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Evolutionary diversification and historical biogeography of orchidaceae in Central America with emphasis on Costa Rica and Panama

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Chapter 5

Two new *Lepanthes* (Orchidaceae: Pleurothallidinae) from Panama

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Abstract. Panama is still far from completing its orchid flora inventories, where large genera such as *Lepanthes* (Pleurothallidinae) reveal novelties regularly. Here, we describe and illustrate two new species of *Lepanthes*. *Lepanthes aures-ursinae* is similar to *L. micellilabia* but differs by the orbicular-ovate, obtuse, convex leaves, larger sepals $2.7\text{--}3.0 \times 2.2\text{--}2.3$ mm the yellow petals, shorter column to 1 mm long and Y-shaped bi-laminate lip with the blades embracing the column and the body elongated towards the base of the column forming a cylindric structure. *Lepanthes vertebrata* is most similar to *L. demissa*, from which it can be distinguished by the inflorescences bearing 20–73 pedicels in well-developed inflorescences, the vinaceous flowers, the larger lateral sepals to 6.0×2.3 mm, wider petals to 4.5 mm with the lower lobe longer than the blades of the lip, narrowly oblong upper lobe of petals, oblong lower lobe, shorter lip ca. 1 mm long with ovate pink blades and ventral stigma. Data on distribution, habitat and ecology, etymology and phenology are provided for each species.

5.1 Introduction

Comprising about 1,000 species, *Lepanthes* Sw. is one of the largest genera of the Pleurothallidinae (Luer and Thoele, 2012). The genus ranges from southern Mexico and the Antilles to Peru and Bolivia, with a few species in the Guianas and Brazil. The highest diversity is found in the Andean region of Colombia and Ecuador with more than 300 species in each country (Luer, 1996c; Luer and Thoele, 2012). In Mesoamerica, most of the species are concentrated in the southeast, in the highlands of Costa Rica and Panama (Ossenbach et al., 2007). Plants of *Lepanthes* are mostly found in montane and premontane rain forests at elevations of 1000–2500 m a.s.l. in the Cordillera de Talamanca, which extends from central Costa Rica towards western Panama. However, a number of species are recorded in humid mid-elevation to coastal lowlands (below 1,200 m a.s.l.) such as the slopes of Cerro Azul (571 m a.s.l.), Campana (1,030 m a.s.l.), Gaital (1,185 m a.s.l.), and Jefe (1007 m a.s.l.) in central Panama, or the Caribbean plains of the Bocas del Toro province (Luer and Dressler, 1986). Few records are known from the provinces of Colón, Darién and Los Santos where intensive fieldwork is needed (Bogarín et al., 2013). The level of endemism in *Lepanthes* is high. The species often have narrow distributions, and they are usually found in certain ridges or mountains with similar geological or climatic characteristics (Luer and Thoele, 2012). For instance, Costa Rica and Panama share 41 species (66% of the species known to Panama), most of which are endemic to the Cordillera de Talamanca (Bogarín et al., 2014b). *Lepanthes* has been little studied in Panama. Extensive collections led by Henri Pittier and William R. Maxon during 1911 in the region of Cerro de La Horqueta, in Boquete, Chiriquí, led to the description of the first two known species for the country: *Lepanthes eciliata* Schltr. and *Lepanthes maxonii* Schltr. (Schlechter, 1913). In 1915, Charles H. Powell continued the botanical exploration, mostly based in the Canal Zone and Chiriquí highlands. He collected another species named *L. chiriquensis* Schltr. (Schlechter, 1922). In the Orchidaceae chapter for the flora of Panama, (Williams, 1946) provided the first treatment of the genus for Panama. Based upon collections by Mary E. Spence Davidson and Paul H. Allen, L.O. Williams included five species, in addition to the three species described by (Schlechter, 1922). There were no further additions until 1984, when (Luer, 1984; Luer, 1996a, 1997) and (Luer and Dressler, 1986) published several species new to Panama. (Luer, 2002) described 26 species and added 10 new records for the country (mostly species already described from Costa Rica). Later, he reduced five species to synonymy (Luer, 2003a). Only one species has been described after Luer's contributions (Pupulin et al., 2009). Our latest account of the genus in Panama revealed 66 species, 21 of which are endemics (Bogarín et al., 2014b). As part of the botanical activities for the project aimed to complete the inventory of the Orchidaceae of Panama carried out by Jardín Botánico Lankester of the Universidad de Costa Rica and Herbario UCH of the Universidad Autónoma de Chiriquí, we are currently revising the genus. Herein, we describe and illustrate two new species.

5.2 Materials and Methods

This study was conducted at Herbario UCH of the Universidad Autónoma de Chiriquí, Panamá and Finca Drácula, Guadalupe, Chiriquí. Sketches and images were prepared from living specimens with a Leica® MZ 9.5 stereomicroscope with drawing tube, Nikon® D7100 digital

camera with a 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 CS6. Ink drawings were prepared on smooth Fabriano paper of 240 g m with a Rotring Rapidograph 0.1 mm using black capillary cartridges and traced in Artograph LightPad A920. Herbarium specimens were deposited at UCH and PMA. Phenological data were recorded in the field and from cultivated specimens. The map and georeferences for specimens were obtained by using Google Earth and data from JBL, MO, PMA and UCH herbaria.

5.3 Taxonomic treatment

5.2.1 *Lepanthes aures-ursinae* Bogarín and Serracín, *Nordic J. Bot.*, 36 (1–2(e01292)): 2–58, f. 1A–F, 2A. 2017. (Fig. 5.1, 5.2A, 5.3).

Diagnosis: A *Lepanthes* micellilabia Luer and Escobar foliis orbicularibus obtusis convexis, sepalis latioribus, petalis flavis, laminis labelli amplexantibus, connectivis basi elongatis, columna brevioribus differt.

Type: Panama, Coclé, El Valle de Antón, La Pintada, collected by E. Olmos and A. Maduro, 1,200 m a.s.l., without further locality data, cultivated in Finca Drácula, Chiriquí, Guadalupe, Panamá 2006, flowered in cultivation at Finca Drácula, Guadalupe, Cerro Punta, Chiriquí, 10 Dec 2008, *D. Bogarín 5932* (holotype: UCH).

Etymology: The epithet is derived from the Latin *auris*, ‘ears’ and *ursus*, ‘bear’, in reference to the appearance of the petals resembling a bear’s ears.

Description: Plant epiphytic, caespitose, erect, to 5.2 cm tall. Roots slender, flexuous, up to 0.5 mm in diameter. Ramicaul erect, up to 1.5–3.3 cm, enclosed by 6–8, tightly fitting, glabrous, blackish lepanthiform sheaths, each 4–6 mm long; ostia slightly dilated, acute. Leaves convex, erect, coriaceous, with a prominent median vein, green, orbicular or oblong-ovate, obtuse; emarginate with a short apiculus, 1.5–1.9 × 1.4–1.6 cm; the rounded base abruptly contracted into a petiole to 1.5 mm long. Inflorescence racemose, distichous, successively flowered, remaining on abaxial surface of the leaf, shorter than the leaves, to 1.2 cm long, with peduncle 9 mm long and rachis 3 mm. Floral bracts to 1 mm long, triangular-ovate, glabrous. Pedicel to 1.3 mm long, persistent. Ovary to 0.8 mm long. Flowers with yellow sepals, the base of the lateral sepals tinged with red; petals yellow with red lip. Dorsal sepal ovate, acute, dorsally carinate, entire, slightly convex at the base, connate to the lateral sepal for about 0.7 mm, 3.0 × 2.3 mm, 3-nerved. Lateral sepals ovate, acute, flat, entire, connate at the base for about 1.2 mm, 2.7 × 2.2 mm, 2-nerved. Petals reniform-suborbicular, minutely papillose, obscurely bilobed, inconspicuous, 0.5–0.7 mm; lobes rounded, subsimilar. Lip bi-laminate, adnate to about the middle of the column, Y-shaped, 1.1 × 1.2 mm; blades transversely triangular, with rounded apices; connectives cuneate, embracing the column; body elongated towards the base of the column but not adnate to the column, forming a cylindric structure with some part of the tissue folding, up to 0.8 mm long; appendix cylindric, very small, minutely ciliate. Column cylindric, 1 mm long; anther apical; stigma sub-apical. Pollinia two, ovoid, joined at the base by an obovate viscidium. Anther cap cucullate.

Phenology: The species has been recorded in flower throughout the year but mostly from December to June.

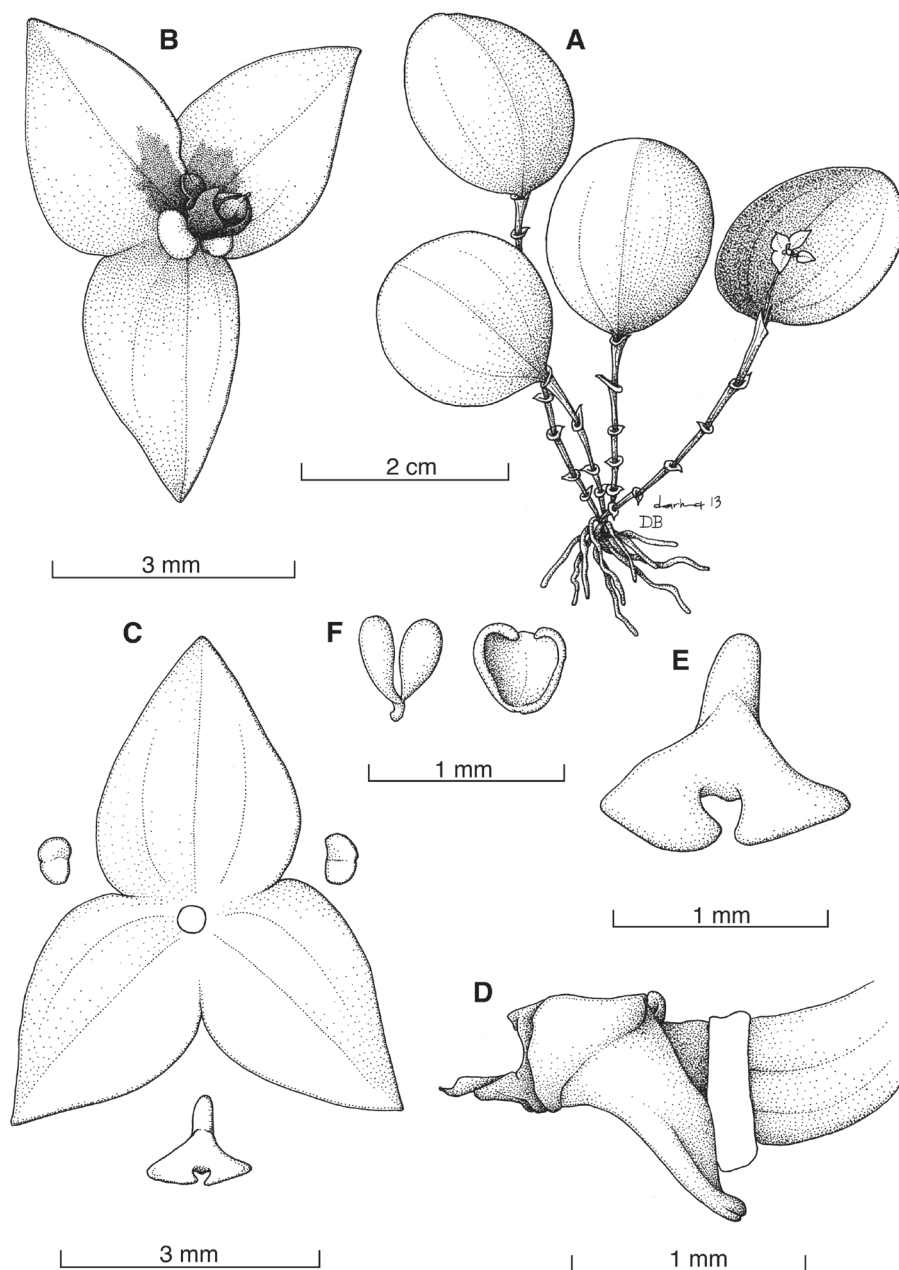


Figure 5.1. *Lepanthes aures-ursinae*, **A.** habit. **B.** flower. **C.** dissected perianth. **D.** ovary, column and lip (lateral view). **E.** lip (spread showing the cylindric structure made up by the elongation of the body). **F.** pollinarium and anther cap. Drawn by D. Bogarín and D. Solano from the holotype.

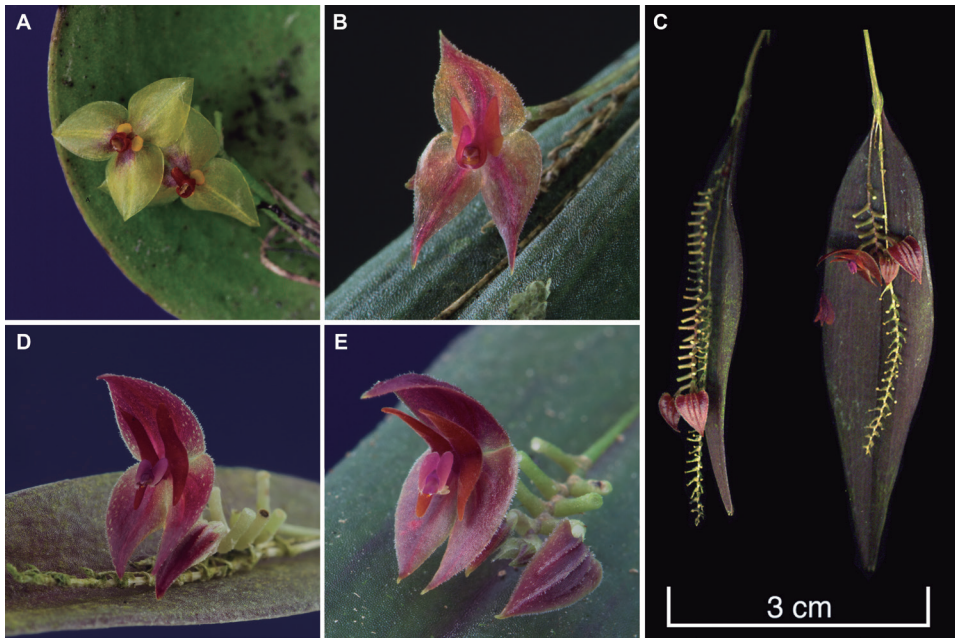


Figure 5.2. *Lepanthes aures-ursinae*, **A.** flower (Bogarín 5932). *Lepanthes demissa*, **B.** flower (Bogarín 10973). *Lepanthes vertebrata* **C.** detail of the inflorescence showing the elongate rachis of the inflorescence with several persistent pedicels (Bogarín 2975). **D.** flower (Bogarín 2975), **(E)** flower (Serracín 1006). Photos by D. Bogarín.

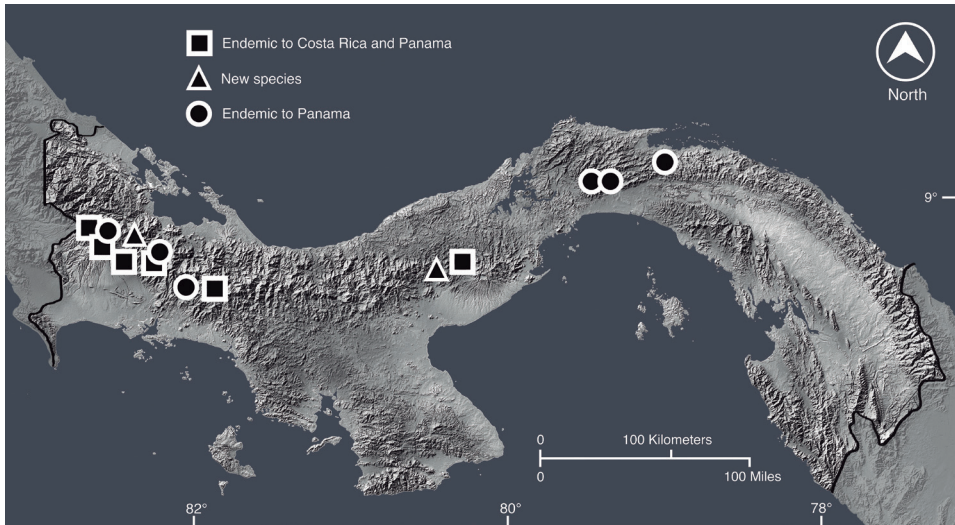


Figure 5.3. Distribution map of collecting sites of *Lepanthes* in Panama showing the endemic species (circles), endemics to Costa Rica and Panama (squares) and the new species here described (triangles).

Habitat, ecology and distribution: *Lepanthes aures-ursinae* is only known from Panama where it is an epiphyte in primary and secondary forest in Valle de Antón, Coclé, at around 1,200 m a.s.l.

Similar species: *Lepanthes aures-ursinae* is similar to *L. micellilabia*, but differs by the orbicular-ovate, obtuse, convex leaves (rather than ovate, flat, acute), the larger lateral sepals 2.7×2.2 mm (rather than 2.50×1.25 mm), the yellow petals (rather than red) and the shorter column to 1 mm long (rather than 1.5 mm long). However, the most important feature distinguishing *L. aures-ursinae* is the Y-shaped bilaminar lip with the blades embracing the column and the body that is elongated towards the base of the column forming a cylindric structure (rather than reduced lip at the base of the naked column). No other species of *Lepanthes* of Panama has this feature. Flowers of *L. aures-ursinae* have minute petals compared to the expanded triangular sepals. This characteristic is also present in several other species of *Lepanthes*, and may have evolved several times in different unrelated groups within the genus (Pupulin et al., 2010). *Lepanthes equus-frisiae* Pupulin and H. Medina, *Lepanthes isosceles* Luer and R. Escobar, *L. micellilabia*, *L. pelorostele* Luer and Hirtz, *L. rigidigitata* Luer and Hirtz and *L. vestigialis* Bogarín and Pupulin are among the species characterized by the presence of extremely reduced, simple petals and lip. The differences among these species are summarized in Table 5.1. The plant habit of *L. aures-ursinae* is similar to the species of the *Lepanthes disticha* Garay & R.E. Schult. complex, characterized by the erect ramicauls with blackish, amplexant lepanthiform sheaths with narrow ostia and coriaceous leaves. In the new species, the leaves are orbicular-ovate and convex, resembling the habit of *L. dotae* Endres ex Luer and *L. whittenii* Pupulin and Bogarín. However, the new species can be distinguished from them mainly by the proportionally very small, reniform-orbicular petals and the Y-shaped lip.

5.2.2 *Lepanthes vertebrata* Bogarín, Mel.Fernández and Serracín, Nordic J. Bot. 36(1–2(e01292)): 518–7, f. 2C–E, 4A–E. 2017. (Fig. 5.2C, 5.2D, 5.2E, 5.4).

Diagnosis: A *Lepanthes* demissa Luer inflorescentia longiore, floribus vinaceis, sepalis latioribus, lobulis petalorum subequalibus lobo infero falcato et laminis labelli ovatis roseis differt.

Type: Panama, Chiriquí, Boquete, without further locality data, collected by Erick Olmos and A. Maduro, 30 Oct 2000, flowered in cultivation at Finca Dracula, Guadalupe, Cerro Punta, Chiriquí, 12 Dec 2006, *D. Bogarín* 2975 (holotype: UCH, isotype: PMA).

Etymology: From the Latin *vertebratus*, ‘vertebrate, jointed’ in allusion to the elongate rachis of the inflorescence with persistent pedicels forming a vertebral spine-like or fish backbone-like structure.

Description: Plants epiphytic, caespitose, pendent, to 21.5 cm tall. Roots slender, flexuous, up to 0.5 mm in diameter. Ramicaul pendent or suberect, straight, up to 2.5–15.5 cm, enclosed by 5–15-ciliate, lepanthiform sheaths, 1.0–1.8 cm long; ostia markedly dilated, acuminate. Leaves pendent, subcoriaceous, with a prominent mid vein, purplish-green, elliptic to narrowly elliptic, acute to acuminate, emarginate with a short apiculus, $5.3\text{--}8.6 \times 1.3\text{--}2.2$ cm, with cuneate base narrowing into a petiole ca 1 mm long. Inflorescence racemose, distichous, successively flowered, born above the leaf, in some specimens becoming longer than the leaf as it elongates and produces new flowers, to 4.0–5.5 cm or longer, forming a conspicuous, congested chain of pedicels with age (20–73 pedicels on each rachis); peduncle 1.5–2.0 cm long; rachis 2.8–4.0 cm. Flo-

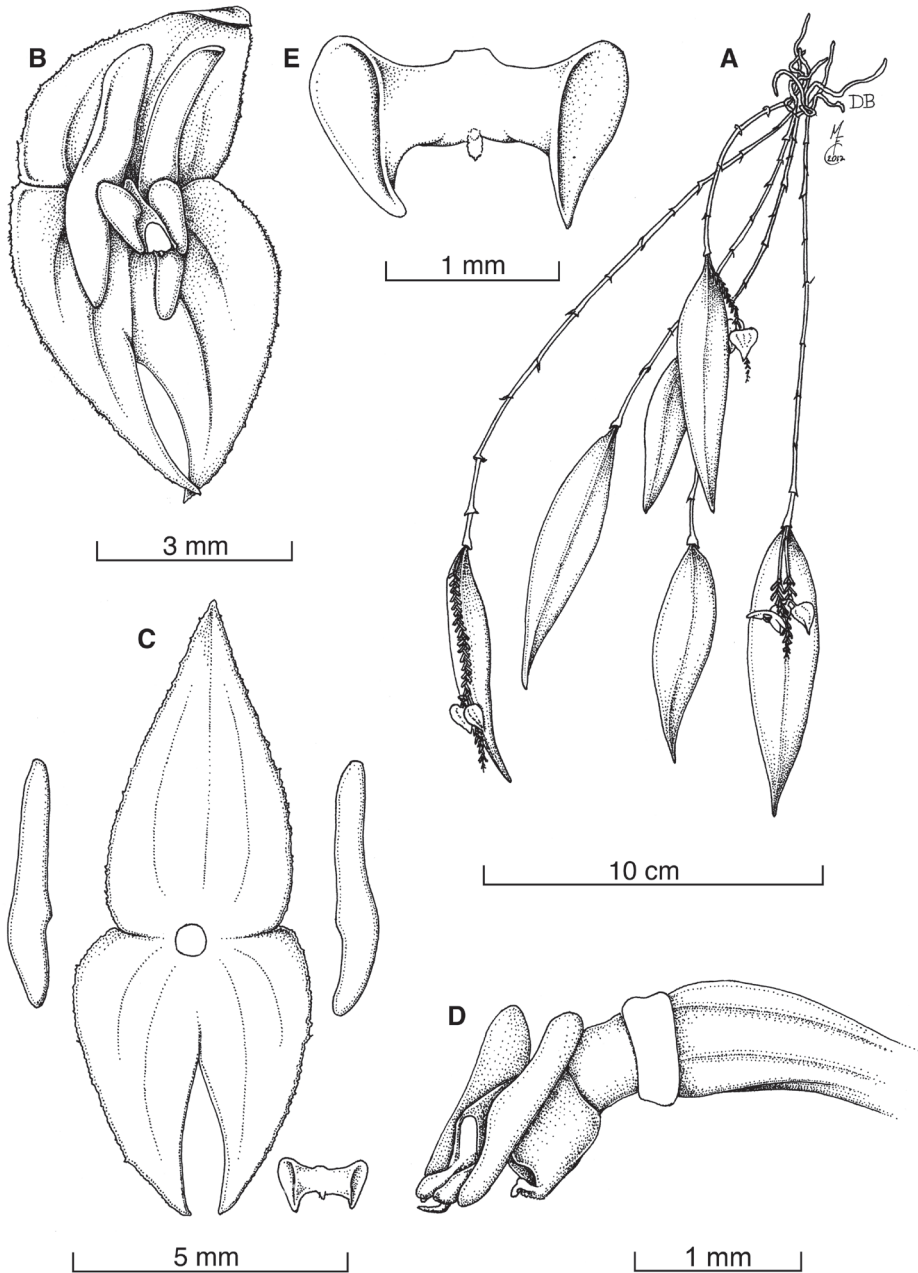


Figure 5.4. *Lepanthes vertebrata* A. habit. B. flower. C. dissected perianth. D. ovary, column and lip (lateral view). E. lip (front view, spread). Drawing by D. Bogarín and M. Fernández from the holotype.

Table 5.1. Morphological differences among *L. aures-ursinae* and similar species.

Character	<i>L. aures-ursinae</i>	<i>L. equus-frisiae</i>	<i>L. micellilabia</i>	<i>L. vestigialis</i>
Habit	erect	suberect-prostrate	erect	suberect-prostrate
Plant size (cm)	5.5	to 3.5	8	2.5
Flower color	yellow with red lip	reddish-brow with pink	yellow suffused with red	yellowish-pink
Dorsal sepal (mm)	3.0 × 2.3	5.0 × 1.5	2.5 × 1.5	4.0 × 1.5
Lateral sepals (mm)	2.7 × 2.2	4.5 × 1.2	2.50 × 1.25	4.0 × 1.5
Petals (mm)	reniform-suborbicular, 0.5 × 0.7 mm	reniform-suborbicular, 0.3 × 0.4 mm	oblong, 0.25 × 0.5	0.5 × 0.5
Lip (mm)	Y-shaped, 1.1	subspherical, 0.3	cordate, 0.25	triangular, 0.5
Stigma	subapical	apical	apical	subapical

ral bracts triangular-ovate, glabrous, 0.5 mm long. Pedicel to 2.5 mm long, persistent. Ovary up to 1.4 mm long, cylindrical, carinate. Flowers with red-vinaceous sepals, externally suffused with dark vinaceous color along veins, submarginal area pale yellow; petals and lip pink vinaceous. Dorsal sepal ovate, acute, concave, dorsally carinate, ciliate, connate to the lateral sepal for about 1 mm, 6.0 × 3.4 mm, 3-veined. Lateral sepals ovate, acute, subfalcate, flat, ciliate, connate at the base for about 1 mm, 6.0 × 2.3 mm, 2-veined. Petals microscopically pubescent, ciliate, transversely bi-lobed, 0.8 × 4.5 mm; upper lobes narrowly oblong, rounded at apex; lower lobes oblong, subfalcate, with rounded apex, smaller than the upper lobes. Lip bi-laminate, adnate to the column, ca 1 × 2 mm; blades ovate, microscopically pubescent, with rounded, falcate, ciliate apices; connectives cuneate, up to 1 mm long; body oblong, connate to about the middle of the column; appendix external, oblong, hirsute. Column cylindrical, ca 1.5 mm long; anther apical; stigma ventral Pollinia two, ovoid. Anther cap cucullate.

Phenology: Plants have been recorded in flower throughout the year but mostly from December to March.

Habitat, ecology and distribution: *Lepanthes vertebrata* is only known from western Panama where it is an epiphyte in primary and secondary forest on the Pacific watershed of Cordillera de Talamanca, north of Boquete, Chiriquí between 1600–2000 m a.s.l. A population was found on twigs of a Melastomataceae tree.

Similar species: *Lepanthes vertebrata* is morphologically similar to *L. demissa* Luer (Fig. 5.2B). Both species have hanging narrowly elliptic-ovate, dark-green leaves. However, *Lepanthes vertebrata* is distinguished by the inflorescences bearing 20–73 pedicels in well-developed inflorescences (vs less than 10 persistent pedicels), vinaceous flowers (vs reddish-orange), larger sepals to 6.0 × 2.3 mm (vs 5.0 × 1.8 mm), wider petals 4.5 mm (vs 1.8 mm), narrowly oblong upper lobe of petals (vs oblong-ovate), oblong lower lobe which is longer than the blades of the lip (vs ovate, shorter), shorter lip ca 1 mm long with ovate pink blades (vs 1.4 mm long with narrowly oblong, orange blades) and ventral stigma (vs apical). *Lepanthes vertebrata* is recorded between 1600–2000 m a.s.l. in premontane forests whereas *L. demissa* is found in cloud forest mostly on *Podocarpus* sp. and *Quercus* spp. above 2300 m a.s.l. Another similar species is *L.*

Table 5.2. Morphological differences among *L. vertebrata* and similar species.

Character	<i>L. vertebrata</i>	<i>L. demissa</i>	<i>L. machogaffensis</i>
Habit	pendent	pendent	suberect
Plant size (cm)	to 21.5	to 15	to 12
Rachis	2.8–4.0 cm, longer than the peduncle	2.5 cm, shorter or equal to the peduncle	1.5 cm, shorter than the peduncle
Pedicels in mature inflorescences	>20	< 10	< 10
Flower color	red-vinaceous	reddish-orange	purple-red
Dorsal sepal	6.0 × 3.4 mm	5 × 2.6 mm	7.0 × 2.5 mm
Lateral sepals	6.0 × 2.3 mm, acute	5.0 × 1.8 mm, acute to acuminate	7.0 × 1.9 mm, acuminate-attenuate
Petals	0.8 × 4.5 mm	0.5 × 1.8 mm	0.7 × 2.5 mm
Petal (upper lobe)	narrowly oblong	oblong-ovate	subrectangular
Petal (lower lobe)	oblong	ovate	narrowly ovate-sub-falcate
Lip blades	ovate	narrowly oblong	ovate
Lip length	ca. 1.0 mm	1.4 mm	1.0 mm
Stigma	ventral	apical	apical

machogaffensis from Costa Rica (Pupulin et al., 2009). However, this species differs mainly by the shorter plants < 12 cm, mature inflorescences with <10 pedicels, rachis 1.5 cm, shorter than the peduncle, acuminate-attenuate sepals and apical stigma. The differences among these species are summarized in Table 5.2.

Additional specimens examined (paratypes): Panama. Chiriquí-Bocas del Toro, Cerro Pata de Macho, north of Boquete, 2000 m a.s.l., collected Mar 2005, cultivated by Steve and Marjorie Sarner, no. 624, Boquete, Panamá, 19 Dec 2008, *D. Bogarín* 5995 (UCH-spirit); Panama, Chiriquí, Boquete, Los Naranjos, Bajo Mono, Sendero Culebra, orillas del Río Caldera, 8°50'55.0" N, 82 °29'36.9" W, 1904 m a.s.l., epífita a orillas del camino, 14 Jul 2014, *D. Bogarín* 11151, *J. Harrison*, *L. Harrison*, *Z. Samudio* and *Z. Serracín* (UCH); Panama, Chiriquí: Boquete, Los Naranjos, Bajo Mono, Sendero Culebra, orillas del Río Caldera, 8°50'34.1" N, 82°28'53.0"W, 1673 m a.s.l., epífitas a orillas del camino, 18 Jun 2015, *Z. Serracín* 1006, *D. Bogarín*, *Z. Samudio* and *C. Rodríguez* (UCH) (Fig. 5.2E).

