Phytotaxa 112 (2): 33–42 (2013)
www.mapress.com/phytotaxa/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

http://dx.doi.org/10.11646/phytotaxa.112.2.1

A new species of *Hechtia* (Bromeliaceae) from southwestern Tamaulipas, Mexico

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Abstract

A new species of *Hechtia* from the Mexican State of Tamaulipas is herein proposed as new: *Hechtia hernandez-sandovalii*, which is known only from the municipality of Villa de Miquihuana in the southwestern portion of the state. The new species is easily recognized by the following combination of characters: its white cotton-like indument (turning brownish with age) on the branches, rachis, and peduncle of both staminate and pistillate inflorescences. The new taxon is compared with *H. glomerata*, a species morphologically similar.

Resumen

Una nueva especie de *Hechtia* Klotszch del estado mexicano de Tamaulipas se propone como nueva: *Hechtia hernandez-sandovalii*, la cual se conoce solo del Municipio de Villa de Miquihuana en la porción suroeste del estado. La nueva especie se reconoce fácilmente por la siguiente combinación de caracteres: inflorescencia, ramas, pedúnculo y raquis cubiertas por un indumento blanco parecido al algodón, que se torna café con el tiempo. El nuevo taxón se compara con *H. glomerata,* especie morfológicamente similar.

Key words: Dioecy, endemism, *Hechtia glomerata*, IUCN, lateral inflorescence

Introduction

Hechtia Klotzsch (1835: 401) members range from Southern Texas (Big Bend National Park) to northern Nicaragua in Central America (Departments of Nueva Segovia and Jinotega), occurring on an area defined as Megamexico III by Rzedowski (1991). Most of the species of the genus are in Mexico (94% of them) and are endemic to it; Oaxaca houses ca. 20 species (Espejo *et al.*, 2007), but species numbers decrease toward northern Mexico, with only 2-3 species reported for the northern states of Baja California: *H. montana* Brandegee (1889: 9) and *H. gayorum* Lenz (1995: 59), and only three species reported from Tamaulipas: *H. epigyna* Harms (1935: 531–532) described from Jaumave but recently reported from Hidalgo as well (Espejo *et al*., 2010b), *H. mexicana* Smith (1935: 149) described from Sierra del Abra in San Luis Potosí, and *H. glomerata* Zuccarini (1840:240). This last binomial has been applied to several populations from Tamaulipas in Mexico to Honduras in Central America but the status of this species was recently clarified by Jiménez (2011) and Espejo *et al.* (2010a) currently remaining restricted to the Mexican states of Guanajuato, Hidalgo, Querétaro, and San Luis Potosí. Espejo *et al.* (2004) referred *Hechtia* populations from several municipalities in Tamaulipas to *H. glomerata*. Among these, some actually represent a new entity from the Municipio de Miquihuana, herein described as a new species and henceforth compared with *H. glomerata*.

Accepted by Eric Gouda: 30 May 2013; published online in PDF: 19 June 2013

Materials and methods

Herbarium specimens were prepared from plants collected in Tamaulipas from 2009 through 2012. Morphological variation of rosette features at population level was evaluated in the field. The complete material was cross examined to verify its status as a new species against all species recorded from Tamaulipas and neighboring states with the information on the protologues, including type material or images of them. Species assessed include *Hechtia epigyna* Harms, *H. glomerata* Zucc., and *H. mexicana*.

We compared different structures ranging from growth habit, through rosette features, inflorescence origin and architecture, flower shapes, color, etc. across species with close geographical distributions. We consider this approach very useful for people trying to identify populations from the same general area. In performing this exercise, we aim at the use of characters preserved in herbarium specimens as well as those only observed in living plants. To accomplish this, besides relevant description, we provide images and drawings.

The sequence of the description of the fertile structures of new entity is as follows: first the staminate inflorescence, then the pistillate inflorescence followed by fruit characteristics.

Taxonomy

Hechtia hernandez-sandovalii I. Ramírez, C. F. Jiménez & Treviño, *sp. nov.* (Fig. 1 (A,C,E,F), 2, 3).

Species similar to *Hechtia glomerata* Zucc. in its acaule rosettes with narrowly triangular blades, glabrous above, densely white lepidote below, lateral inflorescence, and staminate and pistillate flowers with white petals. However, *H. hernandez-sandovalii* presents branches of the inflorescence densely covered with a initially white indumentum that turns brownish with age and flowers totally immersed in it (vs. thin indumentums and flowers not immersed in it), rosettes taller than wide, leaves erect, falcate, laminae green, never developing red color (vs. rosette ellipsoid, wider than tall, leaves horizontally extended, apices deflexed, leaves green, shiny above, usually develop red color in *H. glomerata*); foliar sheaths shorter (2.5–3 cm vs. 3–6 cm in H. glomerata); floral parts (floral bracts, petals, sepals, ovary, anthers, and staminodes) and fruits larger, but seeds smaller in *H. hernandez-sandovalii*.

TYPE:—MEXICO. **Tamaulipas**: Municipio de Miquihuana, 17 km al W de Miquihuana camino a Estanque de Los Walle, 23°62'N, 98°57'–99°06'W, 28 mayo 1986, *Hernández & Martínez 1797* ♀ (holotype MEXU! (2), isotypes (QMEX!, TEX-LL, UAT!).

Terrestrial, caespitose, rosetofilous *herbs,* when blooming 1–1.80 m tall. *Rosettes* up to 35 cm diameter, taller than wide, leaves erect, falcate, new rosettes originating at the base of old ones and forming large colonies. *Leaves* 25–35 per rosette, succulent, straight and pointing upwards, foliar sheaths transversally oblong, 2.5–3 cm long, (2.6–) 3.7–4.8 cm wide, when dry white-yellowish adaxially and brownish abaxially, sometimes with a distally darker brown area, glabrous on both surfaces, basally entire, finely dentate close to the lamina; foliar blades narrowly triangular, acuminate, pungent, 21–39 cm long, 1.3–2.9 cm wide at base, 0.5–1.1 cm wide on the mid area, green, glabrous to sparsely white lepidote adaxially, white lepidote abaxially, margins spinose, spines 4–7 mm long, , uncinate, generally retrorse, (0.8–) 1.6–4.4 (–5.1) cm apart, laxly arranged toward the apex, reddish. *Inflorescence* lateral, erect.

Staminate inflorescence a 2-divided panicle, 1.15–1.53 m long; peduncle 58–61 cm long, 0.9–1.3 cm diameter, base flattened, light brown, sparsely white lepidote but sometimes glabrous, much longer than leaves; peduncle bracts triangular to triangular-ovate, acuminate, 2.3–6.2 cm long, 1–2.7 cm wide, brownish, sparsely lepidote, finely and laxly denticulate at base, entire towards the apex, strongly nerved, longer than internodes at the base, shorter towards the apex; main axis 57–92 cm long, 0.4–0.8 cm diameter, cylindrical, sometimes slightly sinuose, light brown, sparsely lepidote, soon glabrous; its internodes 1.4–4.8 cm long, shorter towards the base; primary bracts triangular, acute, acuminate, 1–4 cm long, 0.6–1.2 cm wide, brownish, sparsely lepidote, entire, strongly nerved; primary branches ca. 30 per inflorescence, 2–8.3 cm long, 0.8–1.3 cm diameter, sessile, ascending or appressed to main axis, ca. 8–50 (–70) flowers per branch;

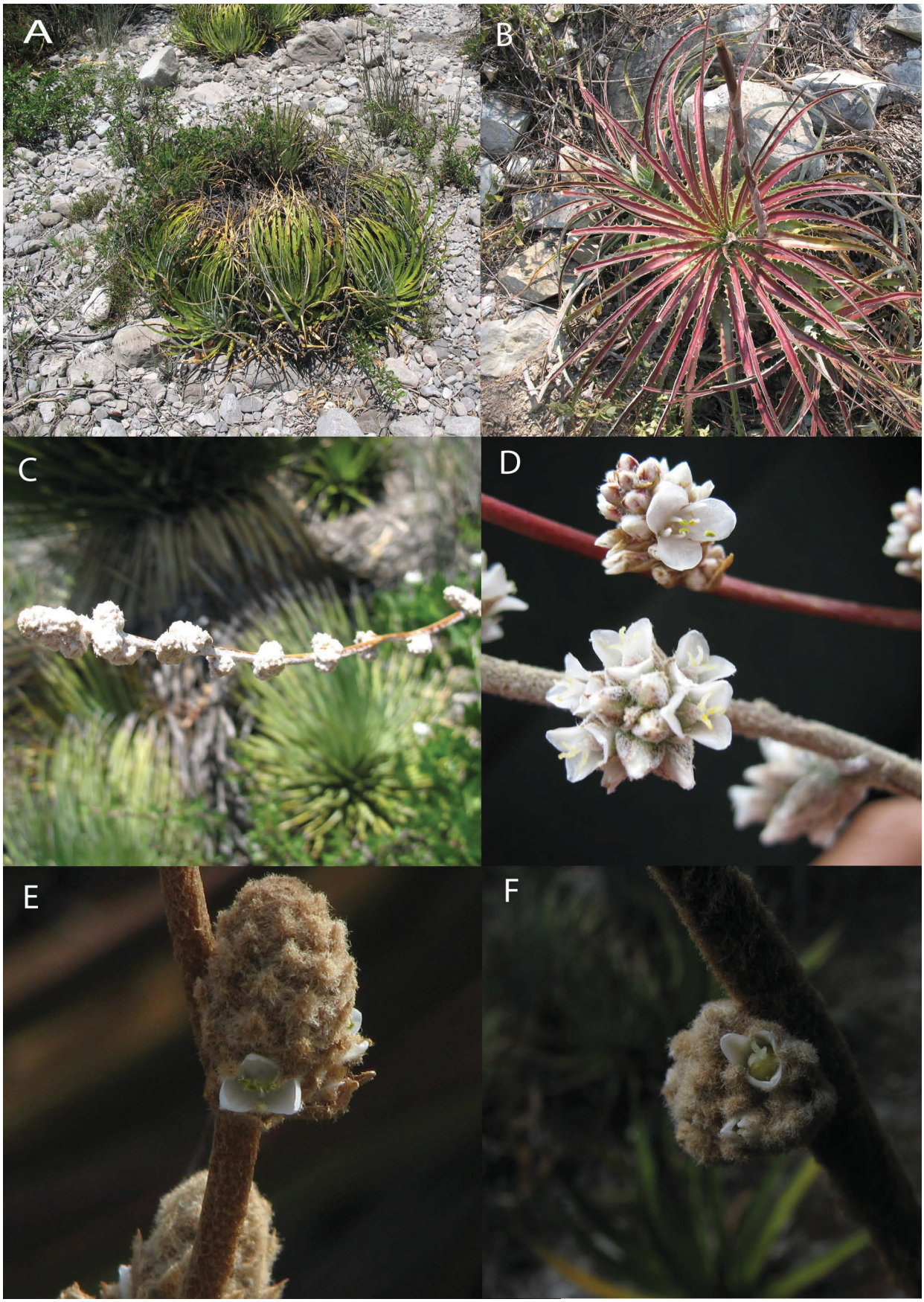

FIGURE 1. *Hechtia hernandez-sandovalii* (A, C, E, F). A. Plant in habit. C. Young staminate inflorescence showing white indumentum. E. Staminate branch. F. Pistillate branch. *Hechtia glomerata* (B, D). B . Plant in habit, see rosette shape and leaf color. D. Staminate (above) and pistillate (below) flowers. Photographs A, B, C, D by Ivón Ramirez; E and F by Jacinto Treviño Carreón.

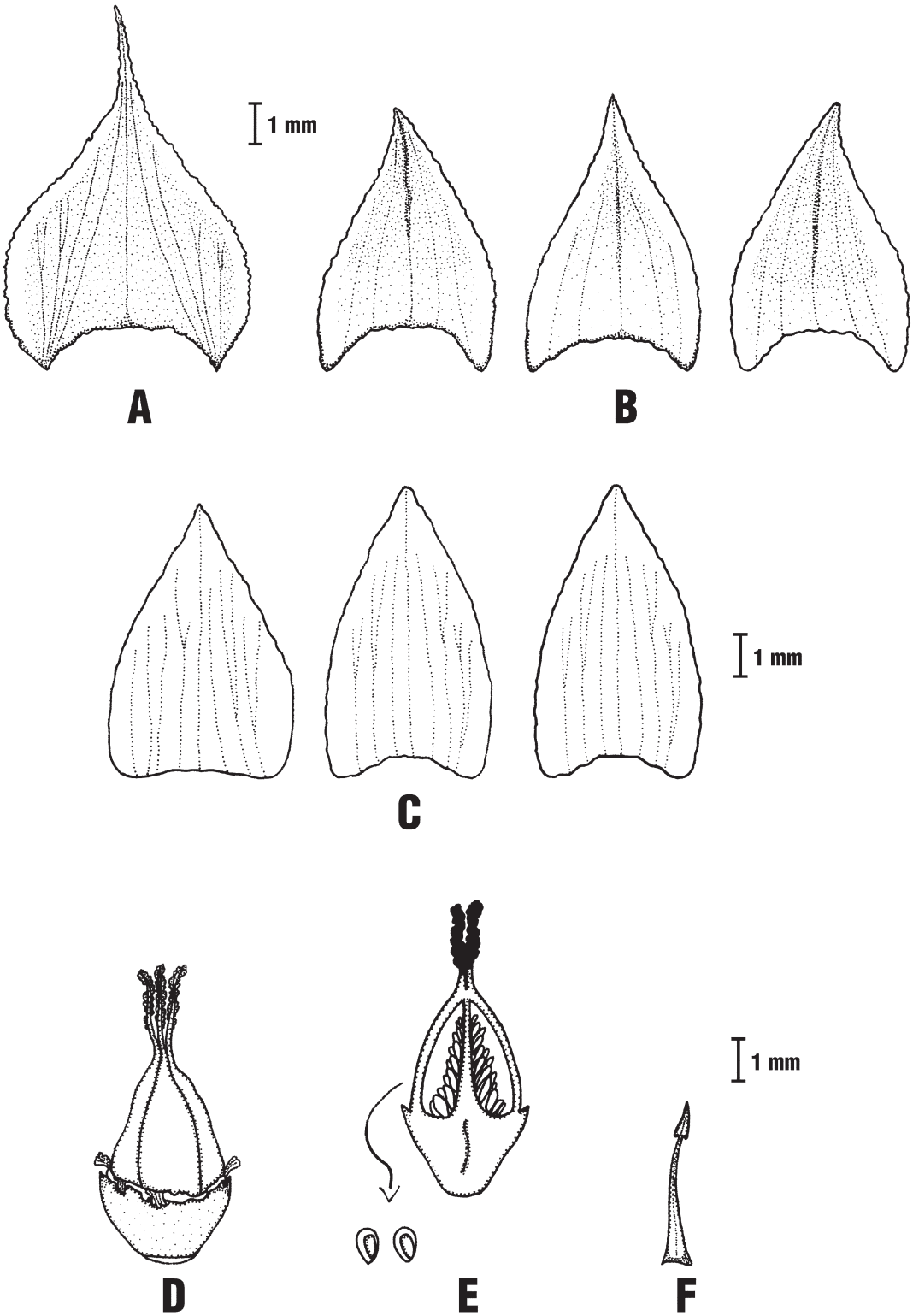

FIGURE 2. *Hechtia hernandez-sandovalii*. Pistillate plant. A. Floral bract. B. Sepals. C. Petals. D. Ovary with sessile stigma E. Longitudinal section of the ovary showing details of ovules. F. Staminode. (Based on *C. Jiménez et al. 27* (CICY)). Illustration by Carlos Jiménez.

secondary branches 1.3–2.5 cm long, ca. 10–20 flowers on each branch; floral bract long-ovate, short-acuminate, 6.3–8.2 mm long, 4–4.4 mm wide, brownish, erose, densely white lepidote, 7-nerved, exceeding sepals and petals; flowers densely clustered and covered by a dense white indumentums which is cotton like and becomes brownish with age, 6.5–7.5 mm long, 3–3.2 mm diameter, sessile; sepals connate by ½ of their

length, oblong, acute, 4.4–5.3 mm long, 2.3–2.5 mm wide, brownish, erose, densely white-lepidote, 5-nerved, slightly carinate, shorter than petals; petals free, obovate, rounded, 5.5–6 mm long, 2.8–3 mm wide, entire, white, densely white-lepidote, 7-nerved; stamens erect, adnate to the petals and pistillode base, barely protruding at anthesis, 3.2–4 mm long; filaments narrowly triangular, 2.9–3.5 mm long, 0.7 mm wide, white; anthers ca. 2.2 mm long, ca. 0.8 mm wide; pistillode conical, 1.4 mm long including vestigial stigmatic lobes, ca. 1.2 mm diameter, greenish to almost white; vestigial stigmatic lobes narrow, erect, 0.7 mm long.

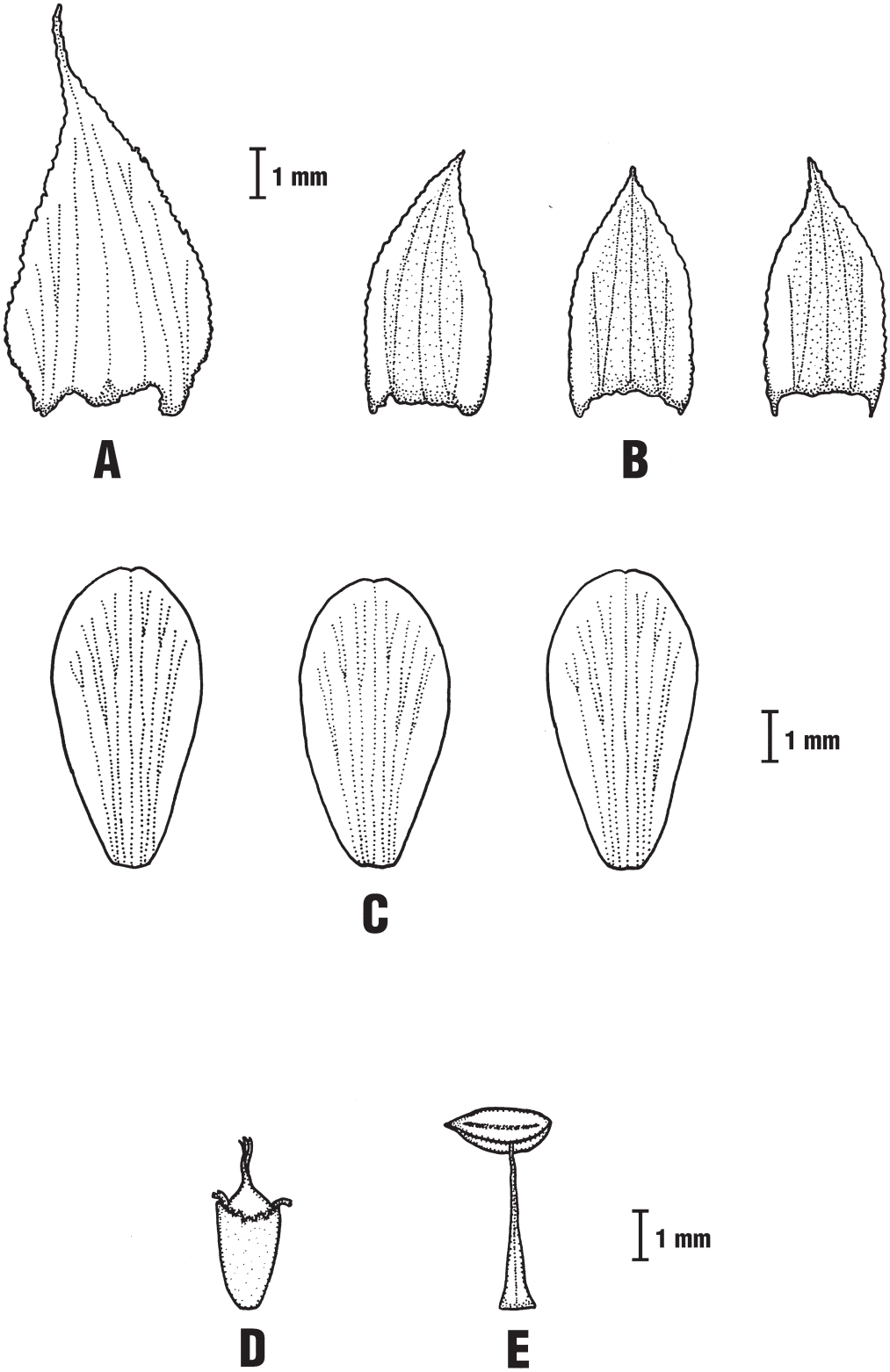

FIGURE 3. *Hechtia hernandez-sandovalii*. Staminate plant. A. Floral bract. B. Sepals. C. Petals. D. Pistillode. E. Stamen. (Based on *C. Jiménez et al. 27a* (CICY)). Illustration by Carlos Jiménez.

Pistillate inflorescence a 1–2 divided panicle, 0.73–1.30 m long; peduncle 37–75 cm long, 0.5–0.9 cm diameter, base flattened, reddish or brownish, sparsely white lepidote, soon glabrous, much longer than leaves; peduncle bracts triangular, acuminate, 1.7–6.3 cm long, 0.7–2.6 cm wide, brownish, sparsely lepidote, finely and loosely denticulate at base, entire towards the apex, strongly nerved, longer than basal internodes, equal or shorter on apical ones, its internodes 1.5–2.6 cm long, increasing in length from base to apex; main axis 27–80 cm long, 0.3–0.4 cm diameter, terete, sometimes sinuous, reddish or brownish, sparsely lepidote, sometimes glabrous, its internodes 1.5–5.8 cm long; primary bracts triangular, acuminate, 0.9–3 cm long, 0.7–1 cm wide, brownish, sparsely lepidote, entire, strongly nerved; primary branches 11–13 per inflorescence, 0.9–4.7 cm long, (0.5–) 0.9–1.7 cm diameter; its rachis 0.15–0.2 cm diameter, basal portion of the branch (sterile portion), ca. 1–3 (–12) mm, flattened at base, ascending or appressed to the main axis, ca. 6–30 flowers on primary branches; secondary branches 1–1.5 cm long, with ca. 4–10 flowers each ; floral bracts transversely oblong to wide elliptic, short acuminate, 8.7–9.4 mm long, 5.8–6 mm wide, brownish, margin erose, densely white lepidote, 7-nerved, exceeding sepals and petals; flowers densely clustered and covered by a dense white indumentums which is cotton like and becomes brownish with age, 7–7.5 mm long, 4–4.6 mm diameter, sessile; sepals connate by ½ of their length, ovate, acute, 6.2–6.5 mm long, 4–4.2 mm wide, brownish, margin erose, densely white lepidote, 5-nerved, carinate, sometimes as long as the petals; petals free, ovate, acute, 6.5–6.9 mm long, 3.8–4.4 mm wide, white, entire, densely white lepidote, 7-nerved; staminodes narrowly triangular, 2.6–3.8 mm long, 0.5–0.7 mm wide at base; vestigial anthers triangular; filaments adnate to the base of petals and ovary, white; ovary superior, ovoid, 6 mm long, 3 mm diameter, white or greenish; stigmatic lobes erect, ca. 1.5–1.8 mm long; placentation central, ovules ovoid, covered by a membranous, transparent wing, 0.8 mm long, 0.6 mm de diameter including the wing. *Fruits* ellipsoid to wide ellipsoid, 7.2–8 mm long, 4–5.2 mm wide, brown, sepals, petals, staminodes, and stigmatic lobes persistent remaining on the fruit; seeds fusiform, 3.3–3.9 mm long, 1–1.4 mm wide, brown with two apical wings; apical wing 0.3–0.5 mm long, basal wing 0.4–0.9 mm long.

Distribution and habitat:—*Hechtia hernandez-sandovalii* has been so far only collected in a very restricted area in the extreme southwestern portion of Tamaulipas, Municipio Miquihuana, at the localities of La Peña, Estanque de Los Walle, Estanque Eguia, Servando Canales, La Perdida, San José del Llano, and Miquihuana (figure 4). The new species is an important component of what has been denominated "rosetofilous acaulescent thickets of *Hechtia*" (Treviño-Carreón & Valiente-Banuet, 2005), on extensive limestone hills or rocky exposed areas. Also but less often, the new species can be found inhabiting the lower stratum of pine forest and rosetofilous caulescent thickets of *Dasylirion miquihuanense* Bogler (1998: 76) and *D. qudrangulatum* S. Watson (1879: 250). In the plains and plateaus of these same sites, *Hechtia hernandez-sandovalii* is often found associated with *Agave lechuguilla* Torrey (1858: 213) forming a plant association called "*Agave-Hechtia* acaulescent rosetofilous shrubland". Rosetofilous shrublands are interspaced with rosetofilous forests of *Yucca filifera* Chabaud (1876: 432) and *Y. carnerosana* (Trelease 1902: 118) McKelvey (1938: 24), as well as microphilous shrublands of *Larrea tridentata* (Candolle 1824:706) Coville (1893: 75). The distribution area is located between 1800 to 2200 m above sea level, with rains during summer (July to September) ranging from 500 to 700 mm, with temperatures ranging from -4°C and 41°C. The new species blooms from May to June, producing fruits in the following three months, which remain on the plant for a year when they open and free the seeds.

Other species usually found growing with *Hechtia hernandez-sandovalii* are *Agave striata* Zucc. (Karwinsky & Zuccarini, 1833: 678), *Celtis pallida* Torrey (1859: 250), *Cylindropuntia leptocaulis* (Candolle 1828b: 118) F.M. Knuth (Backeberg & Knuth 1935:122), *Euphorbia antisiphylitica* Zuccarini (1832: 292), *Jatropha dioica* Sessé in Cervantes (1794: 4), *Koeberlinia spinosa* Zuccarini (1832: 359), *Lippia graveolens* Kunth (1817 "1818": 266), *Opuntia imbricata* (Haworth 1819: 70) Candolle (1828a: 278), *Opuntia stenopetala* Engelmann (1856: 289), *Pinus cembroides* Zuccarini (1832: 392), *Pinus nelsonii* Shaw (1904: 122), *Prosopis glandulosa* Torrey (1827: 192), among others.

Additional specimens examined (paratypes):—MEXICO. Tamaulipas: Mun. Palmillas, 8.5 al noroeste de Palmillas [23°22'06''N, 99°30'53''O], 1550 m snm, 7 Julio 1985, *P. Hiriart, V. Juárez y R. Molczadzki* 937

fruits (MEXU!, UAT!); *926*♀ (MEXU!); Mun. Miquihuana, 1 km delante de la Perdida, [23°33’18’’N, 99°51’58’’O], 1850 m snm, 4 Junio 1986, *H. Sánchez-Mejorada 3648*♀ (MEXU! (2)); 17 km al O de Miquihuana camino a Estanque de Los Walle, 23°62' N, 99°06' W, 28 Mayo 1986, *L. Hernández & M. Martínez 1799*♂ (MEXU! (2), TEX-LL!, UAT!); 1.5 km después de la desviación hacia Estanque Los Walle, 23°32’41’’N, 99°53’53’’O, 1461 m snm, 12 Julio 2012, *C. Jiménez, J. Treviño, A. de León, O. López y T. Hernández 27* ♀ (CICY!, IEB!, US!), *C. Jiménez, J. Treviño, A. de León, O. López y T. Hernández 27a* ♂(CICY!, HGOM!, IEB!, US!, XAL!); 5.5 km al O de Miquihuana, por la carretera a San José del Llano, 2 km antes del entronque de la Perdida, 23°32’34.3’’N, 99°50’31.5’’W, 1592 m, 12 Junio 2009, *I. Ramírez, J. Treviño & S. Terán Treviño 1610* ♂ (CICY!); 1610a fruits (CICY!).

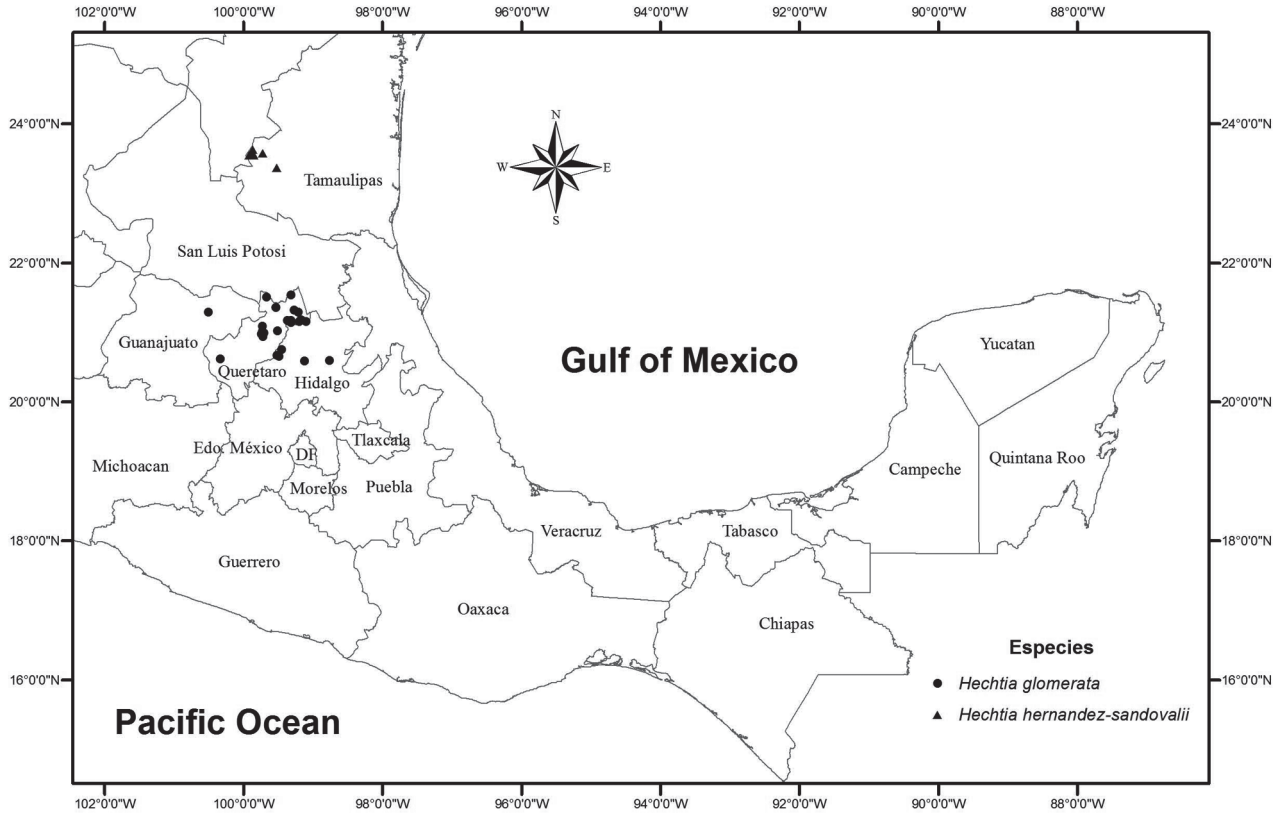

FIGURE 4. Geographical distribution of *Hechtia hernandez-sandovalii* (black triangles) and *Hechtia glomerata* (black circles).

Etymology:—We dedicate this species to Luis G. Hernández Sandoval who collected the type material of this new species.

Discussion:—The new species along with additional ca. 10 taxa, are part of a group defined as the *Hechtia glomerata* Zucc. complex by Jiménez (2011) who characterized it by the presence of lateral, paniculate inflorescences, 1–3 divided, peduncle flattened at its base, a white indumentum covering all the inflorescences and its parts in both staminate and pistillate plants. Flowers on species on this complex are generally grouped in glomerules or sometimes laxly disposed along the branches, sessile to subsessile, pistillate and staminate flowers with white petals, those staminate with white filaments, green to yellow-greenish anthers, those pistillate with white stigma, and fruits with fusiform seeds. Phylogenetic analysis are on their way but preliminary results with morphological characters and sequences of the plastid region *rpl*32 for 38 taxa of *Hechtia* suggest the monophyly of the complex (I. Ramírez *et al*., unpublished).

The new species resembles *Hechtia glomerata* Zucc., a species also characterized by the presence of lateral inflorescences, but with rosettes producing stolons, leaves horizontally extended with deflexed apices, producing open rosettes that are wider than tall, foliar laminae with adaxial surface shiny and usually coloring red. Its pistillate branches are condensed, glomerule like, but staminate branches are elongated, and both of

them covered by a thin layer of white indumentums and flowers present white petals. On the other hand, rosettes of *Hechtia hernandez-sandovalii* do not produce stolons, their leaves are erect, falcate, producing rosettes that are taller than wide, with foliar laminae green without developing red color. Its pistillate as well as staminate branches are cylindrical and these covered by a dense white indumentums which is cotton like and becomes brownish with age.

A more detailed study of floral features shows that foliar sheaths on the new taxon are shorter (2.5–3 cm vs. 3–6 cm in *H. glomerata*), its floral parts larger (floral bracts, petals, sepals, ovary, anthers, and staminodes), as well as larger fruits but contrastingly smaller seeds in *H. hernandez-sandovalii*. Growth habit also differs between these species: *H. hernandez-sandovalii* form circular colonies of tens of rosettes. New ones are produced on the periphery with central, old ones gradually dying (and becoming black when eventually burned), making the colony acquire the aspect of a "fairy ring". On the other hand, rosettes of *H. glomerata* form small colonies of few rosettes, usually developing stolons, but never forming a circular colony on a shape of a fairy ring, with and all rosettes remaining alive.

The indumentum density in the new taxon varies from populations at high elevations (ca. 1800 m, e.j. locality La Peña) to slighter thinner at elevations below 1800 m. We have under cultivation representatives of several populations of *Hechtia glomerata* spanning the altitudinal range of the species and the indumentum density in the inflorescences is not affected by changes of elevation brought about by this common garden experiment, thus supporting the notion that this character is not affected by elevation differences within the species.

IUCN Conservation assessment:—IUCN Conservation assessment:—VU. *Hechtia hernandez-sandovalii* meets criteria D2 of the IUCN (2001). The species is known from an area of less than 2 km^2 within which it occurs only at a handful of small sites. Albeit local populations of the species can be rich in individuals and are often inaccessible, they are widely dispersed and isolated on the slopes and tops of small hills.

MER Conservation assessment:—MER Conservation assessment:—A ("Amenazada", "threatened"). *Hechtia hernandez-sandovalii* is known from an area of smaller that 0.2% of the Mexican territory. After assessing all the criteria of this method, and based upon the relevant factors established in the preceding paragraphs, *H. hernandez-sandovalii* scores 12 points, which places it in the mentioned category (SEMARNAT, 2002).

TABLE 1. Main differences between *Hechtia glomerata* Zucc. and *H. hernandez-sandovalii.*

Feature	*H. glomerata*	*H. hernandez-sandovalii*
Rosette features	Leaves horizontally extended with apices deflexed, green, may develop red color; rosette ellipsoid, wider than tall	Leaves erect, apices erect; falcate, green, never develop red color; rosettes taller than wide
Foliar sheaths	3–6 cm long	2.5–3 cm long
Floral bract (staminate flower)	4–5 mm long, as long as the petals	6.3–8.2 mm long, longer than the petals
Petals (staminate flowers)	3.5–4 mm long, ovate to wide-elliptical	4.4–5.3 mm long, oblong
Floral bract (pistillate flower)	Triangular-ovate to triangular, 4.5–6 mm long, equal to the petals	Transversely oblong, 8.7–9.4 mm long, longer than the petals
Sepals (pistillate flower)	4.2–6 mm long	6.2–6.5 mm long
Ovary	Ellipsoid to oblong, ca. 5 mm long	Ovoid, 6 mm long
Anthers	Ca. 1 mm long	Ca. 2.2 mm long
Staminodes	Ca. 2 mm long, no vestigial anthers	2.6–3.8 mm long, with vestigial anthers
Fruit	Ovoid	Ellipsoid
Seeds	5.2–7.2 mm long	3.3–3.9 mm long

Acknowledgments

We are indebted to the Elizabeth Bascom Fellowship and to the KLARF Program for the scholarship granted to the first author that allowed the study of material from several herbaria while at Herbarium MO and Herbarium K respectively. To the Deutscher Akademischer Austauschdienst (DAAD), Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin and Centro de Investigación Científica de Yucatán, A. C. for financial support to visit and study the Bromeliaceae collection at Herbarium B during 2011. Our thanks to the curators of the following herbaria: B, BM, CICY, F, GH, IEB, HEID, HGOM, K, LG, LL, M, MEXU, MICH, MO, NY, OAX, RSA, TEX, UAMIZ, UAT, UC, US, VT, WU, XAL, and Z for allowing us to study the herbarium material deposited at their herbaria. We would like to thank Tania Hernández López, Oscar López Hernández, Adán De León Contreras, and Sergio Antonio Terán, for their help in the field, Paola Marfil for editing the line drawings figures and Germán Carnevali for editing the English of this paper. Finally, we thank two anonymous reviewers for their comments and suggestions which improved the clarity and quality of this paper. Field work was supported by Consejo Nacional de Ciencia y Tecnología's Project 183281, as well as Proyect UAT10-NAT0101 of Dirección de Estudios de Posgrado e Investigación de la Universidad Autónoma de Tamaulipas, awarded to the first and third author respectively.

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