



A new species of *Hechtia* (Hechtioideae, Bromeliaceae) from Puebla, Mexico

IVÓN M. RAMÍREZ M.¹ & CARLOS F. JIMÉNEZ NAH¹

¹Centro de Investigación Científica de Yucatán, A. C. Unidad de Recursos Naturales-Herbario CICY, Calle 43 # 130. Colonia Chuburná de Hidalgo, Mérida, Yucatán 97200, México.

ramirez@cicy.mx

Abstract

A new species of *Hechtia*, *H. pueblensis*, from the Mexican State of Puebla, is described and illustrated. The new taxon is well documented with illustrations and photographs of staminate and pistillate flowers, as well as fruits. It shares its small-sized rosette and usually simple panicles with *H. lyman-smithii* (from a nearby geographical region in Oaxaca) and with *H. fragilis* (from Puebla and Oaxaca).

Key words: dioecy, endemism

Introduction

Hechtia Klotzsch (1835: 401) previously included in the polyphyletic subfamily Pitcairnioideae, is the only genus of the recently proposed subfamily Hechtioideae (Givnish *et al.* 2007, 2011). Hechtioideae, as characterized by Givnish *et al.* (2007), is represented by plants with “capsular fruits, seeds winged to almost naked, flowers dioecious (sic), leaves succulent, spinose or rarely entire, without stellate clorenchyma”. In addition, members of the genus are always terrestrial; furthermore, only rarely the central leaves and bracts subtending the scape color brightly as in most other bromeliads, flowers are unisexual and species dioecious, whereas and pistillate flowers have sessile stigmas. The genus comprises ca. 65 described species (modified from Espejo *et al.* 2004) distributed from the southern USA (Texas) to northern Nicaragua (Megamexico III region *sensu* Rzedowski 1991), from 0 to 2500 m elevation with 94% of them exclusive to Mexico; the state of Oaxaca holds the largest number of species for Mexico in the genus (20 spp.) and in the Bromeliaceae (172 species; Espejo *et al.* 2007).

Eleven species of *Hechtia* have been reported from the Mexican State of Puebla (modified from Espejo *et al.* 2004), one of them endemic to the state: *H. liebmannii* Mez (1901: 6). The other species recorded for Puebla are *H. bracteata* Mez (1896: 550), *H. caulescens* López-Ferrari, Espejo & Martínez-Correa (2009: 197), *H. colossa* Martínez-Correa, Espejo & López-Ferrari (2010: 746), *Hechtia confusa* Smith (1937: 22), *H. konzattiana* Smith (1937: 19), *H. fragilis* Burt-Utley & Utley (1987: 40), *H. perotensis* I.Ramírez & Martínez-Correa in Espejo *et al.* (2007: 103), *H. podantha* Mez (1896: 549), *H. roseana* Smith (1937: 17), and *H. tehuacana* Robinson (1904: 265). All the species in Puebla, except *H. caulescens*, *H. konzattiana*, *H. fragilis* and the species herein proposed as new, belong to the so-called *Hechtia podantha* complex characterized by “having ovate to ovate-triangular primary bracts that are equal or larger than the primary branches, green to green-yellowish flowers, inflorescences twice branched and seeds with circumferential wing”, members of this informal complex also occur in xerophytic shrublands in Hidalgo, Morelos, Oaxaca, Puebla, Queretaro and Veracruz between 1400 and 2650 m elevation (Martínez-Correa *et al.* 2010).

To assess and explain morphological similarities or phylogenetic relationships among *Hechtia* species is a difficult task that we are just beginning to understand. In the first place, many described taxa are only known from a fruiting, staminate or pistillate plant. Secondly, there is not even a rudimentary phylogenetic analysis

for the genus, and finally, based on our current knowledge, several characters seem to have evolved in a homoplasious manner. These include rosette size (from 20 cm to 100 cm diameter), inflorescence origin (central or lateral), presence (or absence) of indumentum on floral parts, petal color (white, pink, yellow, green, and red), among others. Geographical distribution may be useful to rule out potential new species since they usually display geographically restricted distributions and it is uncommon for closely related *Hechtia* species to occur in sympatry. However, documented cases of sympatry exist (for example *H. lundelliorum* Smith (1938: 97) and *H. glomerata* Zuccarini (1840: 240) in Queretaro state, personal observation) making it difficult to assess the systematic status of a species relying only on its geographical distribution. We are also aware of the facts that there are groups of species sharing various vegetative characters (rosette: size, growth pattern), and floral characters (origin of the inflorescence (central vs. side), petal color (white, green, red, etc.) as well as the presence of indumentum on floral parts (for example, Jiménez 2011) among other features. Such groups also have coherent but usually complementary geographical distributions, suggesting that geography and allopatry have played an important role in the branching of lineages in the genus. The most useful method to convey the specific concept in the genus is to compare the new species with taxa that are closely distributed, since they will have high probabilities of sharing a common phylogenetic history and comparable morphological character states with the new entity.

Materials and methods

Live specimens collected in Puebla from 2005 to 2010 of the new species were cultivated and bloomed obtaining staminate and pistillate flowers as well as fruits that were used to prepare herbarium specimens. Also, herbarium material from pertinent national and international herbaria was studied. When plants are cultivated, many of them undergo changes in their sizes responding to more water and fertilizer. For this reason, we examined plants in the field, including fruits, pistillate and staminate flowers; those were compared with herbarium material deposited in national and international herbaria, as well as the information published in the protologues of species, including type material when available, for all species described from areas close to the type locality of the new species. For this, we studied type material of species described or known to occur in Puebla and Oaxaca, except for *Hechtia liebmanni* where we used the information published in the protologue. *Hechtia sphaeroblata* Robinson (1900: 323), was not considered since it was erroneously cited for Puebla (Espejo *et al.* 2004) but, based on actual, reliable collections, the species appears to occur only in the State of Guerrero.

Material was examined and floral parts drawn with the use of a Zeiss Stemi 2000 C stereoscope at $\times 64$ to $\times 400$ magnifications. Digital pictures of live plants and flowers were taken with a digital camera SONY DSC-S70.

Taxonomy

Hechtia pueblensis I.Ramírez & C.Jiménez, *sp. nov.* (Fig. 1–3)

This new species is characterized by its caespitose habit, small sized-rosette, leaves with white indument on both surfaces, central inflorescence, a simple pistillate panicle, a 2-divided staminate panicle, branches ascending, both emerging from a young, undeveloped rosette, erect, glaucous, flowers with green petals, fruits dark maroon, seeds elongated with two wings.

TYPE:—MEXICO. Puebla: Mpio. Coxcatlán, ca. poblado San Rafael, a 3 km al Este en la carretera Coxcatlán-Teotitlán del Camino, 943 m of elevation, 18°10'39"N, 97°07'29"W, colectada originalmente por Ivón Ramírez & Carlos Durán en marzo 2005, florecida en cultivo julio del 2011, *Ivón M. Ramírez M. & Germán Carnevali 1689* ♂ (Holotype: CICY, isotypes: B, G, K, MEXU, MO, SEL, UAMIZ, XAL, WU).

Epitype (designated here):—MEXICO. Puebla: Mpio. Coxcatlán, ca. poblado San Rafael, a 3 km al Este en la carretera Coxcatlán-Teotitlán del Camino, 943 m of elevation, 18°10'39"N, 97°07'29" W, colectada

originalmente por Ivón Ramírez & Carlos Durán en marzo 2005, florecida en cultivo, julio del 2011, *Ivón M. Ramírez M. & Germán Carnevali 1689* ♀ (epitype: CICY, isoepitype: MEXU).

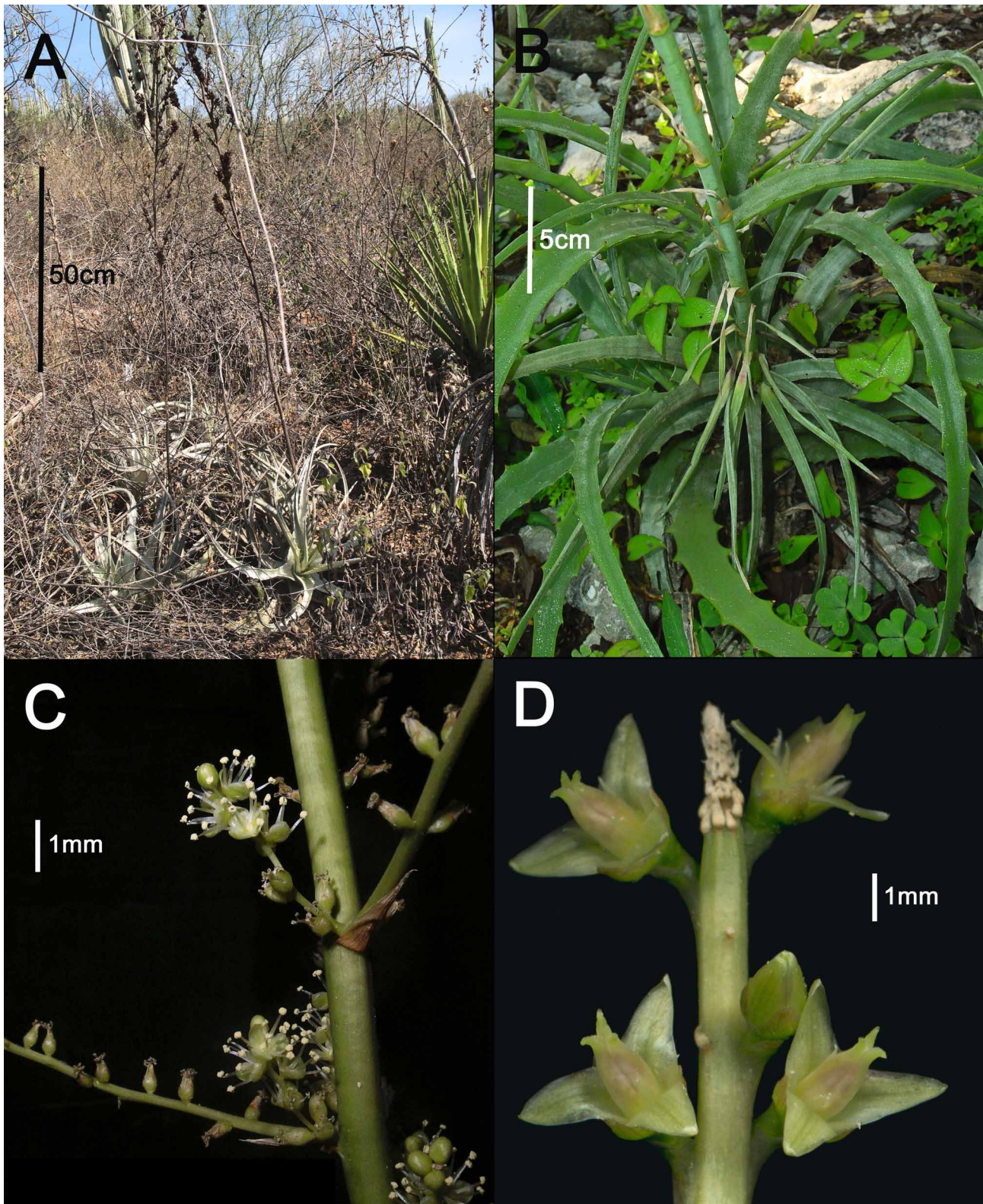


FIGURE 1. **A.** Plant in habitat with fruits. **B.** Plant in cultivation (observe bluish color on leaves) with a young staminate inflorescence. **C.** Partial portion of a staminate inflorescence. **D.** Pistillate flowers in anthesis. (Photographs by I. Ramírez).

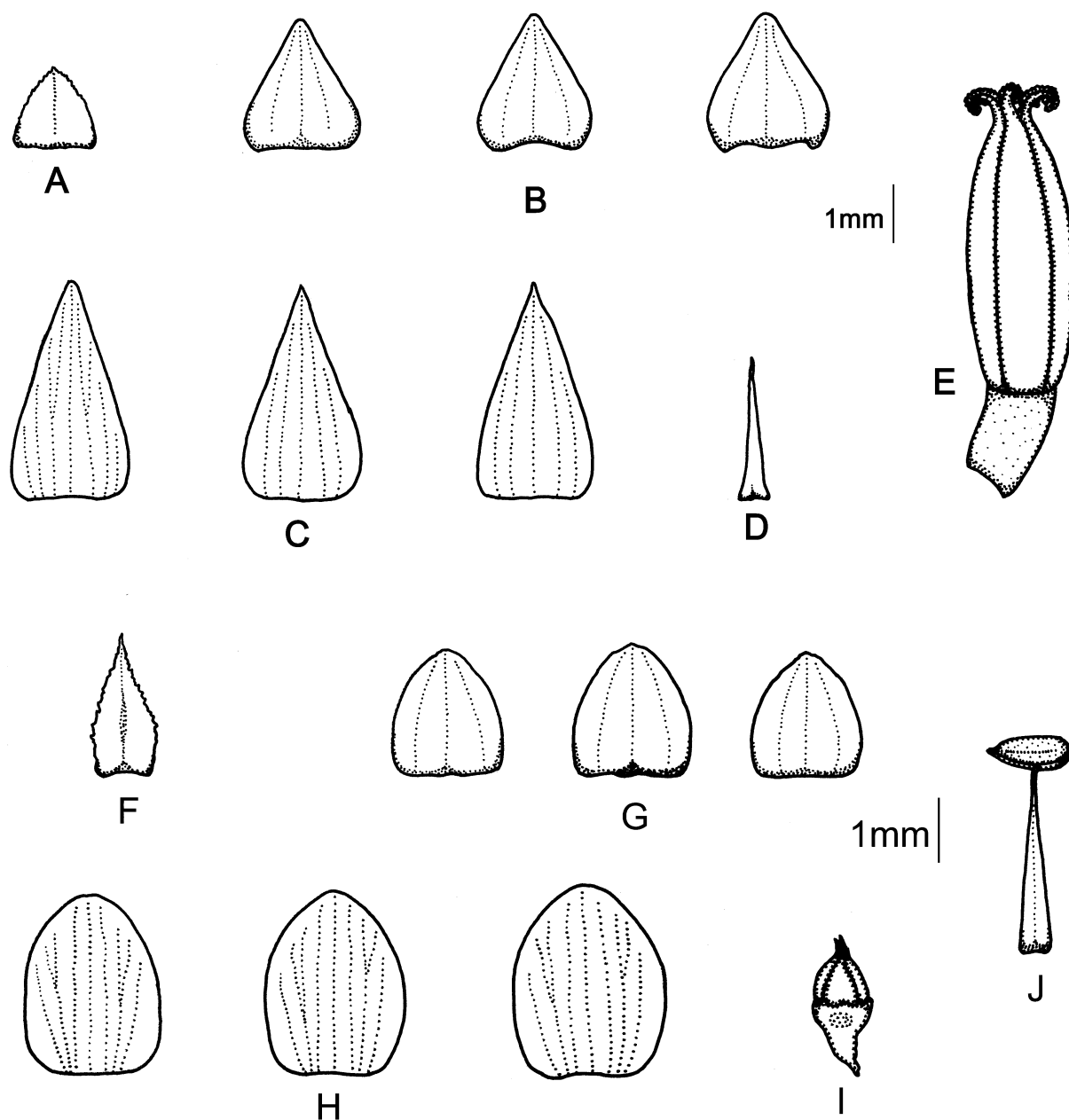


FIGURE 2. Flattened floral parts. Pistillate flower (A–E): A. Floral bract. B. Sepals. C. Petals. D. Staminode. E. Ovary with sessile stigmata. Staminate flowers (F–J). F. Floral bract. G. Sepals. H. Petals. I. Pistillode. J. Filament and anther. Illustrations by Carlos Jiménez.

Plants terrestrial, caespitose, small-sized rosettes for the genus, 35–40(–60) cm diameter, 30–40 cm tall. *Leaves* 12–16 per rosette, forming an open rosette; foliar sheath transversely oblong, 3–3.5 cm long, 3.5–5 cm wide, drying pale brown, glabrous, margins entire; *foliar blades* narrowly triangular, acute, pungent, 22–30 cm long, 2–2.5 cm wide at the base, densely white lepidote abaxially and white-lepidote adaxially, margins spinose, spines 0.4–0.5 mm long, half the size toward the apex, 1.5 cm apart, brown, forming a ca. 90° with the margin. *Staminate inflorescence* an erect, 2-branched panicle, central, emerging from a immature rosette, peduncle 13–30(–39) cm long, 8–9 mm diameter, terete, glabrous, green when fresh, drying dark maroon, internodes 1.7–2 cm long, peduncle bracts narrowly triangular, membranaceous, abruptly acute and long acuminate, 4.2–6.5 long, 1–1.2 cm wide, margins laxly serrate, basally entire, apical portion white lepidote, brownish when dry; rachis 1.5–1.6 m long, pale green, glabrous, straight, secondary branches when present

two at the base of the primary branch, rachis internodes 2–2.5 cm long; 55 branches plus the apical one, these forming ca. 90° angle with the main rachis, some an acute angle, 10–23 cm long, 27–70 flowers each; secondary branches 3–4.5 cm long, 9–13 flowers; primary bracts triangular, acute, short apiculate, 1.5–3 cm long, 5 mm wide, brown, multinerved, apically white lepidote; floral bract ovate, acuminate, minutely serrate, 2.2–2.4 mm long, 1.1–1.3 mm wide, uninervate, basally light green, apically brown, glabrous; flowers ca. 5 mm long, cup-like, fragrant, short pedicellate, pedicel 1.4 mm long, thick; sepals broad-ovate, obtuse, entire, 2.1–2.2 mm long, 1.8–2 mm wide, green, 3-nerved; petals broad-oblong, obtuse, entire, 3–3.1 mm long, 2.3–2.5 mm wide, pale green, fleshy, 7-nerved, some of the secondary nerves bifurcated; filaments 3.6–3.8 mm long; anthers basifixed, ca. 5 mm long; pistillode ovoid, 11 mm long, 1 mm diameter, with three remnant apical stigmata, 2.5 mm long, erect, white. *Pistillate inflorescence* an erect 1-branched panicle, with 2 (3) flowers at the base of each branch, peduncle and peduncle bracts as for the staminate inflorescence; rachis straight, glabrous, green, internodes 1.5–3 cm long; branches 15 plus the apical one, 18–20 cm long, forming an acute angle with the rachis, 34–60 flowers per branch, sometimes the apex of branches do not develop and become abortive, brown; primary bracts triangular, short acuminate, 1.2–1.5 cm long, 4–7 mm wide, brownish, multi-nervate, surpassing the pedicels of basal flowers; floral bract wide triangular, acute, 1–1.4 mm long, 1.4 mm wide, margins minutely serrate, brown, scarious, appressed to the short pedicel, 1-nerved; flowers 5–6 mm long, with petals spreading at anthesis, fragrant, short pedicellate; pedicel thick, 15–17 mm long, 6–7 mm diameter; sepals deltoid, obtuse, 2.2 mm long, 2 mm wide, entire, pale green, 3-nerved, nerves dark green, conspicuous, margins brown, scarious; petals triangular, acute, 3.7–3.8 mm long, 2 mm wide, green, margins very thin, 5-nerved, some branching into two; staminodes very narrowly triangular, acute, 2.2–2.4 mm long, 0.5 mm wide, erect, white; ovary oblongoid, 7 mm long, 2.8 mm diameter, pale rose; stigmatic lobes green, strongly curved. *Fruit* a capsule, light brown when dry, smooth, ovoid to ellipsoid, 6–9 mm long, 3.5–5.8 mm in diameter, sometimes covered by a wax, sepals, petals and staminodes remnant; seeds brown, fusiform, 2.8–5.7 mm long, 0.8–1.2 mm diameter, with a terminal wing at each end, one 0.7–1.7 mm long and the other 0.4–1.2 mm long.

Distribution:—*Hechtia pueblensis* occurs in the southeastern portion of Puebla (Fig. 3), close to the limits of the State of Oaxaca, in the area of the Tehuacan- Cuicatlán Biosphere Reserve, in xerophytic shrubland at elevations above 900 m. The Tehuacán Valley is located in the Sierra Madre del Sur, and it is characterized by mountains that surround the valley in the Rio Papaloapan drainage. It is an area with a warm or warm semi-tropical, dry climate, with moderate rains during the summer. It is located between 17° 39'–18° 53' N and 96° 55'–97° 44' W covering an area of 490.187 ha with elevations ranging from 600 to 2950 m. Median annual temperature varies from 18° to 22°C, depending on the elevation (INEGI, 1981). The importance of the Tehuacán-Cuicatlán Biosphere Reserve lies in the great diversity of its flora. Rzedowski (1973, 1978) defined the area as a Floristic Province, belonging to the Mexican Xerophytic Phytogeographic Region. Smith (1965) suggested that at least one third of the plant species occurring at the Reserve are endemic. At several of its localities, *Hechtia pueblensis* is sympatric with an additional *Hechtia* species (*Hechtia* sp. (Ivón Ramírez et al. 1581, CICY)) near Calipán, a species probably belonging to another group in the genus due to its inflorescences originating from the center of a mature rosette and a growth habit featuring long, thick axillary stolons. This species is also characterized by the pale green-yellowish color of its entire vegetative body.

Etymology:—The epithet refers to the Mexican State of Puebla, an area that houses several *Hechtias* species.

Additional specimens examined:—MEXICO. Puebla: Mpio. Coxcatlán ca. poblado San Rafael, a 3 km al Este en la carretera Coxcatlán-Teotitlán del Camino, 943 m of elevation, 18°10'39"N, 97°07'29" W, colectada originalmente por Ivón Ramírez & Carlos Durán en marzo 2005, florece en cultivo junio del 2006, Ivón M. Ramírez M. & Germán Carnevali 1528a♂ (ENCB, OAX, UC, US); Ivón M. Ramírez M. & Germán Carnevali 1528♀ (G, US); ca. 2 km NNE de Calipán, 0.8 km después del puente de carretera federal 908, camino que atraviesa maizal, sobre barranca, en selva baja caducifolia, 1033 m of elevation, 18°17'22"N, 97°11'37"W, 1 marzo 2005, Ivón M. Ramírez M. & Carlos Durán 1290 (frutos, CICY, MEXU, SEL, XAL,

WU); 2 km después de Calipán, por el camino al poblado Cinco Señores, al NE de Calipán, carretera libre Tehuacán-Oaxaca, 18°18'14"N, 97°09'03"W, 1210 m, *Ivón Ramírez, R. Duno, W. Tezara, G. Castillo & J. Pinzón 1586*, frutos (CICY); Municipio Caltepec, 2 km antes del puente Calapa, km. 81.3 de la autopista Cuacnopalan-Oaxaca, 1200 m of elevation, 18°11'02"N, 97°16'30"W, *A. Espejo, A. R. López-Ferrari, J. Ceja & A. Mendoza R. 6308* (♂CICY, ♂UAMIZ).

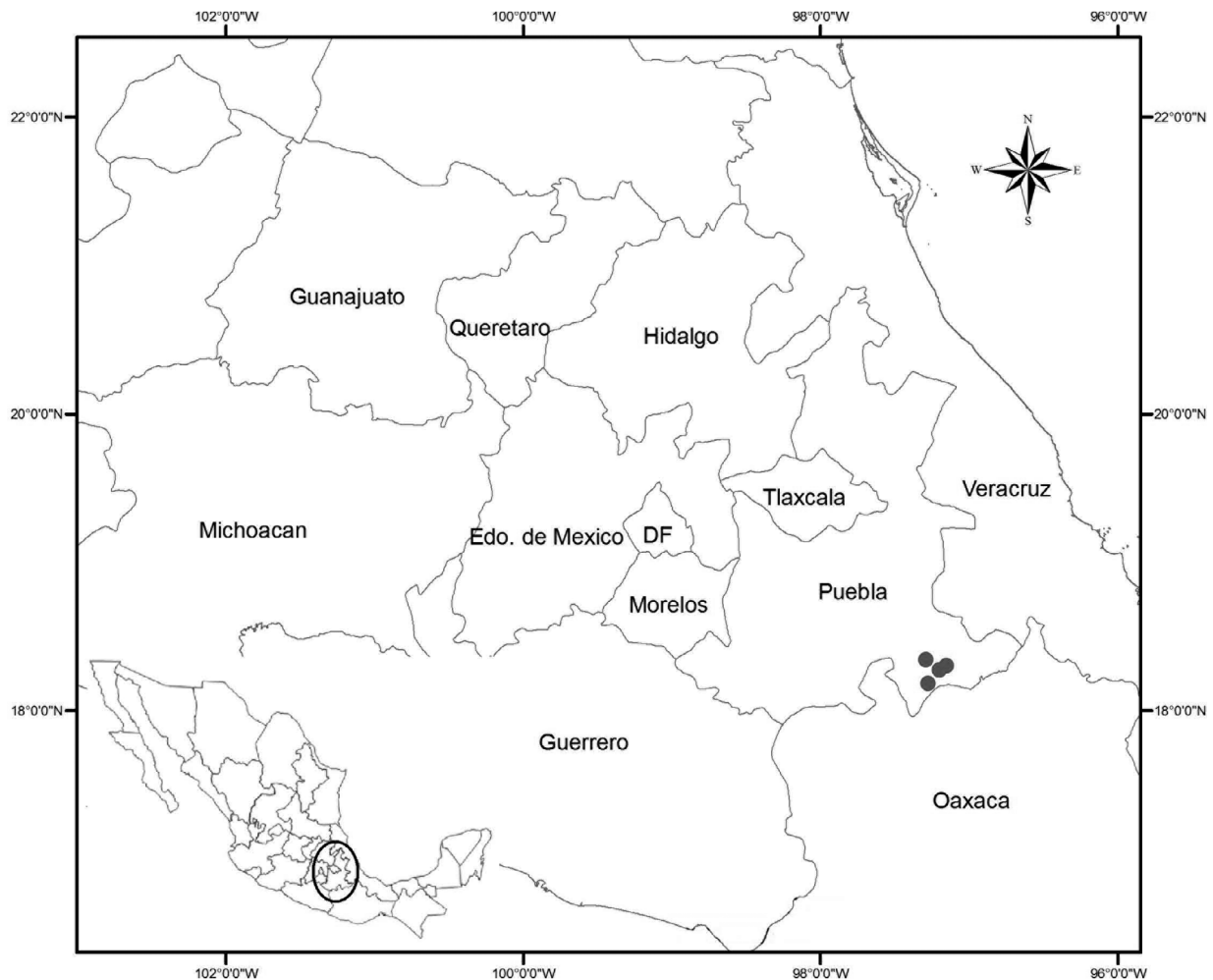


FIGURE 3. Distribution map of *Hechtia pueblensis* in Mexico (black dots).

Discussion:—This species is very distinctive, particularly when compared with other *Hechtia* taxa in the State of Puebla. Relevant features of the species include the relatively small rosette (35–40(–60) cm diameter), thick succulent leaves, which are densely covered with trichomes on both surfaces. Furthermore, the whole vegetative body is silvery gray in natural habitats, often displaying red margins when stressed (Fig. 1A); the leaves become of a distinctive bluish hue in cultivation (Fig. 1B). Petals are mostly greenish in staminate flowers but some clones present pale green flowers; petals in the pistillate flowers are also green, widely opening as to form a star-shaped corolla at anthesis (Fig. 1D). The infructescence is pale brown, which starkly contrasts with the gray color of the rosette (Fig. 1A) in natural habitats. Fruits of the new species are similar to those of *Hechtia tehuacana* from Oaxaca and Puebla, but this species has central inflorescences emerging from a well developed, mature rosette and a large primary bract subtending proportionally short primary branches. Furthermore, the new species, by virtue of its small-sized rosettes, with usually simple panicles, is phenetically similar to such species as *H. lyman-smithii* Burt-Utley & Utley (1987: 37) and *H. fragilis*, both from Oaxaca, the second ranging into Puebla. Characters to differentiate these three phenetically similar species are featured in Table 1.

TABLE 1. Characters to distinguish *Hechtia fragilis*, *H. lyman-smithii* and the new taxon, *H. pueblensis*.

Character/species	<i>H. fragilis</i>	<i>H. lyman-smithii</i>	<i>H. pueblensis</i>
Rosette size (diameter)	22–34 cm	21.5–27 cm	35–40(–60) cm
Leaves texture	brittle	non brittle	non brittle
Inflorescence architecture (♂)	1-branched panicle	1-branched panicle	2-branched panicle
Inflorescence architecture (♀)	1-branched panicle	1-branched panicle	1-branched panicle
Scape, rachis, and primary bracts indument (both sexes)	Lepidote	Glabrous	Apically white lepidote
Primary branch length (♀) and position in anthesis or fruiting	0.8–6.1 cm; forming an acute angle with rachis	(0.5)–2.2–6.3 cm almost forming a right angle with rachis	10–23 cm forming an acute angle with rachis
Floral bract, pedicels and sepal of flowers (♀)	Tomentose-to tomentose-lepidote	Glabrous	Glabrous
Floral bracts length (♂)	2–3.1 mm	0.8–2 mm	2.2–2.4 mm
Floral bracts length (♀)	1.6–4.5 mm	1–2 mm	1–1.4 mm
Petal color	White (both sexes)	White, greenish (♂), greenish to lilac (♀)	Green (both sexes)

Acknowledgments

We are indebted to Francisco Lorea and Carlos Durán from Herbario XAL, and Rodrigo Duno, Gregorio A. Castillo, Juan Pinzón and Wilmer Tezara from herbarium CICY, for the field assistance when collecting in Puebla. We thank the curators of the herbaria B, GH, IEB, MEXU, MICH, MO, OAX, UAMIZ, UC, US, WU, XAL, for sending *Hechtia* material on loan. The senior author is indebted to the Elizabeth Bascom Fellowship and the Missouri Botanical Garden, the DAAD-ANUIES, and Klarff foundation for financial support to study the Bromeliaceae collection at herbaria MO, B, BM, K and OXF. Thanks to Silvia Hernández-Aguilar for handling the herbarium material and loans. To José Luis Tapia for elaborating and maintaining a data base of Mexican Bromeliaceae. We acknowledge Paola Marfil for her help in elaborating the figures. Thanks to Germán Carnevali, Rodrigo Duno, and Lizandro Peraza for comments in a first draft of this paper, and to Gustavo Romero-González and Kanchi N. Gandhi for their assistance in matters of botanical nomenclature.

References

- Burt-Utley, K. & Utley, J.F. (1987) Contributions toward a revision of *Hechtia* (Bromeliaceae). *Brittonia* 39: 37–43.
- Espejo-Serna, A., López-Ferrari, A.R., Ramírez-Morillo, I., Holst, B.K., Luther, H. & Till, W. (2004) Checklist of Mexican Bromeliaceae with notes on species distribution and levels of endemism. *Selbyana* 25: 33–86.
- Espejo-Serna, A., López-Ferrari, A.R., Ramírez Morillo, I. & Martínez-Correa, N. (2007) Dos nuevas especies de *Hechtia* (Bromeliaceae) de México. *Acta Botánica Mexicana* 78: 97–109.
- Givnish, T.J., Millam, K.C., Berry, P.E. & Sytsma, K.J. (2007) Phylogeny, adaptive radiation, and historical biogeography of Bromeliaceae inferred from *ndhF* sequence data. *Aliso* 23: 3–26.
- Givnish, T. J., Barfuss, M. H. J., Van Ee, B., Riina, R., Schulte, K., Horres, R., Gonsiska, P. A., Jabaily, R. S., Crayn, D. M., Smith, J. C., Winter, K., Brown, G. K., Evans, T. M., Holst, B. K., Luther, H., Till, W., Zizka, G., Berry, P. E. & Systema, K. J. (2011) Phylogeny, adaptive radiation, and historical biogeography in Bromeliaceae: insights from an eight-locus plastid phylogeny. *American Journal of Botany* 98: 872–895.
- INEGI (1981) *Carta Topográfica, 1:250,000. Oaxaca. E 14–9*. Instituto Nacional de Estadística, Geografía e Informática (INEGI). México.
- Jiménez, C. (2011) *Sistemática del complejo Hechtia glomerata Zucc.* (Bromeliaceae). Tesis para obtener el grado de Licenciado en Biología. Instituto Tecnológico de Conkal, Yucatán. 157 pp.

- Klotzsch, J.F. (1835) *Hechtia*, eine neue gattung der Bromeliaceen. *Allgemeine Gartenzeitung* 3: 401–403.
- López-Ferrari, A.R., Espejo-Serna, A. & Martínez-Correa, N. (2009) *Hechtia caulescens* (Bromeliaceae), a new species from Central Mexico. *Novon* 19: 197–200.
- Martínez-Correa, N., Espejo-Serna, A., López-Ferrari, A.R. & Ramírez M., I. (2010) Two novelties in *Hechtia* (Bromeliaceae, Hechtioideae) from Mexico. *Systematic Botany* 35: 745–754.
- Mez, C. (1896) Bromeliaceae. In: De Candolle, C. (ed.). *Monographiae Phanerogamarum* 9: 1–990.
- Mez, C. (1901) Bromeliaceae et Lauraceae novae vel adhuc non satis cognitae. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 30 (Beibl. 67): 1–20.
- Robinson, B.L. (1900) New phanerogams, chiefly Gamopetale, from Mexico and Central America. *Proceedings of the American Academy of Arts and Sciences* 35: 323–342.
- Robinson, B.L. (1904) New spermatophytes of Mexico and Central America. *Proceedings of the Boston Society of Natural History* 31: 265–271.
- Rzedowski, J. (1973) Geographical relationships of the flora of Mexican dry regions. In: Graham, A. (ed.). *Vegetation and vegetational history of northern Latin America*. Elsevier. Amsterdam. Pp. 61–71.
- Rzedowski, J. (1978) *Vegetación de México*. Limusa, México, D. F. 432 pp.
- Rzedowski, J. (1991) El endemismo en la flora fanerogámica mexicana: una apreciación analítica preliminar. *Acta Botánica Mexicana* 15: 47–64.
- Smith, L.B. (1937) Studies in the Bromeliaceae-VIII. *Contributions from the Gray Herbarium of Harvard University* 117: 3–33.
- Smith, L.B. (1938) Bromeliaceae. In: Britton, N.L. (ed.). *North American Flora*, 19: 61–128. New York Botanical Garden, Bronx.
- Smith, C.E. (1965) Flora, Tehuacan Valley. *Fieldiana, Botany* 31: 50–100.
- Zuccarini, J.G. (1840) Plantarum cognitarum vel minusmognitarum. *Abhandlungen der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften* 3: 221–251.