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THE CALOCHORTUS SOCIETY  
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At the urging of some members, we will devote this issue entirely to horticulture. This is the beginning of the planting season for most spp., so it seems like a good time to list the best media for growing *Calochortus*, optimum watering schedules, planting depth, etc. Some of this will involve recapitulation of material printed earlier, but in this issue the material will be presented in a more compact and explicit format. It will also involve your editor going out on a limb and stating judgments and growing tips which may prove to be in error later. This is because the long-term results of the growing trials which we discussed in V.II, #1 are not in yet. It may be that entirely unforeseen developments may force revision of much of what will be set forth here. Growers should keep this in mind as they read this growing guide, and use it with reservations. Local conditions should be given as much consideration as the incomplete and short-term results we will use as a basis for this guide.

## I. Media

In pots, the best mix has proven to be the UC Davis mix developed for general use. UC Davis recommends that it be used with fertilizer, but it has proven best for *Calochortus* seedlings even without any fertilizer. This mix contains 1/2 sand, 1/2 sphagnum peat moss. The mix has proven superior for a wide range of spp. The related watering schedule is once a week, at 1/4" planting depth. Those in climates with heavier rains (1 1/2 or more times a week on average) might prefer a lighter mix yet, while those in drier climates might use a more humusy mix, to retain more water. It should be kept in mind that others have used quite different mixes successfully (see MARIPOSA V.I, #2-4 and V.II, #1 for C. Baccus', S. Farwig's, and J. Robinett's mixes. Farwig's mix is leaner than the UC Davis mix, while Baccus' and Robinett's are more humusy.)

The second best mix was UC Davis solless. This mix consists in 1/3 perlite, 1/3 vermiculite, and 1/3 sphagnum peat moss.

In the ground, the best results were obtained using clay soil, in which many of the spp. grow in the wild. Unless you live in proper rainfall area, however, it might be better to mix in 50% organic matter to your soil. This can be redwood compost, fir bark, leaf mold or other common soil amendments.

## II. Watering

The best watering schedule proved to be once a week, with qualifications. A one-day rainstorm counts as a watering. The amount used for watering from a can in non-rainy weeks was one inch, applied at one time but not all at once. A watering can was used, and each pot or plot was watered in consecutive sequence, so that the seedlings would not be deluged all at once.

A twice a week schedule proved to be too wet, while twice a month was too little. The qualification here is that the desert spp. did better if they were given a once a week schedule at first, until they are about 1" in height, and then watered less, 1/2, twice a month. The desert spp. include *C. aureus*, *C. bruneauensis*, *C. concolor*, *C. flexuosus*, *C. kennedyi*, *C. macrocarpus*, and perhaps *C. ambiguus*, *C. gunnisoni*, *C. nuttallii*, and *C. weedii* as well. A few spp. receive more than one inch per week in the wild, particularly those from Northern California and Western Oregon, but it should be kept in mind that for the most part, these are xerophytic plants, which should be kept on the dry side. Also keep in mind that watering is proportional to drainage; a well-drained mix requires slightly more water than a water retentive mix. Thus C. Baccus uses only rainfall to water his plants, by using a humusy, water-retentive mix. All species should be kept dry during dormancy, although some receive occasional rains during dormancy. If it rains significantly in your area during the dormancy of an in-ground spp. it should be dug

Thanks for the slides - we're sending them up to Dr. Weera. Will give a more extensive answer to your letter in a bit. Meanwhile, here's II#2 as requested - in time for planting season. - KRS

and stored. Otherwise the bulb may rot, especially under hot conditions. The bulbs may be stored in vermiculite or sand to avoid dessication. Seedlings should not be uprooted during their first year, thus growers in rainy climates are advised to start their seedlings in pots. By doing so they will be able to avoid having to dig up first year seedlings after dormancy. Bulbs grown in pots can be merely dried out: no digging or storage are necessary.

### III. Shade and Sun

The fairy lanterns and pussy ears prefer shade. All the others prefer part shade, especially if the lower part of the plant is in shade and the upper part is in sun. In very hot climates, full shade during the hottest parts of the day may be advisable, with part shade during the early morning and late afternoon. Areas with frequent fog, overcast, clouds or rain may do better with full sun at all times.

### IV. Fertilizer

I just started using Lilly-Miller "Bulb & Bloom," a complete, low-nitrogen bulb fertilizer, this year. Results are impressive with regard to both seedling growth and flower quantity and size. Others use ammonium nitrate (Baccus), superphosphate (Kline), "Miracle-Gro" (Robnett), and dolomitic limestone (Farwig). I use one teaspoon per 5 gal. pot, or per square foot of ground. In the trials so far, "Miracle-Gro", a commercial fertilizer, proved as effective as the bulb fertilizer.

### V. Pesticides

Fungicides have proven safe for seedlings (Ortho "Captan" and Lilly-Miller Soil and Bulb Dust). A small amount may be mixed in the top of the mix or soil to aid in the prevention of damping-off. Follow package directions, and be sure the fungicide is specific to damping-off pathogens. An alternative is pasteurization of the media by baking it at 180° for 2 hours.

### VI. Planting Depth

As we indicated last edition, the best planting depth proved to be 1/4" for seedlings of all spp. Next best is 1/2". Again, it should be noted that other growers have quite successfully used other planting depths. Specifically, Jim Robnett places his seed 3/4" below the surface.

For bulbs, 3-4" is adequate. Except for the pussy ears, a large pot should be used--at least one gallon for three bulbs. These larger pots allow for more support for the taller spp., especially the Mariposas. A 3- or 5-gallon pot is even better.

### VII. Spacing

Bulbs prefer 3-4" apart, but will tolerate less if given enough fertilizer. Seedlings tolerate 1/2-1", but will eventually need more space.

### VIII. Planting Time

There does seem to be some genetic code in *Calochortis* which inclines them to germinate at the optimum time of year for rainfall in their indigenous areas. Thus the California spp. germinate in fall or winter, during the rainy season on the Pacific Coast; while the Mexican spp. germinate in early summer, the season of rainfall on the Mexican plateau.

It is difficult to judge when is the optimum planting time for the different spp., then, unless one lives in or near their indigenous zone. In general, the Pacific Coast spp. are best planted in late autumn, the Inland U.S./Canada spp. in very early spring, and the Mexican plateau spp. in late spring to early summer.

Exceptions are for growing spp. under conditions which are severe or unusual for a

particular spp. Most Pacific Coast spp. require a degree of chilling to germinate, and cool conditions for optimum growth. The exceptions are certain Southern California coastal spp., which grow in mild conditions year round. As these spp. do not require chilling, but will not take cold, they can be planted in spring in cold climates (*C. weedii*, *C. plummerae*, and *C. catalinae*). Other winter growing spp. should be planted in late winter or very early in the spring in severely cold climates, in order to prevent growth until spring.

If your area is on the dry side in winter, the inland spp. can be planted in the late fall, provided it is not a mild climate. (Growers in mild climates must cold stratify the seeds of many inland spp. to get them to germinate--see section below on cold stratification.) These inland or high altitude spp. include *C. apiculatus*, *C. elegans*, *C. lyallii*, *C. subalpinus*, *C. nudus*, *C. minimus*, *C. nitidus*, *C. eurycarpus*, *C. greenii*, *C. howellii*, *C. longebarbatus*, *C. persistens*, *C. bruneauensis*, *C. palmerae*, *C. leichtlinii*, *C. macrocarpus*, *C. aureus*, *C. invenustus*, *C. kennedyi* var. *munz*, *C. nuttallii*, and *C. gunnisoni*. Some of the SW high altitude spp. may do better with some cold stratification as well (*C. flexuosus*, *C. concolor*, *C. kennedyi*, and *C. ambiguus*).

The Mexican spp., with the exception of those from Baja, require summer germination and watering (June to the end of October). Depending upon the altitude at which they were collected, they prefer dry winters with cool to cold temperatures.

With the exception of the Mexican spp., almost all of the *Calochortis* can be planted out of season, so long as some attention is paid to their optimum growing conditions. As most of the growth is in spring, cool temperatures are requisite. It is quite difficult to grow any of the inland U.S./Canada spp. or the Pacific Coast spp. (with the exception of the So. California spp. discussed above) in hot weather. But the spring growers can be started in fall in mild climates, provided they are first cold stratified. And the winter growing Pacific Coast spp. can be started in spring if they are kept sufficiently cool.

## IX. Vegetative Propagation

The only known method of vegetative propagation for *Calochortis* is bulbiliferous. So far as is known, all *Calochortis* bulbs divide slowly, over time. Certain spp. also produce bulbils, small bulblets, in the leaf axils (where the leaf meets the stem). These spp. are *C. uniflorus*, *C. longebarbatus*, *C. umbellatus* (rarely), all of section *Mariposa* except for *C. dunni* and *C. striatus*, (rarely for several spp.), *C. gilesbreghtii* (rarely), *C. barbatus* (rarely), *C. spatulatus*, *C. pringlei*, *C. cernuus*, *C. purpureus*, *C. foliosus*, and *C. hartwegii* (rarely).

It is not known, at present, whether other vegetative propagation techniques used with other genera of bulbs will work with *Calochortis*.

## X. Cold Stratification of Cold Climate Seeds

Seeds of spp. from cold climates require chilling under moist conditions to germinate. In their native range this is provided by melting snow. In mild climates, it must be provided artificially, by simulating melting snow. It should be noted that mere cold is not enough: both cold and moisture must be present (per field trials). Providing an atmosphere which hovers around 32°F (0°C) during moist stratification of seeds will achieve good results. Either one can place the entire pot in a(n old) refrigerator, keeping it covered with ice as it slowly melts; or the seeds can be put in moistened vermiculite in a ziploc bag, and transplanted when they germinate. This process usually takes about six weeks, but some of the seeds may take longer.

## XI. Seedling Care

The most difficult stage of growth for *Calochortis* is the seedling stage. We have treated seed care under most of the above headings, but here are some additional tips:

1. It is better to start the seedlings in pots or flats and transplant them to the soil after their second year of growth, unless one lives in or near the native range of a sp.

2. Bottom watering of pots will reduce the danger of seeds floating about, or becoming dislodged during the germination period. Some growers place a top dressing of tiny pebbles or bark pieces on top of the soil or mix to hold the seeds in place during watering and keep the moisture even. As a bonus, the top layer insulates against excessive heat or cold.

3. The seeds must be kept evenly moist, but not sopping wet. This applies especially to the desert spp., which can be particularly finicky as to water. Too much water encourages damping-off, which can carry off half or more of the seedlings, or cause the tiny bulbs to rot. Too little water can cause dessication.

4. Warmer, drier climates may require somewhat more water; cloudier or cooler climates somewhat less, and so on. The seedlings should be checked every 4-5 days for moisture, especially potted ones. It is advisable to let them dry off a bit between waterings both to discourage damping-off and to increase aeration, but not more than a week should elapse between waterings or rain (except for the desert spp. as above).

5. Enough water should be applied to keep the water table below the roots, and thus prevent salt build-up. Thus enough water should be applied to flush any excess salts (fertilizer) from the root zone, but no more: a trickle should appear out of the pot's drain holes after watering.

6. Dormancy will vary by sp., but it is generally summer to mid-autumn for the winter (Pacific Coast) spp., mid-summer to late winter for the inland and high altitude spp., and late autumn to spring for the Mexican plateau spp. The bulbs should be kept as dry as possible during this period. Dormancy is marked by a browning of the tiny first year leaf, and then its withering.

## XII. Greenhouse Culture

Cold climate growers can simulate native conditions for mild climate spp. through the use of an alpine house, an unheated greenhouse. Most Pacific Coast spp. prefer cool, but not frigid winters. In the hilly or mountainous areas where most of them grow, they are specialists in surviving where the nights dip below freezing, but the days warm up to above freezing. This is what an alpine house can provide: warm days, but cool to cold nights.

Only a few sp. will tolerate a heated greenhouse, viz., the Southern California coastal spp. This holds especially if the greenhouse is kept humid. Most spp. prefer cool growing conditions. An alpine house can also be used to keep desert spp. on the dry side, and dormant spp. out of the rain.

I have no experience of forcing, but there is one source on the subject (to be printed in the Jan. 1991 MARIPOSA. Also cf. the section on out of season planting above, sect. VIII).

## XIII. Pests

Apart from damping-off, discussed above (sect. V), *Calochort* are relatively pest-free. There may be the occasional rodent or gopher, but these can be kept away with *Felis domestica*. Near the coast mildew (*botrytis*) has been reported, but I've never encountered it. Proper drainage as well as thorough drying between waterings may prevent it. The occasional aphid can be checked with ladybugs. Snails and slugs must be watched for.

## XIV. *Calochort* for Specific Climates

1. Mild, moist climates: *C. albus*, *C. amabilis*, *C. amoenus*, *C. pulchellus*, *C. monophyllus*, *C. tolmiei*, *C. umbellatus*, *C. uniflorus*, *C. catalinae*, *C. palmerae*, *C. splendens*, *C. venustus*, *C.*

*superbus*, *C. vestae*, *C. luteus*, *C. simulans*, *C. clavatus*, *C. plummerae*, *C. weedii*, *C. obispoensis*, *C. fuscus*, *C. ghiesbreghtii*, *C. barbatus*, *C. spatulatus*, *C. pringlei*, *C. cernuus*, *C. purpureus*, *C. hartwegii*.

2. Mild, dry climates: *C. albus*, *C. catalinae*, *C. flexuosus*, *C. dunnii*, *C. splendens*, *C. striatus*, *C. venustus*, *C. concolor*, *C. kennedyi*, *C. clavatus*, *C. ambiguus*, *C. plummerae*, *C. weedii*, *C. barbatus*, *C. spatulatus*, *C. pringlei*, and the other Mexican *cyclobothras*, if they are kept moist in summer and dry in winter.

3. Cold, dry climates: *C. elegans*, *C. longebarbatus*, *C. nitidus*, *C. eurycarpus*, *C. flexuosus*, *C. leichtlinii*, *C. macrocarpus*, *C. nuttallii*, *C. kennedyi* (var. *munz*), *C. ambiguus*, *C. gunnisoni*, *C. aureus*, *C. bruneaunis*, and the higher elevation Mexican spp., e.g., *C. venustus*, and high altitude strains of *C. barbatus*.\*

4. Cold, moist climates: *C. albus* (Sierra form), *C. apiculatus*, *C. coeruleus*, *C. elegans*, *C. lyallii*, *C. subalpinus*, *C. minimus*, *C. nudus*, *C. nitidus*, *C. greeni*, *C. howellii*, *C. persistens*, *C. palmerae*, *C. superbus*, *C. vestae*, *C. luteus*, *C. leichtlinii*, *C. invenustus*.

\*With protection, one can grow the Mexican spp. in cold climates as well. Simply dry them out in late autumn, and store them in a cool place, which will not freeze.