

STUDIES ON MEXICAN CACTACEAE. III. A NEW HYBRID IN  
THE GENUS *OPUNTIA*

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# STUDIES ON MEXICAN CACTACEAE. III. A NEW HYBRID IN THE GENUS *OPUNTIA*

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**Summary.** *Opuntia × andersonii*, a new hybrid cactus from San Luis Potosí and Tamaulipas, Mexico, is described, illustrated, and mapped. Its relationships to its putative parental species (*Opuntia microdasys* and *O. engelmannii*) are discussed.

## Introduction

Hybridization is not a rare phenomenon in the Cactaceae, and numerous instances of interspecific and even intergeneric natural hybrids have been reported, especially among North American taxa (e.g., Britton & Rose, 1919; Pinkava et al., 1973, 1985, 1992; Grant & Grant, 1971, 1979; Benson, 1982; Pinkava & Parfitt, 1982; Baker & Pinkava, 1987, 1999; Powell et al., 1991; Griffith, 2001). Most hybrid cacti mentioned in the literature belong to the genus *Opuntia*, and it has been suggested that the taxonomic complexity of this genus is caused in part by hybridization and polyploidy (Pinkava et al., 1985, 2002).

In the course of our investigations on Chihuahuan Desert Cactaceae (Gómez-Hinostrosa & Hernández, 2000; Hernández et al., 2001a), individuals with intermediate morphological characters between *Opuntia microdasys* (Lehmann) Pfeiffer and *O. engelmannii* Salm-Dyck ex Engelmann were detected at several localities. These plants, which we interpret as the product of natural hybridization between these two species, are described and documented here. This is the third of a series of papers aimed at synthesizing the available knowledge of poorly known or undescribed Mexican cacti (Hernández et al., 2001b, c).

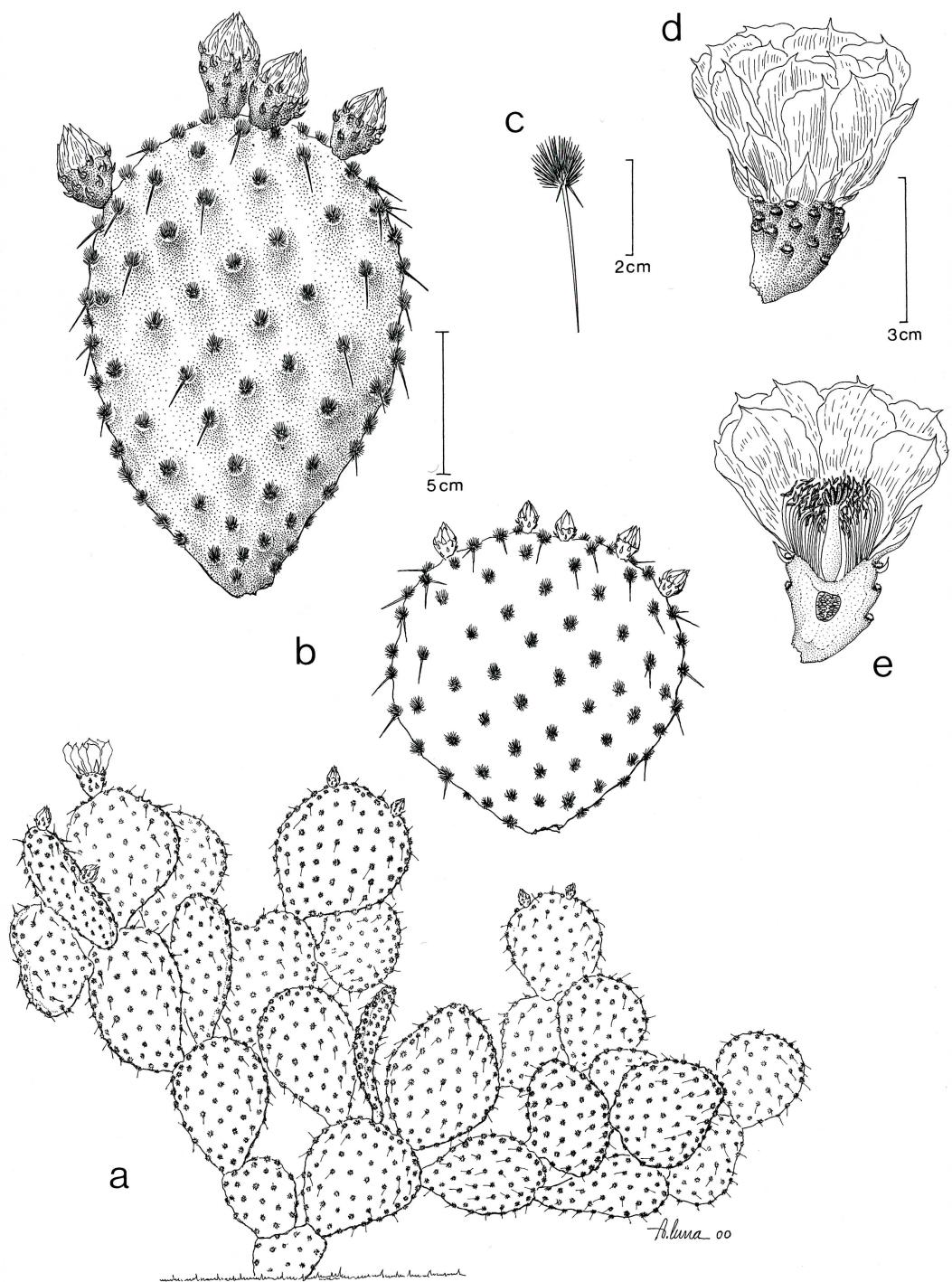
## Description

***Opuntia ×andersonii* H. M. Hernández, C. Gómez-Hinostrosa et R. T. Bárcenas, hybr. nov.** [= *O. engelmannii* Salm-Dyck ex Engelmann × *O. microdasys* (Lehmann) Pfeiffer]. TYPE: Mexico: San Luis Potosí: Municipio Guadalcázar: 4.7 km south of highway 80 (Huizache-Ciudad Victoria) on the road to La Hincada, 22° 42' 58" N, 100° 01' 43" W, 1065 m alt., March 13, 2000, H. M. Hernández, C. Gómez-Hinostrosa & R. T. Bárcenas 3318 (holotype, MEXU; isotypes, ASU, MEXU, MO) (Figures 1 and 6-9).

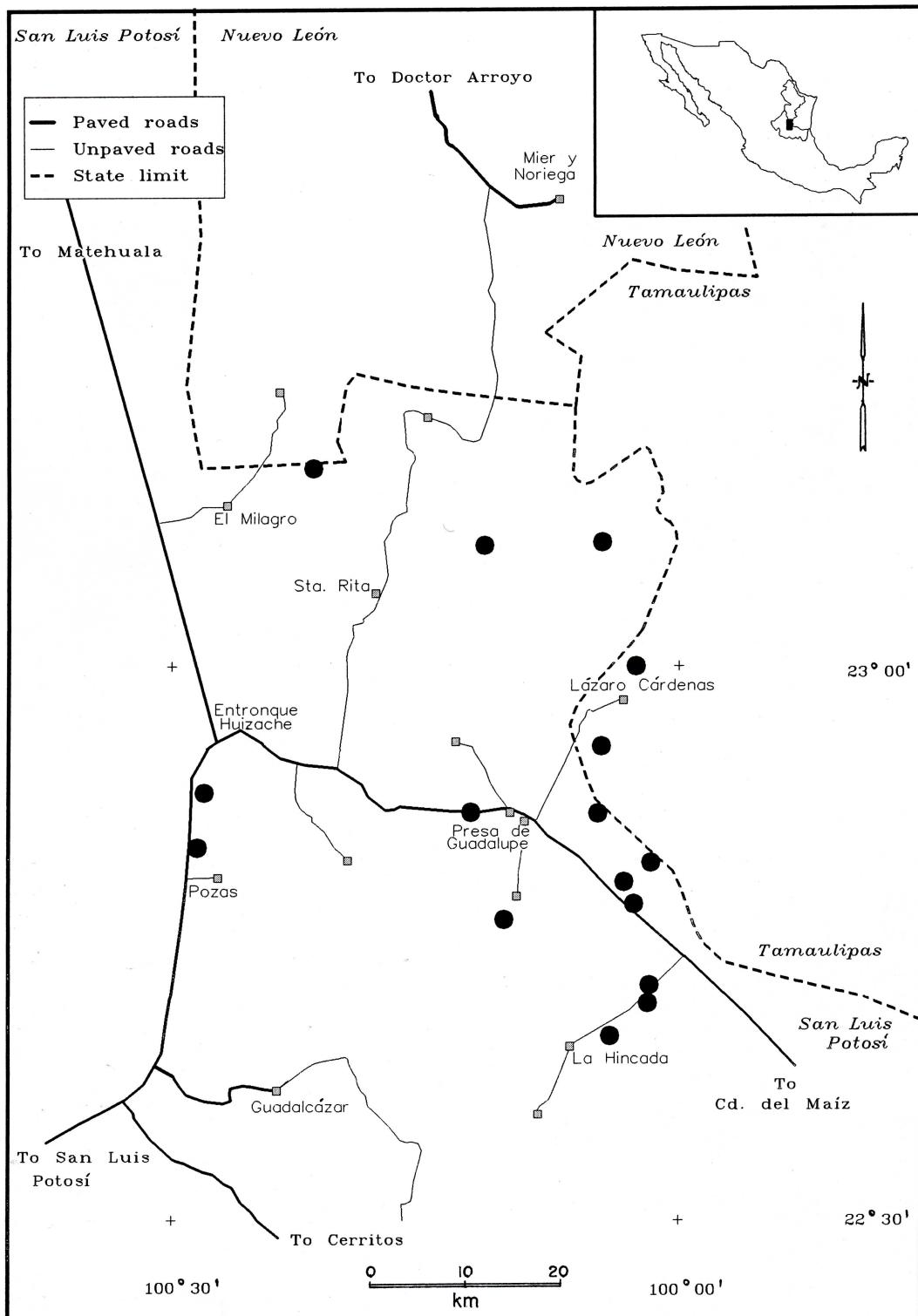
Hybrida naturalis ex *O. engelmannii* Salm-Dyck ex Engelmann × *O. microdasys* (Lehmann) Pfeiffer genita, 30-80(-100) cm, erecta, ramosa, caule principali bene definito. Cladodia glabra, ad 17(-23.5) cm longa. Spinae plerumque in areolis ad cladodii partes distales et marginales (raro

in omnibus areolis) adsunt. Glochides ochraceae vel flavo-brunneae, numerosissima, confertim conglomerata. Perianthii segmenta viridia vel flavo-virentia vel flavissima. Stigma viride.

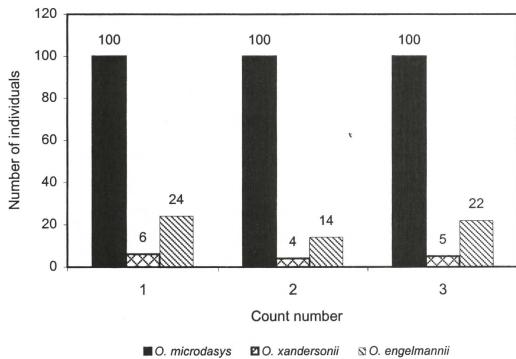
Plants erect, with a well-defined main stem, much-branched, 30-80(-100) cm high. Cladodes green, glabrous, orbicular, elliptic or ovate, flattened, to 17(-23.5) cm long, 12.5(-14.5) cm broad, 5(-7) mm thick. Areoles typically 1-2.5(-3) cm apart, with a density of 7-25 areoles per each 25 cm<sup>2</sup>, circular, 2-3(-3.5) mm diameter, with brown or canescent wool at the proximal portion of the areole. Spines usually present in the areoles at the distal and marginal portions of the cladode, rarely in all areoles, not differentiated into radials and centrals, arising from the proximal portion of the areole, descending to depressed, light yellow to light brown, rarely gray, acicular, 1-3(-5) per areole, of unequal length, 3-21 mm long. Glochids ochre to yellow-brown, very numerous, forming compact conglomerates generally in the distal portion of the areole, usually (1)-2-3(-4) mm long. Flowers emerging from the margins of the distal portion of the cladodes, campanulate, 3.6-4.4(-5) cm long at anthesis. Pericarpel green, obovate, truncate at the apex, 12-20 mm long, 11-19 mm diameter at anthesis; areoles with abundant light brown to canescent wool, with ascending to appressed, yellow-translucent glochids; spines absent; most areoles with lanceolate or conical, caducous leaves 2-6 mm long. External perianth segments green to yellow-green, succulent, becoming membranous inward, lanceolate to obtuse, truncate at base, acute to apiculate at apex, to 2 cm long; internal perianth segments bright to intense yellow, becoming orange at late anthesis, membranous, obtuse, acute to subtruncate at base, usually mucronate at apex, margin entire, to 3 cm long. Stamens numerous, erect; filaments white, the most external ones to 17 mm long, decreasing inwards to 4 mm long; anthers light yellow, 2 mm long. Style white, subconical, narrowed at base, 16-19 mm long, ca. 3-4.5 mm diameter at the widest portion. Stigma green, with 9-11 incurving, convergent lobes, giving the stigma a capitate appearance, 3.7-5 mm diameter. Fruits obo-



**Figure 1.** *Opuntia ×andersonii* H. M. Hernández, C. Gómez-Hinostrosa & R. T. Bárcenas. A, habit. B, cladodes. C, areole with spines and glochids. D, external appearance of the flower. E, internal appearance of the flower. Drawn from H.M. Hernández et al. 3318.



**Figure 2.** Documented geographical distribution of *Opuntia × andersonii* (solid dots).



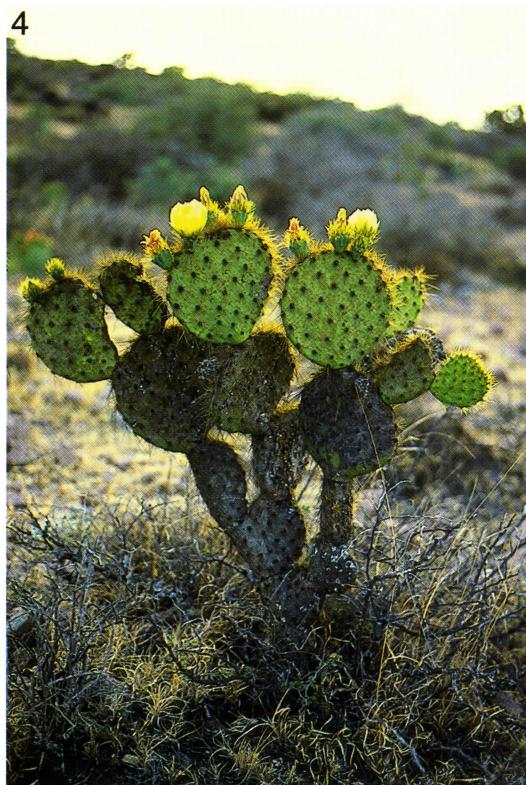
vate, truncate at apex, umbilicate, sometimes slightly tuberculate, red when mature, to 3.4 cm long, 2.5 cm diameter.

### Etymology

We take pleasure in naming this hybrid plant to honor our friend and colleague, Edward F. Anderson, recently deceased. During his profes-



**Figure 3.** Numbers of individuals of *Opuntia microdasys*, *O. ×andersonii*, and *O. engelmannii* in a locality near La Hincada, San Luis Potosí (Hernández et al. 3325, 3327, 3326).



**Figures 4–7.** 4. *Opuntia engelmannii* growing near Venado, San Luis Potosí (Hernández et al. 1895). 5. *Opuntia microdasys* near La Hincada, San Luis Potosí (Hernández et al. 2767). 6. Habit of *Opuntia ×andersonii* plant growing near La Hincada, San Luis Potosí (Gómez-Hinostrosa & Goetsch 1872c). 7. Habit of *Opuntia ×andersonii* plant growing near La Hincada, San Luis Potosí (Gómez-Hinostrosa & Goetsch 1914).

sional career Dr. Anderson made important contributions to our knowledge of Mexican cacti.

### Habitat and distribution

Populations of *O. ×andersonii* have been localized in a compact sector southeast of the Chihuahuan Desert region, at altitudes ranging from 1015 to 1575 m, in northern San Luis Potosí and southern Tamaulipas (Fig. 2). So far, we have documented the presence of hybrid populations in 16 localities within the Municipality of Guadalcázar, San Luis Potosí and adjacent southern Tamaulipas. These populations are found on deep soils on alluvial plains dominated by dense stands of *Larrea divaricata*, *Yucca filifera*, and *Prosopis juliflora*. This area, which has been intensively studied (Gómez-Hinojosa & Hernández, 2000; Hernández et al., 2001a), is an important region for conservation purposes due to its extraordinarily high diversity of cactus species.

### Conservation status

*Opuntia ×andersonii* is exceedingly rare in nature. We made three independent counts of individual plants of the two parental taxa and the hybrid in a locality near La Hincada (Hernández et al. 3325, 3326, 3327). The overall results (Fig. 3) indicate that the three entities occur in this locality in a proportion of 20:1:4 (*O. microdasys*: *O. ×andersonii*: *O. engelmannii*). However, despite the obviously low population density and relatively narrow range of the hybrid, its conservation status cannot be considered at

risk, due to the fact that its parental species are quite common, both in terms of distribution and local abundance.

### Discussion

It is important to recognize that previous cactus researchers have noticed the presence of this natural hybrid. Britton and Rose (1919, p. 21), for instance, made reference to a hybrid between *O. microdasys* and *O. cantabrigiensis* Lynch. (= *O. engelmannii* var. *cuija* Griffiths & Hare). In addition, in the National Herbarium of Mexico (MEXU) there is a specimen collected in the state of Hidalgo by Helia Bravo (Bravo s.n.) identified as *O. × microdasys*. However, this entity has remained undescribed.

When individuals of *O. ×andersonii* are observed in the field there is little doubt that its putative parental species are *O. engelmannii* and *O. microdasys* (Figs. 4, 5), with which it always co-occurs and consistently flowers synchronously. We have been unable to corroborate, however, whether hybridization between these two species always takes place when they are sympatric. Clearly, more fieldwork is needed to assess this possibility.

In contrast to *O. microdasys*, the taxonomy of *O. engelmannii* has been subject to debate by several authors (see, for example, Bravo, 1978; and Benson, 1982, under *O. lindheimeri* Engelmann and *O. ficus-indica* (L.) Miller respectively). More recently, Parfitt and Pinkava (1988) made a nomenclatural and systematic assess-

**Table 1. Comparison of *Opuntia microdasys* (n = 10) (Hernández et al. 3325, MEXU), *O. ×andersonii* (n = 5) (Hernández et al. 3327, MEXU), and *O. engelmannii* (n = 10) (Hernández et al. 3326, MEXU). All figures are averages (± standard deviation) except maximum height, number of areoles, style length, stigma diameter, and number of lobules**

		<i>O. microdasys</i>	<i>O. ×andersonii</i>	<i>O. engelmannii</i>
Maximum height (cm)		70	70	170
Cladodes	Length (cm)	7.8 (±1.8)	13.7 (±3.6)	17.7 (±3.4)
	Width (cm)	5.8 (±1.2)	10.3 (±2.8)	14.5 (±2.4)
	Thickness (mm)	7.3 (±1.4)	5.5 (±0.7)	5.3 (±0.9)
	Pubescence	present	absent	absent
Areoles	No./25cm <sup>2</sup>	44-66	7-25	3-5
	Spines	absent	present	present
Flower length (cm)		3.7 (±0.5)	4.4 (±0.7)	6.3 (±0.8)
Pericarpel	No. of areoles/flower	70-98	30-45	15-20
	Diameter (mm)	12.3 (±1.3)	14.3 (±3.8)	19.2 (±3.2)
	Length (mm)	16 (±2)	20 (±2)	27 (±4)
Style	Length (mm)	14-17	16-19	17-20
Stigma	Color	green	green	white
	Diameter (mm)	3-4.2	3.6-4.4	4.2-4.5
	No. lobules	9-13	9-11	7-9

ment of this entity, in which they demonstrated that the correct name is *O. engelmannii* Salm-Dyck ex Engelmann. These authors proposed six varieties for *O. engelmannii*, of which var. *cuija* corresponds to the taxon considered here as one of the parents of the hybrid (determination made by D. Pinkava). Parfitt and Pinkava (1988) suggested that this variety probably merits recognition as a separate species, considering its diploid condition ( $2n = 22$ ), whereas the remaining varieties are hexaploid ( $2n = 66$ ). However, the taxonomic status of *O. engelmannii* var. *cuija* remains unresolved with regard to its relationship to *O. cantabrigiensis*.



**Figures 8–9.** 8. *Opuntia ×andersonii* (Gómez-Hinostrosa & Goetsch 1914). The yellow segments turn orange at late anthesis. 9. *Opuntia ×andersonii* (Gómez-Hinostrosa & Goetsch 1914). The mature fruits turn red.

The distribution ranges of *O. microdasys* and *O. engelmannii* var. *cuija* overlap considerably and are clearly much wider than that of the hybrid. Both occur roughly in the southern half of the Chihuahuan Desert region, although the range of the latter appears to be wider. *Opuntia microdasys* is found typically in areas of high aridity (<300 mm average annual precipitation), whereas *O. engelmannii* var. *cuija* is occasionally found in less arid conditions. It must, however, be recognized that the ranges of the two parental species cannot be determined precisely, due to the paucity of herbarium collections.

As indicated in Table 1, many of the most conspicuous morphological characters of the hybrid are intermediate between the parental species (Figs. 6–9). This is true of several characters of the cladode (i.e., length, width, thickness; number of areoles per unit area; and spination) and flower (i.e., total length; and the diameter, length and number of areoles on the pericarpel). Regarding some of the qualitative characters varying between the two parent taxa (e.g., cladode pubescence and stigma color), the hybrids inherit the features of one of the parents. For instance, the glabrous condition of the cladode epidermis of the hybrid agrees with that of *O. engelmannii*, whereas the color of the stigma is inherited from *O. microdasys*.

No developmental anomalies were detected in the hybrid individuals. Specifically, the pollen grains appear to be highly fertile as reflected by a high degree of stainability with cotton blue in lactophenol (80% normal pollen,  $n = 108$ ). Also, although the pollen grains are considerably variable in diameter (range = 76–105  $\mu\text{m}$ ), the stained grains appear to be morphologically normal. In addition, no abnormalities were detected in fruit development.

**Specimens examined.** MEXICO. San Luis Potosí: Mpio. Guadalcázar: 27 km E of El Huizache junction on the road to Cd. Victoria, 22°52'05" N, 100°12'19" W, 1275 m alt., R.T. Bárcenas & C. Gómez-Hinostrosa 1154 (MEXU); 5 km N of Los Antejos on the road to Lázaro Cárdenas, 22°52'01" N, 100°04'48" W, 1085 m alt., R.T. Bárcenas & C. Gómez-Hinostrosa 1176 (MEXU); mountains E of Jaujal, El Jaujal (35 km NE of the road from El Huizache to Cd. Victoria), 23°06'31" N, 100°11'33" W, 1185 m alt., C. Gómez-Hinostrosa & R.T. Bárcenas 478A (MEXU); 5 km S of El Huizache junction near the road from San Luis Potosí to Matehuala, on road to La Verdolaga, 22°53'09" N, 100°28'06" W, 1310 m alt., C. Gómez-Hinostrosa & R.T. Bárcenas 1137 (MEXU); 10 km NW of El Milagro de Guadalupe, on the road to the reservoir of Siete Cerros and the canyon of El Cazo, 23°10'43" N, 100°21'42" W, 1575 m alt., C. Gómez-Hinostrosa & Santos Martínez 1406 (MEXU); 5 km SE of the Puerto de Clavellinas, 23°06'40" N, 100°04'34" W, 1375 m alt., C. Gómez-Hinostrosa 1451

(MEXU); 3 km S of Las Negritas, 22°46'18" N, 100°10'20" W, 1135 m alt., *C. Gómez-Hinostrosa & R.T. Bárcenas 1525* (MEXU); 4.7 km S of highway 80 (Huizache-Ciudad Victoria), on the road to La Hincada, 22°42'58" N, 100°01'43" W, 1065 m alt., *C. Gómez-Hinostrosa & B. Goetsch 1872c* (MEXU); 4.9 km S of highway 80 (Huizache-Ciudad Victoria), on the road to La Hincada, 22°42'34" N, 100°01'11" W, 1095 m alt., *C. Gómez-Hinostrosa & B. Goetsch 1914* (MEXU); 5 km SW of the Huizache-Cd. Victoria highway on road to La Hincada, 22°42'44" N, 100°01'44" W, 1100 m alt., *H.M. Hernández et al. 2768* (MEXU); 2 km N of the Huizache-Cd. Victoria highway, at about 56 km E of El Huizache junction, 22°47'09" N, 100°02'39" W, 1060 m alt., *H.M. Hernández et al. 2801* (MEXU); 7 km S of the Huizache-Cd. Victoria highway on the road to La Hincada, on small hills, 1 km E of the road, 22°41'45" N, 100°01'50" W, 1060 m alt., *H.M. Hernández et al. 3018* (MEXU); plain 2 km E of the road from San Luis Potosí to El Huizache junction and 20 km N of the detour to Guadalcázar, 22°50'10" N, 100°28'29" W, 1310 m alt., *H.M. Hernández et al. 3100* (MEXU); 4 km NE of La Hincada on the road leading to highway 80 (Huizache-Tula), 22°39'59" N, 100°04'04" W, 1100 m alt., *H.M. Hernández et al. 3166* (MEXU); 1.3 km N of highway 80 (Huizache-Tula), near entrance to Rancho El Cardón, 22°48'20" N, 100°03'14" W, 1040 m alt., *H.M. Hernández et al. 3220* (MEXU); 4.7 km S of highway 80 (Huizache-Ciudad Victoria), on the road to La Hincada, 22°42'58" N, 100°01'43" W, 1065 m alt., *H.M. Hernández et al. 3318 & 3327* (MEXU). **Tamaulipas:** 20 km SE of Presa de Guadalupe, 22°49'21" N, 100°01'39" W, 1100 m alt., *C. Gómez-Hinostrosa & R.T. Bárcenas 1582* (MEXU); 2.5 km N of Lázaro Cárdenas on the road to Los Treinta, 22°59'59" N, 100°02'33" W, 1015 m alt., *H.M. Hernández et al. 2673* (MEXU); 10 km SE of Lázaro Cárdenas on the road to Los Antejitos, in mountains E of the road, 22°55'40" N, 100°04'35" W, 1120 m alt., *H.M. Hernández et al. 3237* (MEXU).

### Acknowledgements

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