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Prosthechea tinukiana sp. nov. (Orchidaceae: Laeliinae): an update of the *Prosthechea prismatocarpa* complex

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Abstract: We describe and illustrate a new species of *Prosthechea* from Costa Rica. The species is similar to *Prosthechea ionocentra*, but it is easily distinguishable by its inflorescence originating from the penultimate mature pseudobulb; its purple spotted sepals and petals; the cordate, acute labellum; the disc with two longer, narrower keels; the stigmatic arms of the column, which are convergent and rounded; and the narrower stigma. Differences from other related species are given and discussed. Data on distribution, habitat and ecology, etymology, and phenology are provided. An updated key to the species of the *Prosthechea prismatocarpa* complex is presented.

Key words: Costa Rica, Cerro Tinuk, *Panarica*, paramo, new species, Talamanca, taxonomy

1. Introduction

Prosthechea Knowles & Westc. comprises 24 species in Costa Rica and about 100 species ranging from Florida southward through Central America and the Antilles down to Argentina (Higgins, 2003; Withner and Harding, 2004; Mó et al., 2014). The genus was resurrected by Higgins (1998), who proposed a broad concept of *Prosthechea*, segregating it from the well-known genus *Encyclia* Hook. to embrace species variously treated at some point under the generic concepts of *Anacheilium* Rchb.f. ex Hoffmanns., *Coelogyne* Lindl., *Epidendrum* L., *Epithecia* Knowles & Westc., *Hormidium* Lindl. ex Heynh., and *Microstylis* (Nutt.) Eaton (Pupulin, 2004).

In their treatment of *Prosthechea*, Withner and Harding (2004) proposed a separate genus with the name *Panarica* Withner & Harding for the species belonging to the *Prosthechea prismatocarpa* (Rchb.f.) W.E.Higgins complex. They based their characterization mainly on Pupulin (2002), who recognized the *P. prismatocarpa* complex by the pyriform, 2- to rarely 3-leaved pseudobulbs; the showy flowers produced on long, erect inflorescences; the usually 3-lobed lip (entire in *P. brassavolae* (Rchb.f.) W.E.Higgins) with the median lobe larger than the lateral lobes, acute to attenuate; and the column provided with large lateral teeth with a deep sinus and a median fimbriate tooth. With the exception of *P. brassavolae*, ranging from Oaxaca and Veracruz in Mexico to western Panama and its closely

allied *P. mulasii* Soto Arenas & L.Cerv., from Guerrero, Mexico, the group is restricted to Costa Rica and western Panama.

Panarica, as most other segregates of *Prosthechea*, has received little support as a distinct genus (Higgins, 2005; Pupulin and Karremans, 2007; Higgins, 2008; Karremans, 2009; Mó et al., 2014). Nonetheless, the species of the *P. prismatocarpa* complex form a natural and easily recognized group to which the species here described can be added.

2. Materials and methods

This study was performed at the Lankester Botanical Garden (JBL), University of Costa Rica, and Cerro Tinuk at the Cordillera de Talamanca (9°17'29.1"N, 83°10'11.2"W). Living specimens were gathered, cultivated, and documented at JBL between 2012 and 2014. Georeferences for specimens were obtained using a Garmin eTrex Vista GPS, Google Earth Pro 6.1.0, and field observations. Ecological zones were estimated by using the Holdridge Life Zone System (Holdridge, 1967, 1987) and the ecological map of Costa Rica (Bolaños et al., 2005). Phenology data were recorded both in the field and for cultivated specimens. Individual plants were photographed, illustrated, and preserved as herbarium specimens and spirit specimens in formaldehyde: acetic acid: ethanol [FAA (53% ethanol, 37% water,

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5% formaldehyde, and 5% glycerol)] (only including flowers) for future reference. Whenever possible, the herbarium specimens were complemented with sketches, photographs, and FAA material. The material preserved in FAA was deposited at JBL. Sketches and images were prepared from living specimens with a Leica MZ9.5 stereomicroscope with drawing tube, Nikon D5100 digital camera with AF-S VR Micro-NIKKOR 105mm f/2.8G IF-ED lens, and Epson Perfection Photo Scanner V600. Composite plates were diagrammed in Adobe Photoshop.

Ink drawings were prepared on smooth Fabriano paper of 240 g/m² with a Rotring Rapidograph 0.1 mm using black capillary cartridges and traced in Artograph LightPad A920. Descriptions were prepared both from living specimens and data taken in the field.

3. Results

3.1. Taxonomic treatment

Prosthechea tinukiana Bogarín & Karremans, sp. nov.
(Figures 1–5)

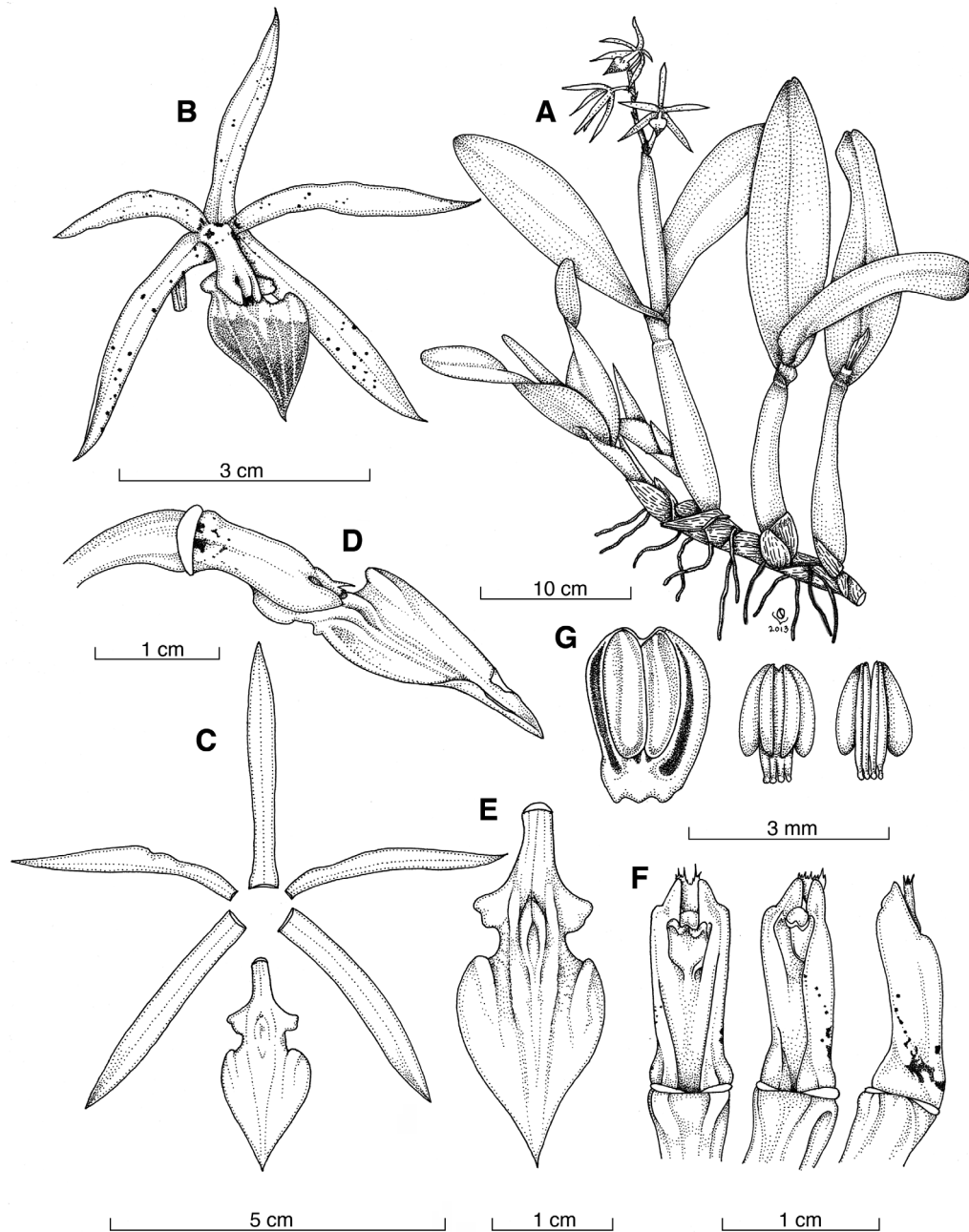


Figure 1. *Prosthechea tinukiana*. A- Habit. B- Flower. C- Perianth, flattened. D- Column and lip, side view. E- Lip. F- Column, front and side views. G- Pollinarium and anther cap. Drawn from the holotype by L. Oses.

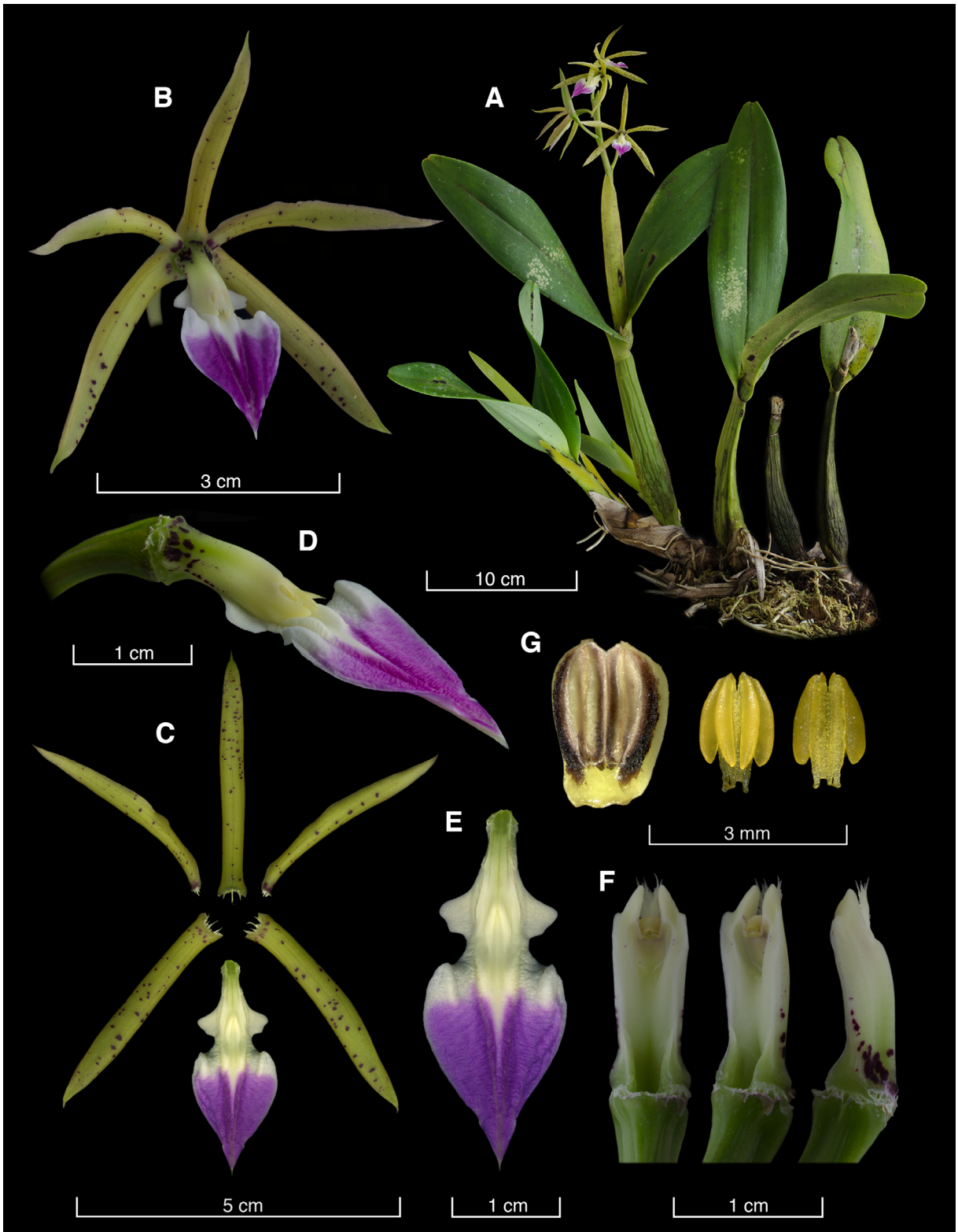


Figure 2. Lankester composite dissection plate (LCDP) of *Prosthechea tinukiana*. A- Habit. B- Flower. C- Perianth, flattened. D- Column and lip, side view. E- Lip. F- Column, front and side views. G- Pollinarium and anther cap. Photographs and scans from the holotype by D. Bogarín.

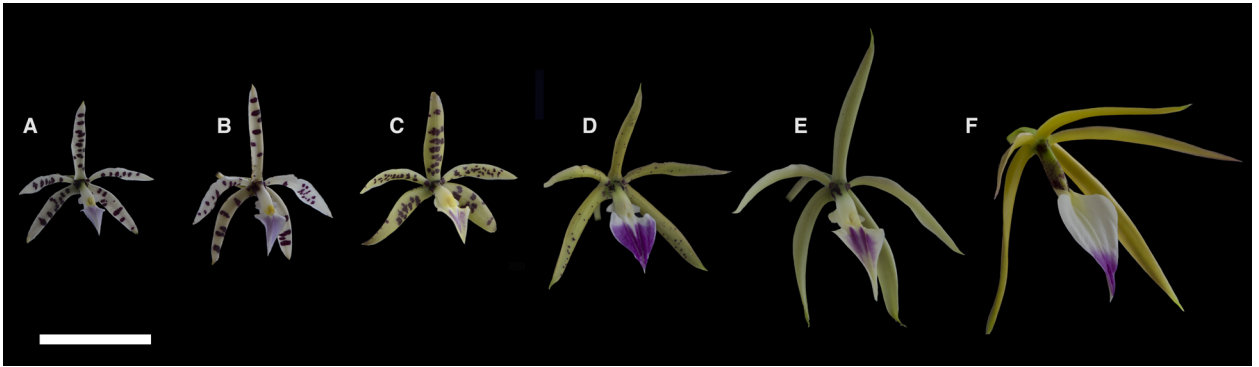


Figure 3. Comparison of flowers among the Costa Rican species of the *P. prismatocarpa* complex. A- *P. neglecta* (G. Villalobos s.n.). B- *P. prismatocarpa* (Z. Serracín s.n.). C- *P. tardiflora* (J.J. Zúñiga s.n.). D- *P. tinukiana* (D. Bogarín 9723). E- *P. ionocentra* (D. Bogarín 5213). F- *P. brassavolae* (JBL-03512). Scale bar = 3 cm.

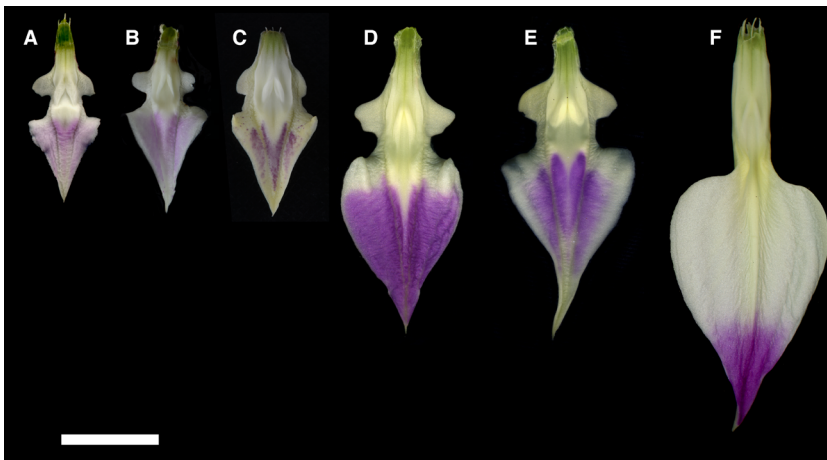


Figure 4. Comparison of labella among the Costa Rican species of the *P. prismatocarpa* complex. A- *P. neglecta* (G. Villalobos s.n.). B- *P. prismatocarpa* (Z. Serracín s.n.). C- *P. tardiflora* (J.J. Zúñiga s.n.). D- *P. tinukiana* (D. Bogarín 9723). E- *P. ionocentra* (D. Bogarín 5213). F- *P. brassavolae* (JBL-03512). Scale bar = 1 cm.



Figure 5. Comparison of the ventral view of the column among the Costa Rican species of the *P. prismatocarpa* complex. A- *P. neglecta* (G. Villalobos s.n.). B- *P. prismatocarpa* (Z. Serracín s.n.). C- *P. tardiflora* (J.J. Zúñiga s.n.). D- *P. tinukiana* (D. Bogarín 9723). E- *P. ionocentra* (D. Bogarín 5213). F- *P. brassavolae* (JBL-03512). Scale bar = 1 cm.

Type: Costa Rica, Puntarenas: Buenos Aires, Buenos Aires, Olán, cumbre del Cerro Tinuk, 9°17'29.1"N, 83°10'11.2"W, 2412 m, bosque pluvial premontano, terrestre en bosque de páramo, 25.06.2012, D. Bogarín 9723, E. Herrera, D. Jiménez, A.P. Karremans & V.H. Zúñiga (holotype, JBL; isotypes, CR, USJ).

Diagnosis: The species is similar to *Prosthechea ionocentra* (Rchb.f.) W.E.Higgins; it differs mainly in the inflorescence always developed from the penultimate mature pseudobulb; the purple spotted sepals and petals; the cordate and acute labellum; the disc with two longer, narrower keels; the convergent, rounded stigmatic arms of the column; and the narrower stigma.

Description: Plant lithophytic or terrestrial, up to 40 cm tall, forming large groups of individuals, with elongate rhizome covered by papyraceous, brown bracts; the internodes to 4 cm long. Roots flexuous, glabrous, to 3 mm in diameter. Pseudobulbs pyriform, ovoid, laterally complanate, elongate, to 13.5–15.0 × 3.3–3.4 cm, 2-foliate at apex. Leaves separated by an internode to 2 cm long, oblong-elliptic, coriaceous, conduplicate, acute, retuse, narrowed to a conduplicate; subsessile, 18.8–20.0 × 5.0–6.2 cm. Inflorescence terminal, racemose, emerging from a papery spathe to 11.2 cm long, developed from the apex of the penultimate mature pseudobulb, to 17 cm long including the peduncle, rachis 6 cm long, many-flowered (up to 9 flowers). Ovary prismatic, pedicellate, about 2.2 cm long including the pedicel. Flowers relatively large, to 7.5 cm in diameter, showy, with sepals and petals free, spreading, the margins reflexed, yellowish, finely spotted with dark purple, the lip basally white, with a rose-purple stain from the middle to the apex. Dorsal sepal oblong-elliptic, acute to acuminate, 3.8 × 0.4 cm. Lateral sepals oblong-elliptic, acute, subcarinate, 3.6 × 0.6 cm. Petals basally subfalcate, narrowly lanceolate, acute, 3.4 × 0.4 cm. Lip 3-lobed, shortly clawed, basally adnate to the column, 3.2 × 1.3 cm, the lateral lobes oblique, truncate, slightly reflexed; the midlobe cordate, concave, acute; disc with a callus formed by 2 fleshy keels converging near the middle and diverging at apex. Column stout, semiterete, 1.4 × 0.5 cm, with a pair of fleshy, lateral teeth, and a central, erose lobe above the anther. Anther incumbent, operculate, subspherical, 4-celled. Stigma ventral, cordate. Pollinia 4, waxy, fusiform, with linear caudicles.

Distribution: Known only from the type locality on Cerro Tinuk in the Cordillera de Talamanca, Costa Rica.

Etymology: Named after Cerro Tinuk where the only known populations of this species were observed. Tinuk is probably an indigenous word, but we were unable to find its meaning.

Ecology: Cerro Tinuk is located in front of the paramo of Cerros Utyum in the Cordillera de Talamanca. The slopes of the hill are covered by primary oak forest.

At the summit and above the continuous timberline, there is a small plateau of isolated dwarf vegetation. Some common species on the top are shrubs of *Budlejja nitida* (Loganiaceae), *Pernettya* sp., *Satyria* sp., and *Vaccinium* spp. (Ericaceae), and herbs of *Alchemilla* spp. (Rosaceae), *Castilleja* sp. (Schrophulariaceae), *Cortaderia* sp. (Poaceae), *Fuchsia* spp. (Onagraceae), *Gamochaeta* sp. (Asteraceae), *Hypericum* spp. (Clusiaceae), *Lycopodium* sp. (Lycopodiaceae), *Maianthemum gigas* (Convallariaceae), and *Nertera granadensis* (Rubiaceae) and lichens among others. Interestingly, the paramo of Cerro Tinuk is located at a lower elevation (2458 m) with respect to most of the other paramos of Costa Rica, which lie mostly above 3000 m in elevation. Climatic characteristics and vegetation of this plateau have not been studied previously. We think that the origin of the dwarf vegetation at the summit of the hill is due to the influence of the eastern trade winds of the Caribbean, which pass the summit of Cerro Utyum and collide frontally with the summit of Cerro Tinuk. The location is exposed and very windy. The few isolated trees are bent by the action of strong winds. Plants of *P. tinukiana* are growing terrestrially, forming groups of several plants among the coarse vegetation on the summit of the hill. The population of *P. tinukiana* remains isolated from the surrounding hills where no other plants of this species were observed. No similar combination of particular conditions, vegetation, elevation, and climate are found on the surrounding mountain tops. Aside from plants of *P. tinukiana*, no other species of the *P. prismatocarpa* complex are known from this site. Populations of the related *P. brassavolae* are common in the oak forest below the summit of Cerro Tinuk, but they are absent in the paramo at the top of the slope.

Phenology: Plants were observed in flower from May to June.

Additional specimen examined: Puntarenas, Buenos Aires, Buenos Aires, Olán, cumbre del Cerro Tinuk, 9°17'29.1"N, 83°10'11.2"W, 2412 m, bosque pluvial premontano, terrestre en bosque de páramo, 25.06.2012, A.P. Karremans 5550, D. Bogarín, E. Herrera, D. Jiménez & V.H. Zúñiga (JBL).

4. Discussion

The species is similar to *Prosthechea ionocentra* (Rchb.f.) W.E.Higgins; it differs mainly in the inflorescence that is developed from the penultimate mature pseudobulb (rather than developed from the youngest pseudobulb). Additionally, the purple spotted sepals and petals (rather than immaculate); the cordate, acute lip (rather than cordate-sagittate, acuminate) (Figures 3 and 4); the disc with two long, narrow keels (shorter, thickened); the stigmatic arms of the column, which are convergent, rounded (rather than parallel, acute); and the narrow

stigma (rather than wider) suggest that this is a completely different species (Figure 5; Table). It shares the “tardiflorous” condition of the inflorescence with *P. brassavolae* and *P. tardiflora* Mora-Ret. ex Pupulin. From *P. brassavolae* the new species can be distinguished by the presence of two lateral lobes of the lip (rather than without the basal lobules) and the spotted sepals and petals (rather than immaculate) (Figure 3). From *P. tardiflora* it is readily distinguished by the elongate rhizome and the cordate lip of more than 3 cm long (rather than the short, congested rhizome and the obovate-subpandurate lip of less than 2 cm long) (Figure 4; Table). The other related species, *P. prismatocarpa* and *P. neglecta* Pupulin, have a similar floral architecture, but they differ in the smaller flowers with tepals less than 2 cm long (vs. more than 3.5 cm long); the triangular, narrower midlobe of the lip to 0.9 cm (vs. cordate, wider to 1.2 cm); the sepals and petals mostly stained with purple blotches (vs. sparsely purple freckles) (Figure 3); and the shorter column, 0.9–1.0 cm long (vs. 1.4 cm long) (Figure 5; Table).

The following key of the *P. prismatocarpa* group was modified from Pupulin (2002) to include the species described herein:

Key to the species of the *Prosthechea prismatocarpa* group (= *Panarica*)

1. Lip entire, without basal lobules
2. Pseudobulbs elongate, pyriform to lanceolate, lip lanceolate-ovate, subcordate **P. brassavolae**
2. Pseudobulbs shortened, ovoid, lip triangular and basally truncate.....**P. mulasii**
1. Lip 3-lobed, with 2 small lobules at the base
3. Sepals and petals immaculate.....**P. ionocentra**
3. Sepals and petals spotted or blotched
4. Inflorescence developed from the pseudobulb of the previous year
5. Rhizome elongated, lip >3 cm long; midlobe cordate... **P. tinukiana**
5. Rhizome short, lip <2 cm long; midlobe obovate-subpandurate.....**P. tardiflora**
4. Inflorescence developed from the new pseudobulb
6. Sepals adaxially papillate; ovary swollen; inflorescence lax..... **P. neglecta**
6. Sepals adaxially glabrous; ovary clavate; inflorescence dense..... **P. prismatocarpa**

Table. Comparison among the species of the *P. prismatocarpa* complex.

Character	<i>P. brassavolae</i>	<i>P. ionocentra</i>	<i>P. mulasii</i>	<i>P. neglecta</i>	<i>P. prismatocarpa</i>	<i>P. tardiflora</i>	<i>P. tinukiana</i>
Internode rhizome length (mm)	20–45	20–40	20	to 50	20–40	< 20	40
Pseudobulb shape	Ovoid to pyriform	Ovoid to pyriform	Ovoid	Narrowly ovoid	Pyriform to narrowly ovoid	Ovoid to lanceolate-pyriform	Ovoid to pyriform
Leaf length (cm)	15–26	10–20	14.0–25.5	26–32	13–32	19–35	18.8–20.0
Leaf width (cm)	3.0–4.5	2.6–5.0	14.0–25.5	1.8–4.6	2.5–5.2	3.6–5.0	5.0–6.2
Inflorescence	Developed from the new mature pseudobulb	Developed from the new mature pseudobulb	Developed from the previous mature pseudobulb	Developed from the new mature pseudobulb	Developed from the new mature pseudobulb	Developed from the previous mature pseudobulb	Developed from the previous mature pseudobulb
Inflorescence length (cm)	13–40	25–35	to 28	To 33	15–45	26–35	To 17
Sepal length (mm)	35–55	35–41	27–37	19	25–31	18–23	36–38
Color of sepals and petals	Immaculate	Immaculate	Immaculate	Blotched or maculated	Blotched or maculated	Blotched or maculated	Freckled or spotted
Labellum shape	Unlobed	3-lobed	Unlobed	3-lobed	3-lobed	3-lobed	3-lobed
Labellum length (mm)	25–30	26–33	40–61	15	20–25	16–19	32
Column length (mm)	15	13	13–15	9–10	9–10	9–10.0	14
Blooming season	January–August	May–August	August (mainly)	March–June	April–August	January–March	May–June
Elevation (m a.s.l.)	1100–2700	900–1600	1850	1900–2800	1500–2400	200–600	2400
Distribution	Mexico–western Panama	Costa Rica–Panama	Mexico	Costa Rica	Costa Rica–western Panama	Costa Rica	Costa Rica

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