A new species of *Polianthes* subgenus *Bravoia* (Asparagaceae, Agavoideae) from Jalisco, Mexico

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Abstract

During recent botanical explorations in western Mexico, otherwise known as the Nueva Galicia region, a new species of *Polianthes* subgenus *Bravoia* was discovered. The new taxon is described and illustrated. It resembles *P. bicolor* and *P. geminiflora* var. *clivicola*, but differs from both by its oblong-obovate and generally prostrate leaves, (3–)4–6(–9) floral nodes, pedicels recurved and 1.1–1.7 cm long in anthesis, perigone tubular, not curved, depressed, and bicolor with imbricate and erect lobes in anthesis, and filaments 1.4–1.6 mm long, inserted in the perigone 1–1.5 mm above ovary tip. Notes on phenology, geographic distribution and habitat of the new species and an identification key to the species of *Polianthes* subgenus *Bravoia* growing in western Mexico are also provided.

Resumen

Exploraciones recientes en el occidente de México, conocido también como región de Nueva Galicia, permitieron descubrir una especie nueva de *Polianthes* subgénero *Bravoia*. El nuevo taxon es descrito e ilustrado. La nueva especie se relaciona con *P. bicolor* y *P. geminiflora* var. *clivicola*, pero difiere de ambos por presentar hojas oblongo-obovadas y generalmente tendidas sobre el sustrato, (3–)4–6(–9) nodos florales, pedicelos de 1.1–1.7 cm de longitud en antesis y recurvados, perigone tubular, no curvado, depreso, bicolor y con lóbulos imbricados y erectos en antesis, y filamentos de 1.4–1.6 mm de longitud, insertos en el perigone 1–1.5 mm por arriba del ápice del ovario. Además, se aportan datos sobre la fenología, distribución geográfica y el hábitat del taxon nuevo, y una clave para la identificación de las especies de *Polianthes* subgénero *Bravoia* que crecen en el occidente de México.

Key words: Atenguillo river, endemism, entomophily, ornithophily, Sierra Verde

Introduction

*Polianthes* Linnaeus (1753: 316) is a genus that comprises 20 species, arranged in two subgenera: *Polianthes* and *Bravoia* (La Llave & Lexarza 1824: 6) Roemer (1847: 245) (Verhoek-Williams 1975, Eguiarte et al. 2000, Solano 2000; Table 1). *Polianthes* subgenus *Polianthes* includes 12 species with geminate flowers, sessile or with pedicels up to 6 mm long. The perigone is erect or curved almost to midportion and then infundibular, with an expanded throat between the curvature of the tube and the base of the lobes, white or pink when mature, with perpendicular or reflexed lobes relative to the perigone tube axis, scented, and pollinated by nocturnal moths. The stamens are inserted 2–3 mm below the perigone lobes. In contrast, *Polianthes* subgenus *Bravoia* includes eight species with geminate flowers, or solitary in *P. howardi* Verhoek-Williams (1976: 365), and with pedicels 1.1–3.5 cm long. The perigone is pendulous, tubular, with perpendicular lobes or extended at the same plane as the perigone axis, usually red, yellow, pink, or exceptionally bicolor greenish orange as in *P. bicolor* Solano & García-Mendoza (1998: 473), scentless, but scented in *P. multicolor* Solano & Dávila (2003: 119), and pollinated by hummingbirds. Lastly, the stamens are inserted below the middle of the perigone tube.
TABLE 1. Diversity and distribution of the genus *Polianthes* (Asparagaceae, Agavoideae) in Mexico. The state abbreviations follow the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT 2013). *Concerning *P. tuberosa*, its origin and natural distribution in Mexico is unknown, but it is widely cultivated in the country and in the tropical and subtropical areas of the world.

<table>
<thead>
<tr>
<th>Species</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. bicolor</em> E.Solano &amp; García-Mend. (Fig. 3F)</td>
<td>Oax</td>
</tr>
<tr>
<td><em>P. cernua</em> Art.Castro, J.G.González &amp; Aarón Rodr. sp. nov. (Fig. 3A–E)</td>
<td>Jal</td>
</tr>
<tr>
<td><em>P. geminiflora</em> (Lex.) Rose var. <em>geminiflora</em> (Fig. 3H)</td>
<td>D.F., Dgo, Gro, Hgo, Jal, Méx, Mich, Mor, Nay, Pue, Qro, Tlax</td>
</tr>
<tr>
<td><em>P. geminiflora</em> var. <em>clivicola</em> McVaugh (Fig. 3G)</td>
<td>Jal, Mich</td>
</tr>
<tr>
<td><em>P. geminiflora</em> var. <em>pueblensis</em> E.Solano &amp; García-Mend.</td>
<td>Pue</td>
</tr>
<tr>
<td><em>P. graminifolia</em> Rose (Fig. 3I)</td>
<td>Ags, Jal, Zac</td>
</tr>
<tr>
<td><em>P. howardii</em> Verh.-Will. (Fig. 3J)</td>
<td>Col, Jal</td>
</tr>
<tr>
<td><em>P. multicolor</em> E.Solano &amp; Dávila (Fig. 3K)</td>
<td>Gto</td>
</tr>
<tr>
<td><em>P. oaxacana</em> Garcia-Mend. &amp; E.Solano</td>
<td>Oax</td>
</tr>
<tr>
<td><em>P. zapopanensis</em> E.Solano &amp; Ríos-Gómez (Fig. 3L–M)</td>
<td>Jal</td>
</tr>
<tr>
<td><em>P. alboaustralis</em> E.Solano &amp; Ríos-Gómez</td>
<td>Oax</td>
</tr>
<tr>
<td><em>P. densiflora</em> (B.L.Rob. &amp; Fernald) Shinners</td>
<td>Chih</td>
</tr>
<tr>
<td><em>P. durangensis</em> Rose</td>
<td>Dgo, Nay</td>
</tr>
<tr>
<td><em>P. elongata</em> Rose</td>
<td>Gro</td>
</tr>
<tr>
<td><em>P. longiflora</em> Rose</td>
<td>Jal, Mich</td>
</tr>
<tr>
<td><em>P. montana</em> Rose</td>
<td>Jal, Nay</td>
</tr>
<tr>
<td><em>P. nelsonii</em> Rose</td>
<td>Ags, Chih, Dgo</td>
</tr>
<tr>
<td><em>P. palustris</em> Rose</td>
<td>Nay</td>
</tr>
<tr>
<td><em>P. platyphylla</em> Rose</td>
<td>Jal, Nay, Zac</td>
</tr>
<tr>
<td><em>P. pringlei</em> Rose</td>
<td>Ags, Gto, Jal, Mich, Zac</td>
</tr>
<tr>
<td><em>P. sessiliflora</em> (Hems.) Rose</td>
<td>Ags, Dgo, Jal, Nay, SL, Zac</td>
</tr>
</tbody>
</table>

The phylogenetic position of *Polianthes* has been addressed several times. However, contradictions between the different results prevent generating a single and unified hypothesis. The phylogenetic analysis by Bogler & Simpson (1996), based on ITS sequences, showed that *Manfreda* Salisbury (1866: 78), *Polianthes* and *Prochnyanthes* Watson (1887: 457) constitute a clade apart from *Agave* Linnaeus (1753: 323). Meanwhile, Rocha et al. (2006) generated a phylogenetic tree based on previous works (Alvarez de Zayas 1987, Hernández 1995, Bogler et al. 1995, 2006, Eguiarte et al. 2000), and stressed that the basic relationships among the main groups are congruent in the majority of the studies. These authors admitted the difficulty of solving the relationships within *Agave* s.l. (including *Agave* s.s., *Manfreda*, *Polianthes*, and *Prochnyanthes*), arguing little variation in the considered molecular markers. Given the recent origin of many species in *Agave* s.l., the phylogenetic relationship among them may be hard to solve because of either insufficient time for lineage sorting or hybridization and introgression. In contrast, Thiede & Eggli (1999) merged *Manfreda*, *Polianthes* and *Prochnyanthes* within *Agave*, after collating the results of several analyses based on both morphological and molecular evidence.

The genetic and morphological differentiation within the *Manfreda-Polianthes-Prochnyanthes* alliance is not easy to assess. Good-Ávila et al. (2006) and Rocha et al. (2006) suggested that the group had a recent origin (10–2 MYA) and high diversification rates (0.32–0.51 net speciation events per MYA). However, the diversification rates did not parallel with complete genetic differentiation among the taxa. In addition, Good-Ávila et al. (2006) and Rocha et al. (2006) argued that diversification rates were higher early in the evolution of *Agave* s.l. and associated with the North American desertification, about 15 MYA. The process was coupled with an intense volcanic activity that produced a complex topography, environmental heterogeneity, and a number of diverse ecological niches.
In face to the uncertainties and contradictions of phylogenetic results, some authors prefer to retain the traditional classification (García-Mendoza et al. 2000; Solano & Dávila-Aranda 2003; Hernández-Sandoval et al. 2006; García-Mendoza & Solano 2007; Rodríguez 2009; García-Mendoza 2011; Solano & Ríos-Gómez 2011, 2014). These authors are reluctant to accept a wider Agave circumscription, as proposed by Thiede & Egli (1999), until taxon sampling is expanded and more informative characters are employed to obtain a robust unified phylogeny. Hence, we provisionally recognize Polianthes as a genus distinct from Agave, for the purpose of the present study.
Polianthes is restricted to Mexico, but *P. tuberosa* Linnaeus (1753: 316) is widely cultivated (Table 1). The geographic distribution of the genus extends from northern (Chihuahua and Tamaulipas) to southern Mexico (Oaxaca). Fourteen taxa are endemic to one or two Mexican states, while 15 species are restricted to north-western Mexico. In this territory, *Polianthes* is commonly known as “amole”, “azucena”, “nardo”, and “omixochitl” (from the words “omitl”, bone, and “xochitl”, flower, a name that in Spanish is translated as “flor de hueso”; Emmart-Trueblood 1973).

The Nueva Galicia region (McVaugh 1961, Rzedowski & McVaugh 1966) is highly rich in *Polianthes*. It harbours 11 species (McVaugh 1989; Table 1, Fig. 1). In recent field explorations, focused on collecting *Polianthes*, we detected some populations that did not match any known species. Hence, it is proposed as a new taxon. Illustrations and photographs for the new species are included. In addition, an identification key to *Polianthes* subgenus *Bravoa* in Nueva Galicia is provided.

### Description of the new species

**Polianthes cernua** Art.Castro, J.G.González & Aarón Rodr. sp. nov. (Figs. 2, 3)

Species *P. bicolori* et *P. geminiflorae* var. clivicolae affine sed foliis oblongo-obovatis et plerumque prostratis, nodis floralibus (3–)4–6(–9), pedicellis per anthesin 1.1–1.7 cm longis et recurvatis, perigonii tubularibus, nullo modo curvatis, depressis et bicoloribus, perigoniorum lobis per anthesin imbricatis et rectis, et filamentis 1.4–1.6 mm longis ad 1–1.5 mm insertis supra ovaris apicem differt.

**Type:**—MEXICO. Jalisco: Mixtlán, 5 Km NE de Mixtlán, alrededores del puente Los Tablones de la carretera Ameca-Mascota, brecha a Macuchi, 1918 m, 20º22’8’’N, 104º35’ 58’’ W, 2 August 2011 (fl, fr), A. Castro-Castro, J.G. González-Gallegos, M. Harker & E.A. Suárez-Muro 2495 (holotype IBUG!, isotypes IEB!, MEXU!).

Perennial herb. Corm oblong 0.6–1.9 × 1.1–1.5 cm, with growth buds and thickened contractile and fleshy roots. Bulb ovoid, 2–2.6 × 1.5–1.9 cm, covered by the persistent leaf bases. Leaves (2–)3(–4) in a basal rosette, sometimes with an additional one attached a few cm above the peduncle base, prostrate or slightly elevated from the surface; alternate, oblong-obovate, (6–)8–12 × 0.6–2.2(–4.5) cm, widest at the middle and tapering somewhat abruptly at both ends, semi-succulent, shiny when fresh, acute, margin entire, hyaline, upper and lower surface glabrous. Inflorescence racemose, 45–80 cm long, internodes decreasing in size towards the apex, with (3–)4–6(–10) floral nodes; scape bracts 2–3, primary sterile bract linear-lanceolate, 2.5–4.4 cm × 0.4–0.5 cm, apex acute, base truncate, margin smooth, primary floral bracts lanceolate to triangular, 0.6–1.5 × 0.2–0.3 cm, apex acute, base truncate, margin smooth, becoming scarious. Bracteoles enisiform, 0.2–3 × 0.1–2 mm, entire, acute, truncate. Pedicels 1.1–1.7 cm during anthesis, 1.5–2 cm in fruit, strongly recurved. Flowers geminate, 2–2.5 × 0.3–0.6 cm, bicolor, succulent, odourless; perigone tube 1.6–1.9 × 0.4–0.6 cm at the base of the lobes, tubular, not curved, the first 2/3 orange, the last third and the lobes yellowish green. Lobes broadly ovate, almost equal, 2–4 × 2.5–3 mm, margin hyaline, apex truncate in the internal series to obtuse in the external one and with a tuft of white hairs at the tips, both erect and imbricate. Stamens included, filaments yellow, filiform, 1.4–1.6 cm long from their insertion into the perigone tube, inserted 1–1.5 mm above the ovary apex; anthers linear, 4.5–5 × 1–2 mm, green, in anthesis on the upper portion of the mouth of the tube. Ovary 4.5–5 × 2.5–3 mm; style filiform, 1.6–2 cm, greenish orange, exserted from the tube 2–3 mm in anthesis; stigma triglobed, papillose. Fruit a loculicidal capsule, 0.8–2 × 0.7–1.1 cm, globose to oblong, crowned by the remains of the perigone. Seeds ovate-depressed, 4–6 × 3–5 mm, flat, black to dark brown, opaque (Figs. 2, 3).

**Etymology:**—The specific epithet refers to its pendulous flowers; this feature is characteristic of other species of *Polianthes* subgenus *Bravoa*, but is very noticeable in *P. cernua*.

**Distribution, habitat and phenology:**—*Polianthes cernua* grows in the upper basin of the Atenguillo River, in western Jalisco. It is endemic to a mountain system known as Sierra Verde, in the municipalities of Atengo and Mixtlán, Jalisco, Mexico (Fig. 1). It inhabits open *Quercus* L., *Juniperus* L., and *Pinus* L. forests. *Polianthes cernua* is associated with *Ageratina* Spach sp., *Cosmos intercedens* Sherff, *C. sessilis* Sherff, *Dahlia pugana* Aarón Rodr. & Art. Castro, *Juniperus flaccida* Schltdl., *Pinus lumholtzii* B.L.Rob. & Fernald, *P. oocarpa* Schiede ex Schltdl., *Prochnyanthes mexicana* (Zucc.) Rose, *Quercus castanea* Née, *Q. resinosa* Liebm., *Salvia pugana* J.G.González & Art.Castro, *Tagridia dukesii* S.Watson, and *Verbesina* L. sp. The plants are found in areas with deep and acid soils at 1700–2120 m elevation. They flower in early August and fruit in September. During numerous fieldwork trips, we noticed hummingbirds visiting *P. cernua*.  

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*POLIANTHES SUBGENUS BRAVOA* Phytotaxa 201 (2) © 2015 Magnolia Press • 143
Additional specimens examined (paratypes):—MEXICO. Jalisco: Atengo, Sierra Verde, km 18.5 de la brecha Los Tablones-Soyatlán del Oro-Tenamaxtlán, 2110 m, 20°25′17.8″N, 104°18′8.1″W, 5 August 2013 (fl, fr), A. Castro-Castro, J.G. González-Gallegos & J.L. Villa-Vázquez 3269 (IBUG!). Mixtlán, km 48 carr. Méx. 70 entre Ameca y Mixtlán, puente Los Tablones, 1719 m, 20°27′44.7″N, 104°22′45.7″W, 5 August 2011 (fl, fr), A. Rodríguez, A. Castro-Castro & M.A. García-Martínez 6722 (ENCB!, IBUG!, IEB!, MEXU!); km 47–48 carr. Méx. 70 entre Ameca y Mascota, puente Los Tablones, 1704 m, 20°27′44.8″N, 104°22′45.5″W, 17 August 2012 (fl, fr), A. Rodríguez et al. 6727 (IBUG!, IEB!, MEXU!); km 6 de la brecha Los Tablones-Soyatlán del Oro, Sierra Verde, 1918 m, 20°27′1.3″N, 104°21′44″W, 5 August 2013 (fl, fr), A. Castro-Castro, J.G. González-Gallegos & J.L. Villa-Vázquez 3260 (IBUG!, IEB!, MEXU!); Sierra Verde, km 17 de la brecha Los Tablones-Soyatlán del Oro, rumbo a Tenamaxtlán, 2052 m, 20°24′26.3″N, 104°18′41.1″W, 5 August 2013 (fl, fr), A. Castro-Castro, J.G. González-Gallegos & J.L. Villa-Vázquez 3263 (IBUG!, IEB!, MEXU!); puente Los Tablones, km 47–48 carretera Méx. 70 entre Ameca y Mixtlán, 1705 m, 20°27′50″N, 104°22′38.8″W, 29 July 2014 (fl), A. Rodríguez & A. Castro-Castro 7138 (IBUG!, IEB!, MEXU!).


Taxonomic relationships:—Morphologically, Polianthes cernua falls within P. subgenus Bravoa. It has scentless and geminate flowers at the nodes and the filaments inserted below midportion of the perigone tube. It is characterized by a combination of character-states including: oblong-obovate and generally prostrate leaves, (3–)4–6(–10) floral nodes, pedicels 1.1–1.7 cm long during anthesis and recurved, perigone tubular, not curved, depressed, and bicolor with imbricate and erect lobes in anthesis and filaments 1.4–1.6 mm long, inserted 1–1.5 mm above ovary tip (Figs. 2, 3). Polianthes cernua shares morphological similarities with P. bicolor and P. geminiflora var. clivicola McVaugh (1989: 252). Both P. cernua and P. bicolor have bicolor flowers, and P. cernua and P. geminiflora var. clivicola produce depressed flowers. Their differences are highlighted in Table 2.
<table>
<thead>
<tr>
<th>Character</th>
<th>P. cernua</th>
<th>P. bicolor</th>
<th>P. geminiflora var. clivicola</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves number, shape, size, and consistence</td>
<td>(2–)3(–4); oblong-obovate, widest at the middle and tapering somewhat abruptly to both ends, prostrate or slightly elevated from the ground, (6–)8–12 × 0.6–2.2(–3.9) cm, semi-succulent</td>
<td>(3–)4(–6)(–12); lanceolate, ondulate, erect, (5–)8–15 × 0.6–1.0(–1.4) cm, semi-succulent</td>
<td>3–9; linear or slight widest at the middle and tapering gradually or somewhat abruptly to both ends, erect, (12–)25–30(–48) × (0.4–)1.5–2.5(–3.7) cm, chartaceous and soft</td>
</tr>
<tr>
<td>Inflorescence length (cm)</td>
<td>45–80</td>
<td>24–40(–55)</td>
<td>(24–)45–100(–150)</td>
</tr>
<tr>
<td>Number of floral nodes</td>
<td>(3–)4(–6)(–10)</td>
<td>3–5(–9)</td>
<td>(3–)6–20</td>
</tr>
<tr>
<td>Pedicel length and orientation</td>
<td>1.1–1.7 cm during anthesis, 1.5–2 cm in fruit, recurved (Fig. 3A-E)</td>
<td>0.6–1.3 cm during anthesis, 0.8–1.6(–2.3) cm in fruit, erect (Fig. 3F)</td>
<td>0.4–0.8(–1.1) cm during anthesis, 1.0–1.8(–3.5) cm in fruit, recurved (Fig. 3G)</td>
</tr>
<tr>
<td>Perigone size (width taken at the base of lobes, form, and colour)</td>
<td>1.6–1.9 × 0.4–0.6 cm; tubular, not curved; bicolor, the first two thirds orange, the last third and the lobes yellowish green (Fig. 3A-E)</td>
<td>(2–)2.3–2.9 × (1.6–)2.4–3(–5.5) cm; perigone-tube funnel-shaped, abruptly broadened near the base, basal portion erect and abruptly curved outward just above the ovary; bicolor, orange-greenish and the lobes green (Fig. 3F)</td>
<td>(1.4–)2.3 × (1.6–)2.4–3(–5.5) cm; perigone-tube tubular, slender and terete proximally, and slightly dilated in anthesis from near or below the middle to the base of the lobes; concolor pale red (Fig. 3G)</td>
</tr>
<tr>
<td>Flower orientation during anthesis</td>
<td>depressed</td>
<td>divergent to diffuse</td>
<td>divergent to depressed</td>
</tr>
<tr>
<td>Bracteole position</td>
<td>basal</td>
<td>most frequently inserted at middle portion of the pedicel, rarely basal</td>
<td>basal</td>
</tr>
<tr>
<td>Lobe size and orientation</td>
<td>2–4 × 2.5–3 mm; erect and imbricate (Fig. 3A-E)</td>
<td>2–(4) mm × (1.7–)2–3(–5) mm; free and extended or reflexed (Fig. 3F)</td>
<td>3–5 mm × 1.5–3 mm; free and extended (Fig. 3G)</td>
</tr>
<tr>
<td>Filament length and insertion</td>
<td>1.4–1.6 mm long; inserted 1–1.5 mm above ovary tip</td>
<td>1.8–2.8 cm long; inserted 1.1–1.8 mm above ovary tip</td>
<td>1–1.5 cm long; inserted 1.7–5 mm above ovary tip</td>
</tr>
<tr>
<td>Style length</td>
<td>1.6–2 cm</td>
<td>1.9–2.6 cm long</td>
<td>1.9–2.5 cm long</td>
</tr>
<tr>
<td>Fruit</td>
<td>globose to oblong; 0.8–1.5 × 0.7–1.1 cm</td>
<td>globose; 1.1–1.3 × 1–1.1 cm</td>
<td>short-oblong to globose; 0.7–1.0 × 0.7–0.8 cm</td>
</tr>
<tr>
<td>Distribution in Mexico</td>
<td>western Jalisco</td>
<td>Oaxaca</td>
<td>eastern Jalisco and western Michoacán</td>
</tr>
<tr>
<td>Elevation range (m a.s.l.)</td>
<td>1700–2120</td>
<td>2300–2500</td>
<td>1250–2560</td>
</tr>
</tbody>
</table>
Key to the species of Polianthes subgenus Bravoa in Nueva Galicia, Mexico

1. Pedicels 0.3–1.5 cm long; perigone funnel-shaped and abruptly curved just above the ovary, almost white, white-pinkish, pink to orange-yellowish, fragrant, lobes perpendicular to perigone axis ................................................................. P. multicolor
   - Pedicels 1.5–5.5 cm long; perigone tubular or funnel-shaped and slightly curved just above the ovary, concolorous (red, pink, or yellow) or bicolor (tube red, orange, or pink with lobes greenish), odourless, lobes parallel to perigone axis .................................................... 2
2. Flowers solitary at the nodes; lobes epinastic ........................................................................................................ P. howardii
   - Flowers paired at the nodes; lobes homomorphous ............................................................................................. 3
3. Leaves (abaxially) pectinately hispidulous on nerves and margins with thick erect blunt gland-tipped hairs 0.1–0.2 mm long; exposed portions of sheaths, and to a lesser extent the lower stem, similarly pubescent ..................................................... P. graminifolia
   - Leaves (as well as the rest of the plant) glabrous, at most with marginal papillae, or scattered papillae along the nerves ......4
4. Perigone tubular not curved ........................................................................................................................................ 5
   - Perigone funnel-shaped, slightly curved just above the ovary ............................................................................ 6
5. Leaves oblong-obovate, prostrate or slightly elevated from the ground, (6–)8–12 cm × 0.6–2.2(–4.5) cm, semi-succulent; per igone bicolor (tube orange and lobes greenish); imbricate and erect lobes in anthesis; stigma exerted the length of the lobes or more ....... P. cernua
   - Leaves linear, erect, (12–)25–30(–48) cm × (0.4–)1.5–2.5(–3.7) cm, chartaceous; perigone concolor, red; extended and free lobes in anthesis; stigma included (occasionally slightly exserted, but no more than half the length of the lobes) .................................................. P. geminiflora var. clivicola
6. Leaves in a basal rosette at flowering time; inflorescence axis without branching .............................................. P. geminiflora var. geminiflora
   - Leaves not grouped in a basal rosette at flowering time; inflorescence axis generally branching ..................... P. zapapanensis

Acknowledgments

We are grateful to the Consejo Nacional de Ciencia y Tecnología (CONACyT) for the research grant # 80200 and doctoral scholarships to the first author. The Universidad de Guadalajara offered financial aid to ACC. Thanks to the Idea Wild organization for the equipment provided to ACC. Likewise, we thank the curators and staff of the following herbaria: CIIDIR, CIMI, CREG, GUADA, IBUG, IEB, MEXU, XAL and ZEA. We appreciate the suggestions made to the document by Lorenzo Peruzzi, Sue Templeton and two anonymous reviewers. This study depended greatly upon the generosity of Guadalupe Munguia Lino, Mollie Harker, Esteban A. Suárez-Muro, José Luis Villa-Vázquez, Miguel A. García-Martínez, Pablo Carrillo-Reyes and Ricardo Guerrero-Hernández. Thanks to Eloy Solano and Pablo Carrillo Reyes for providing us with information and photographs. We thank Guadalupe Munguia Lino and Josué Ortiz Catedral, who elaborated figures 1 and 2, respectively.

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