

Added to California Rare Plant Rank 1B.1 of the CNPS Inventory on October 30, 2019**Rare Plant Status Review: *Claytonia peirsonii* subsp. *bernardinus*
Proposed Addition to California Rare Plant Rank 1B.1, G3G4T1 / S1**

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Background

Claytonia peirsonii (Munz & Johnston) T.R. Stoughton subsp. *bernardinus* T.R. Stoughton is a perennial herb in the Montiaceae that is only known from the San Bernardino Mountains of San Bernardino County, California. It was recently described by Stoughton et al. (2017) and is therefore not included in *The Jepson Manual* (Chambers 1993), *The Jepson Manual, Second Edition* (Miller and Chambers 2012), or *Flora of North America North of Mexico* (Miller 2004). *Claytonia peirsonii* subsp. *bernardinus* was previously identified as a disjunct occurrence of *C. lanceolata* var. *peirsonii* in the San Bernardino Mountains. “Stoughton and Jolles (2013) suggested in their review of *C. lanceolata* that some populations in the San Bernardino Mountains of *C. lanceolata* var. *peirsonii* had considerably narrower leaves than plants in the San Gabriel Mountains and elsewhere, which they illustrated for comparison in figure 10 of their paper. In fact, the plant on the far right side of this figure, and the leaf in the lower left corner, serve perfectly for an illustration of *C. peirsonii* subsp. *bernardinus*: they were drawn from images of plants at the type locality (Bertha Ridge) for this taxon. The rest of the plants in Stoughton and Jolles’ (2013) figure 10 are representative of *C. peirsonii* subsp. *peirsonii* and are illustrated from images of plants in the San Gabriel Mountains near (and at) the type locality for *C. peirsonii* subsp. *peirsonii*.” (Stoughton et al. 2017). The subspecific epithet, *bernardinus*, is in reference to the type locality of this subspecies in the San Bernardino Mountains (Stoughton et al. 2019). See Appendix I for additional background information on this taxon along with other revisions in the *C. lanceolata* species complex.

Taxonomy

Based upon current understanding and evidence presented in Stoughton et al. (2017), *C. peirsonii* subsp. *bernardinus* is most similar morphologically to *C. serpenticola* from northern California and most closely related genetically to *C. peirsonii* subsp. *californacis* (concurrently under review for addition to 1B.1) from the San Bernardino Mountains. It is also morphologically similar to *C. panamintensis*, *C. serpenticola*, and to the broad interpretation of *C. lanceolata* (sensu Miller and Chambers 2006), but is generally differentiated by its ecological setting (associated with variable, carbonate dominated sedimentary substrates in transmontane habitats), betalain pigmentation on leaf abaxial surfaces, and by the presence of raised 2 degree veins on the adaxial surfaces. “The weakly thickened (appearing raised) secondary veins, if present, and lanceolate to lance-linear shape of the cauline leaf pair in *C. peirsonii* subsp. *bernardinus*, make it easily distinguished from all other subspecies of *C. peirsonii*.” (Stoughton et al. 2017).

Stoughton et al. (2017) observed a great amount of morphological variation within the population of *C. peirsonii* subsp. *bernardinus*, but found that even in sympatric situations *C. peirsonii* subsp. *bernardinus* was readily distinguished from *C. peirsonii* subsp. *californacis* by the shape of the cauline leaf pair alone. Even though they are both currently known to be endemic to the San Bernardino Mountains, Stoughton et al. (2017) didn’t notice any intergradation among subsp. *bernardinus* and subsp. *californacis*. See Stoughton et al. 2017 for a

taxonomic key and Table 1 in Appendix II for additional characters used to differentiate subsp. *bernardinus* from other taxa in the *Claytonia lanceolata* species complex in California.

Ecology

Claytonia peirsonii subsp. *bernardinus* occurs on north-facing, stony and talus slopes comprised of carbonate-dominated (meta)sedimentary substrates, such as limestone or marble, that are often mixed with decomposing organic material from the surrounding forest. It is mostly found in openings of mixed pinyon-juniper and white fir-limber pine associations at approximately 2,360 to 2,465 meters in elevation (Stoughton et al. 2017). Subspecies *bernardinus* is known to flower from March to April based on collection records. Associated trees include one or more of the following: *Juniperus grandis*, *J. occidentalis* var. *australis*, *Pinus monophylla*, *P. flexilis*, and *Cercocarpus ledifolius* (Stoughton et al. 1514, Stoughton 1077; CCH1 2019).

Distribution and Abundance

Claytonia peirsonii subsp. *bernardinus* is known from only a single occurrence, from the north slope of Bertha Ridge between Holcomb and Bear valleys in the San Bernardino Mountains of California. “It should be sought out in additional areas in southeastern California, particularly in transmontane, carbonate dominated habitats near and in the San Bernardino Mountains, and in similar habitats in the White Mountains of Inyo Co., based on shared species that occur on carbonate substrates in these two mountain ranges.” (Stoughton et al. 2017). The single occurrence of *C. peirsonii* subsp. *bernardinus* is known from more than 600 individuals and is reported as being locally abundant (Stoughton 1077 and 1717; CCH1 2019). It is entirely within San Bernardino National Forest. The eastern half of its distribution co-occurs with *Physaria kingii* subsp. *bernardina* (1B.1, Federally Endangered; EO 2).

Status and Threats

There are no known direct threats to *Claytonia peirsonii* subsp. *bernardinus*, but its single occurrence implies that even small changes in land use or climate within its distribution could have drastic reductions in population size. The record of *Physaria kingii* subsp. *bernardina* that co-occurs with subsp. *bernardinus* was last seen/documentated in 2009 and is ranked Excellent, with no threats noted. Since the only known occurrence of *C. peirsonii* subsp. *bernardinus* is wholly within the San Bernardino National Forest, it should be designated by the Forest Service as a Species of Conservation Concern.

Summary

Based on the available information, CNPS and CNDDDB recommend adding *C. peirsonii* subsp. *bernardinus* to 1B.1 of the CNPS Inventory. Although no direct threats are currently documented, its known existence from a single occurrence indicates a threat rank of 0.1 is warranted, and it is potentially threatened by stochastic events. If knowledge on the distribution, threats, and rarity status of *C. peirsonii* subsp. *bernardinus* changes in the future, we will re-evaluate its status at that time.

Recommended Actions

CNPS: Add *Claytonia peirsonii* subsp. *bernardinus* to 1B.1

CNDDDB: *Claytonia peirsonii* subsp. *bernardinus* to G3G4T1 / S1

Draft CNPS Inventory Record

Claytonia peirsonii (Munz & Johnston) T.R. Stoughton subsp. *bernardinus* T.R. Stoughton

Sent to: SW, D. Jolles on 08/26/2019

San Bernardino spring beauty

Montiaceae

CRPR 1B.1

San Bernardino

Fawnskin (131C) 3411638

Pinyon and juniper woodland, upper montane coniferous forest / rocky, talus, carbonate, usually openings; elevation 2,360 to 2,465 meters.

Perennial herb. Blooms March to April

See *Aliso* 31(1):35-42 for notes on discovery, and *Systematic Botany* 42(2):283-300 (2017) for original description.

Literature Cited

[CNDDDB] California Natural Diversity Database. 2019. RareFind 5 [Internet]. California Department of Fish and Wildlife [Government Version, August 2019].

[CNPS] Rare Plant Program, California Native Plant Society. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website <http://www.rareplants.cnps.org> [accessed 21 August 2019].

Chambers, K. L. 1993. *Claytonia* L. (Portulacaceae). Pp 898–900 in Hickman, J. C. (ed.), *The Jepson manual: Higher plants of California*. University of California Press, Berkeley, CA.

[CCH1] Consortium of California Herbaria 1. 2019. Data provided by the participants of the Consortium of California Herbaria. Regents of the University of California, Berkeley. Website <http://ucjeps.berkeley.edu/consortium/> [accessed 20 August 2019].

Miller, J. M. 2004. *Claytonia* Linnaeus, in *Flora of North America* Editorial Committee (eds.), *Flora of North America North of Mexico, Volume 4*. Website http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=107275 [accessed 19 August 2019].

Miller, J. M. and K. L. Chambers. 2006. Systematics of *Claytonia* (Portulacaceae). *Systematic Botany Monographs* 78: 1–236. (Not seen.)

_____. 2012. *Claytonia lanceolata*. In: Jepson Flora Project (eds.), *Jepson eFlora*. Website http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=19622 [accessed 18 December 2018].

Stoughton, T. R. and D. D. Jolles. 2013. Discovery of *Claytonia lanceolata* var. *peirsonii* in the San Bernardino Mountains perpetuates a history of taxonomic uncertainty. *Aliso* 31(1): 35-42. (Notes on discovery.)

Stoughton, T. R., D. D. Jolles, and R. L. O’Quinn. 2017. The western spring beauties, *Claytonia lanceolata* (Montiaceae): A review and revised taxonomy for California. *Systematic Botany* 42(2): 283-300. (Original description.)

APPENDIX I – BACKGROUND

The following is a general summary of the revised taxonomic treatment of the *Claytonia lanceolata* species complex in California published by Stoughton et al. (2017), with emphasis on taxa that are being reviewed for addition to the *CNPS Inventory of Rare and Endangered Plants of California*.

Recent field, taxonomic, and molecular work by Stoughton and Jolles (2013) and Stoughton et al. (2017) has led to a recircumscription of *C. lanceolata* var. *peirsonii* to *C. peirsonii* subsp. *peirsonii*, along with the description of three additional subspecies, *C. peirsonii* subsp. *bernardinus*, subsp. *californacis*, and subsp. *yorkii*, which are all rare and concurrently under review for addition to the CNPS Inventory. As a result of their work, the taxonomic recognition of *Claytonia obovata* (formerly treated as a synonym of *C. lanceolata*) was also resurrected by Stoughton et al. (2017), and a new taxon, *C. serpenticola* was described; both occurring in the Klamath-Siskiyou region of northern California and southwestern Oregon. Lastly, Stoughton et al. (2017) also newly described *C. panamintensis*, a species known in California only from the Panamint Mountains of Death Valley National Park, but ranging more widely across southern Nevada. All three of these latter *Claytonia* species (*C. obovata*, *C. panamintensis*, and *C. serpenticola*) are undergoing status reviews for addition to the CNPS Inventory.

In 2013, Stoughton and Jolles reported on the discovery of new populations of *C. lanceolata* in southern California, and discussed the taxonomic uncertainties associated with the *C. lanceolata* species complex and the southern California var. *peirsonii*. Up to ten subspecific taxa have been described in the *C. lanceolata* complex (Davis 1966), with var. *peirsonii* being the only one known from southern California. Taxonomic uncertainty of var. *peirsonii* remained present for at least 25 years, evidenced in part by Chambers (1993), who considered variation in the group to be environmentally induced, and did not formerly recognize infraspecific taxa in his treatment of *Claytonia* in *The Jepson Manual*. As originally described, *C. lanceolata* var. *peirsonii* was considered to be restricted to the higher ridges of the eastern San Gabriel Mountains, distinguished by both its relative geographic isolation (at least 450 km away from other known conspecific populations) and by a primary inflorescence axis that is shortened as to make the inflorescence appear umbellate (Munz and Johnson 1923) (Stoughton and Jolles 2013). However, var. *peirsonii* was described from only two voucher specimens, indicating that variation within var. *peirsonii* was not well captured. After reviewing the entire collection of *C. lanceolata* specimens at RSA (including the holotype of var. *peirsonii*) and additional specimens at CAS/DS, HSC, UC/JEPS, and UNLV, Stoughton and Jolles (2013) found reason to believe that the southern California populations of *C. lanceolata*, including those in Kern and Inyo counties and in the Spring Mountains of Nevada, were unique and distinct from other alleged conspecific populations in northern California and adjacent northern Nevada. Their claim was also substantiated by detailed field observations of new populations discovered in the San Bernardino Mountains and all but two of the known locations in the San Gabriel Mountains, Panamint Range, and southern Sierra Nevada.

Stoughton and Jolles (2013) also noted that preliminary molecular evidence indicated that the morphological variation of *C. lanceolata* found in differing regions in California and Nevada also had a genetic basis. Four years later, Stoughton et al. (2017) conducted a Bayesian phylogenetic inference using gene sequences available on GenBank, along with new sequences generated from collections within and outside of California. Their phylogenetic comparison included more than half of the tuberous, perennial *Claytonia* species, which encompasses *C.*

lanceolata. Stoughton et al. (2017) isolated genomic DNA from leaf material of 12 *C. lanceolata* samples. “Two or more individuals per taxon were used to sample multiple examples in the *C. lanceolata* species complex (15 total samples). Nine samples of other tuberous, perennial *Claytonia* were included as outgroups with respect to *C. lanceolata* s. l. Thirty-one total samples were used for the phylogenetic analysis, including more distant outgroups from *Claytonia* and *Lewisia*” (Stoughton et al. 2017).

In order to identify substrate affinity, Stoughton et al. (2017) collected parent rock material from selected field sites of *Claytonia* in California and southern Oregon. Slope aspect, geomorphic landform, associated species, elevation, and other local site information were also recorded at field sites. Lastly, five morphological characters (stem length, cauline leaf width, cauline leaf length/width ration, and peduncle length) were measured and used in a morphometric analysis. Results of their phylogenetic analysis were inconclusive with regards to monophyly of *C. lanceolata*, mostly due to an unresolved backbone separating major lineages within a clade that included all tuberous, perennial *Claytonia* sampled in their study. Furthermore, the use of nrITS in their study may have been problematic considering the possibilities of concerted evolution and multiple copies. However, although the results of their preliminary analysis did not permit new inferences regarding relationships among tuberous *Claytonia*, this was not a specified goal of their study, and instead their phylogenetic results fully complemented their morphological analysis of Californian taxa. Ultimately, the taxonomic and molecular work by Stoughton et al. (2017), coupled with that of Stoughton and Jolles (2013), elucidated some of the complex taxonomy and relationships surrounding *C. lanceolata* s. l. in California, and distinguished new taxa from each other by habitat (with many appearing to be edaphic-endemics), betalain pigmentation, inflorescence architecture, and morphology of cauline leaves, subterranean stems, and flowers.

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- Stoughton, T. R., D. D. Jolles, and R. L. O’Quinn. 2017. The western spring beauties, *Claytonia lanceolata* (Montiaceae): A review and revised taxonomy for California. *Systematic Botany* 42(2): 283-300.

APPENDIX II – TABLES AND FIGURES

Table 1: Selected characters used to differentiate taxa in the *Claytonia lanceolata* species complex in California. Taxa are listed in same order of appearance as the taxonomic key provided in Stoughton et al. (2017), with exception of the more recently described *C. crawfordii*. Light gray cells indicate duplicate entries to assist with making comparisons. (Table developed using characters from Stoughton et al. 2017 and 2018.)

Scientific name	Cauline leaves	Adaxial leaf surface	Inflorescence	Geology	Range
<i>C. panamintensis</i>	2-4, opposite at least proximally, 1-nerved elliptic to oblanceolate, distinctly petiolate	dark green (often at least weakly beet-red abaxially)	1-3, terminal and often also axillary, pedunculate, unibracteate, bracts 1-3 mm long	marble, sandstone, shale/slate	Panamint Mountains east to Spring Mountains of southern Nevada
<i>C. serpenticola</i>	2–4, alternate to subopposite, 1-nerved gen. > 5 x longer than wide, blades narrowly elliptic to lance linear	gen. greenish 1° veins at base, blades gen. similar in color on ab/adaxial surfaces	1-3, terminal and often also axillary, pedunculate, unibracteate, bract 1-2 mm long	gabbro, peridotite, serpentinite or shale	Klamath-Siskiyou, North Coast Ranges
<i>C. lanceolata</i>	2, opposite, 3-nerved gen. < 5 x as long as wide, ovate to lance ovate to lance linear	gen. greenish 1° veins at base, blades gen. similar in color on ab/adaxial surfaces	1(2), terminal (rarely also axillary), pedunculate, unibracteate, bracts 1-5 mm long	granite, rhyolite	Klamath-Siskiyou, central and northern Sierra Nevada
<i>C. obovata</i>	2(3), opposite, gen. 3-nerved with parallel veins equal in length, lateral veins converging with midrib at apex	gen. reddish 1° veins, not raised	1(2), terminal (rarely also axillary), sessile to short-pedunculate, unibracteate, bracts 1–3 mm long	graywacke, limestone, shale or gabbro, peridotite, serpentinite	Klamath-Siskiyou, North Coast Ranges

Scientific name	Cauline leaves	Adaxial leaf surface	Inflorescence	Geology	Range
<i>C. peirsonii</i> ssp. <i>bernardinus</i>	2-4, opposite at least proximally, 1-nerved often $\geq 6 \times$ longer than wide, linear to lanceolate, sessile	gen reddish, sunken 1° veins; 2° veins of cauline leaves weakly if at all raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bracts 1-3 mm long	limestone, marble	San Bernardino Mountains
<i>C. peirsonii</i> ssp. <i>yorkii</i>	2-4, opposite at least proximally, 1-nerved < 6 \times longer than wide, gen. weakly pigmented on abaxial surfaces (reddish to purplish pigmentation often absent in stem and pedicels)	gen reddish, sunken 1° veins; 2° veins gen. noticeably raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bract 1-3 mm long	rhyolite	southern Sierra Nevada
<i>C. peirsonii</i> ssp. <i>peirsonii</i>	2-4, opposite at least proximally, 1-nerved < 6 \times longer than wide (gen. < 3.5 \times as long as wide), variously shaped but gen. not oblanceolate, sessile	gen. reddish, sunken 1° veins (sometimes branched); 2° veins gen. noticeably raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bracts 1-3 mm long	gneiss, granite, schist	San Gabriel Mountains
<i>C. peirsonii</i> ssp. <i>californiacis</i>	2-4, opposite at least proximally, 1-nerved < 6 \times longer than wide (gen. > 3.5 \times as long as wide), gen. oblanceolate to elliptic, sessile	gen. reddish, sunken 1° veins; 2° veins gen. noticeably raised	1-3, terminal and often also axillary, sessile to short-pedunculate, unibracteate, bracts 1-3 mm long	limestone, marble	San Bernardino Mountains
<i>C. crawfordii</i>	narrower than <i>C. obovata</i>	2° veins gen. noticeably raised	1-3, terminal (rarely also axillary), elongate peduncle	volcanic	central Sierra Nevada

Sources:

Stoughton, T. R., D. D. Jolles, and R. L. O'Quinn. 2017. The western spring beauties, *Claytonia lanceolata* (Montiaceae): A review and revised taxonomy for California. *Systematic Botany* 42(2): 283-300.

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