TWO NEW SPECIES OF *LEPANTHES* (ORCHIDACEAE: PLEUROTHALLIDINAE) FROM THE ANCHICAYÁ RIVER VALLEY IN COLOMBIA

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Abstract. Two new species of *Lepanthes* from the Anchicayá River Valley in the department of Valle del Cauca in Colombia, in the Pacific lowlands of the Chocó biogeographic region, are described and illustrated. Both species are discussed and compared with their closest relatives, and information about their distribution, conservation, habitat, and ecological characteristics is provided.

Keywords: conservation, Chocó biogeographic region, distribution, taxonomy

Resumen. Se ilustran y se describen dos nuevas especies de *Lepanthes* del Valle del Rio Anchicayá en el departamento del Valle del Cauca en Colombia, en las tierras bajas del Pácifico del Chocó biogeográfico. Ambas especies son discutidas y comparadas con sus parientes más cercanos y se provee información acerca de su distribución, conservación, habitát y caracteristicas ecológicas.

Palabras claves: conservación, región biogegráfica del Chocó, distribución, taxonomía

Lepanthes Sw. (Orchidaceae) is a relatively recent group of species that diverged ca. 5–10 MYA with the highest net diversification rate among genera in subtribe Pleurothallidinae (Pérez-Escobar et al., 2017; Bogarín et al., 2018), possibly correlated with pollination by pseudocopulation. Flowers are pollinated by male fungus gnats of the family Sciaridae, probably attracted by a pheromone-mimicking strategy. *Lepanthes*, with morphological features such as a bilaminate lip with a central and very small appendix of different shapes, exhibits a highly specialized pollination system involving sexual deception (Blanco and Barboza, 2005; Luer and Thoerle, 2012; Bogarín et al., 2019).

Lepanthes in Colombia has been studied extensively thanks to the collaboration of Carlyle A. Luer (1922–2019) and Rodrigo Escobar (1935–2009), who described 208 species between 1980 and 2011. A year later, Luer and Thoerle (2012) provided a comprehensive review of the genus. Despite this revision, *Lepanthes* is a taxonomic group that continues to be challenging to study, primarily because of the generally minute size of its flowers and the complexity of its floral structures (a lip composed of two blades and a central appendix). Typically, press-and-dry practices used to prepare herbarium specimens make the study of these structures difficult, and the careful examination of living plants and the preservation of material in alcohol are essential to identify most species.

Little work has been done on Colombian *Lepanthes* since Luer and Thoerle (2012) published their monograph. From 2014 to 2019, nine new species were described (Vieira-Uribe and Larsen, 2014a,b; Moreno et al., 2017, 2018; Vieira-Uribe and Moreno, 2018, 2019); two species described by Pérez-Escobar et al. (2013a,b) and one by Szlachetko et al. (2019) are excluded because they are most likely synonyms of already known taxa.

As a result of several field trips conducted two years ago to document flora and fauna of the Anchicayá River Valley in the Cauca Valley, carried out by the members of the Schultes Investigation Group of the Ecotonos Foundation, two new species of *Lepanthes* were detected and are described and illustrated here, with information about their ecology and comparisons with similar species.

Materials and Methods

Descriptions and Drawings

The descriptions were prepared from living specimens. Specimens were preserved in alcohol and dissected under a stereo microscope (AmScope SM-1TNZ-144A-3M). Digital images were taken with a Nikon D750 with a Nikkor 105 mm f/1.8 macro lens. Sketches from living and preserved specimens were digitized, and the images were used for diagramming draft composite templates in Adobe Photoshop® CS6. Digital drawings were prepared (using lines and stippling) in Procreate illustration for Apple iPad 6th generation tablet computer (Bogarín et al., 2019).

The first author thanks CELSIA and the Corporación Paisajes Rurales for their financial support, which made possible the description of the two new species in this investigation. Also, JSM would like to thank the Harvard University Herbaria for a travel grant used to review all the specimens and literature related to the genus *Lepanthes*, especially to Gustavo A. Romero and Irina Ferreras for their kind help during the stay at AMES. We are grateful to Robinson Galindo Tarazona, director of the regional Los Farallones National Natural Park (Parque Nacional Natural; PNN), who let us collect the species within the PNN and the central hydroelectric complex of Empresa Energía del Pacífico S. A. (EPSA); to Gilberto Collazos Bolaños, Camilo E. Sánchez, and Alejandra Herrera, who kindly invited the first author to participate in the Global Big Day (the day the two new species were found). Luis Baquero thanks Universidad de Las Américas (UDLA) for funding research on orchids in Ecuador. Two anonymous reviewers and the editor improved this manuscript greatly and their help is appreciated. Finally, we thank the Missouri Botanical Gardens Press for letting us use drawings by C. A. Luer in figure 5.

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Plant Material

Lepanthes specimens at AMES, CAUP, ICESI, JAUM, HPUJ, HUA, FMB, VALLE, JBB, CUVC, SEL, MO (online), TOLI, and COL (online) were consulted, although no additional material was found in these collections to include in the description of the new species.

Study Area

The Anchicayá River Valley (Fig. 1) in the department of Valle del Cauca, located in the Pacific slope of the Western Cordillera, receives constant rainfall (up to 183 mm in 24 hr, in higher proportion at night), has a mean temperature of 26 C, and a relative humidity of 86% (Tovar, 2004). This valley is located close to the Pacific Ocean in the Chocó biogeographic region, the world's ninth most biodiverse hotspot and perhaps one of the least understood in terms of species diversity (Pérez-Escobar et al., 2019). The area hosts nearly 3% (~11,000) of all plant species, of which ~2,750 are endemic (Gentry, 1982; Myers et al., 2000; Pérez-Escobar et al., 2019).

FIGURE 1. Landscape view of the Anchicayá River Valley in the department of Valle del Cauca in Colombia. Photograph by J. S. Moreno.

TAXONOMY

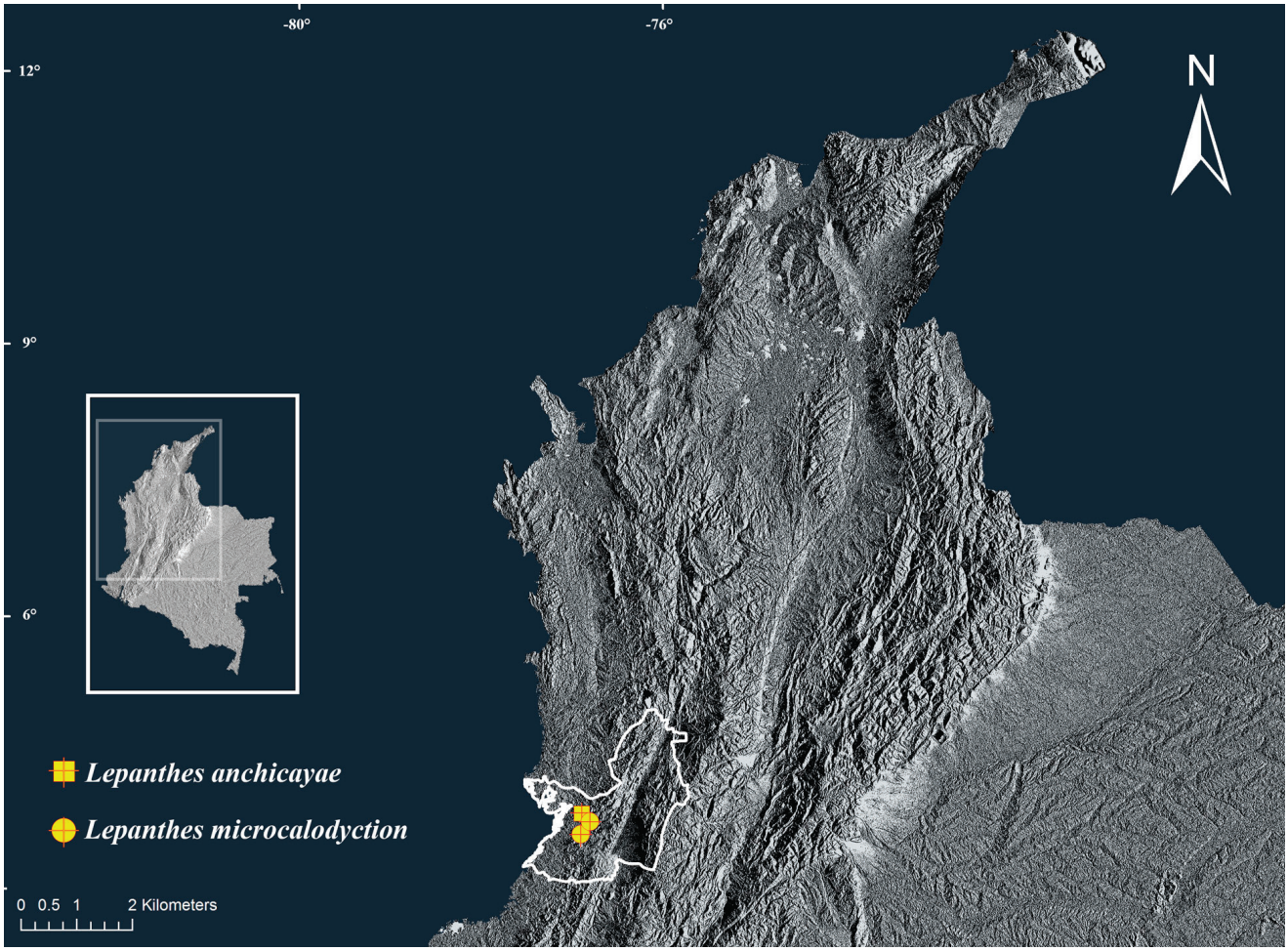
Lepanthes anchicayae J.S. Moreno & S. Vieira-Uribe, *sp. nov*. TYPE: COLOMBIA. Valle del Cauca: Buenaventura, Cañón del Rio Anchicayá, La Cascada, 3°37'33.5"N, 76°56'34.7"W, 300 m, 4 May 2018, *Juan Sebastián Moreno and Astrid Erazo* 429 (Holotype: CAUP) (Fig. 2, 3, 4A, 5A).

Lepanthes anchicayae is similar to Lepanthes pleurorachis Luer but can be distinguished by its wider petals, the lip transversely bilobed with cuneate lobes (vs. transversely bilobed-cordate with rounded lobes) with margins not ciliate (vs. ciliate,) and the stigma ventral and widely dilated (vs. stigma apical).

Plant small, epiphytic, caespitose; *roots* slender, terete. *Ramicauls* slender, erect, 2.25–3.00 cm long, enclosed by 5–6 microscopically ciliate-scabrous lepanthiform sheaths. *Leaves* suffused with purple on the abaxial side, erect, coriaceous, narrowly ovate, acute, 2.25–2.50 × 0.5–0.6 cm, the base cuneate into a petiole l–2 mm long. *Inflorescence* a congested, distichous, successively several-flowered raceme, up to 7.5–12.0 mm long, borne underneath the leaf by a slender peduncle 4–7 mm long; *floral bracts* muricate, acute, 1 mm long; pedicels 1.5 mm long. *Ovary* costate, 1.5 mm long. *Sepals* translucent yellow, suffused with burgundy at the base, glabrous, carinate, reflexed. *Dorsal sepal* ovate to elliptical, acute, 3-veined, 2 × 1.2–1.3 mm, connate to the lateral sepals for 0.5 mm. *Lateral sepals* ovate, oblique, apiculate, 2 × 1.5–1.7 mm, connate at the base for 0.8 mm, 2-veined. *Petals* orange strongly suffused with burgundy at the base, microscopically pubescent, 0.75–0.80 × 3.3–3.5 mm, transversely bilobed, the upper lobe ovate, oblique, acute, with a second point midway on the inner margin, the lower lobe triangular, oblique, shorter than the upper, with the apex attenuate, incurved. *Lip* burgundy, microscopically pubescent, 2-veined, transversely bilobed, the lobes cuneate, 0.5 × 1 mm embracing the column, the apex retuse with a wide sinus, connate close to the base of the column. *Column* magenta, terete, 0.5 mm long, the anther apical, stigma ventral and widely dilated.

Etymology: the specific epithet refers to the region of the Anchicayá River Valley in the department of Valle del Cauca, Colombia, the type locality where the species was found.

Habitat and ecology: an epiphyte of secondary vegetation along the western slope of the Western Cordillera, where it has been recorded at 300 m of elevation (Map 1). The species was found growing on small branches close to a very wet clump of *Sphagnum* moss located on the rocks under a waterfall. *Lepanthes anchicayae* is probably distributed all along the road to Agua Clara, Buenaventura, and may be very well protected within the area occupied by the hydroelectric power station of the Bajo Anchicayá, located within the perimeter of Los Farallones National Natural Park, where access for the general public is highly restricted.



Map 1. Distribution of *Lepanthes anchicayae* J.S. Moreno & S.Vieira-Uribe and *Lepanthes microcalodyction* J.S. Moreno & L. Baquero in the Anichayá River Valley, Valle del Cauca, Colombia.

Lepanthes anchicayae belongs to a group of species with very congested, distichous racemes, reflexed sepals, transversely bilobed petals with the lobes somewhat triangular and a lip without appendix, transversely bilobed-cordate to subcordate and reniform, which embraces the column. Among this informal group, three species share some similar traits with the new species: *Lepanthes petalopteryx* Luer & R. Escobar (Fig. 4B), *Lepanthes pleurorachis* Luer (Fig. 4C), and *Lepanthes viahoënsis* Luer & R. Escobar (Fig. 4D) (Luer and Thoerle, 2012). *Lepanthes petalopteryx*, from the Western Cordillera in the department of Antioquia, has sepals minutely denticulate along the margins (vs. smooth margins), transversely bilobed petals with the lobes truncate (vs. transversely bilobed with the upper lobe ovate, and the lower triangular, attenuate), and a reniform transversely bilobed lip (vs. transversely bilobed with lobes cuneate; Fig. 5B). It is most similar to *Lepanthes pleurorachis*, but it can be easily distinguished from the latter by its wider petals, the lip transversely bilobed with the lobes cuneate and the microscopically pubescent (vs. transversely bilobed with the lobes cordate and the margins ciliate; Fig. 5C). The only other species to which it can be compared, *Lepanthes viahöensis*, is characterized mainly by its 3-veined lateral sepals (vs. 2-veined in *L. anchicayae*), petals transversely bilobed, with the upper lobe erect, obliquely triangular, the lower lobe oblong, shorter, oblique at the apex (vs. transversely bilobed), with the upper lobe ovate, oblique, triangular, the lower lobe triangular, oblique, shorter than the upper, lip microscopically ciliate (vs. microscopically pubescent), and subcordate lobes (vs. transversely bilobed, cuneate lobes; Fig. 5D). The new species is also recognized by its widely dilated ventral stigma.

Lepanthes microcalodyction J.S. Moreno & L. Baquero, *sp. nov*. TYPE: COLOMBIA. Valle del Cauca: Buenaventura, Cañón del Rio Anchicayá, PNN Farallones, Campamento Yatacué, EPSA, 3°34'32.6"N 76°52'46.4"W, 640 m, 11 September 2016, *Juan Sebastián Moreno and Astrid Erazo 432* (Holotype: CAUP) (Fig. 6, 7, 8B, 9B).

Lepanthes microcalodyction is similar to Lepanthes calodyction Hook., but it can be distinguished by its unique very small, diminutive flowers and plants; petals with the margin velvety (vs. ciliate) acaudate (vs. long caudate), and the lip transversely reniform (vs. transversely oblong-reniform).

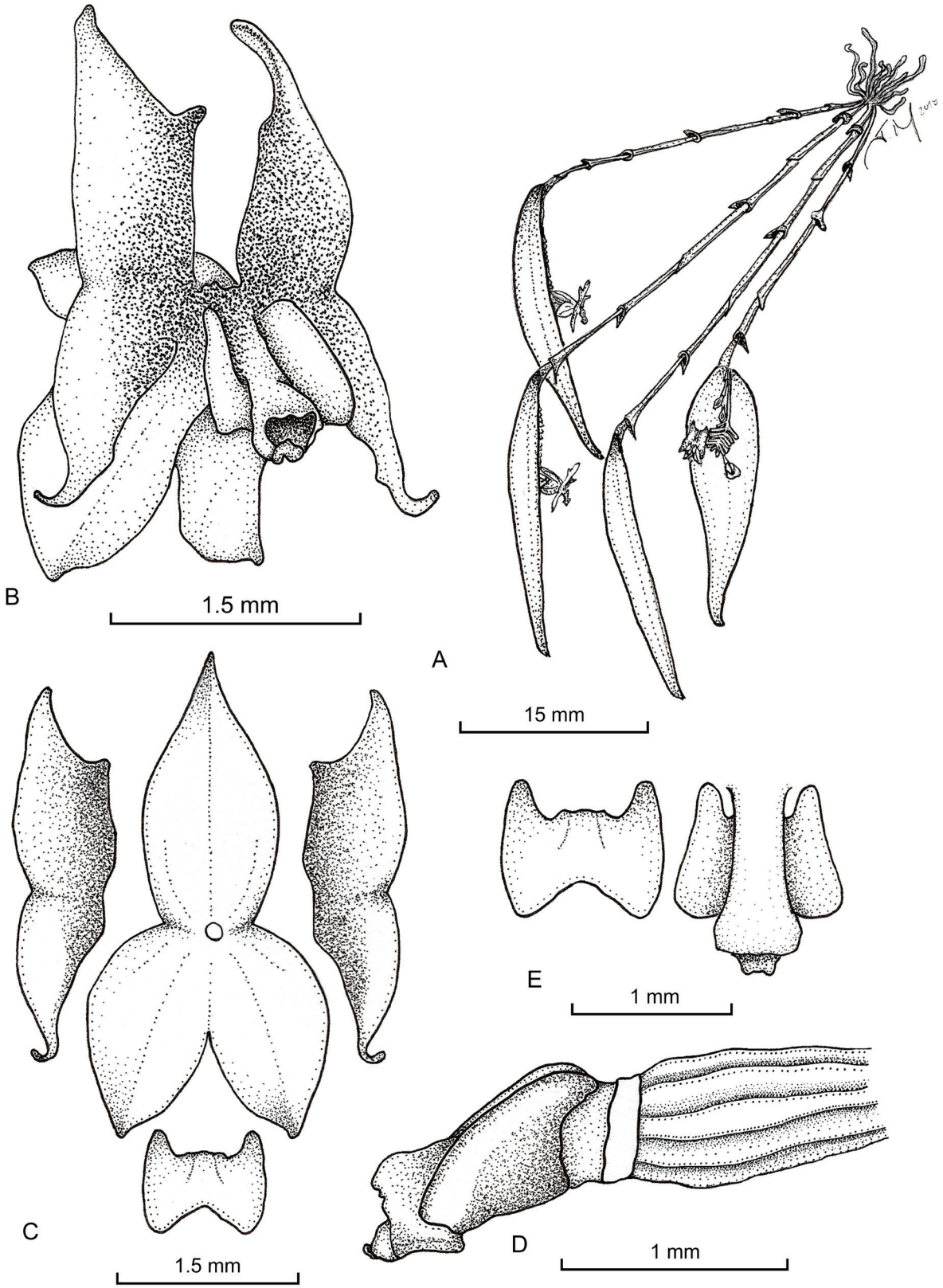


FIGURE 2. Illustration of *Lepanthes anchicayae* J.S. Moreno & S.Vieira-Uribe. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column, lip, and ovary lateral view (pollinia and anther cap absent); **E**, lip. Drawn by J. S. Moreno based on *J. S. Moreno & A. L. Erazo 429* (CAUP).

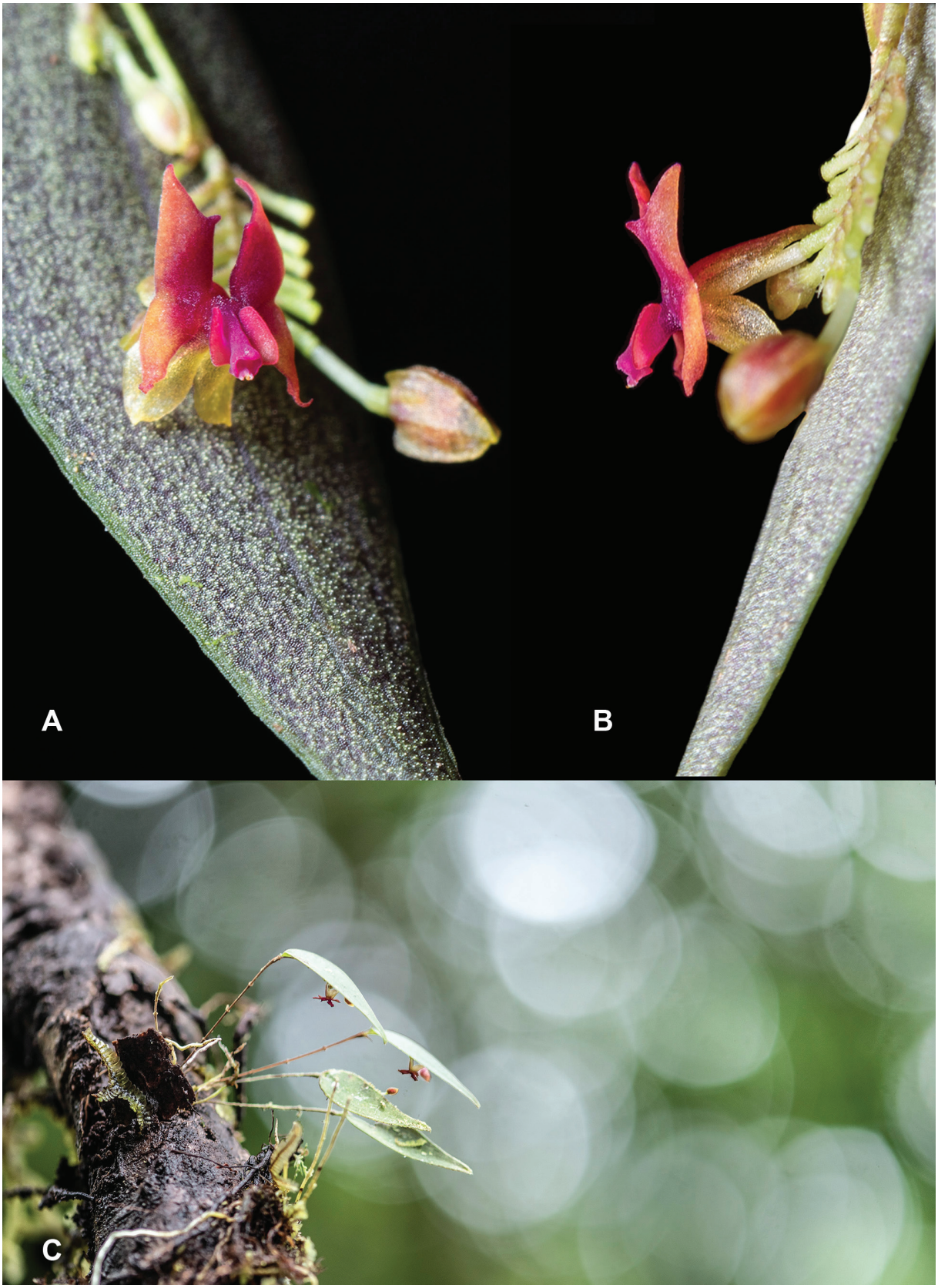


FIGURE 3. *Lepanthes anchicayae* J.S. Moreno & S.Vieira-Uribe. **A**, frontal view; **B**, lateral view; **C**, plant and habit, in situ. Photographs by J. S. Moreno.

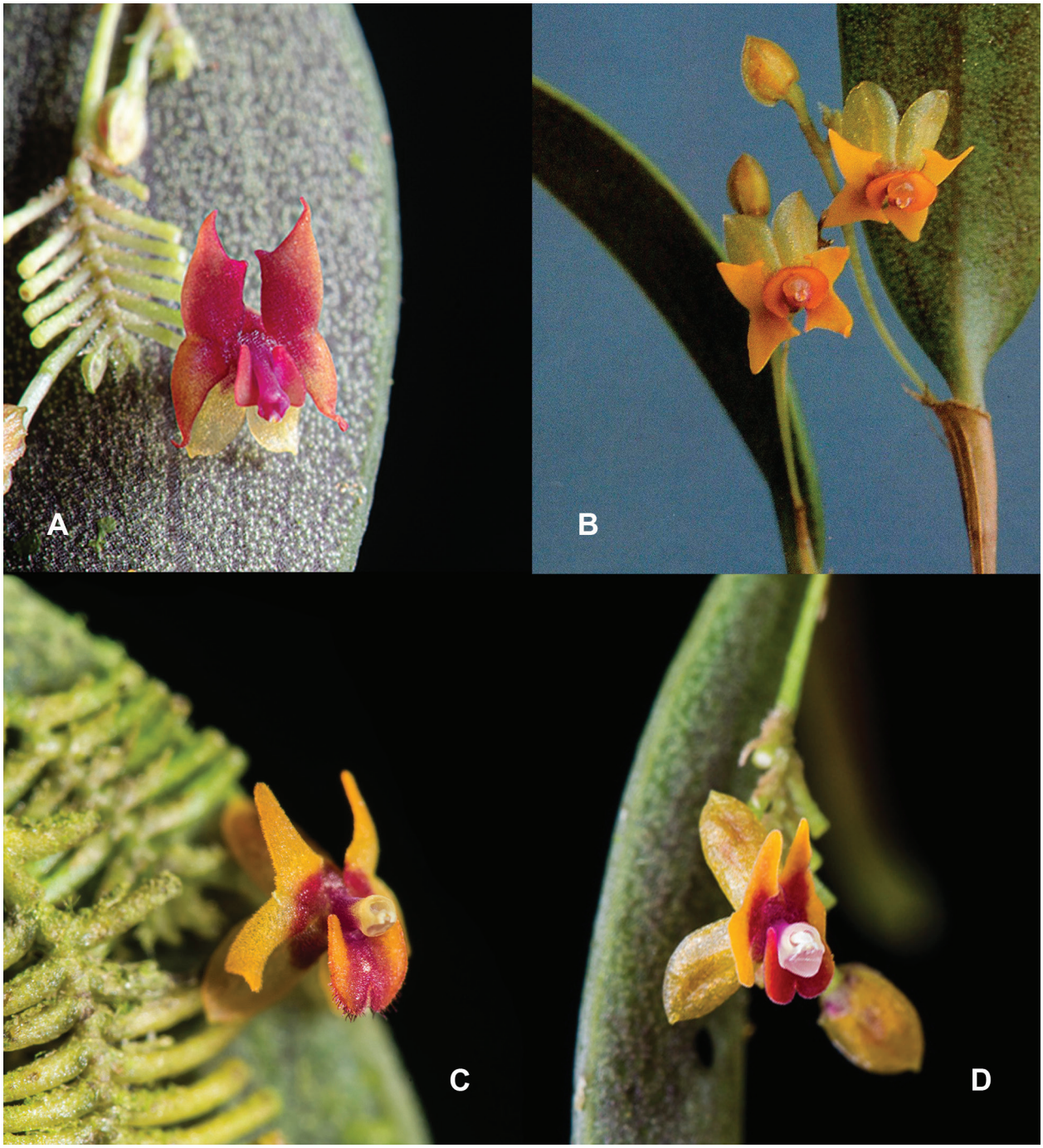


FIGURE 4. Comparison of the most similar species to *Lepanthes anchicayae* J.S. Moreno & S. Vieira-Uribe. **A**, *Lepanthes anchicayae*; **B**, *L. petalopteryx* Luer & R. Escobar; **C**, *L. pleurorachis* Luer; **D**, *L viahöensis* Luer & R. Escobar. Photographs by J. S. Moreno (A, C), Sebastián Vieira-Uribe (D), and Rodrigo Escobar (B), courtesy of the Sociedad Colombiana de Orquideología.

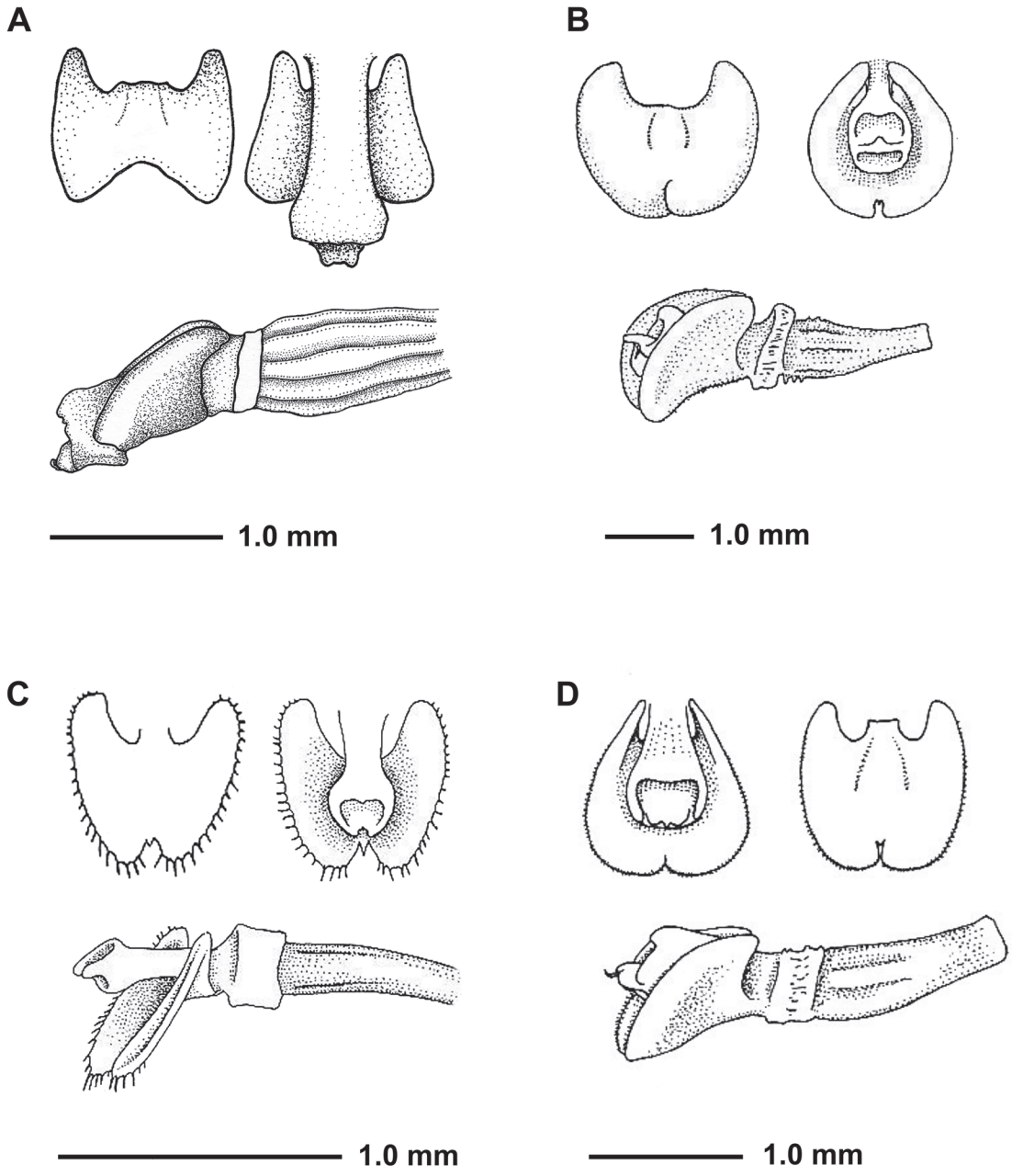


FIGURE 5. Illustration and comparisons of the lip and columns of the species most similar to *Lepanthes anchicayae* J.S. Moreno & S. Vieira-Uribe. **A**, *L. anchicayae*; **B**, *L. petalopteryx* Luer & R. Escobar; **C**, *L. pleurorachis* Luer; **D**, *L. viahöensis* Luer & R. Escobar. Original drawings by J. S. Moreno (A) and Carlyle Luer (B–D), courtesy of the Missouri Botanic Gardens Press.

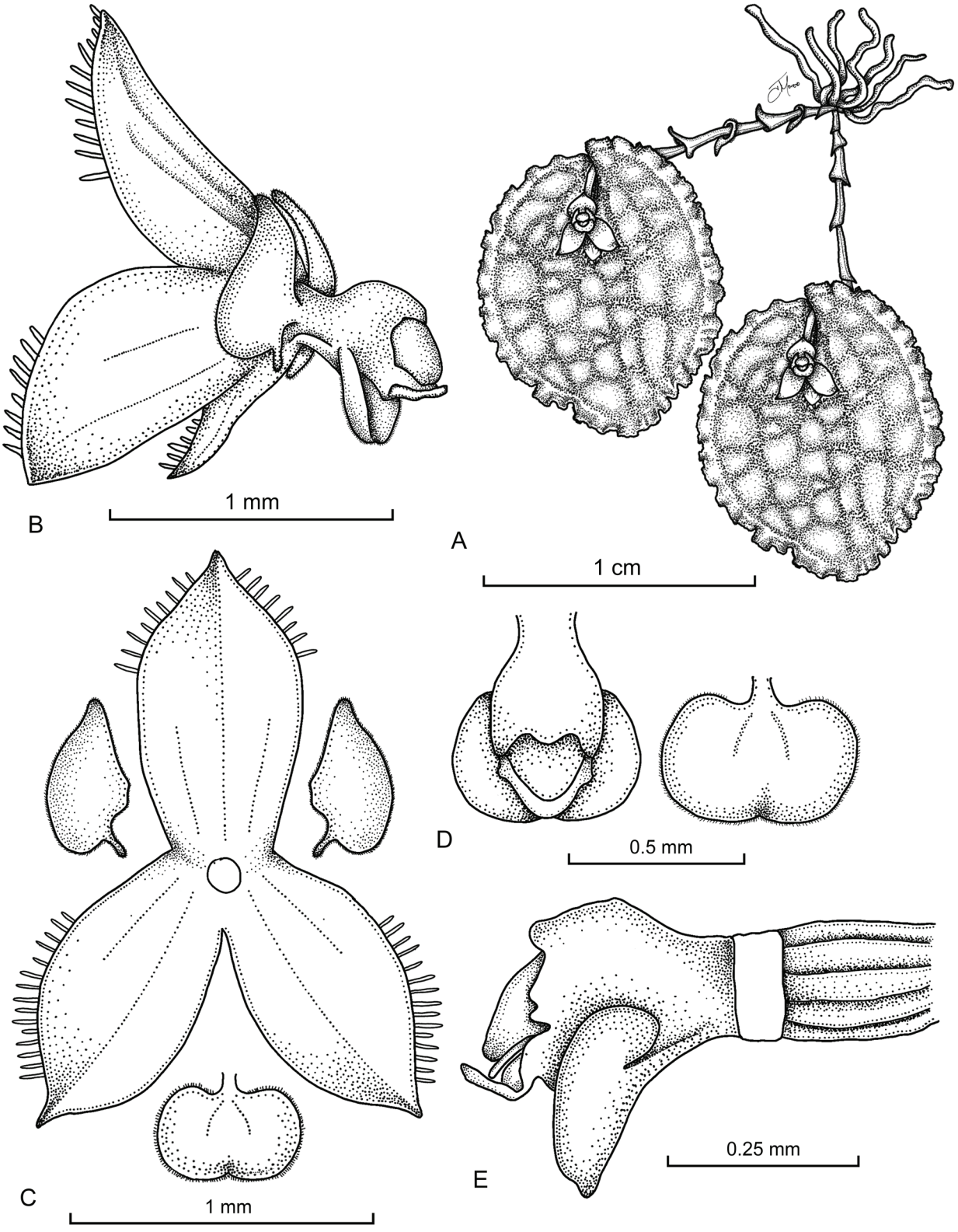


FIGURE 6. Illustration of *Lepanthes microcalodyction* J.S. Moreno & L. Baquero. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, lip; **E**, column, lip, and ovary lateral view (pollinia and anther cap absent). Drawn by J. S. Moreno based on *J. S Moreno & A. L. Erazo 432* (CAUP).

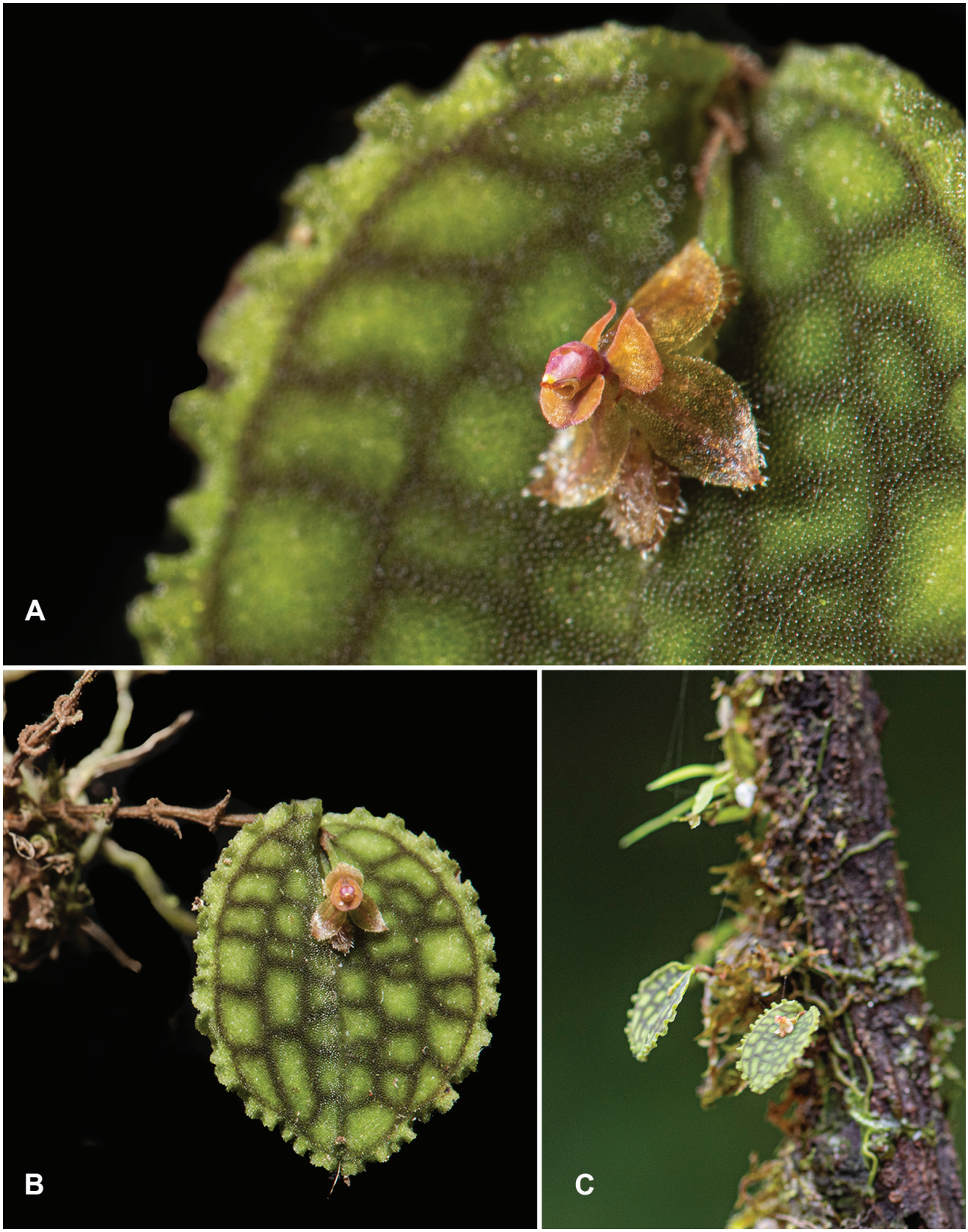


FIGURE 7. *Lepanthes microcalodyction* J.S. Moreno & L. Baquero. **A**, 3/4 frontal view; **B**, plant; **C**, habit and plant, in situ. Photographs by J. S. Moreno.

FIGURE 8. Comparison of the most similar species to *Lepanthes microcalodyction* J.S. Moreno & L. Baquero. **A**, *L. calodyction* Hook.; **B**, *L. microcalodyction*. Both photographs represent the real scale of the two species. Photographs by J. S. Moreno.

Plant very small, up to 2 cm tall, epiphytic, caespitose; *roots* slender. *Ramicauls* erect, slender, 6.0–6.5 cm long, enclosed by 5–6 microscopically ciliate-scabrous lepanthiform sheaths. *Leaves* thinly coriaceous, light green, heavily reticulated with purple, subcircular to broadly ovate, broadly obtuse, 1.0 × 0.8 cm, a marginal vein, margins undulate, the base cordate, abruptly contracted into a petiole ca. 0.5 mm long. *Inflorescence* a congested, distichous, successively several-flowered raceme up to 3–4 mm long, borne on top of the leaf including the 2-mm-long, slender peduncle; *floral bracts*, echinate 0.5 mm long; pedicels 1 mm long. *Ovary* costate, 0.3–0.4 mm long. *Sepals* tawny translucent, glabrous, reflexed, carinate at the abaxial side with long spiculate margins toward the apex. *Dorsal sepal* obovate, acute, 3-veined, 1.0 × 0.5 mm, connate to the lateral sepals for 0.1 mm. *Lateral sepals* obovate, acute, 2-veined, 1.0 × 0.5 mm, connate for 0.1 mm. *Petals* coppery, velvety, transversely bilobed, 0.25 × 1 mm, the upper lobe ovate, oblique, with the apex obtuse, the lower lobe ovate, oblique, the base rounded and abruptly contracted into a short, filiform structure. *Lip* coppery, minutely pubescent, transversely reniform, bent upward at each side of the column, 0.3 × 0.6–0.7 mm, connate to the column close to the base. *Column* scarlet, clavate, papillose, terete, 0.25 mm long; the anther apical; stigma with the tip of the rostellum acute and facing upward.

Additional specimen examined: COLOMBIA. Valle del Cauca: Buenaventura, Cañón del Rio Anchicayá, La Cascada, 3°37'33.5"N, 076°56'34.7"W, 300 m, 4 May 2018, *J. S. Moreno and A, Erazo 433*: CAUP).

Etymology: the specific epithet "microcalodyction" refers to the diminutive flower with a strong resemblance to *Lepanthes calodyction*.

Habitat and ecology: *Lepanthes microcalodyction* was found in two different locations within the Anchicayá River Valley, the first one characterized by having a fairly pristine wet forest located inside Los Farallones National Natural Park and one of the oldest hydroelectrical dams built by CELSIA known as Alto Anchicayá (Map 1). Thanks to the creation of the National Natural Park and the construction of the dam, the forests are well preserved because, as mentioned above, access to the general public is carefully supervised by the company and park authorities. It was also collected in the type locality of *Lepanthes anchicayae* where both species were found growing together in small, continuous tree branches close to the bajo Anchicayá. As a result, anthropic pressure on *Lepanthes microcalodyction* will be minimal and its conservation status will be of least concern in the future.

Lepanthes microcalodyction belongs to an informal group of species from the lowlands of the Pacific Ocean in South America and Panamá, characterized mainly by having heavily reticulate leaves (except for the Panamanian species *Lepanthes pantomima* Luer & Dressler and *Lepanthes arachnion* Luer & Dressler; Baquero, 2018) with margins undulate, small flowers with caudate petals, lip transversely reniform, oblong, cordate, and without an appendix, connectives and body. Several species, such as *Lepanthes pretiosa* Luer & Hirtz, *L. volador* Luer & Hirtz, *L. barbelifera* Luer & Hirtz, *L. tentaculata* Luer & Hirtz, *L. tortuosa* Luer & Hirtz, *L. bibarbullata* Luer, *L. saltatrix* Luer & Hirtz (Luer and Thoerle, 2011), and the recently described species *L. kayii* L. Baquero (Baquero, 2018), share very similar flowers and plants with the new species. The most similar species is *Lepanthes calodyction* (Fig. 8–9), characterized mainly by larger, transversely bilobed petals, 0.5–1.0 × 1.25–2.00 with ciliate margins and the upper and lower lobe long, caudate (vs. petals transversely bilobed, 0.25 × 1 mm, with margins smooth, acaudate, with the base of the lower lobe rounded and abruptly contracted into a short, filiform structure), and a larger lip of 0.66–1.00 × 1.25–2.00 mm, (vs. smaller lip 0.3 × 0.6–0.7 mm).

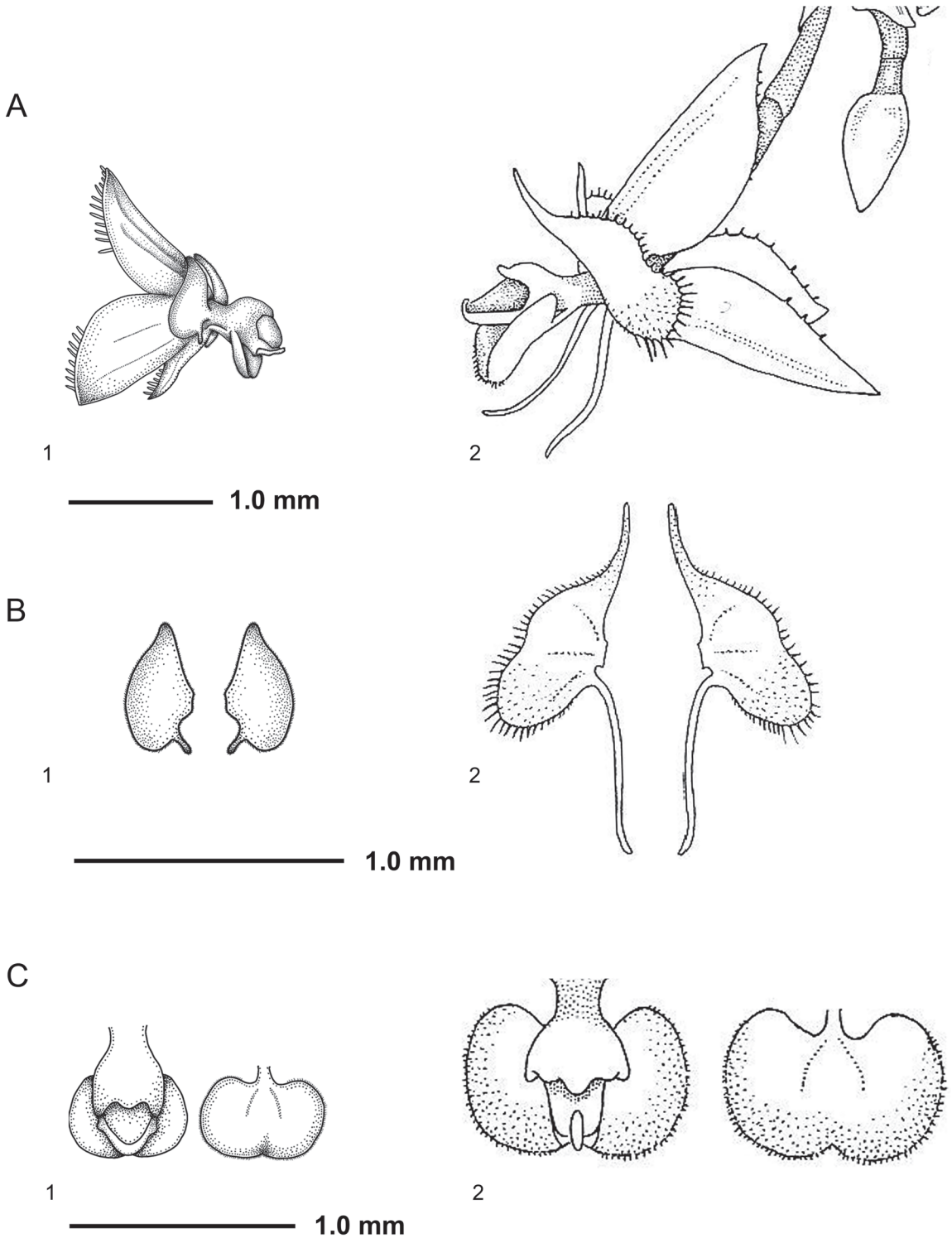


FIGURE 9. Floral illustration and comparisons of *Lepanthes microcalodyction* J.S. Moreno & L. Baquero (1) and *L. calodyction* Hook. (2). **A**, flower; **B**, petals; **C**, lip. Original drawings by J. S. Moreno (1) and Carlyle Luer (2), courtesy of the Missouri Botanic Gardens Press.

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