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SEED
PROPAGATION
of
Native California Plants

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the GARDEN

Introduction

California has a diverse flora that is widely used in cultivation. California native plants were successfully introduced into European gardens over a hundred years ago from collections of botanical explorers visiting the west coast of North America. In recent years there has been a steadily increasing interest in the use of native plants in California gardens. They offer great landscaping possibilities, are relatively disease and pest free, and often have low maintenance requirements.

Currently, a diverse array of native species is available from at least some wholesale growers, but any one retailer is apt to stock only a few. Many species that are desirable for cultivation are best grown from seeds and often these require special germination procedures. This book is, therefore, designed as a guide to the seed propagation of California native plants. The first part consists of comments on methods used in collecting and propagating such plants from seeds. It includes descriptive information on different pre-sowing treatments and seed germination temperatures; some seeds have very narrow limits of tolerance. There is also a section on general methods for propagating annual wildflowers from seeds. The major part of this publication is a list of suggested pre-sowing treatments for seeds of over 900 species and varieties of California native plants.

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1. Seed Collection and Storage

Seeds of native California species are not always easy to obtain, but seeds of a number of species, particularly annuals, can be purchased from seed companies and seed collectors. Still others are occasionally available from botanic gardens throughout the state. Often, however, it is necessary for the propagator to collect them himself. Seeds should be harvested only from healthy plants showing no sign or the least sign of disease or insect damage. All drying seeds must be protected from birds and rodents.

Seeds that are wind dispersed or borne in fruits that, upon drying, dehisce (or discharge) must be harvested when slightly green or immature; they can then be dried in loosely covered containers. Lupine (*Lupinus*) and poppy (*Eschscholzia*) are examples of plants that discharge their seeds at maturity and therefore must be harvested just before fully ripe. California lilac (*Ceanothus*) capsules must also be picked when slightly green and dried in a screen-covered container at day temperatures of 85° to 100°F. If dried at much lower temperatures, the capsules may not open, and then they must be thrashed by pounding with a heavy object in order to separate the seeds and chaff. It is important to note that seeds found to contain milky or gelatinous substances are too immature to harvest.

Fleshy fruits such as those from nightshade (*Solanum*), barberry (*Mahonia*), and gooseberry (*Ribes*) should be crushed, and the mashed pulp containing the seeds should be spread in a thin layer on paper to dry. The seeds and pulp can then be readily separated. Another method is to add water to the mashed pulp and seeds, preferably in a tall container. After standing for a day or two, the seeds and pulp will separate.

If seeds are to be stored for future use, thorough drying is necessary to prevent mold and to insure reasonable longevity. With a few exceptions, noted below, the harvested seeds or fruits should be placed in a warm (85°-100°F day temperature), dry place for several weeks. They should be protected from dew during this period. After being cleaned, the seeds should be placed in appropriately sized envelopes or bags (labeled with name and date) and placed in a sealed container with several crystals of a moth larvicide for a day or two to kill any seed-eating insects or their eggs.

The longevity of seeds of California native plants is highly variable and

depends upon the species. Willow (*Salix*) and poplar (*Populus*) seeds are extremely short-lived. They remain viable for only a few hours. They die in the wild, unless they are dispersed promptly to a moist substrate like a streambank. Species of oak (*Quercus*), buckeye (*Aesculus*), chinquapin (*Chrysolepis*), hazelnut (*Corylus*), maple (*Acer*), and snowdrop bush (*Styrax*) also have short-lived seeds that must be sown before they dry out, usually a month or so after harvesting. Conversely, some lupine (*Lupinus*) seeds have given fair germination after 30 years of storage at room conditions. Short-lived seeds should be sown as soon as they have been harvested and cleaned. If they must be held over from fall harvest for spring sowing, they should be stored under cold, moist conditions (see cold stratification).

Moderate to long-lived seeds are best stored in cold, dry conditions such as in the refrigerator in a closed container to which a packet of desiccant has been added. Packets of desiccant are obtainable at a pharmacy.

Seeds of most species, unless known to be long-lived (those with impermeable seed coats), can be stored two or three years in a cool, dry room; however, if stored as suggested in a refrigerator, they will remain viable for several additional years.



2. Seed Dormancy and Treatments

Germination is the resumption of active growth of the seed's embryo. It requires moisture, proper temperature, and oxygen. The time necessary for complete germination varies with the species. Seeds of most annual wildflowers germinate with no difficulty in one to two weeks. Seeds of many longer-lived plants take three to six weeks; however, some take up to several years to germinate under natural conditions. Since slow and sporadic germination is usually the result of some form of seed dormancy, treatments to break the dormancy just prior to sowing are often used.

In general, there are two types of seed dormancy: seed coat dormancy and internal dormancy. Seeds with seed coat dormancy usually have a seed coat that is impermeable to oxygen and/or water. Occasionally the dormancy is caused by an inhibiting chemical in the epidermis or adjacent interior membranes. Under natural conditions these seeds remain on or in the ground without germinating until they have weathered sufficiently to allow penetration of water, exchange of gases, or neutralization of inhibiting chemicals. Seeds of some species germinate only after being subjected to fire. The length of time involved—it can be several years or more—depends upon the species and the environmental conditions. Seed coat dormancy is common in California lilac (*Ceanothus*), manzanita (*Arctostaphylos*), sumac (*Rhus*), and many members of the legume family. If seeds of such plants are harvested when slightly green or immature and sown immediately before they dry out, germination problems may be reduced; however, once the seeds have dried out, the dormancy factor is present and must be counteracted to obtain prompt germination. Methods of breaking seed coat dormancy include scarification, hot water, dry heat, fire, charate, acid and other chemicals, mulch, water, cold and warm stratification, and light. For a detailed article on water-impermeable seeds (seed coat dormancy), see Rolston (1978).

Internal dormancy is a general term encompassing a number of physiological conditions that delay germination. Not all of these conditions are fully understood or easy to counteract. The most common one is called after-ripening. Seeds that require an after-ripening period, even though harvested when mature, germinate poorly or not at all until they

have been subjected to moisture and either high or low temperatures or both in sequence; sometimes, however, a period of dry storage is sufficient to break dormancy. As might be expected, internal dormancy is most often found among species that grow in the high mountains or deserts. For the montane species, a moist cold period is required, simulating a cold winter. For some desert seeds a few weeks of dry storage at over 100°F, simulating summer desert heat, is necessary; then the seeds will germinate at lower temperatures. The more common method for breaking internal dormancy is cold stratification. In some cases, the use of chemicals can be substituted for part or all of the stratification requirement.

Multiple dormancy factors also occur. In one general type there is seed coat dormancy plus internal dormancy. Seeds with this dormancy combination must be treated for the impermeable seed coat first, then for internal dormancy. In another type there are two or more distinct internal dormancy factors, which unlock sequentially at different temperatures. One group requires warm temperatures first for a small amount of primary root growth, then cold to break shoot bud dormancy, then warm again to initiate shoot growth and complete germination. Another group needs cold temperatures first to break primary root dormancy, then warm to initiate a small amount of root growth, then cold again to break shoot bud dormancy, then warm again to initiate shoot growth and complete germination. In the wild, seedlings of plants with these dormancy types would not appear until the first or second spring after the seeds had matured and dropped from the parent plant. For a detailed discussion of dormancy and germination in nature, see Gutterman (1980-1981).

A general summary of practical methods for breaking seed dormancy is outlined in the next few pages. Recommendations for appropriate seed treatments of specific plant species are included in the table beginning on page 29.

Scarification

Mechanical scarification can be accomplished by rupturing the seed coats with sandpaper, a file, a pin, or a knife. Even a vise can be used to squeeze seeds along the suture until they crack open. Care must be taken not to injure the embryo. It may be necessary to open a couple of seeds to see where the embryo is located in relation to the micropyle, the former point of attachment to the fruit. Large seeds like those of the bush lupine (*Lupinus*) are easily scarified with a knife; the hot water treatment is easier for small seeds.

Hot Water

For small to medium-sized seeds or large quantities of seeds, the hot water treatment is more practical than scarification. For this treatment seeds should be dropped into about six times their volume of 180°-200°F water (rain water is desirable if it is near neutral in pH). They should be left to cool and soak in the water for 12 to 24 hours, after which they are ready for sowing. The container used for this treatment should not be made of aluminum as it may be toxic to the seeds. Also softened water should not be used since the amount and ratio of salts may be toxic to the seeds.

Another and more drastic hot water treatment is sometimes used for especially thick or hard-coated seeds. For this treatment, the seeds should be placed in vigorously boiling water for a specific length of time depending on the species, then immediately removed from the boiling water and cooled in cold water.

With both hot water treatments, the seeds should be sown promptly and not stored again.

Dry Heat

Oven or dry heat is not often recommended, and the temperatures required are more suitable to an incubator than a kitchen oven. For this seed coat treatment the seeds should be placed in shallow containers in a preheated incubator or oven. The specific temperature and duration depend on the species. After the treatment, the seeds should be cooled immediately and sown.

Where the temperature suggested is between 180°-212°F, it is possible that the hot water treatment of the same temperature and for the same length of time would give comparable results.

Charate

The char from burned plant stems has been shown to be a good neutralizer of germination inhibitors in the seeds of several herbaceous species associated with chaparral fires (Keeley & Keeley 1982). These authors report that of the fire-followers tested [snapdragon (*Antirrhinum*), pincushion flower (*Chaenactis*), whispering bells (*Emmenanthe*), golden yarrow (*Eriophyllum*), and *Phacelia* species], all had greatly enhanced germination with the addition of a small amount of chamise (*Adenostoma fasciculatum*) charate to the sown seeds.

Charate can be prepared by burning chamise stems of 3/8-inch or less in diameter with a propane torch until they are blackened through and then grinding the charred stems in a Wiley mill to produce a uniform powder.

The Keeleys applied 0.154 ounces of charate to each petri dish of 20 to 50 seeds.

Charate made from woody species other than chamise gave different degrees of germination enhancement for different species (Keeley & Keeley 1982). Baking the stems (500°F for 10 minutes or 347°F for 30 minutes) instead of treating with a blowtorch may give comparable results. In some cases, seeds heated in an oven for short periods and then treated with charate showed further enhanced germination, sometimes synergistically.

In the family Hydrophyllaceae there are many fire-following species with seeds that are difficult to germinate. These include whispering bells (*Emmenanthe*), yerba santa (*Eriodictyon*), *Eucrypta*, *Phacelia*, and poodle-dog bush (*Tutricula*). Whispering bells and species of *Phacelia* have been tested with charate, and in each case, germination has been enhanced.

Fire

Seeds of some genera have tough, thick seed coats and germinate most satisfactorily when subjected to the heat of fire. For this treatment the seeds should be sown in the fall in a slightly moist medium but not watered. A layer of dry pine needles or excelsior, four to six inches deep, should be placed over the top of the seedbed. A few small pieces of wadded paper will help to ignite the material. One or two strips of aluminum foil placed over the exposed edges of the wood container will prevent it from burning; plastic containers should not be used. After the seedbed has cooled following burning, it should be thoroughly watered and then treated as any other batch of sown seeds. Since the small flash fire produced by this treatment is quite hot, this method should be used outdoors in the open, away from combustible material, and on a calm day. The seeded container should be left outdoors for germination, since seeds of many plants also have internal dormancy factors and therefore need a cold, moist period for germination. Even using this treatment, manzanita (*Arctostaphylos*) seeds require a minimum of two months to germinate. If the seeds are sown and treated in mid-October and no germination has occurred by June, the seedbed can be dried out for the remainder of the summer. Watering should be resumed in the fall when the weather begins to cool. Some germination may occur as late as the following spring.

This fire treatment is not exact, and the results obtained may not be consistent because the amount and duration of heat actually reaching the seeds is governed by several variable factors.

Acid

Acid treatments are often used to break down especially thick impermeable seed coats. Since seeds placed in concentrated sulfuric acid (H_2SO_4) will become charcoal in time, the temperature of the acid and

the length of time the seeds are soaked are very important. The acid should be used at room temperature for a period of a few minutes to several hours depending on the species. The seeds should be immersed in acid in a glass, china, or earthenware container, and should be stirred occasionally with a glass rod; however, too much stirring will cause the acid to heat undesirably. The seeds must be removed from the acid just before any acid penetrates the seed coats. When the allotted time is finished, the seeds should be removed promptly and washed thoroughly in several changes of water to neutralize completely all remaining acid. For some species the duration of the acid bath depends on the specific batch of seeds and can only be determined empirically. After treatment and a thorough washing, the seeds may be sown or dried and stored for several months.

Since sulfuric acid is caustic and dangerous to handle, its use is recommended only for those familiar with the use of caustic chemicals. In lieu of the acid treatment for seeds with thick coats, such as manzanita (*Arctostaphylos*), the fire or mulch treatments can be used. With thinner-coated seeds, hot water or scarification is satisfactory.

Other Chemicals

About 50 years ago researchers in various agencies and private industry began experimenting with chemicals to neutralize dormancy conditions present in seeds. Results have shown that inhibiting chemicals can be present in one or more parts of the seed; other dormancy-causing factors (i.e., immature embryos or impermeable seed coats) may also be present in a given seed.

Three chemicals that have proven very helpful in breaking certain types of dormancy are gibberellic acid (GA_3), potassium nitrate, and thiourea. The aqueous solutions of these chemicals should be used at room temperature. The concentration and length of treatment depends on the species to be treated. Seeds soaked in GA_3 or thiourea should be stirred occasionally and not rinsed afterwards, unless specified, but sown immediately. After this soaking they can also be air-dried and stored for short periods and then sown or given a subsequent treatment. The no-rinse-afterwards also applies to the use of potassium nitrate and hydrogen peroxide, other chemicals occasionally recommended as aids to germination.

Great care should be taken in working with these chemicals as some are poisonous. Due to their toxic or poisonous nature, some are difficult to obtain; however, in nearly all cases there is an alternate method of seed treatment noted. The main advantages of these chemicals are speed, ease of use, and unaltered physical condition of the seeds following treatment.

Mulch

The mulch treatment hastens the microbial breakdown or softening of the seed coats. It is a slow method but is what often occurs in the wild. For this treatment, fill a six- to eight-inch deep container half full with seedbed medium. Then the sown seeds should be covered with a mulch of wood shavings (not redwood or cedar). A one-inch thick layer of old composted shavings is best; but if not available, a three-inch layer of fresh shavings is satisfactory. If fresh shavings are to be used, they should be soaked a few hours in a bucket of water first and mixed with a compost starter of microbial inoculant [see Germination Media section]. Neither the seeds nor the medium should be treated with a fungicide. If this treatment is initiated in early spring or early summer and if the shavings are kept moist all summer, germination will require three to four months or longer, depending on the species. This mulching technique also works well in a ground bed; however, transplanting may be a bit more difficult.

Water

For the occasional species whose seed coats contain a readily water-soluble, germination-inhibiting chemical, this substance can be removed by soaking the seeds in tap water or by leaching the seeds in slowly running tap water for various lengths of time just prior to sowing. The length of time depends on the species. With the water bath, changing the water every 12 to 24 hours will hasten this leaching process. Softened water should not be used for this treatment.

Cold Stratification

Cold stratification for seeds with internal dormancy simulates cold winter conditions. For small quantities of seeds, mix at a ratio of 1:3 or more with moist peat moss or moist vermiculite, place in a tightly sealed polyethylene bag or glass jar, and store in the refrigerator at a temperature of 35°-41°F. With a few species, freezing the seeds at 28°-32°F is required. For bulk seeds, soak in water for a few hours first, then place wet in a sealed container. In either case, the seeds must be kept moist during the entire length of the treatment. This will require periodic checking and the addition of water if necessary. Another reason for periodically checking the stratifying seeds is to see if they have started to germinate. If, for example, a California-lilac (*Ceanothus*) species has a three-month cold stratification recommendation, it should be visually checked for germination a couple of weeks prior to the end of the third month. If any white root tips are visible, the whole batch should be sown immediately. The

longer the radicals are when the seeds are sown, the greater the probability of damage and the greater the mortality rate is apt to be. If the stratification period is inadvertently lengthened, it is usually not detrimental, providing the radicals are still very short or not yet showing.

In contrast, to cut the stratification period short by even a few days could be harmful if no radicals are visible. By prematurely discontinuing stratification, primary dormancy may not be broken. Consequently, a secondary dormancy may be induced which is more difficult to break than the original dormancy. If one must err, do it on the long side.

The cold stratification period necessary to break dormancy may last from a few days to several months, depending upon the species, with one to three months being the most common. After stratification, the seeds should be sown promptly before they have a chance to dry out.

Warm Stratification

The exposure of seeds to moist, warm conditions at room temperature (65°F) or above is called warm stratification. Sometimes this treatment is necessary for seeds with internal dormancy to facilitate after-ripening of the embryos, in which case it is followed by cold stratification. Occasionally it is used in lieu of the acid treatment for seed coat dormancy. It also may be an intermediate stage in a multiple dormancy treatment.

For warm stratification the seeds should be mixed with moist peat moss or moist vermiculite and sealed in a polyethylene bag or a glass jar. Possible places for warm stratification include desk tops, kitchen cupboards, the top of a refrigerator, or perhaps near the furnace—anywhere that stays warm night and day for the prescribed period of time.

Photochemical Dormancy

Seeds of some species are light-sensitive and must receive light during germination. The intensity and duration of the light, as received by seed photoreceptors, interact with the available moisture and temperature to control germination. When light and temperature are each partially inhibitory, the effect can be synergistic. The first 36 to 72 hours of germination is the critical period. Photochemical dormancy is most pronounced in freshly harvested seeds and usually disappears naturally with age. For further information on photochemical dormancy, see Cruden [1974].

When germinating seeds indoors in order to break photochemical dormancy, a cool, white fluorescent light source of 75-125 foot candles (750-1250 lux) for eight hours per day can be used [Association of Official Seed Analysts 1981].

Seeds that require light should not be covered when sown but merely

watered-in. A covering of glass or plastic over the container will help to maintain a saturated atmosphere around the seeds. A few species must be kept in darkness during the first part of the germination period.

Germination Temperatures

Though not really a form of dormancy, undesirable temperatures used for germination can be partially or completely inhibitory. Temperature requirements for the germination of seeds of most native California species will be met if the seeds are sown at the proper time of year (see the following section). The range of temperatures required by the seeds of a few species, primarily those of the desert and mountain regions, can be very narrow and specific. If seeds of these plants are sown at the wrong time of year or if temperatures in the area where the seeds are sown are not within the narrow limits for the species, no germination, or at best very poor germination, will occur. For coastal Southern California growers, the greatest problem is encountered with seeds that require high temperatures or wide diurnal temperature fluctuations.

If the recommended daily high-low temperatures are not present naturally, artificial means must be used to produce them, or the propagator will have to be content with poor germination. Where these specific and unusual diurnal temperature fluctuations are necessary, they are noted in the table for the species involved.



3. Seed Propagation

Time to Sow Seeds

At the Santa Barbara Botanic Garden most seeds are sown in small containers in the lathhouse. When stratification is necessary, it is done prior to the sowing date. Seeds of annuals are sown in late October, herbaceous perennials by July 15, and shrubs and trees by the middle of March. There are several exceptions to the above: seeds of live-forever (*Dudleya*), buckwheat (*Eriogonum*), and alum-root (*Heuchera*) are sown by July 1; bush monkeyflower (*Diplacus*) species are sown in early July with herbaceous perennials; seeds of sea-dahlia (*Coreopsis maritima*) are sown by September 1 for late fall, winter, and early spring flowers; lupine (*Lupinus*) species seeds, including both bush and herbaceous perennial types, are sown by October 10 for planting out from three-inch pots in late fall for spring flowers; and seeds of *Iris*, manzanita (*Arctostaphylos*), and bush poppy (*Dendromecon*) are sown by October 15. Seeds of desert shrubs and cacti are sown by July 1 in the glasshouse with a minimum temperature of 60°-65°F; our outdoor night temperatures are too low at this time of year for satisfactory germination. With the above schedule, germination and growing temperatures are favorable; and the timing, in most cases, will produce plants of sufficient size to be ready for late fall planting, when the winter rainy period usually commences.

Germination Media

There are many suitable media for germinating seeds, and the majority of the California native species have no unusual requirements. A satisfactory general purpose seedbed medium is composed of equal parts of garden loam, builders sand or river sand (not beach sand as it contains too many soluble salts), and moist peat moss, thoroughly mixed together. The soil and sand should be sifted through a sieve of 1/8-inch mesh; the peat moss, through either a 1/4- or 1/2-inch mesh screen. Since dry peat moss, as it comes from the bale, absorbs water very slowly, it should be soaked for several hours before use or soaked for a few minutes with constant agita-

tion. The excess moisture should be squeezed out before use. Once peat moss has been wet, it is usually easily remoistened.

To prevent unnecessary seedling losses due to soil-borne diseases and pests, all mixes containing soil or leaf mold should be pasteurized before use by heating to 140°F for 30 minutes to kill insects, their eggs and larvae, and most pathogenic fungi and bacteria. At much above this temperature, beneficial soil microorganisms start to die off. Sterilization requires 180°F for 30 minutes; this temperature kills most organisms and is usually not desirable.

For pasteurization, moistened soil mix should be placed in a shallow pan in an oven at low heat. The temperature of the mix should be raised and held at 140°F, or a little above, for 30 minutes. If the soil mix is not pasteurized or sterilized, young seedlings, particularly very small ones, are likely to succumb to damping-off fungi. In lieu of pasteurization, seeds can be dusted with a fungicide such as "Cooke's Fungicide" or a similar material that specifies on the label that it kills damping-off fungi. Alternatively after sowing, the seedbed can be watered thoroughly with such a fungicide.

A relatively new approach to the problem of pathogenic organisms in containers is the addition to the medium of a beneficial microbial inoculant; this material can be used in place of pasteurization or a fungicide. Even in a sterilized mix its use is beneficial. These microbes have an effect on the soil analogous to the immune system in animals; the beneficial microorganisms, if added in quantity, tend to isolate and neutralize the pathogens. At the Santa Barbara Botanic Garden, in containers smaller than one-gallon, we use a soil-less medium with a microbial inoculant available locally from Material Science Company. There are, no doubt, other similar products available.

Alternatives to media containing soil are the soil-less mixes such as peat moss and perlite [equal parts], vermiculite (medium or fine, depending on the seed size), or a packaged potting mix. These do not need pasteurization or a microbial inoculant, though the latter is beneficial in a soil-less mix also. When using a medium composed of peat moss, perlite, and/or vermiculite, all of the necessary elements for plant growth must be added since these components are nutrient-free. One way to provide required nutrients is to use a dilute solution of a water-soluble, complete fertilizer with each watering.

To further prevent contamination by pathogenic organisms, used porous containers such as clay pots and wood containers should be cleaned of all foreign material, such as old mix and roots, then soaked 30 minutes or longer in a 1:18 solution of household bleach before re-use. Used plastic containers need to be soaked only for a few minutes. It is important also that the top of the potting bench and all tools, such as trowels, sifters, and wood blocks, be rinsed periodically in a bleach solution or similar sterilant and then kept off the ground to avoid contamination.

Seed Sowing

Good seed germination depends largely on proper preparation of the seedbed, depth to which seeds are covered, maintenance of uniform moisture and appropriate temperatures, and, of course, viable seeds. To prepare the seedbed, a container with drainage holes is filled to slightly overflowing with a well-mixed moist medium. The medium is then leveled to the top of the container or about 1/8-inch below the lip, firmed lightly and uniformly with a flat-surfaced board or large-surfaced object, and watered thoroughly. After watering, the surface of the medium should still be level.

The seeds should be sown in rows about 1 1/2 inches apart or broadcast evenly on the surface. The sown seeds should then be covered. Milled sphagnum moss (sphagnum moss put through a 1/4-inch mesh sieve) is very good for this purpose as its slight acidity helps to discourage damping-off. Washed sand or seedbed mix may also be used as a seed cover. After the seeds have been sown and covered, the container should be lightly sprinkled again with a fine spray of water and placed in a sheltered location out of direct sunlight. A beneficial microbial inoculant can be used for these waterings and also for the initial moistening. The depth of sowing or thickness of the seed covering is especially important as seeds sown too deeply will not produce seedlings. Such seeds may start to germinate, but the developing shoots will die before reaching the light at the surface of the seedbed. A general rule is to cover a seed to a depth equal to one to two times its smallest diameter. Very fine seeds, such as those of alum-root (*Heuchera*), bush-anemone (*Carpenteria*), or monkeyflower (*Mimulus* and *Diplacus*), should be covered just slightly with milled sphagnum moss or watered-in without a covering. It is desirable to label each seeded container with the name of the species and the date sown. For protection against rodents, snails, birds, and drying out, the container should then be enclosed in a polyethylene bag or covered with a piece of polyethylene film, with a single sheet of newspaper on top to prevent heat build-up. During the germination period, the surface of the medium must be kept moist. As the seeds start to germinate, the newspaper and plastic should be removed; better results may be obtained by leaving very small seedlings completely enclosed in plastic until germination is complete. However, the plastic should not touch the seed leaves. If the weather is unusually hot and dry, it is best to acclimatize very small seedlings gradually by poking a few holes in the plastic each day or two and then removing the plastic entirely. A glass cover can be used instead of plastic. Germination for most species takes one to four weeks.

Transplanting

Seedlings should be spotted-off or transplanted into flats, trays, or small pots (liners) as soon as they are large enough to handle. Species with large seed leaves, such as sugar bush (*Rhus ovata*), should be spotted-off to liners at the two-leaf stage, but those with very small seed leaves, such as monkeyflower (*Mimulus* and *Diplacus* species), should not be transplanted until the six- or eight-leaf stage. Since seedlings are bare-rooted in spotting-off, care must be taken to protect the tender roots from drying out and from excessive breakage; also when handling, care must be taken not to crush the fragile stems. Young plants in seed flats are sometimes spaced very close together and can be difficult to separate. To facilitate separation, a small group of seedlings may be lifted out with a putty knife or a fork and dropped to the potting bench from a height of three to four inches. Seedlings should be planted at the same depth that they were in the seed flat, or slightly lower.

The medium can be the same as that used for germination and must always be moist when used. Again, a soil medium should be pasteurized with heat or moistened with a microbial inoculant.

The young seedlings should be transplanted a second time when their roots begin to fill the soil mass in the container. Annuals should be moved directly into the open ground at this time. Herbaceous perennial seedlings may be planted out also, but receive less setback and have a better chance if they are transplanted to four-inch pots first and later moved to the open ground.

Shrub and tree seedlings should be spotted-off from the seedbed to three-inch pots, then to one-gallon cans, and finally to the garden. It may be more appropriate for trees to be moved from one-gallon to five-gallon containers and then to the garden. The five-gallon stage normally takes one or two growing seasons.

Seeds of tap-rooted tree species should be individually sown in deep containers such as quart milk cartons. If the bottom of the container is removed and the container set on hardware cloth covered with one thickness of newspaper or a screen and placed three to six inches above the ground, the tap roots will prune themselves, because the root tips will die when they reach dry air. Seedlings can be root pruned manually by snipping no more than $\frac{1}{8}$ to $\frac{1}{4}$ inch off the tip of the root; the thumb nail does a fine job.

Another method of handling the seeds of tap-rooted species, particularly those of oaks, is to place the seeds in a polyethylene bag containing moist peat moss. Kept at room temperature, the primary roots will soon become visible. When a seed has a visible root, it should be removed from the bag, root-pruned as noted above, and planted. Again, the recommended planting sequence is from a quart milk carton or a one-gallon can to the field, or from a quart milk carton to a five-gallon can and to the field. Four by 14-inch plastic pots (2 $\frac{1}{2}$ -inch diameter bottom hole) set on hardware

cloth are excellent for propagation of tap-rooted species. The seeds can be sown directly; the seedlings can be grown for a season and then planted out without any transplanting at all. This size container is much more appropriate than a one-gallon can for tap-rooted tree species. Slightly shorter containers would be necessary if plants in five-gallon containers are required.

Regardless of how the tap-rooted species are handled, it is imperative to transplant their seedlings before the roots circle the container, particularly at the liner stage (3" pot). Generally speaking, pot-bound trees and shrubs become culls instead of beautiful mature specimen plants.

Although the same medium used for the seed flats and liners can be used for one-gallon or larger containers, a coarser mix is also satisfactory. A light, well-drained, pasteurized, or microbial-inoculated mix of sandy loam and peat moss or wood shavings serves quite well. If the soil is too coarse, it should be sifted through a $\frac{1}{2}$ -inch mesh screen.

Care should be taken not to overwater newly potted or canned plants. In regions away from the immediate coast, some protection from full summer sun is needed for container plants. This protection can be critical during occasional heat waves when root systems of container-grown plants can become overheated, killing the plants. Thirty percent shade saran is adequate.

Most native plants respond well to light applications of commercial fertilizer and will require some fertilization while in containers.

Field Sowing of Annual Wildflowers

Although seeds of California wildflowers can be started in flats like those for bedding plants, better results are usually obtained by sowing them directly on the open ground, or with very small-seeded types, several seeds to a three-inch peat or paper pot. The seedlings, when large enough, can be thinned and later planted out in the garden with practically no root disturbance. For field sowing, the moistened soil should be cultivated and leveled, the seeds broadcast, and the area kept moist throughout the germination period. In the case of large-seeded species such as sea-dahlia (*Coreopsis maritima*) and some lupines (*Lupinus*), the seeds should be raked in lightly after sowing and before watering. If a mixture of large and small seeds is used, the large seeds should be separated out, sown and lightly raked in, then the small seeds broadcast on top. Following this procedure, the seeds can be sown as late as early December with good results.

For large areas where no seedbed preparation is made, the seeds should be broadcast just before the first rains in the fall. This enables the wildflower seeds to germinate with and to compete with any annual vegetation. A few of the tougher annuals like California poppy (*Eschscholzia californica*),

tidy tips (*Layia platyglossa*), and *Clarkia* may give good results when sown under these conditions; however, wildflower seed germination is always better in a well-prepared seedbed.



4. Recommended Seed Treatments for Some Native California Plants

The table that follows these comments is a compilation of the original publication published in 1964 plus information from records of subsequent propagation at the Santa Barbara Botanic Garden and also additional data from other sources (see "Literature Cited").

It should be emphasized that the suggested seed treatments are not necessarily the only ones that will prove satisfactory. For problem species [those whose seeds are difficult to germinate], there may be more than one treatment listed.

For example, if you refer to *Ceanothus cuneatus* (buck brush) in the table, two treatments are listed. "Hot water and three months stratification" results in significantly better germination than the chemical treatment but leaves the seeds in an unusable condition if they are to be sown with mechanical equipment. After stratification, the seeds are rather soft and moist, some radicals may be showing, and the seeds should not be dried out before sowing. With the chemical treatment, no germination will have started; the seeds can be dried out before sowing, need not be sown immediately, and can be sown with mechanical equipment. The chemical treatment also has the advantage of being quicker, even though a lower percentage of germination usually results.

Stratification, as used in these recommendations, refers to cold stratification unless stated otherwise; diurnal fluctuation refers to temperature. Scarification, if practical, can be substituted for the hot water treatment.

The seeds of the majority of the native species germinate promptly without pretreatment. Since this is true of most annuals, only those annuals known to require special treatment and for which a satisfactory treatment is known are included in this table. Dormancy is highly variable, sometimes even in seeds from the same plant harvested in the same year, hence an entry like that for incense cedar (*Calocedrus decurrens*)—"two months stratification; no treatment may give good germination." For more information on the variability aspect of seed dormancy, see Gutterman [1980-1981]. Some seeds germinate without pretreatment if they are sown when fresh [as soon as ripe, or even when slightly green], but become dor-

mant as they dry out; in such cases, stored seeds require treatment while fresh seeds do not. Some seeds of other species may normally have low viability.

Since seeds are living protoplasm and subject to many environmental variables, the seed treatments suggested here may not always give consistent results, particularly for different seed batches harvested from different localities. The recommendations will, however, serve as a guide for the plant propagator.

If a particular problem species or perhaps even the genus is not listed here, for possible direction, see Atwater (1980).

Plant nomenclature follows Munz and Keck (1973), and Munz (1974) with selected changes in Kartesz and Kartesz (1980).

Scientific Name	Common Name	Recommended Treatment
<i>Abies bracteata</i>	Santa Lucia Fir, Bristlecone Fir	2-3 mos. stratification. ¹
<i>Abies concolor</i>	White Fir	1 mo. stratification. ¹
<i>Abies grandis</i>	Giant Fir	1 mo. stratification; for small lots of seeds, scarification may give better results. No treatment can also give good results [USDA Forest Service 1974]. ¹
<i>Abies magnifica</i>	Red Fir	1 mo. stratification. ¹
<i>Abies magnifica</i> var. <i>shastensis</i>	Shasta Fir	1-2 mos. stratification. ¹
<i>Abies procera</i>	Noble Fir	2 wks. stratification or, for small lots, scarification [USDA Forest Service 1974]. ¹
<i>Abronia maritima</i>	Sticky Sand-verbena	No treatment [Emery and Frey 1971].
<i>Abronia umbellata</i>	Beach Sand-verbena	No treatment. Germination may be poor.
<i>Abutilon palmeri</i>	Palmer's Indian-mallow	No treatment.
<i>Abutilon parvulum</i>	Small-leaf Indian-mallow	No treatment [Emery and Frey 1971].
<i>Acacia farnesiana</i>	Sweet Acacia	Scarification.
<i>Acacia greggii</i>	Catclaw	No treatment; scarification or hot water may improve germination.
<i>Acaena californica</i>	California Acaena	4-6 wks. stratification [Emery and Frey 1971].
<i>Acalypha californica</i>	California Copperleaf	No treatment [Emery and Frey 1971].

<i>Acer circinatum</i>	Vine Maple	Scarification, 1-2 mos. warm, and 3-6 mos. cold stratification; when periodic checks during cold stratification indicate incipient germination, the whole lot should be sown [USDA Forest Service 1974]. Use fresh seeds.
<i>Acer diffusum</i>	Mountain Maple	3-4 mos. stratification; use fresh seeds.
<i>Acer glabrum</i>	Rocky Mountain Maple	6 mos. warm, then 6 mos. cold stratification [Heit 1971].
<i>Acer macrophyllum</i>	Bigleaf Maple	1½-2 mos. stratification; use fresh seeds.
<i>Acer negundo</i> subsp. <i>californicum</i>	California Box Elder	Scarification and 2-3 mos. stratification; use fresh seeds.
<i>Achillea borealis</i>	Yarrow	No treatment.
<i>Aconitum columbianum</i>	Columbian Monkshood	No treatment [Emery and Frey 1971]. 2 mos. stratification may improve germination [<i>Plants of the Southwest</i> 1984].
<i>Actaea rubra</i> subsp. <i>arguta</i>	Baneberry	2-3 mos. cold, 1 mo. warm, and 2-3 mos. cold stratification. May take several mos. for germination. 3 mos. cold, 2-3 mos. warm, and 3 mos. cold stratification may hasten germination.
<i>Adenocaulon bicolor</i>	Trail-plant	No treatment.
<i>Adenostoma fasciculatum</i>	Chamise, Greasewood	Seeds collected from plants, no treatment. Seeds collected from duff, hot water. Alternative treatments: burn a 1" thick layer of pine needles or excelsior over the seed bed, oven heat of 212°F for 5 mins. [Stone and Juhren 1953], or soak in 10% H ₂ SO ₄ for 15 mins.
<i>Adenostoma sparsifolium</i>	Red Shanks, Ribbonwood	No treatment. Soaking in 10% H ₂ SO ₄ for 15 mins. may improve germination.

¹ *Abies* seed storage life is less than one year unless kept refrigerated. Sow *A. concolor* in late fall as there will be less seedling loss to disease if the first growth period is during the cool months [Heit 1968b], this may have reference to related species.

Scientific Name	Common Name	Recommended Treatment
<i>Adolphia californica</i>	California Adolphia	No treatment [Emery and Frey 1971].
<i>Aesculus californica</i>	Buckeye, California Horse-chestnut	No treatment; use fresh seeds.
<i>Agastache urticifolia</i>	Nettle-leaf	No treatment.
<i>Agave deserti</i>	Desert Agave	No treatment.
<i>Agave shawii</i>	Shaw's Agave	No treatment.
<i>Agave utahensis</i> var. <i>nevadensis</i>	Pygmy Agave	No treatment.
<i>Agoseris grandiflora</i>	Large-flowered Agoseris	No treatment [Emery and Frey 1971].
<i>Agropyron dasystachyum</i>	Northern Wheatgrass	No treatment.
<i>Agropyron riparium</i>	Montana Wheatgrass	No treatment [Plants of the Southwest 1984].
<i>Agropyron saxicola</i>	Rock Wheatgrass	No treatment.
<i>Agropyron smithii</i>	Western Wheatgrass	No treatment.
<i>Agropyron spicatum</i>	Bluebunch Wheatgrass	No treatment.
<i>Agropyron subsecundum</i>	Bearded Wheatgrass	No treatment.
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	No treatment.
<i>Agrostis alba</i>	Redtop	No treatment.
<i>Agrostis exarata</i>	Spike Bentgrass	No treatment.

<i>Agrostis scabra</i>	Ticklegrass	No treatment.
<i>Agrostis stolonifera</i> var. <i>palustris</i>	Creeping Bentgrass	1 wk. stratification; no treatment may give satisfactory germination.
<i>Alisma triviale</i>	Water-plantain	No treatment.
<i>Allium acuminatum</i>	Hooker's Onion	No treatment.
<i>Allium amplexans</i>	Narrowleaf Onion	No treatment.
<i>Allium crispum</i>	Crinkled Onion	No treatment.
<i>Allium dichlamydeum</i>	Coastal Onion	No treatment.
<i>Allium fimbriatum</i> var. <i>diabolense</i> & var. <i>parryi</i>	Fringed Onion	No treatment.
<i>Allium haematochiton</i>	Red-skinned Onion	No treatment.
<i>Allium howellii</i> var. <i>clokeyi</i>	Clokey's Onion	No treatment.
<i>Allium peninsulare</i>	Peninsular Onion	No treatment.
<i>Allium siskiyouense</i>	Siskiyou Onion	No treatment.
<i>Allium validum</i>	Swamp Onion	No treatment.
<i>Alnus species</i>	Alder	No treatment; 1-3 mos. stratification may improve germination of <i>A. rubra</i> , <i>A. sinuata</i> , and <i>A. tenuifolia</i> . Alder seeds may have very low percent viability.

Scientific Name	Common Name	Recommended Treatment
<i>Alopecurus aequalis</i>	Meadow Foxtail, Short-awn Foxtail	No treatment.
<i>Amelanchier alnifolia</i>	Western Service-berry, Saskatoon Service-berry	4-6 mos. stratification (USDA Forest Service). 4 mos. warm then 4 mos. cold stratification (Heit 1971) may improve germination.
<i>Amelanchier pallida</i>	Pallid Service-berry	2½-3 mos. stratification then germinate at low temperature, i.e. outdoors in early spring.
<i>Amelanchier pumila</i>	Dwarf Service-berry	4 mos. warm and 4 mos. cold stratification (Heit 1971).
<i>Amelanchier utahensis</i>	Desert Service-berry	1½ mos. stratification then germination with a diurnal fluctuation of from 50° to 80°F (Heit 1971).
<i>Amorpha californica</i>	California False Indigo	Fresh seeds, no treatment; scarification may improve germination of stored seeds.
<i>Amorpha fruticosa</i> var. <i>occidentalis</i>	Western False Indigo	No treatment; scarification may improve germination.
<i>Anaphalis margaritacea</i>	Pearly Everlasting	No treatment (Emery and Frey 1971).
<i>Andropogon barbinodis</i> (see <i>Bothriochloa</i>)		
<i>Anemone occidentalis</i>	Western Anemone, Pasque Flower	No treatment (Emery and Frey 1971).
<i>Anemone multifida</i>	Globe Anemone	2 mos. stratification; no treatment may give satisfactory germination.
<i>Anemone tuberosa</i>	Desert Anemone	No treatment (Emery and Frey 1971).

<i>Anemopsis californica</i>	Yerba Mansa	No treatment.
<i>Antennaria umbrinella</i>	Pussytoes	No treatment (McLean 1967).
<i>Antirrhinum coulterianum</i>	White Snapdragon	No treatment gives some germination. Addition of a small amount of charate over the sown seeds greatly improves germination (Keeley and Keeley 1982).
<i>Antirrhinum multiflorum</i>	Sticky Snapdragon	No treatment. Germination may be poor.
<i>Antirrhinum virga</i>	Tall Snapdragon	No treatment.
<i>Aquilegia eximia</i>	Van Houtte's Columbine	No treatment.
<i>Aquilegia formosa</i> var. <i>truncata</i>	Western Columbine	No treatment.
<i>Aquilegia pubescens</i>	Sierra Columbine	No treatment.
<i>Arabis blepharophylla</i>	Coast Rock-cress	No treatment.
<i>Arabis hoffmannii</i>	Hoffmann's Rock-cress	No treatment.
<i>Arabis lyallii</i>	Lyall's Rock-cress	No treatment.
<i>Arabis subpinnatifida</i>	Klamath Rock-cress	No treatment.
<i>Aralia californica</i>	Spikenard, Elk-clover	No treatment.
<i>Arbutus menziesii</i>	Madrone	2-3 mos. stratification.
<i>Arctostaphylos glandulosa</i>	Eastwood Manzanita	Soak in concentrated H ₂ SO ₄ for 4-15 hrs. (USDA Forest Service 1974). ²

² For the acid treatment, single nutlets and stone pieces (often without embryos) and entire stones should be treated separately, as they require different amounts of time in acid (Giersback 1937). For all species an alternate method is fire treatment in fall; this gives germination by spring. More easily propagated from tip cuttings in winter using bottom heat.

Scientific Name	Common Name	Recommended Treatment
<i>Arctostaphylos glauca</i>	Bigberry Manzanita	Soak in concentrated H ₂ SO ₄ for 6-15 hrs. (USDA Forest Service 1974). ²
<i>Arctostaphylos patula</i>	Greenleaf Manzanita	Soak in concentrated H ₂ SO ₄ for 2 hrs, then 3 mos. stratification (Carlson and Sharp 1975); or concentrated H ₂ SO ₄ for 4 hrs. then 4 mos. stratification (USDA Forest Service 1974). ²
<i>Arctostaphylos uva-ursi</i>	Bearberry, Kinnikinnick	Soak in concentrated H ₂ SO ₄ for 3-6 hrs. then 2-4 mos. warm and 2-3 mos. cold stratification (USDA Forest Service 1974); or 6 hrs. of concentrated acid and 2 mos. each of warm then cold stratification (McLean 1967). ²
<i>Arenaria aculeata</i>	Spring Sandwort	No treatment.
<i>Argemone munita</i>	Prickly Poppy	Fire treatment.
<i>Aristida wrightii</i>	Three-awn	No treatment.
<i>Aristolochia californica</i>	Dutchman's Pipe	No treatment (Emery and Frey 1971).
<i>Armeria maritima</i> var. <i>californica</i>	Sea Thrift	No treatment.
<i>Arnica amplexicaulis</i>	Streambank Arnica	No treatment.
<i>Artemisia norvegica</i> var. <i>saxatilis</i>	Mountain Sagewort	No treatment.
<i>Artemisia pycnocephala</i>	Sandhill-sage	No treatment.
<i>Artemisia tridentata</i>	Great Basin Sagebrush	3-3½ mos. stratification (USDA Forest Service 1974); 10 wks. may be sufficient (Stidham et al. 1980).
<i>Asclepias californica</i>	California Milkweed	No treatment.

<i>Asclepias cordifolia</i>	Heartleaf Milkweed	No treatment.
<i>Asclepias eriocarpa</i>	Broadleaf Milkweed	No treatment.
<i>Asclepias fascicularis</i>	Narrowleaf Milkweed	No treatment.
<i>Aster chilensis</i>	Common Aster	No treatment.
<i>Aster foliaceus</i> var. <i>parryi</i>	Leafy Aster	No treatment.
<i>Aster tortifolius</i> (see <i>Xylothiza tortifolius</i>)		
<i>Astragalus antiselli</i>	Antisell's Locoweed, Rattle-weed	No treatment.
<i>Astragalus layneae</i>	Layne's Locoweed	No treatment.
<i>Astragalus miguelensis</i>	San Miguel Island Locoweed	No treatment.
<i>Astragalus purshii</i> var. <i>tinctus</i>	Pursh's Woolly-podded Locoweed	No treatment.
<i>Astragalus trichopodus</i> var. <i>lonchus</i>	Santa Barbara Locoweed	No treatment.
<i>Atriplex canescens</i>	Wingscale	Fresh seeds need dry storage for about 10 mos.; stored seeds, no treatment (USDA Forest Service 1974), or 2½ mos. stratification (Stidham et al. 1980).
<i>Atriplex confertifolia</i>	Sheep-fat, Spiny Saltbush	Fresh seeds need dry storage for about 6 mos.; stored seeds, no treatment (USDA Forest Service 1974). 2 wks. stratification may improve germination (Stidham et al. 1980).

² For the acid treatment, single nutlets and stone pieces (often without embryos) and entire stones should be treated separately, as they require different amounts of time in acid (Giersback 1937). For all species an alternate method is fire treatment in fall; this gives germination by spring. More easily propagated from tip cuttings in winter using bottom heat.

Scientific Name	Common Name	Recommended Treatment
<i>Atriplex hymenelytra</i>	Desert-holly	Stored seeds, no treatment.
<i>Atriplex lentiformis</i>	Quail Brush	No treatment; optimum germination occurs in darkness with alternating diurnal temperatures (Young <i>et al.</i> 1980).
<i>Atriplex patula</i> subsp. <i>hastata</i>	Spearleaf Saltbush	No treatment; optimum germination occurs with light and alternating diurnal temperatures (Young <i>et al.</i> 1980).
<i>Atriplex polycarpa</i>	Common Saltbush, Allscale	No treatment. Germination in darkness may give better results (Sankaryand Barbour 1972).
<i>Baccharis glutinosa</i>	Mule Fat, Water Wally	No treatment.
<i>Baccharis pilularis</i> var. <i>pilularis</i>	Dwarf Chaparral Broom, Dwarf Coyote Brush	No treatment.
<i>Baccharis sarothroides</i>	Broom Baccharis	No treatment.
<i>Bahia dissecta</i>	Bahia	No treatment (Emery and Frey 1971).
<i>Baileya multiradiata</i>	Desert-marigold	No treatment.
<i>Balsamorhiza sagittata</i>	Balsam Root	3 mos. stratification (Young and Evans 1979). Check periodically to remove and pot germinating seeds.
<i>Bebbia juncea</i>	Sweetbush, Chuckwalla's Delight	No treatment.
<i>Beloperone californica</i> (see <i>Justicia californica</i>)		
<i>Berberis</i> (see <i>Mahonia</i>)		

<i>Betula occidentalis</i>	Water Birch	3 mos. stratification. No treatment with light during germination may give equally good results (Association of Official Seed Analysts 1981; USDA Forest Service 1974).
<i>Bidens laevis</i>	Bur-marigold	No treatment.
<i>Bloomeria crocea</i>	Golden Stars	No treatment.
<i>Bloomeria humilis</i>	Dwarf Golden Stars	No treatment.
<i>Bolandra californica</i>	Sierra Bolandra	No treatment (Emery and Frey 1971).
<i>Bothriochloa barbinodis</i>	Silver Beardgrass, Cane Beardgrass	No treatment. Germination may be poor.
<i>Bouteloua curtipendula</i>	Side-oats Grama	No treatment. Freshly harvested cleaned seeds need 3-4 mos. dry storage before sowing.
<i>Bouteloua gracilis</i>	Blue Grama	No treatment.
<i>Boykinia elata</i>	Brook Foam	No treatment.
<i>Boykinia rotundifolia</i>	Round-leaf Boykinia	No treatment.
<i>Brickellia californica</i>	California Brickell Bush	No treatment. Germination may be poor.
<i>Brickellia frutescens</i>	Rigid Brickell Bush	No treatment.
<i>Brickellia incana</i>	White Brickell Bush	No treatment.
<i>Brodiaea</i> (see also <i>Dichelostemma</i> & <i>Triteleia</i>)		
<i>Brodiaea californica</i>	California Brodiaea	No treatment.

Scientific Name	Common Name	Recommended Treatment
<i>Brodiaea coronaria</i>	Harvest Brodiaea	No treatment.
<i>Brodiaea elegans</i>	Elegant Brodiaea, Harvest Brodiaea	No treatment.
<i>Brodiaea kinkiensis</i>	San Clemente Island Brodiaea	No treatment.
<i>Brodiaea minor</i>	Small Brodiaea	No treatment.
<i>Brodiaea stellaris</i>	Star-flowered Brodiaea	No treatment.
<i>Bromus breviaristatus</i>	Short Brome	No treatment.
<i>Bromus grandis</i>	Tall Brome	No treatment.
<i>Bromus laevipes</i>	Woodland Brome	No treatment.
<i>Bromus marginatus</i>	Mountain Brome	No treatment.
<i>Bromus maritimus</i>	Maritime Brome	No treatment.
<i>Bursera microphylla</i>	Elephant Tree	No treatment.
<i>Calamagrostis canadensis</i>	Bluejoint	No treatment; 5 days stratification may improve germination.
<i>Calamagrostis nutkaensis</i>	Pacific Reed-grass	No treatment.
<i>Calamagrostis rubescens</i>	Pine Grass	No treatment.
<i>Calliandra eriophylla</i>	Fairy Duster	Scarify or soak in tap water 12-24 hrs.

<i>Calocedrus decurrens</i>	Incense-cedar	2 mos. stratification; no treatment may give good germination [USDA Forest Service 1974].
<i>Calochortus albus</i>	Fairy Lantern, Globe Lily	No treatment.
<i>Calochortus amabilis</i>	Golden Fairy Lanterns	No treatment.
<i>Calochortus amoenus</i>	Rose Fairy Lanterns	No treatment.
<i>Calochortus catalinae</i>	Catalina Mariposa	No treatment.
<i>Calochortus clavatus</i>	Yellow Mariposa, Club-haired Mariposa	No treatment.
<i>Calochortus concolor</i>	Golden-bowl Mariposa	No treatment.
<i>Calochortus dunnii</i>	Dunn's Mariposa	No treatment.
<i>Calochortus greenii</i>	Greene's Mariposa	5-6 wks. stratification (Stan Farwig, personal communication 1983).
<i>Calochortus kennedyi</i>	Desert Mariposa	No treatment.
<i>Calochortus luteus</i>	Yellow Mariposa	No treatment.
<i>Calochortus macrocarpus</i>	Green-banded Star-tulip	5-6 wks. stratification (Stan Farwig, personal communication 1983).
<i>Calochortus persistens</i>	Siskiyou Mariposa	5-6 wks. stratification (Stan Farwig, personal communication 1983).
<i>Calochortus pulchellus</i>	Golden Lantern	No treatment.
<i>Calochortus splendens</i>	Lilac Mariposa	No treatment.
<i>Calochortus superbus</i>	Splendid Mariposa	No treatment.

Scientific Name	Common Name	Recommended Treatment	44
<i>Calochortus venustus</i>	White Mariposa, Butterfly Mariposa	No treatment.	
<i>Calochortus vestae</i>	Goddess Mariposa	No treatment.	
<i>Calochortus weedii</i>	Weed's Mariposa	No treatment.	
<i>Caltha howellii</i>	Marsh-marigold	No treatment.	
<i>Calycanthus occidentalis</i>	Spice Bush	3 mos. stratification.	
<i>Calyptridium monandrum</i>	Common Calyptridium	Oven (incubator) heat of 122°F for 7 days, then germinate in dark at a constant 51.8°F (Hall 1972).	
<i>Calyptridium parryi</i>	Parry's Calyptridium	Oven (incubator) heat of 122°F for 7 days, then germinate in dark at a constant 73.4°F (Hall 1972).	
<i>Calyptridium umbellatum</i>	Pussy Paws	1 mo. stratification.	
<i>Calystegia occidentalis</i>	Western Morning Glory	No treatment (Emery and Frey 1971).	
<i>Camassia leichtlinii</i> subsp. <i>suksdorfii</i>	Blue Camas	Sow seeds, enclose seed container in polyethylene bag and refrigerate at less than 41°F. Remove from refrigerator and plastic bag when germination starts or in 3 mos. Germination often poor.	
<i>Camassia quamash</i> subsp. <i>linearis</i>	Common Camas	Sow seeds, enclose seed container in polyethylene bag and refrigerate at less than 41°F. Remove from refrigerator and plastic bag when germination starts or in 3 mos.	
<i>Camissonia arenaria</i>	Longtubed-primrose	No treatment.	
<i>Camissonia cardiophylla</i>	Heartleaf-primrose	No treatment.	

<i>Camissonia cheiranthifolia</i>	Beach-primrose	No treatment.	
<i>Camissonia micrantha</i>	Small-primrose	No treatment gives some germination, oven heat of 248° to 302°F for 5 mins. more than doubles germination (Keeley and Keeley 1982).	
<i>Camissonia ovata</i>	Sun-cup, Golden Eggs	No treatment.	
<i>Camissonia tanacetifolia</i>	Tansy Sun-cup	No treatment.	
<i>Campanula prenanthoides</i>	California Harebell	No treatment.	
<i>Campanula rotundifolia</i>	Scotch Bluebell	No treatment. Seeds may need light for good germination [<i>Plants of the Southwest</i> 1984].	
<i>Cardionema ramosissimum</i>	Sandmat	No treatment.	
<i>Carex acuta</i>	Clustered Sedge	No treatment.	
<i>Carex obispoensis</i>	San Luis Sedge	Fire treatment (Emery and Frey 1971).	
<i>Carpenteria californica</i>	Bush-anemone, Carpenteria	No treatment. Sow thinly. Seedlings damp-off readily.	
<i>Cassia armata</i>	Armed Senna	No treatment.	
<i>Cassia covetii</i>	Hairy Senna	No treatment.	
<i>Castanopsis</i> [see <i>Chrysolepsis</i>]			
<i>Castela emoryi</i>	Crucifixion Thorn	No treatment.	

Scientific Name	Common Name	Recommended Treatment
<i>Castilleja affinis</i>	Indian Paintbrush	No treatment. Sow with seeds of an herbaceous perennial as some <i>Castilleja</i> species are obligate parasites. <i>Bouteloua gracilis</i> has been recommended as host.
<i>Castilleja foliolosa</i>	Woolly Paintbrush	No treatment. Sow with seeds of an herbaceous perennial as some <i>Castilleja</i> species are obligate parasites. <i>Bouteloua gracilis</i> has been recommended as host.
<i>Castilleja hololeuca</i>	Island Paintbrush	No treatment. Sow with seeds of an herbaceous perennial as some <i>Castilleja</i> species are obligate parasites. <i>Bouteloua gracilis</i> has been recommended as host.
<i>Castilleja miniata</i>	Great Red Paintbrush	No treatment. Sow with seeds of an herbaceous perennial as some <i>Castilleja</i> species are obligate parasites. <i>Bouteloua gracilis</i> has been recommended as host.
<i>Ceanothus arboreus</i>	Island Ceanothus	Hot water; then 2 mos. stratification may improve germination.
<i>Ceanothus X arcuatus</i>		Hot water and 3 mos. stratification.
<i>Ceanothus cordulatus</i>	Mountain Whitethorn, Snow Bush	Hot water and 3 mos. stratification. ³
<i>Ceanothus crassifolius</i>	Hoaryleaf Ceanothus	Hot water and 2-3 mos. stratification.
<i>Ceanothus cuneatus</i>	Buck Brush	Hot water and 3 mos. stratification. ³
<i>Ceanothus cyaneus</i>	San Diego Lilac	Hot water; then 3 mos. stratification may improve germination.
<i>Ceanothus dentatus</i>	Cropleaf Ceanothus	Hot water and 3 mos. stratification. Hot water only may give satisfactory germination.
<i>Ceanothus divergens</i>	Calistoga Ceanothus	Hot water; then 2-3 mos. stratification may improve germination.

<i>Ceanothus diversifolius</i>	Trailing Ceanothus	Hot water and 2-3 mos. stratification.
<i>Ceanothus ferrisae</i>	Coyote Ceanothus	Hot water; then 3 mos. stratification may improve germination.
<i>Ceanothus foliosus</i>	Wavyleaf Ceanothus	Hot water; then 3 mos. stratification may improve germination.
<i>Ceanothus fresnensis</i>	Fresno Mat	3 mos. stratification.
<i>Ceanothus gloriosus</i> var. <i>exaltatus</i>	Point Reyes Ceanothus, Navarro Ceanothus	Hot water; then 3 mos. stratification may improve germination.
<i>Ceanothus greggii</i> var. <i>perplexans</i>	Cupleaf Ceanothus	Hot water and 2-3 mos. stratification.
<i>Ceanothus griseus</i>	Carmel Ceanothus	Boil in water 1 min., cool immediately to room temperature, and sow.
<i>Ceanothus hearstiorum</i>	Hearst's Ceanothus	Hot water treatment.
<i>Ceanothus impressus</i>	Santa Barbara Ceanothus	Hot water and 2½-3 mos. stratification.
<i>Ceanothus incanus</i>	Coast Whitethorn	Hot water and 2-3 mos. stratification.
<i>Ceanothus integerrimus</i>	Deer Brush	Hot water and 2½-3 mos. stratification.
<i>Ceanothus jepsonii</i>	Jepson's Ceanothus	Hot water only gives poor to fair results; hot water and 3 mos. stratification may improve germination.
<i>Ceanothus lemmonii</i>	Lemmon's Ceanothus	Hot water and 3 mos. stratification. ⁴
<i>Ceanothus leucodermis</i>	Chaparral Whitethorn	Hot water and 1-3 mos. stratification. Hot water only may give satisfactory germination.

³ Alternative treatment: boil in water 1 min.; then, instead of stratification, soak in 400 ppm GA₃ 15 hrs., air dry 4 days, soak in 3% thiourea 5 mins. Seeds may then be sown or dried again and stored. (In tests, this quick treatment gave only 25%, 41%, and 48% germination, respectively, for *C. cordulatus*, *C. cuneatus*, and *C. lemmonii*.) This treatment not effective with *C. integerrimus* (Adams et al. 1961).

⁴ Same alternative treatment as for *Ceanothus cordulatus*.

Scientific Name	Common Name	Recommended Treatment
<i>Ceanothus maritimus</i>	Maritime Ceanothus	Hot water treatment.
<i>Ceanothus megacarpus</i>	Bigpod Ceanothus	Hot water treatment.
<i>Ceanothus oliganthus</i>	Hairy Ceanothus	Hot water treatment.
<i>Ceanothus palmeri</i>	Palmer's Ceanothus	Hot water and 2½-3 mos. stratification.
<i>Ceanothus papillosus</i> var. <i>roweanus</i>	Mount Tranquillon Ceanothus, Rowe's Ceanothus	Hot water and 2½-3 mos. stratification.
<i>Ceanothus parryi</i>	Parry's Ceanothus	Hot water and 3 mos. stratification.
<i>Ceanothus parvifolius</i>	Littleleaf Ceanothus	Hot water and 3 mos. stratification.
<i>Ceanothus prostratus</i>	Squaw Carpet, Squaw Mat, Mahala Mat	Hot water and 3½ mos. stratification (2½ mos. may be sufficient). Boiling in water ½ minute, cooling immediately, then 156 days stratification may give better germination (USDA Forest Service 1974); or 30 mins. in concentrated H ₂ SO ₄ then 2 mos. stratification (Heit 1971).
<i>Ceanothus prostratus</i> var. <i>occidentalis</i>	Western Squaw Carpet	Hot water and 2-3 mos. stratification.
<i>Ceanothus purpureus</i>	Hollyleaf Ceanothus	Hot water and 2-3 mos. stratification. Hot water alone may give satisfactory germination.
<i>Ceanothus ramulosus</i>	Coast Ceanothus	Hot water and 2½-3 mos. stratification. Hot water alone may give satisfactory germination.
<i>Ceanothus ramulosus</i> var. <i>fascicularis</i>	Lompoc Ceanothus	Hot water and 2 mos. stratification. Hot water alone may give satisfactory germination.

<i>Ceanothus rigidus</i>	Monterey Ceanothus	Hot water treatment.
<i>Ceanothus sanguineus</i>	Redstem Ceanothus	Hot water and 3 mos. stratification.
<i>Ceanothus soledadensis</i>	Jim Brush	Hot water, then 2-3 mos. stratification may improve germination.
<i>Ceanothus spinosus</i>	Greenbark Ceanothus	Hot water, then 2 mos. stratification may improve germination.
<i>Ceanothus thyrsiflorus</i>	Blue Blossom, Blue Brush	Hot water and 2-3 mos. stratification.
<i>Ceanothus tomentosus</i> var. <i>olivaceus</i>	Woollyleaf Ceanothus	Hot water treatment.
<i>Ceanothus velutinus</i>	Tobacco Brush	Hot water and 2-3 mos. stratification (USDA Forest Service 1974).
<i>Ceanothus velutinus</i> var. <i>hookeri</i>	Varnishleaf Ceanothus	Hot water and 2-3 mos. stratification.
<i>Ceanothus verrucosus</i>	Wartystem Ceanothus	Hot water, then 2-3 mos. stratification may improve germination.
<i>Celtis reticulata</i>	Hackberry	3-4 mos. stratification.
<i>Cephalanthus occidentalis</i> var. <i>californicus</i>	California Buttonbush, Buttonwillow	No treatment.
<i>Ceratoides lanata</i>	Winter Fat	No treatment.
<i>Cercidium floridum</i>	Palo Verde	No treatment may give satisfactory germination. Boil 1 min., scarify, or soak 3-4 hrs. in concentrated H ₂ SO ₄ ; one of these treatments may improve germination. Seedlings damp-off readily.
<i>Cercidium microphyllum</i>	Littleleaf Palo Verde	Scarification or hot water. Seedlings damp-off readily.

Scientific Name	Common Name	Recommended Treatment
<i>Cercis occidentalis</i>	Western Redbud	Hot water and 2 mos. stratification.
<i>Cercocarpus betuloides</i>	Mountain-mahogany, Western Mountain-mahogany	No treatment; 1-1½ mos. stratification may improve germination (Heit 1971; Hildreth and Johnson 1976).
<i>Cercocarpus intricatus</i>	Littleleaf-mahogany	2-3 mos. stratification.
<i>Cercocarpus ledifolius</i>	Desert-mahogany, Curleaf Mountain-mahogany	2-3 mos. stratification. ⁵
<i>Cercocarpus minutiflorus</i>	San Diego Mountain-mahogany	No treatment.
<i>Cereus giganteus</i>	Saguaro, Giant Cactus	No treatment. Germinate at above 70°F; also requires light during germination (USDA Forest Service 1974).
<i>Chaenactis artemisiaefolia</i>	Pincushion Flower	No treatment may give some germination. The addition of a small amount of charate over the sown seeds greatly improves germination (Keeley and Keeley 1982).
<i>Chamaebatia foliolosa</i>	Mountain Misery	3 mos. stratification. Easily propagated from underground stems.
<i>Chamaebatiaria millefolium</i>	Desert Sweet	Fresh seeds no treatment; stored seeds 3 mos. stratification
<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	No treatment; stratification may improve germination (USDA Forest Service 1974).
<i>Chamaecyparis nootkatensis</i>	Alaska-cedar	2½ mos. stratification [Babb 1959].
<i>Chenopodium californicum</i>	Soap Plant, Soaproot	No treatment.
<i>Chilopsis linearis</i>	Desert-willow	No treatment.
<i>Chlorogalum pomeridianum</i>	Common Soap Plant, Amole	No treatment.
<i>Chrysolepis</i> species	Chinquapin	No treatment; use fresh seeds.
<i>Chrysopsis villosa</i> (see <i>Heterotheca villosa</i>)		
<i>Chrysothamnus nauseosus</i>	Rabbitbrush	No treatment; 1-3 mos. stratification may hasten germination.
<i>Chrysothamnus nauseosus</i> subsp. <i>consimilis</i>		No treatment.
<i>Chrysothamnus viscidiflorus</i>	Sticky-leaf Rabbitbrush	No treatment.
<i>Claytonia perfoliata</i>	Miner's Lettuce	2 mos. stratification (Emery and Frey 1971).
<i>Claytonia sibirica</i>	Candy Flower	No treatment.
<i>Clematis</i> species	Clematis, Virgin's-bower	No treatment.
<i>Cleome isomeris</i>	Bladderpod	No treatment; fire treatment may improve germination.
<i>Clintonia andrewsiana</i>	Red Clintonia	Sow in sand and sphagnum moss 1:1; then 3 mos. cold, 3 mos. warm, and 3 mos. cold stratification. Germinate at about 70°F.
<i>Cneoridium dumosum</i>	Bushrue	1-2 mos. stratification.
<i>Colubrina californica</i>	California Colubrina	Hot water treatment.

⁵ Other methods for better germination: (1) soak in concentrated H₂SO₄ 5 mins, dry 24 hrs., then soak in 3% thiourea 4 hrs., then sow or air dry to store and sow later (Lacos and Noed 1961); (2) no treatment but diurnal fluctuation of 50° and 86°F; 16 and 8 hrs. respectively, during germination period; (3) soak in concentrated H₂SO₄ 10 mins — 1 mo. stratification hastens and increases uniformity of germination (Heit 1971).

Scientific Name	Common Name	Recommended Treatment
<i>Comarostaphylis diversifolia</i> var. <i>planifolia</i>	Summer-holly	Slightly green or fresh seeds no treatment. Stored seeds 3 mos. stratification.
<i>Condalia</i> [see <i>Ziziphus</i>]		
<i>Convolvulus</i> [see <i>Calystegia</i>]		
<i>Coreopsis bigelovii</i>	Bigelow's Coreopsis	Freshly harvested seeds need dry storage at 68 °F for 5-8 wks. before sowing (Capon and Van Asdall 1967).
<i>Coreopsis gigantea</i>	Giant Coreopsis	No treatment.
<i>Coreopsis maritima</i>	Sea-dahlia	No treatment.
<i>Corethrogyne filaginifolia</i> var. <i>robusta</i>	Cudweed-aster	No treatment.
<i>Cornus canadensis</i>	Bunchberry	1-2 mos. warm and 4-5 mos. cold stratification (USDA Forest Service 1974).
<i>Cornus nuttallii</i>	Mountain Dogwood, Western Dogwood	3-4 mos. stratification. Scarification or soaking in concentrated H ₂ SO ₄ 1 hr. first may improve germination. Fresh seeds may need no pre-treatment (USDA Forest Service 1948).
<i>Cornus stolonifera</i>	Creek Dogwood, American Dogwood	Soak in concentrated H ₂ SO ₄ 1 hr. and 3-4 mos. stratification (USDA Forest Service 1974). 2 mos. warm stratification in lieu of acid bath may give equally good germination. 3 mos. stratification only may also give good germination (Peterson 1953).
<i>Corylus cornuta</i> var. <i>californica</i>	Hazelnut	2-3 [-6] mos. stratification; use fresh seeds.

<i>Cowania mexicana</i> var. <i>stansburiana</i>	Cliff-rose	No treatment; sow outdoors in fall. For maximum germination, needs diurnal fluctuation from 50° to 86 °F. One mo. stratification first hastens germination (Heit 1971) or 2½ mos. stratification (Stidham <i>et al.</i> 1980).
<i>Crataegus douglasii</i>	Hawthorn	Scarify or soak in concentrated H ₂ SO ₄ for 2-3 hrs., and stratify 3-4 mos. For fresh dried fruit, soak in water 2-3 days to soften, remove pulp and sow immediately; this has given fair germination (Heit 1971).
<i>Crossosoma bigelovii</i>	Bigelow's Crossosoma	No treatment.
<i>Crossosoma californicum</i>	Catalina Crossosoma	No treatment.
<i>Croton californicus</i>	Croton	No treatment (Emery and Frey 1971).
<i>Cryptantha muricata</i>	White Forget-me-not	No treatment gives some germination. The addition of a small amount of charate over the sown seeds significantly improves germination (Keeley and Keeley 1982).
<i>Cupressus species</i>	Cypress	No treatment gives sporadic germination; 1 mo. stratification may improve the uniformity. Percent viable seeds frequently very low.
<i>Cuscuta campestris</i>	Field Dodder	Store seed outdoors protected from rain and sun for 12 mos.; dry storage in refrigerator for 12 mos. gives fair results; germinate at minimum of 70 °F (Hutchison 1976).
<i>Cynoglossum grande</i>	Western Hound's Tongue	No treatment (Emery and Frey 1971).
<i>Dalea</i> (see also <i>Psoralea</i>)		
<i>Dalea parryi</i>	Parry's Dalea	No treatment.

Scientific Name	Common Name	Recommended Treatment	54
<i>Danthonia californica</i>	California Oatgrass, American Oatgrass	No treatment.	
<i>Darlingtonia californica</i>	California Pitcher-plant	No treatment.	
<i>Darmera peltatum</i>	Indian Rhubarb	No treatment. Use fresh seeds.	
<i>Datisca glomerata</i>	Durango Root	No treatment.	
<i>Datura wrightii</i>	Jimson-weed, Toloache	No treatment (Everett 1957).	
<i>Delphinium californicum</i>	Tall Larkspur	No treatment.	
<i>Delphinium cardinale</i>	Scarlet Larkspur	No treatment; ½-1 mo. stratification or germination in darkness may improve results.	
<i>Delphinium nudicaule</i>	Red Larkspur	No treatment; 1 mo. stratification may improve germination.	
<i>Delphinium parishii</i>	Parish's Larkspur	2 wks. stratification.	
<i>Delphinium parryi</i>	Parry's Larkspur	No treatment.	
<i>Delphinium purpusii</i>	Kern County Larkspur	2 mos. stratification. No treatment may give satisfactory germination.	
<i>Delphinium variegatum</i> subsp. <i>apiculatum</i>	Royal Larkspur	No treatment.	
<i>Dendromecon rigida</i> subsp. <i>harfordii</i>	Northern Island Bush Poppy	Fire treatment or 1½ mos. stratification (Hildreth and Johnson 1976). 3 mos. stratification with a diurnal fluctuation from 46° to 70°F may improve germination. More easily propagated from stem cuttings in winter with intermittent mist and bottom heat.	

<i>Dendromecon rigida</i> subsp. <i>rigida</i>	Bush Poppy	Fire treatment or 2 mos. stratification (Emery and Frey 1971). 3 mos. stratification with a diurnal fluctuation from 46° to 70°F may improve germination. More easily propagated from stem cuttings in winter with intermittent mist and bottom heat.
<i>Deschampsia caespitosa</i>	Tufted Hairgrass	No treatment.
<i>Deschampsia elongata</i>	Slender Hairgrass	No treatment.
<i>Dicentra chrysantha</i>	Golden Eardrops	Fire treatment. Soaking in 400 ppm GA ₃ 24 hrs. may give better germination (Betty Atwater, personal communication 1981).
<i>Dicentra formosa</i>	Bleeding Heart	3 mos. stratification.
<i>Dicentra ochroleuca</i>	Silver Eardrops, Cream-flowered Eardrops	Fire treatment. Soaking in 400 ppm GA ₃ overnight (16+ hrs.) may give better germination (Betty Atwater, personal communication 1981).
<i>Dichelostemma congestum</i>	Ookow	Sow outdoors in fall. Optimum germination requires wide diurnal fluctuation (40° to 80°F), light not critical (Keator 1968).
<i>Dichelostemma ida-maia</i>	Firecracker Brodiaea	Optimum germination requires 40°F [constant] and no light or a wide diurnal fluctuation (40° to 80°F) and no light (Keator 1968). Sowing outdoors in fall and excluding light may give satisfactory germination.
<i>Dichelostemma parviflorum</i>	Many-flowered Brodiaea	1½ mos. stratification or germination with a wide diurnal fluctuation (40° to 80°F) (Keator 1968). Sowing outdoors in fall may give satisfactory germination.
<i>Dichelostemma pulchellum</i>	Blue Dicks, Wild-hyacinth	1 mo. stratification (Keator 1968). No treatment for fall sown seeds may give satisfactory germination.

Scientific Name	Common Name	Recommended Treatment
<i>Dichelostemma venustum</i>	Rose Firecracker Flower	Optimum germination requires 40°F constant with 8 hrs. light per day or a wide diurnal fluctuation from 40° to 80°F with no light [Keator 1968]. Sowing outdoors in fall excluding light may give satisfactory germination.
<i>Dichelostemma volubile</i>	Snake Lily, Twining Brodiaea	Optimum germination requires 40°F constant with 8 hrs. light per day or a wide diurnal fluctuation from 40° to 80°F (Keator 1968). Sowing outdoors in fall may give satisfactory germination.
<i>Dichondra repens</i>	Dichondra	No treatment.
<i>Diplacus</i> (see <i>Mimulus</i>)		
<i>Diplacus parviflorus</i> (see <i>Mimulus flemingii</i>)		
<i>Dirca occidentalis</i>	Western Leatherwood	3 mos. stratification.
<i>Disporum smithii</i>	Smith's Fairybells	2½-3 mos. stratification.
<i>Dodecatheon alpinum</i>	Alpine Shooting Stars	1-3 mos. stratification.
<i>Dodecatheon clevelandii</i>	Cleveland's Shooting Stars	No treatment.
<i>Dodecatheon pulchellum</i>	Red-flowered Shooting Stars	1-3 mos. stratification.
<i>Dudleya caespitosa</i>	Sand-lettuce	No treatment.
<i>Dudleya edulis</i>	Nuttall's Dudleya	No treatment.
<i>Dudleya farinosa</i>	Powdery Dudleya	No treatment.
<i>Dudleya greenii</i>	Greene's Dudleya	No treatment.

<i>Dudleya lanceolata</i>	Rock-lettuce	No treatment.
<i>Dudleya pulverulenta</i>	Chalk Dudleya	No treatment.
<i>Dudleya traskiae</i>	Santa Barbara Island Live-forever	No treatment.
<i>Dudleya variegata</i>	Variegated Dudleya	No treatment.
<i>Dudleya virens</i>	Bright-green Live-forever	No treatment.
<i>Dudleya viscida</i>	Sticky Dudleya	No treatment.
<i>Elymus canadensis</i>	Canadian Rye	2 wks. stratification.
<i>Elymus cinereus</i>	Ashy Rye	No treatment.
<i>Elymus condensatus</i>	Giant Rye	No treatment.
<i>Elymus glaucus</i>	Blue Rye, Western Rye	No treatment.
<i>Elymus triticoides</i>	Alkali Rye	No treatment. Germination may be poor.
<i>Emmenanthe penduliflora</i>	Whispering Bells	Oven heat of 500°F for 10 mins. or 375°F for 30 mins. gives best germination. No treatment but addition of a small amount of charate over the sown seeds gives good results* [Keeley and Keeley 1982]. In late fall, scarification or fire treatment [Jones and Schlesinger 1980; Wicklow 1977].
<i>Encelia</i> species	Bush Sunflower	No treatment. Germination may be poor.
<i>Enceliopsis covillei</i>	Panamint Daisy	No treatment.
<i>Ephedra nevadensis</i>	Green Ephedra	Hot water and 3 wks. stratification.

* Even with the use of charate, the percent germination varies, depending on the seed bed medium used [Keeley and Nitzberg 1984].

Scientific Name	Common Name	Recommended Treatment
<i>Ephedra viridis</i>	Mormon Tea, Mountain Tea	1 mo. stratification. No treatment gives nearly as good results (Stidham <i>et al.</i> 1980).
<i>Epilobium adenocaulon</i>	Willow-herb	No treatment.
<i>Epilobium angustifolium</i>	Fireweed	No treatment; 1 mo. stratification may improve germination (McLean 1967).
<i>Eriastrum densifolium</i> subsp. <i>austromontanum</i>	Mesa-phlox	No treatment.
<i>Erigeron aphanactis</i>	Basin Rayless Daisy	No treatment.
<i>Erigeron foliosus</i> var. <i>covillei</i>	Coville's Leafy Daisy	No treatment.
<i>Erigeron glaucus</i>	Seaside Daisy	No treatment.
<i>Erigeron sanctarum</i>	Saint's Daisy	No treatment.
<i>Eriodictyon</i> <i>crassifolium</i>	Thickleaf Yerba Santa	Oven heat of 194°F for 5 mins. (Went <i>et al.</i> 1952). ⁷
<i>Eriodictyon traskiae</i> subsp. <i>smithii</i>	Trask's Yerba Santa	Fire treatment gives some germination. Oven heat of 194°F for 5 mins. might improve germination. ⁷
<i>Eriodictyon trichocalyx</i>	Hairy Yerba Santa	Oven heat of 194°F for 5 mins. (Went <i>et al.</i> 1952). ⁷
<i>Eriogonum arborescens</i>	Santa Cruz Island Buckwheat	No treatment.
<i>Eriogonum cinereum</i>	Ashyleaf Buckwheat	No treatment.
<i>Eriogonum crocatum</i>	Saffron Buckwheat	No treatment.

<i>Eriogonum elongatum</i>	Long-stemmed Buckwheat	No treatment.
<i>Eriogonum fasciculatum</i>	California Buckwheat	No treatment.
<i>Eriogonum giganteum</i>	Saint Catherine's Lace	No treatment.
<i>Eriogonum grande</i> var. <i>grande</i>	Northern Island Buckwheat	No treatment.
<i>Eriogonum grande</i> var. <i>rubescens</i>	Red-flowered Buckwheat	No treatment.
<i>Eriogonum inflatum</i>	Desert Trumpet	No treatment; leaching in running water for 24 hrs. may improve germination (Stone and Mason, Jr. 1979).
<i>Eriogonum kennedyi</i>	Kennedy Buckwheat	No treatment.
<i>Eriogonum latifolium</i>	Beach Buckwheat	No treatment.
<i>Eriogonum nudum</i>	Naked Buckwheat	No treatment.
<i>Eriogonum ovalifolium</i>	Subalpine Buckwheat	No treatment. Germinate outdoors in cold weather.
<i>Eriogonum parvifolium</i>	Dune Buckwheat, Seacliff Buckwheat	No treatment.
<i>Eriogonum umbellatum</i>	Sulphur-flowered Buckwheat	3 mos. stratification; no treatment may give fair germination.
<i>Eriogonum umbellatum</i> subsp. <i>stellatum</i>		3 mos. stratification.

⁷ Alternative treatment for *Eriodictyon* species: soak seeds 24 hrs. in 1,000 ppm potassium gibberellate ("Gibrel" growth substance; Merck & Co., Chem. Div. Rahway, N.J.), then sow or dry and store in refrigerator for up to 6 mos. before sowing (Francis Ching, personal communication 1962).

Scientific Name	Common Name	Recommended Treatment
<i>Eriogonum wrightii</i>	Wright's Buckwheat	No treatment.
<i>Eriophyllum confertiflorum</i>	Golden Yarrow	No treatment may give satisfactory germination depending on the seed bed medium (Keeley and Nitzberg 1984). Addition of a small amount of charate over the sown seeds greatly improves germination; baking the seeds at 248 °F for 5 mins. first further improves germination. Combined treatment has synergistic effect (Keeley and Keeley 1982).
<i>Eriophyllum lanatum</i> var. <i>arachnoideum</i>	Woolly Daisy	No treatment (Everett 1957).
<i>Eriophyllum nevinii</i>	Catalina Silver-lace	No treatment; leaching in running water for 24 hrs. before sowing may improve germination.
<i>Eriophyllum staechadifolium</i> var. <i>depressum</i>	Seaside Golden Yarrow	No treatment.
<i>Eriophyllum wallacei</i>	Wallace's Woolly Daisy	Store fresh seeds from 2 wks. at 122 °F to 5 mos. at 68 °F before sowing (Capon and Van Asdall 1967).
<i>Eryngium armatum</i>	Coyote-thistle	No treatment (Emery and and Frey 1971).
<i>Erysimum franciscanum</i>	San Francisco Wallflower	No treatment.
<i>Erysimum insulare</i>	Island Wallflower	No treatment.
<i>Erysimum suffrutescens</i> var. <i>lompocense</i>	San Luis Obispo Wallflower	No treatment.

<i>Erythronium grandiflorum</i> var. <i>pallidum</i>	Small-flowered Fawn Lily	3½-4 mos. stratification.
<i>Erythronium hendersonii</i>	Purple Fawn Lily	2 wks. warm, then 3 mos. cold stratification.
<i>Erythronium oregonum</i>	Oregon Fawn Lily	3 mos. stratification.
<i>Erythronium revolutum</i>	Coast Fawn Lily	3 mos. stratification.
<i>Erythronium tuolumnense</i>	Tuolumne Fawn Lily	2-3 mos. stratification.
<i>Eschscholzia californica</i>	California Poppy	No treatment.
<i>Eucnide urens</i>	Rock-nettle	No treatment.
<i>Euonymus occidentalis</i>	Western Burningbush	3 mos. stratification.
<i>Euphorbia polycarpa</i>	Small-seeded Sandmat	Store fresh seeds from 2-3 wks. at 122 °F to 5 mos. at 68 °F before sowing (Capon and Van Asdall 1967). This gives some germination.
<i>Eurotia lanata</i> (see <i>Ceratoides lanata</i>)		
<i>Fallugia paradoxa</i>	Apache Plume	No treatment.
<i>Ferocactus acanthodes</i>	California Barrel Cactus	No treatment; optimum germination temperature 84.2 °F constant (Jordan and Nobel 1981).
<i>Ferocactus viridescens</i>	Coast Barrel Cactus	No treatment.
<i>Festuca californica</i>	California Fescue	No treatment.

Scientific Name	Common Name	Recommended Treatment
<i>Festuca idahoensis</i>	Blue Bunchgrass, Idaho Fescue	No treatment.
<i>Festuca occidentalis</i>	Western Fescue	No treatment.
<i>Festuca rubra</i>	Red Fescue	No treatment. Freshly harvested seeds need 5 days stratification (Association of Official Seed Analysts 1981), or dry storage for 1-2 mos. before sowing (Crocker and Barton 1957).
<i>Forestiera neomexicana</i>	Desert Olive	No treatment; 1 mo. stratification may improve germination.
<i>Forsellesia nevadensis</i>	Nevada Grease-bush	Hot water treatment (Emery and Frey 1971).
<i>Fouquieria splendens</i>	Ocotillo	No treatment.
<i>Fragaria species</i>	Strawberry	No treatment. Germination may be hastened by 2½-3 mos. stratification.
<i>Frankenia salina</i>	Alkali-Heath	No treatment (Emery and Frey 1971).
<i>Frasera parryi</i>	Parry's Fräsera, Green-gentian	No treatment. Sow in cool months.
<i>Frasera speciosa</i>	Giant Fräsera, Monument Plant	4 mos. stratification.
<i>Fraxinus dipetala</i>	Foothill Ash, Flowering Ash	3 mos. stratification.
<i>Fraxinus latifolia</i>	Oregon Ash	3 mos. stratification.
<i>Fraxinus velutina</i> var. <i>coriacea</i>	Leather-leaf Ash	3 mos. stratification.

<i>Fremontodendron californicum</i>	Fremontia, Flannel Bush	Hot water, and 2-3 mos. stratification.
<i>Fremontodendron mexicanum</i>	Southern Fremontia	Hot water, and 2-3 mos. stratification. Hot water only may give satisfactory germination.
<i>Fritillaria agrestis</i>	Stink Bells	No treatment.
<i>Fritillaria biflora</i>	Chocolate-lily, Mission Bells	No treatment.
<i>Fritillaria liliacea</i>	White Fritillary	No treatment.
<i>Fritillaria pluriflora</i>	Fragrant Fritillary, Adobe-lily	No treatment.
<i>Fritillaria roderickii</i>	Roderick's Fritillary	No treatment.
<i>Fritillaria striata</i>	Striped Adobe-lily	No treatment.
<i>Galvezia speciosa</i>	Bush Snapdragon, Island Snapdragon	No treatment.
<i>Garrya buxifolia</i>	Dwarf Silk-tassel, Boxleaf Silk-tassel	3 mos. stratification (Emery and Frey 1971).
<i>Garrya elliptica</i>	Coast Silk-tassel	3 mos. stratification.
<i>Garrya flavescens</i> var. <i>pallida</i>	Pale Silk-tassel	3½-4 mos. stratification.
<i>Garrya fremontii</i>	Fremont's Silk-tassel	3 mos. warm and 3 mos. cold stratification (USDA Forest Service 1948).

Scientific Name	Common Name	Recommended Treatment
<i>Gaultheria shallon</i>	Salal	No treatment. Best sown on milled sphagnum moss.
<i>Gentiana calycosa</i>	Explorer's Gentian	4 mos. stratification.
<i>Gentiana sceptrum</i>	King's Gentian	3 mos. stratification.
<i>Geraea canescens</i>	Desert Sunflower	Store fresh seeds from 1-2 wks. at 122 °F to 5 mos. at 68 °F before sowing [Capon and Van Asdall 1967].
<i>Gernium oregonum</i>	Oregon Geranium, Cranesbill	No treatment.
<i>Geum macrophyllum</i>	Bigleaf Avens	No treatment (Emery and Frey 1971).
<i>Gilia capitata</i>	Ball Gilia	No treatment; 2 wks. stratification improves germination (Grant 1949).
<i>Gnaphalium bicolor</i>	Bicolored Everlasting	No treatment (Mirov 1945).
<i>Grayia spinosa</i>	Spiny Hop-sage	No treatment; best germination occurs at 41 °F constant. Wide diurnal fluctuation from 50° to 86 °F also gives good germination (Heit 1971). Two to 3 mos. stratification may also give good results.
<i>Grindelia camporum</i>	Great Valley Gum Plant	No treatment.
<i>Grindelia robusta</i>	Gum Plant	No treatment.
<i>Gutierrezia californica</i>	San Joaquin Matchweed	No treatment.
<i>Gutierrezia sarothrae</i>	Common Matchweed, Snakeweed	No treatment.
<i>Haploppapus</i> species	Goldenbush	No treatment for lowland species. Some montane species such as <i>H. discoideum</i> need 3 mos. stratification.

<i>Helenium bigelovii</i>	Bigelow's Sneezeweed	No treatment.
<i>Helenium puberulum</i>	Rosilla, Sneezeweed	No treatment (Emery and Frey 1971).
<i>Helianthella californica</i>	California Helianthella	No treatment (Emery and Frey 1971).
<i>Helianthemum greenei</i>	Island Rush-rose	No treatment.
<i>Helianthemum scoparium</i>	Rush-rose, Rock-rose	No treatment; oven heat of 248 °F for 5 mins. before sowing nearly doubles germination (Keeley and Keeley 1982).
<i>Helianthus californicus</i>	California Sunflower	No treatment.
<i>Helianthus gracilentus</i>	Slender Sunflower	No treatment.
<i>Hemizonia clementina</i>	San Clemente Island Tarweed	No treatment. Germination may be poor.
<i>Heracleum sphondylium</i> subsp. <i>montanum</i>	Cow Parsnip	No treatment.
<i>Hesperocallis undulata</i>	Desert Lily	No treatment.
<i>Hesperochiron californicus</i>	California Hesperochiron	3 mos. stratification.
<i>Hesperochiron pumilus</i>	Dwarf Hesperochiron	3 mos. stratification.
<i>Heteromeles arbutifolia</i>	Toyon, Christmas Berry	Fresh seeds no treatment; stored seed 3 mos. stratification.
<i>Heterotheca villosa</i>	Golden-aster	No treatment [Emery and Frey 1971].
<i>Heuchera duranii</i>	Duran's Alum-root	No treatment.

Scientific Name	Common Name	Recommended Treatment
<i>Heuchera elegans</i>	Urn-flowered Alum-root	No treatment.
<i>Heuchera maxima</i>	Island Alum-root	No treatment.
<i>Heuchera micrantha</i>	Crevice Heuchera, Small-flowered Alum-root	No treatment.
<i>Heuchera rubescens</i> var. <i>rydbergiana</i>	Pink Alum-root	No treatment.
<i>Hibiscus californicus</i>	California Rose-mallow	No treatment; soaking in warm water for 24 hrs. may improve or hasten germination.
<i>Hieracium albiflorum</i>	White Hawkweed	No treatment; 3 mos. stratification may improve germination (McLean 1967).
<i>Hierochloa occidentalis</i>	Vanilla Grass	No treatment.
<i>Hilaria jamesii</i>	James' Galleta	No treatment.
<i>Hilaria rigida</i>	Galleta	No treatment.
<i>Holocantha</i> (see <i>Castela</i>)		
<i>Holodiscus discolor</i>	Cream Bush, Ocean Spray	4½ mos. stratification (USDA Forest Service 1974).
<i>Holodiscus microphyllus</i>	Small-leaf Cream Bush	3 mos. stratification.
<i>Hordeum brachyantherum</i>	Meadow Barley	No treatment.
<i>Hordeum californicum</i>	California Barley	No treatment.
<i>Horkelia californica</i>	Honey Dew	No treatment.

<i>Horkelia cuneata</i>	Lindley Cinquefoil, Wedgeleaved Horkelia	No treatment.
<i>Hulsea heterochroma</i>	Red-rayed Hulsea	No treatment; sow in cool months.
<i>Hydrocotyle ranunculoides</i>	Floating Marsh Pennywort	No treatment (Emery and Frey 1971).
<i>Hydrophyllum occidentale</i>	California Waterleaf	No treatment (Emery and Frey 1971).
<i>Hymenoclea salsola</i>	Cheese Bush, White Burrobush	No treatment.
<i>Hymenoxys acaulis</i> var. <i>arizonica</i>	Arizona Goldflower	No treatment.
<i>Hymenoxys cooperi</i>	Cooper's Goldflower	No treatment.
<i>Hystrix californica</i>	California Bottlebrush Grass	No treatment.
<i>Impetata brevifolia</i>	Satintail	No treatment.
<i>Ipomopsis aggregata</i>	Scarlet Gilia, Sky Rocket Gilia	No treatment (<i>Plants of the Southwest</i> 1984).
<i>Iris bracteata</i>	Siskiyou Iris	No treatment. Sow in early fall outdoors.
<i>Iris douglasiana</i>	Douglas Iris	No treatment. Sow in early fall outdoors.
<i>Iris innominata</i>	Oregon Iris	No treatment. Sow in early fall outdoors.

Scientific Name	Common Name	Recommended Treatment
<i>Iris longipetala</i>	Long-petaled Iris, Coast Iris	No treatment. Sow in early fall outdoors.
<i>Iris macrospira</i>	Bowl-tubed Iris	No treatment. Sow in early fall outdoors.
<i>Iris munzii</i>	Munz' Iris	No treatment. Sow in early fall outdoors.
<i>Isomeris arborea</i> (see <i>Cleome isomeris</i>)		
<i>Juglans californica</i>	Southern California Black Walnut	22½ wks. stratification (USDA Forest Service 1974). Some fresh seeds may need only 2-3 mos.; thus germinating seeds should be removed and planted at periodic inspections.
<i>Juglans hindsii</i>	California Black Walnut	22½ wks. stratification; soaking seeds at 190°F for 1½-2 mins. first may reduce stratification time (USDA Forest Service 1974).
<i>Juncus acutus</i> var. <i>sphaerocarpus</i>	Spiny Rush	No treatment.
<i>Juncus lesueurii</i>	Salt Rush	No treatment.
<i>Juncus patens</i>	Common Rush	No treatment.
<i>Juniperus californica</i>	California Juniper	3-4 mos. stratification.
<i>Juniperus osteosperma</i>	Utah Juniper, Desert Juniper	3 mos. warm [diurnal fluctuation from 68° to 86°F], and 3 mos. cold stratification (USDA Forest Service 1974).
<i>Justicia californica</i>	Chuparosa	No treatment.
<i>Kalmia polifolia</i> var. <i>microphylla</i>	Alpine-laurel	No treatment.
<i>Keckiella antirrhinoides</i>	Yellow Penstemon	No treatment (Emery and Frey 1971).

<i>Keckiella breviflora</i>	Gaping Penstemon	No treatment.
<i>Keckiella cordifolia</i>	Climbing Penstemon	No treatment.
<i>Keckiella corymbosa</i>	Redwood Penstemon	No treatment.
<i>Kochia americana</i>	Red-sage, Green-molly	No treatment (Emery and Frey 1971).
<i>Koeleria cristata</i>	Koeleria, June Grass	No treatment.
<i>Larrea tridentata</i>	Creosote Bush	Soak, preferably in distilled water, overnight; germinate in dark under hot bed conditions (optimum temperature 73°F constant). Germination percentage may be low. Germinating seedlings intolerant of water stress (Barbour 1968; Mabry <i>et al.</i> 1977).
<i>Lathyrus splendens</i>	Pride of California, Campo Pea	Scarification. No treatment (Lenz 1956) may give satisfactory germination.
<i>Lathyrus sulphureus</i>	Brewer's Sweet Pea	Hot water or scarification.
<i>Lathyrus vestitus</i>	Wild Sweet Pea	No treatment.
<i>Lavatera assurgentiflora</i>	Island Bush Mallow, Malva Rosa	No treatment. Germination often poor.
<i>Ledum glandulosum</i>	Labrador-tea	No treatment. Germinate in shade; keep seed bed quite moist.
<i>Lepechinia calycina</i>	Pitcher Sage	Hot water treatment, then 3 mos. stratification may improve germination.
<i>Lepidium lasiocarpum</i>	Sand Peppergrass	Store fresh seeds at 122°F for 2 wks. before sowing (Capon and Van Asdall 1967).

Scientific Name	Common Name	Recommended Treatment
<i>Lepidospartum squamatum</i>	Scale Broom	No treatment.
<i>Leptodactylon californicum</i>	Prickly-phlox	No treatment.
<i>Lewisia</i> species	Lewisia	Sow outdoors in late fall [maximum temperature must be less than 50°F for good germination]; or enclose in polyethylene bag with moist peat moss or vermiculite in refrigerator for 3-4 mos. Remove and pot germinating seeds bi-weekly. Germination starts in 1½-3 mos.
<i>Libocedrus</i> [see <i>Calocedrus</i>]		
<i>Ligusticum apiifolium</i>	Lovage	No treatment.
<i>Lilium</i> species	Lily	Sow outdoors in summer for germination the following spring, or 3-6 mos. warm then 2-3 mos. cold stratification. Seeds of <i>L. humboldtii</i> , <i>L. parvum</i> , and <i>L. washingtonianum</i> may also give good germination by spring if sown outdoors in early fall. ^a
<i>Linanthus nuttallii</i> subsp. <i>floribundus</i>	Bush-gilia	No treatment.
<i>Linum lewisii</i>	Western Blue Flax	No treatment.
<i>Lithocarpus densiflora</i>	Tanbark Oak	No treatment; use fresh seeds.
<i>Lobelia cardinalis</i> subsp. <i>graminea</i>	Scarlet Lobelia	No treatment.
<i>Lobelia dunnii</i> var. <i>serrata</i>	Blue Lobelia	No treatment.
<i>Lomatium californicum</i>	Chuchupate	No treatment.

<i>Lomatium insulare</i>	Island Lomatium, Island Biscuitroot	No treatment.
<i>Lonicera conjugialis</i>	Double Honeysuckle	3 mos. stratification.
<i>Lonicera hispidula</i> var. <i>vacillans</i>	California Honeysuckle	1 mo. stratification.
<i>Lonicera interrupta</i>	Chaparral Honeysuckle	2½-3 mos. stratification.
<i>Lonicera johnstonii</i>	Southern Honeysuckle, Santa Barbara Honeysuckle	3 mos. stratification.
<i>Lotus argophyllus</i> var. <i>omithopus</i>	Silver Lotus	Hot water treatment.
<i>Lotus crassifolius</i>	Buck Lotus	Hot water treatment.
<i>Lotus dendroideus</i>	Island Deerweed	Hot water. No treatment may give satisfactory germination.
<i>Lotus grandiflorus</i>	Chaparral Lotus	Hot water treatment.
<i>Lotus hamatus</i>	Small-flowered Lotus	No treatment. Hot water treatment may improve germination.
<i>Lotus heermannii</i>	Woolly Lotus	No treatment.
<i>Lotus purshianus</i>	Spanish-clover	Hot water treatment.
<i>Lotus scoparius</i>	Deerweed	Hot water for fruit or cleaned seed.
<i>Lotus strigosus</i>	Bishop's Lotus	Hot water treatment.

^a For forcing slightly green or fresh seeds: 6-8 wks. warm (70°F) stratification or until the majority of seeds have formed bulblets, then 4-6 wks. cold (about 35°F) stratification, sow, and at 55° to 60°F leaves should be produced in 4-6 wks. [De Graaff 1951].

Scientific Name	Common Name	Recommended Treatment
<i>Ludwigia peploides</i>	Marsh Purslane	No treatment.
<i>Lupinus bicolor</i>	Miniature Lupine	Fresh seeds no treatment. Stored seeds scarification or hot water; no treatment may give fair germination.
<i>Lupinus hirsutissimus</i>	Nettle Lupine, Stinging Lupine	Fresh seeds no treatment. Stored seeds scarification or hot water; no treatment may give fair germination.
<i>Lupinus nanus</i>	Sky Lupine	Fresh seeds no treatment. Stored seeds scarification or hot water; no treatment may give fair germination.
<i>Lupinus stiversii</i>	Harlequin Lupine	Fresh seeds no treatment. Stored seeds scarification or hot water; no treatment may give fair germination.
<i>Lupinus succulentus</i>	Succulent Lupine	Hot water, scarification, or soak in concentrated H ₂ SO ₄ 6-8 hrs.
<i>Lupinus truncatus</i>	Truncate Lupine	Fresh seeds no treatment. Stored seeds scarification or hot water; no treatment may give fair germination.
<i>Lupinus</i> species (herbaceous perennial & shrub species)	Lupine	Fresh seeds no treatment; stored seeds scarification or hot water.
<i>Lycium andersonii</i>	Anderson's Box-thorn	No treatment.
<i>Lycium brevipes</i>	Desert Thorn	No treatment; 2-4 mos. stratification may improve germination.
<i>Lycium pallidum</i> var. <i>oligospermum</i>	Tomatilla, Rabbit Thorn	No treatment.
<i>Lycium torreyi</i>	Squaw Thorn, Torrey Desert Thorn	No treatment.

<i>Lyonothamnus floribundus</i> subsp. <i>asplenifolius</i>	Santa Cruz Island Ironwood	Place seeds in about 6 times their volume of 140°F water then let cool about 45 mins. before sowing [Maunsell Van Rensselaer correspondence to Howard McMinn 1947]. No treatment gives fair germination.
<i>Lyonothamnus floribundus</i> subsp. <i>floribundus</i>	Catalina Ironwood	No treatment.
<i>Lysichiton americanum</i>	Yellow Skunk-cabbage	No treatment.
<i>Machaeranthera canescens</i>	Mountain-aster	No treatment.
<i>Machaeranthera tortifolia</i> [see <i>Xylothiza tortifolia</i>]		
<i>Mahonia amplexans</i>	Dwarf Barberry	3 mos. stratification.
<i>Mahonia aquifolium</i>	Oregon-grape, Hollyleaf Mahonia	4-6 mos. warm then 3-4 mos. cold stratification (Heit 1971). Three mos. stratification may give satisfactory results.
<i>Mahonia fremontii</i>	Desert Barberry	No treatment [USDA Forest Service 1974]; 3 mos. stratification may improve germination.
<i>Mahonia haematocarpa</i>	Red Barberry, Desert Barberry	No treatment [USDA Forest Service 1974]; 3 mos. stratification may improve germination.
<i>Mahonia higginsae</i>	Higgins Barberry	No treatment; 3 mos. stratification may improve germination.
<i>Mahonia nervosa</i>	Longleaf Mahonia	3-7 mos. stratification may give satisfactory germination.*

* The following alternative treatment may improve germination: 30 days cold, 60 days warm, and 196 days cold stratification. During this last period, remove and pot germinating seeds bimonthly. Some additional germination will occur after the remaining seeds are sown, preferably in a cool location, i.e. outdoors in early spring [McLean 1967]. It has been suggested that *Mahonia nervosa* and *Mahonia pumila* need no treatment if the seeds are kept moist from the time they are cleaned until sown; they should be stored moist (stratified) for 7 mos. in the refrigerator for spring sowing [Eugene Bacia, personal communication 1964].

Scientific Name	Common Name	Recommended Treatment
<i>Mahonia nevinii</i>	Nevin Barberry	2½-3 mos. stratification.
<i>Mahonia pinnata</i>	Shinyleaf Barberry	3 mos. stratification.
<i>Mahonia piperiana</i>	Piper Barberry	3 mos. stratification may give fair germination. ⁹
<i>Mahonia pumila</i>	Dwarf Barberry	3-7 mos. stratification may give satisfactory germination. ⁹
<i>Mahonia repens</i>	Creeping Barberry, Creeping Mahonia	3-7 mos. stratification may give satisfactory germination. Easily propagated from divisions in spring or fall. ⁹
<i>Malacothrix incana</i>	Dune Malacothrix	No treatment.
<i>Malacothrix saxatilis</i> var. <i>implicata</i>	Cliff-aster	No treatment gives slow and sporadic germination.
<i>Malosma laurina</i>	Laurel Sumac	Hot water or oven heat of 200° to 240°F for 5 mins. (Wright 1931).
<i>Malus fusca</i>	Oregon Crab-apple	3 mos. stratification (Emery and Frey 1971).
<i>Mammillaria microcarpa</i>	Fish-hook Cactus	No treatment.
<i>Mammillaria tetrancistra</i>	Pincushion Cactus	Fresh seeds no treatment. Stored seeds hot water or soak in 200 ppm GA ₃ for 12 hrs. (Emery and Frey 1971).
<i>Marah macrocarpus</i>	Wild Cucumber, Manroot, Chilicothe	No treatment.
<i>Marah oregonus</i>	Oregon Wild Cucumber, Hill Manroot	Soak in warm water 12 hrs. (Emery and Frey 1971).
<i>Melica californica</i>	Western Melicgrass	No treatment. Best sown in fall.
<i>Melica geyeri</i>	Geyer's Melicgrass	No treatment. Best sown in fall.

<i>Melica imperfecta</i>	Coast Range Melic	No treatment. Best sown in fall.
<i>Melica stricta</i>	Nodding Melicgrass	2 mos. stratification (Emery and Frey 1971).
<i>Melica torreyana</i>	Torrey's Melicgrass	No treatment. Best sown in fall.
<i>Menodora scabra</i>	Rough Twinfruit	No treatment.
<i>Microseris laciniata</i>	Cutleaf Microseris	No treatment.
<i>Mimulus aridus</i>	San Diego Monkeyflower	No treatment.
<i>Mimulus aurantiacus</i>	Northern Bush Monkeyflower	No treatment.
<i>Mimulus bifidus</i>	Azalea-flowered Monkeyflower	No treatment.
<i>Mimulus cardinalis</i>	Scarlet Monkeyflower	No treatment.
<i>Mimulus flemingii</i>	Northern Island Monkeyflower	No treatment.
<i>Mimulus guttatus</i>	Common Monkeyflower	No treatment.
<i>Mimulus lewisii</i>	Lewis' Monkeyflower, Giant Purple Monkeyflower	No treatment.
<i>Mimulus longiflorus</i>	Sticky Monkeyflower, Bush Monkeyflower	No treatment.

⁹ The following alternative treatment may improve germination: 30 days cold, 60 days warm, and 196 days cold stratification. During this last period, remove and pot germinating seeds bimonthly. Some additional germination will occur after the remaining seeds are sown, preferably in a cool location, i.e. outdoors in early spring (McLean 1967). It has been suggested that *Mahonia nervosa* and *Mahonia pumila* need no treatment if the seeds are kept moist from the time they are cleaned until sown; they should be stored moist (stratified) for 7 mos. in the refrigerator for spring sowing (Eugene Baciu, personal communication 1964).

Scientific Name	Common Name	Recommended Treatment
<i>Mimulus moschatus</i>	Musk Flower	No treatment.
<i>Mimulus primuloides</i>	Primrose Monkeyflower	No treatment.
<i>Mirabilis californica</i>	Wishbone Bush	No treatment.
<i>Mirabilis froebelii</i>	Giant Four-o'clock	No treatment.
<i>Mitella breweri</i>	Miterwort, Bishop's Cap	No treatment.
<i>Monardella lanceolata</i>	Mustang Mint	No treatment.
<i>Monardella linoides</i> subsp. <i>viminea</i>	San Diego Monardella	No treatment.
<i>Monardella macrantha</i>	Scarlet Monardella, Large-flowered Monardella	No treatment.
<i>Monardella odoratissima</i>	Mountain Pennyroyal	Fresh seeds no treatment; stored seeds 3 mos. stratification.
<i>Monardella odoratissima</i> subsp. <i>pinetorum</i>		No treatment.
<i>Monardella palmeri</i>	Palmer's Monardella	No treatment.
<i>Monardella villosa</i>	Coyote Mint	No treatment.
<i>Montia</i> [see <i>Claytonia</i>]		
<i>Muhlenbergia asperifolia</i>	Alkali Muhly, Scratchgrass	No treatment.

<i>Muhlenbergia racemosa</i>	Satin-grass, Wild Timothy	No treatment.
<i>Muhlenbergia rigens</i>	Deer Grass	No treatment.
<i>Muilla maritima</i>	Common Muilla	No treatment.
<i>Munzothamnus blairii</i>	Munzothamnus	No treatment.
<i>Myrica californica</i>	California Wax-myrtle, Pacific Wax-myrtle	2-3 mos. stratification.
<i>Nama lobblii</i>	Woolly Nama	Leach in running water 2-3 days; then soak in 200 ppm or stronger GA ₃ for 2 hrs. with constant agitation. Do not rinse or wash treated seeds. Sow immediately or air dry thoroughly and sow within a week of GA ₃ treatment. Germination starts in about 2 wks. but will be sporadic over several months [USDA Forest Service 1974].
<i>Nemophila maculata</i>	Five-spot	No treatment may give satisfactory results. For more uniform germination, stratify for 2 mos. or germinate at cool temperatures (less than 70°F) and in darkness for first 3 days [Cruden 1974].
<i>Nemophila menziesii</i>	Baby Blue Eyes	If sown outdoors in late fall, no treatment may give good results. Germinate at 59°F [Association of Official Seed Analysts 1981], or at cool temperature (less than 70°F) and in darkness first 3 days [Chen 1968; Cruden 1974].
<i>Nicolletia occidentalis</i>	Hole-in-the-sand Plant	No treatment.
<i>Nolina bigelovii</i>	Bigelow's Nolina	No treatment.
<i>Nolina parryi</i>	Parry's Nolina	No treatment [Everett 1957].
<i>Nolina wolfii</i>	Wolf's Nolina	No treatment.

Scientific Name	Common Name	Recommended Treatment
<i>Oenothera</i> [also see <i>Camissonia</i>]		
<i>Oenothera caespitosa</i> var. <i>marginata</i>	White Desert Evening-primrose	No treatment.
<i>Oenothera californica</i>	California Evening-primrose	No treatment.
<i>Oenothera flava</i>	Dandelion Evening-primrose	No treatment.
<i>Oenothera hookeri</i>	Hooker's Evening-primrose	No treatment.
<i>Olneya tesota</i>	Desert Ironwood	Fresh seeds no treatment; soaking in water 12-24 hrs. may improve germination. Stored seeds soak in water 24-36 hrs.; scarification before soaking may improve germination. Seedlings damp-off readily [USDA Forest Service 1974].
<i>Opuntia acanthocarpa</i>	Buckhorn Cholla	No treatment.
<i>Opuntia basilaris</i>	Beavertail Cactus	No treatment.
<i>Orthocarpus purpurascens</i>	Owl's Clover	No treatment; 2 mos. stratification may improve germination.
<i>Oryzopsis hymenoides</i>	Indian Ricegrass	Fresh seeds no treatment but germinating at 59°F [constant] or 37.4°F (constant) gives emergence in 45-60 and 63-128 days respectively. Stored seeds soak in 71% H ₂ SO ₄ [3 parts concentrated acid to 1 part distilled water] for 45-60 mins. and germinate at a diurnal fluctuation from 68° to 86°F or 37.4°F constant. Emergence takes 21 and 70 days respectively [Toole 1940]. ¹⁰

<i>Osmaronia cerasiformis</i>	Oso Berry	4 mos. stratification; sporadic germination occurs during this period. Remove and pot germinating seeds biweekly [USDA Forest Service 1974].
<i>Osmothiza occidentalis</i>	Sweet Cicely	2 mos. stratification [Emery and Frey 1971].
<i>Oxalis oregana</i>	Redwood Sorrel	No treatment [Emery and Frey 1971].
<i>Paeonia brownii</i>	Western Peony	2½ mos. stratification.
<i>Paeonia californica</i>	California Peony	No treatment; scarification may improve germination.
<i>Pectis papposa</i>	Chinch Weed	Leach in running water 10-24 hrs. [Wicklow 1977].
<i>Penstemon</i> [see also <i>Keckiella</i>]		
<i>Penstemon azureus</i>	Azure Penstemon	No treatment.
<i>Penstemon bridgesii</i> [see <i>P. rostriflorus</i>]		
<i>Penstemon cardwellii</i>	Cardwell's Penstemon	1 mo. stratification.
<i>Penstemon centranthifolius</i>	Scarlet Bugler	No treatment.
<i>Penstemon clevelandii</i>	Cleveland's Penstemon	No treatment.
<i>Penstemon davidsonii</i>	Timberline Penstemon	1-2 mos. stratification [Everett 1950].
<i>Penstemon eatonii</i>	Firecracker Penstemon	1-2 mos. stratification.
<i>Penstemon floridus</i>	Inyo Beard-tongue	No treatment.

¹⁰ Larger darker seeds need a slightly longer acid treatment. Just prior to sowing, if the seeds are soaked in water for 5 mins., the floaters (non-viable) can be removed; otherwise germination may appear to be poor [Toole 1940].

Scientific Name	Common Name	Recommended Treatment
<i>Penstemon grinnellii</i>	Grinnell's Penstemon	No treatment; 1-2 mos. stratification may improve germination.
<i>Penstemon heterodoxus</i> subsp. <i>cephalophorus</i>	Sierra Penstemon	2 mos. stratification (Everett 1950).
<i>Penstemon heterophyllus</i>	Foothill Penstemon	No treatment; 1-2 mos. stratification may improve germination.
<i>Penstemon incertus</i>	Mojave Penstemon	No treatment (Everett 1950).
<i>Penstemon labrosus</i>	San Gabriel Penstemon	1-2 mos. stratification.
<i>Penstemon laetus</i> subsp. <i>leptosepalus</i>	Gay Penstemon	No treatment; 2-3 mos. stratification may improve germination.
<i>Penstemon newberryi</i>	Mountain Pride	2 mos. stratification (Everett 1950).
<i>Penstemon palmeri</i>	Palmer's Penstemon, Scented Penstemon	1-3 mos. stratification.
<i>Penstemon parvulus</i>	Small Azure Penstemon	3 mos. stratification (Williams 1986).
<i>Penstemon</i> <i>pseudospectabilis</i>	Desert Beard-tongue, Mojave Beard-tongue	1 mo. stratification (<i>Plants of the Southwest</i> 1986).
<i>Penstemon rostriflorus</i>	Beak-flowered Beard-tongue	No treatment; 1-3 mos. stratification may improve germination.
<i>Penstemon rydbergii</i> var. <i>varians</i>	Rydberg's Penstemon	2 mos. stratification (Williams 1986).
<i>Penstemon speciosus</i>	Showy Penstemon	1-2 mos. stratification.
<i>Penstemon spectabilis</i>	Notable Penstemon, Royal Penstemon	No treatment.

<i>Penstemon utahensis</i>	Utah Bugler	2 mos. stratification (Williams 1986).
<i>Pezophyllum</i> <i>ramosissimum</i>	Squaw-apple	3 mos. stratification. Sporadic germination occurs during this period; remove and pot germinating seeds biweekly (USDA Forest Service 1974).
<i>Perezia microcephala</i>	Sacapellote	No treatment.
<i>Peucephyllum schottii</i>	Pigmy-cedar	No treatment.
<i>Phacelia bolanderi</i>	Bolander's Phacelia	No treatment.
<i>Phacelia cicutaria</i>	Caterpillar Phacelia	No treatment may give satisfactory germination. Addition of a small amount of charate over the sown seeds greatly improves germination. Oven heat of 248°F for 5 mins. first further improves results. Combined treatment has synergistic effect (Keeley and Keeley 1982).
<i>Phacelia fremontii</i>	Fremont's Phacelia	No treatment may give some germination. Addition of a small amount of charate over the sown seeds greatly improves germination (Keeley and Keeley 1982).
<i>Phacelia frigida</i>	Timberline Phacelia	114 days stratification gives some germination; 114 days cold, 35 days warm [room temperature with about 60°F minimum at night] and 140 days cold stratification [32°F] greatly improves germination (Quick 1947).
<i>Phacelia grandiflora</i>	Large-flowered Phacelia	No treatment may give some germination. Addition of a small amount of charate over the sown seeds greatly improves germination (Keeley and Keeley 1982).
<i>Phacelia hastata</i>	Silverleaf Phacelia	142 days stratification at 32°F (Quick 1947).
<i>Phacelia imbricata</i> subsp. <i>bernardiana</i>	Rock Phacelia	No treatment.

Scientific Name	Common Name	Recommended Treatment
<i>Phacelia lemmonii</i>	Lemmon's Phacelia	No treatment gives fair germination; 114 days stratification improves germination (Quick 1947).
<i>Phacelia mutabilis</i>	Changeable Phacelia	4-4½ mos. stratification at 32°F (Quick 1947).
<i>Phacelia sericea</i>	Silky Phacelia	No treatment.
<i>Phacelia tanacetifolia</i>	Tansy Phacelia	No treatment. Sow outdoors in late fall or germinate in cool temperatures (59° to 70°F) in darkness first 24 hrs. (Schulz and Klein 1963).
<i>Phalaris arundinacea</i>	Reed Canarygrass	No treatment.
<i>Phalaris californica</i>	California Canarygrass	No treatment.
<i>Philadelphus lewisii</i> subsp. <i>californicus</i>	California Mock-orange	2-3 mos. stratification.
<i>Pholistoma auritum</i>	Fiesta Flower	No treatment. Seeds sown outdoors in late fall give good results, or germinate in cool temperatures (less than 70°F) in darkness first 3 days (Cruden 1974).
<i>Phyllodoce breweri</i>	Mountain Heather	Fresh seeds no treatment; stored seeds 2 mos. stratification.
<i>Physocarpus capitatus</i>	Western Ninebark	No treatment gives poor germination; 2-3 mos. stratification may improve germination. Easily propagated from stem cuttings.
<i>Picea breweriana</i>	Weeping Spruce, Brewer Spruce	1-3 mos. stratification (USDA Forest Service 1974).
<i>Picea engelmannii</i>	Engelmann Spruce	No treatment (USDA Forest Service 1974).
<i>Picea sitchensis</i>	Sitka Spruce	No treatment (USDA Forest Service 1974); 1 mo. stratification (Babb 1959).

<i>Pickeringia montana</i>	Chaparral Pea	Hot water and 1 mo. stratification.
<i>Pinus albicaulis</i>	Whitebark Pine	3-4 mos. stratification (USDA Forest Service 1974).
<i>Pinus aristata</i> (see <i>P. longaeva</i>)		
<i>Pinus attenuata</i>	Knobcone Pine	2 mos. stratification (USDA Forest Service 1974).
<i>Pinus balfouriana</i>	Foxtail Pine	3 mos. stratification (USDA Forest Service 1974).
<i>Pinus contorta</i>	Beach Pine	Fresh seeds no treatment; stored seeds 1 mo. stratification (USDA Forest Service 1974).
<i>Pinus coulteri</i>	Coulter Pine	Fresh seeds no treatment; stored seeds 1-3 mos. stratification (USDA Forest Service 1974).
<i>Pinus edulis</i>	Nut Pine, Pinyon	Fresh seeds no treatment; stored seeds 2 mos. stratification; or soak in cold (40°F) water for 24 hrs. (USDA Forest Service 1974); or keep maximum germinating temperature below 73°F (Heit 1968a).
<i>Pinus flexilis</i>	Limber Pine	1-3 mos. stratification (USDA Forest Service 1974).
<i>Pinus jeffreyi</i>	Jeffrey Pine	Fresh seeds no treatment; stored seeds 1-2 mos. stratification may improve germination (USDA Forest Service 1974).
<i>Pinus lambertiana</i>	Sugar Pine	2-3 mos. stratification (USDA Forest Service 1974).
<i>Pinus longaeva</i>	Bristlecone Pine	Fresh seeds no treatment; stored seeds 1 mo. stratification may improve germination (USDA Forest Service 1974).
<i>Pinus monophylla</i>	One-leaf Pinyon	1-3 mos. stratification (USDA Forest Service 1974). No treatment necessary if maximum germinating temperature is below 73°F (Heit 1968a).

Scientific Name	Common Name	Recommended Treatment
<i>Pinus monticola</i>	Western White Pine, Silver Pine	1-4 mos. stratification (USDA Forest Service 1974).
<i>Pinus muricata</i>	Bishop Pine	Fresh seeds no treatment; stored seeds 1 mo. stratification (USDA Forest Service 1974).
<i>Pinus murrayana</i>	Lodgepole Pine, Tamarack Pine	Fresh seeds no treatment; stored seeds 1 mo. stratification (USDA Forest Service 1974).
<i>Pinus ponderosa</i>	Western Yellow Pine, Ponderosa Pine	Fresh seeds no treatment; stored seeds 1-2 mos. stratification (USDA Forest Service 1974).
<i>Pinus quadrifolia</i>	Four-needled Pinyon	Fresh seeds no treatment; stored seeds 1 mo. stratification may improve germination (USDA Forest Service 1974).
<i>Pinus radiata</i>	Monterey Pine	Fresh seeds no treatment; 1 wk. stratification may improve germination. Stored seeds 1-3 wks. stratification may improve germination (USDA Forest Service 1974).
<i>Pinus remorata</i>	Santa Cruz Island Pine	No treatment.
<i>Pinus sabiniana</i>	Digger Pine	2-4 mos. stratification; for small lots, cracking seed coats first gives quicker germination (USDA Forest Service 1974).
<i>Pinus torreyana</i>	Torrey Pine	1-3 mos. stratification (USDA Forest Service 1974).
<i>Plantago insularis</i>	Woolly Plantain	Leach 24 hrs. in running water (Capon and Van Asdall 1967). ¹¹
<i>Platystemon californicus</i>	Cream-cups	Freshly harvested seeds need at least 8 mos. dry storage. Some germination may occur after 4 mos. storage (Hannan 1980).
<i>Platanus racemosa</i>	Western Sycamore	2-3 mos. stratification.

<i>Poa douglasii</i> subsp. <i>macrantha</i>	Seashore Bluegrass	No treatment.
<i>Poa nevadensis</i>	Nevada Bluegrass	No treatment.
<i>Poa palustris</i>	Fowl Bluegrass	No treatment.
<i>Poa scabrella</i>	Pine Bluegrass	No treatment.
<i>Polemonium caeruleum</i> subsp. <i>amygdalinum</i>	Great Polemonium	No treatment.
<i>Polemonium carneum</i>	Jacob's Ladder	No treatment.
<i>Polemonium pulcherrimum</i>	Showy Polemonium	No treatment.
<i>Polygonum coccineum</i>	Swamp Knotweed	8½ mos. stratification (Crocker and Barton 1957).
<i>Polygonum hydropiperoides</i>	Common Smartweed	5 mos. stratification at 50°F (Crocker and Barton 1957).
<i>Polygonum paronychia</i>	Beach Knotweed	No treatment.
<i>Polygonum punctatum</i>	Water Smartweed	1 mo. stratification (Crocker and Barton 1957).
<i>Populus species</i>	Poplar, Cottonwood, Aspen	No treatment. Use fresh seeds, usually viable only a few days. Seeds should not be covered or pressed into medium; seedbed should be kept saturated for first mo. Easily propagated from stem cuttings.

¹¹ Alternative treatment: scarify with fine sandpaper, then soak 2-3 days in 100 ppm potassium gibberellate ("Gibrel") growth substance, Merck & Co., Chem. Div. Rahway, N.J.) at 73.3° to 80.6°F, night and day, respectively (cold temperature inhibits germination); give moderate light (day length not critical). During 2-3 day soak, sprouted seeds should be removed and sown, leaving part of each seed exposed (radicals covered) gives best results. If seeds are freshly harvested add 0.5% glucose to the "Gibrel" solution. Enough solution should be used so seeds are not crowded, as the mucilaginous seed coats clump, reducing circulation and inhibiting germination. The above method gives nearly 100% germination for freshly harvested dry seeds as opposed to 17% or less for seeds leached in water only (Stebbins and Day 1967).

Scientific Name	Common Name	Recommended Treatment
<i>Porophyllum gracile</i>	Odora, Poreleaf	No treatment.
<i>Potentilla anserina</i>	Silverweed	2 mos. stratification.
<i>Potentilla fruticosa</i>	Bush Cinquefoil, Buttercup Shrub	No treatment. 2 wks. stratification gives slightly better germination (Stidham <i>et al.</i> 1980).
<i>Potentilla glandulosa</i>	Sticky Cinquefoil	Fresh seeds no treatment; stored seeds stratification may improve germination.
<i>Potentilla gracilis</i>	Slender Cinquefoil	No treatment.
<i>Potentilla pectinsecta</i>	Cinquefoil	No treatment.
<i>Primula suffrutescens</i>	Sierra Primrose	No treatment.
<i>Prosopis glandulosa</i> var. <i>torreyana</i>	Mesquite, Honey Mesquite	Hot water or scarification. Fresh undried seeds no treatment (USDA Forest Service 1974).
<i>Prosopis pubescens</i>	Screw-bean Mesquite, Tornillo	No treatment. Seedlings damp-off very readily. Some lots may need hot water or scarification.
<i>Prunella vulgaris</i> subsp. <i>lanceolata</i>	Selfheal	No treatment.
<i>Prunus andersonii</i>	Desert Peach, Wild Almond	Crack bony endocarp; or soak 2-3 days in water (changing water 1-2 times per day is beneficial) at room temperature for equally good results; then 2-2½ mos. stratification.
<i>Prunus emarginata</i>	Bitter Cherry	Soak in water at room temperature for 8 days, and stratify at 45°F for 5 mos. Fresh seeds give better results (Sorrell 1981).
<i>Prunus fasciculata</i>	Desert Almond	Soak 2-3 days in water at room temperature. Changing water 1-2 times per day is beneficial.

<i>Prunus fasciculata</i> var. <i>punctata</i>	Sand Almond	No treatment.
<i>Prunus fremontii</i>	Desert Apricot	Soak overnight in water at room temperature.
<i>Prunus ilicifolia</i>	Hollyleaf Cherry	Fresh seeds no treatment; stored seeds 1-3 mos. stratification may improve germination.
<i>Prunus lyonii</i>	Catalina Cherry	Fresh seeds no treatment; stored seeds 1-3 mos. stratification may improve germination.
<i>Prunus subcordata</i>	Sierra Plum, Klamath Plum	3 mos. stratification.
<i>Prunus virginiana</i> var. <i>demissa</i>	Western Choke-cherry	3 mos. stratification; 2 wks. warm stratification first may improve germination.
<i>Pseudotsuga macrocarpa</i>	Bigcone-spruce	1 mo. stratification. No treatment may give satisfactory germination.
<i>Pseudotsuga menziesii</i>	Douglas-fir	3-6 wks. stratification. No treatment may give satisfactory germination (USDA Forest Service 1974). ¹²
<i>Psoralea macrostachya</i>	Leather Root	No treatment.
<i>Psoralea physodes</i>	California Tea	No treatment.
<i>Psoralea arborescens</i>	Indigo Bush	No treatment.
<i>Psoralea californica</i>	California Dalea	No treatment.
<i>Psoralea fremontii</i>	Fremont Dalea	No treatment.

¹² Extended stratification lowers optimum germination temperature and germination may occur in refrigerator.

Scientific Name	Common Name	Recommended Treatment
<i>Psoralea polyadenia</i>	Nevada Dalca	No treatment.
<i>Psoralea schottii</i>	Schott Dalea	No treatment.
<i>Psoralea spinosa</i>	Smoke Tree	No treatment.
<i>Ptelea crenulata</i>	California Hoptree	3 mos. stratification.
<i>Purshia glandulosa</i>	Desert Bitterbrush, Waxy Bitterbrush	3 mos. stratification; soak in 3% thiourea 5 mins., air dry, and sow; or no treatment but germinate with wide diurnal fluctuation from 50° to 86°F (Heit 1971).
<i>Purshia tridentata</i>	Antelope Brush, Bitterbrush	3 mos. stratification; 2-7 wks. may be sufficient (Peterson 1953). ¹³
<i>Quercus</i> species	Oak	Fresh seeds sow in fall outdoors or stratify to hold for spring sowing. If started indoors or in glasshouse, the following species should be stratified first as noted: <i>Q. chrysolepis</i> 0-2 mos.; <i>Q. douglasii</i> 1½ mos.; <i>Q. dumosa</i> 1-3 mos.; <i>Q. kelloggii</i> 1-2 mos.; <i>Q. wislizenii</i> 0-2 mos. [USDA Forest Service 1974].
<i>Ranunculus californicus</i>	California Buttercup	No treatment; 1 mo. stratification may improve germination of some varieties.
<i>Ranunculus macounii</i>	Macoun's Buttercup	No treatment. Sow in early winter outdoors.
<i>Rhamnus alnifolia</i>	Alderleaf Coffeeberry	Fresh seeds no treatment; stored seeds 2½-3 mos. stratification (USDA Forest Service 1974).
<i>Rhamnus californica</i>	California Coffeeberry	Fresh seeds no treatment; stored seeds 3 mos. stratification.
<i>Rhamnus crocea</i>	Redberry	No treatment; 2-2½ mos. stratification may improve germination.

<i>Rhamnus ilicifolia</i>	Hollyleaf Redberry	Fresh seeds no treatment; stored seeds 2½-3 mos. stratification.
<i>Rhamnus pitifolia</i>	Island Redberry	Fresh seeds no treatment; stored seeds 2½-3 mos. stratification.
<i>Rhamnus purshiana</i>	Cascara Sagrada	3 mos. stratification.
<i>Rhamnus rubra</i>	Sierra Coffeeberry	3 mos. stratification. No treatment of fresh seeds gives fair germination.
<i>Rhododendron macrophyllum</i>	California Rose-bay, Western Rhododendron	No treatment. Best sown on milled sphagnum moss.
<i>Rhododendron occidentale</i>	Western Azalea	No treatment. Best sown on milled sphagnum moss.
<i>Rhus glabra</i>	Smooth Sumac	Hot water; scarification (Anonymous 1944); or soak 3-6 hrs. in concentrated H ₂ SO ₄ [Heit 1967]. One hr. concentrated acid then 2 wks. stratification may also give good germination [Babb 1959].
<i>Rhus integrifolia</i>	Lemonade Berry	Hot water. For maximum germination, soak in concentrated H ₂ SO ₄ 4-6 hrs., depending on seed batch and age.
<i>Rhus laurina</i> (see <i>Malosma laurina</i>)		
<i>Rhus ovata</i>	Sugar Bush	Soak in tap water for 24 hrs. and immediately sow any seeds that swell. Boil the rest in water 1 min. and cool immediately. ¹⁴
<i>Rhus trilobata</i> varieties	Squaw Bush	Hot water or soak in concentrated H ₂ SO ₄ 1-3 hrs., then 2-3 mos. stratification.

¹³ Alternative treatments: soak in 3% thiourea for 3-5 mins., air dry and sow [Hubbard and Pearson 1958]; soak in 1% hydrogen peroxide (constant or intermittent shaking or stirring will improve germination) for 5 hrs., air dry, and sow [Everett 1975]; no treatment but germinate with wide diurnal fluctuation from 50° to 86°F (Heit 1971).

¹⁴ Alternative treatments: oven heat of 230°F for 5 mins. [Went et al. 1952]; oven heat of 212°F for 5-10 mins. [Stone and Juhren 1951]; fire treatment. For maximum germination soak in concentrated H₂SO₄ 1-6 hrs. depending on seed batch and age [Wright 1931].

Scientific Name	Common Name	Recommended Treatment
<i>Ribes amarum</i> var. <i>hoffmannii</i>	Hoffmann's Bitter Gooseberry	1-1½ mos. stratification.
<i>Ribes aureum</i>	Golden Currant	2½-3 mos. stratification. Alternative treatments: moisten seeds with 0.2% KNO ₃ and stratify 2 wks.; or soak in 0.3% thiourea 40 mins., rinse under running water and sow (Stidham et al. 1980).
<i>Ribes bracteosum</i>	Stink Currant	3 mos. stratification.
<i>Ribes californicum</i>	Canyon Gooseberry, Hillside Gooseberry	3 mos. stratification.
<i>Ribes cereum</i>	Wax Currant, Squaw Currant	4-5 mos. stratification at 28° to 32°F (USDA Forest Service 1974).
<i>Ribes montigenum</i>	Mountain Gooseberry	7½-10 mos. stratification at 32°F (USDA Forest Service 1974).
<i>Ribes nevadense</i>	Sierra Currant	4 mos. stratification at 32°F (USDA Forest Service 1974).
<i>Ribes roezlii</i>	Sierra Gooseberry	3½-5½ mos. stratification at 32°F (USDA Forest Service 1974).
<i>Ribes sanguineum</i>	Red-flowering Currant	3½-5 mos. stratification (USDA Forest Service 1974).
<i>Ribes speciosum</i>	Fuchsia-flowered Gooseberry	3 mos. stratification (Hildreth 1976).
<i>Ribes thacherianum</i>	Santa Cruz Island Gooseberry	3½ mos. stratification.
<i>Ribes viburnifolium</i>	Evergreen Currant	2½-3 mos. stratification.
<i>Romanzoffia suksdorfii</i>	Romanzoffia	No treatment.

<i>Romneya coulteri</i>	Matilija Poppy	Fire treatment in late fall and germinate outdoors; or soak in 1N potassium hydroxide (KOH) ½ hr., then soak in 100 ppm GA ₃ overnight. Soaking in KOH followed by 3 mos. stratification, then GA ₃ may improve germination (Harrington 1975). 3 mos. stratification gives some germination.
<i>Rosa californica</i>	California Wild Rose	3 mos. stratification.
<i>Rosa gymnocarpa</i>	Baldhip Rose, Wood Rose	3 mos. stratification; preceding this by 2-3 mos. warm stratification may improve germination (USDA Forest Service 1974).
<i>Rosa nutkana</i>	Nootka Rose	5 mos. stratification; preceding this by 2-3 mos. warm stratification may improve germination (USDA Forest Service 1974).
<i>Rosa pisocarpa</i>	Cluster Rose	3-4 mos. stratification; preceding this by 2-3 mos. warm stratification may improve germination (USDA Forest Service 1974).
<i>Rosa woodsii</i> var. <i>ultramontana</i>	Mountain Rose	3½-4 mos. stratification; preceding this by 2-3 mos. warm stratification may improve germination (USDA Forest Service 1974).
<i>Rubus parviflorus</i>	Thimbleberry	3 mos. stratification may give satisfactory germination. Soaking in either 1% sodium hypochlorite (household bleach) 7 days or concentrated H ₂ SO ₄ 20-60 mins., then 3 mos. warm and 3 mos. cold stratification may improve germination (USDA Forest Service 1974). Easily propagated from stem cuttings.
<i>Rubus spectabilis</i>	Salmonberry	3 mos. stratification may give satisfactory germination. Soaking in either 1% sodium hypochlorite (household bleach) 7 days, or concentrated H ₂ SO ₄ 20-60 mins., then 3 mos. warm (diurnal fluctuation from 68° to 86°F) and 3 mos. cold stratification may improve germination (USDA Forest Service 1974). Easily propagated from stem cuttings.

Scientific Name	Common Name	Recommended Treatment
<i>Rudbeckia californica</i>	California Cone-flower	No treatment.
<i>Rudbeckia occidentalis</i>	Western Rudbeckia	No treatment.
<i>Rumex hymenosepalus</i>	Wild Rhubarb, Canaigre	No treatment.
<i>Salazaria mexicana</i>	Bladder-sage	No treatment.
<i>Salix species</i>	Willow	No treatment. Use fresh seeds (usually viable only a few days). Seeds should not be covered or pressed into medium; seedbed should be kept saturated for first mo. Easily propagated from cuttings.
<i>Salvia apiana</i>	White Sage	No treatment; sow outdoors in early fall. Germination may be poor if diurnal fluctuation is insufficient; also see alternative treatments for <i>S. mellifera</i> .
<i>Salvia brandegei</i>	Island Black Sage	No treatment.
<i>Salvia clevelandii</i>	Cleveland Sage, Fragrant Sage	No treatment; sow outdoors in early fall. Germination may be poor if diurnal fluctuation is insufficient; also see alternative treatments for <i>S. mellifera</i> .
<i>Salvia columbariae</i>	Chia Sage	No general recommendation possible as several ecotypes involved. Dry storage at 155 °F for 6 mos.; then 1 mo. stratification gives 45-95% germination on seeds from five out of ten locations [Capon <i>et al.</i> 1978]. Dry storage at 155 °F for 1 wk. for desert-collected seeds gives good results [Capon and Van Asdall 1970]. For specific treatments of seeds from 19 locations, see Capon and Brecht 1970. Addition of a small amount of charate over the sown seeds significantly improves germination (Keeley and Keeley 1982).
<i>Salvia leucophylla</i>	Purple Sage	No treatment.

<i>Salvia mellifera</i>	Black Sage	No treatment; sow outdoors in early fall. Germination may be poor. The following alternative treatments may improve germination: stratify 3 mos. or soak in 400 ppm GA ₃ 1 hr., then dry and sow (Betty Atwater, personal communication 1981).
<i>Salvia pachyphylla</i>	Mountain Desert Sage, Rose Sage	No treatment.
<i>Salvia sonomensis</i>	Creeping Sage	3 mos. stratification or soak in 100 ppm GA ₃ 1 hr., then dry and sow within 1 wk. [Nord <i>et al.</i> 1971]. If a longer storage period is needed between treatment and sowing, use either a longer soaking period or higher concentration of up to 500 ppm (USDA Forest Service 1974).
<i>Salvia spathacea</i>	Hummingbird Sage	No treatment; sow outdoors in early fall. Germination may be poor if diurnal fluctuation insufficient; see also alternative treatments for <i>S. mellifera</i> .
<i>Sambucus caerulea</i>	Blue Elderberry	Soak in concentrated H ₂ SO ₄ 10-15 mins. and 2-3 mos. stratification; 4-5 mos. warm [60 °F] and 3-5 mos. cold stratification may also give satisfactory results. Germination apt to be low due to high percentage empty or improperly developed seed [Heit 1971]. For fresh seeds 2-3 mos. stratification may give good results. Easily propagated from stem cuttings.
<i>Sambucus callicarpa</i>	Red Elderberry	Fresh seeds 3 mos. stratification may give satisfactory but sporadic germination. Stored seeds soak in concentrated H ₂ SO ₄ 5 mins. (or scarify), 2-day water bath, then 1 mo. warm and 3 mos. cold stratification [USDA Forest Service 1974]. Easily propagated from stem cuttings.
<i>Samolus parviflorus</i>	Water Pimpernel	No treatment.

Scientific Name	Common Name	Recommended Treatment
<i>Sarcostemma cynanchoides</i> subsp. <i>hartwegii</i>	Climbing-milkweed	No treatment.
<i>Satureja douglasii</i>	Yerba Buena	No treatment (Emery and Frey 1971).
<i>Satureja mimuloides</i>	Satureja	No treatment.
<i>Schoenolirion album</i>	White-flowered Schoenolirion	3 mos. stratification.
<i>Scirpus acutus</i>	Common Tule, Viscid Bulrush	Store fresh undried seeds in water in refrigerator at 35° to 39°F 6 mos., then germinate in water at 86° to 89.8°F in continuous high light [180-200 foot candles] (Isely 1944). ¹⁵
<i>Scirpus americanus</i>	Three-square	Store fresh undried seeds in water in refrigerator at 35° to 39°F 6 mos., then germinate in water at 86° to 89.8°F in continuous high light [180-200 foot candles] (Isely 1944). ¹⁵
<i>Scirpus robustus</i>	Prairie Bulrush	Store in water in refrigerator at 35° to 39°F 6 mos., then germinate in water at 86° to 89.8°F in continuous high light [180-200 foot candles] (Isely 1944). ¹⁵
<i>Scirpus validus</i>	Giant Bulrush, Tule	Store fresh undried seeds in water in refrigerator at 35° to 39°F 6 mos., then germinate in water at 86° to 89.8°F in continuous high light [180-200 foot candles] (Isely 1944). ¹⁵
<i>Scrophularia villosa</i>	Island Figwort	No treatment.
<i>Scutellaria austinae</i>	Austin's Skullcap	No treatment.
<i>Sedum divergens</i>	Cascade Stonecrop	No treatment.

<i>Sedum lanceolatum</i>	Narrow-petaled Stonecrop	No treatment.
<i>Sedum oregonense</i>	Oregon Stonecrop	No treatment.
<i>Sedum purdyi</i>	Purdy's Stonecrop	No treatment.
<i>Senecio blochmaniae</i>	Blochman's Groundsel	No treatment.
<i>Senecio douglasii</i>	Bush Groundsel	No treatment.
<i>Sequoia sempervirens</i>	Coast Redwood	No treatment; 1 mo. stratification may improve germination. Usually a low percentage viable seeds.
<i>Sequoiadendron giganteum</i>	Giant Sequoia, Big Tree	No treatment; 1 mo. stratification may improve germination. Store seeds in polyethylene bag in freezer until ready to use. Usually a low percentage viable seeds.
<i>Setaria geniculata</i>	Perennial Foxtail	No treatment.
<i>Shepherdia argentea</i>	Buffalo Berry	Stratify 2-3 mos. (USDA Forest Service 1974); or soak in concentrated H ₂ SO ₄ 20-30 mins. (Heit 1971). No treatment may also give satisfactory germination.
<i>Sidalcea malviflora</i>	Checker Bloom	Soak in warm water 6 hrs. (Emery and Frey 1971).
<i>Silene californica</i>	California Indian Pink	No treatment.
<i>Silene laciniata</i> subsp. <i>major</i>	Southern Indian Pink	No treatment.
<i>Simmondsia chinensis</i>	Goatnut, Jojoba	No treatment.

¹⁵ Stored dry seeds treated as noted may also give good germination.

Scientific Name	Common Name	Recommended Treatment
<i>Sisyrinchium bellum</i>	Blue-eyed Grass	1½ mos. stratification. No treatment for 3-6 yr. old seeds.
<i>Sisyrinchium californicum</i>	Golden-eyed Grass	No treatment.
<i>Sisyrinchium elmeri</i>	Drew's Golden-eyed Grass	No treatment.
<i>Sitanion hystrix</i>	Squirreltail	No treatment.
<i>Sitanion jubatum</i>	Big Squirreltail	No treatment.
<i>Smilacina racemosa</i>	Western Solomon's Seal, False Solomon's Seal	6 mos. cold, 3 mos. warm, then 5 mos. cold stratification; 3, 2, and 3-5 mos. respectively may also give good germination. Use fresh seeds [Barton and Schroeder 1942].
<i>Smilacina stellata</i>	False Solomon's Seal, Star Solomon's Seal	6 mos. cold, 3 mos. warm, and 5 mos. cold stratification.
<i>Solanum douglasii</i>	Douglas' Nightshade	No treatment; sow outdoors in late summer. Spring sowing gives fair germination.
<i>Solanum umbelliferum</i>	Blue Witch	Stored seeds scarification or hot water for 1 hr. only (Emery and Frey 1971).
<i>Solanum wallacet</i>	Catalina Nightshade	No treatment.
<i>Solanum xantii</i>	Chaparral Nightshade, Purple Nightshade	Hot water for 1 hr. only (Emery & Frey 1971). No treatment may give satisfactory germination.
<i>Solidago confinis</i>	Southern Goldenrod	No treatment.
<i>Solidago occidentalis</i>	Western Goldenrod	No treatment.

<i>Sorbus cascadenis</i>	Cascade Mountain-ash	3 mos. stratification (USDA Forest Service 1974).
<i>Spergularia macrotheca</i>	Sand-spurrey	No treatment.
<i>Sphaeralcea ambigua</i>	Apricot-mallow, Desert-mallow	No treatment. Germination may be poor.
<i>Spiraea densiflora</i>	Mountain Spiraea	1 mo. stratification.
<i>Spiraea douglasii</i>	Douglas Spiraea, Western Spiraea	1-3 mos. stratification.
<i>Sporobolus airoides</i>	Alkali Sacaton	Soak in 1% (2% okay) potassium nitrate for 24 hrs.; sowing wet gives slightly better results than air drying 1-3 days first. Germinate at high diurnal fluctuation, room temperature (70.5° to 78.8°) and 91.4°F (Anonymous 1944). No treatment but using the high diurnal fluctuation (60.8° to 75.2°) and 95°F may also give good results [Toole 1941]; for fresh seeds 2 wks. stratification first may improve germination [Toole 1941]. No treatment if sown outdoors in southern California during July or August may give good germination. ¹⁶
<i>Sporobolus airoides</i> var. <i>wrightii</i>		Soak in water 24 hrs. [72 hrs. okay]; germinate at high diurnal fluctuation, room temperature (71° to 79.7°) and 91.4°F. Sow seeds wet. Drying seeds 48 hrs. before sowing lowers germination 7% [Anonymous 1944; Toole 1941].
<i>Sporobolus contractus</i>	Spike Dropseed	Soak in 71% H ₂ SO ₄ 4 mins. [2-4 okay], then soak in 1-2% potassium nitrate for 24 hrs. Germinate at high diurnal fluctuation, room temperature (60.8° to 75.2°) and 95°F. One mo. stratification instead of acid treatment may also give good germination (Toole 1941). ¹⁶

¹⁶ The treatments noted above for *Sporobolus* by Anonymous [1944] and Toole [1941] indicate some latitude as to H₂SO₄ concentration, germination temperatures, and day length. Anonymous uses concentrated acid [94%], whereas Toole uses a 71% concentration. Soaking seeds in a 1-2% potassium nitrate solution overnight, then sowing rather than germinating in vitro in 0.2% potassium nitrate solution, as done by Toole, should give comparable results. Germination temperatures are critical in that the maximum needs to be above 90°F (91.4° to 95°F). Germination drops significantly at an 86°F maximum but less so at 100°F. Minimum temperature for the diurnal fluctuation seems to be less significant.

Scientific Name	Common Name	Recommended Treatment
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Soak in 71% H ₂ SO ₄ for 2 mins., then soak in 1% potassium nitrate 24 hrs., and germinate at high diurnal fluctuation, room temperature (60.8° to 75.2°F) and 95°F, 17 and 7 hrs. respectively with light. This treatment is the best overall. Omitting the acid may give good results; substituting 68°F constant for room temperature gives slightly less germination. Substituting 28 days cold stratification for the acid treatment gives an average of 81.8% versus 90.8% for the acid [Toole 1941]. No treatment if sown outdoors in southern California during July or August may give good germination. ¹⁶
<i>Sporobolus flexuosus</i>	Mesa Dropseed	Soak in 71% H ₂ SO ₄ 4 mins., then germinate at high diurnal fluctuation, room temperature (60.8° to 75.2°F) and 95°F. Soaking in potassium nitrate for 24 hrs. after the acid bath may improve germination. One mo. cold stratification instead of acid treatment may give fair germination [Toole 1941]. ¹⁶
<i>Stachys bullata</i>	Wood Mint	No treatment.
<i>Stanleya elata</i>	Panamint Plume	No treatment.
<i>Stanleya pinnata</i>	Prince's Plume	No treatment.
<i>Staphylea bolanderi</i>	Sierra Bladdernut	Soak in concentrated H ₂ SO ₄ 1 hr. or 3-4 mos. warm stratification. Germination may be poor.
<i>Stephanomeria cichoriacea</i>	Fort Tejon Milk-aster	No treatment.
<i>Stipa cernua</i>	Nodding Needlegrass	No treatment.
<i>Stipa columbiana</i>	Columbia Needlegrass	No treatment.
<i>Stipa comata</i>	Needle-and-thread	No treatment.

<i>Stipa coronata</i>	Giant Needlegrass, Porcupine Grass	No treatment.
<i>Stipa elmeri</i>	Elmer's Needlegrass	No treatment.
<i>Stipa lepida</i>	Foothill Needlegrass, Small-flowered Stipa	No treatment.
<i>Stipa lettermanii</i>	Letterman's Needlegrass	No treatment.
<i>Stipa occidentalis</i>	Western Needlegrass	No treatment.
<i>Stipa pinetorum</i>	Pine Needlegrass	No treatment.
<i>Stipa pulchra</i>	Purple Needlegrass	No treatment.
<i>Stipa speciosa</i>	Desert Needlegrass	No treatment.
<i>Stipa thurberiana</i>	Thurber's Needlegrass	No treatment.
<i>Stylophyllum insulare</i> [see <i>Dudleya virens</i>]		
<i>Styrax officinalis</i> var. <i>californica</i>	California Snowdrop Bush	2 mos. stratification. Use fresh seeds.
<i>Styrax officinalis</i> var. <i>fulvescens</i>	Snowdrop Bush	2 mos. stratification. Soaking in water 24 hrs. first may improve germination. No treatment may give satisfactory germination. Use fresh seeds.
<i>Swertia perennis</i>	Felwort	3 mos. stratification.

¹⁶ The treatments noted above for *Sporobolus* by Anonymous (1944) and Toole (1941) indicate some latitude as to H₂SO₄ concentration, germination temperatures, and day length. Anonymous uses concentrated acid (94%), whereas Toole uses a 71% concentration. Soaking seeds in a 1-2% potassium nitrate solution overnight, then sowing rather than germinating in vitro in 0.2% potassium nitrate solution, as done by Toole, should give comparable results. Germination temperatures are critical in that the maximum needs to be above 90°F (91.4° to 95°F). Germination drops significantly at an 86°F maximum but less so at 100°F. Minimum temperature for the diurnal fluctuation seems to be less significant.

Scientific Name	Common Name	Recommended Treatment
<i>Symphoricarpos mollis</i>	Creeping Snowberry, Spreading Snowberry	Soak in concentrated H ₂ SO ₄ 1 hr. (or 3-4 mos. warm stratification) and 4-6 mos. cold stratification (Emery and Frey 1971). Easily propagated from cuttings or divisions.
<i>Symphoricarpos rivularis</i>	Common Snowberry	Soak in concentrated H ₂ SO ₄ 1 hr. (or 3-4 mos. warm stratification) and 4-6 mos. cold stratification (Emery and Frey 1971). Easily propagated from cuttings or divisions.
<i>Symphoricarpos vaccinoides</i>	Mountain Snowberry	Soak in concentrated H ₂ SO ₄ 1 hr. (or 3-4 mos. warm stratification) and 4-6 mos. cold stratification (Emery and Frey 1971). Easily propagated from cuttings or divisions.
<i>Tanacetum douglasii</i>	Northern Dune Tansy	No treatment. Germination may be poor.
<i>Taxus brevifolia</i>	Pacific Yew, Western Yew	No treatment. Sow in early summer. Very slow germination (USDA Forest Service 1974).
<i>Tellima grandiflora</i>	Fringe-cups	No treatment.
<i>Thalictrum polycarpum</i>	Meadow Rue	No treatment.
<i>Thermopsis macrophylla</i> var. <i>agnina</i>	False-lupine	Hot water treatment.
<i>Thuja plicata</i>	Canoe-cedar, Giant-cedar	1-2 mos. stratification or soak in 0.2% potassium nitrate overnight (Association of Official Seed Analysts 1981). No treatment may give satisfactory germination (USDA Forest Service 1948).
<i>Tolmiea menziesii</i>	Piggyback Plant	No treatment.
<i>Torreya californica</i>	California-nutmeg	3 mos. stratification. Very slow germination. No treatment may give good germination (USDA Forest Service 1974).

<i>Trichostema lanatum</i>	Woolly Blue-curls, Romero	2 mos. stratification (Hildreth and Johnson 1976); 3 mos. stratification at 32 °F using old stored seeds (Mirov 1945). Difficult. Easily propagated from stem cuttings.
<i>Trientalis latifolia</i>	Star Flower	No treatment; use fresh seeds (Emery and Frey 1971).
<i>Trillium ovatum</i>	Wake Robin, Coast Trillium	1 mo. stratification.
<i>Trisetum canescens</i>	Tall Trisetum	No treatment.
<i>Triteleia bridgesii</i>	Bridges' Tritelleia	No treatment.
<i>Triteleia crocea</i>	Yellow Tritelleia, Golden Stars	No treatment.
<i>Triteleia hyacinthina</i>	White Tritelleia	No treatment.
<i>Triteleia laxa</i>	Grass-nut, Ithuriel's Spear, Common Triteleia	No treatment.
<i>Triteleia ixioides</i>	Golden Tritelleia, Pretty Face	No treatment.
<i>Triteleia peduncularis</i>	Long-rayed Tritelleia	No treatment.
<i>Trixis californica</i>	Trixis	No treatment.
<i>Tsuga heterophylla</i>	Western Hemlock	3 wks. to 3 mos. stratification. No treatment may give satisfactory germination (USDA Forest Service 1974).
<i>Tsuga mertensiana</i>	Mountain Hemlock	3 mos. stratification (USDA Forest Service 1974).

Scientific Name	Common Name	Recommended Treatment
<i>Turricula parryi</i>	Poodle-dog Bush	Fire treatment (Horton and Kraebel 1955).
<i>Typha latifolia</i>	Broadleaf Cattail	2 mos. stratification (Emery and Frey 1971).
<i>Umbellularia californica</i>	California Bay, California Laurel	3-4 mos. stratification (Hildreth and Johnson 1976); no treatment may give satisfactory germination of fresh seeds.
<i>Vaccinium membranaceum</i>	Thinleaf Huckleberry	No treatment. ¹⁷ 3 mos. stratification may improve germination. Sow on milled sphagnum moss or peat moss and sand mix.
<i>Vaccinium ovatum</i>	California Huckleberry, Evergreen Huckleberry	No treatment; 1-2 mos. stratification may improve germination. Sow on milled sphagnum moss or peat moss and sand mix.
<i>Vaccinium parvifolium</i>	Red Bilberry, Red Huckleberry	No treatment; 1-3 mos. stratification may improve germination. Sow on milled sphagnum moss or peat moss and sand mix.
<i>Valeriana capitata</i> subsp. <i>californica</i>	California Valerian	3 mos. stratification (Emery and Frey 1971).
<i>Venegasia carpesioides</i>	Canyon Sunflower	No treatment.
<i>Verbena hastata</i>	Blue Vervain	No treatment (Emery and Frey 1971).
<i>Veronica americana</i>	Brooklime	No treatment (Emery and Frey 1971).
<i>Vicia gigantea</i>	Giant Vetch	No treatment.
<i>Viguiera deltoidea</i> var. <i>parishii</i>	Desert Sunflower	No treatment.
<i>Viguiera laciniata</i>	San Diego Sunflower	No treatment.
<i>Viguiera multiflora</i> var. <i>nevadensis</i>	Nevada Sunflower	No treatment.

<i>Viguiera reticulata</i>	Death Valley Sunflower	No treatment.
<i>Viola douglasii</i>	Golden Violet	No treatment (Emery and Frey 1971).
<i>Viola pedunculata</i>	Johnny-jump-up	No treatment.
<i>Vitis californica</i>	California Wild Grape	No treatment; 1 mo. stratification may improve germination of stored seeds.
<i>Washingtonia filifera</i>	California Fan Palm	No treatment.
<i>Whipplea modesta</i>	Yerba de Selva	No treatment.
<i>Wyethia angustifolia</i>	Narrowleaf Mule-ears	3 mos. stratification. No treatment may give satisfactory germination.
<i>Wyethia elata</i>	Hall's Mule-ears	3 mos. stratification. No treatment may give satisfactory germination.
<i>Wyethia glabra</i>	Mule-ears	No treatment.
<i>Wyethia helenioides</i>	Gray Mule-ears	No treatment.
<i>Wyethia mollis</i>	Woolly Mule-ears, Mountain Mule-ears	3 mos. stratification. No treatment may give satisfactory germination.
<i>Xerophyllum tenax</i>	Beargrass	Soak in distilled water 24 hrs. and stratify 4 mos. in vermiculite. Remove germinating seeds at weekly intervals (Smart and Minore 1977)
<i>Xylococcus bicolor</i>	Mission-manzanita	Fire treatment in fall.
<i>Xylothiza tortifolia</i>	Mojave-aster, Desert-aster	No treatment.

¹⁷ Seeds need "at least intermittent light during the entire pregermination period" (McLean 1967).

Scientific Name	Common Name	Recommended Treatment
<i>Yucca brevifolia</i>	Joshua Tree	No treatment.
<i>Yucca schidigera</i>	Mojave Yucca	No treatment.
<i>Yucca whipplei</i>	Chaparral Yucca, Spanish Bayonet, Our Lord's Candle	No treatment.
<i>Zauschneria californica</i>	California Fuchsia	No treatment.
<i>Zauschneria cana</i>	Hoary California Fuchsia	No treatment.
<i>Zigadenus fontanus</i>	Zygadene	No treatment; sow in fall. 3 mos. stratification may improve germination.
<i>Zigadenus fremontii</i>	Chaparral Zygadene	No treatment; sow in fall. 2-3 mos. stratification may improve germination.
<i>Zigadenus micranthus</i>	Small-flowered Zygadene	No treatment; sow in fall. 2-3 mos. stratification may improve germination.
<i>Zigadenus paniculatus</i>	Sand-corn	No treatment; sow in fall. 2-3 mos. stratification may improve germination.
<i>Zigadenus venenosus</i>	Death-camas	No treatment; sow in fall.
<i>Zizyphus obtusifolia</i> var. <i>canescens</i>	Desert Condalia, Gray Crucillo	No treatment.
<i>Zizyphus parryi</i>	Parry's Condalia, California Crucillo	No treatment.

