MARIPOSA

the newsletter of the ***CALOCHORTUS SOCIETY***
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C. venustus "2-spot form"

Update on Bulbils Lot # 2 –

Readers who ordered seed and/or bulbils were warned when their order was sent that Lot # 2, named as bulbils of *C. balsensis* on the list, probably had been misidentified. Lottie Jenvey provided the bulbils from plants she had grown from materials supplied to her as *C. balsensis,* but once her plants bloomed, she was concerned whether this was the correct classification. She provided photos of the plants, which I sent on to Frank Callahan (since I am unfamiliar with the Mexican species). Frank says Lottie was right to be concerned; the plants are indeed NOT *C. balsensis,* but *C. spatulatus.* So readers who ordered bulbils of Lot # 2 now have two forms of *C. spatulatus,* this second lot having somewhat narrower tepals than the more typical *C. spatulatus* of Lot # 1. Our (Lottie's and my) apologies for the disappointment.

Species of the Issue – *Calochortus aureus*

Background – Like many of the *Calochortus,* this taxon has a somewhat complex history. It was first announced as *C. aureus* by Watson in the ***American Naturalist,*** Vol. 7, p. 303 (1873). The following year, Baker included it in his essay on the genus *Calochortus,* published in the ***Journal of The Linnean Society,*** Vol. 14, pp. 305-06 (1874) as a member of his "subgenus II. PLATYCARPUS." Other members of this new "subgenus" proposed by Baker were *C. flexuosus, C. uniflorus, C. lilacinus* (a Napa-Lake county plant now subsumed into *C. uniflorus* as a tetraploid form), *C. nuttallii,* and *C. nitidus* – a rather odd grouping, and one that has not withstood the test of time and closer examination of the plants themselves. *C. aureus* was subsequently recorded by Bailey in his 1900 *Calochortus* list (***Cyclop. Hort.,*** Vol. 30, p. 634). Purdy included it in his "Revision of the Genus *Calochortus*" (***Proceedings of the California Academy of Sciences,*** 3rd Series, Botany, Vol. II, No. 4, 1901) as a member of his "Group 5" (the only other member being *C. kennedyi)*; but it was not included by Abrams in his ***Illustrated Flora of the Pacific States*** (Vol. I, Stanford University Press, 1923) – perhaps he considered it as occurring outside his intended geographic limits? In 1940, Ownbey listed it as *C. nuttallii* var. *aureus* in his ***Monograph of the Genus Calochortus,*** published as Vol. 27, No. 4 (November 1940) of the ***Annals of the Missouri Botanical Garden.*** Recent authors have once again elevated this plant to full species status.

Description – Ownbey's description, in its entirety, is as follows –

> Petals lemon-yellow, with a maroon blotch above the gland; stems usually short, with a large bulblet near the base; otherwise exactly as in the species. This variety is hardly more than a color form, but it is easily separated, and seems to have a distinct geographical range.

Reference to the photographs raises a question as to whether this was a satisfactory portrayal of the petal markings. A "maroon blotch above the gland" appears to be an inaccurate characterization of reddish blotch immediately below (or contiguous to) the hairy, golden gland, and the distinctive arching or crescent red band above the gland. Ownbey's description better fits the typical *C. nuttallii* markings, and thus it supports his reduction of this taxon to a var. of *C. nuttallii.*

But Beal and Ownbey's later cytological analyses ("Cytological Studies in Relation to the Classification of the Genus *Calochortus,*" ***Botanical Gazette,*** Vol. 104, 1943, pp. 553-62) apparently revealed that *C. aureus* was a tetraploid, with a "double" number of chromosomes, while *C. nuttallii* was not. They noted (p. 559) it was "as distinct morphologically, cytologically, and geographically as *C. davidsonianus"* [the southern California tetraploid plant related to *C. splendens–Ed.*]. This suggests to me that Ownbey had second thoughts about reducing this taxon to a var. of *C. nuttallii.* Even if there were greater similarity between the markings of *C. nuttallii* and those of *C. aureus,* the color differences and the geographic distinction, plus the tetraploidy of *C. aureus,* seem to justify a clear differentiation between the two.

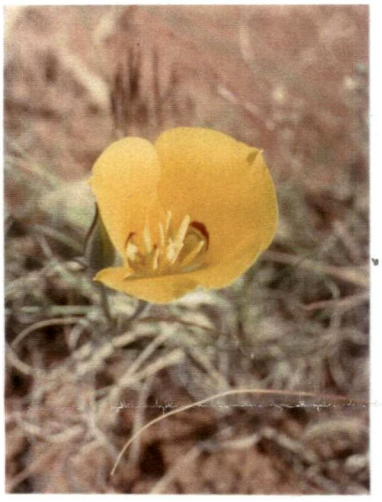
The botanical-powers-that-be now accept *C. aureus* as a species in its own right, while agreeing with Ownbey that it should be classified as a member of Section II. MARIPOSA, subsection NUTTALLIANI. The other members of Ownbey's subsection NUTTALLIANI are *C. nuttallii, C. nuttallii* var. *panamintensis* (now elevated as a separate species, *C. panamintensis), C. nuttallii* var. *bruneaunis* (which is also now elevated as *C. bruneaunis), C. clavatus, C. concolor, C. excavatus, C. invenustus,* and *C. kennedyi.* All these species have a basic chromosome number of 8, as opposed to 7 ("rarely 6," Ownbey says) for the VENUSTI, 7 for the MACROCARPI, and 9 for the GUNNISONI, the other subsections of Section MARIPOSA.

Ownbey's NUTTALLIANI list – and what has happened to it in recent years – is a good example of the struggle between "lumping" and "splitting" – the great botanical "divide" that occurred somewhere around 1900. Prior to then, field botanists and naturalists tended to classify every odd form and color variant they encountered as a *"species novum."* As the twentieth century took hold, however, there was a move toward the simplification of taxonomy by subsuming all variants, minor or major, into a "primary" species, or at most categorizing them as subspecies or vars. (My suspicion is that this was at least in part the result of botanists finding themselves overwhelmed by the ever-increasing list of species, as botanical exploration was extended into more and more areas of the planet.)

In recent years there has been a distinct but more limited return to "splitting." As more advanced analytic techniques such as chromosome counts, sophisticated color studies, and now DNA analysis have become available, many botanists are taking a second look at the issue of when a plant should be elevated to full specific status. There remains the problem of trying to "force" intermediate forms (which occur far more commonly among plants than they do in the animal kingdom) into neatly defined and strictly separated pigeonholes as required by an exacting taxonomic approach. A rigid taxonomy flies in the face of the "real world" and the process of evolution, in my opinion, although I believe it is a far greater problem in botany than in zoology. Part of the difficulty may simply lie in trying to treat the plant and animal kingdoms by the same set of "rules."

Habitat and distribution – *C. aureus* can be found in the high deserts of southernmost Utah, western New Mexico, and eastern Arizona. It is well known in Arizona's "Petrified Forest" (the park which, as readers probably know, now protects some of the remains of the huge inland tropical forest lands which once occupied this area and were later uplifted by more than a mile to become a desert – the trees having become fossilized after dying as a result of the climate change). Frank Callahan tells me that the various

***Calochortus aureus* –**
(photos by Jim Robinett)





species of *Calochortus* in this high desert area from Arizona to Utah (known as the "Chinle Formation") probably became established after the uplift and change in climate. Whatever the origins, Ownbey reports a collection of *C. aureus* from a "dry hillside" on the King Ranch in Emery county, Utah, as well as "on sandstone, near Lupton" in Arizona, but gives no additional information about habitats *per se*.

In mid-June 1995, Jim and I found *C. aureus* in full bloom on dry, gritty, reddish clay flats amid very thin grasses in northeastern Arizona south of Canyon de Chelly, along Highway 191 just west of the town of Ganado in Apache county. Our altimeter registered 5100 feet. While they could hardly be called "thick," many hundreds of blooming plants were scattered along both sides of the highway for a quarter mile or more. The combination of reddish clays, bright yellow flowers, and the glaucous (blue-gray) foliage which prevailed among the plants in the area was very attractive. Ownbey also listed several locations around the town of Holbrook in Navajo county, some 50 air miles southwest of Ganado and nearly a thousand feet lower, giving late May blooming dates. We found nothing in the Holbrook area, and concluded that we were probably too late for bloomtime at this lower elevation. We had no opportunity to check the Utah or New Mexico locations Ownbey listed.

Ownbey's map of the distribution of subsection NUTTALLIANI shows a fairly limited overlapping between reported sites for *C. aureus* and those for *C. nuttallii,* with the latter ranging from scattered locations in northern Arizona and central and western Nevada, far to the northeast – across Utah, western Colorado, southeast Idaho, all of Wyoming, the eastern half of Montana, and the westernmost Dakotas. (Jim and I found *C. nuttallii* easily in western Colorado and north central Utah, and did not perceive much similarity in the petal markings between it and *C. aureus.)*

The website of Utah State University at Logan – <*www.nr.usu.edu*> – offers links to a paper by Ramsey et al., "A Digital Atlas of the Vascular Plants of Utah...," which includes distribution maps for four species of *Calochortus.* The *C. aureus* map gives more than 20 locations clustered in south central Utah, all in the ecoregion called the "Colorado Plateau" (which is entirely southeast of a line drawn across the state roughly from its southwest corner to the lower of its two northeast corners). They report an elevation range for *C. aureus* of 1210 to 1700 meters (about 4000 to 5600 feet). Their map for *C. nuttallii* (which is Utah's "state flower") depicts a great many sites covering the entire state, including even the borders of the Great Salt Desert, at elevations of 1150 to 2850 meters (3800 to 9400 feet). The distribution map for *C. flexuosus* shows about two dozen sites scattered across the southernmost part of Utah, at 840 to 1970 meters (2800 to 6500 feet); and their map for *C. gunnisonii* gives about a dozen locations in the eastern portion of the state, from 2120 to 3030 meters (7000 to 9900 feet).

(I can't help thinking how wonderful it would be if there were similarly detailed site information for all the *Calochortus* on the Internet !!)

Cultivation – Jim never grew this species (although seed is sometimes available from Sally Walker at Southwestern Natives, P. O. Box 50503, Tucson, AZ 85703); he had been discouraged by his poor results with other high-desert *Calochortus.* My guess, given its altitude range, is that *C. aureus* would require cold stratification; a very well draining, gritty mix; and careful protection from both humidity and soil moisture as the weather warms. This is largely borne out by Diana Chapman's experience, detailed below.

Readers' Forum –

I am delighted to be able to offer readers some detailed growing information focused on higher, more inland species, provided by Diana Chapman, proprietor of Telos Rare Bulbs.

❀ Cultivation Tips – Some of the More Difficult Species – by Diana Chapman

My first attempts at growing *Calochortus* species that are adapted to climates quite different from the one in which I live, such as those from the desert, or from mountainous regions, were dismal failures, supporting the reputation that these species have for being difficult or even impossible to grow. At that time my husband and I lived in the hot interior of California. Since then I have, through trial and error, had some limited success with these species, and I'd like to share these techniques in the hopes that others might try the "impossible" ones.

Firstly, my husband and I now live in the far northern part of California, about two miles from the coast. This is the redwood belt, with frequent summer fog, mild wet winters (about 48" average rainfall, which occurs mostly from October to April), and cool summers, with temperatures very rarely going above 7°F. The climate is damp year round, more favorable to *Trillium* than *Calochortus.* In spite of this "unsuitable" climate, we have so far succeeded in growing (almost) to maturity *Calochortus aureus, ambiguus,*

concolor, bruneaunis, excavatus, gunnisonii, invenustus, kennedyi, leichtlinii, macrocarpus, nuttallii and *panamintensis* – all species from regions much drier than this area, with climates that have colder winters and hotter summers. I say "almost" because we have only been in this region for 3½ years – not long enough for them to fully mature and bloom, so this is still an experiment in progress.

Stratifying the seeds – The seed of most *Calochortus* species from regions that experience prolonged freezing temperatures in winter will not germinate without first going through a cold, moist period. In mild winter regions this can be simulated by sowing the seed in the refrigerator – a technique called stratification. Even though the species mentioned above come from very different regions, all the seed is treated the same way. In October, the seed of each one is placed in a small to medium-size plastic Ziploc® bag along with ¼-½ cup of fine grade vermiculite that has been slightly dampened. Each bag is labeled with the species name, source of the seed, and the date. The contents are thoroughly shaken up to distribute the seeds evenly throughout the vermiculite, and the bags are placed in the food compartment of a refrigerator that we keep for this purpose. No fungicide is added. Although some batches DO go moldy, this is rare, and I am convinced that when this occurs it is either due to too much moisture in the bag, or it is simply a poor batch of seed that was probably not viable. The amount of water added to the vermiculite is extremely important. The vermiculite should appear only slightly damp, with no clumping and no free water visible in the bag, although a little condensation after refrigeration is acceptable. It takes very little moisture to initiate germination of *Calochortus* seed, and if the mixture is judged to be too dry, at some later date more water can then be added. Some of the species noted above will germinate without stratification, such as *C. kennedyi* and *C. aureus,* but I get much better and more even germination with these species when I refrigerate the seed as described. I may be mistaken, but I also think the seedlings are more vigorous when the seed has been stratified.

Growing the seedlings – The bags are checked weekly for signs of germination. It is very easy to see when germination occurs (and, by germination, I mean the emergence of the radicle), at which time the seeds are removed and potted up. Germination can be as rapid as two weeks, or can take as long as ten weeks, depending upon the species. I was quite startled to see *C. gunnisonii* germinating after only two weeks the first time I tried this, and this has held true every year – it is always the first to germinate, while *C. macrocarpus* is the last, usually taking several more weeks. When the seeds are potted up, they are removed from the vermiculite using a coarse sieve. I think vermiculite is unsuitable for species that need to be grown very dry, so I do not add it to the potting medium. The seeds are sown on the surface of a very free-draining mix, sprinkled with Captan® to prevent damping-off, then covered with about ½" of very coarse grit or other similar material. Last year I topped off the pots with horticultural pumice with very good results, since it keeps the surface of the pot quite dry between waterings. The potting mix I use is approximately 50% ground fir bark, 25% perlite, and 25% pumice. I don't use sand because I want a very light mix that is extremely free draining and well-aerated; I believe sand would fill up the air spaces between the coarse particles of the mix I use, and also make the pots too heavy. The pot size I use for species that need to be grown dry is 5"x5", and 5½" deep. You need a pot that is deep enough for the bulbs to remain in for the first two years, but not so large that the potting medium will not dry sufficiently between waterings. All the pots of seedlings are kept under cover in alpine-house conditions (i.e., in an unheated greenhouse that is extremely well ventilated). Actually, we grow all our *Calochortus* this way now, to protect them from excessive moisture, since the rainfall in this region is a bit too much for most *Calochortus* species. Once a month the seedlings are fertilized with a liquid tomato-type fertilizer at full strength. Tomato fertilizer has proportionately more phosphorus and potassium than general fertilizers, minerals which are beneficial for bulb formation. In very wet winters when the atmospheric humidity can hover in the 90% range day and night, I turn on an electric fan directed at the trays of seedlings to prevent

moisture from condensing on the seedlings and the surface of the potting medium. More mature bulbs do not seem to be adversely affected by the high humidity, as long as the foliage remains relatively dry.

Watering the seedlings – The seedlings are only watered when the surface of the potting medium appears completely dry. After about one month's growth, I try to allow the upper inch or more to remain fairly dry, with the intention of keeping the tiny bulbs and leaflets as dry as possible, while the roots are in damper conditions. You really can't stick your finger in a pot of tiny seedlings to test for moisture without doing some damage, so I have learned to tell how dry the pots are by hefting the pot to feel its weight, or by looking into the drainage holes to see if the potting medium at the bottom of the pot looks damp. I don't stick my finger in the drainage hole, since that's where Black Widow spiders like to hang out! I have large labels that say "DRY" stuck in the pots of all the species that need infrequent watering so that I don't absent-mindedly water them along with everything else. Some losses do occur, almost always due to too much moisture.

Care of the maturing bulbs – When the seedlings go dormant their first year, the pots are allowed to dry thoroughly in the greenhouse. Their second winter, the entire pot is placed back in the refrigerator in October. In January I bring the pots out, water them, and repeat the same procedure as far as fertilization, etc., is concerned. Shoots will usually appear within a week or two of watering. The third winter, I unpot the bulbs, place them in dry peat in plastic bags, and put them back in the refrigerator in October. When I see roots being energetically produced, I remove the bulbs and pot them up. Some species start producing roots in a month or so, while others take longer.

Final comments – Although the dampness of our climate in coastal Northern California presents some challenges, I believe it is the cool summers here and the lack of extreme temperature fluctuations that have helped in growing some of the more difficult species. When my husband and I lived in the interior of California, with summer temperatures that commonly reached over 100°F for up to five months, I had no success whatever in growing most of the species mentioned in these notes, in spite of stratifying the seeds as described. Germination would occur, but the seedlings would be forced into a premature dormancy, since temperatures could reach as high as the nineties by April. Cutting short the growth cycle prevents the tiny developing bulb from storing sufficient energy to make a comeback the following year. In our climate here, winter merges almost imperceptibly into spring, and summers can feel almost wintry. The alpine species love these conditions, for although daytime temperatures in their native habitats in the mountains of the West can be fairly high, night-time temperatures are quite cool, even in summer. Although one might think that the desert species would have loved the heat of the interior, this was not so, for species such as *C. aureus* and *C. kennedyi* often grow at fairly high elevation, and have completed their growth cycle by the time the hot weather sets in, with their bulbs well-insulated at considerable depth. Bulbs that are grown in pots are subjected to greater fluctuations of soil temperature and moisture than they would experience in their natural growing conditions, and if the temperature swings are too extreme, this can lead to failures. In warmer climates than ours, it may be possible to overcome this by using a sand plunge to keep conditions in the pot more stable. A "plunge bed" is a deep bench filled with damp sand with the pots sunk in the sand up to their rims – essential equipment for growing many alpine plants.

Some of the species mentioned in these notes look as though they will bloom this year, while others.... who knows? It has been said that you can GROW some of these species, but getting them to bloom is another matter! I will keep the Editor of ***Mariposa*** posted, and I hope that readers will find my experiences useful. –