



## A new combination in *Peniocereus* (Cactaceae)

### Una nueva combinación en *Peniocereus* (Cactaceae)

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**Abstract.** *Acanthocereus chiapensis* Bravo was described from plants collected in Chiapas, Mexico in March 1967. Field observations as well as detailed morphological and anatomical studies revealed that this entity rather belongs to genus *Peniocereus*. This taxonomic opinion was supported by the presence in this plant of tuberous roots; relatively thin stems; relatively small flowers and fruits, with numerous, weak spines; absence of primary phloem fiber caps on cortical bundles; and presence of minute, inter-cellular interstices in the seeds. Consequently, the following new combination is made herein: *P. chiapensis* (Bravo) C. Gómez-Hinostrosa and H. M. Hernández.

Key words: Cactaceae, *Peniocereus chiapensis*, *Acanthocereus chiapensis*, *A. griseus*, Mexico, Chiapas, Guatemala.

**Resumen.** *Acanthocereus chiapensis* Bravo fue descrita con base en plantas recolectadas en Chiapas, México en Marzo de 1967. Observaciones en el campo así como estudios morfológicos y anatómicos detallados, revelaron que esta entidad pertenece más bien al género *Peniocereus*. Esta opinión taxonómica está apoyada por la presencia en esta planta de raíces tuberosas; tallos relativamente angostos; flores y frutos relativamente pequeños, con numerosas espinas frágiles; ausencia de fibras sobre el floema primario de los haces corticales; y presencia de intersticios inter-celulares en las semillas. En consecuencia se hace la siguiente combinación nueva: *P. chiapensis* (Bravo) C. Gómez-Hinostrosa and H. M. Hernández.

Palabras clave: Cactaceae, *Peniocereus chiapensis*, *Acanthocereus chiapensis*, *A. griseus*, México, Chiapas, Guatemala.

### Introduction

As part of an ongoing revision of genus *Acanthocereus* (Cactaceae, Cactoideae, Pachycereeae) being carried out by the first author (Gómez-Hinostrosa, unpubl.), a detailed study of several morphological and anatomical characters of the species described in the genus was conducted. As a result of this, we reached the conclusion that two poorly known species (*A. griseus* Backeberg and *A. chiapensis* Bravo) are synonyms, and that rather belong to the closely related genus *Peniocereus*. Due to the fact that the earlier name, *A. griseus*, was invalidly described, *A. chiapensis* is transferred here to *Peniocereus*.

### Taxonomic history of *Acanthocereus griseus* and *A. chiapensis*

*Acanthocereus griseus* was originally described by Backeberg (1965) based upon a live specimen cultivated at Jardin Botanique Les Cèdres, Saint-Jean Cap Ferrat, France, and originally collected in Chiapas, Mexico by Thomas B. MacDougall (collection number A-201). The species was later recognized by Backeberg (1966, 1977) in the German

and English editions of his "Cactus Lexicon". However, the description was found to be invalid due to the fact that no herbarium specimen was preserved (Eggl, 1985). The name is invalid under the current ICBN Art. 32.1, 37.1. (Greuter et al., 2000). However, we found out that the original plant collected by MacDougall still is alive at Les Cèdres (Marc Teissier, pers. comm.), which enabled us to verify the identity of this plant.

Fortunately, much of MacDougall's field notes have been preserved (MacDougall, 1973; Root, 1975; Stix, 1975), which enabled us to localize the site where his collection number A-201 was made: Hacienda Monserrate, Chiapas. Coincidentally, it is well known that this same hacienda was used in the 1920's by Karl A. Purpus as his headquarters during his botanical explorations to Chiapas and Oaxaca (Sousa, 1969). MacDougall (1973) mentioned that on March 3, 1951, while exploring in the vicinity of Hacienda Monserrate "Beds of dwarf, upright *Acanthocereus* (A. 201)" were recorded in flower.

It is important to mention that, before discovering this new taxon in Hacienda Monserrate in western Chiapas, MacDougall recorded in a different locality what we currently consider to be the same species. As a matter of fact, in his field notes of February 9th, 1950 and February 6th, 1951, MacDougall (1973) mentioned the existence of "The

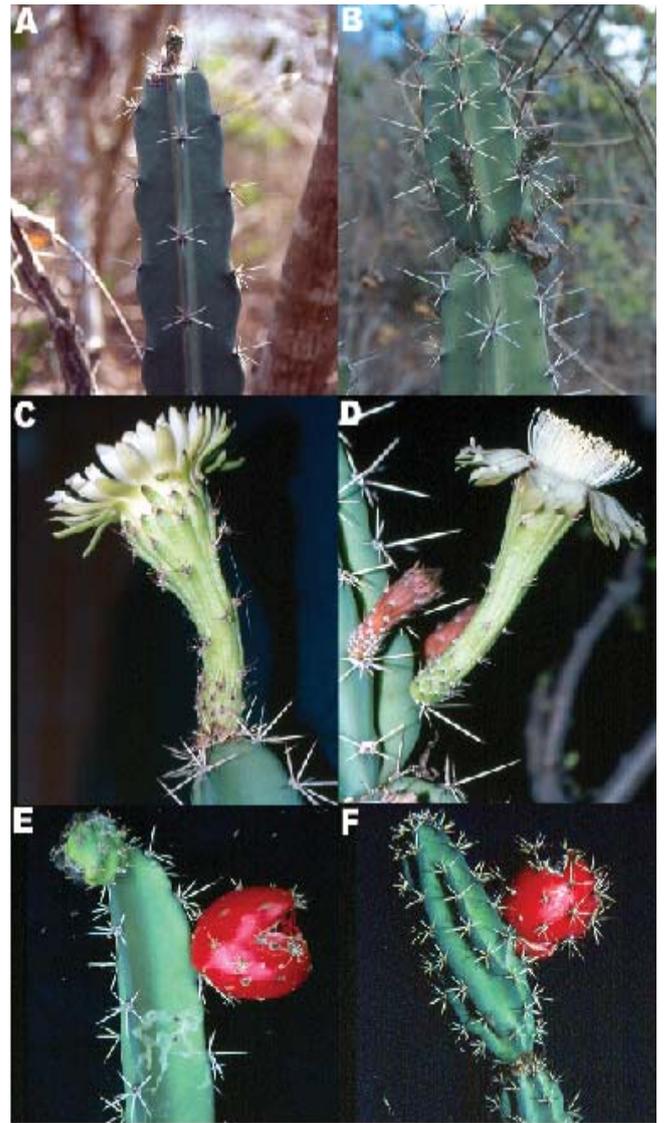
dwarf *Cereanae*” in the vicinity of Soyaló, in north-central Chiapas. Subsequently, between 1961-1963 MacDougall returned in several occasions to Soyaló, where he collected the plant under his collection number A-302. On April 26th, 1964, MacDougall visited once again the Soyaló area, but this time with two Mexican botanists, Dr. Helia Bravo and Prof. Eizi Matuda.

Shortly after returning from her fieldtrip to Chiapas, on 10th June, 1964, Helia Bravo informed MacDougall that the “dwarf *Cereus* from Soyaló” is a new species of *Acanthocereus* (MacDougall, 1973), which she described as *A. chiapensis* in 1972. Without mentioning any specific collector or collection number, Bravo only cited in the protologue a specimen collected in “Estado de Chiapas. Localidad Tipo: Entre Soyaló y Bochil, en pedregales calizos, en selva baja caducifolia. (MEXU)”. A search at the National Herbarium of Mexico (MEXU) revealed a specimen collected by H. Bravo (no. 5584) (MEXU 118868) containing exactly the same data as in the original publication. An annotation label added to the specimen, presumably by Bravo herself, indicates that it was considered as the “holotype”. Thus, in accordance with ICBN Art. 9.1 (Greuter et al., 2000), there is no doubt that this specimen represents the holotype of *A. chiapensis*.

We recently visited Hacienda Monserrate, where we were successful in finding, along a seasonal stream, a population of *A. griseus* (C. Gómez-Hinostrosa and H. M. Hernández 2317a). The morphological characteristics of this plant coincide accurately with those of Backeberg’s original description. In the same way, we found the plants from the vicinity of Soyaló (C. Gómez-Hinostrosa and H. M. Hernández 2325), which Bravo named *A. chiapensis*. After making careful observations, we concluded that without doubt the populations from Hacienda Monserrate and Soyaló are conspecific. The only apparent difference is that plants from the Soyaló population have stems with a higher number of ribs (5-7), as compared from those of Hacienda Monserrate, which usually have 4 to 5 ribs. We consider that, due to the fact that plants from the two localities resemble in virtually all of their vegetative (stem and spination) and reproductive (flower and fruit) features (Fig. 1 A-F), the continuous variation in rib number is insufficient to maintain the two populations as separate taxonomic entities. Consequently, we consider *A. griseus* as conspecific with and synonymous of *A. chiapensis*.

#### *Peniocereus* or *Acanthocereus*?

*Peniocereus* was originally described by Britton and Rose in 1909, on the basis of a subgenus of *Cereus* proposed by A. Berger (1905). As currently understood, this genus comprises about 18 species, most of which are distributed along the Pacific slope of Mexico, from Baja California Sur and Sonora to Chiapas. Only two species are found outside Mexico: *P. greggii* (Engelmann) Britton and Rose is distributed in parts of the Chihuahuan and Sonoran desert regions in Mexico, including parts of Texas, New Mexico,



**Figure 1.** Comparison between *Acanthocereus griseus* and *A. chiapensis*. A, C. *A. griseus* from the type locality at Hacienda Monserrate (Gómez-Hinostrosa and Hernández 2317a). B, D, F. *A. chiapensis* from the type locality at Soyaló (B, D: Gómez-Hinostrosa and Hernández 2325, F: Gómez-Hinostrosa et al. 2100). E. *Acanthocereus griseus* from Motozintla (Gómez-Hinostrosa et al. 2188).

and Arizona, whereas *P. hirschtianus* (K. Schumann) D. R. Hunt extends its distribution range from Guatemala to Costa Rica (Bravo, 1978; Anderson, 2001). Most of the species grow in tropical dry and tropical semi-deciduous forests (*sensu* Rzedowski, 1978), although *P. greggii* and *P. johnstonii* Britton and Rose are found in xerophytic vegetation types.

The close taxonomic affinities of *Peniocereus* to *Acanthocereus* have been suggested by several authors (Sánchez-Mejorada, 1974; Hunt, 1998, 2000). Most members of the two genera are shrubby, with dimorphic

stems (excl. *Peniocereus* subgen. *Peniocereus*), and have infundibuliform, nocturnal flowers and large, black seeds, with hexagonal cellular ornamentation. Table 1 summarizes the morphological and anatomical characters distinguishing the two genera. *Acanthocereus* usually has fibrose roots, more robust stems, larger and wider infundibuliform flowers, with the pericarpel and the receptacular tube with less spines per areole. By contrast, all *Peniocereus* species have tuberous roots, relatively thinner stems, and smaller flowers. In addition, the receptacular and fruit areoles bear more spines, which usually are weaker than in *Acanthocereus*, and in some instances [e.g., *P. greggii*, *P. marianus* (Gentry) Sánchez-Mejorada and *P. viperinus* (F. A. C. Weber) Kreuzinger] these are setose. Regarding the roots of *Acanthocereus*, it is important to mention that, although in most cases these are clearly fibrose, we have observed in some populations, plants of *A. tetragonus* with tuberous roots.

It is important to mention that Hunt (1998) recently noticed that *A. chiapensis* has a higher number of ribs (7) and smaller flowers (up to 11 cm long) than the other species of *Acanthocereus*, and suggested that the species might belong to *Peniocereus* (see also Hunt, 2000). In fact, in the Cactaceae Checklist (Hunt, 1999) he maintained this taxonomic opinion provisionally considering *A. chiapensis* as *Peniocereus* sp. Anderson (2001), on his part, did not mention this entity, perhaps as a consequence of being poorly known and taxonomically ambiguous.

Recent anatomical studies (Mauseth et al., 1998; Terrazas and Mauseth, 2002; Gómez-Hinostrosa, unpubl.) have shed additional evidence on the differences of *Acanthocereus* and *Peniocereus* (Table 1). One anatomical character that has provided useful taxonomic information is the presence of primary phloem fiber caps on cortical bundles. These studies have pointed out that these fibers, which are rather uncommon in the subfamily Cactoideae, occur in *Acanthocereus* and are absent in *Peniocereus* (Table 2). The only exception to this pattern are *P. marnierianus* Backeberg [name not included in Hunt (1999) checklist] and *A. colombianus* Britton and Rose; however, these records have to be considered with caution as the examined material of these plants were of doubtful origin (Teresa Terrazas, pers. comm.). Our own anatomical observations have confirmed that these fibers are present in all of the *Acanthocereus* species provisionally accepted by Hunt [1999; *A. tetragonus* (L.) Hummelinck, *A. baxaniensis* (Karwinsky ex Pfeiffer) Borg, *A. subinermis* Britton and Rose, *A. occidentalis* Britton and Rose, and *A. horridus* Britton and Rose], with the exception of *A. chiapensis* (Fig. 2 A-B; Table 2).

There are several instances in which seed characters have proved to be taxonomically useful in the Cactaceae (Barthlott and Hunt, 2000). One of these characters corresponds to the inter-cellular interstices in the lateral face of the seed. These inter-cellular minute depressions have been recorded in several genera of Cactoideae, including some species of

*Peniocereus*, such as *P. hirschtianus*, *P. striatus* (Brandege) Buxbaum, *P. viperinus* (see Barthlott and Hunt, 2000), and in *A. chiapensis* (Fig. 2 D, F). However, according to our own unpublished observations, these are absent in the remaining species of *Acanthocereus* (Fig. 2 C, E), and in some additional *Peniocereus* species [e.g., *P. castellae* Sánchez-Mejorada, *P. oaxacensis* Britton and Rose) D.R. Hunt, *P. cuixmalensis* Sánchez-Mejorada, and *P. fosterianus* Cutak] (Gómez-Hinostrosa, unpubl.).

With all of the elements mentioned above, we concluded that this taxonomic entity belongs to *Peniocereus*, and propose the following new combination.

***Peniocereus chiapensis*** (Bravo) C. Gómez-Hinostrosa and H. M. Hernández, comb. nov. Basionym: *Acanthocereus chiapensis* Bravo, Cact. Suc. Mex. 17: 117. 1972. TYPE: México, Chiapas: entre Soyaló y Bochil, 23 Mar. 1967, H. Bravo 5584 (Holotype, MEXU 118868). Figure 3. *Acanthocereus griseus* Backeberg, Cactus 85: 103-108. 1965. *nom. inval.* (ICBN art. 37.1).

Shrubs to 1.7-2 (-3.5) m high, usually branching from the base. Roots tuberous, relatively slender (ca. 2-4 cm diam.), from which numerous fibrose roots develop. Stems dimorphic, articulate, cylindric, erect to diffuse, sometimes recurvate, to 4 m long, up 11.5 cm diam. at the base, glaucous-green in field, light-green in dry specimens; young stems with 6-9 ribs, to 2.6 cm diam. in its widest part, 10-20 (-25) spines per areole; developed stems with (-3) 4-7 (-8) ribs, to 11.5 cm diam. in its widest part; ribs rounded, 1-2.5 cm high, 1-3 cm wide at the base (in cross section), rib margin straight, sometimes slightly concave or convex. Areoles of the developed stems hemispheric, 4-8 mm diam., 3-6 (-7) cm distant between them, with light-brown or beige wool; spines acicular, conspicuously bulbous at the base, of unequal length within one areole, radiating in various directions, not clearly differentiated into centrals and radials, extremely rigid and pungent, 1-3.5 cm long, 0.5-1.5 mm diam. at the base, 4-9 (-15) per areole, beige or gray, reddish-brown at the tips. Flowers hypocrateriform, (7.5-) 8-12 (-13.5) cm long at anthesis, the tube to 2.5-3 cm diam. in its apical extreme; pericarpel 1-1.5 cm diam., areoles 1-1.3 mm diam.; ovary ellipsoidal to slightly ovoid or obovoid, 10-18 mm long, 4.5-10 mm diam.; receptacular tube covered by imbricate podaries, light green to reddish, areoles with spines caducous, acicular, relatively flexible, not so pungent as the stem spines, 0.5-1.0 (-1.3) cm long, (5-) 6-12 (-14) per areole, reddish, sometimes turning beige in its middle part and reddish-brown at the tips; perianth external segments linear, truncately attenuate at the base, acuminate to acute, sometimes mucronate, margin entire, 1.8-3.8 cm long, 0.3-0.6 cm wide in their widest portion, succulent, becoming membranose inside wards, reddish-green to pink; internal segments linear, truncately attenuate at the base, acute to obtuse, mucronate, margin entire, 2-3.6 cm long, 0.4-0.6 cm

**Table 1.** Comparative morphological and anatomical characters of *Peniocereus*, *Acanthocereus*, and *A. chiapensis*. \* Figures are mean  $\pm$  standard deviation ( $n = 22$ ).

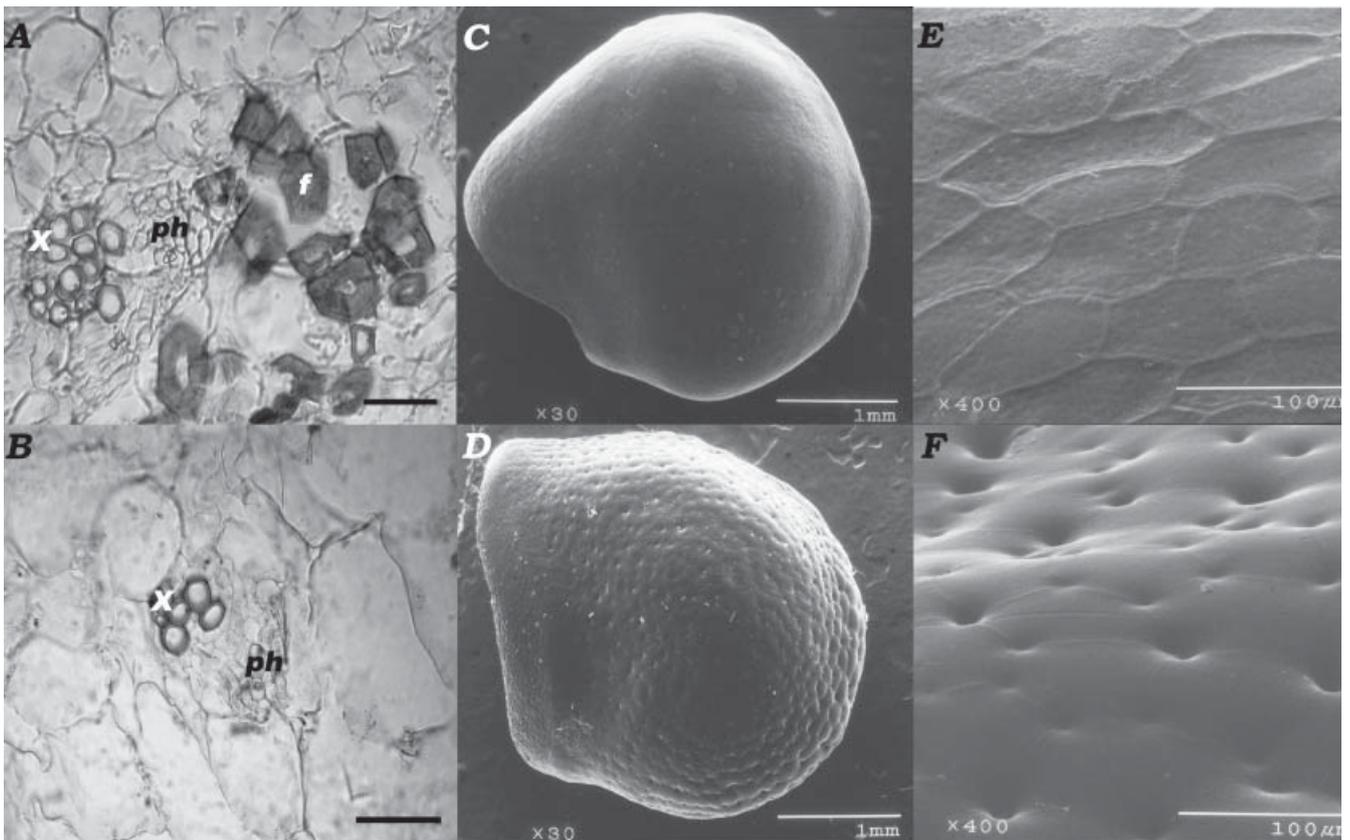
	<i>Peniocereus</i>	<i>A. chiapensis</i>	<i>Acanthocereus</i>
Plant's maximum height (m)	3	3.5	5
Main stem maximum diameter (cm)	6.5	11.5	20
Dimorphic stems	+ -	+	+
Rib number in adult plants*	8.1 ( $\pm 3.3$ )	5.7 ( $\pm 1.4$ )	3.4 ( $\pm 0.7$ )
Root type	tuberous	tuberous	mostly fibrose
Flower length (cm) *	11.2 ( $\pm 4.8$ )	10.4 ( $\pm 2$ )	20 ( $\pm 3.1$ )
Number of spines in tube areoles*	8.3 ( $\pm 3.5$ )	9 ( $\pm 2.8$ )	2 ( $\pm 1.7$ )
Length of mature fruit (cm) *	4.3 ( $\pm 1.7$ )	4.2 ( $\pm 0.6$ )	7 ( $\pm 1.6$ )
Number of spines per fruit areole*	10.5 ( $\pm 3.7$ )	9.3 ( $\pm 2.4$ )	4.7 ( $\pm 2.1$ )
Inter-cellular interstices	+ -	+	-
Primary phloem fiber caps on cortical bundles	-	-	+

**Table 2.** Presence (+) or absence (-) of fibers in *Peniocereus* and *Acanthocereus*. \* The examined material of these plants was of doubtful origin.

Species	Fibers	References
<i>P. cuixmalensis</i>	-	Mauseth et al., 1998
<i>P. greggii</i>	-	Mauseth et al., 1998
<i>P. maculatus</i>	-	Mauseth et al., 1998
<i>P. marnierianus</i> (juvenile)	-	Mauseth et al., 1998
<i>P. marnierianus</i> (spiny)*	+	Mauseth et al., 1998
<i>P. guatemalensis</i> = <i>P. hirschtianus</i>	-	Mauseth et al., 1998
<i>P. oaxacensis</i>	-	Mauseth et al., 1998
<i>A. chiapensis</i>	-	This paper
<i>A. tetragonus</i>	+	Mauseth et al., 1998; Gómez-Hinostrosa, unpubl.
<i>A. horridus</i>	+	Mauseth et al., 1998; Gómez-Hinostrosa, unpubl.
<i>A. colombianus</i> *	-	Mauseth et al., 1998
<i>A. subinermis</i>	+	Gómez-Hinostrosa, unpubl.
<i>A. occidentalis</i>	+	Gómez-Hinostrosa, unpubl.
<i>A. baxaniensis</i>	+	Gómez-Hinostrosa, unpubl.

wide in their widest portion, membranose, yellow-green to white; stamens numerous, erect, slightly reclinate towards the pistil; filaments of unequal length, inserting along the apical half of the internal wall of the receptacular tube, the longer ones to 4.5 cm long, white; anthers oblong, basifixed, 1.6-2.5 mm long, pale-yellow; style tubular, 5-8 cm long, white; stigma with 10-12 radiate lobes, these 6-12 mm long, white-cream. Fruits almost spherical or obovoid, tuberculate, bright-red when mature, 3.5-5.5 cm long, 2.3-4 cm diam. when mature; areoles with spines caducous, acicular, relatively flexible, 0.5-1.2 (-1.5) cm long, (6-) 7-11 (-13) per

areole, brown at the base, beige at its middle part and light-brown at the tips; dehiscing through a longitudinal aperture, with red pulp. Seeds broadly oval, very large, 3.6 x 3.2 mm, glossy, black, periphery keeled, cells of periphery forming a crest; border expanded around hilum; cells gradually smaller towards hilum, isodiametric, anticlinal boundaries channeled, straight; interstices minutely pitted; sometimes cuticle fielded-striate only on periphery crested with large cells; relief convex; convexities low domed; hilum medium; oblique, impressed, micropyle conjunct, but separated by sclerified band, hilum-micropyle region oval.

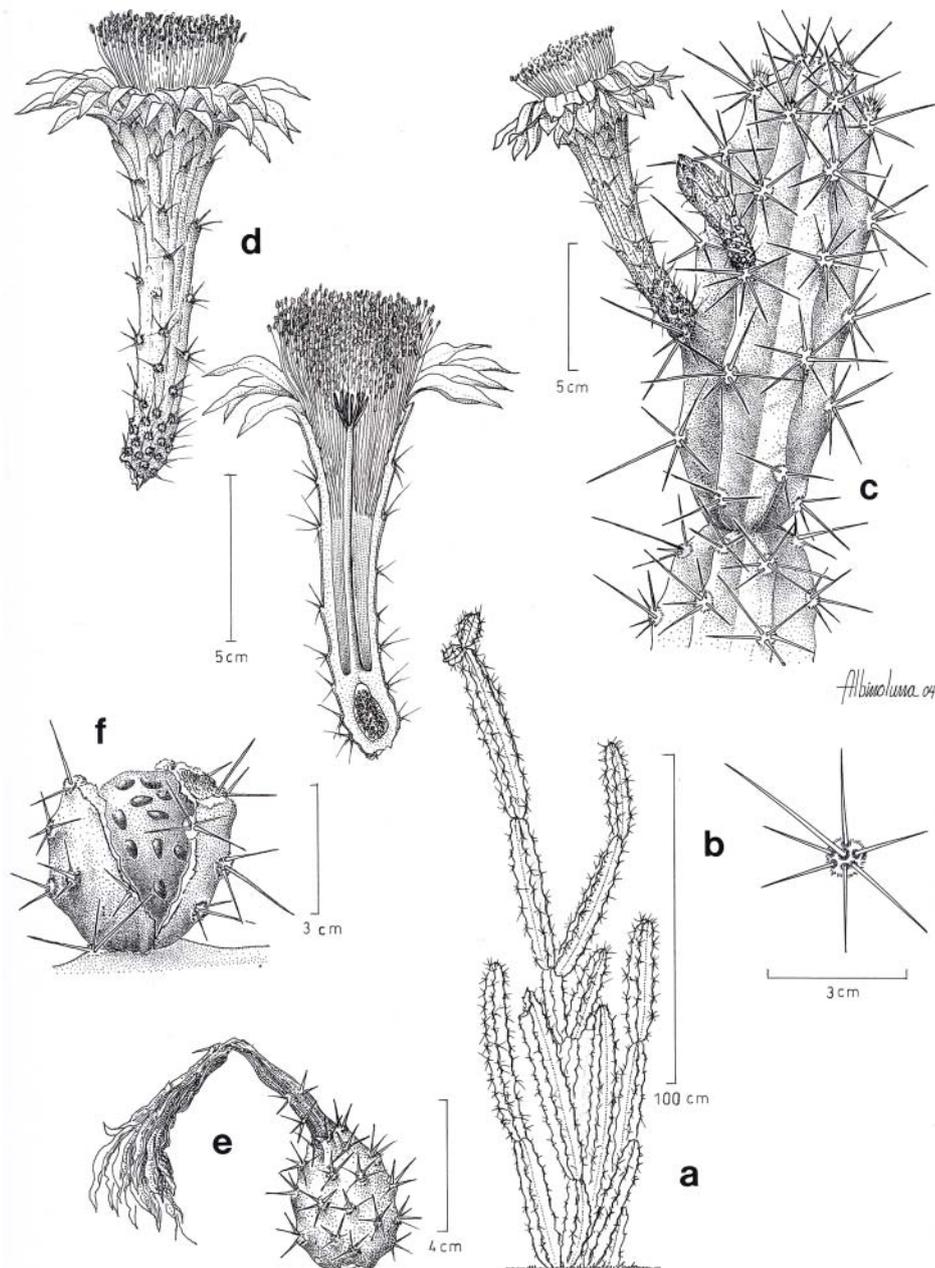


**Figure 2.** Comparative characteristics of *Acanthocereus tetragonus* and *A. chiapensis*. A, C, E. *A. tetragonus* (Gómez-Hinostrosa 2230). B, D, F. *A. chiapensis* (Gómez-Hinostrosa et al. 2100). f = fibers; ph = phloem; x = xylem. Scale bars: A, B = 50  $\mu$ m.

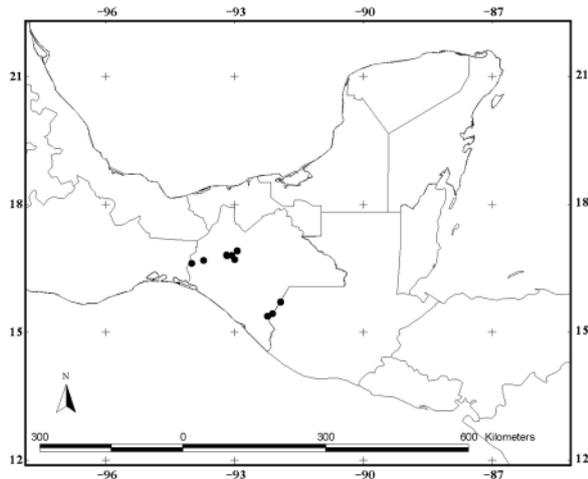
*Distribution and habitat.* *Peniocereus chiapensis* appears to be endemic to the Central Depression of Chiapas, where known populations are aggregated in three areas located at the western, central, and southeastern portions of Chiapas, México and adjacent Guatemala (Fig. 4). It primarily occurs in tropical dry forests at altitudes ranging from 517 to 1320 m. Flowering occurs between March and April, and fruiting between May and July.

*Specimens examined.* MEXICO. CHIAPAS: Mpio. Amatenango, Amatenango de la Frontera; 17.7 km al NE de Motozintla, rumbo a San Cristóbal Las Casas, 15°26'8"N, 92°7'5"W, 872 m, 13 June 2002, C. Gómez-Hinostrosa et al. 2194 (MEXU); Mpio. Chiapa de Corzo, Chiapa de Corzo, Mar. 1957, E. Greenwood 3228 (MEXU); Puente Belisario Domínguez, 1964, H. Bravo 4984 (MEXU); Mpio. Cintalapa, Monserrate, C. A. Purpus 269? (US); Cintalapa, 1952, H. Bravo 879 (MEXU); Lázaro Cárdenas, 21 Mar. 1967, H. Bravo 5628 (MEXU); 2.6 km al NW de la Hacienda Monserrate, rumbo a Betel, Monserrate se localiza a 15 km al NW de Vista Hermosa, 16°36'57"N, 93°59'56"W, 805 m, 26 Mar. 2004, C. Gómez-Hinostrosa and H.M. Hernández 2317a (MEXU); specimen cult. at Jardin Botanique Les Cèdres, St. Jean Cap. Ferrat, France, 20 Sep. 2004, M.

*Teissier s. n.* (from the original collection made by T. MacDougall A-201 in Hacienda Monserrate, Chiapas) (MEXU, B); Mpio. Motozintla de Mendoza, 1 km al NE de Motozintla, rumbo a Mazapa, 15°22'29"N, 92°13'53"W, 1214 m, 12 June 2002, C. Gómez-Hinostrosa et al. 2188 (MEXU); Mpio. San Fernando, El Destiladero, a un lado de La Encañada; La Encañada se encuentra 13 km al NW de Tuxtla Gutiérrez por camino a San Fernando, 16°48'38"N, 93°11'18"W, 820 m, 28 July 2001, C. Gómez-Hinostrosa and A. Cervantes 2089 (MEXU); El Barrancón; a un lado de La Encañada, 16°47'22"N, 93°10'38"W, 615 m, 29 July 2001, C. Gómez-Hinostrosa 2091 (MEXU); La Encañada, 1 km adelante de La Virgen, rumbo a San Fernando, 16°48'11"N, 93°11'15"W, 813 m, 29 July 2001, C. Gómez-Hinostrosa 2096 (MEXU); La Encañada, 16°48'13"N, 93°11'17"W, 862 m, 14 June 2002, C. Gómez-Hinostrosa et al. 2195 (MEXU), 26 Mar. 2004, C. Gómez-Hinostrosa and H.M. Hernández 2323 (MEXU); Mpio. Soyaló, Soyaló, 23 Mar. 1967, H. Bravo 5578 (MEXU); H. Bravo 5637 (MEXU); H. Bravo 5639 (MEXU); 28 Mar. 1967, H. Bravo 5630 (MEXU); 4 km al N de Soyaló rumbo a Bochil, 16°54'24"N, 92°56'2"W, 1320 m, 30 July 2001, C. Gómez-Hinostrosa and T. González 2100 (MEXU); 3 km al N de Soyaló, rumbo a Bochil, 16°54'20"N, 92°56'15"W, 1300 m, 14 June 2002,



**Figure 3.** *Peniocereus chiapensis* (Bravo) C. Gómez-Hinostrosa and H. M. Hernández. –a. Habit. –b. Areole. –c. Stem with flower and bud. –d. Flower. –e. Immature fruit. –f. Mature fruit. a, Gómez-Hinostrosa 2091 (MEXU); b-e, Gómez-Hinostrosa and Hernández 2325; f, Gómez-Hinostrosa et al. 2100.



**Figure 4.** Geographical distribution of *Peniocereus chiapensis* (solid dots).

*C. Gómez-Hinostrosa et al.* 2201 (MEXU), 27 Mar. 2004, *C. Gómez-Hinostrosa and H. M. Hernández* 2325 (MEXU); Mpio. Tuxtla Gutiérrez, Parque Nacional El Sumidero, entre kms. 8-19, 16°48' N, 93°04' W, 25 Aug. 1990, *H. M. Hernández and I. Méndez* 1685 (MEXU). GUATEMALA. HUEHUETENANGO: Canyon tributary to Río Trapichillo, between Democracia and canyon of Chamushú, 1000 m, 24 Aug. 1942, *J. A. Steyermark* 51231 (F); La Democracia, Aldea Guilá, 15°42'25'' N, 91°55'21'' W, 734 m, 15 Mar. 2001, *M. Véliz et al.* 11214 (BIGUA, MEXU); Santa Ana Huista, cerca de río Selegua, 15°42'18''N, 91°55'21''W, 517 m, 4 June 2001, *M. Véliz and J. Véliz* 11458 (BIGUA, MEXU).

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