

TWO NEW SPECIES OF PLEUROTHALLIDINAE FROM CLOUD FOREST REMNANTS IN THE EASTERN ANDES OF COLOMBIA

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ABSTRACT. Two new pleurothallid species of the genera *Lepanthes* and *Pleurothallis*, native to cloud forest remnants of the Eastern Andes of Colombia, are described and illustrated. *Lepanthes pseudoabitaguae* is compared with *Lepanthes abitaguae*, from which it differs by the color of the flowers and by the oblong and biglandular appendix. *Pleurothallis falcata* is similar to *Pleurothallis suspensa*, but can be recognized by the falcate to lanceolate leaves, denser inflorescences, longer sepals, and the lip completely recurved with erose apical margins. We also provide comparisons with similar species and offer comments on their ecology. Furthermore, we discuss the significance of this highly anthropized region and its richness in orchid species.

RESUMEN. Se describen e ilustran dos nuevas especies de Pleurothallidinae de los géneros *Lepanthes* y *Pleurothallis*, nativas de remanentes de bosque nublado en los Andes Orientales de Colombia. *Lepanthes pseudoabitaguae* se compara con *Lepanthes abitaguae*, de la cual difiere por el color de las flores y por el apéndice oblongo y biglandular. *Pleurothallis falcata* es similar a *Pleurothallis suspensa*, pero puede ser reconocida por las hojas falcadas a lanceoladas, inflorescencias más densas, sépalos más largos y el labelo completamente recurvo con márgenes apicales erosas. También proporcionamos comparaciones con especies similares y ofrecemos comentarios sobre su ecología. Además, discutimos la importancia de esta región altamente antropizada y su riqueza en especies de orquídeas.

KEYWORDS / PALABRAS CLAVE: endemism, endemismo, flora of Colombia, flora de Colombia, *Lepanthes*, *Pleurothallis*, taxonomy, taxonomía

Introduction. The tropical montane cloud forests constitute nearly 2.5% of the surface of tropical forests. Despite their relatively small extent, they are of utmost priority for biodiversity conservation, considering the outstanding values of endemic and threatened species they harbor (Armenteras *et al.* 2007, Bubb *et al.* 2004). Moreover, these forests play a crucial role in providing fresh water and storing carbon, among other benefits for human well-being (Aparecido *et al.* 2018).

Neotropical cloud forests exhibit exceptional diversity, particularly in certain groups of birds, amphibians, and vascular epiphytes, notably orchids (Carmona-Higueta *et al.* 2023, Gentry & Dodson 1987, Pérez-Escobar *et al.* 2017). Among orchids, the Pleurothallidinae subtribe show one of the highest evolutionary diversification rates, representing a significant portion of the orchid flora found in montane forests (Pérez-Escobar *et al.* 2017). A recently published cata-

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logue of the Pleurothallidinae subtribe for Colombia listed 1854 species, with almost 60% of them being endemic to the country. The most species rich genera are *Stelis* Sw. (521 species), *Lepanthes* Sw. (377 species) and *Pleurothallis* R.Br. (248 species) (Karrermans *et al.* 2023).

In the Neotropics, the major threat to this unique ecosystem is the clearance for cattle ranching. In the case of Colombia, despite trends of rural depopulation, the expansion of grasslands has continued (Bubb *et al.* 2004), resulting in cloud forests becoming isolated islands on mountain tops or along steep hills, remnants of the once extensive areas of Andean forests. The eastern range of the Colombian Andes, known as “Cordillera Oriental,” has undergone extensive transformation, particularly towards the Magdalena Valley. Approximately 51% of its original natural ecosystems have been lost, with only 45% of the original cover of Andean forests remaining, and less than 5% designated as protected areas, as estimated two decades ago (Armenteras *et al.* 2003).

However, small remnants of well-preserved cloud forests within transformed landscapes play a crucial role as a refuge for epiphyte diversity (Koster *et al.* 2009). This significance increases when considering narrow endemic species such as orchids of the Pleurothallidinae subtribe.

Previously unexplored areas of the Neotropics may host several undescribed plant species (Gentry 1982). Recent studies of the orchid flora in remnants of cloud forests in a floristically rich area of the eastern Andes in Santander, Colombia, have led to the discovery of new orchid species (Gutiérrez Morales *et al.* 2018, 2021, 2023, Hágater *et al.* 2018, Moreno *et al.* 2018, Vieira-Urbe & Gutiérrez 2020). As part of this ongoing research, we present two new orchid species from the same locality, specifically of the genera *Lepanthes* and *Pleurothallis* within the Pleurothallidinae subtribe.

TAXONOMIC TREATMENT

Lepanthes pseudoabitaguae N.Gut., K.Gil-Amaya & J.S.Moreno *sp. nov.* (Fig. 1, 2, 3A)

TYPE: COLOMBIA. Santander: La Belleza, Vereda El Chircal-Ojo de Agua, 2530 m. 18 November 2016, N. Gutiérrez 17 (holotype, JBB 17269).

DIAGNOSIS: *Lepanthes pseudoabitaguae* is most similar to *Lepanthes abitaguae* Luer & L.Jost, as its name suggests. The primary distinguishing feature lies in their appendices which in *L. abitaguae* is triangular, positioned below the stigma and acutely reflexed (vs. oblong and biglandular in *L. pseudoabitaguae*).

Plant epiphytic, caespitose, up to 22 cm tall. *Roots* slender, flexuous, filiform, ca. 1.0–1.2 mm in diameter. *Ramicauls* slender, suberect, 3.5–14 cm long, enclosed by 7–13 ribbed, minutely ciliate, acuminate, lepanthiform sheaths. *Leaves* suberect, papyraceous, purple on the abaxial surface, lustrous, likely iridescent, ovate to elliptical, the margins recurved, reticulate-veined, obtuse, the apex emarginate with an abaxial central apiculum, 4.5–7.2 cm × 1.7–2.3 cm wide, the base cuneate, contracted into a petiole 1.0–1.2 mm long. *Inflorescence* (1–2) per ramicaul, a congested, distichous raceme successively many-flowered, up to 4.5 cm long, borne on the adaxial side of the leaf by a slender and filiform peduncle, 2.0–3.7 cm long; *floral bracts* conical, acuminate, 1.4–1.9 mm long. *Ovary* costate, 3.3–3.9 mm long. *Flowers* with sepals magenta to pale red, with pale yellow at the margins, petals and lip cinnabar, the column vermilion with the apex claret, the anther cap purple. *Dorsal sepal* glabrous, ovate, slightly concave in the middle, acute-attenuate, 3-veined, 5.0–6.7 × 3.8–5.5 mm, connate to the lateral sepals for up to 2.65 mm. *Lateral sepals* shortly papillate along the margins, ovate, oblique, each-2-veined, 4.4–6.1 × 2.4–3.3 mm, connate up to 3.4 mm into an ovate, bifid synsepal with attenuate, divergent apices. *Petals* transversally trilobed, 3-veined, minutely pubescent, the upper lobe quadrate, oblique, 4 × 2 mm, 2 mm long, the flagelliform midlobe uncinately from the outer margin between the lobes, the lower lobe narrowly triangular, acute, 3.7 × 1.2 mm. *Lip* bilaminar, the blades suboblong, 1.7–2.6 × 0.6–0.9 mm, the base obtuse, the apex truncate, minutely pubescent, sharply folded over the thin and broadly cuneate connectives, adnate to the base of the column, with a pubescent, oblong, sinuose, biglandular appendix. *Column* terete, stigma ventral, bilobed, anther dorsal, elongated beyond the stigma, 2.9 mm long. *Anther cap* cucullate, elongate, 1.7 × 0.5 mm. *Pollinia* 2, yellow, narrowly oblanceolate, attached to a viscidium, 1.4 mm long.

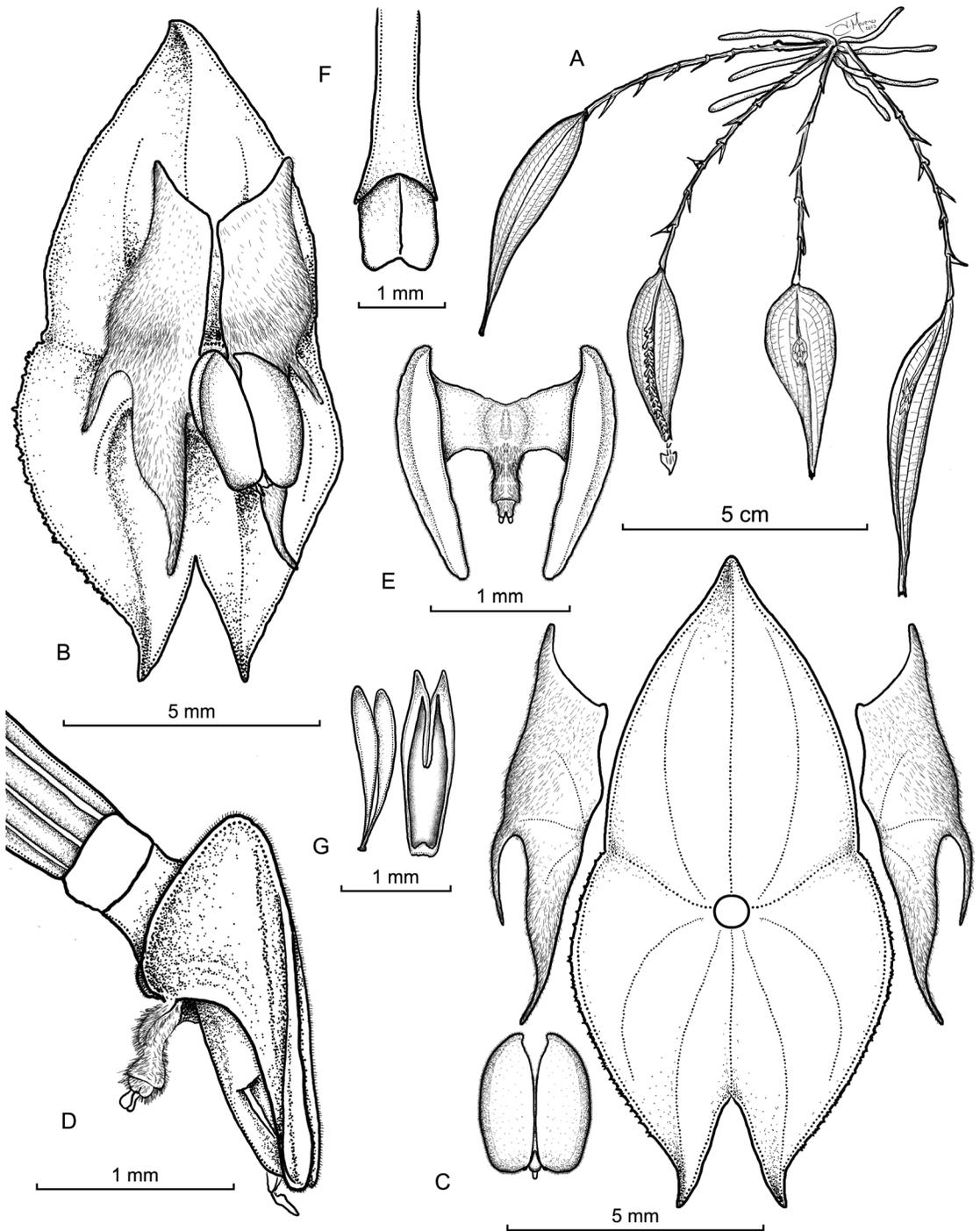


FIGURE 1. Illustration of *Lepanthes pseudoabitaguae* N.Gut., K.Gil-Amaya & J.S.Moreno. **A.** Habit. **B.** Flower. **C.** Perianth, with lateral view of the synsepal. **D.** Ovary, column and lip, lateral view. **E.** Lip, ventral view. **F.** Column, dorsal view. **G.** Anther cap and pollinia. Illustration by Juan Sebastián Moreno based on the paratype.



FIGURE 2. *Lepanthes pseudoabitaguae* in situ. A. Flower, frontal view. B. Flower, lateral view. C. Habit. Photos by Juan Sebastián Moreno.



FIGURE 3. Comparison with the most similar species. **A.** *Lepanthes pseudoabitaguae*. **B.** *Lepanthes abitaguae*. Photos by Juan Sebastián Moreno (A) and Andreas Kay (B).

ADDITIONAL MATERIAL EXAMINED: COLOMBIA. Santander: La Belleza, Vereda El Chircal-Ojo de Agua, 2583 m. 11 May 2022, *N. Gutiérrez 232*, (paratype, JBB). Bolívar, Hoya de Panamá, 2790 m. February 2016 (photo voucher: David Haelterman).

Eponymy: Named due to its remarkable similarity with *Lepanthes abitaguae*.

Distribution: *Lepanthes pseudoabitaguae* is apparently restricted to montane humid forests on the western slope of the Eastern Andes of Colombia, in La Belleza Municipality, Santander (Fig. 4). Despite the high degree of fragmentation of these cloud forests, this species has been observed several times in the type locality and once in a second area located near the top of the “Hoya de Panamá,” in the Municipality of Bolívar, Santander.

Habitat and Ecology: The type specimen was found growing near the ground on branches densely covered

by bryophytes, with limited exposure to light. Other *Lepanthes* species registered in these forest remnants include *Lepanthes agglutinata* Luer, *Lepanthes saccata* Luer & R.Escobar, *Lepanthes palaga* Luer & R.Escobar and *Lepanthes dryades* Luer & R.Escobar.

Discussion. The most similar species to *Lepanthes pseudoabitaguae* is undoubtedly *Lepanthes abitaguae* (Fig. 3B), endemic to the eastern slope of the Andes of Ecuador. The plants are similar in overall size and in the proportions between ramicauls and leaves, the leaves are iridescent, suffused with purple beneath. The flowers are apparently identical, just differing in the color of petals and sepals (yellow-orange in *L. abitaguae*, magenta to pale red in *L. pseudoabitaguae*), in the degree of connation of the dorsal sepal to the lateral sepals (1 mm in *L. abitaguae*, 3.4 mm in *L. pseudoabitaguae*), and in the appendix morphology.

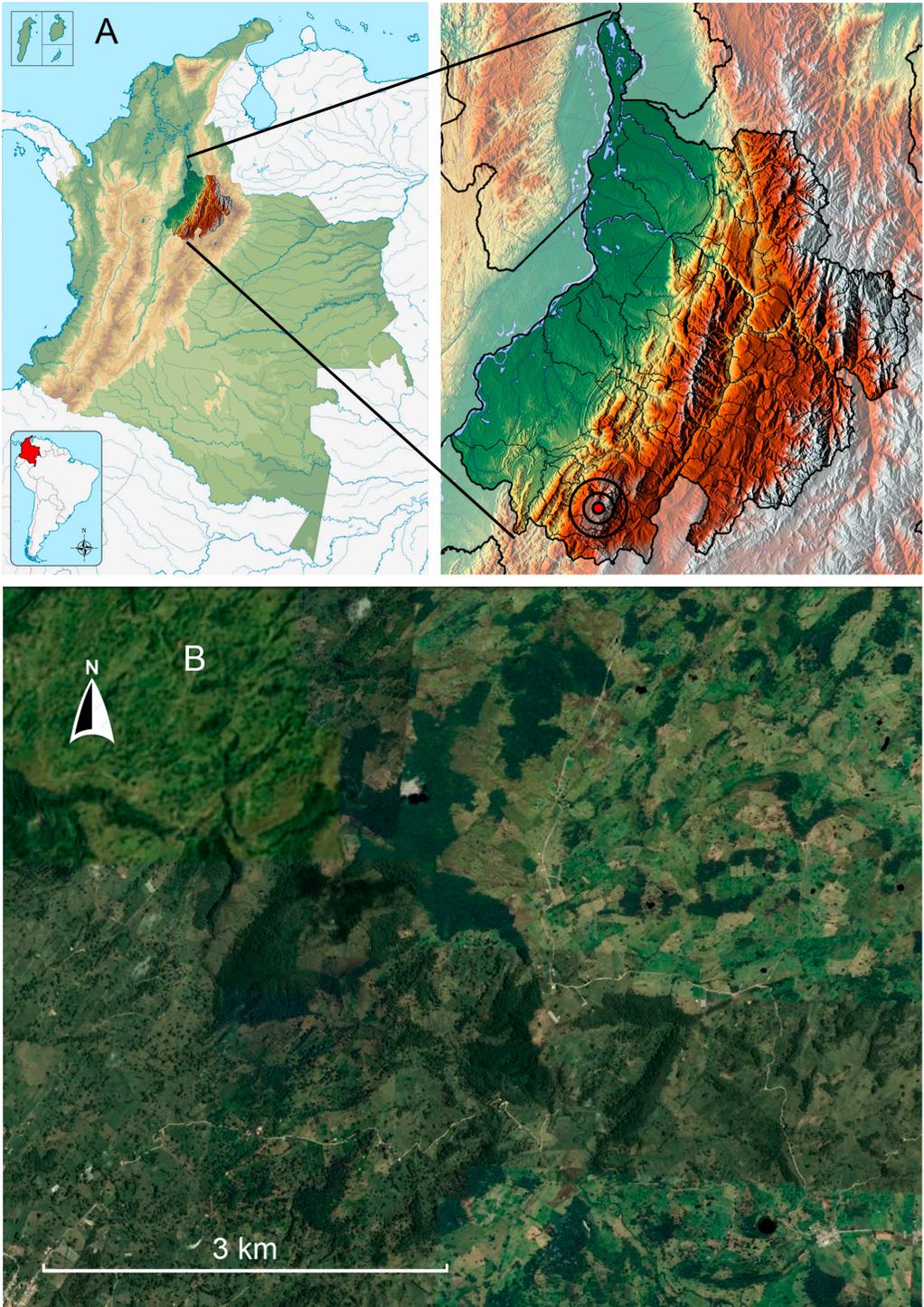


FIGURE 4. **A.** Santander department in the Eastern Andes of Colombia, the specific region is marked to the south. **B.** Satellite images of the forest fragments that harbors the two new species, along with several other endemic orchid species, within a highly transformed landscape. Photos by Wikipedia (A) and Google Earth (B).

When we first collected and photographed the new species, we erroneously identified it as *Lepanthes abitaguae* due to their remarkable similarity in plant and flower morphology. However, considering the distribution range of *L. abitaguae*, and some minor discrepancies in flower morphology that we mentioned earlier, we decided to dissect the specimens under a stereo microscope to confirm its identity. Focusing on the defining feature of many *Lepanthes* species, which is the appendix, we found a significant difference in this structure, which is oblong and biglandular in *Lepanthes pseudoabitaguae*, but reflexed and triangular in *L. abitaguae*. This is the most distinct difference between the two species.

On the other hand, it is worth noting that when describing *L. abitaguae*, Luer did not provide detailed descriptions or illustrations of the column, stigma, or anther, which may also vary between both species. Instead, he placed emphasis on the lip blades and the appendix.

Pleurothallis falcata N.Gut. & K.Gil-Amaya, *sp. nov.* (Fig. 5, 6, 7A–B)

TYPE: COLOMBIA Santander: La Belleza, Vereda El Chircal-Ojo de Agua, 2457 m. 14 January 2023, *N. Gutiérrez* 270 (holotype, JBB 38541; isotype, *N. Gutiérrez* 271, JBB 38542).

DIAGNOSIS: Similar to *Pleurothallis suspensa* Luer, distinguished by the falcate to lanceolate leaves (*vs.* elliptical-ovate), the denser inflorescences with pinkish and pale yellow flowers (*vs.* inflorescences with distant, purple flowers), the larger sepals, (sepals >10.5 mm *vs.* <8.0 mm long), and the lip with the apex completely recurved, with the apiculum recurved and the apical margins erose (*vs.* lip partially recurved, the apiculum straight, the apical margins entire).

Plant epiphytic, caespitose, up to 27 cm tall. *Roots* slender, flexuous, *ca.* 1 mm in diameter. *Ramicauls* erect to suberect, slender, 8.5–16.5 cm long, partially enclosed by a pair of close, tubular, ribbed, truncate sheaths. *Leaf* suberect, thinly coriaceous, falcate to lanceolate, the apex attenuate, acuminate, 6.3–11 × 1.0–1.3 cm, the base cuneate. *Inflorescence* 1–10 per ramicaul, loose, pendant, fragile, subcongested, 5–10 flowered racemes of simultaneous, pinkish to light yellow, non-resupinate flowers, 6.0–9.5 cm long in-

cluding the peduncle *ca.* 5 cm long, emerging from a spathe *ca.* 1–2 cm long at the base of the leaf; *floral bracts* tubular, slightly dilated, truncate, 4 mm long, pedicels 3 mm long. *Ovary* green to vinaceous, sulcate, 2 mm long. *Flowers* not resupinate, pinkish to pale yellow. *Sepals* membranous, glabrous, the *dorsal sepal* narrowly lanceolate, acute, 9.7 × 1.9 mm, 3-veined, the *lateral sepals* completely connate into a lanceolate, deeply concave, acute synsepal, 10.5 × 2.8 mm, each 2-veined. *Petals* membranous, narrowly linear, acute, 8.6 × 0.4 mm, 3-veined. *Lip* vinaceous, darker centrally, broadly ovate, 3-lobed, arcuate, 1.6 × 1.7 mm unexpanded, the lateral lobes erect, broadly rounded, slightly oblique, the midlobe with the apex apiculate, erose, vinaceous, the disc convex, slightly sulcate, without callus, the base truncate, hinged to the column-foot. *Column* stout, semiterete, 1.2 mm long. The *anther* and *stigma* apical, the rostellum elongate, triangular, tinged with rose. *Pollinia* two, yellow, ovoid, *ca.* 0.4 mm long, attached to a rounded viscidium. *Fruit* 0.8 cm long, 0.6 cm wide.

ADDITIONAL MATERIAL EXAMINED: COLOMBIA. Santander: La Belleza, Vereda El Chircal-Ojo de Agua, 2530 m. 31 May 2017, *N. Gutiérrez* 63 & *S. Moreno* (paratype, JBB 17607).

ETYMOLOGY: From the Latin *falcatus*, “hooked, curved like a scythe or sickle,” in allusion to some of the leaves of this species, such character is more evident in the photograph of the paratype specimen (Fig. 7A).

DISTRIBUTION: Only known from the western slope of the Eastern Andes, in La Belleza, Santander, Colombia, where it inhabits cloud forests at elevations of 2400 to 2600 m, in the same forest remnants that host populations of *Lepanthes pseudoabitaguae*.

HABITAT AND ECOLOGY: Epiphytic in partial shade in mature vegetation, on trunks of several Melastomataceae trees and tree ferns of the genus *Cyathea* Sm. (Cyatheaceae). The type specimen was found alongside other orchid species such as *Lepanthes palaga*, *L. saccata*, and *Oliveriana ortizii* Á.Fernández. Flowering occurs from January to May. Individuals from different populations exhibit variations in overall flower size and color, ranging from entirely white, cream to pink, while the leaves of a single specimen may also display varying degrees of curvature.

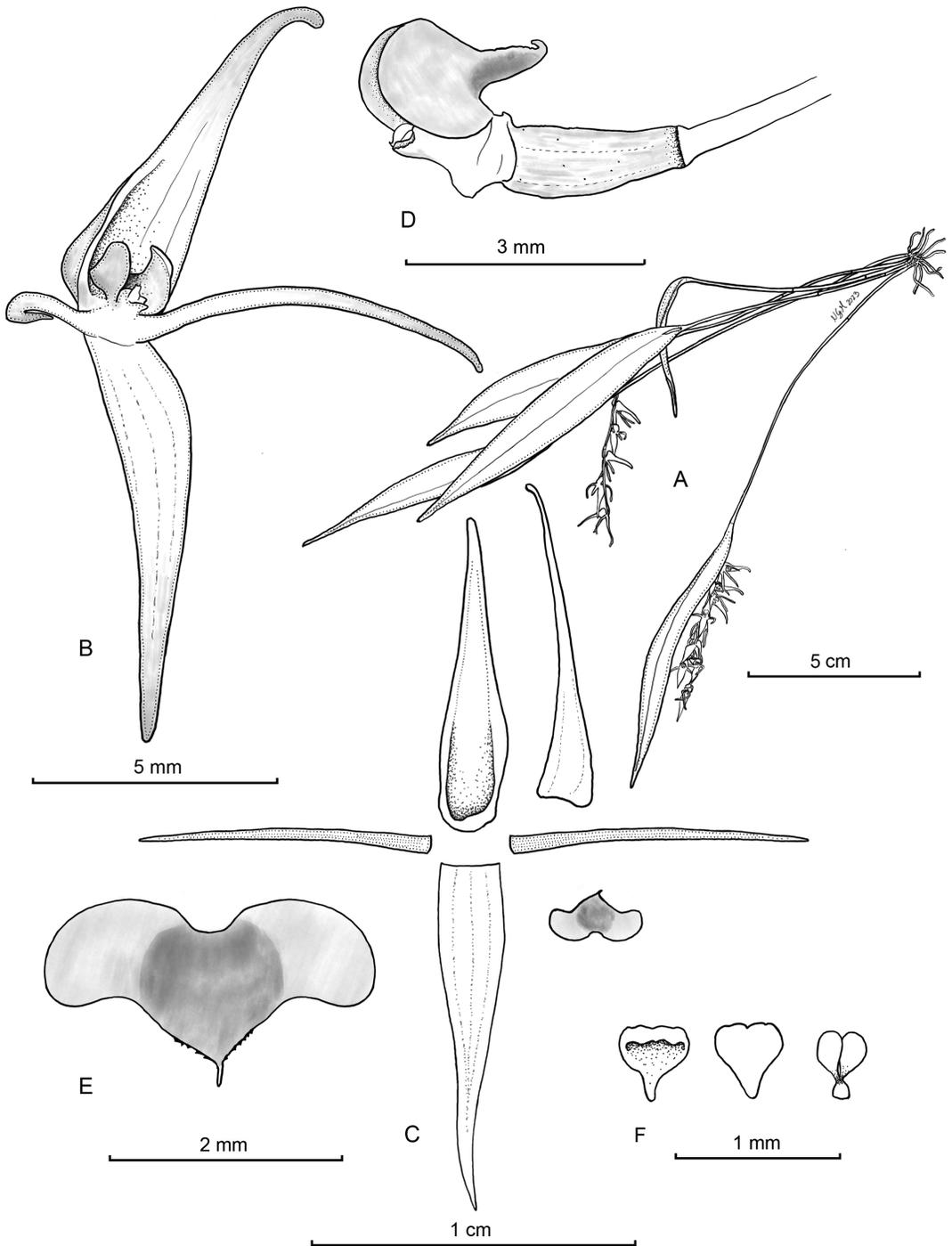


FIGURE 5. Illustration of *Pleurothallis falcata* N.Gut. & K.Gil-Amaya. **A**. Habit. **B**. Flower. **C**. Perianth, with lateral view of the synsepal. **D**. Ovary, column and lip, lateral view. **E**. Inverted, expanded lip. **F**. Anther cap and pollinarium. Illustration by Nicolás Gutiérrez Morales based on the paratype.

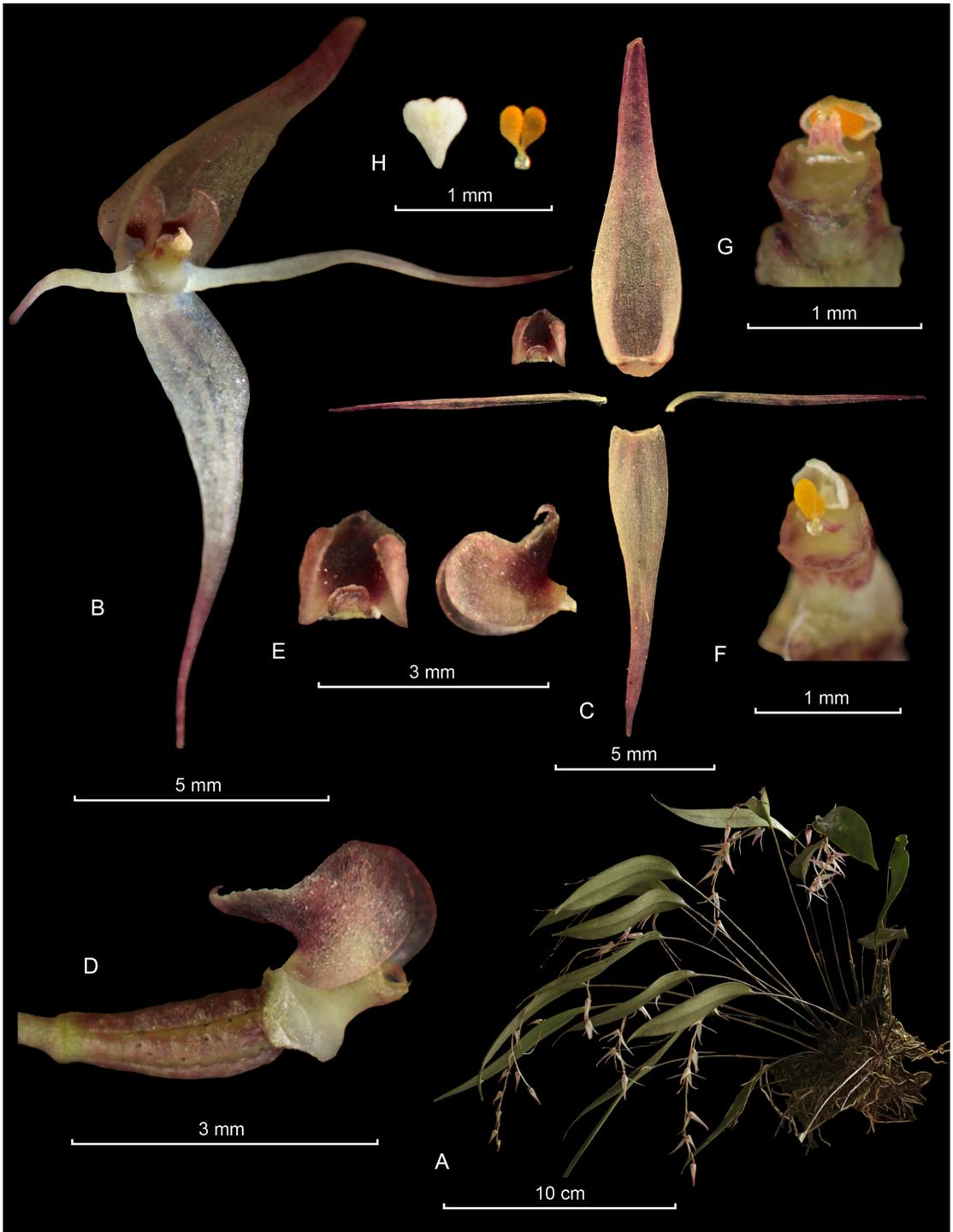


FIGURE 6. Lankester Composite Digital Plate (LCDP) of *Pleurothallis falcata*. **A.** Habit. **B.** Flower. **C.** Perianth. **D.** Ovary, column and lip, lateral view. **E.** Lip, dorsal and lateral views. **F.** Column, front view. **G.** Column, ventral view. **H.** Anther and pollinarium. Photos by Nicolás Gutiérrez Morales.

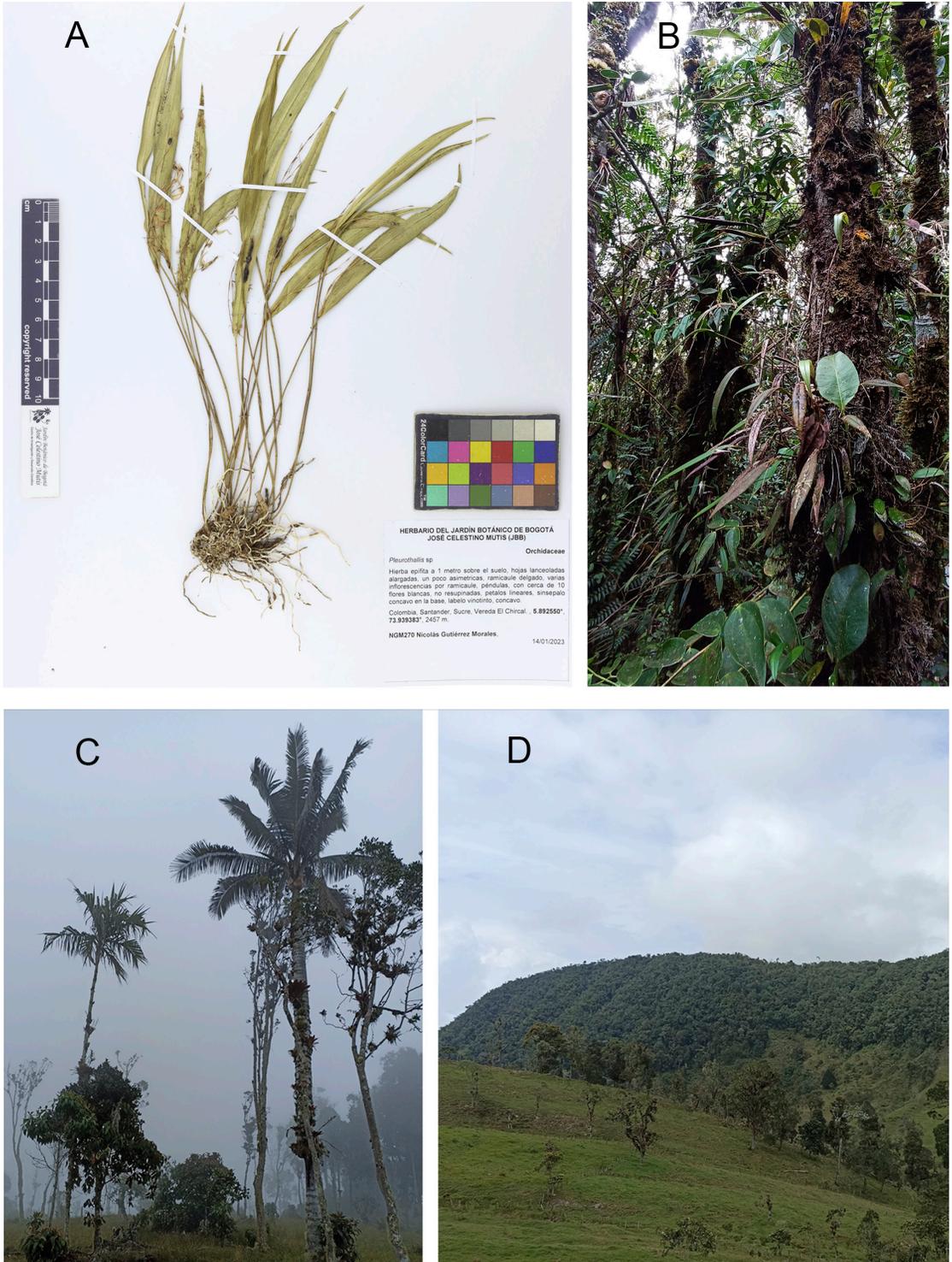


FIGURE 7. **A.** Holotype of *Pleurothallis falcata*. **B.** *Pleurothallis falcata* in situ. **C.** Clearance of cloud forest to grasslands. **D.** Forest remnants in steep hills. Photos by Nicolás Gutiérrez Morales (B–D), and courtesy of the JBB (A).

Discussion. *Pleurothallis falcata* can be distinguished by the elongated ramicauls with falcate to lanceolate leaves, pendant, loose racemes of pinkish or yellow, non-resupinate flowers, the synsepal deeply concave, the narrow-linear petals and the recurved lip with prominent lateral lobes, with the apex apiculate and minutely erose. *Pleurothallis falcata* is similar to some species included in Luer's (1999) revision of *Pleurothallis*, subgen. *Pleurothallis*, subsection *Antennifera* Luer, such as *Pleurothallis suspensa*, which occurs in lowlands of Suriname, Guyana, and Venezuela; and *Pleurothallis antennifera* Lindl., widely distributed in the mid to high altitudes in the Andes of Venezuela to Bolivia.

Pleurothallis suspensa is without a doubt the most similar species, because of its overall size of the plant, with slender, elongated ramicauls, loose, pendant racemes with no resupinate, simultaneous flowers, the petals narrowly linear, and the recurved lip with the sides broadly rounded, the disc slightly sulcate and the apex minutely apiculate. *Pleurothallis falcata* differs by the longer, lanceolate to falcate leaves (*vs.* elliptical-ovate leaves), the congested racemes (*vs.* racemes with flowers distant from each other), the flowers pinkish or pale yellow (*vs.* flowers purple), the sepals larger, the dorsal sepal narrowly lanceolate (*vs.* narrowly ovate), the deeply concave synsepal (*vs.* concave), and the lip with the apex completely recurved, with the apiculum recurved and the apical margins erose (*vs.* lip partially recurved, the apiculum straight, the apical margins entire).

Pleurothallis antennifera is also similar to the new species, albeit to a lesser extent. It shares the elongated ramicauls, lanceolate leaves, subcongested inflorescences with simultaneous flowers, linear petals, concave synsepal, lip concave with pronounced lateral lobes, with the apical margins erose and apiculate at the apex. It can be easily distinguished from *P. falcata* by the larger size, reptant habit (*vs.* caespitose habit), the absence of falcate leaves, the erect inflorescences (*vs.* pendant), the shape of the sepals, and the lip with the lateral lobes oblong, incurved, and the apex incurved (*vs.* lobes rounded, straight, apex recurved).

The new species can be treated within *Pleurothallis* subsection *Antennifera* considering the elongate leaves, narrowly linear petals, recurved lip with prominent and broad lateral lobes, and the undeveloped glenion. However, contrary to Luer's (1999) statement that erect inflorescences with resupinate flowers are typically fre-

quent in subsection *Antennifera*, the pendent raceme of *Pleurothallis falcata* carries no resupinate flowers. Such a combination of characters seems uncommon within the subsection *Antennifera* but is commonly found in subsect *Macrophyllae-Racemosae* Luer.

It's important to emphasize that the subsection *Antennifera*, as noted by Wilson *et al.* (2017), is not a natural group, instead, it is embedded within a larger group that also includes the species of *Pleurothallis* subsect. *Macrophyllae-Racemosae*.

Final considerations. With the discovery of these two new taxa, we have identified seven new species from five orchid genera in this area of fragmented cloud forest. Interestingly, all the species are within 5 km from each other, within an elevational range of 2350 to 2570 m (Fig. 4B, 7C–D). Our comparisons of the orchid community between fragments indicates a high species turnover (Gutiérrez Morales *unpubl.*). For example, there is no more than 2.6 km between the three *Lepanthes* species described, *Lepanthes agatarum* J.S.Moreno, N.Gut. & S.Vieira-Uribe, *Lepanthes marielana* N.Gut., J.S.Moreno & S.Vieira-Uribe, and *Lepanthes pseudoabitaguae*. To date, they have not been seen growing close or together.

Furthermore, the inventory of the orchid species in this specific area has also contributed several new records to the Colombian flora: *Andinia ciliaris* (Luer & Hirtz) Karremans & S.Vieira-Uribe, *Lankesteriana caudatipetala* (C.Schweinf.) Karremans, *Platystele jesupiorum* Luer, and *Ophidion compactum* (Vierling) Karremans & J.S.Moreno, reported in Karremans *et al.* (2023). Additionally, *Myoxanthus parvilabius* (C.Schweinf.) Luer, as reported in Rojas Alvarado *et al.* (2021).

Unfortunately, the specific region of the Eastern Andes in Colombia lacks adequate protected areas. Consequently, the outstanding vegetal diversity in this area faces a high level of threat and can gradually disappear due to the ongoing expansion of grasslands and selective logging (Fig. 7C–D). The absence of protective measures puts these unique species at risk of gradual disappearance. Therefore, the establishment of natural reserves, even if they are small in size, is imperative for the long-term conservation of these species and the preservation of the still undiscovered biodiversity within these forests

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