

The Confusing Identity of Red Flowered *Silene* (Caryophyllaceae) in California

Two Chloroplast Genes Reveal Multiple Lineages

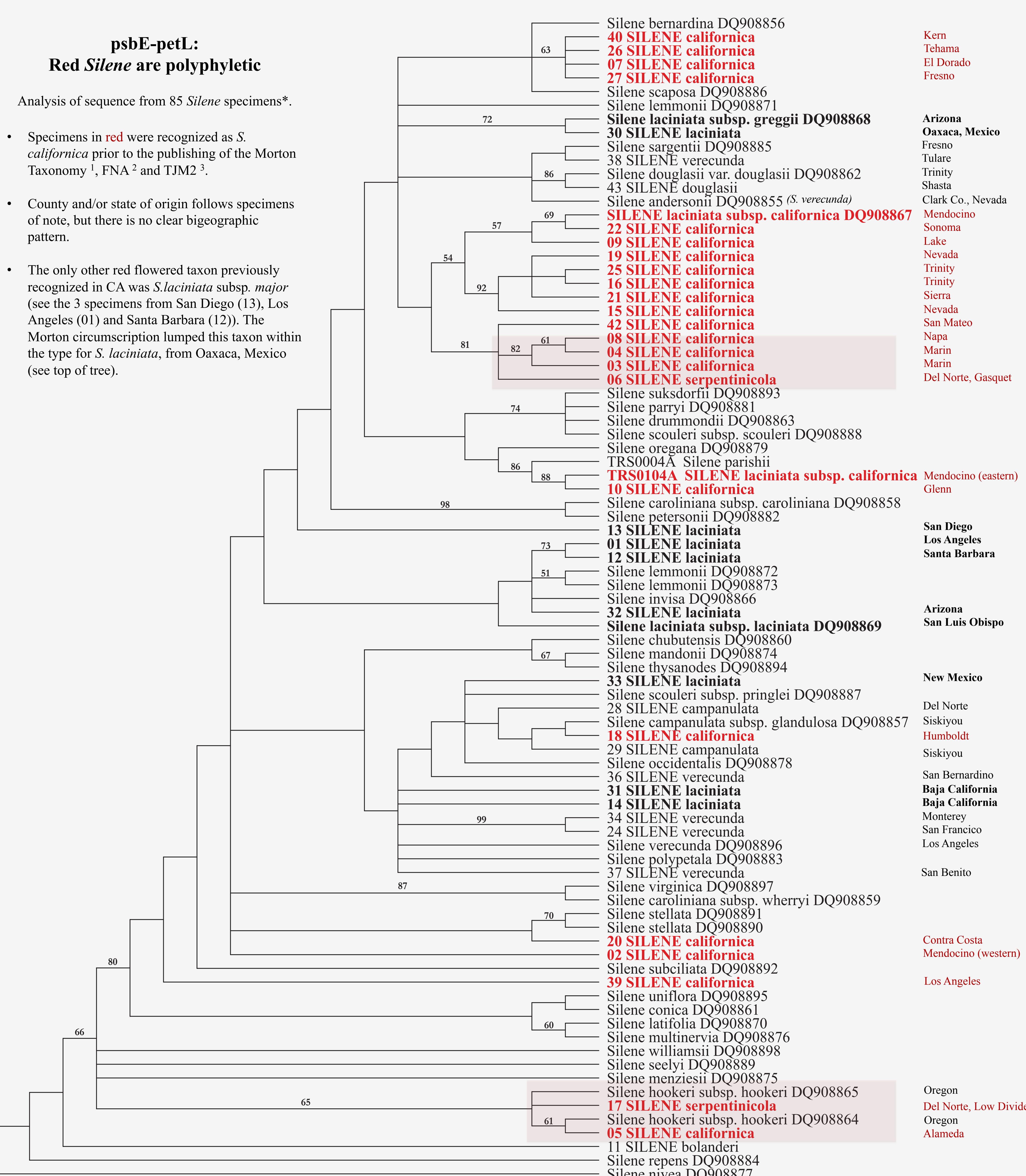
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Current taxonomy for *Silene* in North America lumps the former red flowered California endemic, *S. californica* Durand, into *S. laciniata* Cavanilles, with a center of diversity in central Mexico^{1, 2, 3}. Based on morphology, this circumscription of *S. laciniata*, and specifically *S. laciniata* subsp. *californica* (Durand) J.K. Morton, along with the western Del Norte County endemic, *S. serpentincola* Nelson, leaves many California populations of red flowered *Silene* outside of currently recognized taxa. Previous molecular research has not supported a close relationship between infraspecific groups now recognized in *S. laciniata* in California. Only one specimen previously identified as *S. californica* was included and so no conclusions could be drawn about species identity⁴. Most California *Silene* are allopolyploids that likely formed from separate hybridization events, different populations, and even different members of a population, may represent distinct lineages⁴. My analysis of populations of red flowered *Silene* throughout California explores whether these populations form a monophyletic group or represent distinct lineages.

psbE-petL: Red *Silene* are polyphyletic

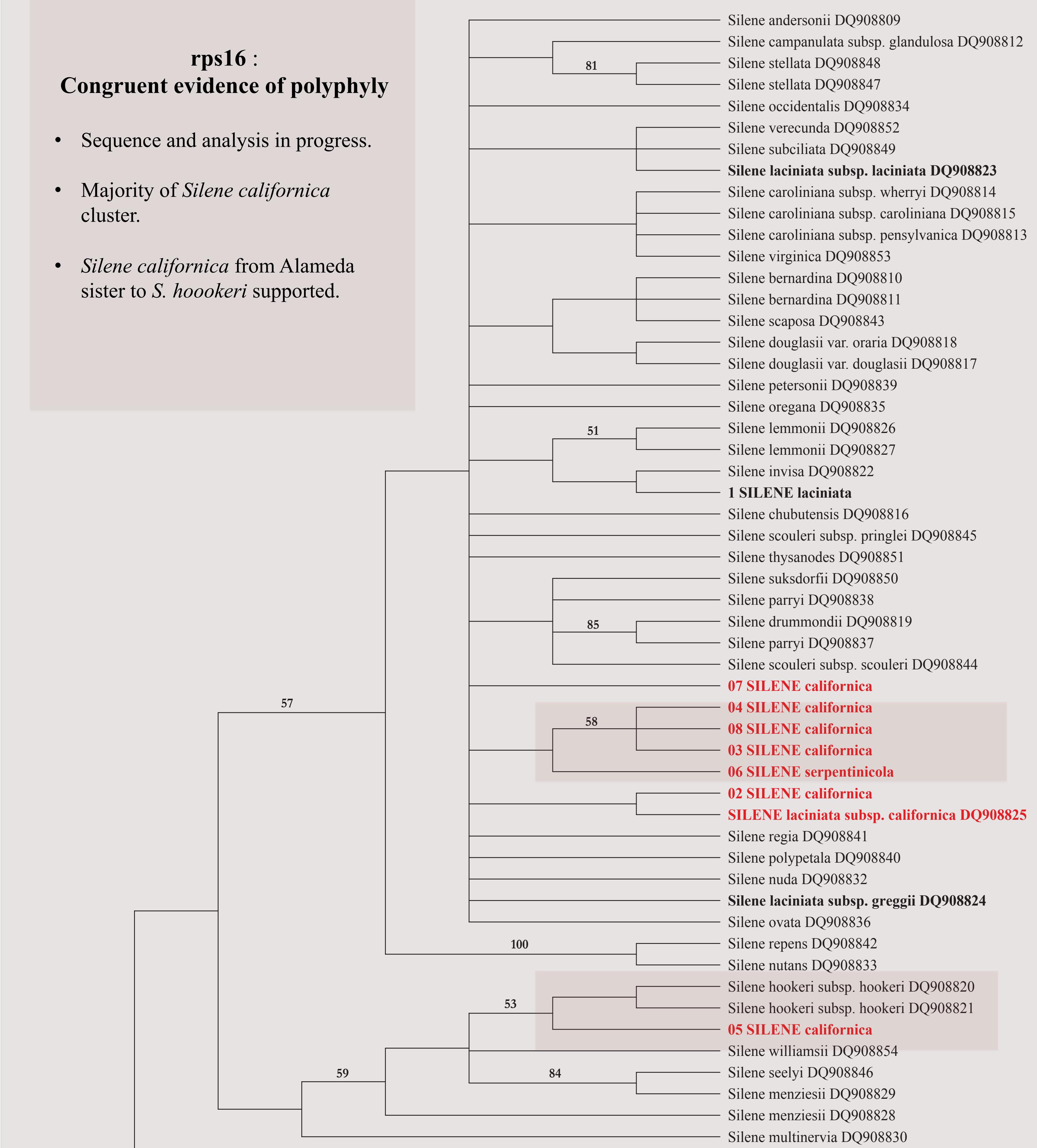
Analysis of sequence from 85 *Silene* specimens*.

- Specimens in red were recognized as *S. californica* prior to the publishing of the Morton Taxonomy¹, FNA² and TJM2³.
- County and/or state of origin follows specimens of note, but there is no clear biogeographic pattern.
- The only other red flowered taxon previously recognized in CA was *S. laciniata* subsp. *major* (see the 3 specimens from San Diego (13), Los Angeles (01) and Santa Barbara (12)). The Morton circumscription lumped this taxon within the type for *S. laciniata*, from Oaxaca, Mexico (see top of tree).



rps16 : Congruent evidence of polyphyly

- Sequence and analysis in progress.
- Majority of *Silene californica* cluster.
- Silene californica* from Alameda sister to *S. hookeri* supported.



Discussion and Continuing Research:

Taxonomy: The clustering of “*Silene californica*” hints that the former taxonomy was a better estimation of evolutionary relationships, as does a review of morphological characters and distributions, though it is still paraphyletic, as is *S. laciniata*. The various subspecies of *S. laciniata* appear distantly related to each other and may form separate “species complexes”.

Molecular Data: Along with chloroplast sequence, I have begun sequencing the ITS region of the nuclear genome. The nuclear genome of polyploid species of hybrid origin may have multiple, polymorphic copies of the same region and require cloning.

Ploidy: Determined for individuals of many western N.A. *Silene*⁵ (diploid *Silene* 2n = 24). Some, like *S. californica*, have multiple ploidy counts (48, 72, 96), but others, like *S. hookeri*, have a uniform count (hexaploid, n = 72). Flow cytometry may allow inference of chromosome number for sister terminal taxa and determine if there is a pattern that matches phylogenetic groupings.

*Majority rule consensus of maximum parsimony trees with bootstrap support. Sequence was obtained from GenBank, field collected specimens and herbarium sheets (40 from Scott Simono: # SILENE...; 43 from GenBank: Silene...DQ####; 2 from Tommy Shoughton: TRS##A), was assembled in Sequencher, aligned in ClustalX and MCLade, and analyzed in PAUP.

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References: 1- Morton, J.K. 2004. New Combinations In North American Caryophyllaceae. Sida, Contributions to Botany. BRIT, Fort Worth Texas. 21. (2): 887-888. 2- Morton, J.K. 2005. *Silene*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 16+ vols. New York and Oxford. Vol. 5:166-214. 3- Hartman, Ronald L., Richard K. Rabeler and Dieter Wilken. 2012. *Silene*. In: Bruce Baldwin (Ed.) The Jepson Manual, Vascular Plants of California, 2nd edition. University of California Press, Berkeley, California: 616-622. 4- Popp, Magnus and Bengt Oxelman. 2007. Origin and Evolution of North American Polyploid *Silene* (Caryophyllaceae). American Journal of Botany, 94(3): 330-349. 5- Kruckeberg, A.R. . 1960. Chromosome Numbers in *Silene* (Caryophyllaceae): II. Madrono, 15: 205-215.