to nine feet wide. Fruiting occurred within five years.

***Ribes aureum* Pursh.**

Golden Currant.

Shrub (deciduous).

Our original collection of this species came from along a river bank in the sagebrush plant community at 7,200 feet elevation. In California, this is essentially a Sierran species, and was planted in that plant community in the garden. Propagation: The first lot of a fresh wild collection of seeds were sown untreated and began germinating in 26 days. Four additional lots of the same seed collection were sown at one year intervals failed after the third year. All were sown untreated except one that was cold-stratified. The seedlings of the first lot were readily grown in the nursery.

Culture: The plants were planted in an open, rocky situation in the garden, where many died during the first three years. At ten years, the two remaining plants were in poor to fair condition and ranged in heights from six to 11 inches and had spreads of seven to ten inches wide. No flowering or fruiting had been recorded. There is no question that this species requires a moist situation and a loam soil for best results.

***Ribes aureum* Pursh var. *gracillimum* (Cov. & Britt.) Jeps.**

Shrub (deciduous).

Propagation: Two collections of seeds were gathered from our own plants provided excellent results when sown untreated. Germination started in 13, 15 and 17 days, and all were grown from fresh seed, except for one lot of two-year-old seeds that did not germinate at such a high rate. No pretreatments appear necessary for good germination. Maximum germination occurred within 15 days to one month later. Losses were minor and we had no serious problems growing the young plants in the nursery.

Culture: This variety is found growing on brushy slopes and on alluvial deposits below 2,500 feet from Alameda County southward through the Coast Ranges to San Diego County. It has always grown well for us and our results in this location were no different. It does particularly well in the clay-loam soil of the mesa and on the semi-shaded banks of the mesa. While plants grew satisfactorily in our open rocky soils, losses there (over a period of 15 years) were greater than 50%. Plants range in heights from three to ten feet and clumps measured ten feet or more across. Flowering and fruiting may start during the second year.

***Ribes californicum* Hook. & Arn. var. *hesperium* (McClatchie) Jeps.**

Hillside Gooseberry.

Shrub (deciduous).

Propagation: Three collections of seeds were harvested from our cultivated plants, two from the old site, and one from plants growing at our Claremont site. Several lots of seeds were sown from these three collections, and were untreated. In all lots, germination was excellent, except for two (one was of seven-year-old seeds that failed to germinate, and the other was of eight-year-old seeds that germinated poorly). No problems were encountered raising the seedlings in the nursery, and nearly 100% were successfully raised.

Culture: This species inhabits canyons below 2,500 feet in the Santa Ana and San Gabriel Mountains to Santa Barbara County. We could only grow this variety well in a similar situation on the side of the mesa, in clay-loam soil, surrounded by other shrubs. In such places it did exceedingly well, while those planted in the open rocky soils were nearly complete failures (about 99% died). However, when the hardiest of a group settled in, they have continued to show good growth and health. Some 15-year-old plants were measured from six to eight-and-a-half feet tall and from seven-and-a-half to 11 feet across. Flowering and fruiting started in the third and fourth years.

***Ribes canthariforme* Wiggins.**

Shrub (deciduous).

Propagation: Seeds were gathered from our original plants growing at the old site. The seeds were sown, untreated, two years after harvesting. They began germinating in 99 days with maximum germination (noted as poor) reached two months later. A second untreated lot of five-year-old seeds were sown and started germinating in 26 days and results were excellent. There was no evident explanation for the difference except that the soil mix for the second lot could be considered more open than for the first lot. For both lots, there was no loss of seedlings in the nursery.

Culture: This species is restricted to a very small area of chaparral in San Diego County. Our planting is growing in a rocky clay, and is somewhat shaded by other large shrubs and some

trees. The first planting suffered a high mortality rate due to mice stripping off the bark near the base of the plants. Otherwise, since the mice have been controlled, losses have been minimal. Our plants require little water when they are grown under such conditions. Plants that are 15-years-old range in height from four to seven feet and have spreads from four to 12 feet wide. Flowering and fruiting started the second year.

***Ribes cereum* Douglas.**

Currant.

Shrub (deciduous).

This montane species is found growing in dry rocky places at elevations from 5,000 to 12,000 feet, from the Santa Rosa and San Jacinto mountains in Southern California northward through the Sierra Nevada and in the desert ranges of California, and extends north to British Columbia (Canada), and east to Colorado.

Propagation: In a period of 11 years, we have gathered eight wild collections of propagation material for this species. Seven were of seeds and one was of cuttings from wild plants. The cuttings, treated with CUTstart, failed to root. Fifteen seed lots were sown from the seven seed collections. Twelve lots were cold-stratified and three lots were untreated. Of these, only one lot of untreated seeds failed, while six lots of the cold-stratified seeds failed. However, we feel that four to six months of cold-stratification is necessary for this species.

Two seed collections from the San Bernardino Mountains were the most successful. One after a period of three months cold-stratification, and the second after intermittent periods of cold-stratification over a period of one-and-a-half years. Two seed lots of the second collection were sown on the same day. One lot of untreated seeds was sown and produced only one seedling that germinated in 18 days, but had no further germination so after a period of four months the seed pan was discarded. The second lot was put in a jar with moist sphagnum moss and was cold-stratified for almost seven months. Then, the seeds were sown in a flat and were cold-stratified for an additional three months, after which they were removed from the cold for nearly a month (during which time two seedlings germinated and were potted up). The seed flat was then returned to cold-stratification for three-and-a-half months, after which seedlings began to emerge soon after the flat's removal from the cold. A month later, 100 seedlings were potted up from the original "trace" of seed that had been sown.

Collections from several other locations in the state failed to produce as many seedlings, although none were given such persistent periods of cold-stratification. To our surprise, we suffered only minor losses while raising the seedlings in the nursery. One lot of seedlings was attacked by a fungus that caused the loss of eight seedlings. All of our other lots of seedlings typically had losses ranging from two to four seedlings per lot.

Culture: As might be expected at our 1,300 foot elevation, and our hot dry conditions, our record with this species has been extremely poor. All of our plantings have succumbed within a period of five years after planting.

***Ribes indecorum* Eastw.**

White-flowered Currant.

Shrub (deciduous).

Propagation: Four collections of untreated seed were gathered from our plants. One collection from the old site produced fine stands of seedlings with germination starting from 16 to 29 days with maximum germination recorded from 15 to 30 days later. There were either no losses or only minor losses encountered while raising the seedlings in the nursery.

One lot of soft tip-cuttings was taken in May and was treated with Rootone. These rooted 100%, with root initiation starting the 24th day. While only two died after potting them up into four-inch pots, only three survived to the gallon-can stage in the nursery.

Culture: In the wild, this species follows the interior washes and canyons of Southern California below 2,000 feet. In the garden, this species developed into fine specimens whenever they were properly sited. When planted in semishaded locations on the slope of the clay-loam soil of the mesa, they grew vigorously. Open, rocky, loam was not as favorable, but even there they developed into nice colonies. After ten years these plants ranged from three to six feet tall and had spread from four to 11 feet wide. Flowering and fruiting were recorded in the second year.

***Ribes malvaceum* Sm.**

Chaparral Currant.

Shrub (deciduous).

Propagation: Four lots of untreated seeds required 27, 28, 29, and 34 days to begin germinating, and required an additional one to two months to reach maximum germination. Three of the resulting lots of seedlings were highly successful when grown in the nursery, though the fourth lot of seedlings experienced excessive losses in the nursery for unknown reasons. All plants were ready for planting within one year.

Culture: This species is a component of the dry wooded slopes and open hills of the Inner and Outer Coast Ranges, and also on Santa Cruz and San Clemente islands. Our plants suffered excessive losses when they were planted in rocky, open sunny areas, but grew into strong plants when planted in semishaded situations in the heavier clay-loam soil and given minimum water.

Our one wild collection was gathered in the redwood forest, and as a consequence had to receive quite heavy irrigation as they were planted among our redwoods. Ten-year-old plants ranged in heights from three to four feet tall and had spread from five to seven feet wide. Flowering and fruiting started the second year.

***Ribes malvaceum* Sm. var. *viridifolium* Abrams.**

Shrub (deciduous).

Propagation: Two lots of a seed collection harvested from cultivated plants at the old site began to germinate in 21 and 25 days and took about a month longer to reach maximum germination. A third lot of nine-year-old seeds failed to germinate. We suffered about 50% losses of seedlings in the nursery, therefore considerable care in watering, particularly, should be exercised. This is a plant that naturally goes dormant during the summer months.

Culture: This species is found growing below 5,000 feet elevation in the dry gullies and canyons of the chaparral belt in the San Jacinto, Santa Ana, and Santa Monica Mountains of Southern California. It has fared well with us, growing best where the plants receive some protection from the sun, or when mixed in with other shrubbery. These plants have a rather rapid growth rate,

with two-year-old plants measuring four feet tall and four feet wide. Plants appear to grow best in a rocky clay-loam soil, rather than in the rocky granitic loam. Watering should be kept to a minimum in order to allow these plants their natural dormant period during the summer months. Flowering and fruiting begin early, usually in December to February, and started in the second year. Fifteen-year-old plants measured four to seven feet tall and were two-and-a-half to eight-and-a-half feet across.

***Ribes menziesii* Pursh.**

Canyon Gooseberry.

Shrub (deciduous).

Propagation: Two seed lots of a wild collection of seeds were sown untreated and began germinating in 70 days. These required another month to reach maximum germination. Losses of seedlings and young plants in the nursery were minor.

Culture: This species is native to the Outer Coast Ranges from San Luis Obispo County northward to Oregon. It has performed poorly for us when planted in the drier, rocky granitic loam in considerable sun. When planted on the mesa in the clay-loam soil, a few specimens have grown naturally and developed into good sized specimens. Two plantings made in the rocky soils either died out completely or suffered over 90% losses after ten years. The surviving plants measured five to six feet tall and were from four to ten feet wide. Flowering and fruiting were recorded in the third year.

***Ribes nevadense* Kellogg.**

Sierra Currant.

Shrub (deciduous).

Propagation: Four lots of seed from three wild collections were cold-stratified for periods of two and four months. Those from the longer period were in a jar of moist sand, while those of the shorter period were in flats and seeds had already begun germinating in one of these collection before they were removed from cold-stratification. For the others, initial germination started in 12, 17, and 28 days after removal from the cold. Germination was fair to good. Seedling survival in the nursery was excellent.

Cutting material from wild plants failed to root due to poor quality of the cuttings. However, 90% of tip cuttings taken in June that were treated with CUTstart and Captan, successfully rooted with roots starting in 18 days. All except five of the rooted cuttings were raised for planting in the garden.

Culture: The natural habitat for this species is in moist meadows or along streams at elevations of 5,000 to 10,000 feet from the Palomar Range in San Diego County northward through the Sierra Nevada and in the northern Coast Ranges to southern Oregon. When planted in our garden, the species fared poorly, although a few specimens were grown in the rocky, decomposed granite loam soil in full sun. After ten years of growth, these survivors have reached heights of two to three feet and have spread from three to five feet wide. Some losses occurred from disturbance of the soil by moles, while others were killed by gophers.

Additional cutting-grown plants were taking hold in a similar garden situation, although 60% died within three years.

Attempts to establish this species on the mesa in clay and in shadier spots have not been any more successful. An occasional, very deep-red flowered form is found in the wild but we have not been able to root cuttings from this wild material.

***Ribes roezlii* Regel.**

Sierra Gooseberry.

Shrub (deciduous).

Propagation: Four wild collections of seeds were harvested and a total of ten seed lots were sown. Three lots of untreated seeds failed.

Seven seed lots were cold-stratified for periods from two to three months. Three of these failed, and four lots germinated (but results of two of these were recorded as poor).

Only a single collection from the San Bernardino Mountains provided a satisfactory quantity of seedlings. The seeds were sown and were cold-stratified for 56 days, and many of the seeds had already germinated (while in the cold-stratification) and this lot resulted in a good rate of germination. However, we had even better results after the seeds had been cold-stratified for 70 days, and the first seedlings germinating five days after they had been removed from the cold, and with maximum germination 12 days later. Only minor losses were encountered while raising the seedlings in the nursery, and these were mainly discarded weak plants.

Culture: This species inhabits dry open slopes at elevations of 3,000 to 8,500 feet from the northern Coast Ranges and the Sierra Nevada to the mountains of Southern California (to San Diego County). This species was established with some difficulty, even though we were able to provide situations as close to its natural habitat as possible. Losses have been high, and few plants have survived over four to five years.

***Ribes roezlii* Regel var. *cruentum* (Greene) Rehder.**

Shrub (deciduous).

Propagation: In 1965, our only wild collection of seeds was gathered. The seeds were cold-stratified for 47 days and began germinating in 15 days with maximum germination recorded at 32 days. The results were excellent, and all of the seedlings were potted up and were successfully raised in the nursery.

Culture: This variety is found growing below 5,000 feet elevation from the northern Coast Ranges to Oregon. We have grown it since 1941, when live specimens were brought to the old site. In February 1951, 13 were transplanted to five-gallon-cans for transfer to Claremont. All survived the move and were replanted in April 1951. After 20 years, three had survived the move and measured two-and-a-half to four-and-a-half feet tall and had spread from three to seven feet wide. These plants were noted as being in good condition. They had been planted in a rocky, decomposed granite loam, in sun. In the intervening years, some beneficial shade had developed in the area. The most recent planting in 1966 was planted in a similar situation, but with the semi-shaded conditions already present, and the first year results were recorded as excellent with no losses.

***Ribes sanguineum* Pursh.**

Red Flowering Currant.

Shrub (deciduous).

Propagation: An untreated lot of seeds began germinating in 68 days and reached maximum germination a month later. Another lot of seeds collected from the cultivar ‘**King Edward VII**’ was given three months cold-stratification and began germinating 12 days after removal from the cold, and reached maximum germination 14 days later.

Cuttings from several selected plants rooted 100% in most attempts. Untreated cuttings were taken in April, and with usual procedures started rooting in 11 and 14 days. A Rootone treated group taken in May took only six days to initiate rooting. None of the seedlings or young plants were lost in the nursery.

Culture: No wild collections of this species, which is found growing in moist shaded habitats at elevations of 2,000 to 6,000 feet from northern Lake County to British Columbia (Canada), were ever gathered in the wild by our staff.

For experimental purposes, we acquired seed of a selected type and of the named cultivar, ‘**King Edward VII**’. These seedlings were planted-out in experimental plots for testing. Some nice color forms were observed, but none were considered to be of outstanding merit. [Ed: It is interesting to note that Everett did select and name the cultivar ‘**Mesa Red**’ from this group of seedlings in 1964.] Under shady conditions, the plants developed nicely in the clay-loam soil of the mesa. When planted under and near the edge of a large coast live oak tree, where the plants received more sunshine, the plants flowered three to four weeks ahead of plants growing in shadier conditions. The plants receive very little irrigation, and no losses were observed or recorded. These plants have grown into nice specimens exhibiting some fine color forms.

***Ribes sanguineum* Pursh var. *glutinosum* (Benth.) Loudon.**

Shrub (deciduous).

Propagation: Four collections were raised from seeds, three of which had been gathered in the wild. The seed lot from cultivated plants at the old site was sown untreated and began germinating in 23 days, reached maximum germination in 36 days, and the results were excellent. Four lots of three wild source seeds were sown that were cold-stratified for periods of 86, 62, 92, and 76 days. Seedlings had already germinated during the 86 and 92 days cold-stratification periods, but took an additional six and seven days after removal for those that were cold-stratified for 62 and 76 days. In all cases, maximum germination was recorded in 11, 14, 15, and 17 days. While cold-stratification does no harm, it appears unnecessary and while results were excellent in all cases, they were best for the untreated seed lot. Raising the seedlings posed no problem in the nursery. The only exception was when we pruned back a robust group of plants that were then subsequently attacked by a fungus that resulted in severe losses.

A selected color type was grown from cuttings on several occasions. Cuttings were rooted, though often poorly, in a cold frame; those placed in a mist frame with bottom heat produced good results; and the best results were produced when in our cutting glass-house room under mist and foggers. Cuttings were treated either with Rootone, Hormodin #3, or CUTstart XX. The percentage of successfully rooted cuttings was high, and was usually from 90 to 100%. First rooting of treated cuttings started in 12 to 32 days, though one lot of untreated cuttings took 53

days to begin rooting. Tip cuttings of semihard wood taken in April or May appeared to give best results, although some successful lots were taken in March. Generally, excellent results were recorded for growth in the nursery, with the plants often growing from one to two feet tall and flowering in the nursery before planting in the garden.

Culture: Ranging from Del Norte County to Santa Barbara County on brushy slopes and woodlands below 2,000 feet of the Coast Ranges, this handsome variety has long racemes of pale- to deep-pink flowers. Early spring visitors to the garden have been delighted by these plants for many years. Plants favorably situated in the clay-loam soils of the mesa, and receiving limited irrigation, have grown into handsome specimens reaching up to ten feet tall. A selected, deep pink flowered form (Ed: later named and introduced as the cultivar ‘**Claremont**’) has been planted extensively and has always created much favorable comment among our visitors. This selection, along with the **var. deductum Jeps.** and **var. melanocarpum (Greene) Jeps.** have also been planted in the plant community section of the garden, where they have not performed as well. In these areas, we are unable to provide the necessary shade and the required additional irrigation. The lack of appropriate conditions in that part of the garden has caused problems for these young plants, and as a result our have been extremely severe in most cases. In more favorable locations, we have maintained collections for over 15 years, and the plants have attained heights of six to ten feet and have spread from six to ten feet wide. Flowering and fruiting were observed in the second and third years, and seemingly depended on the speed and vigor of growth. Cutting grown material will flower the first season.

Ribes speciosum Pursh.

Fuchsia-Flowered Gooseberry.

Shrub (deciduous).

Propagation: Two lots of seeds were harvested at the old site and were sown untreated, four years apart. The first lot began germinating in 42 days and reached maximum germination in one-and-a-half months, with excellent results. The second lot, four-years-older and untreated, began to germinate in 34 days, but the results were not as good. Three more lots of these seeds were sown at eight, nine, and ten years, and none of them germinated.

Another collection of seeds gathered from cultivated plants was sown for a month and was then cold-stratified for 11 days, produced excellent results when removed from cold-stratification. We found cold-stratification to be equally successful but producing no better results than the sowing of untreated seeds. In all cases, only minor losses occurred raising the seedlings in the nursery.

One lot of untreated tip softwood cuttings were taken in April, and were planted in flats that were placed on bottom heat and were given four hours of extra light, had a 40% success rate at rooting, but eventually all died in the nursery. It was noted that cuttings collected at a later month might perform better, and others have recommended fall cuttings. Treating the cuttings with rooting hormones might be more successful, too.

Culture: This beautiful shrub with its dark green, glossy leaves and brilliant red flowers borne in masses on the underside of its long arching branches is found growing in shady canyons below 2,000 feet in the Coast Ranges from Santa Clara County to San Diego County and into northwestern Baja California (Mexico). Plants can be nearly evergreen in some conditions, particularly the shadier sites. For us, it performs best on a steep bank that is semi-shaded by large coast live oak trees (*Quercus agrifolia*). In this location, the plants can be viewed from below

where the full beauty of the flowering branches may be observed. Huge bushes have developed in well-drained locations where irrigation is applied and where the drainage is excellent. In these situations, the branches have rooted (layered) and have added to the strength and size of the plants. In our hotter, more open sites they have not fared quite so well, particularly due to the lack of protection from the sun. In such locations losses have been relatively high and growth is much slower. Fifteen-year-old plants measured two to six feet tall and were from two to seven feet wide. Flowering and fruiting started in the second year.

***Ribes viburnifolium* A. Gray.**

Evergreen Currant. Catalina Perfume.

Shrub (evergreen).

Propagation: A single collection of seeds harvested from cultivated plants was sown untreated on four occasions over the course of five years, and began germinating in 27, 28, 15, and 37 days, with maximum germination recorded within one month. The results of the first three lots varied from good to excellent, while the last sowing (at five years) resulted in many fewer seedlings due to deteriorating viability of the seeds. We encountered no problems while raising the seedlings in the nursery.

Most of our plants were grown from tip-cuttings that were taken in February, April, May, June, August, September, and December. Under optimum conditions, treated or untreated tip cuttings rooted in ten to 15 days with 90 to 100% rate of success. Earlier treatments required more days to root, but with almost equal results. Tip-cuttings taken at almost any time of year appear to root more quickly than semi-hardwood cuttings. Even cuttings from the wild came through with excellent results. Cuttings taken from nursery plants (in the lath house) gave excellent and quick results, rooting in ten days with or without Rootone. Likewise, cuttings placed on bottom heat and with four to five hours of extra light in the mist frame performed well.

We generally encountered little trouble while raising the cutting-grown plants in the nursery.

Culture: This is the one evergreen species among our native *Ribes*, and this fine plant is found on Santa Catalina Island where it growing in the shady canyons (Note: a few plants are known from the U.S. side of the border in San Diego County and it is abundant in northwestern Baja California, Mexico.) We have grown it successfully for years, but never any better than here in Claremont on a steep bank under the shade of large coast live oak trees where it thrives as an excellent groundcover. Plants grow not more than two feet tall, and the long branches stretch out many feet to solidly cover a large area. We also have successful plantings growing on flat surfaces under sycamore trees. Overall, this species has proved to be an excellent low-growing groundcover as long as it receives some light pruning. Direct sunshine, especially during the summer, will burn the foliage and may eventually kill the plants. In shadier locations, and with moderate irrigation, it is one of our best groundcover plants.

***Romneya coulteri* Harv.**

Matilija Poppy.

Perennial.

Papaveraceae. Poppy Family.

Propagation: Two seed lots from cultivated plants, and two collections from plants in the wild were sown. One lot of seeds from cultivated plants were sown in flat containing a mixture of one-quarter peat moss and three-quarters loam. Pine needles were then burned on top of the flat. Germination started in 53 days. A second seed lot of the same amount and from the same source was sown on the same date but with sphagnum moss added on top of the soil mix (and then had the fire treatment) and started germinating in only 19 days. Thereafter sphagnum moss was used on top of all flats. Two wild collections were sown on the same date, with the same amount of seeds, and excelsior was burned on the flat began germinating in 61 and 28 days. Maximum germination was recorded two to three months later. Either pine needles or excelsior can be used for burning on the flat after sowing, and best results were obtained when sphagnum moss was used on top of the seeds. Seedlings were handled with great care (as they are fragile and brittle), so our loss of seedlings during transplanting was minimal. However, seedlings are readily killed by damp-off fungus. Once through the first transplanting stage, there is no problem in raising the plants in containers.

One practice we used once but quickly discontinued was to prune back the quick growing plants while they were in containers. Our losses were heavy from a fungus that attacked the plants at the point of the cut.

If it is not convenient to grow new plants from seed, additional plants are readily grown by digging parts of the roots in the fall (November), and planting them in containers of sand. These root-cuttings may also be planted directly into the garden, provided the soil drains well.

Culture: This species is native to the canyons and hillsides of the mountains of Orange and San Diego counties where it flourishes in quite dry, rocky situations up to 4,000 feet elevation. We had no difficulty in establishing colonies, which in a matter of ten years spread over considerable areas, almost becoming a pest. It is recommended in horticultural literature to prune back each year after the flowering season. This practice will cause the clumps to spread more rapidly by the underground root suckers. This plant should not be used unless plenty of space is available, or soil stabilization is needed. While plants are usually found growing in dry, rocky situations in the wild, they will grow equally well in heavy soils as long as excessive irrigation is not practiced, or as long as the water drains away fairly quickly. Full sun and dry banks are ideal for this plant. Plants start flowering in their second year from seed.

***Romneya trichocalyx* Eastw.**

Matilija Poppy.

Perennial.

Papaveraceae. Poppy Family.

Propagation: The same procedures were used as for *R. coulteri*.

Culture: Known from the same sort of habitat as *R. coulteri*, except that this species is found in Ventura and San Diego counties as well as in Baja California (Mexico). Plants raised in containers at the old site were planted at our Claremont site in very rocky decomposed granite loam in May 1951. These 30 plants became one gigantic mass that reached heights of six to ten feet tall in a few years. Flowering and seeding were recorded in the first and second years.

***Rosa californica* Cham. & Schtdl.**

California Wild Rose.

Shrub.

Rosaceae. Rose Family.

Propagation: Nine collections were grown, seven were grown from seed, and two collections were of bare-root plants. A total of 12 seed lots were sown from the seven seed collections from the wild. All seed lots (except one) were given two-and-a-half, three, and four months of cold-stratification. One lot was given hot water treatment for 24 hours before sowing and germination started in 32 days, and maximum germination was recorded after two months. Seeds sown after three or four months of cold-stratification had either begun germinating while in cold-stratification or within a few days after removal from the cold, and maximum germination was recorded in one to three weeks. Generally there were minimal losses of seedling in the nursery, though there were a few occasions when many seedlings were weak. Bare-rooted plants are easily established, and cuttings, while not used, can be rooted readily.

Culture: This common rose is found throughout the western portions of the state as well as in southern Oregon and Baja California (Mexico), often growing in fairly moist situations up to 6,000 feet elevation. We had no problem maintaining our plantings and all have done well, whether they have been planted in very rocky situations or in the heavier clay soils of the mesa. Because of its habit of spreading widely by underground root suckers, we maintained our plantings with the minimum of care. Clumps from ten to 15 feet or more across were recorded at ten to 15 years of growth. Flowering and fruiting usually began by the third year. One thornless plant was sent to us in early 1964. To date (1970) only a few small thorns are present on the oldest wood of this plant.

***Rosa gymnocarpa* Nutt.**

Wood Rose.

Shrub.

Propagation: Eight lots of wild collected seeds were gathered from northern populations and sown. All lots were either cold-stratified for three or four months in a jar with sand or peat moss or in flats of our standard soil mix. Usually some germination had started before the seeds were removed from the cold, with the remainder germinating soon afterward. To obtain more seedlings, we often repeatedly cold-stratified the seed flats, each time procuring a few more seedlings over a period of one to two years.

Only the one from Monterey County provided excellent results. A trace amount of seeds were cold-stratified for three months, and had begun germinating before their removal from the cold, and over 100 more followed within a few days.

In all other cases, no more than two to 35 seedlings were germinated and grown from any other collection. Only two or three seedlings were lost from all the lots while they were grown in the nursery. The seedlings exhibited good strength and quick growth. Most seedlings grew from one to two feet tall in gallon-cans within a year of germination, and were then planted in the garden.

Culture: While ranging in shaded woodlands up to 6,000 feet in a large portion of our state, our results were only fair. While each planting became well-established in the rocky, decomposed granite loam, losses ranged on the average of 50%. Ten-year-old clumps had spread up to ten

feet across and had grown up to six feet tall. Flowering and fruiting were observed during the second year.

***Rosa nutkana* C. Presl.**

Nootka Rose.

Shrub.

Propagation: Only one wild seed collection was raised. Seeds were treated with three months of cold-stratification in flats, with germination starting 37 days after removal from the cold, and maximum germination was recorded about a month later. When sufficiently large, the seedlings were transplanted to containers where they were grown on with good success in the nursery.

Culture: This species grows from Mendocino and Trinity counties north to Alaska and to the Rocky Mountains. In California, we find this species growing at elevations under 1,500 feet in damp, shady woods. We moved four plants bare-root from the old site in March 1952. Only one died, and the remaining three have grown into one large clump measuring 36 feet long and 15 feet across and up to nine feet tall. This planting is in sun and in a loamy, rocky soil.

The most recent collection was planted in November 1962, and has developed poorly and has suffered 50% losses in four years. These plants measure from one to five feet tall. Flowering and fruiting started the second year.

***Rosa nutkana* C. Presl var. *muriculata* (Greene) G.N. Jones.** [Ed: the var. is not recognized in TJM2]

Shrub.

Propagation: Seeds were gathered in October 1953, and the first lot was sown in the following April in a jar of moist sand and was cold-stratified for four months after which they were sown in flat. After five additional months there was no germination, so the flat was dumped. In 1955 and 1956, additional lots were sown, and after three months of cold-stratification were removed from the cold, and were returned to cold-stratification at two month intervals. A few came up in five months, and additional seedlings appeared over a period of a year. Only a total of 24 seedlings were obtained from over one-quarter ounce of seed. A few of the seedlings died in the nursery, but the remainder were successfully raised for planting.

Later, seeds were harvested from one of these plantings and a small amount of seeds were cold-stratified for two months. Seedlings germinated nine days after removal from the cold, and maximum germination was reached in 18 days. A total of five seedlings were produced, all of which were successfully raised.

Culture: This variety is occasionally found growing with the species. Three separate plantings were made in 1956 and 1957. Those placed in the rocky, decomposed granite loam succumbed in three years, while a planting grown in the clay soils on the mesa and with some shade produced seeds in three years and is still growing. Seedlings raised from this collection were again planted in the plant community section of the garden, where in five years they had spread widely into an area measuring 16 to 18 feet across and were two to four-and-a-half feet tall. Flowering began the third year.

***Rosa pisocarpa* A. Gray.**

Cluster Rose.

Shrub.

Propagation: Our first seed lot failed after five months of cold-stratification. The second seed lot was sown a year later and was cold-stratified for 14 months before the first seedlings germinated. A total of 75 seedlings were potted up from the one-quarter ounce of seed that had been sown. Only one seedling was lost while the plants were grown in the nursery.

A second wild collection of seeds were given three months of cold-stratification, and were then sown in an outside seed bed where they failed to germinate and were discarded after one-and-a-half years.

Culture: This species grows on shaded slopes below 5,000 feet in the mountains of northern central California and northward to British Columbia (Canada). Our plants were planted among pines in very rocky, decomposed granite loam, mostly in sun, where they performed poorly. The best of these plants were the ones growing in the shade cast by nearby pine trees. About 90% of the planting had died over the course of ten years, but if there were better conditions we feel that this species would grow well here. Surviving ten-year-old clumps measured from one to four feet across and grew from one to three feet tall. Flowering and fruiting started the second year.

***Rosa woodsii* Lindl. var. *ultramontana* (S. Watson) Jeps.** [Ed: *Rosa woodsii* Lindl. var. *ultramontana* (S. Watson) Roy L. Taylor & MacBryde. TJM2]

Shrub.

Propagation: Three wild collections of seed were gathered, and a total of four seed lots were sown. All seeds were given prolonged cold-stratification (four months or longer) and all produced at least a few seedlings, except for one lot that was five-years-old when it was sown and was a complete failure. Seedlings losses were minimal in the nursery, and plants were ready to plant in the garden within a year.

Culture: This unusually fragrant rose grows in dampish places at elevations of 3,500 to 11,000 feet along the eastern slope of the Sierra Nevada from Kern and Inyo counties northward into British Columbia (Canada) and east to Nevada and Montana. We have grown it since 1951, and our plantings have generally succeeded fairly well, despite not being grown in a more suitably moist habitat. As with all the roses, plants soon spread out, and in 15 years clumps in the garden measured 15 feet across had grown from 15 inches to four feet tall. Rabbits took an early toll of the young plants, slowing their growth and often killing them from their constant nibbling. However, this was true for all the rose species when the young plants were first set out. Cages were necessary to protect the new plants.

***Rubus leucodermis* Torr. & A. Gray.**

Western Raspberry.

Shrub.

Rosaceae. Rose Family.

Propagation: Our first collection of seeds from the wild were sown without any treatment. Germination began in 62 days and reached maximum germination 12 days later. We enjoyed excellent results and all the seedlings were successfully raised in the nursery.

Three additional lots were sown from two later wild collections. One seed lot failed, but the two other lots subsequently produced good stands of seedlings. After over three months of cold-stratification followed by three months in the glass house, the seeds were removed from the flats and were sown in an outside seed bed in the lath house. Germination began two months later for one collection, and four months later for the other. Following necessary growth, all seedlings were potted up and grown for planting in the garden.

Culture: This vine-like plant is commonly found through nearly all ranges of the mountains from the middle of California northward, usually below 7,000 feet. A vigorous grower, we used this species for covering the chain-link fence bordering the garden, where it provided a formidable barrier. As the years went by, rather vigorous efforts were made each year to control their unwelcome spread into adjacent planting areas. Plants grow best in richer soils and with some irrigation. Flowering and fruiting were recorded during the third year.

***Rubus parviflorus* Nutt.**

Thimbleberry.

Shrub.

Propagation: Two collections of rooted plants were successfully grown in containers. One seed collection had excellent germination after two months of cold-stratification. Seedlings began germinating nine days after they were removed from the cold, and maximum germination was reached after another 15 days. Excellent growth occurred in the nursery containers. Eventually, they became overcrowded and pot-bound in the containers, and we lost one-third of the plants.

Culture: This species usually grows below 8,000 feet in open woodlands and canyons in mountains from San Diego County northward through the Sierra Nevada, and on northward to Alaska. A collection started at the old site in 1942 was moved from the old site after first establishing them in containers. These plants were planted on a somewhat shady slope of the mesa, in rocky clay soil where they became well established. They spread vigorously over a sizable area and intermingled with wild grape, creating a wooded effect under the large coast live oaks (*Quercus agrifolia*). Subsequent plantings from other sources have been established in the garden, but have not fared as well. Losses in drier and rockier locations were high, but some plants remained strong enough to settle in and begin growing.

***Rubus ursinus* Cham. & Schldl.**

California Blackberry.

Shrub.

Propagation: Two seed collections were gathered from the wild and were sown untreated began germinating in 62 and 78 days, reaching maximum germination in another two months. Cold-stratification probably could have been helpful, but in both cases, we obtained a plentiful supply of seedlings. Seedlings and young plants were easily raised in the nursery.

Culture: Growing throughout most of cismontane California usually below 3,000 feet, and in many plant communities, this species is commonly seen in waste places, in canyons, along fence rows, etc. Our two collections have vigorously climbed over chain link fences and have spread over large flat areas, exhibiting an aggressiveness that requires yearly control. Quantities of flowers and fruits were produced from the second year.

***Rubus vitifolius* Cham. & Schltldl.** [Ed: *Rubus ursinus* Cham. & Schltldl. TJM2]

California Blackberry.

Shrub.

Propagation: Cold-stratification probably would have been beneficial since our single collection of seeds from the wild seed required slightly over five months to begin germinating, and took another month to achieve maximum germination. While only 32 seedlings resulted, all of them were raised for planting out into the garden.

Culture: This species grows in wooded and somewhat damp places below 4,000 feet near the coast from Mendocino County to San Luis Obispo County. Our seed collection came from the redwood forests of Humboldt County. Seedlings were planted in rocky, decomposed granite loam adjacent to a chain-link fence. Four years after planting, no losses had occurred, and plants seemed to have taken hold, measuring three to five feet tall and spreading six to ten feet wide. The first record of fruiting was recorded in ten years. However, if the plants were grown in a more suitable location it is highly likely that fruiting would have occurred earlier. After ten years, slightly over 50% had succumbed in this dryish and somewhat sterile location.

***Rudbeckia californica* A. Gray.**

California Cone Flower.

Perennial.

Sunflower Family.

Propagation: Seeds harvested in October 1952 were sown untreated in December 1952, and began germinating in 58 days. Excellent results were obtained. A second lot from the same seed collection was sown untreated two years later, and in same soil mix, began germinating in three days, but results were not so good. In the fourth year, another seed lot was sown of this same seed collection, and these began germinating in 25 days. Two more lots were sown, one each in the fifth and sixth years and both failed to germinate, indicating that the seeds of this species do not retain viability for very long – as there was a decreasing number of seedlings with each subsequent sowing. Very few seedlings were lost while they were grown in the nursery.

Culture: This species grows in the Sierra Nevada, from Kern County to El Dorado County, in moist meadow slopes at elevations from 5,500 to 7,800 feet. We planted our plants in the clay-loam soil of the mesa. A year after the first planting, a flowering plant measuring four-and-a-half feet tall was recorded. However, none of these plants lived for more than two to three years.

***Rudbeckia occidentalis* Nutt.**

Perennial.

Propagation: Our one collection of wild seeds was sown untreated and began germinating in 17 days, and reached maximum germination two-and-a-half months later. Very good results were recorded. About a third of the seedlings failed to grow in the two- and four-inch pots in the nursery.

Culture: Naturally growing in wet ground in woods at elevations from 4,000 to 6,000 feet, we find this species in the Sierra Nevada from Placer County to Butte and Plumas counties, and

north and east to Washington, Montana, and Utah. Our plants were grown in the clay-loam soils of the mesa in 1960, but information on their growth and performance was not recorded.

***Rumex crassus* Rech. f.**

Perennial.

Buckwheat Family.

Polygonaceae. Buckwheat Family.

Propagation: One wild collection of seeds were sown, untreated, and after 24 days were put into cold-stratification for 28 days at which time germination had started. Maximum germination was recorded in another two weeks, and the results were excellent. All of the seedlings were successfully raised in the nursery. A lot of seeds that sown directly into a site in the garden failed to germinate.

Culture: This species inhabits coastal dunes from Los Angeles County northward to Washington. Young plants were planted in a depression in our coastal sand dune garden. Two years later it was noted that there had been very high losses, but that some of the plants were alive, but in poor condition. Whether the plants flowered and produced seeds was not recorded.

***Rumex fueginus* Phil.**

Golden Dock.

Annual or Biennial.

Polygonaceae. Buckwheat Family.

Propagation: One collection of untreated seeds were sown and began germinating in ten days and reached maximum germination in 28 days. All seedlings were successfully raised in the nursery.

In addition to these seed-grown plants, a few bare-root plants were collected and were grown in containers before they were planted in the garden.

Culture: This species is often found growing in brackish wet places, particularly in Southern California though it also grows northward in the coastal mountains and rarely in the northern Sierra Nevada. Since we could not provide a brackish habitat, we planted these plants in a depression in the coastal sand dune garden and provided them with as much water as possible. However, all plants died within three years.

***Salazaria mexicana* Torr. [Ed: *Scutellaria mexicana* (Torr.) A.J. Paton. TJM2]**

Bladder-Sage.

Shrub.

Lamiaceae. Mint Family.

Propagation: Seeds sown untreated will provide excellent germination in five to ten days, averaging six days. Even if the seeds are six years or older excellent results are still possible. The various seed lots were sown from August through March. The seedlings are highly susceptible to damp-off and other fungi if the soil gets too wet. Despite our greatest care, seedling loss was

high, particularly when shifted into gallon-cans and during subsequent months when the plants were growing in the nursery. Sometimes after transplanting into gallon containers, prolonged wet spells would cause the young plants to rot, particularly when the seeds were sown too early in the season (August or September sowings). After these experiences, we sowed the seeds later so that the young plants would miss the wet season out in the open in the nursery.

Culture: This common desert plant inhabits dry, rocky washes, gravelly slopes, etc. at elevations below 5,000 feet from Inyo County to Riverside County, and to Utah, Texas, and northern Mexico. Four plants were transplanted bare-root from the old site in September 1951, when they were then ten-years-old. They were then planted in our desert garden, where just one survived and in its 25th year, it was in fair condition and measured 22 inches tall and 17 inches wide. Other more recent plantings range in age up to 15 years, and are growing in well-drained rocky granitic loam. Early plantings of nursery raised plants suffered severely during several winters from frost and rabbit damage. Caging was necessary for all new plantings of this species. Despite what we considered good growing conditions for this species, losses over the years were generally high, but some excellent specimens were grown. Some plants spread by underground root suckers. Plants that were ten- to 15-years-old measured one to three feet tall and spread from one to five feet wide. Flowering and fruiting started in two to three years.

***Salix breweri* Bebb.**

Shrub.

Salicaceae. Willow Family.

Propagation: In April 1963, a wild collection of untreated tip cuttings were inserted in a pot and given usual greenhouse treatment. Only five rooted, with root initiation noted in 16 days. Three of the rooted cuttings died, and two were successfully raised in the nursery for planting in the garden.

Culture: This species inhabits gravel bars and moist ravines in the Inner North Coast Ranges, below 4,500 feet, from San Benito County to Butte County. Our plantings failed as the plants died during their first year, probably from a lack of water.

***Salix lasiolepis* Benth.**

Arroyo Willow.

Tree.

Willow Family.

Propagation: Cuttings were gathered from the wild in October 1958. They were stuck without treatment in the greenhouse. The first roots were initiated after 13 days and all of the cuttings rooted and were potted up 12 days later. Ten were raised in the nursery for planting in the garden.

Culture: This is a widespread species, growing in stream beds, along banks, and in other moist locations throughout cismontane California below 7,000 feet. Beyond California, it ranges to Washington, Idaho, and New Mexico. Eight plants failed to establish in a flat clay and rocky loam area, but the remaining two developed rapidly, and at the end of seventh year of growth

measured from 22 to 27 feet tall and had spread from 30 to 37 feet wide. First flowering and seeding were not recorded.

***Salix lutea* Nutt.**

Yellow Willow.

Shrub.

Propagation: In early July 1952, 27 untreated semi-hardwood to hardwood cuttings were collected from the wild and were directly planted in individual four-inch pots or gallon-cans, in our standard soil mix. Root initiation started in 21 days, and all plants in four-inch pots were moved to gallon-cans seven days later. All but one of the cuttings were raised without loss in nursery.

Culture: In California, this species grows in wet places along stream banks, etc., at elevations of 5,000 to 9,500 feet, along the eastern slope of both the Cascades and the Sierra Nevada, between Nevada and Modoc counties. Beyond California, it ranges into Alberta (Canada), and to Colorado and Arizona. We planted our plants in a stream bed on the mesa, where they did reasonably well, although diminishing in numbers until after a period of 15 years there was only one of the original 18 left. These plants have been severely attacked by borers, and plants that had been transplanted (and therefore weakened) did not survive. These plants had attained heights up to 11 feet tall and had spread up to 16 feet wide, but never developed the bright yellow fall color noted in the wild. The lack of fall color in our location was attributed to the lack of the cold fall temperatures found at the higher elevations of their native habitat.

***Salvia* L.**

Cuttings of some *Salvia* species will not take intermittent misting, but do well when placed in individual pots that are placed under the fogger in the greenhouse.

***Salvia* ‘Allen Chickering’ (*S. clevelandii* × *S. leucophylla*).**

Shrub.

Propagation: Hundreds of cuttings, tip and side shoots, firm in texture, were taken at various times, as January, February, May, June, September and November. The percent that successfully rooted was always about the same, ranging between 90 to 98% for both Rootone treated or untreated cuttings. Untreated cuttings usually took a day or two longer to initiate roots, but on one occasion these rooted in 12 to 13 days while those treated with Rootone took nearly 30 days to initiate roots. The cuttings were provided usual treatments and suffered no ill effects in the greenhouse.

Generally, rooting initiated in 12 to 16 days if the cutting material was of soft tip growth, while those with a semihard base required 24 days or more to begin rooting. Except for minor losses, most of the rooted cuttings were easily grown in the nursery.

For the original report on this presumed cross, see Everett (1957. Page 194).

Culture: This handsome shrub was first propagated in 1937, at the old site. It is a selection from a group of seed-grown plants, and while we have never formerly described it, we have grown it extensively in both of our locations. Plants flower in June and July, when most of the spring

color has passed. We have found it most useful, and while not long-lived in cultivation, the ease of growing it from cuttings has made it possible to maintain large stands of this colorful plant. Plants rapidly attain sizes up to five to six feet tall with equal and greater spread. Plants become massed with the deep purplish flowers with the habit of *S. clevelandii* but much larger, and with the delightful fragrance of *S. clevelandii*. We have highly regarded this plant for its fast growth and beautiful flowers.

***Salvia apiana* Jeps. (including *Salvia apiana* Jeps. var. *compacta* Munz)**

White Sage.

Shrub.

Propagation: Seeds were harvested from wild plants growing at the old site, and were sown untreated. Germination started after four days and reached maximum germination in three weeks. Results were recorded as “good.” Seedlings were easily raised in the nursery.

Culture: This common species grows on the dry slopes and benches of the hills and mountains of cismontane Southern California from Santa Barbara to San Diego County.

A more compact form reaches to the desert edge, and has been described as *S. apiana* Jeps. var. *compacta* Munz. Since the typical form grew naturally in the new site, we produced only a few plants of it for addition to the natural collection. As would be expected, they took hold readily and all but a few were alive 15 years later. These plants grew from four to six feet tall and spread from five to eight feet wide. Flowering and seeding usually occurs either during the first or second season. The var. *compacta*, not growing naturally here, was grown from a seed collection originally gathered from near Jacumba in San Diego County. Plants grown from this collection were planted in our pinyon-juniper woodland, and after ten years measured two-and-a-half to four feet tall and spread from four-and-a-half to eight feet wide. During the ten years of growth, only ten plants died. Flowering and seeding started the first season. A second wild collection from Riverside County germinated poorly in four days, and in ten years has grown well in our creosote bush scrub planting. Plants measured four to eight feet tall (includes flowering stems) and one measured 13½ feet wide. Flowering started in their third year.

***Salvia × bernardina* Parish ex Greene.**

Short-lived Perennial.

Propagation: Untreated firm tip cuttings rooted at 50 to 60%, with root initiation starting in 15 to 45 days (though the bulk began rooting at 15 days). While we had some losses in the nursery, a high percentage of the plants were successfully raised for planting in the garden.

Culture: An obvious hybrid, presumably between *S. columbariae*, an annual, and *S. mellifera*, a shrub, see also Everett (1957. Pg: 194). We continued to maintain this plant from the old site, and while it was a tidy small plant for a year or two, it became scrubby and diminished in strength until they usually were gone after three to five years. It exhibits the weak qualities of some hybrids.

***Salvia brandegeei* Munz.**

Shrub.

Propagation: Untreated seed from cultivated sources will start germinating in five to six days. Tip cuttings treated with Rootone started rooting in seven days. We had minor losses of seedlings, and lost none of the cuttings, while growing these plants in the nursery.

Culture: Seeds from the Santa Rosa Island plants were obtained in 1937, and were first propagated in 1940 at the old site. Seeds harvested from these cultivated plants were used to provide us with a fine colony that we planted in our coastal sage scrub display. The first planting, set out in 1952, was severely attacked by rabbits and a number of plants were killed by frost. Subsequent plantings fared much better, but over a period of ten years, excessive rain and other more vigorous shrubs took their toll. Recent plantings have performed better in the clay-loam soil of a gentle north slope, in full sun. Flowering and seeding was recorded in the first year and plants soon reached mature sizes of three to five feet tall and spread from four to ten feet wide. Best flowering occurs in February.

***Salvia carduacea* Benth.**

Thistle Sage.

Annual.

Propagation and Culture: A collection of seeds gathered in the wild near Arvin in Kern County, was directly sown untreated into a garden site on four different occasions, in the desert sand dunes, in the desert garden, and on a flat covered with a sandy loam soil. Germination was good to poor with germination starting in 21, 12, seven, and 16 days. Twelve lots of seeds were gathered from these garden plantings and were sown in much the same areas. Again germination rates ranged from good to poor, with germination starting in nine to 32 days, but with the highest percentage germinating after 11 days. In some seasons fine plants grew to 18 inches tall and made nice displays. Sometimes, the plants were heavily attacked by caterpillars, which hampered their growth and flowering. In still other years, the plants failed miserably even after the seeds had germinated well. We managed to gather sufficient seeds from nearly all sowings, and we were able to continue this collection for more than a ten year period.

Four other collections were sown once in other locations, and while not in sandy loam (their preferred soil), their germination periods range from 13 to 25 days. Most of the seeds were sown from November to January, and depending on when they were sown, the flowering occurred from March to May.

Some collections were destroyed by birds, rabbits, slugs, and caterpillars, while others succumbed to rots.

Some naturalized for a few years in one sand dune area.

This species grows on sandy flats, and rocky mesas below 4,500 feet from Contra Costa County through the Central Valley to the interior of cismontane Southern California to the edge of our deserts to northern Baja California (Mexico).

***Salvia clevelandii* (A. Gray) Greene.**

Cleveland Sage.

Shrub.

Propagation: Seeds from either wild or cultivated plants began germinating in three to seven days, and provided excellent germination two to three weeks later. We experienced no problems while raising the young seedlings in the nursery.

Tip cuttings treated with Rootone rooted 100% when taken in January from a special selection. Five later succumbed in the nursery, but the remainder grew well and were later planted in the garden. Both a white-flowered form and a fine hybrid of this species (see *Salvia* 'Allen Chickering' above) were readily propagated by cuttings.

Culture: This species inhabits dry chaparral covered slopes below 3,000 feet in San Diego County and northern Baja California (Mexico). This vivid deep blue-flowered *Salvia*, wafts a delightful, penetrating, and characteristic fragrance into the air during warm days. Once one is acquainted with this delightful fragrance, there is no mistaking which sage species is growing nearby. While all of our plantings can be considered successfully established, we find that this species is not particularly long-lived and over a period of 15 years, there were gradual losses. Most plantings were nearly depleted by the end of such a span. Provided excellent and rocky drainage, there was a feeling that perhaps better specimens might have grown if there was a slightly heavier loam soil. However, since this species is easy to raise, there were no problems increasing the plantings with periodic new propagations and plantings. Flowering and seeding began the second season. A white-flowered plant was observed in one planting and was further propagated by cuttings. While interesting, it was not as attractive as the parent species. Seedlings raised from the albino parent will not produce white-flowered plants. This species is one of the parents for the wonderful hybrid, *S.* 'Allen Chickering', which we have previously discussed.

Salvia columbariae Benth.

Chia.

Annual.

Propagation and Culture: This common annual of interior and Southern California ranges southward from Mendocino County, into several adjacent states and into Mexico. The seeds, highly valued for their rich food values by the Indians and early pioneers, produce quantities of seedlings when sown directly into garden sites during the fall and winter months. Seeds were sown many times over the past 15 year period. There was a wide variation in germination dates, ranging from 13 to 45 days for seeds from wild collections, and from five to 56 days for seeds gathered from cultivated plants in the garden. Location, types of soil, etc. appeared to have some effect on this wide variation, but in nearly all cases excellent results were recorded. It was necessary to protect all plantings from birds that delighted in eating the sprouting seedlings and would soon destroy every plant in sight. Our chief collection was gathered near 29 Palms in San Bernardino County, and in its third sowing, three years after it was collected, an interesting hybrid appeared. This plant was a perennial and grew up to 18 inches tall and spread up to 12 inches wide. It produced upright narrow spikes of flowers in widely spaced whorls, and the leaves were densely packed along the stems. No determination of its parentage or further propagation was accomplished, and it has apparently since died.

The flowering period for this species depended on when the seeds were sown, but most plants usually bloomed in April, but on occasion were either earlier or later. Many volunteer seedlings were noted in most areas after original sowing. This species is also native to our area and was seen early on in the various well-drained sections of the garden.

***Salvia columbariae* Benth. var. *ziegleri* Munz.** [Ed: the var. is not recognized in TJM2]

Annual?

Propagation: One seed collection from the wild was sown untreated on December 14, 1964. Germination started in six days, and reached maximum germination in 25 days. All but two of the 18 seedlings were successfully raised for planting in three-inch pots.

Culture: The seeds of this interesting plant were brought to us in December 1964. (See Munz, 1968. Pg. 103.) We planted the seedlings in a row in the clay-loam soil of the mesa on April 16, 1965. While they exhibited some of the differences as described by Dr. Munz, they appeared much like the species under our cultivation. The plants gradually petered out and this variety was not continued.

***Salvia dorrii* (Kellogg) Abrams.**

Shrub.

Propagation: Untreated seed germinates rapidly, most in a matter of five to ten days. One lot of wild collected seeds was cold-stratified (we later determined that such treatment is unnecessary) to test for better germination. After removal from the cold, seedlings appeared a few days later, but were noted as "poor." The quality of seeds collected determines the percentage of germination – as good seed collections provided an abundance of seedlings. Seedling losses in the nursery varied from few to many. One wild seed collection produced the highest number of seedlings, but also suffered severe losses due to the presence of many weak seedlings and of a high number of hybrids. Since many losses were incurred while the plants were growing in the gallon-can stage, we discontinued growing them to that stage in the nursery, and instead planted out plants from five-inch pots directly into the garden.

Culture: This handsome plant usually grows on dry flats and slopes, in several of the typical desert-like plants communities from the Mojave Desert to Lassen County and into western Nevada at elevations from 2,500 to 8,800 feet. As indicated by its natural range, this species prefers dryish conditions, both as to soil and weather. Our severest losses occurred during wet winters, but on the whole we raised many fine plants that flowered and produced seeds. However, our plantings gradually declined over a period of ten years. Ten-year-old plants ranged from one to two feet tall and had spread up to four feet wide. Flowering and seeding were recorded the first season.

***Salvia eremostachya* Jeps.**

Shrub.

Propagation: Seeds were received in July 1963, and were sown untreated. First germination started in seven and nine days for the two seed lots sown. A high percentage of the seedlings died while we grew them in nursery. It is thought that these losses were principally due to the fact that a small amount of fertilizer had been incorporated in the potting mix. Later seed lots were raised in the nursery with minimal losses.

Culture: This is a rather rare species that is found growing in dry rocky and gravelly places at elevations of 1,200 to 4,500 feet along the western edge of the Colorado Desert. Since our plants were planted out toward the end of the period for this report, the only conclusions that can be drawn are from our experiences at the old site, where the species was short-lived under

cultivation. Flowers and seeds were produced the second season, and the plants had grown from one to three feet tall and had spread from one to three feet wide after two seasons.

***Salvia greatae* Brandegee.**

Shrub.

Propagation: Our first seed collection was received in 1948, and was sown untreated four years later. Since this was a minute amount of seeds, only seven seedlings were produced. When the seeds were sown in September, the first germination was recorded in eight days. Five plants were successfully raised in the nursery and were planted out in the garden. A second seed collection that was received in September 1963, was sown untreated in October and produced 50 seedlings, all of which were lost during the initial potting because fertilizer had been incorporated into the potting mix. The second seed lot was sown a year later in September, but the seed flat was not watered until the following February. These seeds started germinating seven days later and produced a total of 165 seedlings. The reason for starting this seed flat so late was to get the young seedlings through the winter months, and to have the young seedlings ready to be planted out in late spring when the weather would be more suitable for this hot dry land species. In this seed lot, a large portion of the seedlings were successfully grown to the three-inch pot stage.

Culture: This species grows in the dry washes and fans of the Orocopia and Chocolate Mountains of Riverside and Imperial counties, at elevations below 600 feet. We never grew this species successfully in the garden, and all seedlings died within a few months of planting in the garden.

***Salvia leucophylla* Greene.**

Purple Sage.

Shrub.

Propagation: Excellent results were obtained by sowing untreated seeds in flats where germination will start in six days. If selected types or hybrids are found within the plantings, cuttings are easily rooted. We had no problems raising the seedlings in the nursery.

Culture: This species is a common component of the coastal sage scrub from Orange County to San Luis Obispo and Kern counties, and grows mostly below 2,000 feet. Since this species is confined almost exclusively to the coastal sage scrub, we had little need to raise this dependable plant in large quantities. Fine plants measuring six to nine feet tall and eight to 16 feet across were measured in the 15th year. First flowering and seeding were recorded in the second season. This is a highly dependable and satisfactory sage for gardens. Grow this hardy plant in either dry land conditions or with moderate irrigation.

***Salvia mellifera* Greene.**

Black Sage.

Shrub.

Propagation: Only one collection was raised from seeds that were sown untreated. First germination was noted in six days, and the results were excellent. A few seedlings died while they were being grown in the nursery, particularly during the gallon-can stage.

Culture: This species is a common constituent of the coastal sage scrub and chaparral plant communities of the Coast Ranges from Contra Costa and western Stanislaus counties to northern Baja California (Mexico), where it usually grows below 2,000 feet. This is another very hardy and easily grown sage. This species was indigenous to the garden, and there was little reason to raise many plants, as we only needed enough to satisfy our needs for data.

***Salvia mohavensis* Greene.**

Shrub.

Propagation: This fast germinating species usually responds in five to seven days after sowing. Only one collection of seeds was gathered from the wild, though there were three later collections of seeds that were gathered from subsequent generations of cultivated plants. Overall, we experienced variable results while raising the seedlings in the nursery. However, all of the seedlings grown from our first seed collection from the wild were successfully raised in the nursery and were planted out in the garden. One seed lot was sown directly into a garden site and germinated poorly with the resulting seedlings later killed by frost. Another seed lot that was sown in nursery was attacked by a fungus. The last seed lot suffered minor to moderate losses while the plants were growing in the nursery.

Culture: This species inhabits dry rocky washes and canyons from 1,000 to 5,000 feet from the California deserts to southwestern Nevada and northwestern Sonora (Mexico). Our first plants were planted mainly in the desert garden, and three successive generations of plants were raised from seeds collected from this original planting. One lot proved to be highly hybridized with *S. clevelandii*, judging from the size of plants, odor of herbage, and color of the flowers. Other groups were very short-lived, with many being killed by winter frosts. First flowering and seeding were recorded during the first and second seasons.

***Salvia munzii* Epling.**

Shrub.

Propagation: Untreated seeds from either cultivated or wild sources starts germinating in six to eight days, but maximum germination is not reached until after another 30 to 60 days. Seedlings and young plants are easily raised in nursery with only minor seedling losses.

Culture: This is a typical plant of the coastal sage scrub plant community, but it is found growing only in a narrow belt from San Miguel Mountain in San Diego County to northwestern Baja California (Mexico). We have grown this species since we first collected cuttings of it from the wild in 1941, and raised them at the old garden site. Seeds were harvested from that collection of cultivated plants, and we were able to produce all the plants we needed. Over a period of 15 years we recorded a little over 50% loss, though most of these losses were from frosts while the plants were very young and because the area was riddled with moles. Once the plants became established, only minor losses were record. After 15 years, our plants had grown to heights of five to eight feet tall and had spread from six to 12 feet wide. Flowering and seeding was recorded the first season.

***Salvia pachyphylla* Epling ex Munz.**

Shrub.

Propagation: Untreated seed, either from cultivated or wild sources, will start germinating in six to 11 days, and reaches maximum germination 30 days later. Seedling losses in the nursery were moderate to high, and varied over the years.

Culture: This species grows on dry rocky slopes, in the pinyon-juniper woodland and yellow pine forests at elevations of 5,000 to 10,00 feet, on the desert sides of the San Bernardino Mountains, the Santa Rosa Mountains and several ranges in the Mojave Desert. Considering the differences between the garden's conditions and that of its native habitat, it is rather surprising that we were able to raise these plants with some degree of success. However, none of the plantings were very long-lived, the oldest being a few plants that have survived for 15 years. Seeds harvested from the garden plantings usually brought forth many hybrids, and some groups of seedlings had to be discarded because of excessive hybrids of poor quality. Generally the oldest plants measured one to two feet tall and spread from one to three feet wide. First flowering and seeding occurred the second season. Handsome specimens were noted in younger plantings, and these flowered abundantly and the plants were just as beautiful as they were in the wild. However, deterioration began after four or five years.

***Salvia sonomensis* Greene.**

Creeping Sage.

Perennial.

Propagation: Five lots of seeds from cultivated plants were sown untreated and these began germinating in ten, 12, 29, 35, and 39 days, with maximum germination taking an additional two to three months. Seeds collected from wild sources that were sown untreated started germinating in 15, 33, 37, 39, 50 days, and five months, with maximum germination taking an additional 30 to 60 days. The overall rate of germination was usually fair to poor, and which might have been improved by cold-stratification. Seedling losses in the nursery were moderate.

Culture: This species is most widely distributed in the Coast Ranges below 6,500 feet, at intervals from Siskiyou County to San Diego County where it usually grows on dry slopes that are often shaded by trees and large shrubs. We grew plants from several wild collections and from our own cultivated plants. Our overall results were satisfactory, though the plants were rather short lived. Only a few individuals survived over a period of 15 years. Our finest example was a lightly shaded planting that was growing on a flat of finely granitic sand overlaying a rocky soil. In this location, a few plants spread over an area 20 feet by 20 feet and the plants grew only four to six inches tall. Even though conditions and culture did not change, after ten years there was a gradual weakening of the planting. Other fine examples have been recorded in other sections of the garden, but these plants are always growing in lightly shaded, dry, well-drained conditions. First flowering and seeding was recorded the first season.

***Salvia spathacea* Greene.**

Pitcher Sage.

Perennial.

Propagation: Untreated seed from cultivated plants began to germinate in an average of 16 days, though one seed lot took 32 days before the seeds started to germinate. We grew several collections of this species, and always recorded poor germination. Despite this, we were always

able to produce enough plants to meet our requirements. All seedlings that were potted up were raised in the nursery without losses.

Culture: This species grows on grassy and shaded slopes below 2,000 feet in the Coast Ranges from Solano County to Orange County. Our original planting came from the latter and the plants were grown at the old site from the earliest days of the garden. A few plants were transplanted to the Claremont site in February 1952, where they are still growing. Seeds were harvested at the old site, and plants grown from them have resulted in the many fine specimens that are growing happily on a somewhat shaded gentle north slope in a rocky clay-loam soil. From time to time, this planting has to be augmented with additional plants, but it always is in good order. This species has always been one to create much interest among our visitors. Individual plants have been measured up to three feet tall (including the flower spike) and sprawling to six feet wide.

***Salvia vaseyi* (Porter) Parish.**

Shrub.

Propagation: Two wild seed collections were divided into several seed lots that were sown untreated. The seeds, on average, began germinating in five to seven days, though one lot took 17 days to begin germinating. Maximum germination was reached two to three weeks later, and the results varied from fair to excellent. Surprisingly, results varied significantly for the same seed collection sown on different occasions. Seedling losses in the nursery were relatively high, as many as half died.

Culture: This species naturally grows in very dry rocky washes and canyons from Morongo Valley to Mountain Springs along the western edge of the Colorado Desert below 2,500 feet. Both of our seed collections produced a number of hybrids, all apparently with *S. apiana*, but none of these hybrids proved to be of any interest. Even though the plants were planted in the best drained sites possible and were given little irrigation, only two to three plants have lived ten years. These plants are in poor condition as they do not grow at all well in the garden's non-desert conditions. The plants measured two feet tall and three to four feet wide. First flowering and seeding were recorded in their first growing season.

***Sambucus caerulea* Raf.** [Ed: *Sambucus nigra* L. ssp. *caerulea* (Raf.) Bolli. TJM2]

Elderberry.

Tree.

Caprifoliaceae. Honeysuckle Family. [Ed: Adoxaceae. Muskroot Family. TJM2]

Propagation: For best results, use fresh seed and two to three months of cold-stratification. The first lot from our one wild collection of seeds was put in a jar with moist sand and was then cold-stratified for two months (plus a few days), after which the seeds were then sown in a seed flat. First germination began in 42 days and first potting of seedlings was made two months later. A second seed lot was sown four years later, and began germinating in four months, but only produced a total of four seedlings after repeated periods of cold-stratification over a period of eight months. Only minor losses of seedlings occurred while growing the plants in the nursery.

Culture: This species grows primarily in montane coniferous forests at elevations up to 10,000 feet from San Diego County north through the Sierra Nevada and North Coast Ranges to Idaho and to British Columbia and Alberta (Canada). We gathered our wild seed collection from the

slopes of Mount Whitney, at 8,300 feet. One tree was planted on a north-facing shady slope, in clay-loam soil. This specimen produced its first flowers two years later, and measured five feet tall and ten feet wide at that time. Other plantings were made on the mesa, under a large maple tree, but these fared poorly and gradually disappeared. A third planting was made under the shade of a large oak and growing in rocky, decomposed granite loam soil with considerable oak leaf humus. About a quarter of this planting was alive after ten years, and these measured from five inches to two-and-a-half feet tall and spread from eight inches to five feet wide (the plants had been nibbled by rabbits). Flowering had not been recorded at that date.

***Sambucus callicarpa* Greene.** [Ed: *Sambucus racemosa* L. var. *racemosa*. TJM2]

Coast Red Elderberry.

Shrub.

Propagation: The first lot of wild collected fresh seeds was sown after three months of cold-stratification, and yielded excellent results. However, as second lot of this same seed collection failed when it was sown with the same treatment four years later. None of the seedlings were lost while they were grown in the nursery.

Culture: This coastal species is found in the damp woods and flats at low elevations near the coast from San Benito County to British Columbia (Canada). Despite our very dry climate, a little less than 50% have survived. Our successful plantings are growing in semishaded and shaded spots in either clay-loam soil or decomposed granite loam soils. First flowers and fruits were noted in the third season. We experienced initial heavy losses immediately after planting, but there were minimal losses over the next six years. Plants ranged in size from three to eight feet tall and had spread from three to nine feet wide. At this time, the majority of the plants were in good condition, though some were noted as poor or fair.

***Sambucus mexicana* C. Presl.** [Ed: *Sambucus nigra* L. ssp. *caerulea* (Raf.) Bolli. TJM2]

Shrub or Tree.

Propagation: Only one lot of wild collected seeds were sown, and these were soaked for four minutes in Thiourea solution. Good germination began in 41 days and reached a maximum germination after 30 more days. Unfortunately, a control lot of untreated seeds were not sown at the same time, therefore, we do not know if the Thiourea treatment was beneficial or not. Many of the resulting seedlings were runty and were discarded, and about 50% were lost due to a fungus that struck the leaf tips and worked itself down through the plants. Control measures did not stop these losses.

Culture: This species grows in valleys, flats, and hillsides below 4,500 feet throughout cismontane California, from Lake and Solano counties south to Baja California (Mexico), and Arizona. Since the species is native to our Claremont site, we grew only one collection, and it has done very well over a period of ten years. These plants range in size from seven to 14 feet tall and spread from seven to 17 feet wide. First flowering and seeding was recorded during their fifth year, but may have occurred sooner.

***Sambucus microbotrys* Rydb.** [Ed: *Sambucus racemosa* L. var. *racemosa*. TJM2]

Shrub.

Propagation: Two wild collections of seeds were divided up into lots and were sown on nine different occasions. A variety of treatments were tried: varying periods of cold-stratification, hot water treatments, soaks in sulphuric acid and Thiourea. Every lot was a failure except for one that resulted in the germination of one seedling after ten months of cold-stratification. While this seedling was successfully raised in the nursery, it died soon after it was planted in the garden.

***Sarcobatus vermiculatus* (Hook.) Torr.**

Black Greasewood.

Shrub.

Chenopodiaceae. Goosefoot Family. [Ed: Sarcobataceae. Greasewood Family. TJM2]

Propagation: Apparently the seeds from our only collection were not good. Seeds were sown untreated on three occasions, and only one seedling resulted and that germinated in nine days. Our previous experience at the old site indicates that viable seed germinates easily at a high percentage rate. This one seedling was successfully raised in the nursery and was planted in the garden.

Culture: This species grows almost exclusively in highly alkaline places scattered from the Mojave Desert to Modoc County along the east slope of the Sierra Nevada and the Cascade Range in California and into adjacent states at elevations of 3,000 to 7,000 feet. Since seeds were only collected once, and we only grew the one lone seedling, it was planted in the desert garden. No accurate records were recorded, but it is known to have produced flowers the first season. It was written off as dead during its eighth year.

***Satureja chandleri* (Brandege) Druce.** [Ed: *Clinopodium chandleri* (Brandege) P.D. Cantino & Wagstaff. TJM2]

Undershrub.

Lamiaceae. Mint Family.

Propagation: Untreated seed begins to germinate in ten to 13 days, reaching maximum germination two weeks later. With care, a high percentage of the seedlings can be raised for planting out in the garden. Excellent germination is the usual result when the tiny seeds are sown shallowly in a sphagnum mix.

Culture: This interesting little plant may be found growing in rocky canyons below 2,500 feet, in scattered locations from Riverside to San Diego counties. From seed gathered from growing plants at the old site and originally acquired in 1940, we grew our stock of plants that were moved from the old site in February 1951. Half of the plants moved – 40 – survived the transplanting but were not strong when they were planted out at the Claremont site. Frost during their first winter killed most of these plants, and the remainder struggled along for another two years. Those raised from seed grew into fine specimens in a short while. However, our cold winters, well-drained soils, and high shade were not satisfactory for their continued growth. In their earliest years, these are very attractive small plants, but they need constant renewal. First flowering and seeding was recorded during their first season.

***Satureja douglasii* (Benth.) Briq.** [Ed: *Clinopodium douglasii* (Benth.) Kuntze. TJM2]

Yerba Buena.

Perennial.

Propagation: Plants are easily raised from either seeds or cuttings. Abundant seedlings typically germinate in 12 to 17 days, but one seed lot that was seven-years-old began germinating at 26 days. Cuttings typically root in two weeks. Both cutting-grown and seed-grown plants are easily raised in containers in the nursery.

Culture: The affection held for this trailing evergreen perennial by the earliest Spanish settlers has been well-recorded in literature. We find this shade loving plant growing in the wooded parts of the Coast Ranges below 2,500 feet from Los Angeles County north to British Columbia (Canada), and on Santa Catalina Island. Over 50 plants were brought from the old site from a collection originally acquired in 1931. These plants were planted on a shady east-facing slope of the mesa where they took over strongly until they were smothered by other more vigorous plants several years later. Many additional plants were raised from seeds and were planted along pathways and in other suitable shady spots where most of them developed into fine colonies that spread out for many feet in all directions. Under ideal conditions, an evergreen, fine-textured, low-growing, ground cover can be grown.

***Schoenolirion album* Durand.** [Ed: *Hastingsia alba* (Durand) S. Watson. TJM2]

Bulbous Perennial.

Agavaceae. Century Plant Family.

Propagation: While one to two months of cold-stratification might have been beneficial, we sowed our one seed collection from the wild, and our three seed collections from cultivated plants, untreated. The wild seed collection began germinating in 114 days, while the seeds from cultivated plants began germinating in 126, 118, and 90 days. All seed lots were sown in September (except for one sown in October) and all reached maximum germination one to two months later (interestingly, the longer period for the seed lot that had the faster initial germination). Excellent germination was recorded for all seed lots. Each seed lot was successfully raised in the nursery until the bulbs were large enough to transplant into the garden, the usual period being one to two years. As soon as the bulbs started to show signs on dormancy, watering was stopped, but was restarted the following fall – usually in September or October.

Culture: Swinging around from Nevada County in the Sierra Nevada to southern Oregon thence south in the Coast Ranges to Mendocino County, we find this species growing in wet meadows and swampy places, at elevations from 1,500 to 8,000 feet. Our first planting was done in a semishaded spot with a covering of thick humus underlain by rocky soil. Here the plants have been maintained successfully for 15 years and several seed collections have been harvested. Subsequent plantings have been made in similar situations where sufficient moisture could be maintained. Surprisingly, satisfactory growth was made without constant moisture. Flowering and seeding were recorded from the second season onward, and excellent colonies were observed in all garden locations.

***Scirpus cernuus* Vahl. var. *californicus* (Torr.) Beetle.** [Ed: *Isolepis cernua* (Vahl) Roem. & Schult. TJM2]

Perennial.

Cyperaceae. Sedge Family.

Propagation: We collected some bare-root plants from the wild which we then established in seed pans in the nursery before planting them out in the garden.

Culture: This tidal flat and salt marsh plant is seen along the coast from Baja California (Mexico), to Del Norte County and north to Washington. We established our plants at the edge of a pool, where it followed through its seasonal growth but was not recorded as having become established.

***Scirpus robustus* Pursh.** [Ed: *Bolboschoenus robustus* (Pursh) Sojak. TJM2]

Perennial.

Cyperaceae. Sedge Family.

Propagation: Three seed lots were sown within a year, the first and second were sown untreated and the third was cold-stratified for 38 days. For the first lot, the data was unrecorded as well as for the second, but three pots of plants were set out. The third lot (of cold-stratified seeds) produced a few plants with germination occurring in 19 days after removal from cold. The seedlings were potted in late December. The young plants showed dormancy in late February, but started growth again in May. Three clumps were raised for the garden.

Culture: This is the common bulrush or tule. We find this species scattered throughout California as well as into adjacent states and countries, growing in alkali and freshwater marshes, usually below 5,000 feet. Our plants were so recently planted, that they have not been evaluated.

***Scrophularia californica* Cham. & Schtdl.**

Perennial.

Scrophulariaceae. Figwort Family.

Propagation: Three wild collections of seeds, sown untreated and fresh, began to germinate in seven days. Two-year-old seeds began germinating in ten days. Five-year-old seeds began germinating in 17 to 19 days, one collection of latter yielding very poor results while the other collection performed as well as the freshest lot of seeds. Seedling losses in nursery were negligible.

Culture: This species is found in more or less dampish places, particularly in brushy thickets along the coast from the Santa Monica Mountains north to British Columbia (Canada). We planted them in semishaded places where dampish conditions could be maintained. While the original plants were comparatively short-lived, abundant seedlings arose to maintain the species in sufficient quantities.

***Scrophularia californica* Cham. & Schtdl. ssp. *floribunda* (Greene) R.J. Shaw.** [Ed: the ssp. is not recognized in TJM2]

Perennial.

Propagation: Seeds from one wild collection were sown untreated at one year intervals for three years. Results were very poor with the seeds beginning to germinate in ten, 24, and 18 days respectively. Unexpectedly, seeds sown after five years that were sown in same kind of soil mix began germinating in ten days and yielded excellent results. We experienced no problem while raising the seedlings in the nursery.

Culture: This species is from the Coast Ranges and along the western slope of the Sierra Nevada and Southern California. Recorded overall results were poor, but the plants grown in several locations other than in the plant communities portion of the garden, grew vigorously, flowered, and produced seeds in their first season and produced quantities of volunteer seedlings.

***Scrophularia desertorum* (Munz) R.J. Shaw.**

Perennial.

Propagation: Untreated seed harvested from cultivated plants grown at the old site and sown four years later produced excellent results, beginning to germinate in nine days. Seven years after the seeds were collected, our results were just as good but it took 17 days for the seeds to begin germinating. Eight years after the seeds were collected, germination started after 20 days, and results were poor. A lot sown 11 years after the seeds were collected failed completely. No seedling losses were encountered for the first two lots, which were raised in four-inch pots. However, minor losses were recorded for the third lot, which was planted out from six-inch pots.

Culture: This species is found mostly on the dry eastern slope of the central Sierra Nevada and into western Nevada where it grows at elevations from 5,000 to 10,000 feet. The life span for this desert species here in Claremont is about five years. Plants grew strongly, produced flowers and seeds the first season, and volunteer seedlings were noted from time to time.

***Scrophularia villosa* Pennell.**

Perennial.

Propagation: Seeds were harvested in 1950 from a collection that had been growing at the old site since 1941. Five different seed lots were sown untreated between 1953 and 1960. Initial germination time was ten, 15, 17, 15 and 24 days with maximum germination being reached two to three weeks later. These plants were mainly used as cover plantings, and there were few records kept of them other than noting that they continued to reproduce abundantly and were easily maintained. Flowering and seeding occurred during the first season. Plants thrived in the heavier soils of the mesa in protected areas, and were short-lived in the granitic loam soils in the plant communities section of the garden. Plants in bloom grew to heights of five feet, and spread two feet or more wide.

***Scutellaria austinae* Eastw. [Ed: *Scutellaria siphocampyloides* Vatke. TJM2]**

Perennial herb.

Lamiaceae. Mint Family.

Propagation: Two small plants were given to the garden in June 1966, and were established in pots until they were ready for planting.

Culture: This species is found growing in gravelly or rocky places, mostly below 6,500 feet from the Santa Rosa Mountains of Riverside County northward through the Sierra Nevada and swinging over to Coast Ranges south to Lake County. We planted our two plants in the rock garden, where they were recorded as dead nine months later.

***Scutellaria californica* A. Gray.**

California Skullcap.

Perennial.

Propagation: Two wild seed collections were received in September and October 1958, and were sown untreated. The first collection began to germinate after 27 days, and yielded only two seedlings. The second collection began germinating after 14 days and had good results. The seedlings were grown in three-inch and four-inch pots, and losses in the nursery were negligible.

Culture: This species is found growing at elevations below 7,000 feet, in dry, more or less gravelly places, from Alameda and Tuolumne counties northward to Siskiyou County. We planted our plants in the rock garden, where they thrived for a relatively short period and then disappeared.

***Scutellaria tuberosa* Benth.**

Perennial.

Propagation: A clump of native soil containing many tubers of plants that were going dormant was dug from a recently burned hillside. These were planted directly into a garden site with similar soil and conditions, but no record was noted of their survival, and later they could not be found.

***Sedum laxum* (Britton) Berger.**

Perennial.

Crassulaceae. Stonecrop Family.

[Ed: Everett had questioned the identity of this collection, and there is an herbarium specimen of the plant in the wild. That specimen had been annotated by R.T. Clausen as “ssp. *latifolium* – *perplexum*” (**ssp. *latifolium* R.T. Clausen., ssp. *perplexum* R.T. Clausen.**), and neither of these two varieties are recognized in TJM2]

Propagation: Plants were easily established in pots before they were transplanted into the garden.

Culture: Our plants were planted in the rock garden in January 1955. Over the years the planting has increased to fair sized clumps that appear to prosper in this situation.

***Sedum niveum* A. Davidson.**

Perennial.

Propagation and Culture: Our plants were originally gathered at 9,400 feet in the San Bernardino Mountains. Plants growing at the old site were lifted and put in containers for transfer to the Claremont site in February 1951. They were planted in Claremont in August 1951, where they were quickly overgrown by other more vigorous plants. Rescued plants were then re-established in containers in the greenhouse until they were strong enough for replanting in a more suitable site. They were then planted in the rock garden, and after ten years of growth, they had developed into a nice clump that measured four feet by two feet. However, five years later the planting was recorded dead from rotting, as they had apparently become covered by too thick a planting of annuals, and other plants.

***Sedum obtusatum* A. Gray.**

Perennial.

Propagation: Bare-root material was easily established in nursery containers, and usually grew with vigor. A four-year-old lot of seeds failed to germinate.

Culture: This high altitude species grows on dry rocky ridges in the central Sierra Nevada, up to elevations of 13,000 feet. Surprisingly, it has grown well for us. One collection acquired in 1949 and transplanted from the old site was originally planted under oak trees. The leaf fall was too heavy, and the planting had to be removed, re-established in pots, and was then replanted in the rock garden. After 15 years of growth, three clumps measured (combined) two feet by six feet and were noted as being in fine condition. A second planting received too much sun and became riddled by ants and planting failed after four years. A third collection gathered in 1956 and planted in the rock garden is growing very well. The **ssp. boreale R.T. Clausen.**, from the high ridges in the four northernmost counties, has likewise been established and is in good order in the rock garden, after four years.

***Sedum purdyi* Jeps.** [Ed: *Sedum spathulifolium* Hook. TJM2]

Perennial.

Propagation: Bare-root plants are easily established.

Culture: This species is found at lower elevations in the mountains of Siskiyou, Trinity, and Shasta counties. We have one collection that was planted in the rock garden in 1959. To date, the planting is in good order, and is developing nicely into several small clumps.

***Sedum spathulifolium* Hook.**

Perennial.

Propagation: Three collections were moved from the old site, and four new collections were made from the wild. All of these collections of bare-root plants were readily established in containers before they were planted out in Claremont. One lot of seed, harvested from our cultivated plants, was sown directly into the garden site. The first germination was recorded four months later, and a good colony of these plants was established in the garden.

Culture: This species is found from the Coast Ranges and Sierra Nevada from central California northward to British Columbia (Canada) at elevations below 7,000 feet. We have grown seven collections from bare-root plants, and one grown from seed. The latter was recorded as flowering a year after first germination. Originally planted in semi-shaded conditions under a large oak at the Claremont site, we found that the heavy leaf drop quickly deteriorated the planting. The plants were all moved in 1955, re-established in pots and were later relocated to the rock garden, where most have done reasonably well. One collection is in its 30th year with us, having been introduced to the old site in 1937. Other collections have succumbed after five to ten years, depending on their location as to whether they were overrun by other larger plantings or had too much sun or been riddled by ants. The **ssp. anomalum (Britt.) R.T. Clausen & Uhl.** [Ed: the ssp. is not recognized in TJM2], introduced to the rock garden in 1962, was growing nicely in 1966.

***Sedum stenopetalum* Pursh.**

Perennial.

Propagation and Culture: Plants were transplanted successfully from the old site, but failed to survive in our selected site, as it was too hot and too densely covered by oak leaves. An attempt to introduce the *ssp. radiatum* (S. Watson) R.T. Clausen [Ed: *Sedum radiatum* S. Watson. TJM2] failed when the plants we received rotted in the nursery.

***Selaginella bigelovii* Underw.**

Perennial.

Selaginellaceae. Spike-Moss Family.

Propagation: Two wild collections were planted directly into the garden site.

Culture: Both collections were planted in a dry rock wall where both lived for only one season.

***Senecio blochmaniae* Greene.**

Undershrub.

Asteraceae. Sunflower Family.

Propagation: Two seed lots were sown untreated from a single collection from the wild. Seeds began germinating after six to eight days, with excellent results. Some seedlings rotted during periods of wet weather in the winter.

Culture: This coastal strand plant from Santa Barbara and San Luis Obispo counties was planted in our miniature coastal sand dune area. Flowering and seeding were recorded the first season. However, the plantings were short-lived and after two to three years were gone.

***Senecio breweri* Davy.** [Ed: *Packera breweri* (Davy) W.A. Weber & A. Love. TJM2]

Perennial.

Propagation: Seeds from four wild collections were sown untreated. One collection failed, two were poor, and the last excellent. Initial germination periods were nine, 13, and 14 days, with maximum germination reached after another ten to 25 days. There were no problems encountered while raising the seedlings in the nursery.

Culture: Plants are found growing mainly in open, wooded, or brushy slopes below 5,500 feet elevation in the Coast Ranges from Contra Costa County to Los Angeles County and inland to Tulare County. All of our collections were raised since 1962, and for no apparent reason none lived more than two to three years. Flowering plants measured two-and-a-half feet tall in their second year. Naturally inhabiting dry, loose shaly or clay banks, we planted our plants in semi-shaded areas on the mesa. Perhaps the soil is too tight.

***Senecio clevelandii* Greene.** [Ed: *Packera clevelandii* (Greene) W.A. Weber & A. Love. TJM2]

Perennial.

Propagation: Twelve bare-root plants were presented to the garden in May 1962. Eight survived in the nursery and were planted in the garden.

Culture: This inhabitant of moist serpentine places in Napa and Lake counties failed to establish at the side of our stream on the mesa. None survived for a year.

***Senecio douglasii* DC.** [Ed: *Senecio flaccidus* Less. var. *douglasii* (DC.) B.L. Turner & T.M. Barkley. TJM2]

Creek Senecio.

Shrub.

Propagation: Four wild collections of seeds were sown, and only two germinated. These required only four and five days to begin germinating, and reached maximum germination a few days later. Prevention measures against damp-off fungus must be observed in the nursery, but on the whole we had excellent experience growing seedlings and young plants.

Culture: This is a common species found growing in washes and dry streambeds as well as in other dry, loose, and open sites. Originally, the species was observed growing in the Claremont site before all the original brush was cleared off and often volunteers were noted in several locations. Our collections were brought in to have appropriate representatives in various plant communities. While most of the original plants lived for only a few years, volunteer seedling production was high and unless they were controlled, they spread over considerable areas. Some damage to the younger plants was noted during heavier frost periods in the winter. Both flowering and seeding were noted in the second year, from plants that measured up to five feet tall.

***Senecio douglasii* DC. var. *monoensis* (Greene) Jeps.** [Ed: *Senecio flaccidus* Less. var. *monoensis* (Greene) B.L. Turner & T.M. Barkley. TJM2]

Shrub.

Propagation: Over a period of five years, three lots were raised from a wild collection of seed gathered in 1952. Only four to seven days are required to initiate germination of untreated seed. However, the potted seedlings need to be handled very carefully as they will not accept any excess watering, or overly wet periods during winter, and should therefore be kept in as dry a state as possible. While germination was usually high, and we had plenty of plants to meet our requirements, losses were high in the nursery.

Culture: This species is found growing in dry washes and slopes in a variety of plant communities in the northern Colorado Desert, Mojave Desert, to Inyo County, and into Arizona and Utah. Plants produced excellent growth for about two years, flowering and producing abundant seed, but quickly deteriorated and were recorded dead within five years. Only one specimen in the desert garden was noted to have survived for a longer period, and that was not more than six to seven years.

***Senecio eurycephalus* Torr. & A. Gray.** [Ed: *Packera eurycephala* (Torr. & A. Gray) W.A. Weber & A. Love. TJM2]

Perennial.

Propagation: We gathered two collections of seeds from the wild that were both sown untreated and both began to germinate after 12 days and yielded excellent results. We experienced no problems while growing the seedlings and young plants in the nursery.

Culture: This species is found growing in dry open places, from 500 to 1,500 feet elevation, from the Inner Coast Ranges of Sonoma and Colusa counties north and east to Modoc County and into

Oregon. We raised several hundred seedlings that quickly developed into flowering and seeding plants. Our plants were grown in open rocky granitic loam adjacent to the rock garden. As with all of the *Senecio* species that we have grown in the garden, most have survived for not more than three to four years, though a few survive to a maximum life span of five to six years. This species would need to be repropagated to maintain it here in Claremont, unless more suitable growing conditions can be found.

***Senecio integerrimus* Nutt. var. *exaltus* (Nutt.) Cronq.**

Perennial.

Propagation: Wild collected seeds were sown untreated one year apart and both failed. In the third year, a third lot of these seeds were cold-stratified for three months. Germination had started while the seeds were in cold-stratification, and only seven seedlings were potted up. All of the seedlings died after potting.

***Senecio lyonii* A. Gray.**

Shrub.

Propagation: Two wild collections of seeds and one harvested from our plants began germinating in four, nine, and 11 days and reached maximum germination in another two weeks. Good to excellent results were recorded, and all seedlings were successfully raised in the nursery. A collection of six cuttings were collected from San Clemente Island, three had a semihard base and three were greenwood cuttings. All of the cuttings were treated with Rootone and were put into individual three-inch pots under mist. Only the greenwood cuttings rooted, with the first roots noted in 16 days. After the plants were transplanted into gallon-cans, only one survived.

Culture: This species grows on the coastal bluffs of San Clemente and Santa Catalina islands. We planted these plants in several locations, and they grew rapidly during their first few months. The plants flowered and seeded shortly after they were planted out. However, all were killed by frost during the winter months. This species can only be raised in climates without frost. Plants probably prefer a moister atmosphere, although plants can be seen growing well in the driest areas in the interior of Santa Catalina Island.

***Senecio stygius* Greene.** [Ed: *Packera multilobata* (Torr. & A. Gray) W.A. Weber & A. Love. TJM2]

Perennial.

Propagation: Excellent germination resulted from sowing untreated seed gathered in wild and from cultivated plants. The wild collection began germinating in six days while those from cultivated plants began germinating in 12 days. No problems were encountered while raising the seedlings in the nursery – almost 100% survived.

Culture: This species is frequently found growing on dry slopes and mountains of the eastern Mojave Desert and adjacent states, at elevations from 4,000 to 6,500 feet. Plants grow rapidly and mature quickly, flowering was recorded within six months after planting during the early spring months. Plants were extremely short-lived, lingering not more than a year or two, but producing quantities of viable seeds.

***Senecio triangularis* Hook.**

Perennial.

Propagation: Seeds were harvested in the wild and were sown untreated. Germination began in nine days, and reached maximum germination in another three weeks. A few seedlings were lost while they were growing in the nursery.

Culture: This widespread species grows in wet places and along streamsides at higher elevations in the mountains of California. While we did not plant our plants near a streamside, we planted them in a low depression where sufficient water could be added. Survival in the garden was poor, and no further information was recorded.

***Sequoia sempervirens* (D. Don.) Endl.**

Coast Redwood.

Tree.

Taxodiaceae. Taxodium Family. [Ed: Cupressaceae. Cypress Family. TJM2]

“Let him who finds himself beneath thousand year old Redwoods rising majestically into the heavens, tread among them with a spirit of reverence, for he is in a living temple, the pillars of which are mighty monarchs, masterpieces of the Creator’s hand.” Carl B. Wolf. RSABG Leaflets of Popular Information, Number 45, May 23, 1941.

Propagation: A total of 15 lots of seeds were sown from eight wild collections acquired between 1949 and 1967. Four of these lots failed to germinate when the seeds were two- to three-years-old. Three lots were cold-stratified for periods of 24, 30, and 78 days. Untreated seeds began germinating in 14 to 52 days, but averaged about 21 days, and germination rates were usually poor. Generally, the quality of seeds is poor. For one seed lot we sowed two flats, one of which was cold-stratified for 30 days, and the other was untreated. The flat with no treatment provided only six seedlings, with germination starting after 28 days, while the cold-stratified flat produced over 200 seedlings from the same amount of seeds, and these began germinating 11 days after removal from the cold. However, this was the only lot that showed any increase in germination with cold-stratification, the others so treated failed or produced no more seedlings than untreated seeds. The seedlings are easily handled and grow vigorously in containers.

Three lots of cuttings were also raised. The first lot of 16 cuttings was taken in April from basal suckers. These cuttings were untreated, and were put in a cold frame. Over a period of seven months, a total of ten were rooted. A second lot of 16 tip-cuttings collected in late August and were treated with Rootone. All of them successfully rooted, with the first roots noted in 52 days. A third lot of 20 greenwood tip-cuttings were taken in early May and produced only four plants, with the first roots noted in 44 days. These cuttings were placed under intermittent mist, but had not been treated with any rooting compound. It appears on the basis of our limited work, that tip-cuttings gathered in late August or early September and treated with a rooting compound yield the best results. All cuttings were taken from trees growing in the garden, and all except three were raised to planting size.

Culture: Closely following the so-called “coastal fog belt” from San Luis Obispo County to southwestern Oregon, we see this majestic tree growing at elevations under 2,000 feet on flats, slopes and in canyons. While heavily lumbered in parts, many groves have been set aside for posterity to enjoy. While the finest specimens are grown and seen near cool coastal climes, we were encouraged this far inland in a hot and dry climate by the splendid specimens growing on

the Pomona College campus. A redwood forest area has been set aside in the plant communities section of the garden, and there many hundreds of small plants were set out. In full sun and growing in a decomposed granite loam, a high percentage readily took off and have grown into fair sized specimens, in a matter of 15 years. Two plants from the old site were balled and moved in March 1951. One survived and is now a 20-year-old specimen that measures 18 feet tall and ten feet wide. Its first cones were produced in its tenth year. The majority of our collections planted in this area have suffered relatively small losses, and mostly from too much frost in their first season. Ten-year-old plants range in heights from five to 30 feet, depending somewhat on the type of soil in a particular location. To minimize the effects of the high temperatures during the summer months, we covered the area with a deep mulch of sawdust and wood shavings. This helped maintain moisture in the ground and kept the ground temperatures lower. While the species naturally has a rather thin top, our specimens growing in rocky soil situations were not as vigorous as those growing on the mesa in a heavy tight clay soil. On the mesa we had magnificent clumps ranging in heights to 40 feet and with spreads of 20 to 30 feet. Records of first cone production ranged from five to seven years for most collections.

***Sequoiadendron giganteum* (Lindl.) Buchh.**

Big Tree. Giant Sequoia.

Tree.

Taxodiaceae. Taxodium Family. [Ed: Cupressaceae. Cypress Family. TJM2]

Propagation: Three wild collections of seeds were sown, the first collection was untreated and while germination was poor, germination started in 14 and 20 days and reached maximum germination in another 30 days. A third lot, untreated, required 35 days to sprout and the rate of germination was poor. A second lot of the same seed collection was cold-stratified for four months and produced double the number of seedlings and these began germinating 11 days after removal from cold. A third wild collection was cold-stratified for 80 days, and began germinating six days after removal from the cold and the rate of germination was excellent. Therefore, two to three months of cold-stratification helps increase number of seedlings produced. The first two lots were raised to five-gallon-cans at the old site for planting at the Claremont site. Only minor losses occurred while the young plants were grown in the nursery.

Culture: On the western slope of the Sierra Nevada, at elevations of from 4,000 to 8,500 feet, between Placer and Tulare counties, we find this magnificent tree growing in groves of a few trees in the north to large numbers in the south. Seven trees, measuring from two-and-a-half to six-and-a-half feet tall, were balled and transplanted from the old site to the Claremont site in late March 1951. We were unable to provide adequate care for the plants at that time, and six died during that first year. However, the one that survived is now 20-years-old and measures 15 feet tall and is ten feet wide. We raised about 50 plants in five-gallon-cans at the old site before planting them in Claremont in various places in the garden between 1951 and 1953. Many handsome specimens measuring up to 25 feet tall are now growing on the mesa. Two of these were measured when they were 14-years-old from seed and were 16 feet tall, and had produced a few cones. The cones were produced on the central trunk near the tip. No cones have been observed on any of our trees since then. Other ten-year-old groves have recorded only small losses when they are growing in decomposed granite loam. They range in height from four to 20 feet tall and are three to 11 feet wide. None of these younger plants have produces cones. Our

chief trouble growing this species has been attacks by the fungus *Botryosphaeria ribis* that causes unsightly tip and branch die-back. This has been particularly severe since the trees have reached an age of ten- to 15-years-old. Damage from this fungus is most prevalent beginning with the hotter months of August through October. A fertilizing and spray program has been followed recently but no real control has been noted. This is a problem that frequently arises when growing this species out of its natural habitat conditions.

***Shepherdia argentea* (Pursh) Nutt.**

Buffalo-Berry.

Shrub.

Elaeagnaceae. Oleaster Family.

Propagation: Fresh untreated seeds will begin germinating in 15 days, but our one seed collection raised during this time period was cold-stratified for 30 days began germinating in 13 days. Maximum germination was reached in another 30 days and the rate of germination was recorded as fair. No seedlings were lost while they were grown in the nursery, and all the plants grew rapidly to two feet tall before they were planted in the garden.

Culture: In California, this species is found growing along streamsides mainly along the eastern slope of the Sierra Nevada from Inyo County to Modoc County and in a few scattered locations in Southern California, at elevations of 3,500 to 6,500 feet. Beyond California, this species ranges to Canada and to the Rocky Mountains. We started growing this species at the old site in 1942. In January 1951, 15 dormant plants plus several rooted suckers, were transferred bare-root to the Claremont site. It is remarkable that none of these plants died, since they were not pruned back. These plants were planted out into a very rocky garden site, where the plants spread out rapidly, creating a rather dense colony with individual plants measuring ten to 14 feet tall and 13 to 17 feet wide in their 25th year. Plants in other garden sites have done equally well. In the 25th year, we recorded the first fruits. Previously records had also noted this lack of fruit production, but always noted that only pistillate flowers were found. In 1961 a group had attained heights of four to nine feet and were from five to ten feet wide, but no fruiting had been recorded. Three plants were planted beside a stream and grew rapidly into large tree-like specimens. These were later dug and transplanted to a less moist location where they continued to grow and developed. Other plantings of this species in the garden are not growing in wet conditions and are irrigated only in basins or by overhead sprinklers.

***Sidalcea glaucescens* Greene.**

Perennial.

Malvaceae. Mallow Family.

Propagation: One seed collection was sown untreated and began germinating in five days and reached maximum germination two weeks later and yielded 50 seedlings. Seeds from this same collection were sown two years later and began germinating in 11 days and the rate of germination was very poor, and yielded only three seedlings. Seedlings were easily raised in the nursery.

Culture: This species is from the northern Sierra Nevada, at high elevations where it grows in dry grassy places or open woods. Our results were poor, as the plants are apparently short-lived here. There is no further recorded data.

***Sidalcea hickmanii* Greene.**

Perennial.

Propagation: Seeds were harvested from a planting at the old site in June 1950. The first lot of seeds were sown untreated in September 1952, and began germinating in 18 days. The second lot of seeds were sown untreated in October 1960, and began germinating in ten days, with an equal success to those of the first lot. The third lot of seeds were sown untreated in September 1966, and began germinating in 15 days, with about 50% less seedlings. Maximum germination for all lots was reached in another 30 days. Seedling losses were relatively minor while they were being grown in the nursery – so long as the plants were not transplanted to gallon size containers and kept in the nursery through the summer months. Unless watering can be held to very minimum amounts, heavy losses can be expected during the plant's normal dormant period.

Culture: This species is endemic to the Santa Lucia Mountains where it grows on dry ridges at elevations under 2,800 feet. We found it very short-lived, with most plants not living more than a year or two. Flowering and seeding was noted the first season. A rather scrubby plant.

***Sidalcea oregana* (Torr. & A. Gray) A. Gray ssp. *spicata* (Regel) Hitchc.**

Perennial.

Propagation: Seeds were harvested in the wild in September 1950. Four seed lots were sown untreated, over a period of ten years. Three lots (first, third, and fourth) began germinating in 13 days, while the second seed lot began germinating in 20 days. Except for the first seed lot (when the seeds were two-years-old) all the later lots produced a small number of seedlings. Only one seedling was lost in two of the lots, the others came through 100%, even when raised in gallon-cans.

Culture: No data was recorded for these plants, but they were planted along and near the stream on the mesa (between blocks 14-18 and 13-22). Plants were thought to not have lived for very many years. [Ed: There was a later herbarium specimen made from a plant in full bloom in the garden.]

***Silene bernardina* S. Watson ssp. *maguirei* Bocquet.** [Ed: the ssp. is not recognized in TJM2]

Perennial.

Caryophyllaceae. Pink Family.

Propagation and Culture: A small packet of seed was presented to the garden in September 1953, and was sown directly into the rock garden in January 1955. In 62 days, a few seedlings were noted. Flowering was recorded in August 1955, and notes made later indicated stronger growth but after a winter, the plants died.

***Silene californica* Durand.** [Ed: *Silene laciniata* Cav. ssp. *californica* (Durand) J.K. Morton. TJM2]

Perennial.

Caryophyllaceae. Pink Family.

Propagation: Only two seedlings were raised from seed sent to us in August 1958. Seeds were sown untreated in October 1959, and began germinating in 54 days. Both seedlings were successfully raised and were planted out into the garden within another four months.

Culture: This species grows in cismontane California from Los Angeles County and Kern County north to Oregon in several plant communities below 5,000 feet. We planted our plants in the rock garden, but no further data was recorded.

***Silene laciniata* Cav. ssp. *major* Hitchc. & Maguire.** [Ed: the ssp. is not recognized in TJM2]

Perennial.

Propagation: Five seed collections were gathered from the wild, and three more were collected from cultivated plants in the garden. These seed collections were divided into a total of ten lots. Three seed lots were sown directly into the rock garden and these began germinating in 17 and 19 days. Seven seed lots were sown untreated in flats and began germinating in five to nine days, reaching maximum germination in another two to three weeks. Except for the first lot, in which five seedlings were lost in the nursery, only one to three seedlings died of the several hundred plants that were subsequently raised. All seedlings were raised in three- and four-inch pots in the nursery.

Culture: This frequently seen species of the grassy or brushy somewhat shaded slopes of the coastal region from Santa Cruz County to Baja California (Mexico), has been grown most successfully during the past 15 years. Our plants were planted in either the lightly shaded parts of the rock garden or under scrub oaks. While individual plants are not particularly long-lived, they produced much seed and fine crops of volunteer seedlings appeared in the garden. The flowering period started the first season and continued for most of the year, but was best between March and July.

***Silene parishii* S. Watson. var. *viscida* Hitchc. & Maguire.** [Ed: the var. is not recognized in TJM2]

Perennial.

Propagation: Seeds were gathered from the wild and were sown untreated in the nursery. Germination began in seven days and reached maximum germination ten days later. A nice group of seedlings resulted and all were successfully raised in the nursery.

Culture: This variety is from the higher elevations (7,000 to 11,000 feet) of the San Jacinto and Santa Rosa Mountains of Riverside County. Our plants were planted in a well-drained loose soil under oak trees that provided a light shade. Flowers were noted a few months after planting, but due to the heavy oak leaf drop, the colony gradually disappeared until all were gone after five years. In areas less heavily covered by dead leaves, the plants might have continued for several more years.

***Simmondsia chinensis* (Link) C.K. Schneid.**

Jojoba. Goatnut.

Shrub.

Buxaceae. Box Family. [Ed: Simmondsiaceae. Jojoba Family. TJM2]

Propagation: Seeds were collected in August 1949 from a planting at the old site that had been planted in 1929. Two seeds were sown in 100 gallon-cans on January 13, 1950. Several months later ten cans were replanted with three seeds per can. Germination started in 80 days and reached maximum germination in another 12 days. Losses in the nursery were minimal. Plants may also be grown from cuttings.

Culture: Scattered in more or less isolated colonies in Southern California this very hardy plant has been grown successfully for many years. Our initial propagations were used in several garden locations, but principally in the desert garden, where handsome specimens to six to seven feet tall and six to ten feet wide developed. In the chaparral community, after an initial loss caused by severe nibbling by rabbits, no losses have been recorded in this 15 year period. Plants were measured at two to six-and-a-half feet tall and two-and-a-half to nine-and-a-half feet wide. First flowering was noted in the third year and first fruiting was recorded in the fourth year. Despite the very dry natural habitats this species grows in, it will accept cultivation readily and develops faster into fine specimens. For the interesting oil from the seeds, this plant has been experimented with over a period of many years.

***Sisyrinchium bellum* S. Watson.**

Blue-Eyed-Grass.

Perennial.

Iridaceae. Iris Family.

Propagation: Several seed and plant collections were grown, both from cultivated plants and from bare-root plants collected from the wild. Bare-root plants are easily re-established in pots, and seeds may take from two to six weeks to germinate. While there were variable responses, the best germination results were from those that sprouted fastest. Seedlings are easily raised in the nursery. Many seed lots were sown directly into different garden sites.

Culture: This exceedingly variable species is widely distributed, particularly along the coastal regions, growing mainly on open grassy slopes, etc. throughout Southern California to Humboldt County. It was growing naturally at the Claremont site when we came here, growing on the gentle north slope of the mesa. We brought plants from the old site, planting them in many locations where they rapidly spread through the garden display areas. Selected types were grown in quantity for observation – some taller, some with larger flowers, some with brighter colors, etc., etc. An altogether useful plant for mixing with other similar members of the family. Although determined to be the same species, one collection of bare-root plants brought in from 8,500 feet growing along a wet stream bank on Mount San Antonio, behaved as an evergreen and was much smaller, growing in tufts and had smaller flowers. It was grown for over ten years.

***Sisyrinchium californicum* (Ker Gawl.) Dryand.**

Golden-Eyed-Grass.

Perennial.

Propagation: While some seeds lots were cold-stratified for various periods, it proved unnecessary as the seeds will germinate readily in nine to 12 days, culminating in maximum germination in another one to two weeks. Many seed lots were sown directly into garden sites that were adjacent to streams or pools and these took two to three weeks to germinate. Nearly 100% of the seedlings were successfully raised in nursery.

Culture: Growing near the coast in moist places at low elevations from Monterey County north to Oregon we started our first colonies from a Monterey County collection in 1956. Thereafter with the addition of several other wild collections, we had many hundreds of plants blooming beautifully along our mesa stream and poolsides as well as in a constructed vernal pool. These plants need considerable moisture, so they respond in strength alongside the stream where it is very wet. They acted almost as annuals, as they disappeared for a time but then each spring came back in abundance.

***Sitanion hystrix* (Raf.) Swezey.**

Squirreltail.

Perennial.

Poaceae. Grass Family.

Propagation: Five small bare-root clumps were presented to the garden in May 1963. They were all readily established in pots in the nursery before they were planted in the garden.

Culture: This species is widely distributed and grows in dry open places at elevations up to 13,000 feet. Our plants came from a desert location and were planted in the dry streambed in the desert garden. Here, with an occasional soaking, the plants developed into satisfactory colonies.

***Smilacina racemosa* Desf. var. *amplexicaulis* (Nutt.) S. Watson.** [Ed: *Maianthemum racemosum* (L.) Link. TJM2]

Perennial.

Liliaceae. Lily Family. [Ed: Ruscaceae. Butcher's-Broom Family. TJM2]

Propagation: Five wild collections of seeds were sown in eight lots, three of which failed to germinate. Germination requires considerable time. One collection was cold-stratified for five months and began germinating while in the cold. Other wild collections required periodic cold-stratifications of two to five month periods for over two years before any seedlings appeared. After they germinated, the seedlings grew quite well in containers until they were large enough for planting after another year. One collection of bare-root plants was established first in containers with trouble, before they were planted out in the garden.

Culture: Unfortunately, no recorded data is available but it is known that none survived for more than a few months in the garden, even when they were planted in several different locations.

***Smilacina stellata* (L.) Desf.** [Ed: *Maianthemum stellatum* (L.) Link. TJM2]

Perennial.

Propagation: One seed collection from the wild was harvested in October 1952. Seeds were sown untreated two months later and germination began in 78 days with fair results. (Note: Germination was rapid in July; long roots were produced before primary leaves.) All of the

seedlings were successfully raised in the nursery. A second seed lot of this wild collection was sown two years later and was cold-stratified in a jar of moist sphagnum for nine months. When it was removed from the cold, seedlings were germinating. This sowing failed to produce as many seedlings as the first untreated lot. A third seed lot of the same wild seeds were sown four years after it was harvested and failed completely. Bare-roots harvested in December 1964 were planted directly into site.

Culture: All plantings failed after planting in several different sites. The planting of bare-root plants did the best, flowering nicely for two to three seasons after which they disappeared.

***Smilax californica* (A. DC.) A. Gray.**

Perennial.

Liliaceae. Lily Family. [Ed: Smilacaceae. Smilax Family. TJM2]

Propagation: Requires a year or two of intermittent periods of cold-stratification, such as five months cold-stratification, removal for one to two months, re-cold-stratified for another five to seven months, then perhaps a few seedlings will appear. Gradually, over a period of one to two years, we potted up 50 to 75 plants that had been grown from one-eighth to one-quarter ounce seed. Perhaps more would have germinated if left longer. We encountered no particular problems while raising the seedlings in the nursery.

Culture: Growing in the wild in thickets (fence rows) and along stream banks in central northern California, we grew our plants mainly on a chain link fence. While preferring and doing better in a heavier type soil with more moisture, our plants grew relatively well in a rocky decomposed granite loam. After a period of ten years about 40% were alive, and had grown up to six feet tall on the fence, but had not produced any fruits. Damage from digging animals, rats, and gophers plus nibbling rabbits caused many of our losses. Watering was applied at two to four week intervals, but even then the plants probably would have performed better in loamy moist soils.

Solanum L.

Nightshade.

Shrubs and subshrubs.

Solanaceae. Nightshade Family.

***Solanum douglasii* Dunal.** and ***Solanum xanti* A. Gray.** are native to the area.

***Solanum umbelliferum* Eschsch.**

Subshrub.

Propagation: Originally 12 bare-root seedlings were collected, and all were grown in containers in the nursery before they were planted in the garden. Seed was later harvested from these plants growing in the garden. One lot of fresh untreated seeds began germinating in 34 days. However, a second lot of these seeds that were sown untreated six years later failed to germinate. All seedlings were potted up and were successfully raised in the nursery.

Culture: The first group of 12 plants were planted in rocky decomposed granite loam and started flowering and producing fruits as well as spreading via underground rootstocks during the first year. However, rapid losses occurred until all were dead after six years. The accompanying note

indicated “overcare.” Much the same history was noted for the lot grown from seeds, which had attained heights of two feet and spreads up to five feet in their sixth year. Flowering and seeding started the first season, and suckering was noted during the second year. Cuttings were taken in the wild from an albino plant of the **var. *glabrescens* Torr.** [Ed: the var. is not recognized in TJM2] in March. These were treated with Rootone and failed to root.

***Solanum wallacei* (A. Gray) Parish.**

Catalina Nightshade.

Subshrub.

Propagation: Germination began in ten to 20 days. We experienced no problems while raising the seedlings in the nursery, with nearly 100% surviving to be planted in the garden. Cuttings were not attempted.

Culture: Plants grow best in somewhat protected locations. Handsome plants have developed quickly, but on the whole none are very long-lived in cultivation. Our plants usually thrive for five to seven years, but when they are growing with other protecting plants that they can clamber over, they may last a few years longer. Plants are readily attacked by chewing insects, particularly some kinds of caterpillars. The first flowering occurred in the lath house in the nursery before plants were planted out, with fruiting noted within the year. Plants are heavily browsed on Santa Catalina Island, and only where they are protected by thickets of other strong shrubs is it able to survive. Plants clamber over other supporting shrubs.

***Solidago californica* Nutt.** [Ed: *Solidago velutina* DC. ssp. *californica* (Nutt.) Semple. TJM2]

California Goldenrod.

Perennial.

Asteraceae. Sunflower Family.

Propagation: Untreated seed begin germinating in about five days. Bareroot plants are easily established in pots. Seeds that are five-years-old produce few seedlings, and seven- and nine-year-old seeds fail. Untreated seeds sown directly into garden sites will begin germinating in about two months on our rocky, dry, garden soil.

Culture: Plants spread rapidly into large colonies, whether they are grown on rocky soils or clay-loam soils. We had no problems growing this species wherever it was planted.

***Solidago canadensis* L. ssp. *elongata* (Nutt.) Keck.** [Ed: *Solidago elongata* Nutt. TJM2]

Perennial.

Propagation: Seeds were gathered from plants at the old site and were sown fresh and untreated and begin germinating in seven to 12 days, and the results are excellent. Fresh seeds are required, as seeds that have been stored for four or five years failed. We were also successful growing bareroot plants.

Culture: We had been growing this species successfully at the old site since 1940, and that success continued at the Claremont site. Plants planted near and in the stream bed quickly developed into large colonies. Some colonies had to be confined. Flowering and seeding started the first season.

***Solidago confinis* A. Gray.**

Perennial.

Propagation: Seeds were harvested in September 1949 from plants growing at the old site from plantings that had been growing there since 1935. These seeds were sown untreated in September 1952. Germination started in eight days, and reached maximum germination in two months. Results were excellent, and all seedlings were successfully grown in the nursery. Only some of the seedlings were planted in the garden. A second seed lot was sown seven years later and failed to germinate.

Culture: Our plants were planted around the pool where they spread rapidly. Plants continued to excel for over ten years. First flowers were noted the first season, and the plants measured five feet tall.

***Solidago occidentalis* (Nutt.) Torr. & A. Gray. [Ed: *Euthamia occidentalis* Nutt. TJM2]**

Perennial.

Propagation: Seeds were sown untreated and started germinating in 11 days, reaching maximum germination a month later. Results were noted as fair. No problems were encountered while raising the seedlings in the nursery.

Culture: We planted these plants in the stream bed on the mesa, where they initially grew slowly. They took hold after the first year, and then control measures had to be taken to keep the planting within bounds. This planting developed into a solid colony measuring 20 feet by 20 feet, with plants up to five feet tall. Plants flowered during their first year.

***Solidago spathulata* DC.**

Perennial.

Propagation: Seeds were sown untreated and start germinating in seven to 12 days. Four-year-old seeds failed to germinate. No problems were encountered while raising the seedlings in the nursery.

Culture: This species was growing nicely at the old site since 1942. So, 14 of those plants were transplanted into nursery containers and were re-established in the lath house in March 1951. In July, these were planted in semishade at the base of the mesa where they grew well and produced an abundance of flowers and seeds. Additional seedlings were grown from them, and these were planted in a semishaded position at the edge of a large oak in the coastal sand dune section of the garden. These plants have grown equally well and have developed into nice colonies.

***Solidago spectabilis* (D.C. Eat.) A. Gray.**

Perennial.

Propagation: Seeds were gathered from the wild and were sown fresh and untreated began germinating in seven days. A second seed lot from the same collection, now four-years-old, was sown and started germinating in 24 days with very poor results. A third seed lot from the same collection, now five-years-old, was sown but failed to germinate.

Culture: It was not recorded as to how long these plants lived on the mesa, but they were in good condition and flowered a few months later. They disappeared at some later time.

***Sorbus* L.**

Mountain-Ash.

Shrubs or Trees (deciduous).

Rosaceae. Rose Family.

***Sorbus californica* Greene.**

Shrub.

Propagation: Two seed lots were planted. The first lot was cold-stratified in a jar of moist sand for a period of two years. The second lot was placed in a jar with moist peat moss and finely crushed granite (Con-Rock), and was subjected to intermittent periods of cold-stratification for several months at a time. Neither lot produced a single seedling.

***Sorbus cascadensis* G.N. Jones.** [Ed: *Sorbus scopulina* Greene. TJM2]

Shrub.

Propagation: The results with this species, as with any, depends on the quality of the seeds. Our first wild collection of seeds was sown on two different occasions two years apart and after prolonged periods of intermittent cold-stratification, produced only four seedlings, two of which survived and were planted in the garden.

A second seed collection was made two years later and produced well over 100 seedlings from a trace of seed on two different occasions that were sown two years apart. The first seed lot was subjected to six months of cold-stratification in a jar of moist sphagnum moss. When it was removed from the cold, 80% of the seeds had germinated. The remaining seeds were then sown in a flat and maximum germination was reached 30 days later. All seedlings survived initial transplanting into four-inch pots and into gallon-cans. The second seed lot was sown in a flat two years later and was given over four months of cold-stratification. Seedlings began germinating two days after the flat was removed from the cold, and reached maximum germination in another three weeks. Even more seedlings were recorded: 175 from a trace of seed (one-eighth ounce or less). Because we had used some sulphur in the container soil mix, many young plants died during a severe hot spell in the summer.

Culture: None of the plants survived for more than two to three years except for two or three plants that were planted in a rocky clay in a semishaded location. Here, after ten years, they had grown into poor specimens that continue to hang on. These plants had grown two to three feet tall after ten years.

***Spergularia macrotheca* (Cham. & Schtdl.) Heynh.**

Sand-Spurrey.

Perennial.

Caryophyllaceae. Pink Family.

Propagation: Three lots of seeds from two wild collections were sown untreated and began germinating in seven days, and reached maximum germination within one to three weeks.

Results were excellent. Not more than three seedlings out of 320 potted were lost while they were growing in the nursery. All plants were planted out into the garden from three-inch pots.

Culture: This coastal species is found growing near salt water marshes or in nearby waste place from one end of California to the other. Plants failed to take hold in any of the garden areas where we attempted to grow it. All of the plants that were planted on our coastal sand dunes and in heavier soils adjacent to a pool failed. Not one of them became established, and all were noted dead within a few months.

***Sphaeralcea ambigua* A. Gray.**

Desert Hollyhock. Desert-Mallow. Apricot Mallow.

Perennial.

Malvaceae. Mallow Family.

Propagation: Sixteen lots of seeds were sown from five collections of seeds that were gathered in the wild. Five seed lots of untreated seeds were sown directly into garden sites in our desert garden. The rate of germination was very poor, and the seeds germinated in two to three months. Eleven seed lots were sown in flats in the nursery, and all were sown untreated (except for one seed lot that was cold-stratified for 37 days). In all of the untreated lots, the seeds began germinating in four to seven days, with maximum germination in an additional ten to 20 days. The rate of germination was generally good, since the viability of the seeds of this genus are generally of low percentage. Fresh seeds generally produced the most seedlings. However, several seed lots were five-, six-, seven-, and eight-years-old when they were sown, and fair germination rates were noted. Seedlings were transplanted from two-inch to four-inch pots, and were then either planted out or were transplanted into gallon-cans. For most of the collections, losses were minimal, although greater in the gallon-can stage. One seed collection over a period of eight years consistently had a high mortality rate from damp-off fungus, while for all of the other collections there was no indication of this problem. However, this factor should be carefully guarded against while raising this dry land desert plant.

Culture: This colorful woody plant commonly grows below 4,000 feet on very dry, well-drained rocky slopes and canyons throughout our California deserts. We have planted it extensively in our desert garden and desert sand dunes. Other plantings of this species have been made in the plant communities section of the garden, where the soil is a very rocky granitic loam. Some losses were sustained from rabbit grazing, invasions by moles, and frost. Overall, this species is generally short-lived here, usually not surviving for more than four to six years. To offset this factor, a goodly quantity of volunteer seedlings appear each year and keep the areas well supplied with plants, thus contributing the all year color display, as many of these plants will be found in flower at all times of the year. Flowering and seeding were recorded the first season, even while they were growing in the lath house in the nursery.

***Sphaeralcea ambigua* A. Gray ssp. *monticola* Kearney.** [Ed: the ssp. is not recognized in TJM2]

Propagation: Two wild collections of seeds and one from cultivated plants were sown in a total of eight different seed lots.

Untreated wild seeds began germinating in four to ten days and yielded few seedlings, while those from cultivated plants began germinating in four to six days and resulted in many more seedlings.

One lot of wild seeds was cold-stratified for 99 days, and began germinating four days after removal from the cold, but produced only two seedlings. An untreated lot of these same seeds was sown and began germinating in seven days, but produced only one seedling.

No treatment seems necessary and seeds from cultivated plants produced many times more seedlings than those from wild collections. A high percentage of the seedlings were weak and were discarded, otherwise those seed lots producing stronger seedlings suffered only minor losses in the nursery.

Culture: This subspecies grows at elevations from 4,000 to 7,000 feet on dry rocky slopes from San Bernardino County to Mono County and into adjacent Nevada. Even though our losses have been high, this subspecies has been a much longer lived plant than the typical species. After ten years, about 60% of the plants had died, but many volunteers were noted in the area. The plants had grown two to three feet tall and had spread three to six feet wide. Flowering and seeding was recorded the first year.

***Sphaeralcea emoryi* Torr. var. *nevadensis* Kearney.** [Ed: *Sphaeralcea angustifolia* (Cav.) G. Don. TJM2]

Perennial.

Propagation: Four seed lots were grown from a seed collection gathered from cultivated plants at the old site. All were sown untreated over a period eight years. The age of the seeds appeared to have no effect on their germination, as all lots began germinating in three to five days, reaching maximum germination about a month later. Not more than three seedlings were lost in any one lot, and plants were planted out from either four-inch pots or gallon-cans. Seeds sown in October produced flowering plants the following June in gallon-cans.

Culture: This subspecies is found flowering from March through May at elevations below 2,000 feet almost always in the creosote bush scrub plant community from eastern Riverside County to eastern Inyo County and into adjacent Nevada and Arizona. Our plants developed rapidly into bushes three to six feet tall and spread from four to ten feet wide, but were comparatively short-lived here in Claremont. We planted these plants extensively in the desert garden and in the creosote bush scrub plant community section of the garden. They maintained themselves with an abundance of volunteer seedlings that appeared at all times of the year. Flowering and fruiting started within a period of six to ten months after the seeds were sown in the nursery.

***Sphaeralcea orcuttii* Rose.**

Annual or Biennial.

Propagation: Seeds were harvested from cultivated plants at the old site in June 1949, and in July 1950. Seeds were first sown in September 1952, and subsequent seed lots were sown periodically through 1958. A 1957 sowing failed, a 1956 lot produced poor results, but the last and first seed lots provided fair germination. Germination started in five to seven days, and a greater percentage of seedlings were lost in the nursery, particularly during the gallon-can stage. Very

careful watering procedures need to be followed. Seedlings germinating in late September produced flowers the following June.

Culture: This species is a frequent inhabitant of low, semi-alkaline sandy places in the Colorado Desert. We have maintained this species since its first introduction at the old site in 1932. Many generations of seedlings have been raised since then, as this species is rather short-lived with us. Numerous volunteer seedlings have been enough to maintain it in our garden.

***Sphenosciadium capitellatum* A. Gray.**

Ranger's Button. White Heads.

Perennial.

Apiaceae. Carrot Family.

Propagation: A wild collection of seeds was acquired in 1952, and was sown on four different occasions. Two untreated seed lots failed. Two lots of cold-stratified seeds were sown and one of these failed. The successful lot was sown in June, three years after it was harvested, and it was cold-stratified for 75 days. Seedlings had started germinating before removal from the cold. From one-eighth ounce of seeds, 16 seedlings emerged and 12 of these were successfully raised in the nursery and were planted out in the garden.

Culture: This rather widespread species is observed growing in swampy and streamside locations in the mountains at elevations from 3,000 to 10,400 feet. Our collection came from the side of Mount Whitney beside a stream at 8,300 feet. Our plants were placed in a shallow well-drained, semi-shaded area where they could be kept moist. They did not respond to our conditions and after six years were written off as having failed.

***Spiraea densiflora* Nutt. ex Rydb. [Ed: *Spiraea splendens* K. Koch. TJM2]**

Shrub (deciduous).

Rosaceae. Rose Family.

Propagation: Our first collection of seeds that had been gathered from the wild was separated into two seed lots that were sown untreated when they were five-year-old. After five months, neither had germinated, and the seed flats were discarded. A second collection of seeds from 6,600 feet in the wild was sown two months after the seeds were harvested, and was then cold-stratified for over five months in a jar with moist sphagnum. A year later another lot of these seeds were sown in June, and were cold-stratified until the following January. The seeds started germinating in eight days after their removal from the cold, and reached maximum germination two months later. Results were noted as excellent. None of the seedlings were lost while they were grown in the nursery.

Culture: This species grows in moist rocky habitats at elevations from 5,000 to 11,000 feet through most of the Sierra Nevada. We endeavored to grow this montane species in a slight depression that was shaded by alders and where plenty of water was supplied. Other specimens were planted in a somewhat similar position that was shadier and had loose granitic soil with more humus. Neither planting lived for more than six years, with most of the plants rapidly disappearing after the third year. Plants spread somewhat by underground suckers making small

clumps eight to 20 inches tall and spreading eight inches to two feet wide. Flowering and seeding started the first year when the plantings appeared to be in good condition.

***Spiraea douglasii* Hook.**

Shrub (deciduous).

Propagation: A four-year-old collection of seed was sown untreated and began germinating in 18 days, with maximum germination after another month. Results were noted as fair. A second collection of seeds that were gathered in the wild were sown fresh and untreated and began germinating in 11 days and reached maximum germination 17 days later. Results were noted as excellent. Five years later, a second lot of these same seeds was sown untreated and failed to germinate. None of the seedlings from either collection were lost while they were being grown in the nursery. This species may also be grown from cuttings, but we have had no occasion to use this method.

Culture: This common species grows in low damp places below 6,000 feet, from the northern part of California to British Columbia (Canada). Our plants behaved very well for us and were planted around a pond and in depressions where sufficient water could be supplied. Plants grew equally well in heavy clay-loam soil or well-drained gravelly soils with humus. Specimens grew into large spreading clumps that measured six to eight feet across and four to six feet tall. No losses were recorded for many years until we attempted to move several large clumps, some of which were then lost. Flowering and seeding occurred the first year. Our plants were tardily deciduous, and through the summer months they became leaf-scorched and looked rather unkempt.

***Stachys mexicana* Benth.**

Perennial.

Lamiaceae. Mint Family.

Propagation: Seeds were sown untreated and began germinating in eight days, and reached maximum germination in 22 days. We recorded a good rate of germination from a minute amount of seeds. Only one seedling died in the nursery.

Culture: This species grows in very moist places along the Mendocino County coast and northward to British Columbia (Canada). We attempted to establish our plants in a similar situation, adjacent to our coastal sand dunes where they failed to establish. Five years later, they were recorded as dead.

***Stanleya elata* M.E. Jones.**

Perennial.

Brassicaceae. Mustard Family.

Propagation: Three collections of seeds were gathered from the wild and were divided into four seed lots that were sown untreated. Three lots began germinating in five days, and maximum germination was reached in about a month with the results noted as good. The fourth lot began germinating in nine days, with maximum germination reached in about a month, and the results were poor. Two attempts to germinate ten-year-old seeds failed. Small losses were recorded

while the plants were growing in the nursery and happened principally during growth in gallon-cans when watering must be carefully controlled.

Culture: This species grows in dry rocky washes and slopes at elevations from 4,500 to 6,500 feet in the mountains of central eastern California and into adjacent states. Our record with the species has not been good, with most of our plants succumbing over a period of two to five years. We planted our plants in the desert garden and in the pinyon-juniper woodland plant community, where soils are rocky and dry. Although these plants flowered and seeded poorly after the first year, they appeared to generally be unhappy with us.

***Stanleya pinnata* (Pursh) Britton.**

Prince's Plume.

Perennial.

Propagation: Untreated seeds from four different wild collections, and of one collection from cultivated plants, were sown. Germination began in five to six days, with maximum germination recorded within three weeks. All seed lots produced good results, except for one lot that failed to germinate.

One seed lot was directly sown in the desert garden and began germinating in 14 days.

The seedlings are highly susceptible to damp-off, so it was necessary to transplant the seedlings out of the seed flat quickly, otherwise losses were high. Once transplanted, losses were considered minor. Some garden plantings were made from four-inch pots while others were from gallon-cans.

Seeds of a wild collection of **ssp. *inyoensis* Munz & Roos**. [Ed: the ssp. is not recognized in TJM2], was sown untreated on two different times. The first sowing of fresh seeds produced excellent results, but the second sowing (two years later) had poor results. Seeds began germinating in four and seven days (respectively), with maximum germination recorded in one to two weeks. Losses of seedlings were severe in the first lot from damp-off, but were only minor for the second lot. The plants were planted in the garden from gallon-cans.

Culture: In California, this species inhabits seleniferous soils from the north base of the Santa Rosa Mountains inland to Cuyama Valley and Inyo County from 1,000 to 5,000 feet. It ranges as far east as North Dakota, Kansas, and Texas. While the species has not been very long-lived in either of our garden locations, (the average lifespan is two to five years) it has been less so here in Claremont. The plants here were never as vigorous, nor have they flowered as well. They usually produce thin, poorly developed racemes that are often severely attacked by black aphids. This woody perennial produced a few volunteer seedlings here in Claremont, but these were plentiful at the old site.

The **ssp. *inyoensis*** is a distinct shrub that is found in sandy places of the southeastern end of Eureka Valley and at the eastern base of the Inyo Mountains. We first grew this subspecies in 1954. Our plants were planted in a sand dune area and have not done well, though a few plants have become established. Other plantings set out in full sun in a very rocky site, suffered severely the first year from mole and gopher predation. After ten years, one shrub remained, and it measured two feet by three feet, and was noted as being in poor condition. This plant was at its best during its seventh year, when it measured four-and-a-half feet by five-and-a-half feet, and was in good condition. First flowering and fruiting occurred in the first and second years.

***Staphylea bolanderi* A. Gray.**

Bladdernut.

Shrub (deciduous).

Staphyleaceae. Bladdernut Family.

Propagation: Five seed lots were sown from four collections of seeds that were gathered from the wild. None of them were treated with sulfuric acid, as has been recommended. All were subjected to varying periods of cold-stratification, ranging from two to four months with periods of the same length of time out of the cold, and were then returned to cold-stratification. Germination occurred over a period of six to 18 months, and the results were not good.

One lot was soaked for five minutes in Thiourea solution and then sown, nearly three months later they were put in cold-stratification for nearly two months, and germination started in 11 days after they were removed from the cold, and maximum germination was recorded a month later. From seven-eighths ounce of seeds, 62 seedlings were produced and potted up, and this was our best result.

Sulfuric acid treatments had been used on some seed lots that were sown at the old site, but these treatments apparently did not produce any better results. However, more experimentation is recommended.

One collection of seeds gathered from our cultivated plants failed to germinate. Seedling losses in the nursery were minor except for one lot where nearly two-thirds died in the gallon-can stage.

Culture: This uncommon shrub is found growing on dry canyon walls, and on north slopes among pines and oaks at elevations of 1,000 to 4,500 feet. Three plants, measuring from two to six feet tall and up to three feet across, were transplanted bare-root from the old site to the Claremont site in January and March 1952. They were in 15-years-old when they were transplanted, and all survived the move and were still alive when they were 25-years-old. One plant died when it was 30-years-old. At 30 years of age, the plants measured six to eight-and-a-half feet tall and were four to six feet wide. These plants had produced seeds since the summer of 1945. They are growing in a rocky clay soil and are somewhat shaded by other large shrubs on the gentle north slope of the mesa.

Later plantings, made from 1957 and later, had records of severe losses during their first two years, after which they settled in and no additional deaths were recorded. Ten-year-old plantings measured five to eight-and-a-half feet tall and were five to ten feet wide, and were noted as being in good condition. First flowering started by at least by the sixth year, and the plants flowered and fruited periodically throughout the year, although the main flowering period was in April to May, or in June. The large inflated pods make an interesting display on the plants.

***Stillingia spinulosa* Torr.**

Perennial.

Euphorbiaceae. Spurge Family.

Propagation: Seeds were gathered from the wild and were sown untreated. These began germinating in 13 days, and reached maximum germination in one month. We experienced only

minor losses while growing the seedlings in the nursery. All plants were planted out into the garden from four- and five-inch pots.

A seed collection of the **ssp. *linearifolia* S. Watson.** failed to germinate.

Culture: This species is frequently seen in the dry sandy areas of the Mojave and Colorado deserts of California, below 3000 feet. We planted our plants, which may be considered either annual or perennial, in the desert garden. The plants were starting to flower when planted out in the garden at six months from seed. However, none survived after the winter, when most were killed by frosts.

***Stipa lepida* Hitchc.**

Perennial.

Poaceae. Grass Family.

Propagation: Seeds were gathered in the wild and were sown untreated. Seeds began germinating in five days, reached maximum germination in ten days, and yielded excellent results. Clumps of seedlings were transplanted into five-inch pots where they grew quickly and were planted out in the garden within six months.

Culture: This common grass is found from the Coast Ranges and Channel Islands of California. Our plants were planted in rocky clay-loam soil on a gentle north slope where they were somewhat protected by sages, etc. Until a wire cage was provided, the plants suffered severely from grazing by rabbits. It is assumed that these recently planted grasses will become established in this area.

***Stylomecon heterophylla* (Benth.) G. Taylor.** [Ed: *Papaver heterophylla* (Benth.) Greene. TJM2]

Annual.

Papaveraceae. Poppy Family.

Propagation: Seeds were sown directly into a variety of locations and soil types in the garden. However, the principal plantings were in our rock garden and in a well-drained area under large oaks, where the soil was filled with rotted oak leaves. In partial shade, in the latter area, the quickest and best germination was recorded with germinating beginning in 11 and 18 days. In the rock garden area, seedlings began germinating in 16 to 35 days, and the results were usually poor or fair. Some seed lots that were sown in the fall produced the best results the following spring, but at no time were any volunteer seedlings noted in subsequent years.

Culture: Flowering occurred in April, occasionally in May, and seeds were harvested the following month.

Natural Habitat: The species is found growing on grassy and brushy slopes below 4,000 feet from Lake County southward in the Coast Ranges, the Channel Islands, and from the southern Sierra Nevada foothills and the San Joaquin Valley south to northwestern Baja California (Mexico).

***Styrax officinalis* L. var. *californica* (Torr.) Rehder.** [Ed: *Styrax redivivus* (Torr.) L.C. Wheeler. TJM2]

Storax. Snowdrop Bush.

Shrub (deciduous).

Styracaceae. Storax Family.

Propagation: Four collections of seeds were gathered from the wild, and these were divided into eight seed lots. Four seed lots were sown untreated and began germinating in 41, 42, 51, and 55 days, with maximum germination recorded four-and-a-half to six months later. One seed lot was sown directly into a garden site and took three-and-a-half months to germinate, and the results were poor. In general, untreated seeds produced poor to fair germination rates.

Two seed lots were cold-stratified for 78 and 80 days, and began germinating in ten and 14 days after they were removed from the cold, and both reached maximum germination in a month, with both lots recording good germination.

A collection of seeds that was received from the USDA in moist peat moss arrived with about 50% already germinating. The seeds were bursting out of their seed coats after several months of ripening at about 35° F.

A little over one ounce of seeds were sown in a deep seed bed in the nursery, and over 200 seedlings germinated. All of these were later transplanted bare-root into the garden with excellent results. This method appears to be an excellent way to raise these plants.

In general, losses in the nursery were only minor with fall germinated seedlings, except when sulphur was used in the soil mix.

Culture: This species inhabits dry rocky places in the Inner Coast Ranges from Lake County to Shasta County and in the Sierra Nevada from Tulare County northward at elevations below 3,000 feet. Our earliest plantings date from 1954, and once the plants became established, losses were minimal. However, initial losses were high, with as many as 90 to 98% lost during their first two years in the garden, but with no further losses recorded thereafter. Ten-year-old specimens, all growing in very rocky granitic loam, measured one to five-and-a-half feet tall and were two to five-and-a-half feet wide. First flowering and fruiting were recorded in their sixth and seventh years. It is recommended that this species be planted in a clay soil in our area.

***Styrax officinalis* L. var. *fulvescens* (Eastw.) Munz & I.M. Johnst.** [Ed: *Styrax redivivus* (Torr.) L.C. Wheeler. TJM2]

Shrub (deciduous).

Propagation: Two seed lots were gathered from cultivated plants at the old site and were sown untreated. These began germinating in 51 days, and reached maximum germination a month later. The germination rate was excellent for the first lot, and poor for the second.

A collection of seeds that were gathered from the wild and was sown untreated began germinating in 51 days, and reached maximum germination two months later. The rate of germination was poor.

Another collection of seeds were gathered from cultivated plants (however, this time from those growing at the Claremont site) and were cold-stratified for 86 days at which time germination had already started. Maximum germination was recorded ten days later.

Minor losses of seedlings were recorded for some lots while they were growing in the nursery. Some lots suffered losses especially in the gallon-can stage, while other lots recorded no losses. None of these seedlings were raised in deep seed beds nor transplanted bare-root, though these are highly recommended procedures.

Culture: As might be expected, this native variety from our central coastal and Southern California mountains performed much more satisfactorily for us than the northern variety. Several fine stands were established, and while some lots recorded losses, in general the results have been very good, particularly after the plants have survived their first two to three years in the garden. These plants grow well in rocky and clay soils, however the latter appears to be preferred. Fifteen-year-old specimens measured three to ten feet tall and had spread from two to ten feet wide (the smallest specimens had been subject to repeated grazing by rabbits). First flowering and fruiting began in the third and fourth years. The attractive, white, bell-like flowers pass quickly and the flowering period seldom lasts more than a couple weeks.

***Suaeda californica* S. Watson.**

Perennial.

Chenopodiaceae. Goosefoot Family.

Propagation: Plants were directly transplanted from their salt marsh habitat into pots in the nursery, where they re-established quickly. No seed collections were made.

Culture: We planted our plants in our closest approximation of a salt marsh, the native habitat of this species. However, our few plants failed to survive for more than a few months.

***Symphoricarpos mollis* Nutt.**

Snowberry.

Shrub (deciduous).

Caprifoliaceae. Honeysuckle Family.

Propagation: We processed five collections: one of bare-root plants, one of seed from our cultivated plants, and three were from seeds gathered from the wild.

The bare-root plants were re-established successfully in gallon-cans.

Four seed lots were sown from the three wild collections, and two seed lots were sown from the cultivated material. The first wild collection was cold-stratified in a jar with moist sphagnum moss, and after six-and-a-half months, one seed had germinated. Then, all the seeds were sown in a flat and when no further germination had occurred after a month, the flat was cold-stratified again for two-and-a-half months at which time seeds were beginning to germinate, and good germination resulted almost 11 months after the original cold-stratification. However, subsequent sowings with five months of cold-stratification had begun germinating before they were removal from the cold.

The seeds from cultivated plants were cold-stratified for two-and-a-half to three months, but the germination results were poor.

Poor results were also obtained from a third wild collection of seeds that were cold-stratified for three and four months.

Excellent to poor results were recorded in the nursery during the transplant and growing stages. Many of the seedlings from some collections appeared to be very weak, and as a consequence many died, particularly during the gallon-can stage. Other collections produced vigorous seedlings and little trouble was encountered while growing them. In general, we had little trouble growing the seedlings and young plants during the smaller sized pot stages.

Culture: This species is commonly found growing on shaded slopes below 5,000 feet in the Coast Ranges from Mendocino County to northern Baja California (Mexico). We had two collections that grew quite well and became thoroughly established in our rocky, granite loam. One group was somewhat shaded by other larger shrubs, and another group was planted in a shallow depression in full sun but where irrigation can be applied. The best planting is growing on a semishaded bank of the mesa in clay-loam soil. Other collections failed after two years. In all locations, the plants have spread out from underground root suckers, forming fine clumps that measure several feet across. Heavy flowering and fruiting were recorded during their second year.

***Symphoricarpos parishii* Rydb.** [Ed: *Symphoricarpos rotundifolius* A. Gray var. *parishii* (Rydb.) Dempster. TJM2]

Shrub (deciduous).

Propagation: Our first collection of seeds that had been gathered in the wild failed to germinate after three months of cold-stratification in a jar of moist sand. Two seed lots of a later collection of seeds that were gathered from the wild were cold-stratified for 122 days and 90 days, and began germinating in four and ten days, with both reaching maximum germination after another month. However, each of the two lots produced only nine seedlings. These 18 seedlings were raised successfully in the nursery. However, one entire group that was transplanted into gallon-cans with a soil mix that contained sulphur died after a severe spell of hot weather.

One bare-root plant brought to us was successfully established in a container.

Culture: This species grows on higher and drier rocky slopes and ridges of the mountains of Southern and central California. Plants were never successfully established in the garden. All collections succumbed within a period of two years.

***Symphoricarpos rivularis* Suksd.** [Ed: *Symphoricarpos albus* (L.) S.F. Blake var. *laevigatus* (Fernald) S.F. Blake. TJM2]

Shrub (deciduous).

Propagation: Only by repeated periods of cold-stratification could we get any seedlings to germinate, and then only a few. Two collections of seeds that were gathered in the wild failed completely after several months of cold-stratification. Another collection of seeds that were gathered from the wild in 1954 was cold-stratified in a jar with moist sphagnum for a period of over seven months, then removed from the cold and sown in a flat. A few days later the flat was returned to cold-stratification for four more months. It was then removed from the cold for one-and-a-half months after which it was again put in cold-stratification for two more months. It was then removed from the cold, and the seeds began germinating 11 days later, but only a total of 22 seeds germinated.

During a period of four years, more seeds were sown, but only one seedling was produced from each of two seed lots, and the last sowing was a complete failure.

All of the seedlings were raised in the nursery at a 98% success rate.

A seed collection of *S. vaccinoides* Rydb. [Ed: *Symphoricarpos rotundifolius* A. Gray. TJM2] failed to germinate.

Culture: This species is found growing in moister habitats in the mountains of central California and northward at elevations under 4,000 feet. Our plants were planted in a slight depression that received some shade from a collection of large deciduous shrubs and small trees. We felt that this species needed considerable moisture in our very rocky, granitic loam, so our plants frequently received irrigation. For the first five years in the garden, only one plant was lost. The plants first fruited and flowered during their second year. Rabbit grazing damaged the plants. Colonies were established by spreading underground root suckers. At the end of ten years, about a third of the plants were still alive and were in good condition. These plants measured one to two-and-a-half feet tall and colonies had spread from one to five-and-a-half feet across. In Claremont, this species would probably grow better in heavier soil and in more shade.

***Tanacetum camphoratum* Less.** [Ed: *Tanacetum bipinnatum* (L.) Sch. Bip. TJM2]

Dune Tansy.

Perennial.

Asteraceae. Sunflower Family.

Propagation: Untreated seeds sown untreated, from either cultivated or wild plants, begin germinating in about 14 days (though occasionally may take as long as a month). The rate of germination was poor for one seed collection from cultivated plants and from two seed collections that were gathered from the wild. When these seed collections were sown after five years in storage, they failed to germinate.

Seeds that were sown directly into a garden site (sand dunes) established and grew well.

We experienced no problems while raising the seedlings and young plants in the nursery.

Culture: This species is from the sand dunes of the San Francisco Bay region. We have never had any trouble raising this species in any of our garden sites. Heavy clay soils or sandy loam soils seem to be acceptable. We have raised plants successfully since 1932 at the old site, where they grew in heavy clay (adobe). Plants have grown equally well for us in Claremont, making fine stands spreading over a considerable area. First flowering and seeding began the first and second years.

***Tanacetum douglasii* DC.** [Ed: *Tanacetum bipinnatum* (L.) Sch. Bip. TJM2]

Perennial.

Propagation: Fresh seeds that were gathered in the wild were sown untreated and began germinating in ten days. We had the same results when a second lot of these same seeds were sown three years later. We experienced no problems and had no losses of seedlings while they were growing in the nursery.

Three collections of a few plants gathered from the wild suffered 50 to 75% losses while they were being re-establishment in pots in the nursery.

Culture: This coastal strand species ranges from Mendocino County northward to British Columbia (Canada). These plants have been entirely hardy with us, growing vigorously in either sandy loam or clay soils, and in sun or semishade. Clumps measuring many feet across were established within a few years. First flowering and seeding began the first and second years from seed. This species tends to form large mats, while *T. camphoratum* may form taller and more discrete individual plants.

***Taxus brevifolia* Nutt.**

Western Yew.

Tree (evergreen).

Taxaceae. Yew Family.

Propagation: A small collection of seeds were gathered from trees in the wild on October 15, 1954. Two lots of seeds were sown on October 26, 1954.

Lot 1: one-eighth ounce of seeds were sown in a flat and put in the greenhouse. Seven months later, since no germination had occurred, the seeded flat was put in cold-stratification for three months. Seeds began germinating twenty days after the flat had been removed from the cold, with maximum germination 17 days later. A total of 84 seedlings were potted-up from a total of 90 seedlings. None of the seedlings died while being grown in the nursery.

Lot 2: The seeds were put in a jar with moist sphagnum and were cold-stratified for seven months, after which the seeds were removed and sown in a flat that was then returned to cold-stratification. Four months later the flat was removed from cold-stratification, and returned to cold-stratification 12 days later. This process was repeated with removal from cold-stratification three months later, and then returned to cold-stratification after five months. The flat was again removed from cold-stratification and began germinating in 38 days. Two years later (after the first cold-stratification in a jar with sphagnum), the flat was again returned to cold-stratification for another three months, which then made for a total of two years and four months from the original sowing. Only three seedlings emerged from this lot.

A third lot of seeds were sown on September 1, 1955 and after two-and-a-half months (and no germination), the seed flat was placed in cold-stratification for 50 days. This was followed by intermittent periods of cold-stratification and time in the greenhouse. Seeds began germinating in 172 days (February 19, 1956), with maximum germination in another three months (May 4, 1956). Only 37 seedlings were produced from one-and-one-quarter ounces of seeds.

Only one seedling was lost from the 121 seedlings originally potted-up from the above three lots of seeds sown between October 26, 1954 and September 1, 1955.

A 1959 collection of seeds failed to germinate, but intermittent periods of cold-stratification and greenhouse time was not followed.

It appears that sowing the seeds in ambient conditions for several months, followed by a period of cold-stratification will yield the best results. Other treatments, such as sulfuric acid, should be tested. Cuttings and grafting are often employed for commercial production of other species, and should be investigated for our native species. However, we did not pursue these tactics.

Culture: This species grows in the more or less shaded canyons of the mountains of central California northward to Alaska and to Montana. This tree produces very hard wood, and is particularly useful for the native Indians. While not a complete success with us, it is surprising how well the plants that have taken hold have grown for us. Seventy-five plants were planted in our plant communities section of the garden, in a rocky, decomposed granite loam soil and where they originally received a lot of sun, but as other trees and shrubs have grown up, some shade has been provided. In their tenth year, nine plants remained and measured from nine inches to two-and-a-half feet tall and had spread from 13 inches to three feet wide. During their early years, they had been considerably damaged by rabbits. No flowering or fruiting had occurred. There had been no losses for the most recent six years. Other plants were planted on a shady bank of the mesa in clay-loam soil. Here the plants grew much better, attaining greater size and producing a few fruits after seven to eight years.

***Tellima grandiflora* (Pursh) Lindl.**

Fringe-Cups.

Perennial.

Saxifragaceae. Saxifrage Family.

Propagation: Seeds were gathered from cultivated plants in the garden, and were sown untreated. Germination started in 14 to 22 days, and reached maximum germination in another two weeks. The seedlings were raised in the nursery without any problems, usually coming through at a rate of 98 to 100%. Plants were mostly raised in four-inch pots before they were planted in the garden.

Culture: This species is an inhabitant of moist woods and rocky places below 5,000 feet in the Coast Ranges from San Luis Obispo County and in the Sierra Nevada from El Dorado County northward to Alaska. This species has grown exceedingly well for us. Our original plants were collected in 1942, and were grown at the old site. Seeds were harvested from these plants, and produced only a few seedlings. However, these in turn produced an abundance of seedlings growing in a shady part of the rock garden. Additional seeds were harvested in 1954 and produced many hundreds of plants that were planted in a variety of places. However, none of these plantings were as successful as those in the rocky, well-drained and shaded area of the rock garden. Those planted on the mesa in clay-loam soil were not successful, and were quite short-lived in such situations. First flowering and seeding began the first season from plants planted out from four-inch pots.

***Tetracoccus dioicus* Parry.**

Shrub (evergreen).

Euphorbiaceae. Spurge Family. [Ed: Picrodendraceae. Bitter-Tree Family. TJM2]

Propagation: Over a period of five years, four seed lots were sown from a collection seeds that were harvested in 1949 from plants growing at the old site. Due to this species' sensitivity to damp-off during the seedling stage, the fourth seed lot, sown in 1954, was dusted with a fungicide containing 50% Captan. While germination was much better, there were still severe losses of seedlings during all potting stages prior to the gallon-can stage.

The seeds were divided into four seed equal seed lots, each containing a trace of seeds weighing less than one-eighth ounce. Lot one was sown in August 1951 and began germinating in 19 days, and yielded a total of 48 seedlings. Lot two was sown in September 1954 and began germinating in eight days, and produced 45 seedlings; Lot three was sown in October 1954 and began germinating in nine days, and produced 28 seedlings; and Lot four was sown in December 1954 and the seeds were treated with Orthocide (a fungicide containing 50% Captan) began germinating in 54 days reaching maximum germination two months later, and produced 75 seedlings. Seedling losses ranged from one or two to 100%. Once the young plants were raised to the gallon-can stage, only one or two plants died.

Culture: This species grows on dry chaparral slopes below 2,500 feet, in the Santa Ana Mountains of Orange County southward to coastal San Diego County and inland to Jacumba and into northwestern Baja California (Mexico). While losses have been gradual, once the plants are well-established they have grown into fine specimens in all locations. The principal planting is in full sun, in the open, in a rocky decomposed granite loam soil. Over a period of 15 years, losses have been about 48%. These plants measure five to eight feet tall and have spread from two to 12 feet wide. First flowering and seeding began the second and third years. Plants growing in very tough situations in clay-loam soil have made equally fine specimens.

***Tetracoccus hallii* Brandegee.**

Shrub (deciduous).

Propagation: Seeds were harvested in August 1949 from plants growing at the old site. The seeds were sown untreated in October 1950, and began germinating in six days, reaching maximum germination in another month, with a total of 30 seedlings. A second seed lot was sown in late August 1951, and was soaked for 24 hours in hot water. Seeds began germinating in 13 days, reaching maximum germination 18 days later, with a total of 30 seedlings. All the seedlings from the first seed lot were lost to damp-off fungus, and only 13 were raised to be planted from gallon-cans from the second seed lot.

In 1962, seeds were gathered from the one remaining plant in the garden, and were sown at the end of October. They were then cold-stratified for 44 days, and the seeds began germinating 17 days after they had been removed from the cold. Maximum germination was achieved 23 days later, and a total of 13 seedlings were produced. All except four of the seedlings died in the nursery. Control of damp-off fungus must be pursued at all times, and great care must be taken with watering.

Culture: This species grows on very dry, rocky slopes below 3,600 feet in the mountains of the Colorado Desert and into southwestern Arizona. We have grown this species for many years at the old site. We planted 13 plants in December 1952, and all but one were lost the first year, principally from a severe frost one month after they were planted. This one remaining plant grew in a very rocky location, in full sun, for 12 years and then died from some unknown cause in its 13th year. It had grown to a height of four feet and had spread to five feet wide. It produced viable seeds in its tenth year. It is interesting to note that while this species is mostly dioecious, there may be monoecious individuals, as typified by this plant. The four seedlings raised from this plant failed to establish in the garden.

***Tetradymia axillaris* A. Nelson.**

Cotton-Thorn.

Shrub (deciduous).

Asteraceae. Sunflower Family.

Propagation: A collection of seeds were gathered from the wild, and the first lot of untreated seeds was sown and failed to germinate. A second seed lot was sown untreated a year later and began germinating in nine days, reaching maximum germination in 33 days, and producing 11 seedlings. Only two were successfully raised in gallon-cans to be planted in the garden.

Culture: This species mainly grows in Joshua tree woodlands at elevations from 2,000 to 6,400 feet, and ranges from the Mojave Desert to Mono County and eastward into Utah and Arizona. Our two plants were planted in the desert garden, and failed to survive for more than two years.

***Tetradymia canescens* DC.**

Shrub (deciduous).

Propagation: Obtaining viable seeds is difficult. We tried to grow seeds from four different wild collections, and several seed lots failed to germinate. Viable seeds sown untreated will begin germinating in five to six days. We managed to germinate a total of six, and all of these seedlings were successfully raised in the nursery in five-inch and gallon containers.

Culture: This widely ranging species grows from the higher elevations of the eastern slope of the Sierra Nevada, in desert mountains, to British Columbia (Canada), and to Montana and Utah, at elevations from 4,000 to 10,000 feet. None of our plants grew for more than two years, and it was noted that the plants were rather weak when they were planted.

***Tetradymia stenolepis* Greene.**

Shrub (deciduous).

Propagation: One collection of seeds were harvested from the wild in October 1952. A lot of these seeds were sown untreated in September 1954, and began germinating in five days, reaching maximum germination in 15 days, with a good rate of germination. Seedling losses in the nursery were not too bad, as only eight died out of the 60 seedlings that had been potted up. A second seed lot was sown a year later and failed to germinate.

Culture: This species is occasionally found growing in the Mojave Desert at elevations of 2,000 to 5,000 feet. None of our plants lived for more than two to three years. Part of our losses were attributed to frost, as the plants were planted in November.

***Thalictrum fendleri* Engelm. ex A. Gray.**

Perennial.

Ranunculaceae. Buttercup Family.

Propagation: One-eighth ounce of seeds were sown untreated and began germinating in 142 days. Only three seedlings were produced, and all were successfully raised in the nursery.

A second collection of seeds that were gathered from the wild were sown untreated, and after they had failed to germinate after 112 days, they were then put in cold-stratification for 83 days. The seeds began germinating nine days after they had been removed from the cold, and reached

maximum germination in another 15 days. A fair rate of germination was recorded, and about 6% of the seedlings were lost while they were growing in the nursery.

A collection of bare-root plants from the wild at 10,000 feet elevation were successfully re-established in containers in the nursery with the loss of only one plant.

Culture: This is a rather widely distributed species that is found growing in moister and shadier places in the mountains at elevations from 4,000 to 10,000 feet, particularly through the Sierra Nevada but extending south to San Diego County and Baja California (Mexico), and in California's Coast Ranges from Monterey County northward and eastward. Our efforts to establish this species were fruitless. While our records fail to note the reasons, none of our plants were known to have become established for more than a period of two to three years, even though we attempted to grow them in several different locations in the garden.

***Thalictrum polycarpum* (Torr.) S. Watson.** [Ed: *Thalictrum fendleri* (Engelm. ex A. Gray) var. *polycarpum* Torr. TJM2]

Meadow-Rue.

Perennial.

Propagation: We have not raised this species from seed in the nursery as our original plants, gathered as bare-root plants in 1940 and raised at the old site, were transplanted to the Claremont site. There can be no problem raising it from seed, as we get thousands of volunteer seedlings springing up everywhere in the garden. Bare-root plants are easily transplanted with minor losses.

Culture: This species is found mostly at lower elevations in woodlands and semishaded, humus-rich areas with situations more moist than dry from the Coast Ranges to San Diego County and occasionally in the Sierra Nevada. We planted our plants at the Claremont site in a shady north exposure with deep humus. There they thrived and have since spread into many areas of like situations. First flowering and fruiting will begin in the first year.

***Thalictrum sparsiflorum* Fisch. & C.A. Mey.**

Perennial.

Propagation: We grew only one collection of a plant from the wild. It was readily established in a six-inch pot in the nursery, and within three months it was ready to be planted in the garden.

Culture: This far ranging species is found growing in moist thickets, wet banks, and boggy places at elevations from 5,000 to 11,000 feet in California and into the Rocky Mountains to Alaska and Siberia. We received our lone plant in December 1962 and planted it in March 1963, in full shade on a rocky mound where more moisture is applied throughout the year. Notes made three years later recorded that it was in good health and had flowered.

***Thamnosma montana* Torr. & Frem.**

Turpentine-Broom.

Undershrub.

Rutaceae. Rue Family.

Propagation: Four collections of seeds were gathered from the wild and were divided into nine seed lots that were sown untreated. All seed lots began germinating in three to ten days, with an average of five days. Maximum germination was achieved in 30 days. Germination rates were fair, but raising the seedlings to planting size was difficult. The seedlings are highly susceptible to damp-off fungus, and our losses ranged from at least 50 to 100% while the seedlings and young plants were growing in the nursery.

Culture: This species is frequently found in our desert regions where it grows on extremely arid slopes and flats below 5,500 feet. While our overall losses have been high over a period of ten years, most of the plants were lost during the first two to five years of growth. We have managed to maintain a few plants in fair to good condition, and these plants average eight to 20 inches tall and have spread from one to three feet wide. First flowering and seeding were noted in the second year for two different collections.

***Thelypodium jaegeri* Rollins.** [Ed: *Hesperidanthus jaegeri* (Rollins) Al-Shehbaz. TJM2]

Perennial.

Brassicaceae. Mustard Family.

Propagation: A collection of seeds that were gathered from the wild were sown untreated on two occasions began germinating in four to seven days. The rate of germination was good, and seedling losses while the plants were growing in the nursery were minor. Some plants were flowering while they were growing in pots in the nursery, a mere three months after they had been potted up as seedlings.

Culture: This species is a narrow endemic of the southern Inyo Mountains and is found growing in shaded rock-crevices at 6,000 to 8,000 feet. Our collection was made at 7,300 feet. We planted our plants in dry, semishaded parts of the desert garden, where they flowered and seeded within a year, but failed to survive more than two to three years.

***Thermopsis macrophylla* Hook. & Arn.**

Perennial.

Fabaceae. Pea Family.

Propagation: The recommended procedure for germinating seeds of this species has been to soak the seeds in hot water. We processed four collections, three of seeds that had been gathered from the wild, and one that was gathered from our cultivated plants.

One collection failed to germinate, and others had good results from very small amount of seed.

One seed lot was soaked for 24 hours in hot water, and was then sown in individual four-inch pots. These seeds began germinating in 18 days. A second seed lot was given the same treatment, but the seeds were sown in a seed flat. These seeds began germinating in nine days.

Another seed collection was sown untreated in seed flat and began germinating in seven days.

Another seed collection was cold-stratified for one month and began germinating eight days after removal from the cold, and reached maximum germination three months later.

Other collections took 30 to 45 days to reach maximum germination.

Losses of seedlings during potting stages in the nursery were generally low. However, one group was potted up into a soil mix that had a small amount of fertilizer, and all but two seedlings were lost.

We noted that all seedlings of the pea family are very sensitive to any fertilizer during the potting stages in the nursery.

Culture: This species is found north of Ventura County in the Coast Ranges at elevations below 4,500 feet, in open places, generally in the foothill woodland and mixed evergreen forest plant communities. We had difficulty establishing this plant in the garden. We planted some of our plants in quite rocky areas, and while these plants grew to three feet high and flowered in the first year, they survived for only two to three years. In another garden location, in full sun, but with more loam in the soil, a fine specimen measuring three to four feet tall and with an even greater spread flowered abundantly for three to four years. The best situation for this species in Claremont, appears to be in the clay-loam soil of the mesa where summer irrigation was kept to a minimum. Each season for the past three to four years, nice plants have flowered and produced a few seeds, the latter a characteristic of the species.

***Thermopsis macrophylla* Hook. & Arn. var. *agnina* J.T. Howell.** [Ed: the var. is not recognized in TJM2]

Perennial.

Propagation: We processed three collections of seeds that had been gathered in the wild. All of these collections were sown untreated, and began germinating in 11, eight, and 22 days, with the latter producing only one seedling. Maximum germination was recorded 12 days later. Seedling losses were minor, except for one collection that was potted up with soil that included a small amount of fertilizer.

Culture: This variety grows on dry slopes and ridges of the Santa Ynez Mountains in Santa Barbara County. We first acquired seeds of this plant only three years prior to the end of this report, so there has not been enough time for evaluating our results. Preliminary observations indicated that these plants will grow best in the clay-loam soil of the mesa where a minimum of irrigation is applied. First flowering was noted in the second year.

***Thuja plicata* D. Don.**

Giant-Cedar.

Tree (evergreen).

Cupressaceae. Cypress Family.

Propagation: While one to two months of cold-stratification has been recommended, we had excellent results from sowing fresh untreated seeds. Germination began in 20 days, reaching maximum germination 20 days later. All seedlings that were potted up were successfully raised in the nursery.

A second wild collection of seeds that were gathered in the wild was sown untreated and with cold-stratification, and both seed lots failed to germinate.

A third collection of seeds that have been gathered in the wild and was sown untreated and with two months of cold-stratification produced very few seedlings, although more seedlings

germinated after cold-stratification. However, this entire collection was apparently poor, and several weak seedlings had to be discarded.

Propagation may also be accomplished by asexual production, but as we had no need to employ these tactics.

Culture: This beautiful tree is found growing along the northern cool coast of California northward to Alaska and east to Idaho and Montana. We succeeded in growing this species, with relatively good success. Our first vigorous group of seedlings was planted in a very rocky, decomposed granite loam soil in full sun. During a period of ten years, there was a loss of 10% of the plants, with most losses occurring during periods of intense heat. These specimens were measured at six to 15 feet tall and had spreads from six to eight feet wide. The first production of male cones was recorded in their sixth year with female cones maturing the following year. Cones were noted every year thereafter. Plants that were planted in the clay-loam soil of the mesa and on the north shaded banks performed extremely well. In one area of fine specimens, two plants died from oak root fungus (*Armillaria mellea*) in their tenth year, and others have succumbed since then.

One plant of *T. plicata* 'Stoneham Gold' was received from the National Arboretum in 1963. It was planted in a semishade situation, and was later recorded as doing very well during its second year.

***Tiarella unifoliata* Hook.** [Ed: *Tiarella trifoliata* L. var. *unifoliata* (Hook.) Kurtz. TJM2]

Sugar-Scoop.

Perennial.

Saxifragaceae. Saxifrage Family.

Propagation: A tiny amount of seeds were gathered from the wild and were sown untreated. Only one seed germinated 63 days later. We had no problems while raising it, as well as two other small acquisitions of plants, in our nursery.

Culture: This shade-loving plant is found growing in moist, wooded areas along the coast below 2,000 feet from the Santa Cruz Mountains to Alaska and Montana. We successfully raised our plants on a fully shaded well-drained mound. Four plants spread to cover an area of about 50 square feet. An occasional irrigation is necessary to keep the plants in good health in our hot interior climate.

***Torreya californica* Torr.**

California-Nutmeg.

Tree (evergreen).

Taxaceae. Yew Family.

Propagation: In an effort to determine suitable procedures for germinating the seeds of this species, we experimented with several methods.

Collection one: Seeds were harvested from cultivated trees at the old site in September 1952. Nine-and-a-quarter ounces of seeds were sown in a flat in October 1952. After a month in the greenhouse, the seed flat was placed in a cold frame with bottom heat set to 70° F. Seeds began

germinating in 127 days and continued sporadically over a period of 11 months. A total of nine seedlings were produced, and all were successfully raised in the nursery to planting size.

Collection two: A collection of seeds were gathered in the wild in October 1953. Two seed lots were sown a month later. The first lot contained two-and-half ounces of scarified seeds and these were sown in a flat. Only one seedling germinated in eight months, the remainder of seeds rotted. The second lot was composed of ten ounces of seeds. The hard outer seedcoat of 12 seeds were removed and the seeds were then sown in a six-inch pot. One seed germinated six months later, and the remainder of the seeds rotted. The remaining portion of the seeds were sown in a flat. After nine months, the seeds were removed and scarified, and two germinated 16 days later. The balance of the seeds were then cold-stratified in a jar of sphagnum for three-and-a-half months, and were then soaked in water for three days and were then resown. A month later these seeds were dumped as all had rotted. Only a total of three seedlings were produced and all were successfully raised in the nursery to planting size.

In July 1954, about ten months after these seeds were originally harvested, a third lot was cold-stratified in a jar with peat moss and sand. Five months later, these seeds were removed and sown in a flat, and pine needles were burned on top of the flat. Two seedlings germinated 53 days later, and after one-and-a-half years, the flat was dumped as all of the seeds had rotted. These seedlings were also successfully raised in the nursery and were planted in the garden.

Collection three: Seeds were harvested from a single specimen in Kings Canyon, in Fresno County. They were sown in a flat of 100% sphagnum. The seeds began germinating in 105 days, with one or two additional seedlings appearing each month until ten months later when the flat was placed in cold-stratification. Four months later the seeds had started germinating before the flat had been removed from the refrigerator, and 41 seedlings were later potted up. This seed collection yielded about 95% success rate. All seedlings were successfully grown in the nursery and were planted in the garden.

Collection four: Prior to sowing in a deep seed flat in the lath house, six-and-a-quarter ounces of were cold-stratified for two months. Eleven months later the seeds were removed from the deep flat and were sown in standard seed flat that was placed in the greenhouse. At that time the seedcoats of many were starting to split, and one-and-a-half months later 38 seedling were potted up, and the remaining unsprouted seeds were put in pots. A total of 43 seeds germinated and were potted up, and 37 of these were raised successfully in the nursery and were planted in the garden.

Collection five: We employed the same procedures as we had used for collection four, but from this two-and-three-quarters ounces of seeds, only two germinated. They were successfully raised in the nursery.

Two other seed collections failed to germinate. One of these was of seeds that were five-years-old and its previous storage conditions were unknown to us.

Cuttings were taken from our plants on two occasions.

Fifteen cuttings with semi-hard bases were gathered in May, and were treated with Hormodin #3 and then placed in a cold frame with intermittent mist. These cuttings started rooting in 91 days and continued intermittently for a period of eight months until a total of eight had rooted. All except three failed to survive in the nursery.

A second lot of 22 cuttings were taken in late June, and were treated with CUTstart XX and each cutting was placed in a three-inch Jiffy pot. Almost three months later, the cuttings were removed from the pots and were placed in a seed pan. The first roots were noted 206 days later. The last two rooted were potted almost ten months after the cuttings were first made. A total of six cutting were rooted, and only three of these were successfully raised in the nursery.

Further experimental work with both seeds and cuttings may speed up the propagation of this excellent plant, but at best, propagation appears to be a slow process. Once the seedlings have germinated, there does not seem to be much of a problem raising them to planting size.

Culture: This interesting small tree of the yew family grows in cool, shady canyons, below 4,500 feet. Our oldest specimens were balled and transplanted from the old site in March 1951. One accession was 21-years-old and measured five feet tall, and was planted in an open site of very rocky soil. In its 35th year, it was measured at 12 feet tall and ten feet across, and it was severely infested with scale insects. A year later it was dead. Nine plants of a second accession were 18-years-old, and these plants measured from three to seven-and-a-half feet tall. These plants were transplanted close to the first plant. Five were alive after the first year in Claremont, and continued alive until the 25th year when two were recorded dead. In the 30th year, three trees were alive and in good condition and cones were noted. They measured ten-and-a-half to 12½ feet tall and had spread from eight to ten feet across.

A third accession that was raised in containers in the nursery at the old site was moved directly to our Claremont site in five-gallon-cans. A group of 25 of these were planted in full sun in a rocky soil. These young trees were severely attacked by rabbits during their first year and there were heavy losses. After 15 years, only three remained, and these measured five-and-a-half to seven-and-a-half feet tall and had spreads from four-and-a-half to six-and-a-half feet wide. At this time, the plants were in good condition. Others of this accession were planted on the mesa, in clay-loam soil, where they grew into fine specimens but many died from root rot caused by excessive irrigation in this situation.

Many others were planted in the considerable shade of coast live oaks where the drainage was excellent. These have done exceedingly well. One of the sturdiest groups was grown from the seeds gathered in Kings Canyon in Fresno County. These were the most vigorous of all the collections we raised, and they grew very well in an open, rocky decomposed granite loam soil, but took hold and grew strongly. In their sixth year, 23 were moved to another garden site for ornamental use as a hedge. However, in this situation more irrigation had to be done and many were lost from root rots. The few remaining fine specimens grew up to six feet tall and were again moved to another location where they continue to grow very well. The plants are best grown with good drainage in a shadier site, but they will take sun and will grow very well in clay if the water is withheld. At the old site, on a steep north facing slope of adobe clay soil that received considerable water, fine specimens were established – but this could not be done in our flat mesa clay soil in Claremont. Thirty seeds were produced on a tree growing on the mesa in its 18th year from seed, but this was its 16th year in Claremont, as this was one of the plants that had been container-grown in the nursery at the old site.

***Trichostema lanatum* Benth.**

Romero. Woolly Blue-Curls.

Shrub (evergreen).

Lamiaceae. Mint Family.

Propagation: Plants of this species usually produce a low percentage of viable seeds, so the rate of germination is often low. Much of the propagation for this species was done by sowing seeds directly into the garden site where the plants were desired, and then thinning the usually abundant seedlings by transplanting them to other areas. Germination usually required one to three months, depending on soils and other conditions, but averaged about one-and-a-half months. Untreated seeds sown in a flat began germinating in 14 to 17 days, and reached maximum germination in another month. Depending on conditions, sowing the seeds in flats or directly into a garden site are equally satisfactory. We had little trouble while raising the seedlings through potting stages in the nursery, but plants that are started in the garden site will generally be stronger since their roots are undisturbed.

Since there is variation in the intensity of flower color, one may want to select certain plants for additional propagation. Asexual production is not difficult, cuttings usually rooting at a success rate of 75 to 90% without too much difficulty. Rootone treated tip-cuttings taken the last of April started rooting in 25 days. Other lots of cuttings were taken in early December and in the middle of March with good results. Since seedlings appear in the garden throughout the year, the time for cuttings depends on the time of ripening of the cuttings on the particular plant. Losses of cutting grown plants through the potting stages in the nursery have been severe in most cases, so careful cultural practices must be followed.

Culture: This species is an infrequent but showy member of the chaparral belt of the Coast Ranges from Monterey and San Benito counties south to San Diego County, with the greatest concentration of plants typically some miles away from the coast. The appearance of volunteer seedlings throughout the year makes for a fair show of flowers throughout the year. This hardy plant is short-lived under irrigation (not more than a year or two). The best location for these plants is where they will receive little or no water during the summer months, or on a dry hillside. While well-drained soils are preferred, equally fine specimens are found in other soils, including the heaviest of clays. Flowering and seeding will begin the first or second season and one can expect volunteer seedlings any time after the seed begins to fall. The peak flowering months are May and June, when well-developed plants will produce dozens of two- to three-foot-long flower spikes will grace the entire plant. This is a truly spectacular and useful plant for difficult parts of one's garden. Occasionally, an albino-flowered plant appears in the group and if the flowers are of good color and it seems desirable to produce more of the same, cuttings are readily rooted.

***Trichostema parishii* Vasey.**

Shrub (evergreen).

Propagation: Plants of this species usually produce a low percentage of viable seeds, so the rate of germination is often low. Seeds sown untreated begin germinating in 40 to 50 days, usually in the high 40s. Fresh seed sown in a mixture of one-third sand, one-third peat moss, and one-third perlite or similar combination seems to be best, but the quality of the seed is paramount for good results. We experimented with hot water treatment and cold-stratification, but neither treatment seemed to affect results. Seed from both cultivated and wild plants was used, and the highest number of seedlings was obtained from seeds from the cultivated plants. Seeds over four-years-old failed to germinate as well as seeds that were younger, though sometimes we did have good

results with older seeds. We had extremely good results while raising the seedlings in the nursery. We seldom lost any, or only one or two seedlings.

Culture: This species is found at elevations of 2,000 to 6,000 feet on very dry slopes farther inland than *T. lanatum*. Several collections were grown but the majority of our plants were not long lived. Individual plants seldom lived for more than five to six years. These plants were planted in our driest locations and produced fine displays in our desert garden and in other dry, rocky sections. Optimum flowering and seeding was reached in their second to fourth years, although the first flowering bloomed while the young plants were still in cans in the nursery. A few plants were recorded in their tenth year and measured two to four feet tall and had spreads from two to three feet wide.

***Trichostema lanatum* × *Trichostema parishii*.**

Trichostema hybrid.

Shrub (evergreen).

Propagation: Two lots of cuttings were made to provide additional plants of this interesting hybrid. Nine tip-cuttings were taken and were treated with Rootone on March 11, 1966. The cuttings began rooting 39 days later, and four were successfully rooted. A second lot of 37 cuttings were taken when the plant was in flower on April 19, 1966. The cuttings were treated with Rootone, and began rooting in 34 days. A total of 33 were successfully rooted. A total of 21 of these survived in the nursery and were planted in the garden.

Culture: This hybrid appeared in a group of seedlings of *T. parishii* that were planted in the desert garden. It had characteristics of both parents, the hybrid being taller and more upright, with somewhat larger leaves than *T. parishii*, and longer inflorescence than *T. parishii* but not as large as *T. lanatum*. The hybrid was also longer-lived than *T. parishii*. While all but two plants of this hybrid had died out in three years, the surviving plants were strong and vigorous when cuttings were taken. The original plant was observed doing well a year later at the end of the period for this report (1966). The plants were last recorded alive in August 1971.

***Trientalis latifolia* Hook.**

Star-Flower.

Perennial.

Primulaceae. Primrose Family. [Ed: Myrsinaceae. Myrsine Family. TJM2]

Propagation: Our material was confined to one collection of roots which were put in a seed pan that was cold-stratified for a period of 60 days. About a month later, the roots began sprouting and a few plants were grown in the greenhouse for another four months.

Culture: This species is chiefly found growing below 4,500 feet in shady, wooded places northward from the central California mountains including the Coast Ranges and the Sierra Nevada. Our plants were planted in a specially prepared shady site adjacent to a stream where a somewhat moist situation could be maintained. However, the plants failed to become established.

***Trifolium tridentatum* Lindl.** [Ed: *Trifolium willdenovii* Spreng. TJM2]

Annual.

Fabaceae. Pea Family.

Propagation: Seeds were sown untreated directly into the clay-loam soil of the mesa where they began germinating in 18 days.

Culture: This annual species is found growing in grassy places of cismontane California. Our collection of seeds was gathered from the wild on Santa Catalina Island. Flowering started four months after the seeds germinated and made a fine display. However, all the plants were accidentally destroyed before the next generation of seeds could be harvested.

***Trifolium wormskioldii* Lehm.**

Perennial.

Propagation: Seeds were sown untreated in a flat, and began germinating in nine days, but only a few seedlings were produced. All of the seedlings were successfully raised in the nursery and were planted in the garden.

A second seed lot, of the same seed collection, was sown two years later directly into garden soil in the sand dunes. In this situation, there was a good rate of germination, and the seeds began germinating in 29 days.

Culture: This species is found growing in many habitats at elevations up to 10,000 feet. We planted this moisture loving species in our sand dunes, since we had collected the seeds in the wet open depressions of the Oso Flaco area in San Luis Obispo County. The first planting was dead within two years, as the plants had probably not received sufficient moisture. The second seed lot that was sown in place grew well for a time, died back in the summer, and then reappeared when cooler weather came. The plants were moved to a depression where better moisture conditions could be maintained and they grew very well there at the time of this report (late 1960s).

***Triglochin maritima* L.**

Arrow-Grass.

Perennial.

Juncaginaceae. Arrow-weed Family.

Propagation: A few seeds were sown untreated in five five-inch pots that were kept quite wet. The seeds started germinating in 22 days, and all of the seedlings were successfully raised in the nursery and were planted in the garden.

Culture: This is a widely distributed species that can be found growing in many kinds of wet habitats, and at varying elevations. Since we have just started growing this species before the end of this report, its success and failure could not be recorded.

***Trixis californica* Kellogg.**

Shrub.

Asteraceae. Sunflower Family.

Propagation: Seeds were sown untreated, from both wild and cultivated sources, begins germinating in five days, reaching maximum germination in ten days. One of our groups of

young plants was subjected to a spell of wet weather while they were growing in lath house, and 50% of them died. Otherwise, we had no trouble growing seedlings and young plants in the nursery.

Culture: This species is a frequently seen in desert washes and canyons below 3,000 feet. In our conditions, these plants grew exceedingly well and demanded little or no attention, except that the plants are frost-tender. Plants suffer considerably when temperatures drop below 27° F. Freezing conditions caused one collection to disappear over a period of 15 years. Over a period of ten years, our plants grew to heights of two to four feet and spread from four to six feet wide. First flowering and seeding was recorded during their first and second years.

***Tsuga heterophylla* (Raf.) Sarg.**

Western Hemlock.

Tree.

Pinaceae. Pine Family.

Propagation: We processed a total of five accessions of this species, three were seed collections, and two were of small seedlings that had been collected in from the wild. Fresh seeds were sown untreated in a flat started germinating in 18 days, and reached maximum germination three weeks later. Fresh seeds were cold-stratified for four months began germinating in 16 days after they were removed from cold.

Seeds sown untreated in deep outside seed beds began germinating in 46 and 52 days, and took longer to reach maximum germination than those sown in flats. While at least three months of cold-stratification has been recommended for germinating this species, our results indicate that fresh seed will germinate quickly without such treatment.

Seed dormancy is variable and cold-stratification may be necessary for some seed lots. Seeds that had been stored for three or four years germinated very slowly, and the results were poor or complete failures.

Losses were generally few while raising the seedlings in the nursery, depending on the strength of the seedlings. Some collections appeared to be weaker, and consequently the seedling losses in these collections were higher. Seedlings raised in the deep seed beds in the lath house moved along rapidly and were a more vigorous lot, while a second weaker group of seedlings incurred a high percentage of deaths.

About 50% of the bare-root seedlings were established in the nursery in small pots and were successfully grown and were planted in the garden.

Culture: This beautiful forest tree of the northern coastal and cooler climes below 2,000 feet was difficult for us to establish in the open, rocky areas of the garden where they were often subjected to difficult weather conditions, such as excessive summer temperatures (as in 1955 when readings of 100 to 115° F were registered). Moles also caused considerable damage to our plants. In other areas, root competition from well-established trees was such that the young hemlock trees could not be kept irrigated enough to get them established. Plants grown in shade and in clay-loam soil grew into fine specimens that measured over ten feet tall in ten years. However, in one area of the garden, such ten-year-old trees were attacked by oak root fungus (*Armillaria mellea*) and destroyed. Specimens in other sections of the garden that were not

infested with this harmful fungus made fair growth. This species will accept greater amounts of water but should have good drainage under such conditions.

***Turricula parryi* (A. Gray) Macbr.** [Ed: *Eriodictyon parryi* (A. Gray) Greene. TJM2]

Perennial.

Hydrophyllaceae. Waterleaf Family. [Ed: Boraginaceae. Borage Family. TJM2]

Propagation: Two collections of seeds were gathered from the wild and were sown in two seed flats. One seed flat was covered with pine needles that were then burned, and the other seed flat was covered with excelsior that was then burned. The flat with the pine needles began germinating in 81 days, while the flat with excelsior began germinating in 71 days. All seedlings were successfully grown in the nursery and were planted in the garden.

Collections of seeds gathered from cultivated plants failed to germinate following either burning or cold-stratification.

Culture: This transitory species is most often seen after a fire, growing on the driest slopes at elevations below 8,000 feet in the mountains and hills of central and Southern California. Our plants grew exceedingly well for two to three years, but rapidly declined thereafter, becoming ratty-looking with many stems incurring a fasciation of leaves and stems. First flowering and seeding took place in the first and second season. Our plants generally died within five years and it is doubtful if plants in their natural habitat live any longer.

***Typha* L.**

Cat-Tail.

Perennial.

Typhaceae. Cat-Tail Family.

Propagation: ***T. angustifolia* L.** and ***T. glauca* Godron** [Ed: *Typha* × *glauca* Godron: (*T. angustifolia* × *T. latifolia*) TJM1] were established in two pools in the garden from plants brought in from the wild. Both of them became so well established they had to be curbed. Both were grown for several years until the process of keeping them in bounds became too much of a problem and the plants were removed.

***Umbellularia californica* (Hook. & Arn.) Nutt.**

California-Bay, California-Laurel.

Tree (evergreen).

Lauraceae. Laurel Family.

Propagation: Seeds are usually harvested in the wild in October, and our seed collections were sown in November. We processed a total of eight collections of seeds that were gathered from the wild, and two collections of seeds that were gathered from our cultivated trees. Seeds that were sown untreated in flats germinated erratically, and began germinating in an average of 25 to 32 days, however some took as long as 65 days to begin germinating. These seed lots took one-and-a-half to four months to reach maximum germination.

Two seed lots were cold-stratified for two months and were then sown in deep seed beds in the lath house. These began germinating in 52 and 65 days after they were removed from the cold, and reached maximum germination in another 12 to 20 days.

Two seed lots failed completely, as the seeds rotted.

Generally, we experienced no problems while raising the seedlings and young plants in the nursery. However, one lot apparently was attacked by damp-off fungus, and many died from rotting at the base at ground level. Bare-root seedlings from the deep seed beds suffered more than normal losses when they were transplanted, but some of these lots were weak plants.

A group of 19 geenwood-tip-cuttings were taken in the middle of July, and were then soaked in Terraclor solution and treated with SUPERthrive and were then placed under intermittent mist in the greenhouse. These cuttings started rooting in 72 days and a total of 17 of the cuttings rooted. All of the rooted cuttings were successfully raised in the nursery, but they developed slowly and some did not grow into strong plants.

Culture: This is a commonly seen tree in the canyons and valleys of the mountains throughout California and into southwestern Oregon, usually growing at elevations below 5,000 feet. This handsome tree has been raised successfully in all parts of our garden. Bare-root plantings suffered especially high mortality in their first year after planting, but subsequently there were minimal or no losses. However, this pattern seems to be shared with most of our plantings.

Some groups were planted in open, rocky situations and initially suffered high mortality but once they settled in they have grown into splendid specimens. Better specimens have been grown in the heavier soils and where an adequate supply of moisture has been available. Fifteen-year-old specimens have measured 17 to 21 feet tall and have spread from 15 to 21 feet wide. Fruiting starts at five or six years of age.

***Umbellularia californica* (Hook. & Arn.) Nutt. var. *fresnensis* Eastw.** [Ed: the var. is not recognized in TJM2]

Tree (evergreen).

Propagation: Seeds were gathered from the wild and were sown untreated in a flat of 100% sphagnum moss. They began germinating in 77 days and continued sporadically until maximum germination was reached 13 months later. Seeds were gathered from the resulting cultivated plants six years later, and were sown to test whether they would come true as our garden-grown plants were planted next to those of the straight species. Seeds were sown untreated in a flat, and began germinating in 68 days, and reached maximum germination a month later. All of these seedlings were successfully raised in the nursery.

To supplement our original collection we took cuttings from them in November 1962 and in March 1963. The first lot of 20 tip-cuttings was treated with CUTstart XX, and began rooting in 71 days. A total of nine cuttings were rooted and all of them were successfully grown in the nursery. Two more collections of tip-cuttings were taken in March 1963. Thirty-five of these were treated with Rootone, and 27 received no treatment. The Rootone cuttings began rooting in 61 days, and 17 were successfully rooted and grown in the nursery. The untreated cuttings also began rooting in 61 days, and 23 were successfully rooted and grown in the nursery.

Culture: This handsome variety is found growing in Fresno County. Our plants were grown from seeds collected from Kings Canyon. These plants have grown exceedingly well for us in rocky,

decomposed granite loam soil, and are handsome specimens that measure four to 12 feet tall and have spread from two to 12 feet wide in ten years. In our opinion, this is a handsomer plant than the species as it has broader, deep green leaves with finely tomentulose undersides that give a pleasing gray contrast. Everyone we have shown it to has agreed with us.

***Vaccinium cespitosum* Michaux.**

Ericaceae. Heath Family.

Propagation: A small clump was brought in from San Bruno Mountain with other material. It was established in a flat and was planted in the garden five months later.

Culture: From San Bruno Mountain in San Mateo County, this species appeared to be far out of range. We grew it for two years in a shady rocky mound with other material included in the clump. It gradually deteriorated, and was gone within a period of three years.

***Vaccinium ovatum* Pursh.**

California Huckleberry.

Shrub (evergreen).

Ericaceae. Heath Family.

Propagation: We processed seven accessions from material gathered from the wild, six were seed collections, and one was of cuttings. The seed collections were divided into a total of 13 lots, of which four lots failed to germinate.

The seeds are very small and should not be sown very deeply. In fact, we found it best to sow the seeds on the surface of sphagnum moss that is then brushed over lightly. The sphagnum moss should be kept quite moist.

Seeds from two lots were sown untreated and began germinating in 74 and 141 days, reached maximum germination in another month, and had excellent germination rates.

Three seed lots were cold-stratified for periods of 68, 68, and 76 days. After they were removed from cold-stratification, the seeds began germinating in 24, 24, and 21 days respectively. All reached maximum germination after another month. Whether the seed amounts were not exactly the same or if the seeds were not quite so good, our overall results were not as good for cold-stratified seeds when compared to untreated seeds. However, it appears either treatment is satisfactory as both require about the same length of time.

The seedlings are very tiny and require some time to grown in the flat before they can be transplanted (we recommend at least two to three months, and nearly all of our seedlings were first potted into two-inch pots in late March and April). We experienced excellent results while growing seedlings and young plants in the nursery. In most cases either no seedlings were lost, or less than a half dozen seedlings failed. Our plants grew to plantable size within a year.

A total of 36 semi-hardwood tip-cuttings were taken in late October from plants growing in containers in the lath house in the nursery and were treated with Rootone. Rooting began after 32 days, and about 90% of the cuttings rooted and were successfully grown in the nursery.

A total of 26 semi-hardwood tip cuttings were taken the first of December from plants growing in the wild and were treated with Rootone. Rooting began after 48 days, and about 90% of the

cutting rooted and were successfully grown in the nursery. Our overall results with cutting-grown plants was equal to those of seed-grown plants.

A few bare-root plants were also grown.

Culture: This hardy species grows on dry ridges and slopes, in sun and semishade, principally in the mountains of the coastal ranges from San Diego County (where it is rare) north to British Columbia (Canada). It also grows on Santa Rosa Island and Santa Cruz Island. We expected that these plants would have adapted well to our Claremont site, but this was not fully the case. Losses were gradual but steady, and few plants lived over ten years. While this species has grown very well in this writer's garden, we had difficulty in maintaining it properly in the garden. Plants grown in partial shade, in both well-drained and heavy clay-loam soils, there was a gradual disappearance of the plants over a period of time. It is such a handsome plant when properly grown. We think that our plants may have received either too much or too little moisture. None of our plants, even those that are ten-years-old, grew over two feet tall and two feet wide. One plant flowered during its first year in the garden, but the first fruits were noted in the fourth year.

***Vaccinium parvifolium* Sm.**

Red Huckleberry.

Shrub (deciduous).

Propagation: Two collections of seeds were gathered in the wild. One was sown untreated and failed to germinate. The other was subjected to cold-stratification and also failed to germinate.

Three seedlings were collected in the wild and were successfully re-established in containers in the nursery and were later planted in the garden.

Culture: This species is found below 5,000 feet in deep moist wooded areas where it often grows in decaying organic material in the Coast Ranges and the Sierra Nevada from central California northward. A total of three plants were planted in the garden, and two of them died within a year or two of planting. The third had been growing under a large coast live oak for two years and had established itself quite well and was in good condition.

***Venegasia carpesioides* DC.**

Perennial.

Asteraceae. Sunflower Family.

Propagation: Two collections of seeds that had been harvested from our cultivated were sown untreated in three seed lots. Seeds began germinating in 18 and 25 days, and the results were excellent. Five-year-old seeds also produced excellent results. We experienced only minor losses while raising the seedlings and young plants to planting size in four-inch pots.

Culture: This species is found not far from the coast from Monterey County south to Baja California (Mexico), and on the Channel Islands where it is found growing on shady rocky canyon walls, in moist canyons and along streambanks. We had grown this species at the old site since 1941. At the Claremont site, we planted many new plants on a semi-shady to shady slope under large coast live oaks. In this location, they grew very well and often produced volunteer seedlings. The plants grew from two to three feet tall and spread three to four feet wide, and on

the whole looked much like what one would see in the wild. Flowering and seeding occurred from the first year. We did not need to replenish this planting until nearly 15 years later.

***Veratrum californicum* Durand.**

Corn-lily. Skunk-cabbage.

Perennial.

Liliaceae. Lily Family. [Ed: Melanthiaceae. False-Hellebore Family. TJM2]

Propagation: Seeds were gathered from the wild and were sown immediately in cold-stratification in a jar containing a mix of one-quarter peat moss and three-quarters finely crushed granite. After 98 days, the seeds were removed from the cold and were sown in a flat, and began germinating in 25 days, reaching maximum germination two months later. The young plants were grown in the flat for another two at which time they failed to show growth and were found to have rotted. Other seed lots of this same seed collection were sown three and four years later, and failed to germinate. An additional collection of seeds that had been gathered from the wild also failed to germinate.

***Veratrum fimbriatum* Gray.**

Perennial.

Propagation: Small plants were presented to the garden in containers. These were grown in the nursery and then planted in the garden.

Culture: This species grows in wet meadows of Mendocino and Sonoma counties. We planted our plants adjacent and in a moist stream bed but since they had only been recently been acquired, there are no records of their development. However, judging from past history, it is assumed they failed to become established. [Ed: This assumption was correct.]

***Veratrum insolitum* Jeps.**

Perennial.

Propagation: Eight seedlings were received in containers and were planted in the garden within a month.

Culture: This species is usually found growing on red clay soils in open thickets in Del Norte County and locally in Siskiyou County as well as in southwestern Oregon. Our plants were planted in the clay soils of the mesa near a stream but not in wet soil. All were dead within a year.

***Veratrum viride* Aiton.**

Perennial.

Propagation: Seeds were sown on January 21st and were cold-stratified for 78 days in a mixture of one-third peat moss, one-third perlite, and one-third sand. The seeds began germinating 18 days after they were removed from the cold, reached maximum germination a month later, and produced excellent results. The seedlings were grown until they went dormant in early June. The roots were removed from the seed flat and were transplanted into six-inch pots. A month later the

plants began growing again, but a year later all of the pots were dumped as the roots had rotted. Another seed lot was sown two years later and failed to germinate.

***Verbena gooddingii* Briq.**

Perennial.

Verbenaceae. Vervain Family.

Propagation: Seeds from either wild or cultivated sources and sown untreated, begin germinating in 12 days when sown in a seed flat. We had no problems while raising seedlings and young plants in the nursery. However, we typically sowed the seeds directly into sites in the garden, and were much slower to germinate, often requiring up to six months or more. A note by Mr. E.K. Balls states, "I have never found this seed to germinate when planted in the open - though it volunteers freely enough!" and this was true.

Plants may also be grown from tip-cuttings but we never followed this practice as it was unnecessary due to the spontaneous appearance of seedlings in the garden.

Culture: This species is quite widely distributed among the mountains of the Mojave Desert in California where it grows at elevations of 4,000 to 6,500 feet. We successfully grow this plant in our desert garden, where rocky, dry conditions prevail. Because we have so many volunteer seedlings, we have found it unnecessary to replenish our plantings through extra propagations in the nursery. First flowering and seeding occur in the first and second years. Though our individual plants are not long-lived here, they grow quickly to several feet across but not more than a foot tall.

***Vicia gigantea* Hook.**

Perennial.

Fabaceae. Pea Family.

Propagation: Seeds that were gathered from the wild and sown untreated began germinating in nine days, and reached maximum germination after another 17 days. All of the seedlings were successfully raised in the nursery.

Culture: This coastal species inhabits moist places from San Luis Obispo County to Alaska. We managed to grow our plants in a semishaded situation for no more than a year. They made excellent growth at first, but did not re-emerge after winter dormancy.

***Viguiera deltoidea* A. Gray var. *parishii* (Greene) Vasey & Rose. [Ed: *Bahiopsis parishii* (Greene) E.E. Schill. & Panero. TJM2]**

Subshrub (evergreen).

Asteraceae. Sunflower Family.

Propagation: Seeds were harvested from our cultivated plants, and were sown untreated two to five years later. These began germinating in four to seven days, reaching maximum germination in another two weeks with good to fair results.

Seeds that were sown fresh began germinating in 13 days, and the germination rate was poor. Tests indicated that a large percentage of non-viable seeds were produced. Overall, we successfully grew a high percentage of the seedlings and young plants in the nursery.

Culture: This species is found growing (in California) from sea level to 4,800 feet, from San Diego County inland through the Colorado and eastern Mojave Deserts. Plants growing in our Claremont garden are subject to damage from our more severe frosts (25° F or a little lower), our greatest losses were from this cause. We grew our plants in some of our driest areas, where they thrived and developed into fine specimens. Many ten-year-old plants measured five feet tall and had grown up to 13 feet across. In our desert garden, quantities of volunteer seedlings arose and helped maintain sufficient numbers of plants for fine displays. Moderate irrigations seemed to be acceptable as long as the soil has good drainage, in fact irrigation enhanced the appearance of our plants.

***Viguiera lacinata* A. Gray.** [Ed: *Bahiopsis laciniata* (A. Gray) E.E. Schill. & Panero. TJM2]

Shrub (evergreen).

Propagation: Seeds from both wild and cultivated sources that were sown untreated began germinating in eight to ten days when sown in seed flats. Seeds that were directly sown into garden sites began germinating in 18 to 20 days. Most seed lots produced only a few seedlings. Unaccountably, a four-year-old seed lot produced a large number of seedlings from what was essentially the same amount of seeds. Except for the loss of two to three seedlings, we experienced no problems while raising seedlings and young plants in the nursery.

Culture: This species grows on dry slopes below 2,500 feet in coastal sage scrub and chaparral plant communities of southwestern San Diego County and in adjacent Baja California (Mexico). As with the other species in this genus, it is not frost hardy much below 27° F. Young plants that have recently been planted will almost always succumb to temperatures below 27° F, and most established plants will be killed outright if temperatures fall much below 25° F. Our plants suffered somewhat each winter but usually grew back vigorously. Plants can grow rapidly as is indicated by one record which showed plants 11 months old measuring four feet tall and six-and-a-half feet across. First flowering and fruiting start in about six months after germination. Volunteer seedlings are produced in quantity. Young plants will need protection from rabbits, and we had some losses due to moles riddling newly planted areas.

***Viguiera multiflora* (Nutt.) S.F. Blake var. *nevadensis* (A. Nelson) S.F. Blake.** [Ed: *Heliomeris multiflora* Nutt. var. *nevadensis* (A. Nelson) W.F. Yates. TJM2]

Perennial.

Propagation: Seeds were gathered from the wild and were sown untreated on four occasions over a period of three years. These began germinating in 57, 61, 38, and 35 days, reaching maximum germination a month later. One time, seeds from this same wild collection were sown directly into a site in the garden, and these began germinating in 38 days.

Seeds gathered from cultivated plants in our garden were sown untreated and began germinating 13, ten, and nine days, reaching maximum germination a month later.

The best seed-flat medium seemed to be one-third peat moss, one-third sand, and one-third perlite.

Generally we had good rates of germination, but seeds that had been stored for three years or longer failed to germinate.

We experienced some trouble while growing the seedlings and young plants in the nursery, primarily from a fungus that attacked the leaves of the young seedlings. We also experienced high rates of mortality of plants that were in the gallon-can stage – however, we dealt with this problem by only growing the plants to four- and five-inch pot stage in the nursery, and then planting them directly into the garden at those sizes.

Culture: This somewhat suffrutescent perennial is found growing in the mountains of Inyo and northeastern San Bernardino counties at elevations between 4,000 and 7,500 feet. While individual plants were short-lived here in the garden, they produced quantities of volunteer seedlings that kept our plantings in good shape. First flowering and seeding occurred within the first year. Flowers covered the plants with quantities of yellow flowers, making nice displays. One five-year-old clump measured 18 inches tall and had spread into a mass that measured seven-and-a-half feet by four-and-a-half feet. We planted this species extensively in our desert garden and in our pinyon-juniper woodland.

***Viguiera reticulata* S. Watson.** [Ed: *Bahiopsis reticulata* (S. Watson) E.E. Schill. & Panero. TJM2]

Shrub (evergreen).

Propagation: Two different collections of seeds that were been gathered from the wild were sown untreated, and began germinating in four and eight days at excellent germination rates. A third wild collection of seeds failed to germinate. Seedlings were raised only through the five-inch pot stage, as there was a high mortality rate for plants growing in gallon-cans in the nursery (for one collection in gallon-cans there were about 55% lost, and in the second collection in five-inch pots there were about three percent lost).

Culture: This species is found in the desert ranges of Inyo County, where the plants grow in dry, gravelly washes and rocky canyons at elevations from ten to 5,000 feet. Our first plantings were in an open rocky situation where they grew very well until the rainy season when they rotted. Some plants were also killed by gophers and moles. Our second collection was planted two years before the time of this report and experienced similar troubles but also had difficulty from frost. Plants, in their third year, measured two feet tall and three feet across. First flowering and seeding were not recorded, but would be expected within the usual first year.

***Viola* L.**

Perennials.

Violet Family.

Violaceae.

Propagation: All of our collections of violas were started from small plants that were potted up in our nursery.

Two species, ***V. pedunculata* Torr. & A. Gray.** and ***V. purpurea* Kellogg.**, were attempted from seed. The one collection of ***V. purpurea*** failed as did one of ***V. pedunculata***. The first seed lot of a second seed collection of ***V. pedunculata*** was cold-stratified for two months, and had started

germinating before they were removed from the cold, and reached maximum germination a few days later. Seedlings were potted up in December and the young plants started to go dormant the following May. At that time, watering was stopped and the pots were kept in the cutting room where the air was moister. The following October the pots were watered, but the entire lot was lost to rots. The second seed lot was sown untreated a year later in September and began germinating in 17 days. The quantity of seedlings produced by this second seed lot was considerably less. Only a few of these seedlings were lost in the nursery as they were planted in the garden before they went dormant. It appears that the best procedure with this species may be to sow the seeds directly into garden site.

Seeds from no other species were harvested.

Culture: The violas in our garden came from a variety of habitats, but most of them required shady, humus soil conditions, with some preferring rather moist soils and others requiring drier conditions. All of the species that we tried were grown without trouble in the greenhouse and nursery, but all suffered after they were planted in the garden.

Viola pedunculata, with which we have had the most experience, prefers a heavy clay soil, and it must be kept strictly dry throughout its dormant period. It reappears only upon the advent of rain. The north slope of the mesa was covered with them when we acquired our Claremont property. The species completely disappeared from the garden after a few years following the disturbances and irrigation that were necessary to establish the garden.

Our principal troubles with growing all the following species were slugs, snails, and the small plants getting covered too thickly with oak leaves.

Viola adunca **Sm.** – One collection was grown and flowered well for at least five years on a well-drained mound that was covered with crushed granite.

Viola glabella **Nutt.** – A planting under a big-cone Douglas-fir (*Pseudotsuga macrocarpa*) on a stream bank grew very well for over three years. Our plants flowered very well and appeared to be established, but all gradually disappeared after the third year.

Viola lobata **Benth.** – Fine plants grown in greenhouse were quickly destroyed by slugs and snails after they were planted in the garden.

Viola macloskeyi **F.E. Lloyd.** – This species lingered over two winters but was seriously damaged by slugs and snails.

Viola sempervirens **Greene.** – Flowered and appeared to take hold for a period of two years, after which the plants gradually disappeared.

***Vitis californica* Benth.**

California Wild Grape.

Vine (deciduous).

Vitaceae. Grape Family.

Propagation: Seeds were gathered from cultivated plants at the old garden site, and were soaked for 24 hours in hot water prior to sowing. These seeds began germinating in 19 days and reached maximum germination two weeks later, and germinated at a good rate.

We followed our standard practice of sowing seeds of naturally winter-deciduous species in December and January, except the first seed lot that was sown in September.

Two collections of seeds were harvested from the wild and were sown untreated. These began germinating in 49 and 51 days, but only with fair results.

Two seed lots of a single wild collection of seeds were sown in January and were cold-stratified for 42 and 80 days. Respectively, they began germinating in 24 and 18 days, reaching maximum germination in another week or two.

Hot water treatment for 24 hours will provide excellent results quickly, although sowing the seeds without treatment will also generate good results but will take longer to do so.

We experienced minor losses of seedling while they were growing in the nursery. Most plants grew vigorously, and reached sufficient size before their first winter dormancy.

Culture: This vigorous vine is frequently found growing along stream banks and in canyons below 4,000 feet from Kern and San Luis Obispo counties northward into southern Oregon. At no time, either in the very rocky or clay soils have we had any problem growing this species. The vines appear to grow most vigorously in our heavy clay soils, but their performance in all parts of the garden has always been satisfactory. We have planted this species extensively on fences and other proper areas where the plants could range without causing problems for other plants. Those planted on fences can be clipped back and make a controlled fence-covering. Occasionally hybrids with *V. vinifera* L. are encountered where wild plants grow near cultivated vineyards. These hybrids often have somewhat more edible fruits. Ten-year-old plants grown on fences ranged in heights of eight to 12 feet and spread from 15 to 20 feet, but where they are able to twine onto trees, their heights ranged up to 50 feet. First flowering and fruiting began during their second year.

***Vitis girdiana* Munson.**

Vine (deciduous).

Propagation: One collection of seeds was harvested from our plants that had been cultivated at the old site since 1930. The seeds were given a 24-hour hot water soak and were then sown. They began germinating in 29 days, reaching maximum germination in another three weeks. Eleven years later a second lot of these same seeds was cold-stratified for 42 days and failed to germinate.

Grapes may also be grown from cuttings.

We experienced only minor losses while growing the seedlings and young plants in the nursery.

Culture: This species is found growing below 4,000 feet in canyons and along stream banks, often climbing up to the tops of the tallest trees, from Santa Barbara County southward to Baja California (Mexico), and occasionally at the edges of our deserts. We planted this species principally on eight feet tall chain-link fences, and it has performed admirably under stress conditions. When clipped once or twice a year, it makes a compact green fence-covering in such conditions. The same results were obtained as for *V. californica*.

***Washingtonia filifera* (Andre) de Bary.**

California Fan Palm.

Tree (evergreen).

Palmae. Palm Family. [Ed: Arecaceae. Palm Family. TJM2]

Propagation: One seed collection was harvested from the wild and was sown untreated. The seeds began germinating in 52 days, reaching maximum germination three weeks later, and yielded a good rate of germination.

A second seed collection was harvested from the wild and was sown untreated on three occasions. The first sowing, of fresh seed sown eight days after it was harvested, began germinating in 34 days. The second sowing, a year later, began germinating in 17 days. The third sowing, when the seeds were eight-years-old failed to germinate, even after the seeds had received some cold-stratification.

We had no problems raising the seedlings in our nursery.

Culture: Scattered groves of this handsome palm are found around seeps, springs, or live water courses in California's Colorado and Mojave deserts, and to western Arizona and northern Baja California (Mexico). A widely cultivated tree, it has been grown in many kinds of situations to enhance the landscape. We have likewise used it to good advantage. Our initial Claremont plantings were of young trees, up to ten-years-old and measuring up to seven feet tall, that were transplanted from the old site in early December 1951. We experienced minor losses while re-establishing these palms in their new location. All of the survivors have developed into handsome specimens that currently measure up to 15 feet tall. A planting in the desert garden measured up to 56 inches tall when they were first planted, and after 25 years of growth they measured up to 20 feet tall. The rapidity of their growth depends on the richness of the soil and how much water is applied and available. No record of first seeding has been made.

***Whipplea modesta* Torr.**

Yerba de Selva.

Trailing Perennial.

Saxifragaceae. Saxifrage Family. [Ed: Hydrangeaceae. Hydrangea Family. TJM2]

Propagation: Our first accession of this species consisted of a few bare-root plants that were established in a flat without any trouble.

A collection of seeds that were harvested from the wild was sown untreated in late August and began germinating in 78 days, reaching maximum germination a month later, and yielded excellent results. A second seed lot of the same wild collection was sown untreated two years later and began germinating in 39 days, reaching maximum germination a month later, but yielded only a fair germination rate. We experienced no problems while raising seedlings and young plants in the nursery.

New greenwood tip-cuttings were taken in April from plants growing in the garden. These were stuck untreated in a cutting flat and 80% of them rooted. Root initiation began in 20 days, and we had no problems raising the plants in the nursery.

Some semihard stems with roots responded poorly when they were planted in Jiffy pots, and nearly all of them succumbed to rots.

Plants growing in the garden root freely along their stems.

Culture: This interesting perennial species grows on shady slopes among undergrowth and in protected open spaces below 4,500 feet in the Coast Ranges from Monterey County to Oregon. We have successfully grown this species under the open shade of our large coast live oaks where there is plenty of humus. Plantings in other garden situations were not quite as successful. Our best planting spread out over an area measuring 30 feet by 30 feet. First flowering was noted within the first year.

***Woodardia fimbriata* Sm.**

Chain Fern.

Perennial.

Blechnaceae. Deer Fern Family.

Propagation: Division of clumps is the simplest method for production of this fern. We made no attempt to raise this species from spores. We had no difficulty dividing the clumps and then re-establishing them in the garden.

Culture: This species is found growing in canyons and other water-fed areas below 5,000 feet throughout the coastal slopes of California, and occasionally along the edges of the deserts. We have maintained an accession that was added to our collection in 1940 that had grown at the old site until divisions were made in December 1951 and were transplanted to the new Claremont garden. These divisions were re-established on the east bank of the mesa, under the shade of large coast live oaks growing in clay soil that was covered with a thick layer of oak leaves. Many clumps of these ferns grew vigorously, and several were later transplanted successfully to other areas of the garden. These, too, have become well-established.

***Wyethia angustifolia* (DC.) Nutt.**

Perennial.

Asteraceae. Sunflower Family.

Propagation: The seeds of this genus typically have a low rate of viability. One seed collection was cold-stratified for one month in a jar of moist sand. The seeds were then sown in a flat and began germinating in eight days, but results were very poor. We experienced no problems while raising the seedlings and young plants in the nursery.

Culture: This species grows on open grassy slopes of cismontane California from central California northward. Although nothing was recorded for the history of this species in the garden, it is known to have survived for several years in one location in the clay soil of the mesa. It flowered each spring, usually from May to June.

***Wyethia bolanderi* (A. Gray) W.A. Weber.**

Perennial.

Propagation: Seeds were sown in February (rather than earlier) in order to avoid a premature winter dormancy period. One collection of seeds were gathered from the wild and were sown untreated and began germinating in 15 days and yielded a good rate of germination. A second lot of seedlings were acquired at the same time as the collection of seeds, and all of these were established in the nursery. All seedlings were successfully raised in nursery to five-inch pots.

Culture: This species is found growing in rocky hard clay soils in the Sierra foothills of Butte County to Mariposa County, usually in grassy places at elevations from 1,000 to 3,000 feet. Our 82 plants were planted late in 1966, near the end of this reporting period, and there were no records about their survival.

***Wyethia elata* H.M. Hall.**

Perennial.

Propagation: A collection of seeds were gathered from the wild and were sown untreated. These began germinating in 14 days and yielded excellent results. The seedlings and young plants were successfully raised through the gallon-can stage, with the largest losses incurred during summer when the plants were in gallon-cans, but even these losses were only minor.

Two seed collections were gathered from plants growing in the garden (from the propagation listed above), and were sown untreated in October and November. These began germinating in eight and ten days, reaching maximum germination in another three weeks, and yielded a fair rate of germination. The seedlings were successfully raised to the four-inch pot stage (as these were then planted in the garden), and losses were generally minor.

Culture: This species is found growing in the Sierra foothills from Mariposa County to Tulare County on dry open slopes at elevations between 3,000 to 4,000 feet. We have grown these plants successfully in the clay-loam soil of the mesa for the past 15 years. While initial losses were heavy, plants that became established have grown into good solid clumps that have produced flowers and seeds from their first year. Some plants even bloomed in pots while they were growing in the nursery.

***Wyethia ovata* Torr. & A. Gray.**

Perennial.

Propagation: One collection of seeds that were gathered in the wild was sown fresh and untreated began germinating in four days, reaching maximum germination in three weeks. All of the seedlings and young plants were successfully raised in the nursery. A second lot of these seeds was sown four years later and produced only one seedling. A third lot of these seeds was sown five years later and failed to germinate.

Culture: This species grows at elevations of 1,200 to 6,000 feet in open grassy dry slopes of the mountains of coastal Southern California and in the southern Sierra Nevada. Our plants were planted in clay-loam soil on the mesa and were known to have survived for several years, but our records are not clear.

***Wyethia reticulata* Greene.**

Perennial.

Propagation: Seeds and seedlings were received in August 1965. The following February, the seeds were sown untreated and began germinating in 15 days, reaching maximum germination in another two weeks. All of the seedlings and young plants were successfully raised in the nursery.

Culture: This species is endemic to El Dorado County at elevations of 1,200 to 1,500 feet, where it grows in dry rocky clay openings. Our plants were planted in the clay-loam soil of the mesa. Since these were planted so recently, there has not been enough time to determine their success.

***Xerophyllum tenax* (Pursh) Nutt.**

Bear-Grass.

Perennial.

Liliaceae. Lily Family. [Ed: Melanthiaceae. False-Hellebore Family. TJM2]

Propagation: Three collections of seeds were gathered from the wild and were divided into eight seed lots. Two seed lots were sown untreated and failed to germinate. Two seed lots were sown and were cold-stratified and failed to germinate. Two seed lots were sown fresh and were cold-stratified for 83 days. About 50% of the seeds had begun germinating before they were removed from the cold. Another seed lot was sown fresh and was cold-stratified for 47 days and began germinating 30 days after they had been removed from the cold, and maximum germination was not reached for at least three months. Longer periods of cold-stratification resulted in much shorter periods of time for the seed lot to reach maximum germination, sometimes reaching maximum in a little as two weeks.

One seed lot, of two-year-old seeds, was sown on October 23, 1956 and was cold-stratified for 123 days, first germination was recorded 11 days after removal from the cold, and reached their first maximum germination a little over one month later, and 20 seedlings were potted up. The seed flat was later put back in to cold-stratification for an unrecorded amount of time after which another 6 seedlings were potted up. The seed flat was then cold-stratified again for another two months and reached the final maximum germination on March 1, 1958. All but one of the 50 seedlings died in the nursery.

It appears that two-and-a-half months of cold-stratification is the best time period to use when sowing fresh seeds. Great care in handling the fragile seedlings is necessary. We had small losses while growing the seedlings and young plants in the nursery, until after they were put in gallon-cans for growth during the summer months. At that time, we experienced extremely high percentages of losses due to the necessity of irrigating the plants. It would seem best to raise the seedlings only into the smaller container sizes, and planting them in the garden at smaller sizes (rather than from gallon-cans).

Small bare-root seedlings from two wild collections were successfully re-established in pots and gallon-cans in the nursery. All 100% of these were successfully raised in the nursery and were planted in the garden.

Culture: This species is found growing on open dry slopes and ridges below 6,000 feet from central California northward to British Columbia (Canada) and to the Rocky Mountains. The only area where we could establish this interesting plant in the garden was in a semishaded situation with ample humus covering a very rocky decomposed granite loam, and even in these conditions not more than three plants have survived a period of six years. Sparse flowering has occurred on the plants that were established from the bare-root seedlings that had been gathered from the wild. Our plants that had been grown from seeds were planted in several garden locations, but all failed to live for more than five years. Once established in the garden, the plants appear to persist. We find that it is critical to get them past the two- to three-year-old stage in the garden.

***Xylococcus bicolor* Nutt.**

Shrub (evergreen).

Ericaceae. Heath Family.

Propagation: Unlike our earlier published results (1957), we had somewhat better experience raising this species in Claremont. After processing many lots of seeds that had been gathered from both wild and cultivated plants, it is recommended that the seeds be soaked for 25 hours in sulphuric acid, or given both a 15 hour soaking in sulfuric acid followed by two- to three-months of cold-stratification. One sowing produced seedlings over a three-year period after the seeds were soaked in sulfuric acid and were then cold-stratified. We also tried hot water soakings, pine or excelsior burning on the seed flats, as well as combinations of several treatments. While none of our results were excellent, we managed to grow enough plants for satisfactory plantings in the garden. We experienced a moderate loss of seedlings and young plants while they were growing in the nursery.

Our best results from cuttings (and this was repeated on several occasions), was of side shoot tip-cuttings that were taken in April and treated with Rootone. A total of 38 out of a total of 50 cuttings were successfully rooted, and root initiation started in 18 days. Another lot of cuttings that was treated with CUTstart and Captan burned, and only three rooted out of 18.

Culture: This chaparral plant is found in scattered locations from Los Angeles County to Baja California (Mexico). We have considered this plant to be one of the handsomest of our evergreen native shrubs, particularly amongst the manzanita group. While our plantings suffered rather heavy losses over a period of ten years, the surviving plants became well-established and were very hardy.

In 1947, a plant that was collected from the wild was established at the old site. In 1951, this plant measured three-and-a-half feet tall and two feet wide, and it was transplanted to Claremont where it was planted in full sun in heavy rocky clay soil. At the time of this report, it now stands over five feet tall and has spread to eight feet wide, and has borne heavy crops of flowers and seeds for several years.

Other seed-raised plantings in rocky, decomposed granite loam soils have produced their first seeds in five to seven years. These plants were in excellent condition and measured up to six feet tall and had spread up to eight-and-a-half feet across.

Yucca L.

While it may be safest to raise seedlings in containers, most California *Yucca* species can be grown successfully from bare-root plants. While we have not yet tried this method with *Y. brevifolia*, we feel that, with care, this method might be successful.

Yucca baccata Torr.

Shrub.

Agavaceae. Agave Family.

Propagation: One collection of seeds were gathered from the wild and were sown untreated. These began germinating in 36 days, and reached maximum germination ten months later due to intermittent germination.

We produced seeds by hand-pollinating flowering plants in the garden. The seeds were then sown untreated and began germinating in 21 days, reaching maximum germination in another three weeks.

Basal suckers of the plant are easily rooted and grown.

One small plant was collected in the wild and was successfully re-established in a container in the nursery before it was planted out in the garden.

All seedlings and young plants were successfully raised in the nursery.

We recommend that seeds should be sown in seed beds or in deep seed flats, where the seedlings may be allowed to develop in size, for perhaps up to two years, before digging and planting in the garden. Seedlings grow very long roots and quickly become root-bound in containers. After planting, irrigation should be continued and the plants should not be allowed to get too dry. After the plants are established, they need very little attention, and in most areas water can be withheld completely. Although an occasional deep watering can be very beneficial for more rapid growth.

Culture: In California, this species is uncommon and grows at elevations of 3,000 to 4,000 feet, on very dry rocky slopes and flats of the mountains of the eastern Mojave Desert and into Utah and Texas. Fifteen 12-year-old plants and four 15-year-old specimens were transplanted bare-root in October 1951 from the old site to Claremont. All were replanted in rocky, decomposed granite loam soil in full sun. The plants ranged in height from eight inches to four-and-a-half feet tall and had spreads up to five feet across. Of the 19 plants that were moved, only four died. At 25 years of age, they had developed into fine specimens measuring five to seven feet tall and from eight to 13 feet across. Their first flowering began eight years after they were transplanted, which means they were actually 20-years-old, as they had been originally planted in 1940 at the old site. Moving undoubtedly delayed flowering. Seeds were only produced by hand-pollinating the flowers as their moth pollinator is not present in the garden. Six-year-old seedlings measured from six inches to two-and-a-half feet tall and had spread from 13 inches to three feet wide.

***Yucca brevifolia* Engelm.**

Joshua Tree.

Tree (evergreen).

Propagation: Many collections of seeds were gathered from the wild of the species and its varieties (*herbertii* (J.M. Webber) Munz. [Ed: the var. is not recognized in TJM2] and *jaegeriana* McKelvey. [Ed: the var. is not recognized in TJM2]). All were sown untreated in very deep seed flats. Deep seed flats are recommended because each seedling quickly develops a long tap root. Seeds began germinating in four to ten days (averaging about five to six days), and reached maximum germination one to two weeks later and always yielding excellent results. We allowed the seedlings to grow for some time in the deep flats, and then would transplant them into six-inch pots or gallon-cans. Excellent growth was made while the plants were growing in containers in the nursery, and we experienced only minor losses.

Despite the difficulty that is so often encountered in separating and transplanting suckers or small plants from the wild, we did these operations quite successfully on several occasions by very carefully controlling our watering while the plants were in containers, and by carefully treating all cut roots with a fungicide. Even after carefully following these methods, more plants were lost than saved.

Culture: The Joshua tree occupies a distinct and clearly defined elevational area between 2,000 and 6,000 feet in the Mojave Desert to Owens Valley, and into southwestern Utah and western Arizona. The **var. *herbertii*** occupies a small area in the Antelope Valley and in Monolith and Walker Passes, while the **var. *jaegeriana*** is distributed in the mountains of the eastern Mojave Desert, southern Nevada and southwestern Utah. We have grown all of them most successfully. In May and October 1951, a total of 49 were moved bare-root from the old site to Claremont. The plants were 21-years-old and ranged in height from seven to 38 inches. Only ten of this accession survived the move, and all are now alive in their 36th year and measure from three to eight feet tall and have spread from 18 inches to three feet wide. None have flowered.

Records for another accession show that 35 plants were transplanted from the old site to Claremont, and only two survived and are now in their 31st year and measure four-and-a-half to five-and-a-half feet tall and are 21 inches wide (each still has just a single stem).

A third accession of 56 small plants were transplanted into containers in March 1951, and 42 were planted in Claremont in October 1951. Of these, 15 have survived are now in their 18th year and measure from two to four feet tall and have spreads from 18 inches to two feet wide (as some are sending out suckers).

Our oldest plants raised from seeds since our move to Claremont range from ten- to 15-years old.

Plants of our accession number 7193, grown from seeds that germinated on October 26, 1950, produced four inflorescences in March 1969. At that time, the plants measured four to six feet tall. These were the first Joshua trees to ever bloom in the garden since its founding in 1927.

Our oldest plants, which were transplanted bare-root in 1951 from the old site had not flowered to this date. They were originally planted at the old site in November 1930, and are now in their 40th year (when this was written). Recorded heights of these specimens averaged two to seven-and-a-half feet and had spreads of 15 inches to three feet wide. Many satellite plants from suckers were noted.

Both rooted suckers and seed raised plants of the **var. *herbertii*** are well established in the garden. Our plantings of rooted sucker plants suffered severe initial losses but the survivors have taken hold nicely, and started producing new suckers in their third season after planting. Seedlings in their sixth year were noted to have many satellite plants from suckers. Five plants that measured four to six feet tall, and that were 13-years-old, flowered for the first time in March 1969. In 1970 they were developing their first branches, since flowers terminate the end of a stem or branch. [Ed: In 1976, it was recorded that at least 14 plants had now flowered and were branching.]

***Yucca brevifolia* var. *jaegeriana* McKelvey.** [Ed: the var. is not recognized in TJM2] – Two accessions, totaling 28 plants (six plants of one accession and 14 of the other), were transplanted into six-inch pots and gallon-cans in March 1951. All were planted at the Claremont site in May 1951. Most of these plants had not yet grown new roots, and consequently all but four died within the first year. The one surviving plant of accession 2509 measured three feet tall and two feet wide in its 25th year. While the three survivors of accession 5199 measure eight to 12 feet tall and have spreads from 16 inches to two feet across now that they are in their 20th year. All four plants are in good condition and have not yet flowered. Losses of seedlings raised in the nursery since 1952 have been small and fine specimens measuring up to seven feet tall and with spreads of seven to 20 inches wide (these plants are six- to ten-years-old, and are still single

stemmed) are developing in the Joshua tree woodland. Eventually specimens in both the desert garden and our Joshua tree woodland should provide a wonderful representation of this stately species.

***Yucca schidigera* Ortgies.**

Shrub (evergreen).

Propagation: The records from several collections of seeds that had been gathered from the wild show that the seeds begin germinating in five to seven days, and quickly reach maximum germination within two weeks. We sowed the seeds untreated in standard flats, and transferred the small seedlings into two- or three-inch pots, gradually shifting them into larger six-inch pots or gallon-cans. Only minor losses of seedlings were noted, as this species proved to be easily handled in the nursery.

Culture: This wide ranging species is found from the coast (in San Diego County) to inland desert regions (Riverside and San Bernardino counties, and to Nevada, Arizona, and Baja California, Mexico) where it grows on dry slopes and mesas mostly below 5,000 feet. Since most of our plants at the old site were too large to transplant, we moved only a few of the smallest specimens, or rooted suckers, to the Claremont site. Of these transplants, several died almost immediately, but a number have developed into fine specimens measuring several feet tall and wide. One plant, in its 30th year, measured six-and-a-half feet tall and six feet wide. Other plantings of similar age measured over seven feet tall and had equal spreads. Ten-year-old seedlings raised at the Claremont site since 1952, measured seven feet tall and were eight feet wide. First flowers and fruits were produced in the plant's seventh year. However, the majority of our ten-year-old plantings have failed to flower. Both the grey and green leaves forms of the species have been successfully raised (the former from Morongo Valley, and the latter from several widely scattered locations).

***Yucca whipplei* Torr.** [Ed: *Hesperoyucca whipplei* (Torr.) Trel. TJM2]

Our Lord's Candle. Chaparral Yucca.

Shrub?

Propagation: Two collections of seeds that were harvested from cultivated plants in the garden were divided into four seed lots that were sown untreated. The seeds, ranging in age from one- to eight-years-old, began germinating in 12 to 28 days, and the rate of germination was excellent for all of them.

A number of collections of seeds that had been gathered from the wild were divided into thirteen seed lots that were sown untreated began germination in nine to 47 days, though the average was from nine to 15 days. The seeds that took longest to begin germinating (47 days) were collected from Mount Wilson, Los Angeles County.

One collection of **ssp. *parishii* (Jones) Haines**. [Ed: the ssp. is not recognized in TJM2] began germinating in 15 days.

All seed lots reached maximum germination in two to four weeks.

While many of our seedlings were initially grown in containers in the nursery, our most recent procedure was to sow the seeds and raise the seedlings in a deep outside bin in the lath house in

the nursery. When they had grown large enough (about a year later) they were transplanted bare-root directly into the garden. One wild collection of the **ssp. *percursa* Haines**. [Ed: the ssp. is not recognized in TJM2] was also planted in the garden using this same practice. Losses were generally small, and rapid growth followed.

Culture: This species, or one of its varieties, is found growing on dry often rocky slopes of the hills and mountains of Southern California north to the Kings River Canyon. We have grown most of the botanical varieties successfully and have made extensive records of their flowering, seeding, and the growth rates of the flowering stalks. After growing and studying these plants, it is very evident that there is great variation in plants from various localities. Seeds grown from a single region may produce plants that are all caespitose, completely monocarpic plants, or a mix of the two. Inflorescences may be narrow or rather broad. Flowers may be small and quite closed, to huge wide open blossoms. Flower color ranges from chocolate to pure white.

Perhaps the most outstanding specimens were seen on Mount Wilson, in the San Gabriel Mountains adjacent to the telescopes. Here extensive records on plant size and growth rates were carefully recorded by Mr. Joseph O. Hickox of the Carnegie Institution of Washington, Mount Wilson. In correspondence to this author in December 1966 [Ed: A copy of this extensive letter is in the living collection's record books.], he states that in 1905 a small group of yuccas was transplanted into an area in front of the laboratory on Mount Wilson. Over the intervening 61 years, 14 of these plants blossomed, and the remaining six plants were large and healthy. Of another group that was transplanted in 1915, about half the group had blossomed by 1966.

One of the earlier transplants (1905) blossomed in 1933 and eighty measurements were made over the course of 30 days while the inflorescence grew. The mature plant measured four feet tall and four feet across. At the beginning, the inflorescence was four-and-a-half inches in diameter. The final height of the inflorescence was 19 feet and three inches. Many inflorescences grow from ten to 18 feet tall on Mount Wilson. The average growth rate of the inflorescence was 6.9 inches per day, and it grew as much as 15 inches during some 24 hours periods. A photograph taken of the mature infructescence showed 696 seed-pods. Each pod consisted of six segments, and each segment contained approximately 30 seeds. It was figured a total of 125,000 seeds were produced by this one plant. About 50% of the seeds had been partially eaten, presumably by the larva of the yucca moth (*Tegeticula maculata*). For several years, we put measuring sticks beside inflorescences of our yuccas for the interest of our visitors. Growth rates ranged from six to 12 inches per 24 hours, reaching their maximum length in 20 to 30 days. Growth of the inflorescences slowed down on cooler days, and spurted on warmer days. While many of our plantings were grown for display purposes, we kept accurate records on large numbers of individuals in our plant community plantings. We noted whether or not the plants were caespitose or not, and the dates that the plants flowered. Since all of our material was raised from seed, it was interesting to note the differences between collections. Collections from Los Angeles or Riverside counties south came into flowers in four to five years, and all plants were either not caespitose or only a very few were. Collections particularly from Kern or Tulare counties produced many or all caespitose plants, with first flowering starting at eight years or having not yet flowered after ten years. Inflorescences ranged from five to ten feet tall, although a few were taller. Two seed collections yielded only caespitose plants, and these produced as many as five inflorescences per plant – the inflorescences were very slender and measured five to six feet tall, and had small flowers. If space permitted, a record of each collection would be useful.

***Zauschneria californica* C. Presl.** [Ed: *Epilobium canum* (Greene) P.H. Raven ssp. *canum*. TJM2]

California Fuchsia.

Perennial.

Onagraceae. Evening-Primrose Family.

Propagation: Seeds sown untreated in flats began germinating in six to 14 days, reaching maximum germination two to three weeks later, and usually yielding good results. We experienced only minor losses while growing seedlings and young plants in the nursery. We grew our plants up to the four-inch pot stage before they were planted into the garden.

Bare-root plants that had been collected directly from the wild were easily re-established in containers in the nursery.

Culture: This species is quite widely distributed in dry, stony, or gravelly places, below 2,000 feet, from central northern California to Baja California (Mexico). While we grew several collections successfully for several years, none of the original plants survived for more than five years. Our plants flowered and seeded profusely their first year, and volunteer seedlings were plentiful. In order to grow this and the other species and varieties, a dry, well-drained soil is required. Our planting grew best in our well-drained, gravelly rock garden.

***Zauschneria californica* C. Presl ssp. *latifolia* (Hook.) Keck.** [Ed: *Epilobium canum* (Greene) P.H. Raven ssp. *latifolium* (Hook.) P.H. Raven. TJM2]

Perennial

Propagation: Seeds sown untreated begin germinating in eight to 11 days (with an average of nine days), and reaches maximum germination two to four weeks later.

Fresh seeds produce the most seedlings, and there is a gradual reduction in the number of seedlings for each successive year after the original collection date.

We experienced no problems while raising the seedlings and young plants in the nursery up to the five-inch pot stage.

Plants are also easily raised from divisions.

Culture: This species grows in the higher mountains of California from San Diego County northward through the Sierra Nevada on dry, stony slopes at elevations up to 10,000 feet. This subspecies has been one of our most successful *zauschnerias* in the garden, although losses have been high over a period of ten years.

Our best results were recorded for a planting in very rocky soil, where the plants received little attention. Fine eight-year-old specimens measured up to two-and-a-half feet tall and had spreads from three to seven feet wide. Profuse flower and seed production was noted in their first year.

***Zauschneria californica* C. Presl var. *villosa* (Greene) Jeps.** [Ed: *Epilobium canum* (Greene) P.H. Raven ssp. *canum*. TJM2]

Perennial.

Propagation: Seeds sown untreated began germinating in six days, reaching maximum germination two weeks later. We experienced minor losses while growing these seedlings and young plants in the nursery. Plants were grown up to the six-inch pot stage, at which time they were planted in the garden.

Later, two seed lots were harvested from our cultivated plants, and both were sown directly into the rock garden. These began germinating in 18 days, and the germination rate was good.

Culture: This variety is found growing on the Channel Islands. Our collection came from Santa Cruz Island, and was planted in October 1960. Flowering followed shortly thereafter, and additional seeds were harvested in August 1961. These seeds were sown into the same planting area in November 1961. Our records indicate that the plants were growing fairly well, although some losses were noted within a two year period. Flowers and seeds were produced in the first year.

***Zauschneria cana* Greene.** [Ed: *Epilobium canum* (Greene) P.H. Raven ssp. *canum*. TJM2]

Perennial.

Propagation: Seeds that were gathered from the wild on two occasions, and that were sown untreated, began germinating in six days, and reached maximum germination three weeks later, and produced excellent results. We experienced minor losses while raising the seedlings and young plants in the nursery. Plants were raised to the four- and six-inch pot stage before they were planted in the garden.

Seeds were harvested from our plants in the garden and were sown untreated directly back into the original planting in loose, rocky soil, began germinating in 21 days, with good results.

Culture: This coastal species grows from Monterey County to Los Angeles County and is also found on Santa Catalina, Santa Cruz, and Anacapa islands. Our plants grew so rampantly that two plantings had to be removed as they were overcrowding more valuable collections of other species. Fine displays were grown the first year, and large quantities of seeds were produced and collected. Another planting was grown on a steep clay bank that is covered with rocks. This proved to be an ideal location, as the soils were dry and drained quickly. Fine displays resulted.

***Zauschneria garrettii* A. Nels.** [Ed: *Epilobium canum* (Greene) P.H. Raven ssp. *garrettii* (A. Nelson) P.H. Raven. TJM2]

Perennial. (herbaceous)

Propagation: Fresh seeds were sown untreated, and began germinating in nine days, with good results. Subsequent seed lots from the same collection were sown, and the results gradually diminished with increasing age. We experienced no problems while raising seedlings and young plants in the nursery.

Culture: This species is found growing at an altitude of approximately 5,500 feet, in the desert mountains of the eastern Mojave. Our collection was from beyond the range of this species, but seems to fit here best. Our plants were planted in several dry, rocky locations where they failed to become established. All plants were gone within a few years, and no further information was recorded.

***Zigadenus brevibracteatus* (Jones) Hall.** [Ed: *Toxicoscordion brevibracteatum* (M.E. Jones) R.R. Gates. TJM2]

Bulbous perennial.

Liliaceae. Lily Family. [Ed: Melanthiaceae. False-Hellebore Family. TJM2]

Propagation: One collection of seeds that were gathered in the wild was sown untreated in September, and began germinating in 46 days, reaching maximum germination in another two months. It was estimated that over 200 seedlings germinated. After each spring when the plants were beginning to go dormant, the flat was dried off and the following September moisture was again supplied. This practice was followed for three years, until the larger remaining bulbs were transplanted into six-inch pots. After four years, only four bulbs remained, as some bulbs rotted each year.

In May 1963, six bulbs growing six to ten inches deep were dug from the wild and were re-established in pots.

Culture: This species inhabits very dry sandy flats and mesas from the western and southern Mojave Desert westward to the inner Coast Ranges of San Luis Obispo County from 2,500 to 5,000 feet elevation. Our collections came from the Mojave Desert. Barely existing, our few bulbs gradually withered away until they were no longer noted after two to three years in the garden. Information on the most recent collection of bulbs was not recorded.

***Zigadenus exaltatus* Eastw.** [Ed: *Toxicoscordion exaltatum* (Eastw.) A. Heller. TJM2]

Bulbous perennial.

Propagation: One collection of seeds that had been gathered from the wild was divided into three seed lots. The first seed lot was sown untreated and began germinating in 102 days, and reached maximum germination 45 days later, and produced an estimated 400 seedlings.

A second sowing of this same seed collection was cold-stratified for 65 days at which time germination had already started. Maximum germination was reached in another three weeks, and resulted in an estimated 300+ seedlings.

A third seed lot was sown untreated four years later, and began germinating in 30 days, but the overall results were very poor.

A second collection of seeds was harvested from our cultivated plants that had been grown from the germinations listed above. These seeds were sown untreated and began germinating in 29 days, and reached maximum germination two months later.

Seedlings and young plants were successfully grown in the nursery using our usual procedures, but only for two years. Some small bulbs were then separated out of the growing flat and were stored in a cool, dry room until they were planted in the garden.

Culture: This species is found growing on the wooded western slope of the Sierra Nevada from Butte County to Tulare County, usually between 2,000 to 4,000 feet elevation. In the wild, it flowers between July and August. Our plants were planted in several sites on the mesa in clay-loam soil. In these locations, they grew most satisfactorily and gradually became fine colonies that produced fine stands of flowers and seeds each year. Our first collection of garden-harvested seeds was made four years after the small bulbs had been planted-out, which would make the

plants five-years-old from seed. These colonies may have produced seeds at an earlier time, but if so that was not recorded.

***Zigadenus fontanus* Eastw.** [Ed: *Toxicoscordion fontanum* (Eastw.) Zomlefer & Judd. TJM2]

Propagation: One collection of seeds that was gathered from the wild was sown untreated and began germinating in 140 days, reaching maximum germination one-and-one-half months later. The seedlings and young plants were raised in the seed flat and pots for one season only, after which they were planted in the garden. We feel that it is likely that our results would have been faster and better if the seeds had been subjected to cold-stratification.

Culture: This species is found growing in wet places in central northern California. We raised one collection which did not grow well, and was recorded lost in the fourth year.

***Zigadenus fremontii* Torr.** [Ed: *Toxicoscordion fremontii* (Torr.) Rydb. TJM2]

Star-Lily.

Perennial.

Propagation: We processed nine collections of seeds, six were gathered from the wild, and three were from our cultivated plants. All seeds were sown untreated from early July to December. Those sown at the earlier dates (July to early September) took the longest time to begin germinating when compared to those sown later (late September to November). However, those that began germinating quicker took a longer time to reach maximum germination (two to three months) when compared to the others (one to two months, though usually about a month).

The first lot sown did not start germinating until the fifth month, and reached maximum germination one-and-a-half months later. The second seed lot began germinating in only 24 days, and reached maximum germination a month later. Seeds harvested from the wild began germinating in 30, 34, 40, 62, 68, and 103 days.

Seeds harvested from our cultivated plants started germinating more quickly than those collected in the wild. Seeds from our cultivated plants started germinating in 23, 24, and 34 days, reaching maximum germination in two to three months.

Usually, an excellent rate of germination was recorded, and many hundreds of bulbs were raised from each seed lot. Our usual procedures were followed: seedlings were grown in the seed-flats until the seedlings went dormant at the beginning of the following summer. The small bulbs were then either removed from the flats and stored in a dry, cool room and planted in the garden the following season, or they were grown on for another season in six-inch pots in the nursery.

Culture: This species prefers dry grassy slopes at low elevations along the coastal ranges from southern Oregon to Baja California (Mexico). We found this species one of the easier *zigadenes* to grow. Some of our earliest colonies were smothered by more vigorous plants. However, colonies established on the mesa in the clay-loam soil grew vigorously and have lived for more than ten years in several suitable locations. First flowering and seeding began in third, fourth, and fifth years, depending on the initial vigor of the plants.

***Zigadenus fremontii* Torr. var. *minor* (Hook. & Arn.) Jeps.** [Ed: the var. is not recognized in TJM2]

Propagation: Twenty-three bulbs were presented to the garden in December 1949. These were grown in six-inch pots at the old site, but were moved and planted out at the Claremont site.

Subsequently, six seed collections have been harvested from plants growing in the garden. These seeds were sown untreated and began germinating in 18, 18, 22, 23, 23, 33, and 34 days, reaching maximum germination from one to three months later, and most often had an excellent germination rate. None of the seedlings were raised for more than a year in the nursery as they were planted out in the garden when they were quite young.

Culture: This variety is found growing along the coast in open fields. It, too, has been equally successful in our Claremont garden. We have several fine colonies which started producing their first flowers and seeds when they were four-years-old. Our oldest plantings are now 16-years-old.

***Zigadenus micranthus* Eastw.** [Ed: *Toxicoscordion micranthum* (Eastw.) A. Heller. TJM2]

Propagation: One collection of seeds were harvested from the wild and were sown untreated. These began germinating in 25 days, reaching maximum germination two months later. All of the seedlings and young plants were successfully raised in the nursery and planted in the garden.

Culture: This species grows from Lake County to Oregon on dry slopes and flats below 3,000 feet. Our plants were planted in 1963, and nothing further about them has been recorded.

***Zigadenus venenosus* S. Watson.** [Ed: *Toxicoscordion venenosum* (S. Watson) Rydb. TJM2]

Death-Camas.

Propagation: Our seeds failed to germinate.

THE END.