Daisie Iris Huang, Ph. D. candidate at Rancho Santa Ana Botanic Garden

Inferring phylogeographic history and speciation processes in the *Lupinus albifrons/Lupinus excubitus* species complex

Two of the most widely distributed species of perennial *Lupinus* in California are *Lupinus albifrons* and *Lupinus excubitus*, both of which have several currently recognized subspecies (Riggins and Sholars 1994). The distinction between these two species has been disputed for years (Isely 1998), but seems to be based primarily on geographic distribution. One of the primary characteristics that has been understood to distinguish the two is that *L. excubitus* has a distinctive "grape soda" scent, while *L. albifrons* does not. However, this distinction is a difficult character to use for identification, as it does not preserve on herbarium specimens, and some investigators, myself included, seem not to be able to smell the "grape soda" scent. Isely concluded that there were no clear morphological distinctions between *L. albifrons* and *L. excubitus* and so lumped them into *L. albifrons* (Isely 1998).

The named subspecies of *Lupinus excubitus* occur in the Mojave Desert, the eastern Sierra Nevada, and the Transverse and Peninsular Ranges. While two subspecies are similar to *L. albifrons* in aspect, being large, woody shrubs (Figure 1), others are very morphologically distinct. For example, *Lupinus excubitus* subsp. *johnstonii* is a caespitose perennial with significantly larger flowers than other subspecies, while *L. e.* subsp. *hallii* is a suffrutescent perennial with felty pubescence on the leaves (Figure 2). The phylogenetic relationships between the subspecies have never been studied in detail. Are these subspecies more closely related to the woody *L. excubitus* of the Mojave and eastern Sierra Nevada than to each other or *L. albifrons?*

To address this question, I have collected many samples of both *Lupinus albifrons* and *L. excubitus* in the field, including many of the named subspecies. I have sequenced two highly variable chloroplast spacer regions for most of these samples as well as a low-copy nuclear gene, *LEGCYC1A* (Citerne 2005). Preliminary parsimony analyses of these sequence data present compelling evidence for two distinct clades in this species complex, approximately corresponding to *Lupinus albifrons s.l.* and *Lupinus excubitus s.l.* (Figure 3). There is conflict between the nuclear and chloroplast data, which needs to be clarified before any firm taxonomic conclusions can be drawn. I hope additional molecular data and morphological data will resolve this conflict.

I need to do additional collecting in the Mojave Desert and the Tehachapi area to collect samples of *Lupinus excubitus* subsp. *medius* and *L. e.* subsp. *austromontanus*. I plan to collect specimens at the population level to increase sampling density. I need to sample populations throughout the described morphological variation and the geographic range of the species. Funds from the Bristlecone Chapter of CNPS will be used to fund field work in the ranges of *L. e.* subsp. *medius* and *L. e.* subsp. *excubitus*.

Acknowledgements:

This research is funded by Rancho Santa Ana Botanic Garden, California Native Plant Society, Southern California Botanists, and CNPS Bristlecone Chapter. Thanks to Dr. Elizabeth Friar, my doctoral advisor, and Drs. Linda Prince and Lucinda McDade for advice and assistance.

Figure 1: *Lupinus excubitus* subsp. *excubitus* (left) and *Lupinus albifrons* subsp. *albifrons* (right). Note the similar aspect and inflorescence morphology. Photo of *L. excubitus* used with permission of Gerald and Buff Corsi © California Academy of Sciences. Photo of *L. albifrons* by the author.

Figure 2: *Lupinus excubitus* subsp. *johnstonii* (left) and *L. e.* subsp. *hallii* (right). Note the different morphology and aspect from the typical subspecies (Figure 1). Both photos taken by Tom Baird.

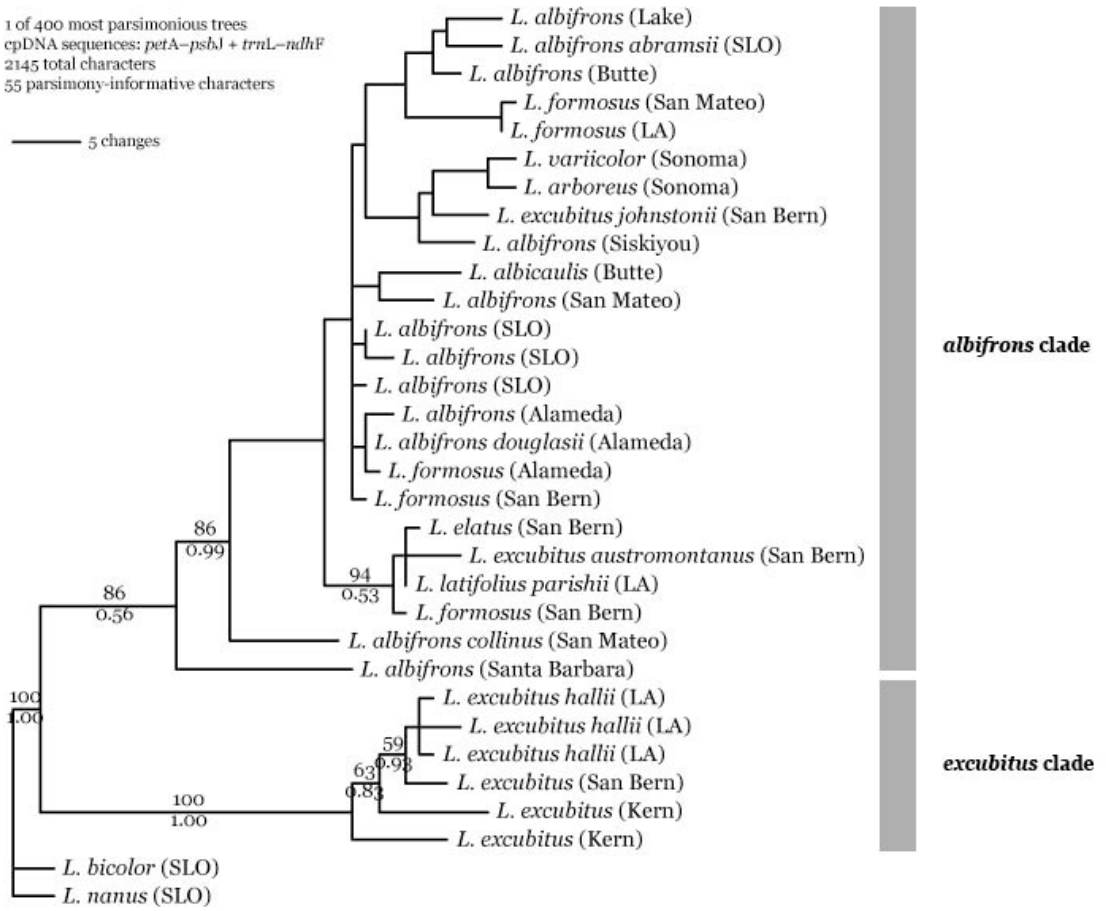

Figure 3: Parsimony analysis of chloroplast regions for many *Lupinus* samples throughout California. Note the strong branch support for the two main clades, one of which corresponds closely with two subspecies of *L. excubitus* and is distinct from *L. albifrons.*

Literature Cited:

CITERNE, H. L. 2005. A primer set for specific amplification of two *CYCLOIDEA*-like genes in the Genistoid clade of Leguminosae subfam. Papilionoideae. *Edinburgh Journal of Botany* **62**: 119-126.

ISELY, D. 1998. *Lupinus*, Native and Naturalized Leguminosae (Fabaceae) of the United States (exclusive of Alaska and Hawaii).

RIGGINS, R., AND T. SHOLARS. 1994. *Lupinus*, 622-636. *In* J. C. Hickman [ed.], The Jepson Manual. University of California Press, Berkeley.