

A REVISION OF THE *ECHIDIOCARYA* SECTION OF *PLAGIOBOTHRYS* (BORAGINACEAE)

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ABSTRACT.— This revision discusses two closely related species of *Plagiobothrys* (Boraginaceae) found in the southwestern United States and central Chile. One of the two species, *P. collinus*, is composed of five varieties that range from southern California and western Arizona to central Chile in South America. The following new combinations are proposed: *P. collinus* var. *californicus*, *P. collinus* var. *gracilis*, *P. collinus* var. *ursinus*, and *P. collinus* var. *fulvescens*. Detailed keys, synonymy, and descriptions are given for each entity.

The section *Echidiocarya*, as here defined, includes those species of the genus that are annuals with opposite or alternate lower leaves and that have the nutlet scar elevated on the end of a conspicuous stipe. The section *Allocarya* (to be treated in a later paper) differs mainly in that the nutlets lack the cylindrical stipe and the leaves are nearly always oppositely arranged.

The section *Echidiocarya* (Gray) Johnston is composed of two species and five varieties that are confined to the western half of the American continent, ranging from central California to central Arizona and southward to northern Sonora and northern Baja California, Mexico, with an outlying population in central Chile. The habitats of the various entities occur from sea level to steep mountain slopes and are characterized by scanty rainfall, warm temperatures, and high evaporation.

In 1857 R. A. Phillipi described the first species in the section when he published *Eritrichium collinum*. In 1908 K. Reiche transferred the species to *Cryptantha* in his treatment of the Boraginaceae published serially in the *Anales de la Universidad de Chile* and in 1910 as part of his *Flora de Chile*. In 1895 Phillipi described *E. inconspicuum*, which falls into synonymy with *E. collinum*.

Asa Gray (1876) proposed the genus *Echidiocarya* for *Echidiocarya arizonica* (*Plagiobothrys pringlei* Greene). It was characterized by the long-stiped nutlets. Gray (1877) added *E. californica* and (1883) *E. ursina* to the genus. Gray (1885), commenting on the very close relationship of his genus to *Plagiobothrys*, said, "The comparatively recent discovery of the preceding species [*P. ursina*] of this section has made it clear that both of them should fall in *Plagiobothrys*." He then transferred *E. californica* and *ursina* to *Plagiobothrys*, leaving the original species by itself.

Greene (1887) disposed of *Echidiocarya*, stating that it had "every aspect and every character of *Plagiobothrys*, except that there is a stipe between the scar, or point of attachment to the gynobase, and the body of the nutlet."

Johnston (1923) placed *Echidiocarya* as one of his sections under *Plagiobothrys*. He also described two additional varieties of *P. cali-*

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fornicus. Since Johnston's treatment only Brand (1931) and Abrams (1951) have accepted *Echidiocarya* as a distinct genus.

During my research—which led ultimately to a complete revision of *Plagiobothrys*—a realignment of the members of this section became apparent because the South American *P. collinus* is conspecific with *P. californicus* of the southwestern United States and Mexico. Johnston (1927) was aware of the close relationship even though he never made any nomenclatural changes. He said, "the relationship between the Californian and Chilean plants is very clear and strong, so incontrovertible in fact, that some changes in the classification of the North American forms will probably be made." Those changes are the primary basis of this paper.

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TAXONOMY

Plagiobothrys Fisch. and Mey. Sect. *Echidiocarya* (Gray) Johnston, in Contr. Gray Herb. 68:65, 1923. *Echidiocarya* Gray, in Benth. and Hook. Genera Pl. 2:854, 1876; Proc. Amer. Acad. Arts 11:89, 1876. Species Holotypus: (*E. arizonica*) *P. pringlei* Greene.

Annual, usually diffusely branched, herb with the lowest leaves opposite or sometimes alternate; flowers in slender spikes, usually bracteate, calyx lobes linear-lanceolate, corolla white, the throat not crested; nutlets 4, incurved, conspicuously rugulose dorsally, conspicuously keeled ventrally; scar on a slightly to prominently elevated stipe.

1. Stipe of nutlet elongate, approximating the body in length; nutlets commonly united in pairs; distribution in southern Arizona and northern Sonora 1. *P. pringlei*
- 1'. Stipe of nutlet short, 0.5 mm long or less, much shorter than the body of the nutlet 2. *P. collinus*
2. Corolla 4-7 mm broad; pubescence fine, appressed, usually somewhat silky; California, Arizona, and northern Mexico 2A. var. *californicus*
- 2'. Corolla 1-3 mm broad; pubescence usually spreading; coarse, setulose 3
3. Leaves narrowly linear, 2-2.5 mm broad 4
- 3'. Leaves oblanceolate, 3-5 mm broad 5
4. Pubescence fine, nutlets rounded-rugulose; California and Baja California, Mexico 2B. var. *gracilis*
- 4'. Pubescence coarse, nutlets sharply rugose; Chile. 2C. var. *collinus*
5. Racemes dense, hidden among leaves; San Bernardino Mountains, San Jacinto Mountains 2D. var. *ursinus*

- 5'. Racemes elongate, projecting from among the leaves and evident; southern California and Baja California, Mexico
 2E. var. *fulvescens*

1. *Plagiobothrys pringlei* Greene

Echidiocarya arizonica Gray, in Benth. and Hook. Genera Pl. 2:854, 1876; Proc. Amer. Acad. Arts 11:89, 1876. Not *P. arizonicus* (Gray) Greene; *Plagiobothrys pringlei* Greene, in Pittonia 1:21, 1887. Mesa Verde, Arizona, Dr. Smart sn. Holotype GH!

Stems several to many branched from near the base, prostrate or decumbent to nearly erect, slender, 1-4 dm long, spreading setose; leaves numerous below, less so above, narrowly oblanceolate, 2-4 cm long, 2-5 mm broad, rounded or obtuse to nearly acute at apex, appressed strigose or canescent to conspicuously setose; floral bracts lanceolate to narrowly oblong, 1-2 cm long; spikes elongating in age, bractless near the apices; calyx segments lance-linear, about 3 mm long in fruit, hirsute; corolla 2-3 mm broad, inconspicuous; nutlets 4, the lowermost commonly joined in pairs, the upper separate, ovate, the apex acute, 1.8-2 mm long, dorsal keel evident above fading to rather distinct tuberculations below, dorsal surface rugulose with short ridges also conspicuously tuberculate; scar elevated on a prominent stipe at least 1.3 mm long and usually as long as the nutlet, ventral keel evident; style shorter than the stipe of nutlet.—Representative collections: J. J. Thornber sn. (CAS, NY); F. R. Fosberg 10663 (CAS, GH); V. L. Cory 3398 (GH); Pultz and Phillips 1572 (GH, NY); I. L. Wiggins 8689, 8190 (GH); L. C. Higgins 2822 (BRY, WTSU).

Distribution

Common in Cochise, Maricopa, Pima, and Pinal counties of Arizona and in northern Sonora, Mexico. Growing on sandy desert flats and mesas.

The most remarkable characteristic of Pringle's *Plagiobothrys* is the long-stiped nutlets, unique among the borages. This species is very closely related to *P. collinus* var. *fulvescens*, which it resembles in most details, except that the former has stalked nutlets and slightly longer calyx segments.

2a. *Plagiobothrys collinus* var. *californicus* (Gray) Higgins

Plagiobothrys collinus (Ph.) Johnston var. *californicus* (Gray) Higgins comb. nov., based on *Echidiocarya californica* Gray, in Proc. Amer. Acad. Arts 12:164, 1877. *Plagiobothrys californicus* (Gray) Greene, in Bull. Calif. Acad. Sci. 2:407, 1887. *Plagiobothrys cooperi* Gray, in Proc. Amer. Acad. Arts 20:285, 1885. *Allocaryastrum californicum* (Gray) Brand, in Pflanzenr. 4²⁵²:100, 1931. Southeastern California in San Bernardino County. 1876. Parry and Lemmon 278. Holotype GH!

Leaves numerous below, oblanceolate, 1-3 cm long, 2-5 mm broad, rounded or obtuse at apex, thinly hirsute with ascending hairs or sometimes canescent with appressed pubescence; spikes slender, at maturity elongate and remotely flowered; calyx segments 3 mm long in fruit, linear-lanceolate, hirsute to hispid; corolla 4-6 mm

broad; nutlets about 1.5 mm long, scar with a short stipe near base.—Representative collections: J. T. Howell 3935 (GH, CAS); T. S. Brandegee 1637 (GH); L. Abrams 3276 (GH); I. M. Johnston 1839 (GH).

Distribution

San Benito County, California, southward to northern Baja California, Mexico.

P. collinus var. *californicus* is most easily recognized by its large corollas, 4-7 mm broad and the more canescent pubescence; even at this, it intergrades with varieties *gracilis* and *fulvescens*.

2b. *Plagiobothrys collinus* var. *gracilis* (Johnston) Higgins

Plagiobothrys collinus (Ph.) Johnston var. *gracilis* (Johnston) Higgins comb. nov., based on *Plagiobothrys californicus* var. *gracilis* Johnston, in Contr. Gray Herb. 68:73, 1923. *Allocaryastrum gracile* Brand, in Pflanzenr. 4²⁵²:100, 1931. *Echidiocarya californica* subsp. *gracilis* (Brand) Abrams, in Ill. Fl. Pacific Stat. 3:571, 1951. San Diego, San Diego County, California, on the mesas. 10 April 1902. T. S. Brandegee 1658. Holotype GH!

Stems slender, with spreading hispid pubescence; leaves linear-lanceolate, sparsely pubescent, with spreading setose hairs, 2-2.5 mm broad, acute or acutish; calyx segments linear, ca 2 mm long, very slender, hirsute; corolla 1.5-2 mm broad; nutlets 1-1.5 mm long, inconspicuously rugulose.—Representative collections: F. R. Fosberg 7681 (CAS, GH); I. L. Wiggins 4462 (GH); F. F. Gander 4955 (GH); Raven & Mathias 12520 (GH).

Distribution.

San Diego County, California, southward to northern Baja California, Mexico, and on the islands of Santa Cruz, Santa Catalina, and San Clemente.

The variety *gracilis* is differentiated from the other varieties by the sparse spreading hirsute pubescence, narrower leaves, and smaller corollas. Its closest relatives are to be found in the varieties *fulvescens* and *collinus*. Intermediates are not uncommon with variety *fulvescens* and are very difficult to separate from true *gracilis*.

2c. *Plagiobothrys collinus* var. *collinus*

Eritrichium collinum Ph. Linnaea 29:17, 1857. *Cryptantha collina* Reiche, in Anales Univ. Chile 121:828, 1908; Fl. Chile 5:233, 1910. *Plagiobothrys collinus* (Ph.) Johnston, in Contr. Gray Herb. 78:81-82, 1927. Hills, Huanta, August 1836, Gay 1623. Holotype MS! Isotype fragment and photograph GH!

Eritrichium inconspicuum Ph. Anales Univ. Chile 90:534, 1895.

Cryptantha inconspicua Reiche, in Anales Univ. Chile 121:820, 1908; Fl. Chile 5:225, 1910. Coquimbo: La Serena, October 1878. Philippi s.n. Holotype MS! Fragment and photograph GH!

Stems several, mostly erect, 3-15 cm long, hispidulous-villous; leaves linear to oblance-linear, obtusish, conspicuously hispidulous, 2-4 mm broad; calyx segments 1.5-2.5 mm long, fulvescent; corolla 1-1.5 mm broad, inconspicuous; nutlets 1.2-1.5 mm long, reticulately rugose with sharp ridges; style approximating nutlets.—Representative collections: C. O. Skottsberg 1371, 723 (NY, GH); G. Montero

1895 (GH); E. Barros 6316, 6361 (GH); Worth & Morrison 16340 (GH).

Distribution

Chile, in the providence of Coquimbo. Apparently restricted to the area around Coquimbo.

This variety is most closely related to the varieties *gracilis* and *fulvescens*. It differs from the former in being coarser and in having broader obtusish more densely pubescent leaves and sharper and more prominently rugulose nutlets. From *fulvescens* it differs in having narrower leaves that are not so harshly pubescent, a more erect habit, and more prominently rugulose nutlets.

2d. *Plagiobothrys collinus* var. *ursinus* (Gray) Higgins

Plagiobothrys collinus (Ph.) Johnston var. *ursinus* (Gray) Higgins comb. nov., based on *Echidiocarya ursina* Gray, in Proc. Amer. Acad. Arts 19:90, 1883. *Plagiobothrys ursinus* Gray, in Proc. Amer. Acad. Arts 20:285, 1885. *Plagiobothrys californicus* var. *ursinus* (Gray) Johnston, in Contr. Gray Herb. 68:74, 1923. *Echidiocarya californica* var. *ursina* (Gray) Jepson, in Fl. Calif. 3:370, 1943. California, San Bernardino Mountains, S. B. Parish 927. Lectotype GH!

Stems much branched, dense, compact, 2-8 cm long; spikes short; flowers concealed by the hispidulous leaves and bracts which are 1-2.5 cm long; corolla 1-2 mm broad; nutlets weakly rugulose.—Representative collections: S. B. Parish 3247 (NY); P. A. Munz 5725 (GH); Munz & Johnston 4550 (GH); C. R. Orcutt 908 (GH).

Distribution

California, in the San Bernardino and the San Jacinto Mountains, growing in sandy to gravelly soils.

The caespitose, compact habit of variety *ursinus* serves best to distinguish it from all the other varieties. It also grows at a higher, more montane elevation.

2e. *Plagiobothrys collinus* var. *fulvescens* (Johnston) Higgins

Plagiobothrys collinus (Ph.) Johnston var. *fulvescens* (Johnston) Higgins comb. nov., based on *Plagiobothrys californicus* var. *fulvescens* Johnston, in Contr. Gray Herb. 68:74, 1923. *Allocaryastrum ursinum* var. *fulvescens* (Johnston) Brand, in Pflanzenr. 4²⁵:101, 1931. *Echidiocarya californica* subsp. *fulvescens* (Brand) Abrams, in Ill. Fl. Pacific Stat. 3:571-572, 1951. California, Santa Barbara, 1888, T. S. Brandegee s.n. Holotype GH!

Plagiobothrys micranthus A. Nels., in Amer. J. Bot. 25:115, 1938. Arizona, Prescott, moist creek banks, 28 April 1925. A. Nelson 10232, Holotype RM! Isotype GH!

Stems slender, elongate, prostrate, hispid-pubescent, leaves oblanceolate, obtusish to acutish, hispidulous 3-5 mm broad; spikes very slender at maturity, remotely flowered; corolla about 2 mm broad.—Representative collections: Eastwood and Howell 3914, 4156 (CAS, GH); F. R. Fosberg 10706 (CAS, GH); J. T. Howell 31075 (CAS); L. Abrams 3315 (NY); T. H. Kearney s.n. (CAS); C. B. Hardham 3049, 5602, 10048 (CAS).

Distribution

Santa Barbara County, California, southward to northern Baja California, Mexico, eastward to central Arizona. Also on the islands of Santa Rosa, Santa Catalina, and Anacapa.

Most closely related to the varieties *collinus* and *gracilis* as discussed under *collinus*. Variety *fulvescens* also introgresses considerably with varieties *californicus* and *gracilis*.

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