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A NEW PERUVIAN HIGHLAND *LEPANTHES* (ORCHIDACEAE)

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Abstract. *Lepanthes phuyupitika*, a new rupicolous species from the high-elevation ecosystems of northern Peru, is described and illustrated. It grows on rocky substrates in the páramo and upper montane cloud forests between 3400 and 3900 m elevation. The new species is most similar to the Venezuelan *L. unitrinervis* but differs by its larger ovate-lanceolate dorsal sepal, larger petals, a labellum with narrowly obovate blades and a suborbicular body, a minute deltoid ciliate appendix, and a longer column. We calculated spatial metrics associated with the species' range following Criterion B of the Red List of Threatened Species, as well as range contraction due to historical fires. The species is known from only two localities, with approximately twenty-five mature individuals, and is assessed as Endangered because of its restricted distribution and ongoing habitat degradation from recurrent burning and livestock grazing.

Resumen. *Lepanthes phuyupitika*, una nueva especie rupícola de los ecosistemas altoandinos del norte del Perú, se describe e ilustra. Crece sobre sustratos rocosos en el páramo y en los bosques nublados superiores de los bosques montanos, entre los 3400 y 3900 m de elevación. La nueva especie es más afín a la venezolana *L. unitrinervis*, de la que se distingue por su sépalo dorsal ovado-lanceolado de mayor tamaño, pétalos más grandes, un labelo con láminas estrechamente obovadas y un cuerpo suborbicular, un apéndice diminuto, deltoide y ciliado, y una columna más larga. Calculamos métricas espaciales asociadas con el rango de la especie siguiendo el Criterio B de la Lista Roja de Especies Amenazadas, así como la contracción de su distribución debido a incendios históricos. La especie se conoce únicamente de dos localidades con aproximadamente veinticinco individuos maduros y se evalúa como En Peligro debido a su distribución restringida y a la degradación continua de su hábitat causada por las quemas recurrentes y el pastoreo.

Keywords/Palabras clave: conservation assessment, evaluación de conservación, rupicolous orchids, orquídeas rupícolas, microendemism, microendemismo, páramo, Piura mountain range, Cordillera de Piura, taxonomy, taxonomía

Introduction. High-elevation habitats can drive lineage divergence through steep topographic heterogeneity, narrow elevation bands, and extreme microclimatic specialization, simultaneously promoting geographic isolation and restricting the spatial area available for independent evolution (Givnish *et al*., 2015; Madriñán *et al*., 2013). Despite their evolutionary significance, the geographical ranges and threats of the specialized biodiversity they harbour remain poorly understood.

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Furthermore, highland ecosystems face compounding anthropogenic pressures such as agricultural expansion, livestock grazing, and recurrent burning that degrade habitat quality and accelerate biodiversity loss (Cavieres *et al*., 2025; Duchicela *et al*., 2024). For instance, in páramo ecosystems, fire is embedded in traditional land management through two-to-three-year burning cycles used to maintain forage quality (Hofstede & Rossenaar, 1995), and burned areas emerge from predictable dynamics within coupled human–natural systems rather than occurring randomly in space or time (Díaz-Timoté *et al*., 2026). Where grazing and high-intensity burning coincide, species richness and plant cover decline sharply, driving soil erosion, reduced carbon stocks, and hydrological alteration (Cavieres *et al*., 2025), with native vegetation progressively replaced by introduced grasses (Urbina & Benavides, 2015) and characteristic taxa such as frailejones (Espeletiinae, Asteraceae) showing elevated mortality and age structures skewed toward younger cohorts (Horn & Kappelle, 2009). Fire thus operates as both a proximate driver and an amplifier of broader anthropogenic degradation for high-elevation species.

The Neotropical orchid genus *Lepanthes* Sw. is among the most species-rich orchid genera in the Neotropics, with over 1,196 described species (Karremans *et al*., 2023), and exemplifies the vulnerability of high-elevation specialists to these pressures. *Lepanthes* species are characteristically microendemic (55% and ~70% of species are endemic to Peru and Colombia, respectively) with highly restricted geographic ranges, sparse populations, and strong dependence on narrow microclimatic conditions (Acevedo *et al*., 2020; Karremans *et al*., 2023; Ocupa-Horna *et al*., 2023). Many populations persist in human-dominated landscapes with severely reduced suitable habitat (Parra-Sanchez *et al*., 2023), and projected climate change may further contract the climatic envelope available for some species (Moreno *et al*., 2025). In Peru, only seven *Lepanthes* species have been formally recorded above 3000 m a.s.l., including *L. alticola* C.Schweinf. and *L. minutipetala* C.Schweinf. (Ocupa-Horna *et al*., 2023), reflecting both the genuine rarity of high-elevation taxa and the critical gaps in taxonomic coverage that persist across montane regions.

During recent explorations of high-elevation habitats in northern Peru, we found an undescribed *Lepanthes* species exhibiting distinct morphological characters, a restricted geographic distribution, and specialized microhabitat requirements. Here we present a formal morphological description with scientific illustrations, an ecological characterization of its rocky substrate habitat, and a conservation assessment following IUCN Red List Criterion B (IUCN, 2025). This discovery underscores the urgency of documenting wild populations in montane regions, where microendemism and habitat transformation frequently outpace taxonomic knowledge.

Materials and methods. *Field sampling*.— We conducted fieldwork in the Piura region across the provinces of Ayabaca and Huancabamba, Peru, in May 2026. The sampling effort involved two orchidologists over eight days, working 7–15 hours a day, and covering ~30 km on foot. We selected ten localities based on tree cover, landscape connectivity, and canopy structure observed using Google Earth Engine (Gorelick *et al*., 2017) and Global Forest Watch (Global Forest Watch, 2024). The selection also considered the upper montane Yungas forest ecosystems identified in the National Ecosystem Map of Peru (Ministerio del Ambiente, 2019). At each locality, we recorded all orchid species observed within forest fragments, natural and human-transformed high-elevation grasslands, and natural and human-created cliffs. Our sampling consisted of random walks finding individuals along our paths and using a Garmin eTrex Legend H GPS unit to record coordinates of orchids found in clusters. Most forest fragments lacked trails, so we opened new ones to extend our sampling. All growth habits (epiphytic, lithophytic, and terrestrial) were included.

Plant material was collected and preserved in a solution of ethanol-glycerine-water (70:5:25) and dried (vegetative and floral parts). *In situ* photographs were taken to document ecological aspects of the natural habitat and general morphological traits of the orchid species. The specimen was deposited at the Herbarium of the Universidad Nacional Mayor de San Marcos (USM).

Taxonomy.— Measurements and descriptions were based on live material and liquid-preserved flowers. Measurements were taken under an AmScope SM-3TPX stereomicroscope (0.7×–4.5×) equipped with

an ocular scale and an AmScope MU1803-HS 18 MP digital camera for image acquisition, and, when appropriate, verified measurements of larger structures using millimeter paper. Original descriptions and other relevant literature (taxonomic treatments, illustrations, and photographs) on *Lepanthes* were consulted (e.g., Luer, 1996, 2010; Luer & Thoerle, 2011, 2012; Ocupa-Horna *et al*., 2023, 2026; Schweinfurth, 1958). Additionally, several specimens of *Lepanthes* deposited in the CUZ, CPUN, HOXA, HUT, MOL, PRG, and USM herbaria were reviewed. Scientific illustration was prepared from the holotype and was created using a Samsung Galaxy Tab S6 Lite with an S Pen and the SketchBook application (Sketchbook, Inc., 2026). Images were processed using Adobe Photoshop 24.0.1 (Adobe, Inc., 2022). The botanical terminology followed Beentje (2016) and Stearn (2004), and inflorescence typology followed Rojas-Alvarado & Karremans (2024).

Geospatial analysis and conservation assessment.— We estimated Area of Occupancy (AOO) following the IUCN Red List Guidelines by overlaying a standard 2 × 2 km grid on the two confirmed occurrence records. Because the records occupied two separate grid cells, the estimated AOO was 8 km². Extent of Occurrence (EOO) could not be estimated directly from only two points using a minimum convex polygon. For consistency with the IUCN requirement that EOO should not be smaller than AOO, an adjusted EOO of 8 km² was reported; however, the preliminary conservation assessment was based on AOO under Criterion B2.

We evaluated the fire pressure surrounding each occurrence record as one of the more common threats to native biodiversity in Andean highlands (Cavieres *et al*., 2025; Duchicela *et al*., 2024). We obtained a single value of fire events over a 26-year period (2000–2025) using the MODIS Burned Area Monthly dataset (MCD64A1 Collection 6.1; Giglio *et al*., 2018) at a native spatial resolution of 500 m. First, we used Google Earth Engine (Gorelick *et al*., 2017) to detect burned areas using a binary mask (1 = burned, 0 = unburned) at 10 km radius (0.09°) around each record of the new species using QGIS (v3.28.3-Firenze; QGIS Development Team, 2022). Second, a zonal histogram analysis was subsequently executed to extract exact pixel value distributions to effectively isolate the net landscape-level fire exposure after removing unburned matrix pixels (value = 0). Third, the map with burned and unburned areas was standardized and converted from pixel counts to hectares based on a localized geographic scale factor (1 pixel≈25 ha/0.25 km²) to determine the net landscape-level fire exposure per record. Finally, the reported net landscape-level fire exposure represents the combined total for the occurrence records.

Taxonomic treatment

Lepanthes phuyupitika Ocupa, Nauray & E.Parra, ***sp. nov.*** Fig. 1–3A

TYPE: Perú. Piura: Provincia Huancabamba, Distrito El Carmen de la Frontera, Laguna de Huaringas, 3463 m, 9 May 2026, *W. Nauray & E. Parra 73* (holotype: USM [accession no. 364996]).

Diagnosis: *Lepanthes phuyupitika* resembles the Venezuelan *L. unitrinervis* Carnevali & I.Ramírez, but differs in having an ovate-lanceolate dorsal sepal, 5.4–5.8 × 3.1–3.5 mm (*vs*. ovate-elliptic, 4.2 × 2.4 mm), larger petals, 1.1–1.3 × 3.1–3.3 mm (*vs*. 0.5 × 2.2 mm), with oblong-ovate to obliquely oblong-ovate lobes (*vs*. transversely narrowly elliptic lobes), labellum with oblique, narrowly obovate blades, 2.5–2.8 mm long (*vs*. elliptic-lunate, 2 mm long), a suborbicular body, adnate to the column for half its length (*vs*. body broadly cuneate, adnate only at the very base of the column), a minute, deltoid, ciliate appendix arising from a subcordate sinus (*vs*. a subtriangular appendix arising from an elliptic sinus), and a larger column, 2.5–2.6 mm long (*vs*. 1.8 mm long).

Lithophytic *herbs*, proliferous, caespitose, up to 23 cm tall, including the inflorescence. Roots fleshy, 1.0–1.5 mm in diameter. *Ramicauls* horizontal to erect, terete, 6–17 mm long, enclosed by 3–5 infundibuliform lepanthiform sheaths, brown, minutely spiculated on the ribs and the ostia; ostia acuminate. *Leaves* green adaxially, often suffused with purple abaxially, coriaceous, obovate to suborbicular, apex rounded, emarginate, with the midvein extending beneath and ending in a short mucro, 13–22 × 7.5–10.5 mm, base cuneate, narrowing into a canaliculate petiole 2.3–3.8 mm long. *Inflorescence* arising from the adaxial surface of the leaf, with multi-flowered, loose, secund, successive coflorescences, suberect to erect,

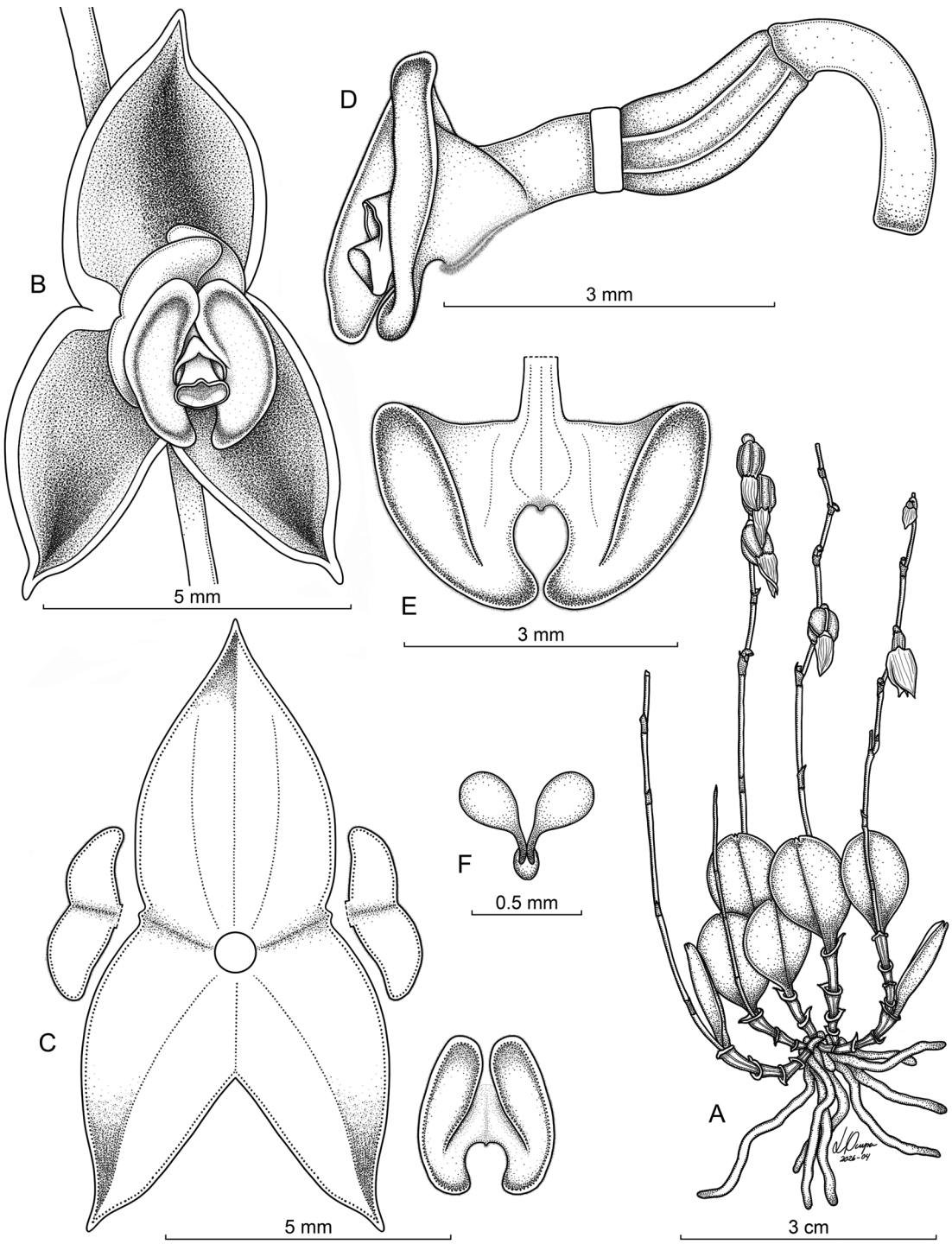


FIGURE 1. Illustration of *Lepanthes phuyupitika* Ocupa, Nauray & E.Parra. **A**. Habit. **B**. Flower. **C**. Perianth dissected. **D**. Labellum, column, and ovary, lateral view. **E**. Labellum expanded. **F**. Pollinia. Drawn by L. Ocupa-Horna based on the holotype.



Figure 2. *Lepanthes phuyupitika* Ocupa, Nauray & E.Parra from Amazonas. **A**. Plant *in situ*. **B**. Close-up of the flower. **C**. Dissected perianth. Prepared by L. Ocupa-Horna from photographs of the paratype taken by J. Edquén.

with one inflorescence developing per ramicaul, with one flower open at a time, 5.0–20.0 cm long, including a pseudopeduncle 2.7–10.8 cm long. *Floral bracts* brown, conical, acute, 2.0–3.0 mm long; pedicels arched, terete, 2.5–3.5 mm long. *Ovary* terete, costate, 1.6–2.0 mm long. *Flowers* resupinate, with dark red sepals, yellow along the margins, petals dark red, turning pale red or orange toward the outer edges, labellum red, turning orange toward the lower apices of the blades, column



FIGURE 3. Comparative floral morphology of *Lepanthes phuyupitika* Ocupa, Nauray & E.Parra and morphologically related species. **A**. *L. phuyupitika* (based on the holotype). **B**. *L. cucullata* Luer & R.Escobar (cultivated plant, without voucher). **C**. *L. series* Luer & Hirtz (cultivated plant, without voucher). Photographs by E. Parra-Sanchez (A), E. Restrepo (B), and F. Tobar (C).

dark red, creamy towards the stigmatic cavity, anther cap dark red, pollinia yellow. *Sepals* abaxially carinate, smooth, acuminate; dorsal sepal concave, ovate-lanceolate, 3-veined, 5.4–5.8 × 3.1–3.5 mm, apex slightly reflexed, connate to lateral sepals for 1.0–1.2 mm; lateral sepals oblique, elliptic-lanceolate, slightly revolute, with occasionally divergent apices, each 5.4–6.0 × 2.6–2.8 mm, 1-veined, connate for 1.1–1.5 mm. *Petals* transversally bilobed, microscopically pubescent, ciliate at the margins, 1-veined, 1.1–1.3 × 3.1–3.3 mm; lobes subequal, oblong-ovate to obliquely oblong-ovate, with broadly obtuse apices; upper lobe 1.5–1.6 mm long; lower lobe slightly broader, 1.5–1.7 mm long. *Labellum* bilaminate, microscopically pubescent, minutely ciliate, 3.7–4.0 × 2.5–2.6 mm; blades oblique, narrowly obovate, with the upper end obtuse and the lower end acute, 2.5–2.8 mm long; connectives subquadrate-cuneate, embracing the column; body suborbicular, externally pubescent, 3-veined, adnate to the column for half its length; sinus deep, subcordate; appendix minute, deltoid, ciliate. *Column* terete, 2.5–2.6 mm long; anther and stigma apical; rostellum truncate, minutely retuse, provided with a laminar, ensiform mucro in the middle; anther cap cucullate. *Pollinia* 2, narrowly pyriform, 0.5–0.6 mm long. *Capsule* dark red, globose, keeled, trilocular, 4.6–7.4 mm long, persistent sepals and column.

ETYMOLOGY: The specific epithet derives from the Quechua words *phuyupi*, meaning "in the mist" or "in the cloud", and *t'ika* (here simplified to *tika*), meaning "flower". The name translates to "flower that grows in the mist," directly referencing the cloud forest habitat where this microendemic species was discovered.

DISTRIBUTION AND ECOLOGY: Currently known only from northern Peru, *L. phuyupitika* grows exclusively on rocky substrates with permanently moist sandy soils associated with shallow surface waterlogging, at elevations of 3400 to 3900 metres above sea level (Fig. 4). This species is rare, with no more than 25 mature individuals documented across the two known localities. Individuals were found growing in association with species of the Cyperaceae and Asteraceae families, as well as *Muhlenbergia* sp. and *Plantago* spp., which are typical of high elevation ecosystems.

PHENOLOGY: Flowering has been observed in March and May, and mature capsules have been recorded in May, indicating that the reproductive period extends at least from March to May.

PRELIMINARY CONSERVATION STATUS: The two confirmed occurrences of *L. phuyupitika* occupy two separate 2 × 2 km grid cells, resulting in an estimated AOO of 8 km². Approximately 25 mature individuals were observed across the two localities. Within the combined

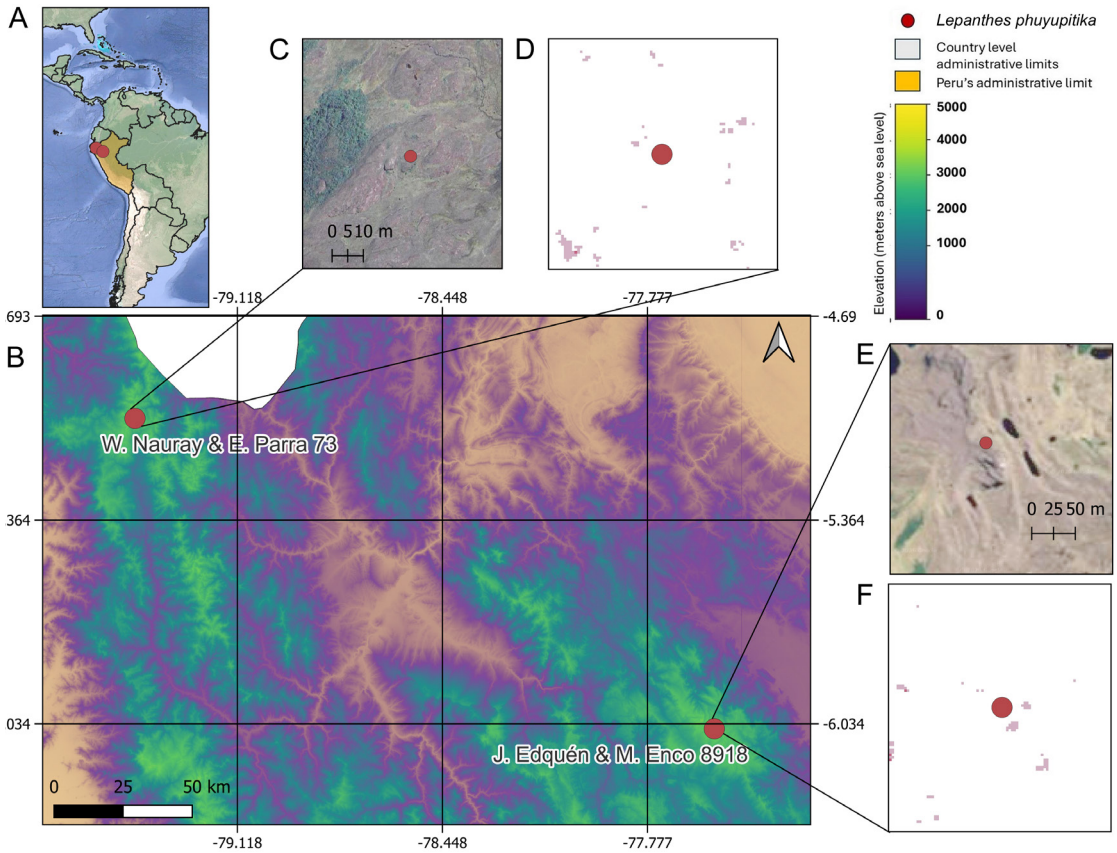


Figure 4. Geographic distribution and landscape-scale habitat context of *Lepanthes phuyupitika* Ocupa, Nauray & E.Parra. **A**. Species' position within South America. **B**. Regional distribution across northern Peru against an elevation gradient ranging from 0–1000 m (dark purple) to 3500–5700 m (light yellow). **C**. Landscape context of Piura. **D**. Burned areas in Piura. **E**. Landscape context in the Amazonas occurrence. **F**. Burned areas. Red points indicate georeferenced localities. Digital elevation model obtained from ALOS-PALSAR (Tadono *et al*., 2014). Map prepared by E. Parra-Sánchez.

10-km buffers surrounding these occurrences, 850 ha burned at least once between 2000 and 2025, representing approximately 1.35% of the nearly 63,000 ha assessed. Field surveys covering approximately 30 km in Piura detected no additional populations.

Lepanthes phuyupitika is provisionally assessed as Endangered under Criterion B2ab(iii). The two occurrences are treated as two locations because a single plausible threatening event, such as localized burning and intensive grazing, is not expected to affect both populations simultaneously. Field observations of these threats in or near the occupied habitat support an inferred continuing decline in habitat quality. Subcriterion b(v) was not applied because the available observations do not demonstrate a continuing decline in the number of mature individuals. Additional surveys and population monitoring are required to refine the species' distribution, population size, and conservation status.

Paratype: Peru. Amazonas: Provincia Chachapoyas, Distrito Granada, comunidad Campesina de Diosán y Granada, 3894 m, 10 March 2026, *J. Edquén & M. Enco 8918* (KUELAP!) (Fig. 2).

Taxonomic discussion: *Lepanthes phuyupitika* belongs to *Lepanthes* sect. *Lepanthes* subsect. *Breves* Luer, traditionally characterized by single-veined lateral sepals (Luer, 2010; Luer & Thoerle, 2012).

TABLE 1. Comparative morphological characters of *Lepanthes phuyupitika*, *L. cucullata*, *L. series* and *L. unitrinervis*. Data extracted from: [a]Luer & Thoerle (2012), [b]Luer (1996), and [c]Carnevali & Ramírez (1993).

Character	*L. cucullata*[a]	*L. phuyupitika*	*L. series*[b]	*L. unitrinervis*[c]
Leaf size (mm)	7–9 × 6–8	13–22 × 7.5–10.5	10–12 × 8–10	9–10 × 6–7
Leaf shape	broadly elliptic to subcircular	obovate to suborbicular	elliptic	broadly elliptic
Inflorescence length	1.5–2.2 cm	5.0–20.0 cm	up to 3.5 cm	2.5–3.0 cm
Coflorescence arrangement	distichous	secund	flexuous	information unavailable
Dorsal sepal shape	broadly ovate	ovate-lanceolate	ovate	ovate-elliptic
Dorsal sepal size (mm)	1.8 × 1.5	5.4–5.8 × 3.1–3.5	5 × 2	4.2 × 2.4
Lateral sepals shape	ovate-triangular, minutely subdenticulate	elliptic-lanceolate, smooth	ovate, denticulate	ovate-elliptic
Lateral sepals size (mm)	1.6 × 0.8	5.4–6.0 × 2.6–2.8	5 × 2	5.0 × 2.3
Petal shape	oblong lobes	oblong-ovate	broadly triangular-uncinate lobes	transversely narrowly elliptic
Petal size (mm)	0.4 × 1.6	1.1–1.3 × 3.1–3.3	0.75 × 1.25	0.5 × 2.2
Lip blades	elliptical-ovate	narrowly obovate	oblong	elliptic-lunate
Lip appendix	bilobed	deltoid, ciliate	ovoid, pubescent	subtriangular
Column length (mm)	1.0	2.5–2.6	3.0	1.8

Recent phylogenomic work retains subsect. *Breves* as an infrageneric unit but highlights substantial morphological homoplasy within *Lepanthes* and the limitations of traditional series-level classifications (Arias *et al*., 2025).

The new species is morphologically most similar to *L. unitrinervis* (Carnevali & Ramírez, 1993), but differs from that species in its proliferous habit (*vs*. non-proliferous), larger leaves and longer inflorescences, as well as by the most important floral differences discussed in the diagnosis and Table 1. Additionally, *L. phuyupitika* shares morphological affinities with *L. cucullata* Luer & R.Escobar and *L. series* Luer & Hirtz (Fig. 3). The four species compared here, *L. phuyupitika, L. cucullata, L. series*, and *L. unitrinervis*, share single-veined lateral sepals characteristic of subsect. *Breves* and show broadly similar floral architecture but differ in several diagnostic floral characters summarized in Table 1.

Ecologically, *L. phuyupitika* has been observed growing as a lithophyte in relatively exposed habitats, whereas *L. cucullata* and *L. series* have been reported as epiphytes in shaded habitats. These differences are treated here as habitat associations rather than taxonomic characters, because light availability and substrate conditions may vary locally. In terms of distribution, *L. unitrinervis* is currently known from Venezuela, *L. cucullata* from Colombia (Luer & Thoerle, 2012), and *L. series* has been reported from Colombia and Ecuador (Karremans *et al*., 2023; Luer, 1996), whereas *L. phuyupitika* is currently known only from northern Peru.

Populations of the new species occur in landscapes heavily used for cattle ranching, where recurrent fires threaten the limited rocky habitat suitable for its establishment. The small size and inconspicuous appearance of *L. phuyupitika*, together with its highly restricted known distribution, may contribute to its being overlooked during field surveys (Luer & Hirtz, 1987; Ocupa-Horna *et al*., 2023). Given its currently restricted distribution and documented habitat threats, *L. phuyupitika* is provisionally assessed as Endangered under IUCN Criterion B2ab(iii). The description of *L. phuyupitika* brings the total number of recognized *Lepanthes* species in Peru to 88. Further field explorations and herbarium revisions are needed to refine its distribution and population size. At present, our results provide a preliminary baseline for future reassessments under the IUCN Red List criteria (IUCN, 2025).

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Author contributions. LO-H: conceptualization, methodology, data curation, validation, writing - original draft, scientific illustration, writing - review and editing. WN: conceptualization, site selection, fieldwork, methodology, data curation, validation, writing - review and editing. JDE: fieldwork, writing - review and editing. EPS: conceptualization, fieldwork, methodology, formal analysis, validation, writing - original draft, writing - review and editing.

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Conflict of interest. The authors have declared that no competing interests exist.

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