



C. splendens

MARIPOSA

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There Are Changes Ahead –

On a personal note, my 70th birthday was in February. Though my health is still good, I am all too aware that I'm no longer able to do all the things I could do 5 or 10 years ago. Then in March, my son informed me that for employment reasons he was moving his family from Southern California to Phoenix, AZ – just enough further away that I suddenly felt isolated in Brookings, OR. My son asked me to come to Phoenix also, and I liked the idea. So I have purchased a “life care contract” at an establishment in a Phoenix suburb, and as you read this am moving. I will be going into an independent, generous-sized one-bedroom apartment, and expect to remain independent for a long time; but as the years – and my needs – progress, my care needs will be met, and my well-being assured by the watchful eyes of my son Tom.

This was a big decision, and several friends expressed concerns. But I am truly looking forward to the change. I grew up in a climate only slightly less hot and dry than Phoenix, and my initial trip there in April satisfied me that I will adapt quickly to the Arizona desert. In addition, I have been living in small towns offering limited resources for more than 20 years. I am eagerly anticipating the access to museums, shows, art galleries, and all the appurtenances of “big city life” I once enjoyed, 30 and more years ago.

At the same time, I decided to transition *Mariposa* into new hands. Diana Chapman of Telos Rare Bulbs has agreed to assume the editorship with the January 2005 issue, and I do not doubt she will do a bang-up job of bringing a fresh perspective to the genus *Calochortus*, with more attention to the challenges of cultivating its species than I have been able to give it. I will remain available as a consultant if and when she needs it. But I am quite tied up with the process of resettling right now, and as a result there will be no Seed Exchange this year. But see a very special bulb offer below...

To be clear, there will be → **NO SEED EXCHANGE** ← this year.

Also, effective immediately, back issues should be ordered from –

Diana Chapman
P. O. Box 4978
Arcata, CA 95503

C. obispoensis bulbs available

Chuck Baccus has been growing *C. obispoensis* from seed for a mitigation project and has received permission to distribute a few bulbs to *Mariposa* readers. If you are interested, send a “Priority Mail” stamp to C. Baccus, 900 Boynton Avenue, San Jose, CA 95117-2032.

More on DNA Analysis of the Genus *Calochortus*

Reader Mia Molvray has kindly sent me a reprint of an article authored by Tom Patterson and his major professor, Thomas J. Givnish (University of Wisconsin-Madison), which was published in the journal *New Phytologist* late last year. It is available on-line at www.newphytologist.com. The paper, though more brief, parallels the material in Patterson's Chapter 2, with particular emphasis on the evolution of the geographic distribution of the species, and the independent development of, on the one hand, serpentine tolerance and, on the other, similar "floral syndromes" (flower types) numerous times within the genus.

The primary cladogram offered here carries no disclaimer that the run was "incomplete" because the computer ran out of memory. I infer that the run must have been repeated with a larger computer; and the results, while quite similar, are not identical. Of particular importance to my concerns with Patterson's original cladogram, *C. kennedy* has been removed from the "Sierra Nevada & Coast Ranges" clade to the "Great Basin-Rocky Mountain" clade (where by chromosome number it fits much better) as "sister" to *C. clavatus* rather than *C. venustus*. And *C. catalinae* has been shifted from Patterson's "Great Basin & Rocky Mountain" clade to the "Coast Ranges-Sierra Nevada" clade, as "sister" to *C. venustus* rather than *C. clavatus*. These assignments make much more sense than those presented in Patterson's original thesis. Otherwise, the core cladogram remains much the same. Mysteriously, there are still discrepancies between the basic chromosome number ($N=7,14$) for *C. concolor*, *C. leichtlinii*, and *C. macrocarpus* compared with other members of the "Great Basin-Rocky Mountains" clade ($N=8$). In new material, the authors suggest that hybridization may have been involved in the origins of *C. leichtlinii*. They also theorize that *C. tiburonensis* may have arisen as a hybrid between *C. umbellatus* and *C. obispoensis*. They estimate the initial divergence of *Calochortus* species from each other at 7.3 ± 0.9 million years ago, probably in the Coast Ranges, and dispersal outward from there.

The paper is somewhat marred by several puzzling mistakes. For example, the ranges of *C. tolmiei* and *C. monophyllus* are described as "abut[ing] where the northern Sierra Nevada and Siskiyou/Klamath Mountains intersect." In fact, the Sierra Nevada and Siskiyou/Klamath Mountains do not "intersect," given that the southeasternmost part of the latter is found some 60 miles west and 50 miles north of the northwesternmost point of the former. And the ranges of these two species, rather than "abut," share a considerable territory in the southernmost lower-elevation Cascades; indeed they often hybridize in that area (see *Mariposa*, Vol. X, No. 2 for photographs).

As another example, the authors offer a photo gallery in support of their hypothesis that similar "floral syndromes" or types have arisen independently in diverse geographic locations in response to similar light and habitat conditions. Species rather like in appearance are paired for easy comparison – the "star tulips" *C. umbellatus* and *C. nudus*; the "fairy lanterns" *C. pulchellus* and *C. balsensis* (one of the Mexican species); and the "catsears" *C. elegans* and *C. ghiesbreghtii* (another Mexican species). But as examples of "mariposas" *C. greenei* (misspelled) is paired with a mariposa labeled "*C. venustus*" – when in fact the latter picture is of Hoover's southern form of *C. argillosus*. (It must be said that the authors may be "in good company" with this latter error, as many people have misidentified *C. argillosus* as *C. venustus*; see *Mariposa*, Vol. XII, #3+4.)

Other errors fall more into the "annoying" category – the use of "west" when the context calls for "east" or the misspelling of *C. greenei* and *C. westoni* or the metamorphosis of *C. davidsonianus*' name into "*C. davidsonii*."

All in all, for those sufficiently interested, a copy of this article is a very useful addition to my efforts to summarize Patterson's thesis.

Species of the Issue – *Calochortus pulchellus*

Background – Happily, *Calochortus pulchellus* has a history only somewhat muddled by confusion over whether or not it was a taxon distinct from the “other” yellow globe lily, *C. amabilis*. According to Carl Purdy (publishing in 1901), the plant he called “*Calochortus pulchellus*” was first described by the prolific botanical explorer David Douglas in a letter, though when and to whom was not stated; Douglas also neglected to give its exact location. It apparently first appeared in print in 1834, attributed to “Douglas ex Bentham,” in the *Transactions of the Horticultural Society of London*, (Series II, Vol. I, p. 412, plate 14, fig. 1). Purdy added that it was also published twice during 1835, first in the *Transactions of the Horticultural Society* (New Series, Vol. 1, p. 415, Plate XIV, Fig. 1 – note that this citation is very similar to but not identical with the one just above); and the same year it appeared in the *Botanical Register* (Vol. XX, Table 1662). In his extensive library research efforts, the earliest work Vic Girard located was W. J. Hooker’s *Flora Borealis-Americana* (1839, p. 183); this is the earliest work I found as well. Hooker listed only three species of *Calochortus* – *C. nitidus*, *C. elegans*, and *C. macrocarpus* – with no mention of either *C. pulchellus* or *C. amabilis*.

In June 1868, Alphonso Wood (in *Proceedings of the Academy of Natural Sciences of Philadelphia*, pp. 167-69), listed a total of 12 species of *Calochortus*, which included *C. pulchellus* but not *C. amabilis*. Attribution for *C. pulchellus* was given to “Bentham” and cited as “*Cyclobothra pulchella* Benth, in Hort. Trans., n. ser., I, p. 413” – again, very similar to but not identical with the first citation given above. Wood observed: “[found on] ...Mt. Diablo (Rev. J. P. Moore), and the interior of California generally, less common than the next [*C. albus*-Ed.]... Its pendulous golden globes make a fine appearance.”

Wood had the primary location of Mount Diablo right, thanks perhaps to the good Reverend, but when he added “the interior of California generally” he created – or at least contributed to – a problem. Either he (or someone else?) had confused *C. pulchellus* (which occurs only on or near Mount Diablo in Contra Costa county) with *C. amabilis* (which is found only to the north, in approximately the southern half of the middle and inner North Coast ranges). Then in 1874, publishing in the *Journal of the Linnean Society* (Vol. 14), J. G. Baker included *C. pulchellus* but not *C. amabilis* in his list of 21 species of *Calochortus*, giving only the general location “California.”

The first effort to clearly distinguish between the two appears to have come in the article by Carl Purdy and L. H. Bailey listing 37 species of *Calochortus*, in *The Standard Cyclopedia of Horticulture* (1900, p. 632). *C. pulchellus* is attributed there to “Douglas” and given a “Cent. Calif.” location; while *C. amabilis* is attributed to Purdy himself, with the location “Cent. and N. Calif.” In both cases, the descriptions were brief, and no specific comparisons between the two were given. The following year, Purdy published his “Revision of the Genus *Calochortus*” in the *Proceedings of the California Academy of Sciences* (Third Series. Botany. Vol. II, No. 4, 1901) in which he offered considerably more detail:

The original specimens [of *C. pulchellus*] were collected by Douglas prior to 1835. The exact locality is not given; but the only place in which the species has since been found is in the Mount Diablo region, a section which was easily accessible at the time of Douglas’ visit to California, and often visited by his Mexican-Californian hosts.

Although in a region much visited by botanists since then, no specimens were to be found in any of the herbariums of this State up to the year 1897, when *C. pulchellus* was collected by Miss Alice Eastwood of the California Academy of Sciences.

The very name *Calochortus pulchellus* had been appropriated by another yellow-flowered species of the same group, which is described and named below as *C. amabilis*, and which is clearly a distinct species. ... The [latter] is found on the hills along the north side of San Francisco Bay, from

Calochortus pulchellus –



– Photographs from the collection of Stan Farwig & Vic Girard

the redwood belt to the Sacramento foot-hills, as far north as Burnt Ranch, Trinity County, California. ... [*C. amabilis*]...has been distributed in large numbers among the flower-growers of the world as *Calochortus pulchellus*, which it resembles in habit and size. The latter is more closely allied to *C. albus*, having the same globular flower and petals silky-haired within. It is also of a much lighter shade of yellow, and never could be confused with *C. amabilis* by anyone who had seen both (pp. 118-19).

Not all botanists accepted Purdy's carefully reasoned argument and accurate reporting, however. No less than Willard Linn Jepson himself disputed Purdy's judgment in his own work, *Flora of Western Middle California*, when he reduced *C. amabilis* to a var. of *C. pulchellus* (1901, p. 113). Then he compounded the error in his original *A Manual of the Flowering Plants of California*, omitting *C. amabilis* entirely from the list, while accompanying the paragraph headed "*C. pulchellus*" with an illustration of a scape with two flowers; one of the flowers has the sub-globular flower with horizontal sepals of *C. amabilis*; while the second is quite globular with more relaxed sepals – more like *C. pulchellus*! (Fig. 278, p. 237.)

In his 1940 "Monograph of the Genus *Calochortus*" (*Annals of the Missouri Botanical Garden*, Vol. 27, No. 4), Ownbey seemed to firmly settle the matter:

[*C. pulchellus*] ...is closely related to *C. amabilis*, but can be distinguished by its larger, more nearly globose flowers, which are of a lighter shade of yellow, and its longer-fringed petals, which are sparsely hairy to the tip (p. 401).

[*C. amabilis*] ...is closely related to, and has been frequently confused with, *C. pulchellus*, but differs from that species in its smaller, deeper yellow flowers and its shorter-fringed, nearly naked petals. These characters are remarkably uniform, and although intermediates occur, these are very rare and appear to represent only an occasional extreme plant within a perfectly normal population (p. 402-3)

Indeed, all subsequent authors have followed this distinction.

Tom Patterson's DNA studies (see *Mariposa*, Vol. XIV, No. 4, July 2003, and the longer summary of his work printed separately), add an interesting note here. His first, "incomplete" run of 74 taxa, using three segments of plant cell chloroplast DNA, suggested that *C. pulchellus* was a "sister" or closest relative to *C. umbellatus*, which at one time was quite abundant in the San Francisco Bay area, although now it is difficult to find outside of the wilder parts of Marin county, immediately north of the Bay. In this "incomplete" run, *C. amabilis* was several steps removed. His repeat run, with only 28 taxa, which was completed, did not include either species. [The revised cladogram presented in Patterson & Givnish (see the previous article) shows the same relationships.] Later he analyzed only the members of Section CALOCHORTUS, this time using two segments of a different type of DNA, from the nuclei of the plant cells. Here *C. pulchellus* emerged as "sister" to *C. albus* (which it more closely resembles in flower shape), and was well removed from both *C. umbellatus* and *C. amabilis*. If I might be given the liberty of an "educated guess" about these differing results, I would speculate that *C. pulchellus* may have "absorbed" some chloroplast DNA from *C. umbellatus* via the process called "introgression" – the result when related species hybridize, then the hybrids "back-cross" with one of the parents. This process is believed to be fairly common, as well as fairly important in the evolution of new species.

Description, Habitat, and Range – Purdy was quite right – no one who has seen both these plants in the field would ever mistake them for each other, at least in flower, even though the plants display much general similarity. Both have a single bright green leaf hanging down from the base; both have scapes that branch, with a few smaller leaves scattered up the stem and a single small leaf above each flower. But the flowers themselves are quite another matter. *C. amabilis* flowers, as noted earlier, have petals that "twist"

or rotate in a manner that makes the flower much less globular in appearance. On the other hand, *C. pulchellus* flowers are distinctly globular. The surface of *C. pulchellus* petals have rather long, silky trichomes or “hairs”, especially immediately above the gland, and noticeably fringed petals, but these characteristics are much reduced to nearly nonexistent in *C. amabilis*. Finally, the color of the two is not the same. The flowers of *C. amabilis* tend to be “on the gold side” of yellow; while the flowers of *C. pulchellus* are a lighter, “clear” yellow, sometimes with a slight greenish tinge. Both grow mostly on or immediately above sharp, grassy banks in open montane woodlands, although they are also sometimes found on more gently sloped grasslands in open woods. But to my knowledge, only *C. amabilis* can also be found amid serpentine scrub and on serpentine barrens as well.

C. pulchellus is known only on or near Mount Diablo (which is south of the Sacramento River), primarily on the north and west shoulders of the mountain, at elevations from about 700 to at most 2500 feet. There have been a few reports of *C. amabilis* in the Martinez area, on the south shore of the Sacramento River; this is just to the northeast of the San Francisco Bay and about 15 air miles from the peak of Mount Diablo. Otherwise it is limited to north of the Sacramento River. It occurs from Sonoma, Napa, and Solano counties on the south, to Humboldt and Trinity counties in the north, at altitudes from 200 feet or less (in Solano county in the Vaca Mountains; or in Humboldt county along the Eel River), to nearly 3500 feet (on Alderpoint Road between Alderpoint and Bridgeville in Trinity county). Geographic location is another way of distinguishing between the two; although their territories come very close to each other, they do not appear to overlap.

Risk – Obviously, *C. pulchellus* is a pretty narrow endemic, since it apparently occurs only around Mount Diablo. Much of its extant territory lies within the borders of Mount Diablo State Park, where it can be seen along foot trails on the north-to-east shoulders of the mountain, and where it presumably enjoys some degree of protection. A few populations remain outside the park, along Marsh Creek Road and Morgan Territory Road, but these areas have been heavily impacted by suburban ranching and “ranchette” development – and probably by overenthusiastic plant collectors, as well. The 2001 (6th) edition of California Native Plant Society’s *Inventory of Rare and Endangered Plants* has placed *C. pulchellus* on its “List 1B. Rare in California,” and given it a “R-E-D” code of “2-2-3” (**R** = distributed in a limited number of occurrences in California; **E** = fairly endangered in California; **D** = endemic to California), noting that it is “threatened by grazing, urbanization, horticultural collection, and feral pigs.” To those threats we might add “deer and rabbits” as well.

Cultivation – We collected a few seeds of *C. pulchellus* twice in ten years, from private land outside the State Park, and Jim enjoyed reasonable success growing it in Sonoma county. He treated it pretty much the same as *C. amabilis* and *C. albus*, planting the seeds in late fall in a well draining mix, and watering only in cool weather, and only if the rains were running below average for our area. He got good germination, but found it a slow grower; it flowered only in its fifth year (as opposed to the others, both of which he could consistently flower in their third years). Its “survival rate” for him (number of plants reaching flowering size, as opposed to number of seeds that germinated) was higher than *C. amabilis*, but lower than *C. albus* “Coast form” and much lower than that of *C. albus* “Sierra form.”

Readers’ Forum

✿ Gordon Fowler, Whitefield, UK, has sent me a June 2002 computer scan of a *C. nudus*, from Scott Mountain Summit campground (west of Mt. Shasta), noting: “there were no crescent marks on any of the flowers we found (~ 30).” Ownbey’s description of *C. nudus* includes flowers with no crescent; its presence was just the way Jim and I divided pure stands from hybrids to the east and south of Mt. Shasta.