A REVIEW OF *CRYPTANTHA FULVOCANESCENS* (BORAGINACEAE) AND RE-EVALUATION OF GREENE'S *OREOCARYA NITIDA*

ROBERT C. SIVINSKI[1]
Museum of Southwestern Biology, Herbarium,
The University of New Mexico, Albuquerque, NM 87131-1091

ABSTRACT

Cryptantha fulvocanescens has a long history of confused taxonomic treatment, exacerbated primarily by the persistent misinterpretation of *Cryptantha echinoides*. *Oreocarya nitida* was mistakenly submerged into synonymy of *C. fulvocanescens* in 1927. It has remained in obscurity because of the many confusing treatments of this variable and difficult group of taxa. *Cryptantha fulvocanescens* var. *nitida* is a new combination for a taxon endemic to the upper Colorado River Basin. It is distinguished from var. *fulvocanescens* most notably by the dense silvery pubescence on the inner surfaces of its calyx lobes.

REVIEW

In 1901, Greene published the name *Oreocarya nitida* with the description of a plant collected by C. F. Baker (*No. 95*) from Deer Run, Colorado. The epithet *nitida* refers to the "bright" silver or canescent hairs on both surfaces of the calyx lobes. Macbride (1916a) recognized *O. nitida* Greene in his revision of the genus but had a poor understanding of its delimiting characteristics. By relying entirely on plant height and color, he placed three of the six almost identical specimens of *O. nitida* he examined within *Oreocarya fulvocanescens* (S. Watson) Greene. Macbride's uncertainty was expressed in his postscript, "Possibly this plant is only a large variety of *O. fulvocanescens*." That comment and Macbride's confused jumble of specimen citations led Payson (1927) to consider the two taxa synonymous when he transferred the members of *Oreocarya* to *Cryptantha*. Unfortunately, Payson placed particular emphasis on the materials previously identified as *O. nitida* in the formulation of his concept of *Cryptantha fulvocanescens* (S. Watson) Payson.

To separate successfully Greene's *nitida* concept from other historical treatments, it is necessary to give a complete taxonomic review of *Cryptantha fulvocanescens*. The first publication of the name was by Watson (1871) in reference to Nevada (and possibly Utah) materials collected by Fremont and a Fendler collection from

[1] Current address: New Mexico Forestry and Resources Conservation Division, P.O. Box 1948, Santa Fe, NM 87504.

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New Mexico that he named *Eritrichium glomeratum* A. de Condolle var. (?)*fulvocanescens.* Watson had seen the name *E. fulvocanescens* as used by Gray to label the Santa Fe, NM, collection by Fendler (*No. 632*). He accepted that specimen as one of his new variety and used the epithet *fulvocanescens* in his trinomial. Watson, however, was not successful in separating distinct species because he included Fendler's New Mexico collection with Fremont's Nevada specimens, which are, in part, conspecific with the type of *Cryptantha humilis* (A. Gray) Payson (Johnston 1932). Watson's aggregate taxon later caused confusion in determining which entity should be associated with the name *fulvocanescens.*

When Gray (1875) finally published *Eritrichium fulvocanescens,* based upon Fendler's New Mexico collection, he was forced to accept Watson's trinomial as a synonym because Watson had referred to the Fendler collection in its publication. For many years this clouded the identity of a type specimen and locality because Watson's original description also included Fremont's Nevada collections. The New Mexico type locality gained acceptance when Macbride (1916b) supported Gray's concept of *fulvocanescens* and Payson (1927) cited the *Fendler 632* collection as the type for *fulvocanescens.* Johnston (1932) was most succinct in his summation: "since Watson included the Fendlerian New Mexican plant in his concept and indicated it was the source of his name, then, it should be taken as the type of *fulvocanescens,* both as variety and species."

In the interval between Gray's (1875) and Macbride's (1916b) publications, the name *Krinitzkia echinoides* M. E. Jones was published for two Utah collections and Fendler's New Mexico collection (Jones 1895). The epithet *echinoides* refers to the minute, bristly setae that ornament the nutlet murications on most *fulvocanescens* to some greater or lesser degree (see Cronquist et al. 1984 for illustration). Jones recognized these plants as different from those of Watson's concept of *fulvocanescens* and determined Fremont's Nevada collections to be "a low altitude variation of *K. sericea* (Gray) i.e., var. *FULVOCANESCENS.*" He included the Fendler collection of Gray's *fulvocanescens* concept in his new species by stating, "the original *Eritrichium fulvocanescens* of Gray . . . based on Fendler's collection from New Mexico is *K. echinoides,* though the specimen is only in flower." Had he inspected the more mature duplicates of Fendler's collection he would have found numerous setae ornamenting the nutlets. In fact, Gray's *fulvocanescens* description of "nuculis granulato-scabris" undoubtedly referred to this characteristic. *Krinitzkia echinoides* is, therefore, a superfluous and illegitimate name. The name *echinoides* should not have continued to be used. It did persist, however, and later became the confounding element between Gray's *fulvocanescens* and Greene's *nitida* concepts.

While monographing this group, under the genus name *Oreocarya,* Macbride (1916a) was faced with its complex synonymy. He disagreed with Jones's inclusion of Fendler's New Mexico collection in *echinoides* and correctly maintained it as the legitimate *fulvocanescens.* Macbride (1916b) further stated "it is rather the plant collected by Watson (actually Fremont's Nevada collections) and wrongly included by him in his description of *fulvocanescens* as a variety of *glomerata* which needs the new name. . . ." He then mistakenly applied the name *Oreocarya echinoides* Macbride to *Eritrichium glomeratum* var. *humile* Gray as having species level priority over Greene's (1896) publication of *Oreocarya humilis* (A. Gray) Greene. Although Macbride retained Jones as the parenthetical authority of *O. echinoides,* Macbride's is the first legitimate publication of name *echinoides* and it referred to a distinctly different concept. *Oreocarya echinoides* Macbride is, therefore, a synonym of *Cryptantha humilis* (A. Gray) Payson.

The next appearance of the name *echinoides* occurred in Payson's (1927) monograph. Payson resurrected Jones's illegitimate name as *Cryptantha echinoides* Payson and cited three specimens that have dense setae on the nutlets. He acknowledged, but purposely disregarded, Jones's statement that Fendler's New Mexico collection is *echinoides* and designated Jones's *5297p* "with hedgehog-like nutlets" as the type for his *C. echinoides.* By retaining *echinoides,* Payson was faced with the problem of finding an identity for *fulvocanescens.* He accomplished this by submerging *O. nitida* into synonymy with *Cryptantha fulvocanescens.* Because *nitida* plants have few, if any, nutlet setae, this combination of taxa gave him the necessary diagnostic criterion to separate *echinoides* from his new concept of *fulvocanescens.* Therefore, Payson's description and most of his specimens cited for *C. fulvocanescens* are actually conspecific with the type of Greene's *nitida,* while his description and specimens cited for *C. echinoides* fit comfortably into Gray's *fulvocanescens.*

While preparing for a revision of the perennial species of *Cryptantha* (subg. *Oreocarya*), Higgins (1969) used the name *echinoides* (again attributed to Jones, with lectotypification attributed to Payson) in a trinomial with *C. fulvocanescens.* After a brief sojourn as the variety *C. fulvocanescens* var. *echinoides* [M. E. Jones] L. C. Higgins (1969), the name *echinoides* was placed into synonymy with *C. fulvocanescens* (Cronquist et al. 1984). This left one highly polymorphic taxon, which tends to minimize the compelling variability that led to much of the confusion described above. In addition to nutlet characteristics, this variability includes the indument variation that originally inspired Greene to describe *O. nitida.*

Oreocarya nitida was resurrected by Weber in his Colorado Flora: Western Slope (1987). Unfortunately, that regionally delimited flora does not allow for diagnostic distinction of *nitida* from *fulvocanes-*

cens. While it is gratifying to see *O. nitida* back in use, two problems may forestall its general acceptance by contemporary botanists. The first is the maintenance of *Oreocarya* as a distinct genus. *Cryptantha* and *Oreocarya* are differentiated only by, respectively, annual and perennial habits. Johnston (1924) studied the distinguishing attributes of both genera and questioned whether they should remain distinct or be combined as *Cryptantha.* The combination of the two genera was accomplished by Payson (1927) in his monograph of the perennial species as *Cryptantha* sect. *Oreocarya* and reinforced by Higgins's (1971) revision of *Cryptantha* subg. *Oreocarya.* The second problem is recognition of *nitida* as a species. Many salient characteristics of *fulvocanescens* and *nitida* are very similar. Their distinctive, but minor, differences appear to result from geographic sorting of variations that occasionally overlap in the few areas of sympatry. Therefore, *nitida* is more suitably recognized at an infraspecific level within *Cryptantha fulvocanescens.*

Taxonomic Treatment

Key to the Varieties of *Cryptantha fulvocanescens*

A Calyces densely hispid-strigose; interior faces of calyx lobes strigulose, the green surfaces partly visible ..... 1a. var. *fulvocanescens*

A′ Calyces densely strigose and sparsely hispid; interior faces of calyx lobes densely silvery strigose, the green surfaces obscured ..... 1b. var. *nitida*

1. Cryptantha fulvocanescens (S. Watson) Payson, Annals of the Missouri Botanical Garden 14:319–321. 1927.—*Eritrichium glomeratum* A. de Condolle var. (?)*fulvocanescens* S. Watson, Botany *in* C. King, Report of the Geological Exploration of the Fortieth Parallel 5:243. 1871.—*Eritrichium fulvocanescens* (S. Watson) A Gray, Proceedings of the American Academy of Arts and Sciences 10:61. 1875.—*Krinitzkia fulvocanescens* (S. Watson) A. Gray, Proceedings of the American Academy of Arts and Sciences 20:280. 1885.—*Oreocarya fulvocanescens* (S. Watson) Greene, Pittonia 1:58. 1887. Type: USA, New Mexico, Santa Fe Co., "Declivities of dry, gravelly hills southwest of Santa Fe," 1847, *A. Fendler 632* (lectotype: GH!—Higgins, Great Basin Naturalist 28:42. 1971; isolectotypes: GH!, PH, US).

Caespitose perennials from woody branching caudices. Stems several from persistent mat of basal leaves, erect, 5–30 cm tall, strigose and hispid. Leaves oblanceolate to spatulate, acute or obtuse, 15–70 mm long, 3–10 mm wide, densely and uniformly coarse-strigose, pustules obvious only on abaxial surfaces of previous year's leaves. Inflorescences, helicoid arrangements of cymes that appear as short,

unilateral, false spikes, narrow or somewhat open at maturity, rarely subcapitate. Cymes 2–11-flowered. Distal foliar bracts reduced, marginally hispid. Bractlets usually present, 1–2 mm long. Pedicels 1–8 mm long. Calyces 4–9 mm long at anthesis, 6–13 mm long in fruit, lobes linear, hispid-strigose. Corollas white to ochroleucous, tubes 7–13 mm long, exceeding calyx lobes by 2–5 mm, crests at bases of tubes usually lacking, fornices yellow and rounded or shallowly emarginate, limbs 6–9 mm broad, rotate, often reflexed after anthesis. Styles heteromorphic, exceeding mature fruits by 2–7.5 mm. Nutlets lance-ovate, 3.1–4.4 mm long, 2–3 mm wide, usually 1, sometimes 2, maturing, margins acute, in contact when more than 1 nutlet present, both surfaces muricate, often with sharp, setose tips terminating some or all murications, scars closed or only slightly open.

1a. CRYPTANTHA FULVOCANESCENS (S. Watson) Payson var. FULVOCANESCENS. *Krinitzkia echinoides* M. E. Jones, Proceedings of the California Academy of Science II. 5:709–710. 1895, nom. superfl. illegit.—*Cryptantha echinoides* Payson, Annals of the Missouri Botanical Garden 14:321–323. 1927.—*Cryptantha fulvocanescens* (S. Watson) Payson var. *echinoides* (Payson) L. C. Higgins, Great Basin Naturalist 28:30. 1969. TYPE: USA, Utah, Kane Co., Pahria Canyon, 26 May 1894, *M. E. Jones 5297p* (lectotype: POM!—Payson, Annals of the Missouri Botanical Garden 14:322. 1927).

Indument fulvous or white. Cymes 2–7-flowered, loosely scorpioid, internodes often reduced so flowers appear in pairs. Fruiting pedicels 3–8 mm long. Calyx lobes densely hispid-strigose on abaxial surfaces, thinly strigulose on adaxial surfaces. Nutlet surfaces muricate and usually with short, sharp setose projections terminating many murications at least on nutlet margins or abaxial surfaces. $n=12$ (Sivinski 1993).

This is a highly variable taxon. The indument is typically fulvous; some scattered populations in northern and southern New Mexico have white indument. The variation in indument color is neither regionally consistent or habitat specific. Some plants have a dense coverage of setose tips on the nutlet murications while others have few or no nutlet setae. The presence/absence or relative density of nutlet setae does not correlate consistently with geographic distribution and can vary considerably among plants within a population. Although there is no holotype for this species, Higgins (1971) designated a *Fendler 632* specimen at GH as the holotype and, thereby, effected lectotypification.

Distribution. Central and southern Utah, Arizona north of the Mogollon Rim, to north and south-central New Mexico (Fig. 1). On shaley, gypseous, or caliche sands in piñon-juniper woodland, Great Basin Desert scrub, and Chihuahuan Desert scrub at elevations from 1200 to 2300 meters.

Representative specimens. USA, ARIZONA: Apache Co., 24–27 km N. of Ganado, 10 Jun 1937, *Peebles 13479, 13490* (GH); Navajo Co., 1.6 km S. of Taylor, 18 May 1970, *Atwood 2580* (BRY); near Winslow, 20 May 1934, *McKelvey 4537* (GH). NEW MEXICO: Catron Co., Tejana Mesa, 8 km NW of Quemado, 7 Jun 1991, *Sivinski 1710* (UNM); Otero Co., White Sands National Monument, 4 May 1933, *Castetter 2127* (RM, UNM); Santa Fe Co., hills at Santa Fe, 13 May 1897, *Heller 3517* (GH, ND-G, US); San Juan Co., 2.5 km S. of Farmington, 20 May 1993, *Sivinski 2186* (BRY, UNM); UTAH: Kane Co., 43 km E. of Kanab, 6 Jun 1942, *Ripley and Barneby 4840* (GH); 6.5 km S. of Cannonville, 28 May 1965, *Cronquist 10212* (BRY, NY); San Juan Co., Monument Valley, Rock House, 17 May 1944, *Holmgren 3225* (GH).

1b. CRYPTANTHA FULVOCANESCENS (S. Watson) Payson var. NITIDA (Greene) Sivinski, stat. et comb. nov.—*Oreocarya nitida* Greene, Plantae Bakerianae 3:21. 1901.—TYPE: USA, Colorado, Mesa Co., Deer Run, 11 Jun 1901, *C. F. Baker 95* (lectotype, here designated: UC!; isolectotypes: GH!, POM!, RM!, US).

Indument white or fulvous with age. Cymes 5–11-flowered, obviously scorpioid, internodes evident. Fruiting pedicels 1–4 mm long. Calyx lobes slightly hispid and densely silky-strigose on abaxial surfaces, densely silvery strigose on adaxial surfaces. Nutlet surfaces usually covered with only rounded murications, occasionally with terminating setae. $n=12$.

Greene thought this taxon "noteworthy by the whiteness and softness of its almost satiny indument" though it can become fulvous with age or frost damage. The tallest and most satiny examples of this taxon occur in the canyon lands from Grand Junction, CO, to Moab, UT. As it ranges south, the plants lose some stature and length of indument. The *Baker 95* specimen at UC is designated as the lectotype because Greene referred only to the Deer Run, Colorado collection and was at UC at the time of publication.

Distribution. Western Colorado and eastern Utah, barely in northeastern Arizona and northwestern New Mexico (Fig. 1). On sandstone in piñon-juniper woodland and Great Basin Desert scrub at elevations from 1400 to 2300 meters.

Representative specimens. USA, ARIZONA: Navajo Co., near Kayenta along Hwy 164, 11 May 1972, *Higgins 5178* (BRY, WTSU).

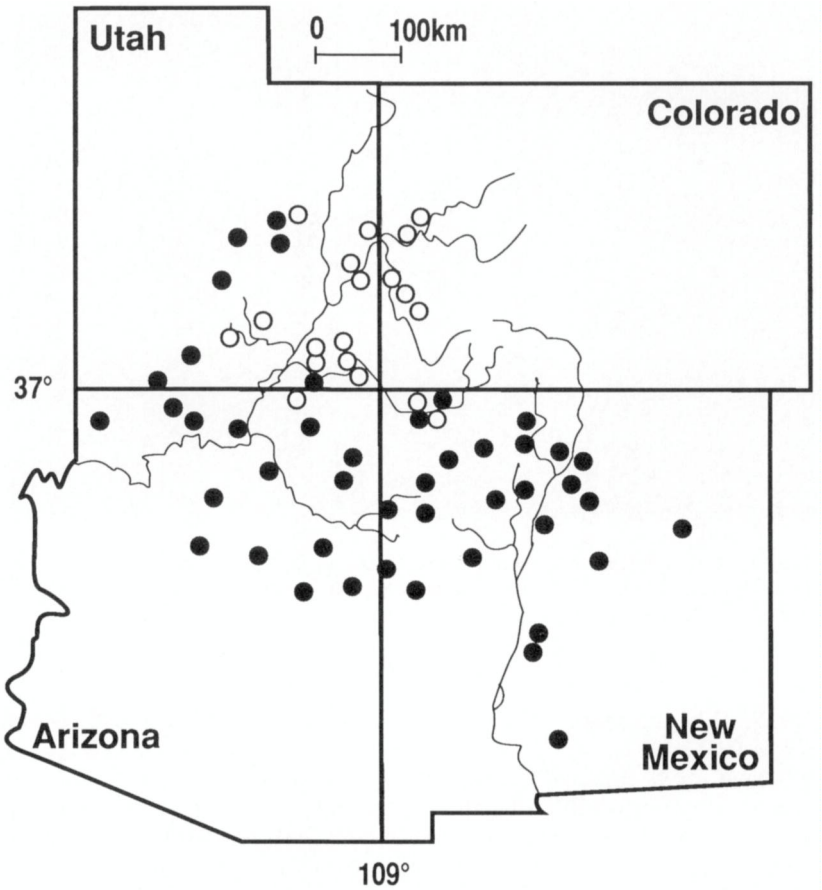

FIG. 1. Distribution of *C. fulvocanescens* var. *fulvocanescens* (solid circles) and *C. fulvocanescens* var. *nitida* (open circles) in the Four-corners region of Arizona, Colorado, New Mexico and Utah.

COLORADO: Mesa Co., Grand Junction, 17 May 1892, *Eastwood s.n.* (GH, RM, US); Mesa Co., hills south of Grand Junction, 11 Jun 1920, *Osterhout 6003* (GH, RM); Montrose Co., "gyp hills" at Paradox, 13 Jun 1912, *Walker 85* (GH, RM); Montrose Co., dry clay slopes on hills, 26 Jun 1924, *Payson and Payson 3876* (GH); San Miguel Co., Gypsum Valley, 6.4 km E. of Gypsum Gap, 9 Jun 1949, *Weber 4718* (COLO, GH, RM). NEW MEXICO: San Juan Co., Hwy 371, 2.5 km S of Farmington, 20 May 1993, *Sivinski 2185* (BRY, UNM). UTAH: Garfield Co., about 1.6 km E. of Waterpocket Fold, 72 km S. of Notom, 9 May 1965, *Cronquist 10053* (NY, RM); Grand Co., Cisco, 2 May 1890, *Jones s.n.* (RM, POM); San Juan Co., 15

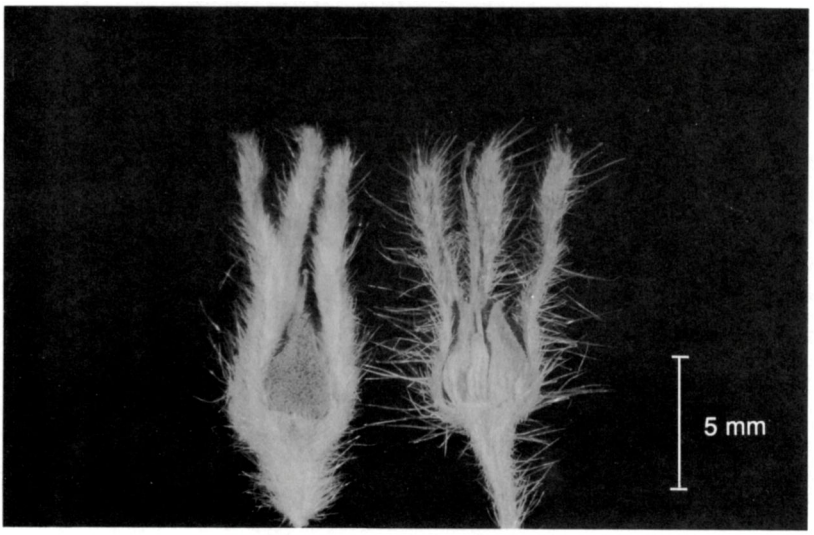

FIG. 2. Characteristic calyx pubescence for *Crypantha fulvocanescens* var. *nitida* (left) (*Sivinski 1211*, UNM) and *C. fulvocanescens* var. *fulvocanescens* (right) (*Clark 12748*, UNM).

km S. of Montezuma Creek on White Mesa Rd., 26 May 1983, *Hiel 1704* (BRY).

Cryptantha fulvocanescens vars. *fulvocanescens* and *nitida* are readily distinguishable in either flowering or fruiting stages. Variety *nitida* is usually larger in morphological features, although there is considerable overlap in measurements taken from the two varieties (Table 1). The notable exception is the range of pedicel length, which is usually shorter for var. *nitida* (0.8–4 mm) than var. *fulvocanescens* (2.5–8 mm). The combination of short pedicels, more flowers per cyme, and longer internodes between flowers gives var. *nitida* a longer, more narrow, scorpoid cyme than is typical of var. *fulvocanescens*. In flower or in fruit, var. *nitida* is distinguishable by the indument of its calyx lobes. The adaxial face of each lobe is so densely silvery-strigose that the green surfaces are completely obscured. In typical *fulvocanescens* the adaxial faces of the calyx lobes are only strigulose and the green surfaces are partly visible (Fig. 2). The density of setae on the nutlets of var. *fulvocanescens* is highly variable, but some murications with terminating setae are usually present, at least on the adaxial nutlet surface. In var. *nitida*, the nutlet murications are typically more rounded and without any terminating setae. Exceptional *nitida* populations with setose nutlets occur in southwestern Utah.

TABLE 1. MORPHOLOGICAL CHARACTERISTICS OF *CRYPTANTHA FULVOCANESCENS* VAR. *FULVOCANESCENS* AND VAR. *NITIDA*. Numbers of *fulvocanescens* specimens examined from New Mexico = 28, Arizona = 20, Utah = 11. Specimens of *nitida* examined from Utah = 23, Colorado = 17, New Mexico = 3, Arizona = 1. Pedicel length measurements are from the oldest flower on the lowest cyme.

	var. *fulvocanescens*				var. *nitida*			
Character	n	Range	Mean	SD	n	Range	Mean	SD
Height (mm)	59	55–270	137	48	44	100–260	178	38
Flowers/cyme	59	2–7	4.3	1.2	44	4–11	6.3	1.7
Pedicel length (mm)	59	2.5–8.0	4.3	1.2	44	0.8–4.0	2.1	1.8
Fruiting calyx (mm)	47	5.2–12.0	8.8	1.3	29	8.2–13.2	10.2	1.5
Corolla tube (mm)	59	6.6–10.2	8.3	1.0	44	8.0–12.4	9.8	1.0
Nutlet length (mm)	47	3.1–4.0	3.4	0.3	29	3.4–4.4	3.8	0.3

Range and habitat preference are also different for these two taxa. Variety *nitida* grows almost exclusively on Colorado Plateau sandstones on the west slope of the Rocky Mountains and in the upper Colorado River Basin. Some var. *nitida* specimen labels indicate that the plants grow on shale. When those sites were revisited, however, the plants were found to be confined to gypseous, sandy soils or sandstones. Variety *fulvocanescens* has a much wider distributional range through Arizona, New Mexico, and Utah. It is not known from Western Colorado. It also occupies a wider variety of habitats, such as shales, clayey sands, and gypsum. The taxa are sympatric along the San Juan River of northwestern New Mexico and southeastern Utah. They grow together on the same outcropping slope approximately 2.5 km south of Farmington, NM. At that location, var. *nitida* grows only on sandstone strata and var. *fulvocanescens* occupies adjacent shale strata. Variety *fulvocanescens* at that location has a whiter indument than is normal for populations of the surrounding area.

Many of the historically early collections exhibit the extreme forms of a highly variable species and have contributed to the numerous efforts to maintain them as distinct species. The taxonomic distinctions become blurred in areas of sympatry in the Four-Corners region. In southeastern Utah and northeastern Arizona some var. *nitida* populations have longer pedicels and, occasionally, setose tips on the nutlet murications. Some northwestern New Mexico populations of var. *fulvocanescens* have unusually short pedicels and occasionally lack nutlet setae. When calyx pubescence is applied as the diagnostic criterion, however, a definite pattern emerges for geographic distribution and habitat substrate preference. Therefore, an understanding of the evolutionary progress of this species is better served by recognizing Greene's *nitida* at an infraspecific level rather than the more conservative approach of maintaining *C. fulvocanescens* as one highly polymorphic taxon.

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