

## ***LEPANTHES CHALALENSIS* (PLEUROTHALLIDINAE), A NEW SPECIES ENDEMIC TO THE SANTANDER DEPARTMENT IN COLOMBIA**

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**ABSTRACT.** We propose *Lepanthes chalalensis* as a newly identified species confined to the north-east Andes of Colombia. We randomly placed 341 sampling plots across the Eastern Cordillera, including transformed and natural habitats. Here, we provide a detailed description, illustrating images, ecological discussions, a taxonomic key for the new entity, and a conservation status analysis. The species is highly geographically restricted (in 2 out of 341 sampling plots) and has a low population size (26 adult individuals). While *L. chalalensis* shows a resemblance to *L. velosa* from Ecuador, it can be distinguished by the wide lower lobe of the petals, which is long ciliated, the lip laminae, which are reduced and bear stiff cilia, and the appendix length, which appear to be twice as long as the lip blades. The species should be considered a conservation concern due to its high rarity.

**RESUMEN.** Proponemos *Lepanthes chalalensis* como una nueva especie confinada al noreste de los Andes de Colombia. La nueva especie fue hallada en un muestreo de 341 parcelas aleatoriamente posicionadas a lo largo de la Cordillera Oriental, incluyendo hábitats transformados y naturales. Se proporcionan la descripción detallada, imágenes ilustrativas, discusiones ecológicas y un análisis del estado de conservación. La especie está altamente restringida geográficamente (en 2 de las 341 parcelas de muestreo) y tiene un tamaño de población bajo (26 individuos adultos). Aunque *L. chalalensis* muestra una similitud con *L. velosa* de Ecuador, puede distinguirse por el lóbulo inferior de los pétalos, que es ancho y presenta una cilios largos, las láminas del labelo, que están reducidas y presentan cilios rígidos, y la longitud del apéndice, que parece ser el doble de la longitud de las láminas del labelo. La especie debe considerarse una preocupación de conservación debido a su alta rareza.

**KEYWORDS / PALABRAS CLAVE:** Cordillera Oriental, Eastern Cordillera, endémico, endemics, muestreo estandarizado, Neotrópico, Neotropics, standardised sampling

**Introduction.** The environmental crisis caused by anthropogenic activities is driving species to extinction at rates never seen before (Ceballos *et al.* 2015). Threats such as habitat loss, fragmentation, and climate change are the main drivers of this negative trend across biologi-

cal groups (Travis 2003). However, these drivers do not impact all species in the same way. For instance, 77.3% of new plant species to science are considered rare species and more likely to face extinction than wide-spread species (Brown *et al.* 2023). Rare species are those spe-

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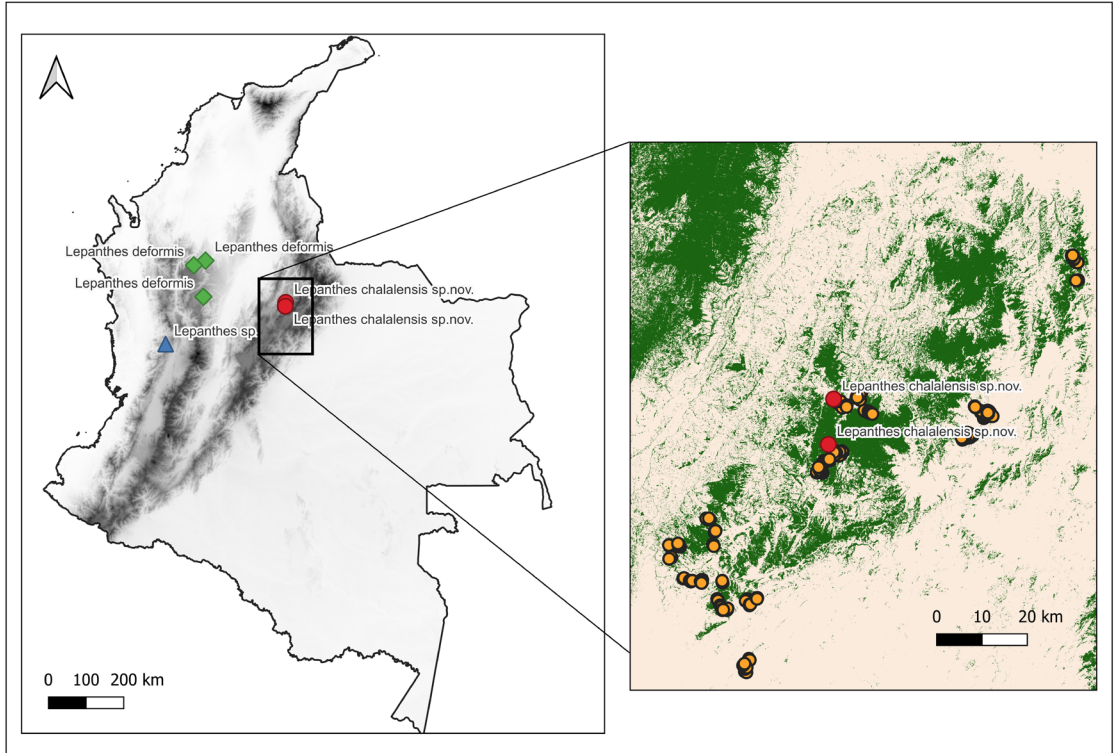


FIGURE 1. Distribution of related species of *Lepanthes chalalensis* E. Restrepo & E. Parra, and study area in the Eastern Cordillera of the Colombian Andes. Left panel shows the distribution of *Lepanthes chalalensis* (red dots), *L. deformis* Luer & Hirtz (green dots), and *Lepanthes sp. as aff. deformis* (blue triangle; Pérez-Escobar O., pers. comm.). Right panel displays study area within Colombia (black box), and elevation (digital elevation model from Tadono *et al.* 2014). The map shows the forest cover (green) and the absence of forest cover (grey; Vancutsem *et al.* 2021), and sampling plots (orange dots). Map composed by E. Parra-Sánchez using QGIS 3.24.1.

cies with a restricted geographical range, low population size, and high habitat specialization (Rabinowitz 1981). Among plant families, Orchidaceae Juss. (Magnoliopsida) hold high levels of rarity, with an estimated 40% of species threatened (Zizka *et al.* 2021) and the highest proportion of endangered species among all plant families by trading (Hinsley *et al.* 2018). New orchid species are discovered every year in small populations and small ranges where natural habitats are highly transformed (Haddad *et al.* 2015, Parra-Sánchez 2023b, 2023c).

*Lepanthes* Sw. (Pleurothallidinae) is a neotropical genus of the Orchidaceae with 1196 species (Karemans *et al.* 2023). The genus is characterized by ramicauls covered with infundibuliform sheaths, often referred to as “lepanthiform sheaths,” each bearing a single leaf that supports a slender, elongated inflorescence carrying one or multiple flowers. These flowers typically feature transversely lobed petals, and, in most

cases, a specialized structure known as an appendix on the lip, facilitating pollination through pseudocopulation (Blanco & Barboza 2005, Luer 1996). Although the genus has many geographically restricted species (Crain & Tremblay 2014), there are some widespread species (e.g. *Lepanthes mucronata* Lindl., Moreno *et al.* 2020). Crain & Tremblay (2014) found that 70% of their *Lepanthes* records occurred in less than three localities (793 out of 1126 species). Drivers of rarity in *Lepanthes* include rapid diversification processes with short divergence time (5–10 Mya; Bogarín *et al.* 2018, Pérez-Escobar *et al.* 2017), dispersal limitation (Acevedo *et al.* 2020, Kindlmann *et al.* 2014, Tremblay 1997), highly specific pollination relationships (Blanco & Barboza 2005), and habitat specificity (Luer & Thorerle 2012). These idiosyncratic features might explain why 73% of the 564 *Lepanthes* species globally assessed are threatened with extinction (BGCI 2023).

We discovered a new species of *Lepanthes* belonging to the section *Lepanthes*, and morphologically similar to *Lepanthes deformis* Luer & Hirtz (1987) and *Lepanthes velosa* Luer & Hirtz (Karremans *et al.* 2021). These species are all characterized by a column twisted about 45 degrees and bending to one side. The discovery was made in the community of Virolin, Santander, in the eastern cordillera of the Colombian Andes. For the new species, we provide a description, diagnostic images, a discussion with the related affinities, and a discussion of its conservation status.

### Materials and methods

**Study area.**— We sampled natural and transformed habitats in a randomised design in the Departments of Cundinamarca, Boyacá, Meta, and Santander in Colombia. Following Parra-Sánchez *et al.* (2023a), sampling points covered natural habitats and pastures across a 2252 m elevational range (1163–3415 m; Tadono *et al.* 2014) and a 2937 mm precipitation range (879–3817 mm per year).

**Sampling design.**— Sampling plots comprised Andean and Altoandino forests (Etter *et al.* 2021) with an average cloud cover of 82% (Wilson & Jetz 2016). In total, we sampled 206 natural habitat plots (148 forest, 48 paramo, and 10 paramo forest), and 135 transformed habitat plots (90 Andean transformed and 45 paramo transformed, Vancutsem *et al.* 2021; Fig. 1). We sampled all understorey orchid individuals at each plot of 10 × 30 m from the ground floor up to 2 m. Identification of species or morphospecies was conducted following specialized literature and consultancy with local experts at the Herbarium VALLE.

**Descriptions and illustrating material.**— We found a species morphologically similar to *Lepanthes velosa* and *L. deformis* that we propose as a new species to science. The flowers of the new entity were dissected, and characters were measured to prepare the description and protologue. Vegetative structures and reproductive structures were measured from living and spirit material. The botanical terminology used for the description followed Stearn (1992) and Luer & Thorerle (2012). We revised the original descriptions of the sister species and the most recent monographs of the genus, for

Colombia (Luer & Thorle 2012), Ecuador (Luer 1996), and Venezuela (Romero-González & Carnevali 2000). Nine herbaria were consulted (AMES, CAUP, COL, CUVV, HUA, JAUM, JBB, VALLE, and MO).

Finally, illustrations and taxonomic revisions for each of the *Lepanthes* species to which the new entity was compared. Illustration done with Procreate® version 5.3.7. Figures and analyses were prepared using specialized software for composite plate, Adobe Photoshop® 2019, and maps on QGIS 3.16 (QGIS 2021).

### TAXONOMIC TREATMENT

*Lepanthes chalalensis* E. Restrepo & E. Parra, *sp. nov.* (Fig. 2–4).

**TYPE:** Colombia. Santander: Municipio de Virolin, Hacienda la Argentina, 2880 m a.s.l., February 2019, E. Parra-Sánchez 2401 (holotype: VALLE).

**DIAGNOSIS:** *Lepanthes chalalensis* resembles the Ecuadorian *Lepanthes velosa* but can be easily distinguished by several characteristics. The lower lobe of the petals in *L. chalalensis* is much wider, measuring 0.93 mm, oblong, with a rounded apex and long cilia. Furthermore, the combination of the dimensions of the body, sinus and appendix in *L. chalalensis* is longer, about 1.62 mm, nearly twice as long as the lip blades when placed in their natural position, including the veil, whereas in *L. velosa*, the combined dimension of the body, sinus and appendix is about 1.2 mm long, nearly as long as the lip, approximately.

**Plant,** epiphytic, caespitose up to 8.5 cm tall; **roots** slender. **Ramicauls** slender, horizontal to pendant, 5.00–5.54 cm long, enclosed by 6–7 blackish, tightly fitting, scabrous lepanthiform sheaths. **Leaves** erect, coriaceous, ovate-elliptical, 4.02–4.56 × 2.29–3.32 cm, the base broadly cuneate, contracted into a petiole 4.81 mm long, the apex shortly acuminate, emarginate with the mid vein extending beneath and ending in a short mucro. **Inflorescence** a very dense, distichous, successively flowered raceme up to 1.41–2.28 cm long, borne at the abaxial side of the leaf by a filiform peduncle 1.61–2.32 cm long; **floral bracts** slender, *ca.* 1 mm long, sparsely spiculate; **pedicel** 4.67–5.84 mm long; **ovary** terete, glabrous,

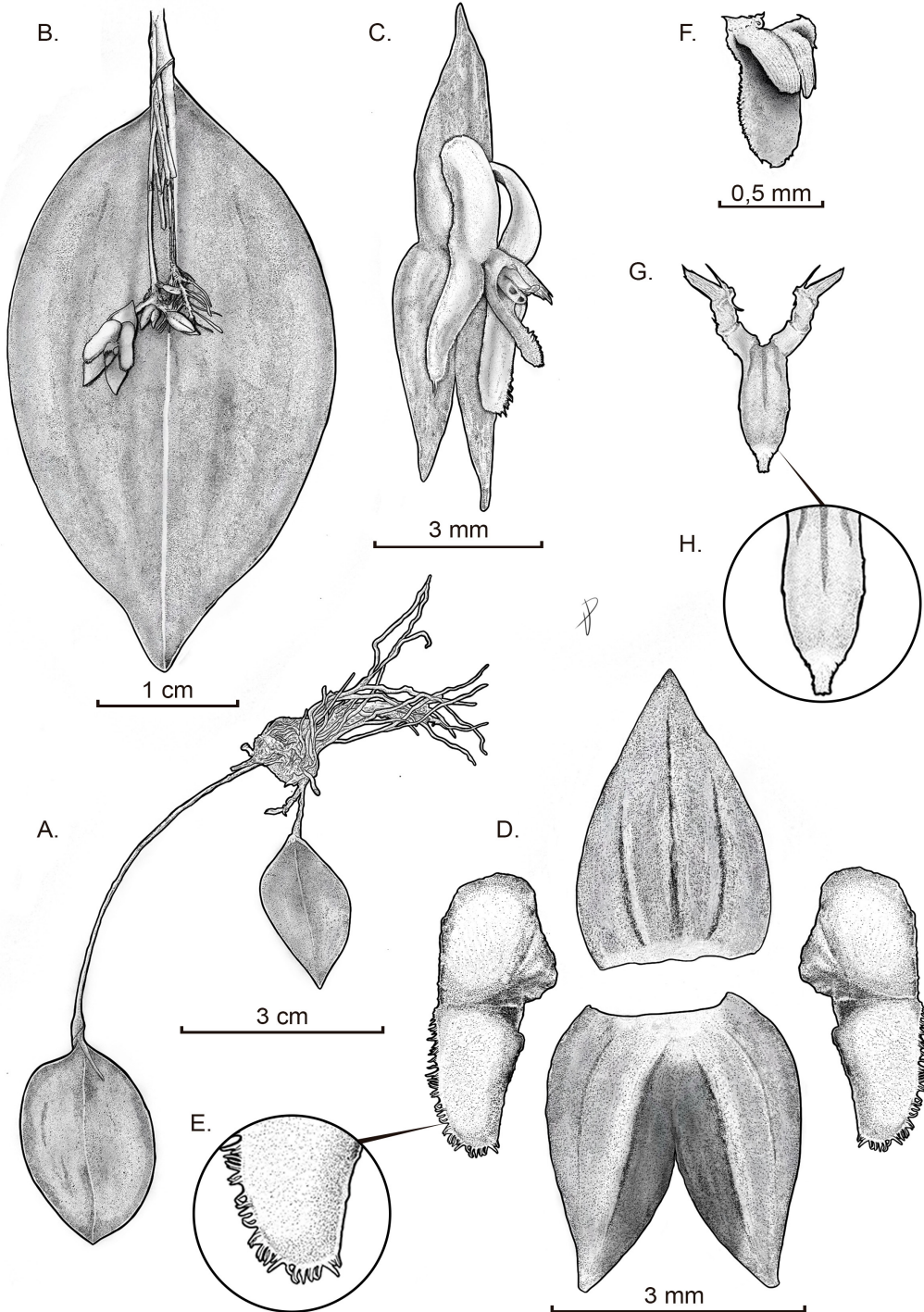


FIGURE 2. Drawing of *Lepanthes chalalensis*. **A.** Habit. **B.** Abaxial view of the leaf with flower. **C.** Flower. **D.** Dissected perianth. **E.** Zoom of the petal's lobe. **F.** Lip in natural position  $\frac{3}{4}$  view. **G.** Lip in natural position without column front view and lip expanded. **H.** Zoom on the lip's apex. Drawn by Daniel Amaya-Jiménez from the plant that served as type.

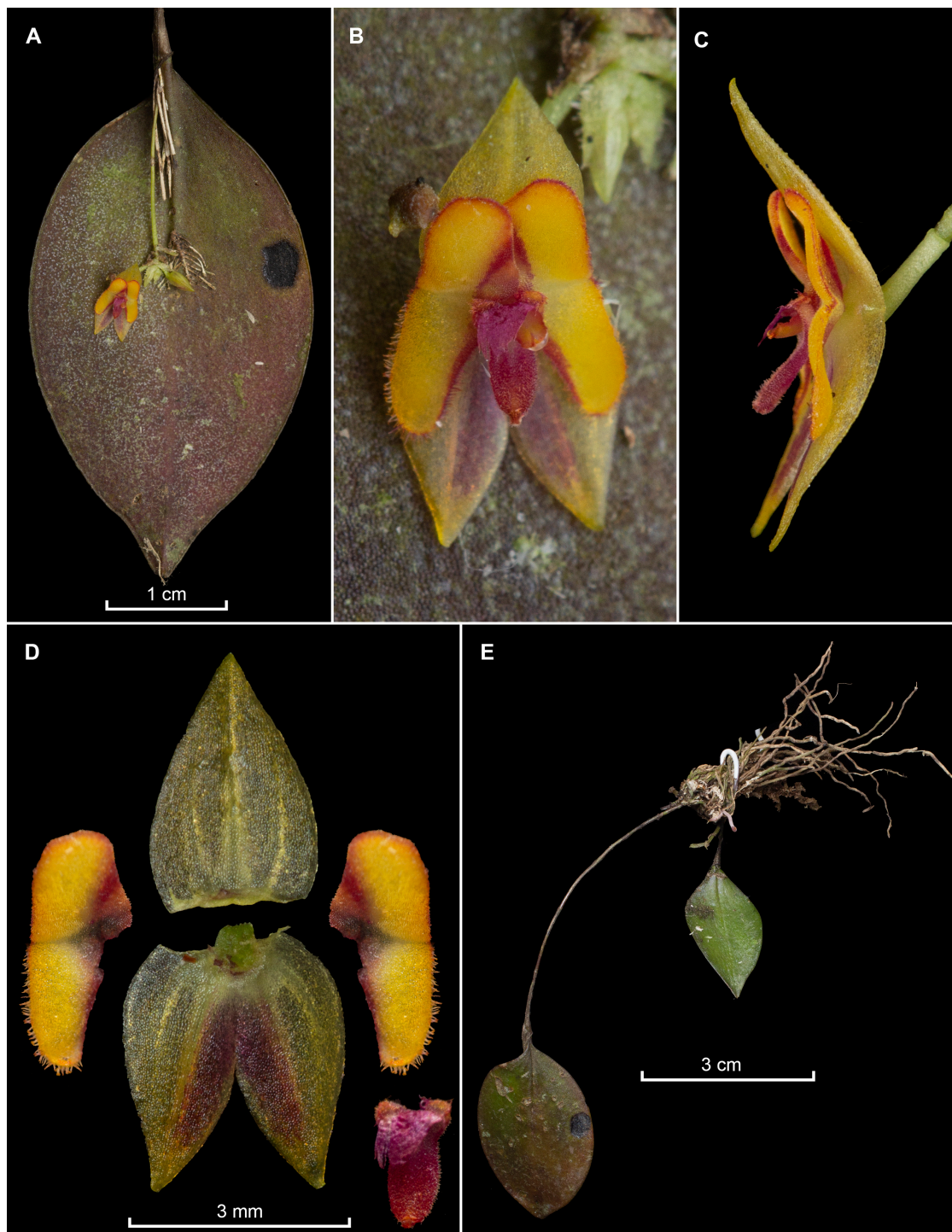


FIGURE 3. Illustrating images of *Lepanthes chalalensis* E.Restrepo & E.Parra, *in vivo*. **A.** Leaf plus flower in abaxial view. **B.** Flower, frontal view. **C.** Flower, lateral view. **D.** Dissected perianth. **E.** Plant habit. Photographed and prepared by Eugenio Restrepo from the plant that served as type (*Parra-Sanchez 2401*, VALLE).

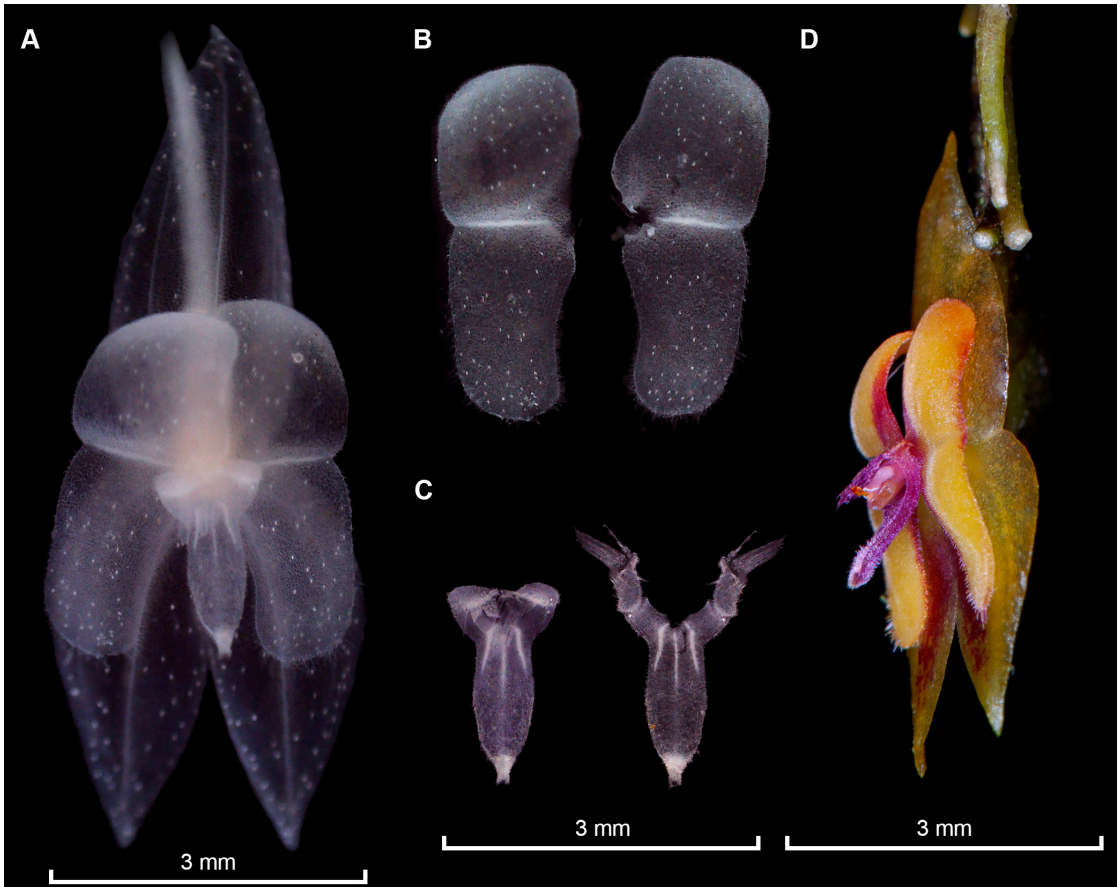


FIGURE 4. Flower dissection in spirit of *Lepanthes chalalensis* E. Restrepo & E. Parra. **A.** Entire flower preserved in spirit showing the “silver-like crystals” present in sepals, petals, column, and lip. **B.** Frontal view of the petals fully extended, note that the long cilia that can be seen *in-vivo* are not striking in the image. **C.** Frontal view of the lip, at the left the laminae not extended and extended at the right depicting the long sinus, and laminae extended. **D.** Flower in semilateral view showing the relation between the appendix and the lip length. Photographs by Melisa Alegría-Valencia (A–C) and Holguer López (D). Prepared by Eugenio Restrepo from the plant that served as type, except D (Parra-Sanchez 2401, VALLE).

keeled, 1.91–2.5 mm long; anatomically, all *flower* parts contain silver-like crystals, *sepals* hyaline, light yellow, glabrous, carinate externally, *dorsal sepal* ovate, acute, 3.47–4.90 × 2.66–2.80 mm, 3-veined, connate to the lateral sepals for *ca.* 1.22 mm; *lateral sepals* connate into a bifid lamina, each being ovate-oblong, the apex attenuate, 2-veined, 3.78–4.44 × 1.22–2.12 mm connate for 1.73–2.00 mm; *petals* yellow suffused with red at the margins, transversely bilobed, microscopically pubescent, 1.33–1.54 × 3.31–3.58 mm wide, 1-veined, the upper lobe oblong with rounded end, *ca.* 1.54 wide, the lower lobe identical to the upper one, long ciliate, *ca.* 1.33 mm

wide; *lip* red, bilaminate, covering two thirds of the column, the blades subrectangular, thickly verrucose, 0.45 × 0.27 each, cellular-papillose at the base, the anterior margins with a row of long, stiff cilia, connated beyond the base into a membranous, veil-like lamina; the body broad, the connectives narrowly oblong, born at either side of the lip; the body and sinus occupied by an oblong, minute appendix, the combined dimensions of the last 1.62 mm long, shallowly 3-veined, pubescent, with an ovoid, minutely pubescent bifid gland at the tip; *column* terete, 1.04–1.20 mm long, bent to one side, the *anther cap* deciduous, *pollinia* not seen *fruit* not seen.



FIGURE 5. Species comparison. **A.** *Lepanthes chalalensis* E.Restrepo & E.Parra. **B.** *Lepanthes velosa* Luer & Hirtz. **C.** *Lepanthes deformis* Luer & Hirtz. Photographs by Robinson Galindo-Tarazona (A), David Haelterman (B), and Andreas Kay (C). Prepared by Eugenio Restrepo.

**ETYMOLOGY:** In reference to “Chalala” the territory of the “Guane” indigenous tribe settled in the territory currently known as Charalá in Santander, Colombia. The translation of “Chalala” from the Guane dialect is subject to dispute among anthropologists and historians. However, historical records trace back the name to the Indigenous Cacique Chalala, the leader of the tribe. The specific epithet of the species was selected by the community where the species was found.

**TAXONOMIC DISCUSSION:** *Lepanthes chalalensis* belongs to the section *Lepanthes* subsection *Lepanthes*. The new species exhibits an unusual development of the lip structures, similar to that seen in *L. deformis* and *L. velosa*. In these species, the lip blades are united into a thin, irregularly veined veil that overlies the column, which is twisted about 45 degrees and bent to the left (Luer & Thoele 2012; Fig. 4B–C, Fig. 5). *Lepanthes chalalensis* can be distinguished for a series of floral morphological differences from similar species and elevations that species dwell in. The new species grows at ~2800 m, while *L. deformis* and *L. velosa* are found relatively in the lowlands, at 750–1100 m. The closer species to *L.*

*chalalensis* is *L. velosa*, which can be distinguished by a set of morphological differences in the lower lobe of the petals, which is much wider, oblong, with rounded apex, long ciliated *ca.* > 1 mm long (*vs.* narrowly triangular, short ciliate; *ca.* < 1 mm long). The key differences in the lip structures between *L. chalalensis* and *L. velosa* are the somewhat subrectangular and strongly reduced, more or less equal in *L. chalalensis*, with the anterior margins forming a row of long stiff cilia, and a much longer, oblong, 3-veined sinus (*vs.* also reduced, somewhat bigger blades, presenting a membranous, longitudinally microscopically veil-like lamina, and a smaller, shallowly channelled (unveined) appendix; Fig. 5). Furthermore, the relationship between the length in natural position of the sinus and the appendix, which *L. chalalensis* appears to be twice as long as the lip blades (*vs.* as long as the lip, *ca.* 1.2 mm long).

The other morphologically similar species is *Lepanthes deformis*, which has been found in the western cordillera of Colombia (*vs.* eastern cordillera of the new taxon). The new entity can be easily distinguished from *L. deformis* by the lateral sepals, which are nearly as wide as the dorsal sepal (*vs.* twice as wide as the dor-

sal sepal; both *ca.* 4 mm wide), the petals, which have subequal lobes, the lower oblong and long ciliated (*vs.* unequal, the lower much narrower, short ciliated (<1mm long). Finally, the appendix of the new species is longer, *ca.* 1.42 mm long, about twice the length of the lip blades (*vs.* appendix minute, not protruding, the lip laminae about 1.2 cm long). Likewise, the blade length in *L. deformis* is larger compared to *Lepanthes chalalensis*, and the sinus is somewhat reduced, ovoid, with a minute and ciliated appendix at the apical part, placing morphologically distant the grade of similarity of this species in the scheme (Fig. 5). *Lepanthes chalalensis* has “silver-like” crystals, that we speculate could be calcium oxalate (Chase & Peacor 1987). This feature is shared by at least one more species with 45 degrees twisted column not threatened here (Pérez-Escobar *pers. comm.*). The actual role of these crystals is uncertain, but these crystals have been proposed to act as pseudonectar clusters for attracting pollinators (Chase & Peacor 1987), or crystal deposits (Luer 1990).

**HABITAT AND ECOLOGY:** The species is exclusively known from its type locality (Fig. 1). Our sampling indicates that it is infrequently encountered at 2200 m in elevation, where it grows epiphytically on lianas and fallen trees. Flowering has been observed throughout the year.

**CONSERVATION STATUS:** According to the IUCN criteria, this species might qualify for the Data Deficient (DD) category (IUCN 2020). However, our data suggests that it warrants conservation concern. We conducted random sampling across a 270 km south-to-north gradient and a 2640 meters elevational gradient (1120–3760 m; Fig. 1). In 341 plots (10 m × 30 m), we found only 26 adult individuals growing epiphytically in the understory in only two plots (tree density = 0.21 – 0.26 trees per m<sup>2</sup>). Specifically, nine plots were within the same forest, and 24 plots were within a 10 km radius (Fig. 1). Our records indicate that the species appears to be geographically rare, with a small population size and specialized habitat requirements.

Population dynamics studies reveal occurrences of low fruit sets (Blanco & Barboza 2005, Tremblay *et al.* 1998), and evidence suggests that small plants experience the highest mortality in their natural habitat (Acevedo *et al.* 2020). Additionally, the sister species *Lepanthes deformis* is traded in the orchid market (<https://ecuagenera.net/products/lepanthes-deformis>), potentially making it highly vulnerable to illegal collection. Limited studies on the conservation impacts of wild collection of epiphytic orchids suggest a low tolerance to harvesting (Fernández *et al.* 2003, Tremblay *et al.* 1998). The detrimental effects of unsustainable collection have been observed in other species, leading to reduced inflorescence development (*Laelia autumnalis* (Lex.) Lindl.; Emeterio-Lara *et al.* 2021), or even pushing them perilously close to extinction (*Paphiopedilum canhii* Aver. & O.Gruss; Averyanov *et al.* 2014). Although the full extent of the impact of illegal collection or other threats on *Lepanthes* populations is not fully understood, we recommend considering this species as a conservation concern as a precautionary measure until a comprehensive risk assessment is conducted (Brown *et al.* 2023).

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**AUTHOR CONTRIBUTIONS.** **EPS:** Writing – review & editing, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Fieldwork, ran the community workshops. **ER:** Taxonomic treatment, Writing – review & editing, Visualization and designing of Figures. **YB,** fieldwork and community leader. **JCOB:** Writing – review & editing. **DPE:** Conceptualization, Writing – review & editing, Supervision, Resources, Funding acquisition.

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