

## AGAVE SIMPLEX, A NEW COMBINATION FOR AGAVACEAE

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### ABSTRACT

Multiple lines of evidence indicate that *Agave deserti* subsp. *simplex* Gentry is more closely related to *A. mckelveyana* Gentry and *A. subsimplex* Trel. than to *Agave deserti* Engelm. In order to reflect these differences, *A. deserti* subsp. *simplex* warrants recognition at specific rank, thus the new combination **Agave simplex** (Gentry) Salywon & Hodgson, **comb. et stat. nov.**, is proposed. Distinguishing features and a distribution map are provided.

Gentry (1982: 376) called *Agave deserti* Engelm. “a large variable complex, the limits of which are hard to define.” Initially this species was narrowly circumscribed as it was known only from a handful of collections, but the species concept grew to include a much wider range of populations as floristic and taxonomic treatments were published.

*Agave deserti* was first described from specimens collected near San Felipe, California. Based on the few specimens known to Engelmann and from communication with early collectors/explorers of the area, he described the range of the species as the “eastern base of the Southern California mountains and in the adjoining deserts” (Engelmann 1875: 310), in today’s Imperial, Riverside and San Diego counties. Trelease (1911: 53) essentially followed Engelmann’s delimitation of *A. deserti* noting its distribution as the “western border of the Colorado Desert in California.” However, he also described *A. consociata* Trel. from the same type locality as *A. deserti* and described its distribution as extending into northern Baja California (Trelease 1911). *Agave consociata* is considered a synonym of typical *A. deserti* (Gentry 1982; Reveal & Hodgson 2002). Floristic works later expanded the concept of *A. deserti* to include disjunct agaves in the Whipple Mountains (Munz 1935) and later to the Granite, Old Dad, and Providence mountains, all in San Bernardino County, California (Munz 1965), and to western Arizona (Kearney & Peebles 1942; 1960). Gentry’s (1972) taxonomic treatment expanded the distribution of *A. deserti* to include plants from northwestern Sonora, Mexico.

It is from within the broader concept of *Agave deserti* in Arizona that *A. mckelveyana* Gentry was described from the chaparral and juniper associations from between 3,000 and 6,000 ft in west-central Arizona. Gentry (1970: 227) stated “its nearest relatives appear to be *A. deserti* and *A. subsimplex* Trel. [from coastal central Sonora, Mexico and nearby islands]” and “I find no intergrading between them [*A. mckelveyana* and *A. deserti*] and believe the two groups to be biologically distinct species.”

The description of *A. deserti* subsp. *simplex* Gentry from the Harquahala Mountains in west-central Arizona further recognized the distinctness of the eastern populations of *Agave deserti*. Gentry (1978: 24) noted that subsp. *simplex* is “a close relative of *A. mckelveyana*, which occupies higher montane elevations northeast of the *simplex* area.”

Two independent lines of molecular genetic evidence support the close relationship of *Agave deserti* subsp. *simplex* to *A. mckelveyana* and *A. subsimplex* previously noted by Gentry. A population genetic study of the *A. deserti* complex (*A. deserti*, *A. cerulata* Trel., and *A. subsimplex*) by Navarro-Quezada et al. (2003), based on RAPD markers, supports a closer relationship of subsp. *simplex* to *A.*

*subsimplex* than to subsp. *deserti*. While phylogenetic studies of agaves in the USA and northwestern Mexico based on whole chloroplast sequence data (Salywon et al., unpubl. data) position subsp. *simplex* in a clade with *A. chrysantha* Peebles (from central Arizona), *A. mckelveyana*, and *A. subsimplex* and reveal that this clade is not closely related to subsp. *deserti*.

The morphological differences between *Agave deserti* subsp. *deserti* and subsp. *simplex* and *A. mckelveyana* are difficult to discern with most herbarium material. Additional fieldwork and a revision of the group is sorely needed to refine their species boundaries and construct better taxonomic keys. Nevertheless, given the data above from two separate molecular DNA studies, subsp. *simplex* warrants recognition at the species rank to more closely reflect its evolutionary position. In preparation for the publication of the Agavaceae assessment by the IUCN Cactus and Succulent Plant Specialist Group, we make the following combination.

**Agave simplex** (Gentry) A.M. Salywon & W.C. Hodgson, **comb. et stat. nov.** *Agave deserti* subsp. *simplex* Gentry, Occas. Pap. Calif. Acad. Sci. 130: 22. 1978. *Agave deserti* var. *simplex* (Gentry) W.C. Hodgson & Reveal, Novon 11: 413. 2001. **TYPE: Arizona.** Yuma Co. [now in La Paz Co.]: N slope of Harquahala Mountain, 12 mi W of Aguila, ca. 2500 ft, 12 Jun 1974, H.S. Gentry 23404 (holotype: US-2826320, seen as image; isotypes: ARIZ!, DES-00010282!, MEXU).

*Agave simplex* is distinguished from *A. deserti* by its usually single or sparingly suckering habit (vs sparingly to prolifically suckering) and flower stalk with 8–17(–19) lateral branches in upper 1/3–2/5 of stalk (vs 8–22 in upper 1/5–1/3 of stalk). Additionally, its primary peduncle is relatively narrow, with a length to width ratio of 1.4–2.0 (vs. 1.2–1.6), and secondary and tertiary peduncles that are short (vs. primary peduncle wide, and secondary and tertiary peduncles much longer). *Agave simplex* flowers have filaments within the tube (vs. inserted at base of tepal lobes) and inner tepal lobes are generally narrower (1.5–5(–7) mm vs. 6–9 mm). *Agave simplex* occurs in southwestern Arizona (Mohave, Pinal, Pima, Yuma, La Paz, and Maricopa counties), southeastern California (San Bernardino County), southern Nevada (southern Clark County) and northwestern Sonora, Mexico, whereas *A. deserti* occurs in south-southcentral California (USA) and northcentral part of the state of Baja California, Mexico.

Differentiating *Agave simplex* from *A. mckelveyana* is more difficult. *Agave simplex* generally has a larger habit, longer leaves 25–40 cm long (vs. 20–35 mm), larger flower stalks (4–7.5 vs 2–3 m), and larger flowers 40–60 mm (vs. 30–40 mm), with larger tepal lobes, deeper and wider tube, and longer ovary.

Mapping the distribution of *Agave simplex*, *A. chrysantha*, *A. mckelveyana*, *A. subsimplex*, and *A. deserti* (subsp. *deserti* and *pringlei*) is also helpful to inferring relationships between these taxa (Fig. 1.). The map reveals a gap of at least ca. 150 km between *A. simplex* and *A. deserti*, with most of this gap being the rather inhospitable lower Colorado Desert, including the Colorado River, which could serve as a barrier to dispersal. In contrast, *A. simplex* is separated by less than 50 km from *A. mckelveyana* and *A. chrysantha*. Given the limited natural dispersal ability of most agaves, it is likely that related taxa would occur in closer versus distant geographical proximity. Thus, the molecular and geographic distributional data provide evidence that regional vicariance events shape the evolutionary history of these taxa more than long-distance dispersal.

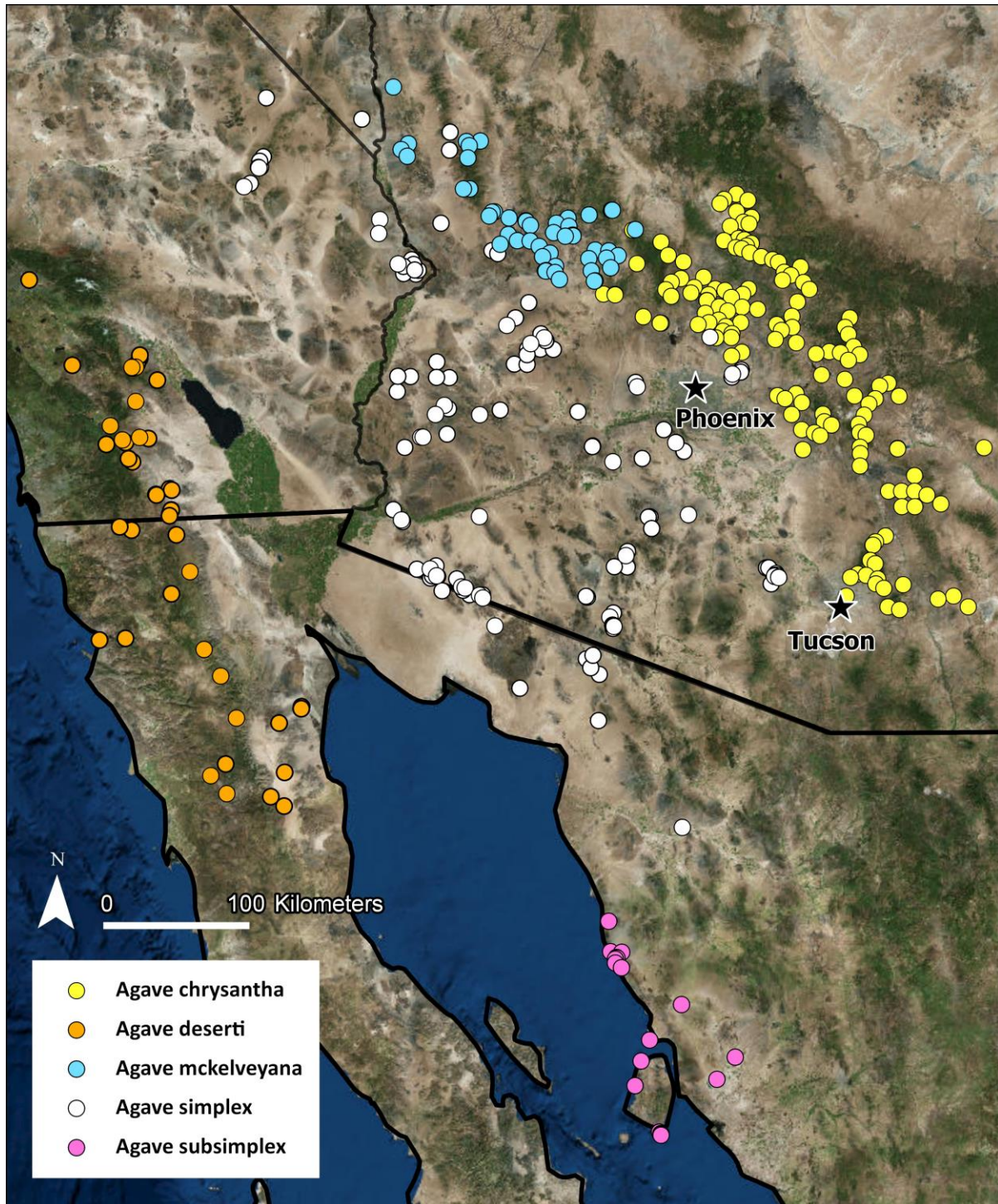


Figure 1. Distribution of *Agave simplex*, *A. chrysantha*, *A. mckelveyana*, *A. subsimplex*, and *A. deserti* (both subspp. *deserti* and *pringlei*) based on specimen data in SEINet (SEINET 2019). Base map source: Esri. “World Imagery” [basemap]. Scale Not Given. “World Imagery”. March 13, 2019. <[https://services.arcgisonline.com/ArcGIS/rest/services/World\\_Imagery/MapServer](https://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer)> Accessed 18 March 2019)

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