Studies on Mexican Cactaceae. II. Opuntia megarrhiza, a poorly known endemic from San Luis Potosí, Mexico

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Hernández, H. M., C. Gómez-Hinostrosa & R. T. Bárcenas (Departamento de Botánica, Instituto de Biología, UNAM, Apartado Postal 70-233, 04510 México D.F., México). Studies on Mexican Cactaceae. II. Opuntia megarrhiza, a poorly known endemic from San Luis Potosí, Mexico. Brittonia 53: 528–533. 2001.— *Opuntia megarrhiza* Rose (Cactaceae) is a species endemic to central San Luis Potosí, Mexico that, since originally described in 1906, has remained poorly understood. A comprehensive morphological description is presented and its presumed taxonomic affinity with *O. chaffeyi* is discussed. General accounts of its distribution, ecology, uses, and conservation status are presented.

Key words: *Opuntia megarrhiza*, Cactaceae, taxonomy, Mexico.

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Opuntia megarrhiza was originally described by J. N. Rose in 1906, on the basis of a collection made by Edward Palmer in the Sierra de Álvarez, east of the city of San Luis Potosí, Mexico. The species was later recognized by Britton and Rose (1919) and by Bravo (1978), whose descriptions were almost identical to Rose's original. Aside from these references, *O. megarrhiza* has been rarely mentioned in the botanical literature. In fact, due to the poor understanding of the species since its original description, Hunt (1999) considers *O. megarrhiza* a provisional name. Likewise, Bravo (1978) regards it as a doubtful species and states that it is probably a form of *O. macrorrhiza* Engelm.

Recently, Hernández Valencia (1988) described *O. macrorrhiza* var. *potosina* from material collected at Cerro de San Pedro (*Hernández Valencia 385*), an area located about 23 air km west of Sierra de Álvarez. A close examination of the protologue and the type material of this taxon, in combination with field observations near its type locality, clearly suggest that this variety and *O. megarrhiza* are conspecific.

For the last several years we have been studying the Cactaceae from the southeastern portion of the Chihuahuan Desert (Hernández & Bárcenas, 1995, 1996; Gómez-Hinostrosa & Hernández, 2000; Hernández et al. A, 2001). As part of these studies, we have examined in detail a population of *O.*

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megarrhiza, in an area located about 85 air km NE from its type locality.

This contribution is the second of a series of publications (Hernández et al. B, 2001) in which we propose to synthesize the available knowledge of poorly known Mexican Cactaceae. Here we provide a detailed morphological description of *O. megarrhiza* and discuss its taxonomic status. In addition, data on its distribution, ecology, local uses, and conservation status are provided.

OPUNTIA MEGARRHIZA Rose, Contr. U.S. Natl. Herb. 10: 126. 1906. TYPE: MEXICO. San Luis Potosí: Municipio Villa Zaragoza, Álvarez, 21°59′N, 100°36′W, 19–22 May 1905, *E. Palmer 607* (HOLOTYPE: US 570115). (Fig. 1)

Opuntia macrorhiza Engelm. var. *potosina* Hernández Valencia, Acta Ci. Potos. 10: 155–162. 1988. TYPE: MEXICO. San Luis Potosí: Mpio. Cerro de San Pedro, Encino, 2140 m, 17 May 1988, *Hernández Valencia 385* (HOLOTYPE: SLPM 22132).

Plants erect, with a well-defined main stem, profusely branched, to 25(–40) cm high; rhizome vertical, succulent, tuberform, to 40 cm long, 5(–10) cm diam.; primary stem larger than normal cladodes, thickened, rarely lignified, to 30 cm high but usually shorter, to 6 cm broad. Secondary cladodes olive-green, sometimes reddish around the areoles, glabrous, narrowly lanceolate when young, becoming lanceolate or oblanceolate, flat, 5–12(–17) × 3.5 (–4.5) cm, 3–6 mm thick. Areoles typically 0.8–1.5(–2) cm apart, elliptical, 2–3 mm diam. in their widest portion, with white wool at center. Leaves present only on the younger cladodes and on the pericarpel, green to reddish, succulent, conical, ephemeral, 2–3 mm long. Spines white to light brown or grey, with yellowish or brown tips, rigid, acicular, of unequal length, usually 3–5(–6) in each areole, 0.5–2(–3.5) cm long. Glochids brown to yellow, 12–30 (–40), 1–4(–6) mm long. Flowers usually emerging from the margins or occasionally from the upper portion of the cladode faces, infundibuliform, 3–5.5 cm long, 2.5–6 cm diam. at anthesis. Pericarpel olive-green, usually tuberculate, narrowly obconical, 1.8–3.3 cm long, 9–16 mm diam. at the apex; areoles sometimes with 1–2 white, caducous spines, with white wool; glochids to 6 mm long, light brown to reddish brown. External perianth segments green to reddish, with the edge yellow-greenish, the larger ones usually with light green or reddish central stripes and yellow-greenish edges, reddish to brownish at the apex, succulent, becoming membranous inward, oblanceolate to spatulate, truncately attenuate at base, acuminate to apiculate at apex, margin entire, to 2.2 cm long; internal perianth segments greenish-yellow, membranous, spatulate, truncate-attenuate at base, mucronate at apex, margin entire, to 3 cm long, 1–1.8 cm at the broadest part. Stamens numerous, erect, slightly reclinate toward the pistil; filaments white, light green at the base, sensitive to touch, 4–7 mm long; anthers yellow, dorsifixed, 1–1.5 mm long. Style white, cylindrical, 1–1.8 cm long, 1.5–2.8 mm diam. at base, becoming narrower toward the apex. Stigma light green, capitate, sometimes with the lobes ascending, 2–3.8 mm diam., with 5–6 lobes. Fruits obovoid, truncate at the apex, umbilicate, 2.5 cm long. Seeds yellow-cream-colored, discoid, ca. 4 mm diam.

Distribution and ecology.—Opuntia megarrhiza appears to be restricted to five sparsely distributed localities, in central San Luis Potosí (Fig. 2), most frequently at 1890–2200 m. The disjunct sites from which this species has been found are located at or near the summits of several secondary mountain ranges belonging to the Sierra Madre Oriental physiographic province (Sierra de Álvarez, Sierra La Trinidad, and Monte Caldera). These relatively mesic areas are surrounded by highly disturbed chaparral of *Quercus eduardii*, *Quercus striatula* with *Agave asperrima*, and *Painteria elachistophylla*; grassland of *Bouteloua gracilis* or *Heteropogon contortus*; or oak woodland. The soils usually are a deep, dark clay, with limestone outcrops. Attempts to locate *O. megarrhiza* at the drier, lowland plains of the Chihuahuan Desert were unsuccessful. However, we were able to locate it on a farm near Palmillas, Tamaulipas, far away from its natural range. According to local informants, these plants were probably brought to this locality for

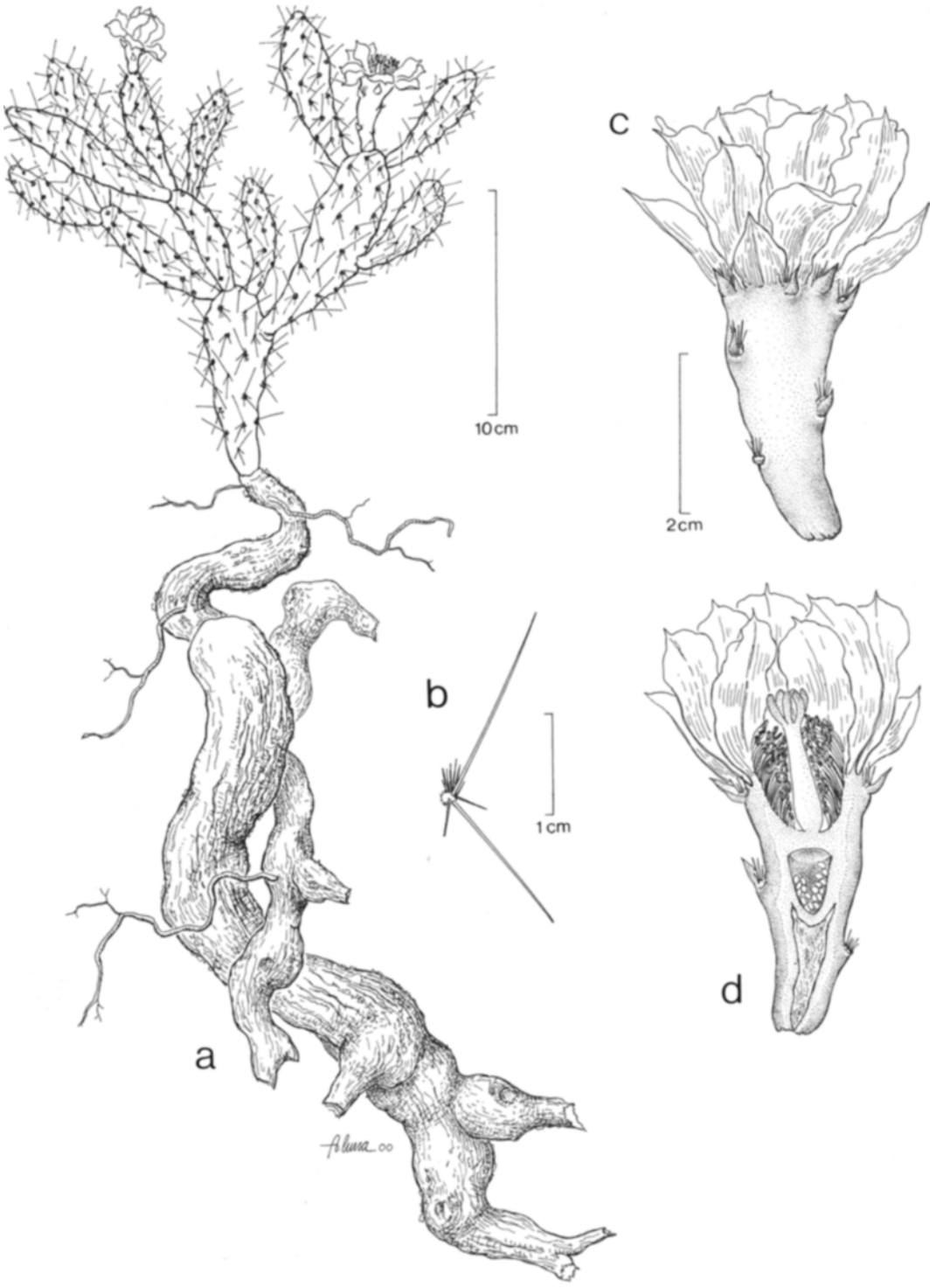

FIG. 1. *Opuntia megarrhiza* (*H. M. Hernández et al. 3313,* MEXU). **A**. Habit. **B**. Areole. **C, D**. Flower.

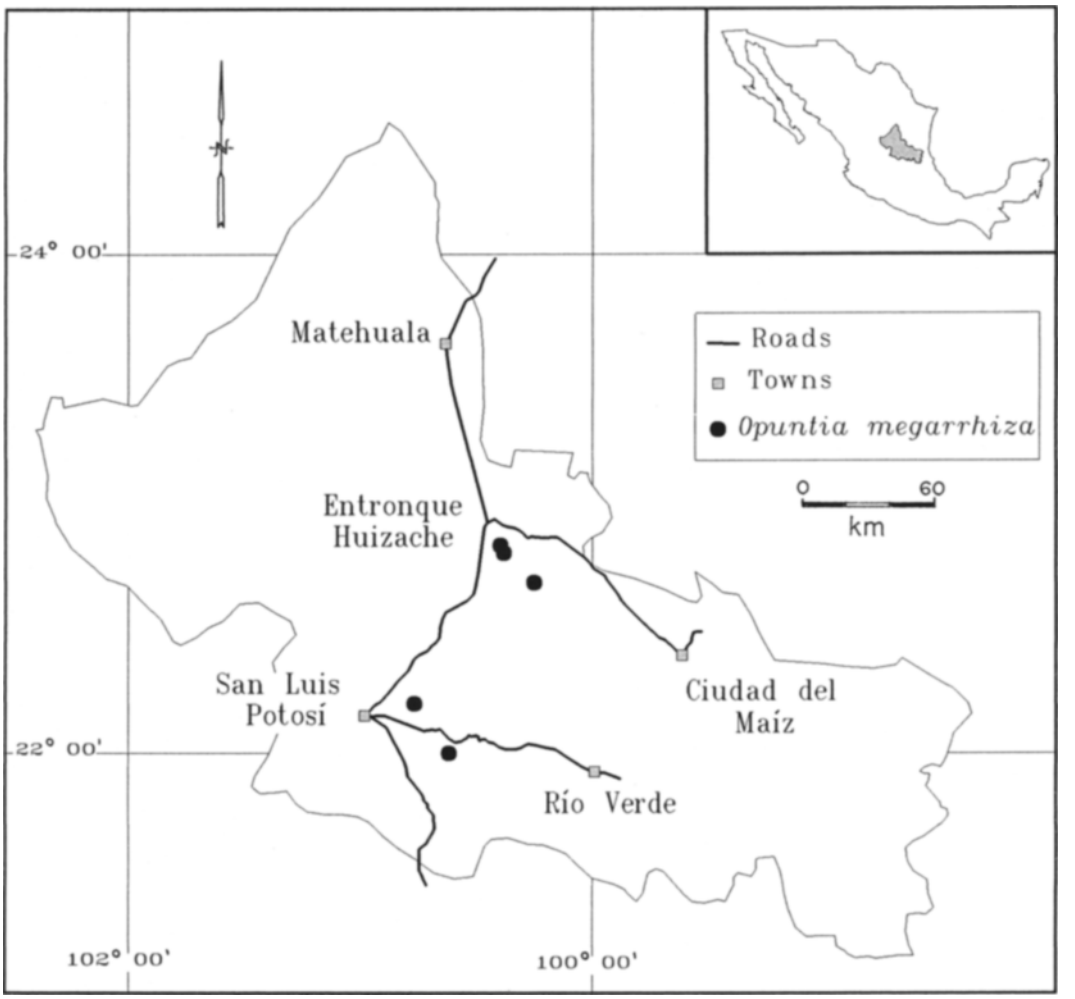

FIG. 2. Geographical distribution of *Opuntia megarrhiza*.

their medicinal use, but their source is unknown.

The individual cladodes appear to die when low temperatures and dry conditions are extreme, or when they are damaged by domestic animals or fire. When this happens, the rhizomes show a clear capability to regenerate the lost structures; however, it is not clear whether this happens on a yearly basis. The deciduous nature of the cladodes of *O. megarrhiza* was also recognized by Hernández Valencia (1988) in her observations of the Cerro de San Pedro population.

Uses.—Opuntia megarrhiza is known as "nopalillo" throughout its distribution range. The local people at Guadalcázar report that the mucilaginous rhizome of this species is highly effective in the preparation of splints for humans or domestic animals (e.g., goats, cows, mules) with broken bones. The rhizomes are macerated in order to prepare a paste, which is smeared into a bandage. This is reinforced with wooden sticks and used to immobilize the wounded portion. Upon drying, the paste hardens, giving the splint a strong consistency. The same process has been described by Hernández Valencia (1988) for the Cerro de San Pedro population.

It is interesting to note that the recently described *O. pachyrrhiza* H. M. Hernández,

C. Gómez-Hinostrosa & R. T. Bárcenas (Hernández et al. B, 2001), which is also characterized by having a massive rhizome and is sympatric with *O. megarrhiza* in Guadalcázar, has the same medicinal use, although the people report the latter to be more effective. Clearly the bone-healing potential of these two species has to be investigated.

Conservation status.—As indicated above, *O. megarrhiza* is a relatively narrow endemic (Fig. 2), and individuals are present in low densities at the natural populations. These two factors, along with the fact that the species is under some human pressure because of its medicinal value, justify its inclusion on the IUCN Red List of Threatened Plants (Walter & Gillett, 1998) as a vulnerable species.

Taxonomic affinities.—As implied by Britton and Rose (1919), Bravo (1978), and Hunt (1999), the taxonomic affinities of *O. megarrhiza* are obscure. *Opuntia macrorrhiza* has been suggested as its closest relative (Bravo, 1978; Hernández Valencia, 1988). However, the cladodes of *O. macrorrhiza* are much broader and orbicular to obovate, and the rhizomes are shorter (see Benson, 1982: figs. 446–451). Also, its flowers are reported to be reddish, at least in the center. This combination of characters of *O. macrorrhiza* contrasts with the usually smaller, lanceolate cladodes, the much longer rhizomes (Figs. 1, 3), and the yellow general appearance of the flowers of *O. megarrhiza*. In addition to their morphological differences, these two species are geographically separated, *O. macrorrhiza* having a more northern distribution as it reaches southern Minnesota and western Michigan (see Benson, 1982: 444).

In our view, *Opuntia megarrhiza* appears to be taxonomically related to *O. chaffeyi* Britton & Rose. This species is only known from Cedros, near Mazapil, Zacatecas (*Gómez-Hinostrosa & Bárcenas 1732*, MEXU) and from Charcas, San Luis Potosí (*Reyes 1146*, SLPM), two areas relatively close to the known localities of *O. megarrhiza*. These two species share several morphological characters, namely, large rhizomes, short stature, narrow, deciduous cladodes, and the general structure of the flowers. A comparison of these two presumably closely related species is presented in Table I.

Additional specimens examined. MEXICO. **San Luis Potosí**: Mpio. Cerro de San Pedro: Monte Caldera, near temple, 22°12′04″N, 100°46′35″W, 2100 m, 16 Oct 2000, *Gómez-Hinostrosa et al. 1770* (MEXU); Encino, 2180 m, 6 Nov 1986, *Hernández Valencia s.n.* (SLPM); Monte Caldera, 2190 m, 7 Feb 1985, *Hernández Valencia 349* (SLPM). Mpio. Guadalcázar: 1 km S La Yerbabuena, [La Yerbabuena is located 15 km N of Pozo de Acuña] 22°41′49″N, 100°15′20″W, 1505 m, 19 Jul 1996, *Gómez-Hinostrosa & Bárcenas 1174* (MEXU); hills SSW of San José de las Flores, 22°47′27″N, 100°23′37″W, 2195 m, 29 Nov 1996, *Her-*

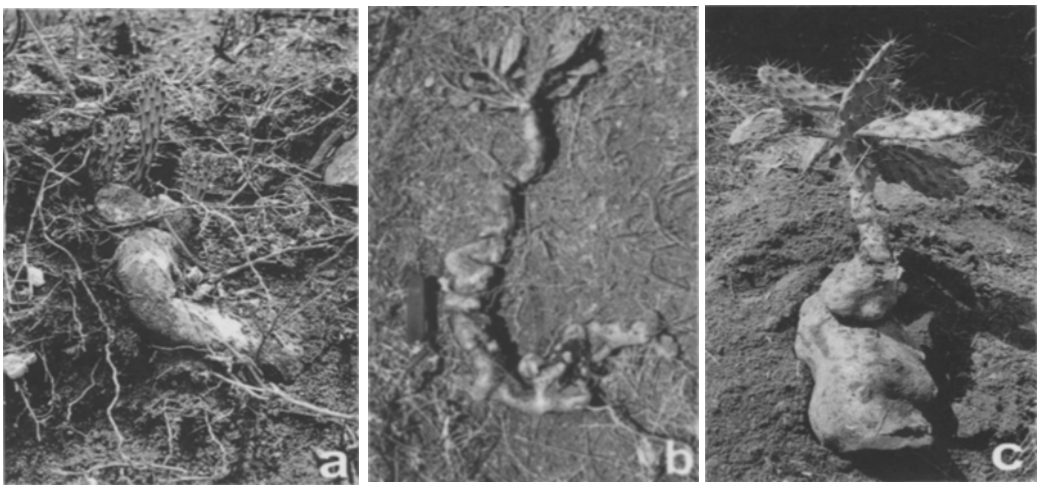

FIG. 3. *Opuntia megarrhiza* in its natural habitat. **A.** *H. M. Hernández et al. 3324* (MEXU). **B.** *H. M. Hernández et al. 3313* (MEXU). **C.** *Gómez-Hinostrosa et al. 1770* (MEXU).

TABLE 1
COMPARISON OF *OPUNTIA MEGARRHIZA* AND *O. CHAFFEYI*

	O. megarrhiza	*O. chaffeyi*
Distribution	Central SLP	Western SLP and NE Zacatecas
Habitat	Mountain summits	Silt plains
Rhizome	Tuberform	Tuberform
Length × diam. (cm)	40 × 5(−10)	40 × 6
Maximum stature	25(−40)	15
Primary cladode	Thickened, short	Narrow, elongated
Secondary cladodes		
Shape	Lanceolate-oblanceolate	Subcylindric
Length × width (cm)	5–12(−17) × 3.5(−4.5)	4–6(−8) × 0.4–0.7
No. of spines per areole	3–5(−6)	Usually 2–3
Flowers		
Color	Yellow	Pale yellow
No. of segments	Ca. 16–18	Ca. 7–9

nández et al. 3125 (MEXU); W San José de las Flores, along trail to Pozas de Santa Ana, 22°49′04″N, 100°24′05″W, 1890 m, 15 Mar 1997, *Hernández & Bárcenas 3203* (MEXU); hills NW of San José de las Flores, 2090 m, 5 Feb 1998, *Hernández et al. 3255* (MEXU); 2 km NW of San José de las Flores, along trail to El Tunalillo, 22°48′47″N, 100°23′11″W, 2085 m, 12 Mar 2000, *Hernández et al. 3313*, 9 Apr 2000, *Hernández et al. 3324* (MEXU). MPIO. SAN LUIS POTOSÍ: El Zapote, 27 Oct 1983, *Hernández Valencia 274* (SLPM). MPIO. VILLA ZARAGOZA: Álvarez, 2200 m, 23 Jun 1988, *Hernández Valencia & Puente s.n.* (SLPM). **Tamaulipas**: MPIO. PALMILLAS: Rancho Las Moras, a 5 km al sur de Palmillas, por camino a 6 de Abril (probably introduced), 23°15′38″N, 99°31′18″W, 1405 m, 19 Jun 1999, *Goettsch & Gómez-Hinostrosa 379* (MEXU).

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Literature Cited

Benson, L. 1982. The cacti of the United States and Canada. Stanford University Press, Stanford.

Bravo, H. 1978. Las cactáceas de México. Vol. I. Universidad Nacional Autónoma de México, México, D.F.

Britton, N. L. & J. N. Rose. 1919. The Cactaceae. Vol. I. Carnegie Institution of Washington, Washington, DC.

Gómez-Hinostrosa, C. & H. M. Hernández. 2000. Diversity, geographical distribution, and conservation of Cactaceae in the Mier y Noriega region, Mexico. Biodivers. Conserv. 9: 403–418.

Hernández, H. M. & R. T. Bárcenas. 1995. Endangered cacti in the Chihuahuan Desert: I. Distribution patterns. Conserv. Biol. 9: 1176–1188.

——— & ———. 1996. Endangered cacti in the Chihuahuan Desert: II. Biogeography and conservation. Conserv. Biol. 10: 1200–1209.

———, **C. Gómez-Hinostrosa & R. T. Bárcenas.** 2001. a. Diversity, spatial arrangement, and endemism of Cactaceae in the Huizache area, a hot-spot in the Chihuahuan Desert. Biodiversity and Conservation 10: 1097–1111.

———, ——— & ———. 2001. b. Studies on Mexican Cactaceae. I. *Opuntia pachyrriza* (Cactaceae), a new species from the Chihuahuan Desert, Mexico. Novon 11: 309–314.

Hernández Valencia, R. E. M. 1988. Una variedad nueva de *Opuntia macrorhiza* Engelmann (Cactaceae) de San Luis Potosí. (México). Acta Ci. Potos. 10: 155–162.

Hunt, D. 1999. CITES Cactaceae checklist. Ed. 2. Royal Botanic Gardens, Kew.

Walter, K. S. & H. J. Gillett (eds.). 1998. The 1997 IUCN Red list of threatened plants. World Conservation Monitoring Center/IUCN, Gland, Switzerland.