CONFUSION: THE GENUS *ERIASTRUM* (WOOLLY-STAR, PHLOX FAMILY). AN EDUCATIONAL GRANT PROGRESS REPORT.

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How many species of *Eriastrum* are there?

The short answer is, we don't know. Although classifications of *Eriastrum* have been made as early as 1833 (Bentham 1833), it appears that no author has fully understood the patterns of variation in the group. The group has been placed in the genera *Hugelia*, *Gilia*, *Navarretia*, *Welwitschia*, and *Eriastrum*. As few as four and as many as twenty-one taxa have been recognized. Some varieties or subspecies have been treated under several different species. Some taxa have been recognized as varieties or subspecies, then as species; or first as species, then as subspecies or varieties.

For example, *Eriastrum filifolium* was called a species of *Gilia* (Gray 1870, 1886), a variety of *Gilia virgata* (Milliken 1904), a species of *Navarretia* (Brand 1907), a species of *Eriastrum* (Wooton and Standley 1913, 1915), a variety of *Gilia floccosa* (Nelson and Macbride 1916), a species of *Welwitschia* (Rydberg 1917), a species of *Hugelia* (Jepson 1925), a species of *Gilia* (Craig 1934), and finally a species of *Eriastrum* again (Mason 1945). Some names have been described, but are not currently recognized, likely because no one understands exactly what they refer to: *Gilia floccosa* (Gray 1870, et al.), *Gilia virgata* var. *floribunda* (Gray 1870, et al.), *Navarretia virgata* subsp. *gymnocephala* var. *oligantha* (Brand 1907), and *Hugelia lanata* (see Mason 1945).

If taxa are not clearly described or appear indistinct, how should they be conserved? If a rare taxon is just one end of variation within a widespread species, conservation is not warranted, however, if it is unique, conservation may be a necessity. The geographic distributions of two sympatric or parapatric species would be difficult to ascertain if it those species cannot be distinguished. Identification can also be a problem—characters in keys may overlap, some taxa may key out to multiple species, or others may not key well at all. How can a plant be protected if it cannot be identified with certainty? This research project is aimed at discovering species and subspecies boundaries in *Eriastrum*, the actual geographic distributions of taxa, revising the taxonomy to reflect natural boundaries, and providing a straightforward means for identification.

Field sampling over two seasons has begun to shed some light on the group, although it is also raising more questions. Material has been collected at a number of type localities, enabling a general understanding of the morphology referred to by each name. Some sampled plants fit subspecies or varieties that are not currently recognized, but perhaps should be, given the observable differences among live plants. Material from Washington County, Utah, fits the description of *Gilia eremica* var. *zionis* (Craig 1934). The combination *E. eremicum* ssp. *zionis* was never made since Craig (1934) was the only author to recognize var. *zionis*, but the "*zionis*" plants were noticeably different from typical *E. eremicum*. However, other plants have been found that do not fit readily into any described species or subspecies. A plant from Contra Costa

County, California, appears most closely related to *Eriastrum hooveri*, a rare species restricted to Kern and Los Angeles Counties (Fig. 1). There may be as many as three different entities within what is now recognized as *E. sparsiflorum* (Fig. 2; David Gowen, pers. comm.). *Eriastrum wilcoxii* also appears to refer to two different kinds of plants (Fig. 3).

Preliminary phylogenetic analysis of nrITS sequence data shows some of the confusion (Fig. 4). Some subspecies of *E. densifolium* appear to be more closely related to several annual taxa than to *E. densifolium* subsp. *mohavensis*. *Eriastrum sapphirinum* subsp. *ambiguum* does not group with the rest of *E. sapphirinum*. *Eriastrum pluriflorum* comes out in multiple places on the tree. Initial morphometric analyses suggest that a number of the taxa are distinct from one another, including plants that are currently recognized as belonging to the same species or subspecies.

Upcoming work on the project will involve continued field sampling, until the vast majority of the variation within each taxon is captured; gathering and analyzing morphometric and molecular data; and using GIS to incorporate morphological and molecular data into a biogeographic analysis. It is hoped that a large sampling from live plants and careful analysis will permit a better understanding of the genus, and hopefully an end to the confusion.

Acknowledgements

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Figures

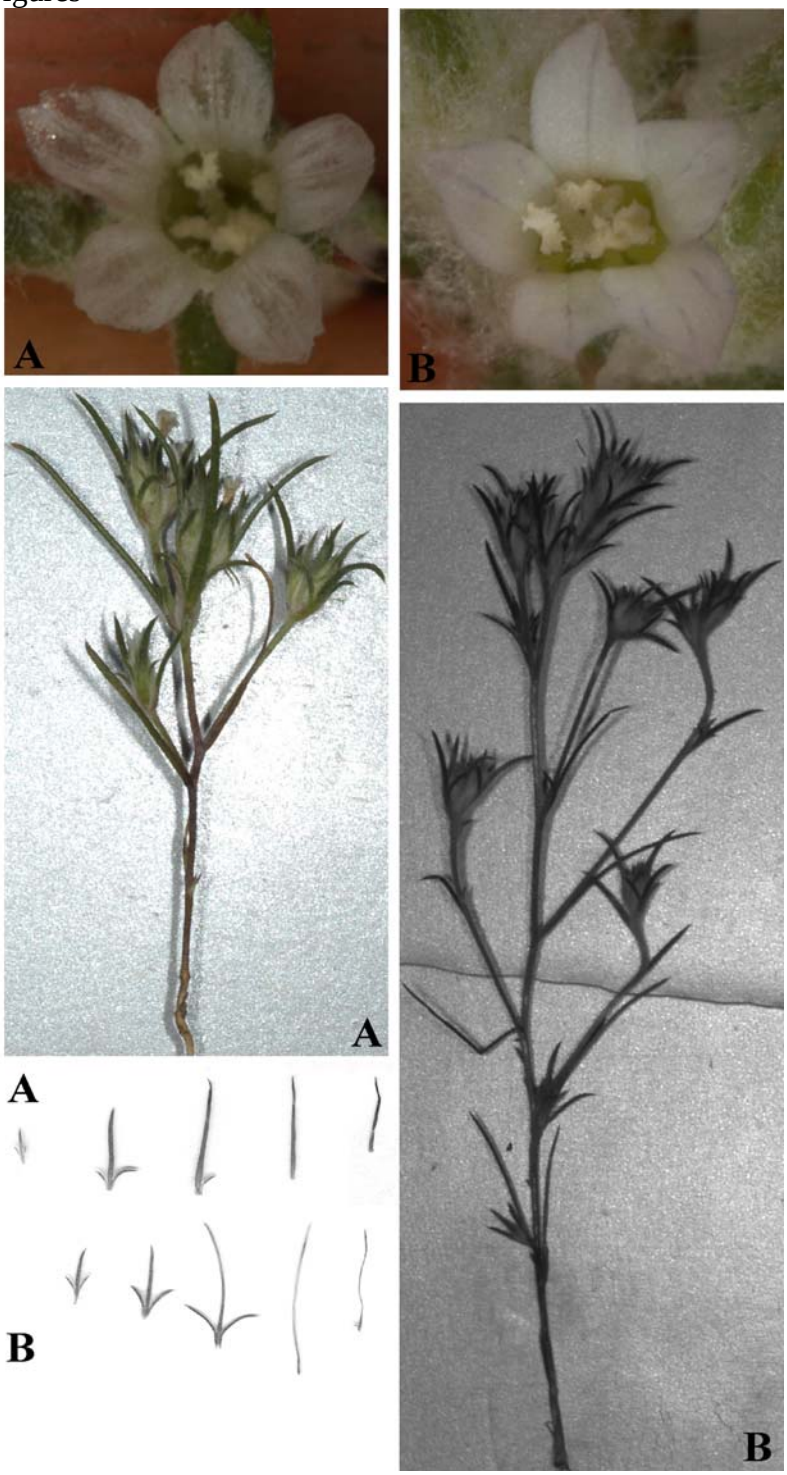

Fig. 1. A. *Eriastrum hooveri* from Kern County, CA. B. Material from Contra Costa County, CA.

Fig. 2. A. Widespread form of *E. sparsiflorum*. B. White flowered *E. sparsiflorum*.

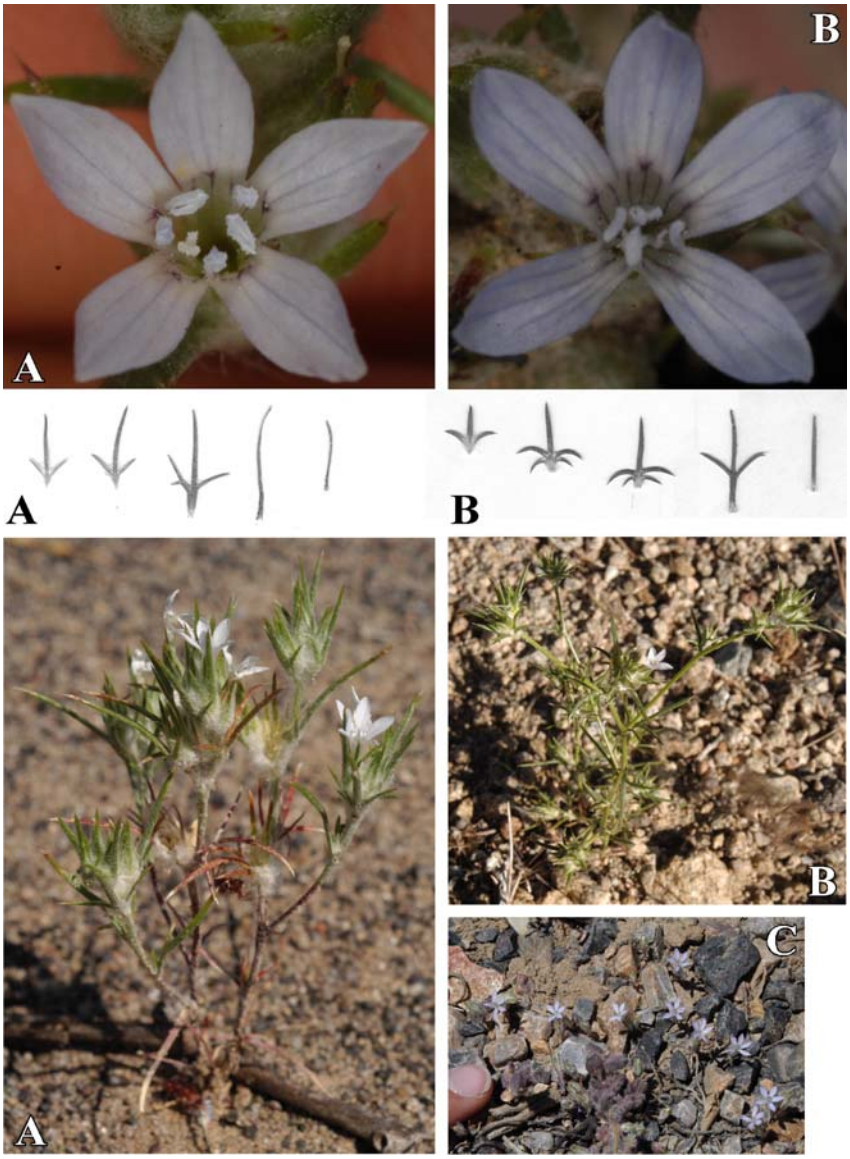

Fig. 3. A. *Eriastrum wilcoxii* from the type locality. B. "*E. wilcoxii*" from the mountains around Owen's Valley, CA. C. Small form of "*E. wilcoxii*" from the Inyo Mountains.

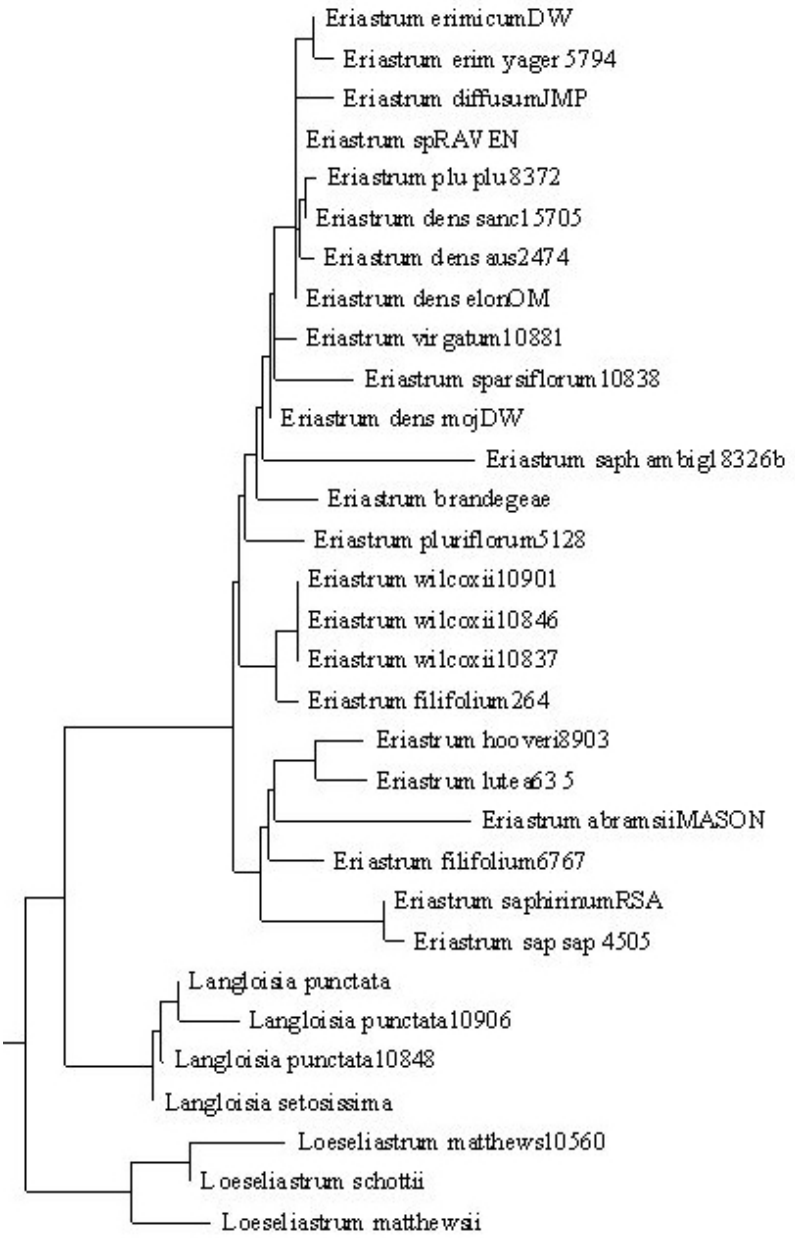

Fig. 4. Preliminary ITS phylogeny (BioNJ method). Most of the *Eriastrum* clade collapses in a strict consensus of 121 most parsimonious trees (not shown).

***Figures have been inserted into text for review purposes only! For publication please request the separate files.

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