CONSPICUOUS PROBLEMS AND INTERESTING DIRECTIONS IN MONKEYFLOWER (SECT. *SIMIOLUS*) TAXONOMY

Many taxonomic problems exist in *Erythranthe* and *Diplacus*. Below are some of the more obvious ones in *Erythranthe*.

Variable species

Each of the following species includes regional variants that might prove to be morphologically discrete and genetically isolated, at least in part, and thus justifiably accorded formal taxonomic recognition: *E. guttata*, *E. grandis*, *E. microphylla*, and *E. nasuta*; *E. tilingii* (not including *E. minor* and *E. caespitosa*); *E. glabrata* and *E. geyeri*.

Status of rare species

Each of these has been recognized on the basis of one or a few collections and treated at specific rank in the recent revision of sect. *Simiola*. Each needs to be sought in the field to determine whether it is a real entity or merely a populational variant of some other species.

Erythranthe arenicola

Known by a few collections from coastal and near-coastal localities in Monterey, San Luis Obispo, and Santa Cruz counties, California. If it is confirmed as a real entity, it may be evolutionarily derived as an annual from a perennial, *E. grandis*-like progenitor (or the two might have a common ancestor of annual duration).

Erythranthe brachystylis

Known only from the type collection from Nye Co., Nevada. It differs from *E. arvensis* in its greatly foreshortened pedicels, so that the flowers and fruits are subsessile to sessile. If it proves to be constant in morphology, it would be interesting to know if the modified inflorescence is correlated with a difference in breeding behavior.

Erythranthe regni

Known from a few collections from the Kofa Mountains, Yuma County, in southwestern Arizona. Its range is on the periphery of *E. cordata*, to which it may be closely related.

Erythranthe scouleri

Known only from a few, mostly historical collections from near the mouth of the Columbia River. Recent field study indicates that its existence is real and extant — documentation is needed. It is hypothesized to be closely related to *E. decora*.

Chromosome numbers

Infraspecific variation in chromosome number has been reported in species of *Erythranthe* sect. *Simiola*, but except in *E. guttata*, very few counts have been made. The existence of chromosome races is a direct indication of significant evolutionary events and the potential for reproductive isolation. Chromosome number surveys usually can be easily made and cover a broad geographic range. Voucher citations and further details regarding most of the comments below are found in Nesom (2012h).

Erythranthe corallina ($2n = 48$ in Tuolumne Co.; $2n = 56$ in El Dorado Co.). Neither of these numbers appears to be directly related to base x = 14, which otherwise is characteristic of most of sect. *Simiola*. *Erythranthe corallina* has a compact and discrete geographic range and is generally consistent in morphology. It is possible that either or both of the reported counts are in error.

Erythranthe guttata ($2n = 28, 56$). Map 8 in Nesom (2012d) shows the geographic distribution of reported diploids and tetraploids within the USA, all from Arizona, Utah, Colorado, and New

Mexico. A tetraploid race of *E. guttata*, apparently derived independently from the sw USA tetraploids, is sympatric with diploids along the Pacific coast of Canada into the Aleutian Islands — these northern tetraploids may range larger in size than the diploids but morphological differences are not otherwise apparent.

Erythranthe nasuta (2*n* = 28 as geographically scattered reports; 2*n* = 26 in California, New Mexico). Apparently dysploid populations have been reported from two, distantly separated locations, where they probably are independently derived. Vickery (1974) found that the New Mexico plants were almost completely genetically isolated from *Mimulus guttatus* (presumably = *E. microphylla*) but that those from California were more similar to 2*n* = 28 *E. nasuta* in their crossability.

Erythranthe tilingii (2*n* = 28 in California and Utah; 2*n* = 56 in Utah). A chromosome number has not been reported for either *E. minor* or *E. caespitosus*, which appear to be the closest relatives of *E. tilingii*.

Erythranthe utahensis (2*n* = 28 in California, Nevada, and Utah; 2*n* = 30 in eastern Nevada and Utah). The relationships of this species are obscure. It is placed here in the *E. glabrata* group (implying that the predominant number for the species is 2*n* = 30), but Vickery's allozyme study (1990) indicated that *E. utahensis* is more similar to Andean species.

Phylogeny

Very little known beyond speculative species groupings. See 'phylogram' in the comments on sect. *Simiolus.*

Herbarium study

Herbarium collections provide a unique resource for documenting and assessing morphological patterns. Major features of monkeyflower taxonomy are known, but it's probable that other previously undescribed species have already been collected and will be encountered as herbaria are studied in more detail.

The entire collections of Phrymaceae have been studied at these herbaria:

Arizona State University (ASU)
Botanical Research Institute of Texas (SMU, BRIT, VDB)
California Academy of Sciences (CAS, DS)
Chico State University (CHSC)
Missouri Botanical Garden (MO)
New Mexico State University (NMC)
Oregon State University (OSC)
Rancho Santa Ana Botanic Garden (POM, RSA)
Sul Ross State University (SRSC)
University of Arizona (ARIZ)
University of California-Davis (DAV)
University of California-Berkeley (JEPS, UC)
University of Texas-Austin (TEX, LL)
University of Utah (UT)

Partial studies at these:
Brigham Young University (BRY)
Univ. of Wyoming, Rocky Mountain Herbarium (RM)
Univ. of Washington (WTU)

Large North American collections remaining to be studied:
San Diego Museum of Natural History (SD) -- particularly to see Baja California collections
University of California-Riverside (UCR) -- particularly to see Baja California collections

Humboldt State University (HSC)
Washington State University (WS)
Utah State University (UTC)

Field Museum of Natural History (F)
New York Botanical Garden (NY)
Philadelphia Academy of Sciences (PH)
Smithsonian Institution (US)

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