

**A NEW SUBSPECIES OF *HELIANTHUS PARADOXUS* (ASTERACEAE)
IN THE CUATRO CIÉNEGAS BASIN, COAHUILA**

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ABSTRACT

Helianthus paradoxus subsp. **cuatrocienegensis** Sivinski **subsp. nov.** is described from wetlands of the Cuatro Ciénegas basin in Coahuila, Mexico. It differs from more northern populations of subsp. *paradoxus* by its bushy branching pattern of dense, well-developed flowering branches from the base of the plant to near the middle of the central stem, its longer outer whorl of phyllaries that are subulate and usually reach half or more the length of the ray flowers, and its central paleae that have shorter, acute terminal lobes with a short mucro.

As the endangered species botanist for the State of New Mexico, I had the opportunity to visit, study and sometimes discover the known populations of *Helianthus paradoxus* Heiser over a period of almost three decades. This species was listed as threatened by the U.S. Fish and Wildlife Service on October 20, 1999 (64 FR 56582-56590) and I drafted its recovery plan in 2004 (U.S. Fish and Wildlife Service, 2005). I have always been impressed at how little morphological variation there is between the widely disjunct *H. paradoxus* populations of New Mexico and west Texas. This species is infrequent and isolated in saline or gypseous ciénega (wet meadow) habitats that are sometimes separated by distances of more than 200 km. Such morphological consistency allowed Heiser (1958) to describe the species from only two herbarium specimens — with a holotype from near Fort Stockton in west Texas and a paratype from Grants in west-central New Mexico (Sivinski 2003), which are more than 500 km apart.

While accompanying invertebrate biologists on a collecting trip to Cuatro Ciénegas Biosphere Reserve in 2011, I frequently observed an annual sunflower in gypseous ciénegas at most of the springs and spring runs we visited. It is similar to *Helianthus paradoxus*, but with some significant morphological differences. Subsequent SNP genetic analysis of a leaf fragment clustered this Coahuila sunflower with *H. paradoxus*, yet it is quite different genetically from populations in New Mexico and Texas (Loren Rieseberg, pers. comm. 2016). This Coahuila population is about 460 km south of the nearest known *H. paradoxus* populations in west Texas. Unfortunately, I was not permitted to take voucher specimens of plants from Mexico and must use the only existing herbarium specimen I can find as the type.

***Helianthus paradoxus* Heiser subsp. *cuatrocienegensis* Sivinski, subsp. nov. TYPE: MEXICO. Coahuila.** Poso de Tio Candido, 17 Aug 1967, *D.J. Pinkava 4111* with Cole and Minckley (holotype: ASU). Figures 1–4.

Differs from subsp. *paradoxus* in large plants having well developed flowering branches at every node from the base of the plant to about the middle of the central stem, lanceolate-subulate outer phyllaries that reach half or more the length of the ray corollas, and terminal lobes of central paleae 1.0–1.5 mm long, acute and often mucronate.



Figure 1. Holotype of *Helianthus paradoxus* subsp. *cuatrocienegensis*, ASU.



Figure 2. Growth form of a single, 2 m tall plant of *Helianthus paradoxus* subsp. *cuatrocienezensis* just prior to flowering near Posas Azules Field Station (26.80589° -102.01636°), 21 Sep 2011. Elongate phyllaries are evident on the immature capitula.



Figure 3. *Helianthus paradoxus* subsp. *cuatrocieneensis* capitulum morphology. A. Involucre with long, subulate outer phyllaries. B. Reddish brown disk with central paleae lacking white cilia. C. Central paleae in previous year's flower head showing short, acute terminal lobes.

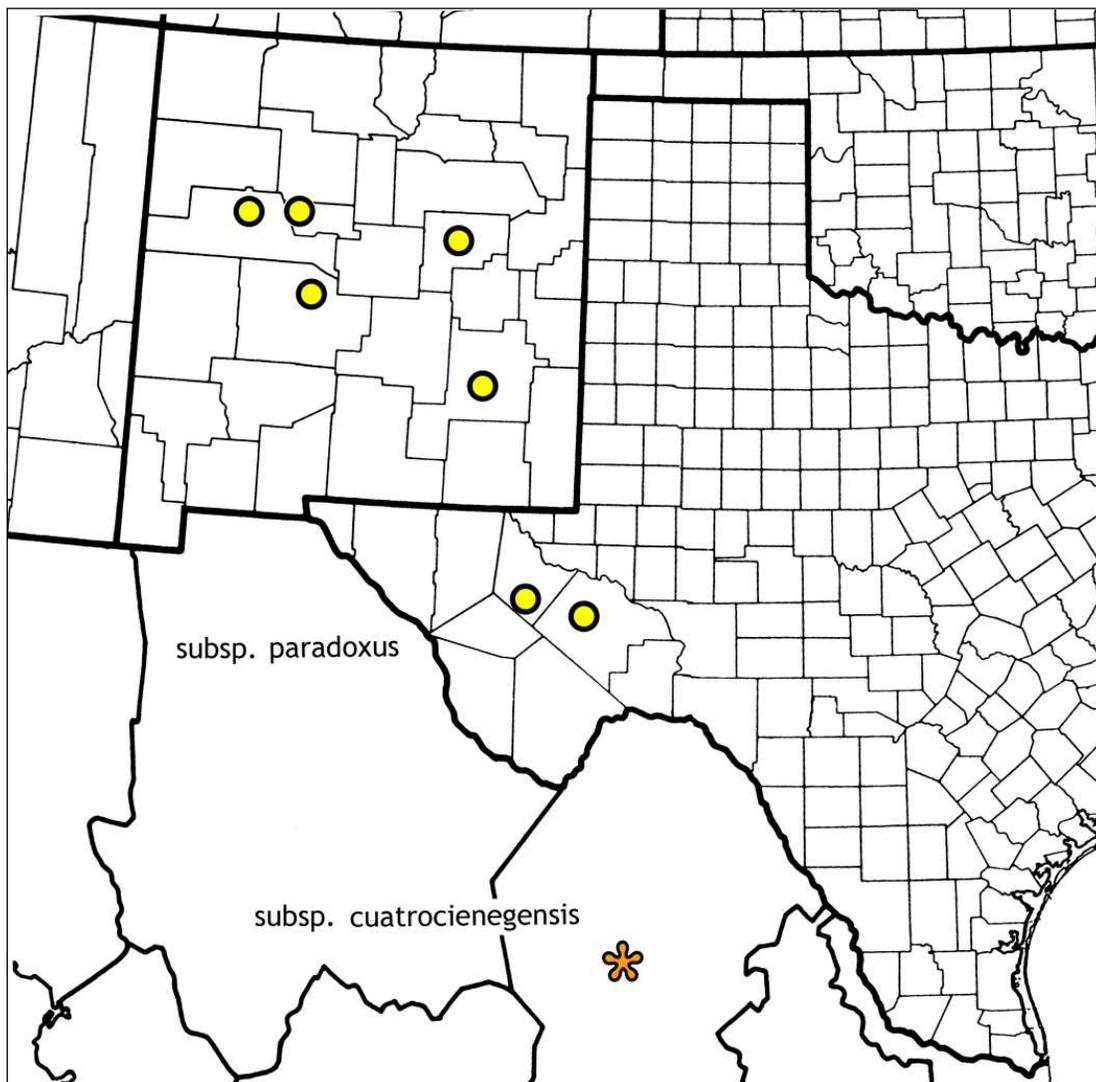


Figure 4. Distribution of *Helianthus paradoxus* subsp. *paradoxus* and subsp. *cuatrocieneensis*.

Helianthus paradoxus is an annual sunflower with lanceolate leaves that are strongly 3-nerved, coriaceous, and usually entire on the margins (rarely with 1 or 2 coarse teeth on each side). The lower leaves at the stem base are opposite and subsequent leaves further up the stem are alternate. Its flower heads are relatively small (3-5 cm across – including rays) with an involucre of narrowly lanceolate phyllaries. Salt tolerance is remarkable in this species, which always occurs on moist soil in or on the margins of aridland spring ciénegas, spring runs and seeps with high concentrations of salts — frequently gypsum (USFW 2005). The wetland sunflower in the Cuatro Ciénegas basin is consistent with all these habitat and morphological traits, but differs as described above. Its substantial morphological similarities, habitat fidelity, and genetic clustering with northern populations of *H. paradoxus* lead here to an infraspecific rank for subspecies *cuatrocienegensis*. Subspecies *paradoxus* (USA populations) has shorter, flatter outer phyllaries that reach less than one third the length of the ray corollas, and central paleae with longer (1.8–3.0 mm) acuminate terminal lobes without a mucro. These northern plants may occasionally branch near the base, but any such branching is not so densely developed and the overall form of the plants is not bushy. Depauperate specimens of both subspecies can lack basal branches and produce only a single, strict central stem.

The type specimen for subsp. *cuatrocienegensis* was initially identified as "aff. *Helianthus petiolaris* Nutt." That species is readily distinguished from *H. paradoxus* by its smaller, thinner leaves, central paleae fringed with white cilia, and upland habitats with drier, sandy soils.

Other locations. The type locality at Poso de Tio Candido is deep within the Cuatro Ciénegas Biosphere Reserve, but subsp. *cuatrocienegensis* can be seen more easily at spring seeps near and within the Highway 30 R-O-W about 10 km southwest of Municipio de Cuatro Ciénegas (26.91319° -102.14048°). It is also accessible (for a fee) in the ciénega and spring runs at the recreation area around Posa de Mesquites (26.91789° -102.10399°). Further within the Reserve several scattered plants were noted in sinkhole seeps at Los Hundidos (26.87162° -102.02108°), but it was exceptionally abundant and widespread in the extensive ciénegas of Posas Azules (26.80589° -102.01636°). This locally common wetland sunflower likely occurs in great numbers throughout most ciénega habitats in the Cuatro Ciénegas basin. It is surprising this large abundant plant has not been identified before this time and is so infrequently collected.

Habitat. Both *Helianthus paradoxus* subspecies occupy low to medium elevation springs and seeps with saline/alkaline soils. Known elevations in the Cuatro Ciénegas basin range from 710-760 m (2300-2500 ft). The plant associations are almost entirely wet meadow herbaceous vegetation called ciénegas by biologists and local people but also occasionally referred to as inland salt marsh (Van Auken & Bush 1998). Plant species common to both southern and northern *H. paradoxus* habitats include *Distichlis spicata*, *Sporobolus airoides*, *Phragmites australis*, *Typha domingensis*, *Flaveria chlorifolia*, *Eustoma exaltatum*, and *Limonium limbatum*. The northern subspecies *paradoxus* populations are sometimes associated with rare ciénega plants such as *Cirsium wrightii* and *Agalinis calycina*, while subspecies *cuatrocienegensis* occurs with *Cirsium coahuilense*, *Sabatia tuberculata*, and other local ciénega endemics. The wetlands of the Cuatro Ciénegas basin abound with endemic flora and fauna, but all are currently threatened by aquifer depletion and non-native species (Hendrickson et al. 2008).

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