NOTEWORTHY COLLECTIONS

Authors: Simpson, Michael G., Stephens, Jillian, and Yang, Stella

Source: Madroño, 67(1) : 5-8

Published By: California Botanical Society

URL: https://doi.org/10.3120/0024-9637-67.1.5

MADROÑO, Vol. 67, No. 1, pp. 5–8, 2020

NOTEWORTHY COLLECTIONS

CALIFORNIA

JOHNSTONELLA ANGELICA (I.M.Johnston) Hasenstab & M.G.Simpson [*Cryptantha angelica* I.M.Johnston] (BORAGINACEAE). —San Diego Co., Borrego Springs, Steele/Burnand Anza-Borrego Desert Research Center, at Tilting T Drive, near south entrance, east of fence, adjacent to old dirt road going north into wash. Fine to gravelly white sand. Annual herb. Stems and leaves gray-green. Corolla white, very small, ca. 0.5 mm wide. Associated species include *Ambrosia dumosa* (A.Gray) Payne, *Cylindropuntia ganderi* (C.B.Wolf) Rebman & Pinkava, *Encelia farinosa* A.Gray ex Torr., *Ferocactus cylindraceus* (Engelm.) Orcutt, *Fouquieria splendens* Engelm., *Justicia californica* (Benth.) D.N.Gibson, *Opuntia basilaris* Engelm. & J.M.Bigelow, *Psorothamnus schottii* (Torr.) Barneby, *Stephanomeria pauciflora* (Torr.) A.Nelson, plus mixed herbs, including *Cryptantha maritima* (Greene) Greene var. *maritima, Diplacus bigelovii* (A.Gray) G.L.Nesom, *Eschscholzia parishii* Greene, and *Johnstonella angustifolia* (Torr.) Hasenstab & M.G.Simpson. *Jillian Stephens 1,* 12 April 2019, *with Stella Yang and Michael G. Simpson* (SDSU22760, SD). Upper berm of desert wash. Rare; observed only at isolated site. ca. 33.240457, -116.387903 (± 20 meters), 210 meters elevation. *Stella Yang s.n.* (SDSU22773), 14 April 2019. Desert wash. Rare. 33.24083, -116.38806 (± 20 meters), 212 meters elevation.

Previous knowledge. This species was thought to be endemic to Mexico (Rebman et al. 2016; Villaseñor 2016), with herbarium vouchers from localities in Baja California and Baja California Sur (Fig. 1). [Note that one collection, cited on SEINet (2019), from Tiburon Island, Sonora, Mexico (*Felger 17753*, ARIZ200386) was identified by the first author as *J. angustifolia* from the loaned specimen.] The closest known locality to the Borrego Springs population is approximately 240 miles (386 kilometers) to the south. Thus, the discovery of this disjunct population, from two nearby collections, is a new record for San Diego County, California, and the United States.

Significance. Among species of the genus *Johnstonella*—a segregate of *Cryptantha* (see Hasenstab-Lehman and Simpson 2012, Simpson et al. 2017, and Mabry and Simpson 2018)—*Johnstonella angelica* is morphologically similar in fruit morphology to *Johnstonella inaequata* (I.M.Johnston) Brand, both species having heteromorphic nutlets: one ("odd") nutlet larger and firmly attached to the gynobase and three ("consimilar") nutlets smaller and readily detaching. All nutlets of *J. angelica* and *J. inaequata* have acute, sharp-edged ("knife-like") margins and, as is common in the genus, whitish tubercles (Fig. 2). However, the fruit sizes of the two species are quite different. *Johnstonella angelica* has a fruiting calyx usually 2–2.1(2.5) mm long, with the large (odd) nutlet generally 0.9–1.2 mm long and the small, consimilar ones generally 0.6–0.8 long (Simpson, unpublished data; see Fig. 2A). *Johnstonella inaequata* has a fruiting calyx ca. 2.5–4 mm long, with the large (odd) nutlet ca. 1.4–1.7 mm and the small, consimilar ones ca. 1.1–1.3 mm long, (Simpson, personal observation; see Fig. 2B). In addition, *Johnstonella inaequata* has a larger corolla (2.5–4 mm limb diameter) and a stem vestiture of both antrorsely appressed and spreading trichomes. *Johnstonella angelica* has a much smaller corolla (ca. 0.5 mm limb diameter) and stems have only antrorsely appressed trichomes. *Johnstonella inaequata* is distributed considerably further north than previously known collections of *J. angelica*. Specimens of the former are recorded mostly from California (Inyo, San Bernardino, and Riverside Counties), with a few cited from Arizona (Coconino and Mohave Counties), Nevada (Clark County), and Utah (Garfield, Kane, San Juan, and Washington Counties) (CCH2 2019, SEINet 2019; see Fig. 1). (See Simpson 2007 onwards for additional images and information.)

The two Borrego Springs collections cited here are a clear match for the great majority of observed *Johnstonella angelica* specimens from Baja California and Baja California Sur, Mexico (Fig. 2C). Both of the collections resemble the typical, heteromorphic form of the species, with the large/odd nutlet having a reduced tubercle density and size, the tubercles minutely (and obscurely) spinulose. However, we note that a few examined specimens from the Baja peninsula have nutlets that are essentially homomorphic, being identical in sculpturing and gynobase attachment (all readily detaching from the fruit), with only a very slight difference in size. From herbarium specimen records cited in the CCH2 (2019) and SEINet (2019), *Johnstonella angelica* occurs in a variety of habitats, including: alluvial flats and washes, canyons/canyon bottoms, coquina-rock plateaus, dunes and upper beaches, edges of dirt or gravel roads, flats (often silty), plains/flood plains, sand and whitish sea bed substrates, slopes/rhyolitic slopes, and dry swales. This species occurs in several phytogeographic/ecoregions of the Baja peninsula, including Central Desert, Gulf Coast Desert, Magdalena Plains, Pacific Islands (Cedros Island only), and Vizcaino Desert (see Rebman et al. 2016). Curiously, it appears to be essentially absent from the Lower Colorado Desert of Baja California, the

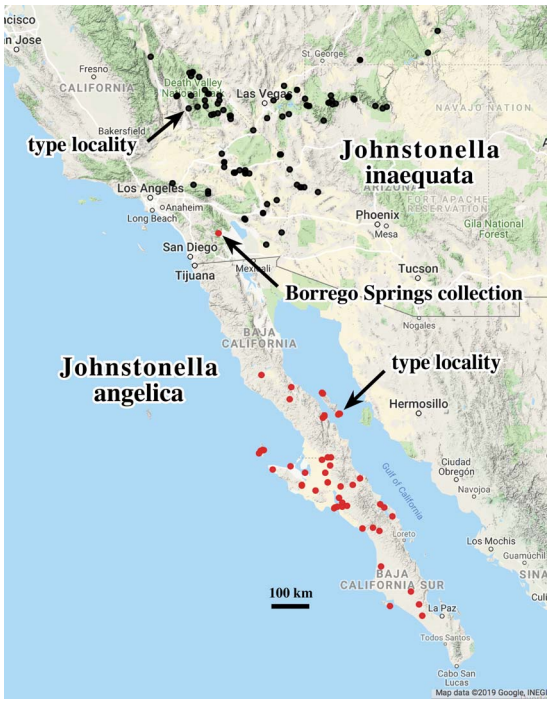

FIG. 1. Distribution map of *Johnstonella angelica* (red/gray dots) and *Johnstonella inaequata* (black dots), data from the Consortium of California Herbaria (CCH2) and SEINet Portals, both accessed 21 Sept 2019. Type localities of the two species indicated with arrows (see Johnston 1922:444, 1924:1143). Note locality of Borrego Springs collections of *J. angelica*, approximately 240 air miles (386 km) from the nearest known population of that species in Baja California, Mexico. Map data from ©Google 2019, INEGI Data.

ecoregion that includes Borrego Springs and the surrounding Anza Borrego Desert State Park.

The closest known relative of *Johnstonella angelica* from molecular phylogenetic studies (Simpson et al. 2017) is the South American *Johnstonella parviflora* (Phil.) Hasenstab & M.G.Simpson. These two species are very similar to one another in both calyx and nutlet morphology and size. In fact the two are barely distinguishable, differing slightly in large (odd) nutlet sculpturing (Simpson, personal observation, albeit from a limited number of specimens). More detailed studies will be needed to evaluate their possible conspecificity; if so, *Johnstonella parviflora* would have priority.

Johnstonella angelica could easily be confused with *J. angustifolia* (Torr.) Hasenstab & M.G.Simpson, one of the most common borages of the lower desert. In fact, the original collection by *Yang s.n.*, 14 April 2019 cited here was a mix of the two species, indicating that they might grow adjacent to one another. However, the two can be distinguished in a number of features. *Johnstonella angustifolia* has upper stem trichomes both antrorsely appressed/strigulose and densely short-spreading (minutely hirsute), whereas those of *Johnstonella angelica* are only antrorsely appressed/strigulose. *Johnstonella angustifolia* generally has larger corollas (varying, however, from 1–4 mm in limb diameter); the corollas of *J. angelica*, however, are quite small, about 0.5 (rarely up to 1.0) mm in limb diameter. *Johnstonella angustifolia* has a larger fruiting calyx, ca. 2.5–4 mm long; that of *J. angelica* is smaller, ca. 2–2.1(2.5) mm long. Lastly, *Johnstonella angustifolia* also has heteromorphic nutlets (very rarely homomorphic), but these generally have rounded margins and are slightly larger: the large, odd nutlets range 1.1–1.6 mm long (vs. 0.9–1.2 mm long in *J. angelica*) and the small, consimilar nutlets range 0.8–1.1 mm long (vs. 0.6–0.8 long in *J. angelica*). Interestingly, *Johnstonella angustifolia* has been observed as (rarely) having "acute" margined nutlets. This form may be due to excessive drying (personal observations, first author), but is in fact quite different from the sharp, "knife-like" nutlet margins of *J. angelica*.

Given that *Johnstonella angelica* has not knowingly been seen or collected in the Anza Borrego area before, this collection, in only two sites very near one another, may represent a waif occurrence. The species could possibly have been human dispersed, perhaps brought in on the shoes or clothing of a visiting student, scientist, worker, or tourist, or possibly on construction fill from the past, although no fill was observed in the immediate area. The dirt road adjacent to the collection site, which is barely visible and is overgrown, has only rarely been used by utility trucks in the past decade and was not involved in any construction activities when the Research Center was built between 2012 and 2014 (Jim Dice, Reserve Manager, Steele/Burnand Anza-Borrego Desert Research Center, personal communication). It is still possible that these Borrego Springs populations were animal-dispersed (likely by birds) over a long distance, not uncommon in this group (subtribe Amsinckiinae) of the Boraginaceae (see Guilliams et al. 2017). It should also be noted that this was a particularly wet season, increasing the probability of propagule germination.

Next spring, we and others will survey the region around the Steele/Burnand Anza-Borrego Desert Research Center for additional plants of this species. We urge other botanists to search for this plant in the Anza Borrego Desert State Park in San Diego County and other desert regions in the state. Herbarium vouchers are likely essential for definitive identification, but these should be collected with care so as not to extirpate local populations, if discovered. Careful examination of existing herbarium specimens, especially those identified as *Johnstonella* [*Cryptantha*] *angustifolia* or even *Johnstonella* [*Cryptantha*] *inaequata,* could reveal hidden collections of *Johnstonella angelica* from localities outside its typical range in Mexico. Although it may be difficult to determine the origin of *Johnstonella angelica* in this desert area of California in lieu of molecular

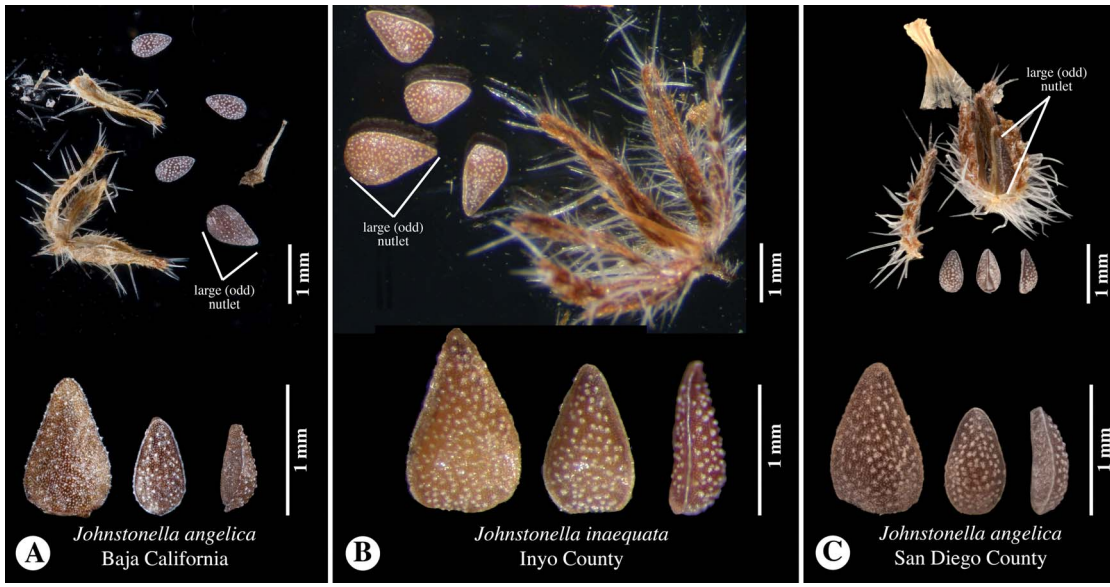

FIG. 2. Comparison of fruit morphology of *Johnstonella angelica* and *Johnstonella inaequata*. Upper images: fruits (calyces and nutlets); all to scale. Lower images: large (odd) nutlet, dorsal view at left; one of three small (consimilar) nutlet, dorsal view at middle, lateral view at right; all to scale. A. *Johnstonella angelica,* from Baja California, Mexico, upper image *Wiggins 16789a*, 20 February 1962 (SD00013663=SD94589), lower image *Philbrick B73-262*, 8 March 1973 (SBBG46949). B. *Johnstonella inaequata,* from Death Valley, Inyo County, California; all images: *André 8132*, 31 March 2006 (RSA0116520=RSA732141). C. *Johnstonella angelica,* from Borrego Springs, San Diego County, California, *Stephens 1*, 12 April 2019 (SDSU22760).

studies, the discovery of additional populations in the area might provide support for hypotheses that the species is indigenous or has become permanently established in California. Additional information will be needed before the species can be evaluated for possible California Rare Plant ranking (California Native Plant Society Rare Plant Program 2019).

—MICHAEL G. SIMPSON, Department of Biology, San Diego State University, San Diego, CA 92182, msimpson@sdsu.edu; JILLIAN STEPHENS, Dana Point, CA 92629; STELLA YANG, San Jose, CA 95129.

ACKNOWLEDGMENTS

We thank Allyson Greenlon and the Jepson Workshop program at the University of California, Berkeley for hosting the workshop: Botany of Borrego Springs with Emphasis on Borages, 12–14 April 2019. We thank Jim Dice, Reserve Manager of the Steele/Burnand Anza-Borrego Desert Research Center, and Larry Hendrickson, Senior Park Aide, California State Parks, Colorado Desert District, for their help in logistics during the workshop. We thank Dr. Jon Rebman, curator of the San Diego Natural History Museum herbarium, for examining the *Stephens 1* collection at SD. We give special thanks to George M. Ferguson of the University of Arizona Herbarium (ARIZ) for providing a loan of the specimen cited as *Johnstonella angelica* from Sonora, Mexico that we determined to be misidentified.

LITERATURE CITED

CCH2. 2019. Consortium of California Herbaria CCH2 Portal. Website: http://cch2.org/portal/index.php [accessed 21 September 2019].

CALIFORNIA NATIVE PLANT SOCIETY RARE PLANT PROGRAM. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website: http://www.rareplants.cnps.org [accessed 21 September 2019].

GUILLIAMS, M. C., K. HASENSTAB-LEHMAN, M. MABRY, AND M. G. SIMPSON. 2017. Memoirs of a frequent flier: phylogenomics reveals 18 long-distance dispersals between North America and South America in the popcorn flowers (Amsinckiinae, Boraginaceae). American Journal of Botany 104:1717–1728.

HASENSTAB-LEHMAN, K. E. AND M. G. SIMPSON. 2012. Cat's eyes and popcorn flowers: Phylogenetic systematics of the genus *Cryptantha* s.l. (Boraginaceae). Systematic Botany 37:738–757.

JOHNSTON, I. M. 1922. Undescribed plants mostly from Baja California. University of California Publications in Botany 7:437–446.

JOHNSTON, I. M. 1924. Expedition of the California Academy of Sciences to the Gulf of California in 1921: The botany (the vascular plants). Proceedings of the California Academy of Sciences 12:951–1218.

MABRY, M. E. AND M. G. SIMPSON. 2018. Evaluating the monophyly and biogeography of *Cryptantha* (Boraginaceae). Systematic Botany 43:53–76.

REBMAN, J. P., J. GIBSON, AND K. RICH. 2016. Annotated checklist of the vascular plants of Baja California, Mexico. Proceedings of the San Diego Society of Natural History 45:1–352.

SEINET. 2019. SEINet Portal Network. Website: http://swbiodiversity.org/seinet/index.php [accessed 21 September 2019].

SIMPSON, M. G. 2007 onwards. Systematics of Amsinckiinae (Boraginaceae): The popcorn flowers. Website: https://plants.sdsu.edu/amsinckiinae. [accessed 21 September 2019].

SIMPSON, M. G., C. M. GUILLIAMS, K. E. HASENSTAB-LEHMAN, M. E. MABRY, AND L. RIPMA. 2017. Phylogeny of the popcorn flowers: use of genome skimming to evaluate monophyly and interrelationships in subtribe Amsinckiinae (Boraginaceae). Taxon 66:1406–1420.

VILLASEÑOR, J. L. 2016. Checklist of the native vascular plants of Mexico, Catálogo de las plantas vasculares nativas de México. Revista Mexicana de Biodiversidad 87:559–902.