

# Harvard Papers in Botany

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Volume 19, Number 2

December 2014

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A Publication of the Harvard University Herbaria Including  
**The Journal of the Arnold Arboretum**

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## ALIAE *LEPANTHES MACHOGAFFENSES* (ORCHIDACEAE: PLEUROTHALLIDINAE)

FRANCO PUPULIN<sup>1-4</sup> AND DIEGO BOGARÍN<sup>1,5</sup>

**Abstract.** Two new species of *Lepanthes* are described and illustrated. *Lepanthes elvirae* is reminiscent of *L. estrellensis* in the large size of the flower and the broad and rounded laminae of the lip, but can be distinguished from the latter by the glabrous sheaths of the ramicaul, the petals with lobes distinctly different in size and the lobes of the lip held subparallel to the column. *Lepanthes queveriensis* is most similar to *L. cribbii*, from which it differs by the inflorescence sub equal to longer than the leaf, the margins of the sepals entire, the shorter body of the lip, provided with two hemielliptic, low, and the rectangular, straight appendix of the lip. Considerations on orchid diversity in unexplored regions of Costa Rica are presented.

**Keywords:** Orchidaceae, *Lepanthes*, new species, Costa Rica, Cordillera de Talamanca, species diversity

The region of Macho Gaff, close to the northernmost end of the Cordillera de Talamanca in Costa Rica, represents an interesting example of how orchid diversity in biologically rich countries is still far from being entirely apprehended. Included in the large area protected by the Tapantí-Machizo de la Muerte National Park, Macho Gaff is located only seventeen kilometers from the center of the ancient capital of Costa Rica, Cartago, and it is relatively close to agricultural lands that have been severely cleared in the second half of the nineteenth century. The partial exploration of Macho Gaff primary forest is actually just a consequence of its random privilege of possessing two different trails that run to the Macho River from the northeastern and southern highs. Thousands of square kilometers of virgin oak forests with similar characteristics, with their intricate system of valleys and rivers, expand uninterrupted from here to the province of Chiriquí in Panama, almost two hundred kilometers to the southeast, crossing the continental division to embrace the two slopes. Even though most of these areas are completely inaccessible, they are probably as rich as Macho Gaff in orchid diversity. For what concerns the genus *Lepanthes* Swartz (1788), we can also estimate that the levels of endemism are likely comparable, with most of the species restricted in distribution to a few tens of square kilometers.

We first explored the region of Macho Gaff in 2008, taking a road that starts from the watershed of the Cordillera de Talamanca close to Paso Macho (Macho Gaff), at about 2400 m elevation, and later goes down toward Queverí, becoming a steep trail crossing the Macho river some 400 meters below (Fig. 1). We discovered several new species of *Lepanthes* during our first visit, conducted along a

practically linear transect of about four km through pristine forest, three of which were described the following year, namely *L. gratiosa* Pupulin & D. Jiménez, *L. machogaffensis* Pupulin & D. Jiménez and *L. pelvis* Pupulin & D. Jiménez (in Pupulin et al., 2009). From the same area, *Lepanthes arenasiana* Bogarín & M. Fernández (Bogarín and Fernández, 2010) was described one year later. At least two other species from the same collection seem to be different from any other known taxa and are actually under study (Bogarín and Pupulin, in prep.).

In January of 2014, we visited the region again, entering the protected area from the north, along the unpaved road running from Queverí to the swinging bridge over the Río Macho. Here we made a second linear transect of about two km, beginning at 2200 m elevation and descending 200 meters to the edge of the Macho river (Fig 1). Along the trail, we found large populations of *L. pelvis* and *L. machogaffensis*, together with *L. gratiosa*, *L. cf. cascajalensis* Ames (1923), *L. tipulifera* Reichenbach f. (1866), *L. latisejala* Ames & C. Schweinfurth (Ames and Schweinfurth, 1930), *L. ciliisejala* Schltr. (Schlechter, 1923) and two unknown species, that we describe herein as new to science.

Including the two species presented here, we have a total of six to eight new species of the genus *Lepanthes* found in two random adjacent transects, totaling six kilometers in length, in the lower montane rain forest of the Talamanca range. One could only speculate about how many thousands of possible transects like this could be traced in the mountainous region of eastern Costa Rica, and how many unknown species of *Lepanthes* and other groups of Orchidaceae with diminutive plants are yet to be discovered.

We wish to thank the scientific services of Ministerio del Ambiente y Energía (MINAE) and Sistema Nacional de Áreas de Conservación (SINAC) of Costa Rica, for issuing the scientific permit R-SINAC-DE-077 under which wild specimens treated in this study were collected. Fabricio Carbonell Torres of ACLA-P for granting access to the Parque Nacional Tapantí (PNT) and for his interest in the development of orchid research at Tapantí. To Carl Luer, who created the fundamental framework that allows comparing species of *Lepanthes*. Melissa Díaz and Melania Fernández helped with fieldwork and logistics. The present paper is part of the Project 814-BO-052, "Flora Costaricensis: taxonomía y filogenia de la subtribu Pleurothallidinae (Orchidaceae) en Costa Rica" supported by the Vice-Presidency of Research, University of Costa Rica.

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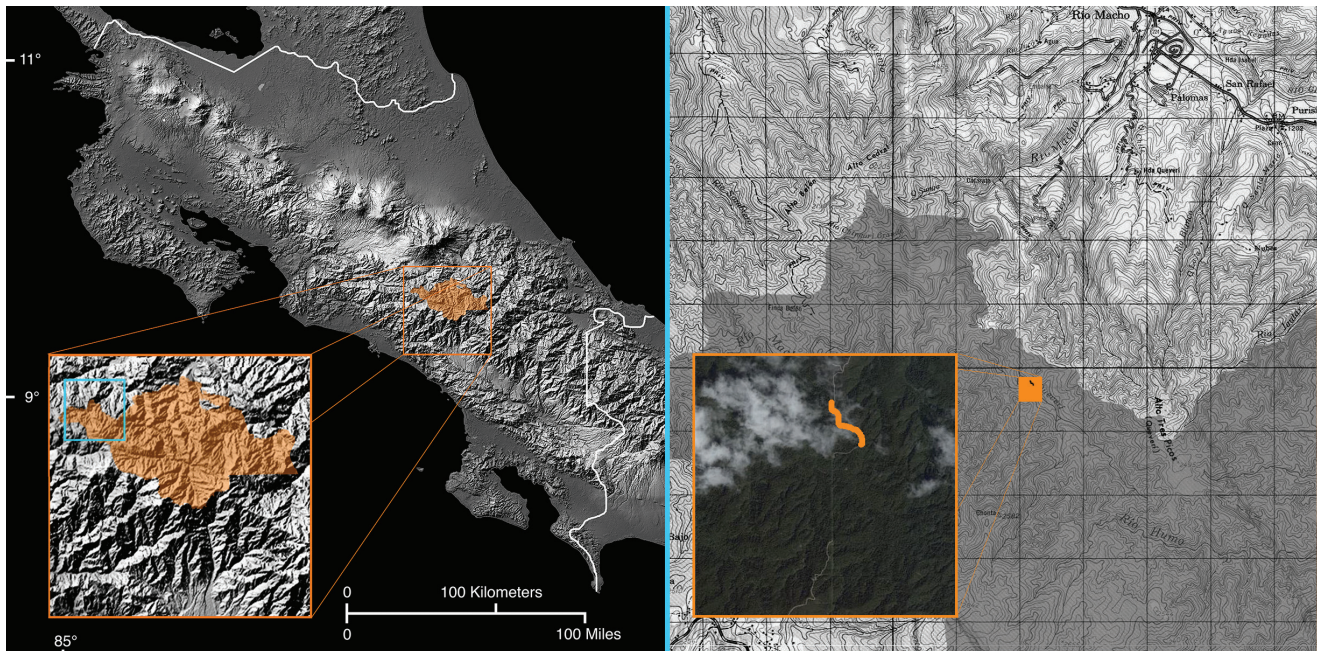


FIGURE 1. Map of the Tapantí-Macizo de la Muerte National Park in Costa Rica (with progressive approximations), showing the location of the 6 km collecting transect.

*Lepanthes elvirae* Pupulin, *sp. nov.* TYPE: COSTA RICA. Cartago: Paraíso, Orosi, Queverí, Finca Durman, Tapantí-Macizo de La Muerte National Park, road to the swinging bridge over the Río Macho, 9°43'46.71"N, 83°51'27.53"W, 2115 m, lower montane rain forest, epiphytic in secondary mature vegetation with remnants of primary vegetation, 21 January 2014, flowered in cultivation under accession number JBL-30025, prepared 2 May 2014, F. Pupulin, D. Bogarín, M. Díaz & M. Fernández 8555 (holotype, JBL; isotypes, JBL). Fig. 2–3.

*Flore magnitudine pro genere magna, labelli laminae latis rotundatisque petalis gracilis discrepantibus, Lepanthes elvirae primo adpectu Lapanthi estrellensi Ames similem est, sed vaginis ramicaulium glabris (vs. breviter muricatas), lobis petalorum inter eos magnitudine distincte dissimilibus (vs. subaequales), lobulis labelli columnae subparalleliis portatis (vs. perpendiculares) ab ea plerumque recedit.*

In the large size of the flower and the broad and rounded laminae of the lip, contrasting with the slender sepals, *L. elvirae* is reminiscent of *L. estrellensis* Ames, from which it mainly differs by the glabrous sheaths of the ramicaul (vs. shortly muricate), the petals with lobes distinctly different in size (vs. subequal) and the lobes of the lip held subparallel to the column (vs. perpendicular).

Epiphytic, caespitose, spreading to pendent herb to 11 cm tall. Roots filiform, flexuous, to 1 mm in diameter. Ramicauls slender, horizontal-arched, rarely suberect, 2.2–7.2 cm long, covered by 4–8, closely adpressed, ribbed, glabrous (microscopically ciliate along the ribs), pale brown sheets, dilated at apex into an obliquely lanceolate ostia, ciliate along the margins, 2.5 × 1.2 mm. Leaf broadly elliptic, thin, flat, pale green, 2.1–3.9 × 1.5–2.0 cm, the base rounded, abruptly contracted into a short, conduplicate

petiole, the apex obtusely shortly cuspidate, excise, with the tip of the central vein protruding abaxially within the sinus. Inflorescence produced on top of and exceeding the leaf, successively few-flowered (at least to 5), the pedicel slender, terete, to 2.7 cm long, covered with two tightly adpressed, tubular, sparsely muriculate, acute bracts; the rachis fractiflex, to 9 mm long; floral bracts broadly lanceolate, acute, sparsely muriculate, 1.2–2.0 mm long. Flowers comparatively large for the size of the plant, the sepals white to pale greenish yellow, hyaline, the petals pale yellow, flushed with red in the basal part, the upper lobes variously flushed with red to almost solid red, the lip pale yellow, with two red-purple, vivid marks at the base of the lateral lobes, the column and the anther white. Dorsal sepal broadly ovate, shortly cuspidate, 3-veined, slightly convex, 6.4–6.7 × 5.2–5.5 mm, connate with the lateral sepals for about 2 mm. Lateral sepals asymmetrically ovate, 2-veined, the shortly cuspidate apices divergent, connate at the base for about 3 mm. Petals transversely bilobed, 1.5–1.7 × 5.0–5.2 mm, erect to incurved in natural position, the upper lobe larger, 1.5–1.7 × 4.0 mm, oblong, subfalcate to falcate, diverging above, rounded; the lower lobe smaller, 1.2 × 2.5 mm, triangular-oblong, rounded. Lip bilobed, broadly rheniform in general outline, 3.0 × 3.7 mm, the lobes elliptic, rounded at the base, incurved at the subacute apices, suberect, the basal margins completely encircling the column; connective trapezoidal, deeply excised in front, the margins of the sinus finely pubescent; appendix external, rectangular, reflexed. Column terete, broadened at the subspherical apex, 3 mm long, the anther dorsal, the stigma apical. Anther cap cucullate, ovate, 2-celled, about 0.5 mm long. Pollinia 2, obpyriform, the basal portion attenuate-filamentous; viscidium rounded, yellowish brown, apical.

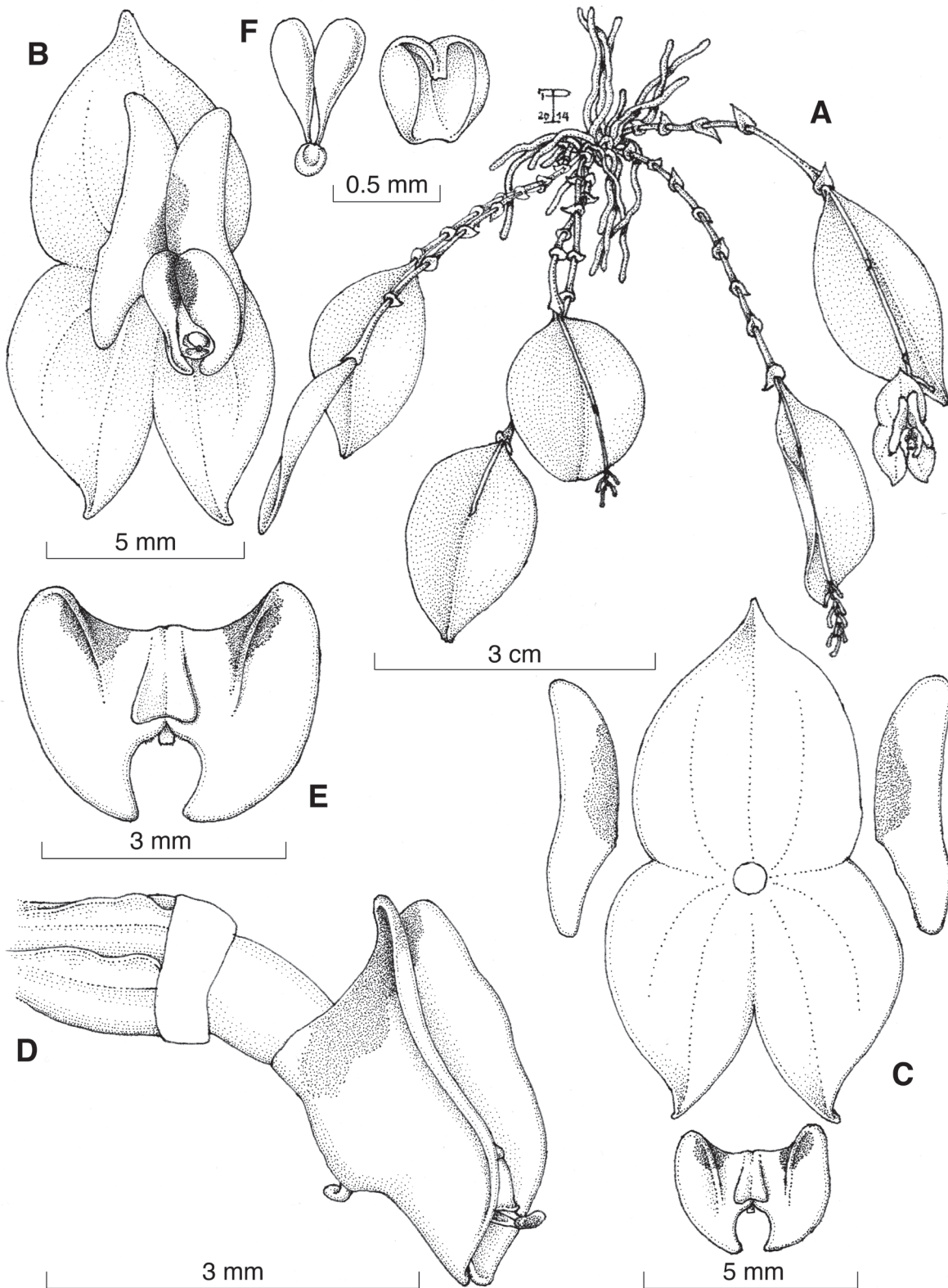


FIGURE 2. *Lepanthes elvirae* Pupulin. A, habit; B, flower; C, dissected perianth; D, ovary, column and lip, lateral view; E, lip, spread; F, pollinarium and anther cap. Drawn by D. Bogarín and F. Pupulin from the holotype.

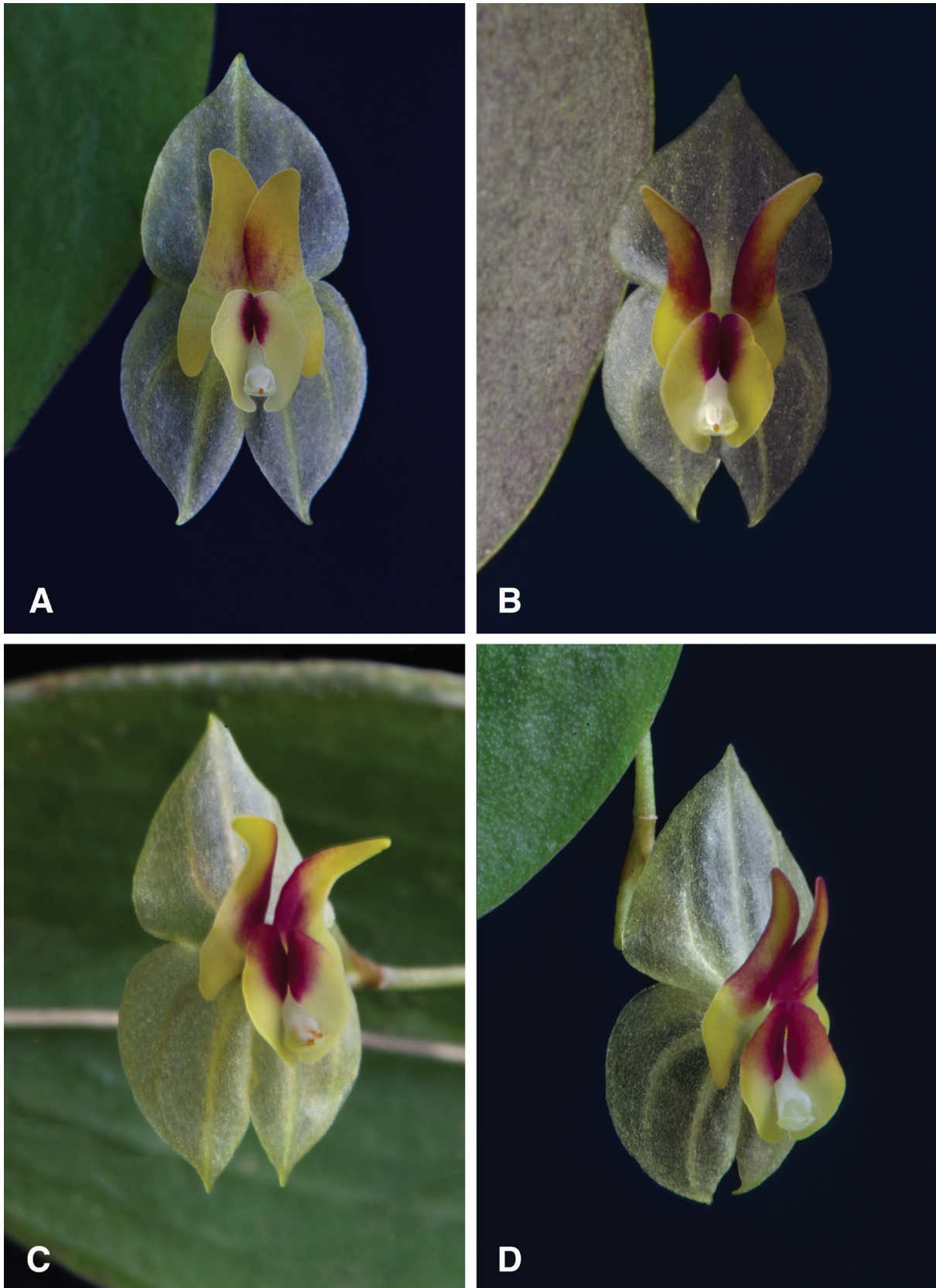


FIGURE 3. Flower variation in *L. elvirae*. A, *Pupulin 8555* (JBL); B, *Pupulin 8553* (JBL); C, *Pupulin 8572* (JBL); D, *Pupulin 8581* (JBL). Photographs by F. Pupulin.

**Paratypes:** Costa Rica. Cartago: Paraíso, Orosi, Queverí, Finca Durman, Tapantí-Macizo de La Muerte National Park, road to the swinging bridge over the Río Macho, 9°43'46.71"N, 83°51'27.53"W, 2115 m, lower montane rain forest, epiphytic in secondary mature vegetation with remnants of primary vegetation, 21 January 2014, flowered in cultivation under accession number JBL-30001, prepared 26 May 2014, *F. Pupulin, D. Bogarín, M. Díaz & M. Fernández 8553* (JBL); same collecting data, flowered in cultivation under accession number JBL-30019, prepared 3 July 2014, *F. Pupulin, D. Bogarín, M. Díaz & M. Fernández 8572* (JBL); same collecting data, flowered in cultivation under accession number JBL-30135, prepared 3 July 2014, *F. Pupulin, D. Bogarín, M. Díaz & M. Fernández 8581* (JBL).

**Distribution:** Known only from Costa Rica, where it has been found along the Caribbean slopes of the Cordillera de Talamanca's northernmost range.

**Habitat and ecology:** *Lepanthes elvirae* inhabits the wet premontane forests of the Cordillera de Talamanca in Costa Rica, where the only known population was found in the Caribbean watershed of the chain, at about 2100 meters of elevation. *Lepanthes elvirae* is one of the species apparently suited to occupy the shaded and constantly wet canopy understory in dense vegetation, where the reduced air movement reduces the loss of water by transpiration. *Lepanthes* species of this "forest group" are commonly characterized by soft-herbaceous instead of coriaceous leaves, very prone to tissue dehydration under suboptimal levels of environmental humidity. Flowering of *L. elvirae* has been recorded in cultivation from February to August, but new flowers are probably produced in succession year-round.

**Eponymy:** Named after the senior author's wife, Elvira Salas-Pupulin, to acknowledge her continuous support in research and in life.

New species of *Lepanthes* are frequently described on the sole basis of morphological features' unique combinations, in both vegetative habit and flower shape. In general, these combinations easily distinguish *Lepanthes* species from each other and, in a few cases, enable recognition of species-groups whose members are probably close relatives (see, for example, Pupulin and Bogarín, 2010; Pupulin et al., 2010; Bogarín et al., 2012; Pupulin and Bogarín, in press). Nevertheless, the lack of both a larger genetic sampling in this hyper-diverse genus of probably more than thousand species, and of a finer resolution of the internal relationships, obscures in many cases the phylogenetic affinities of the new proposed taxa. *Lepanthes elvirae* is no exception. The glabrous ramicauls and the soft-herbaceous leaves are commonly observed in several *Lepanthes* groups adapted to the wet conditions of the lower canopy in pristine, dense forests, while the flower shape is reminiscent of *L. estrellensis* resembling both its rounded flower and the broad laminae of its labellum. Its affinities, as in most species of *Lepanthes*, are therefore purely speculative.

***Lepanthes queveriensis*** Bogarín & Pupulin, *sp. nov.* TYPE: COSTA RICA. Cartago: Paraíso, Orosi, Queverí, Finca Durman, Parque Nacional Tapantí-Macizo de La Muerte,

camino al puente de hamaca sobre el Río Macho, 9°43'46.71"N, 83°51'27.53"W, 2115 m, epífita en ramitas delgadas de *Ocotea* sp. (Lauraceae) en bosque pluvial montano bajo, 21 Enero 2014, *D. Bogarín 10843, M. Díaz, M. Fernández & F. Pupulin* (holotype, USJ). Fig. 4–5.

*Species nova* *Lepanthes cribbii* Pupulin *plerumque similis, inflorescentia folio subequalis vel longiore (vs. breviorum), marginibus sepalorum integris (vs. breviter ciliatis), corpo labelli brevi duabus lamellis pronis semiellipticis munito (vs. corpus elongatum lamellis destitutum), labelli appendice rectangularis rectaque (vs. digitatam, reflexam) ab ea differt.*

The new species is most similar to *L. cribbii* Pupulin, from which it differs by the inflorescence sub equal to longer than the leaf (vs. shorter), the margins of the sepals entire (vs. shortly ciliate), the shorter body of the lip, provided with 2 hemi-elliptic, low flaps (vs. body longer, bare), and the rectangular, straight appendix of the lip (vs. digitate, reflexed).

Epiphytic, caespitose, spreading to pendent herb to 7 cm tall. *Roots* filiform, flexuous, to 0.5 mm in diameter. *Ramicauls* slender, pendent, 1.4–4.5 cm long, covered by 5–9, closely adpressed, ribbed, minutely ciliate-muriculate, pale brown sheets, dilated at apex into an obliquely lanceolate, acuminate ostia, ciliate along the margins, 2.5 × 1.5 mm. *Leaf* ovate, subcoriaceous, flat, grayish green, 1.1–2.4 × 0.5–1.2 cm, the base rounded, gradually contracted into a short, conduplicate petiole, the apex cuspidate-acute, excise, with the tip of the central vein protruding abaxially within the sinus. *Inflorescence* produced on top of and subequal to slightly exceeding the leaf, successively many-flowered (at least to 14), the pedicel slender, terete, to 2 cm long, covered with two tightly adpressed, lanceolate, acute bracts; the rachis fractiflex, to 14 mm long; floral bracts lanceolate, acute, sparsely muriculate, 0.7–0.9 mm long. *Pedicel* terete, 2 mm long. *Ovary* terete, to 1.5 mm long. *Flowers* comparatively large for the size of the plant, the sepals pale greenish yellow to yellow, hyaline, sometimes suffused with rose-purple particularly along the veins (the dorsal sepal almost entirely rose-purple, the lateral sepals yellow in the labeller half), the petals bright yellow, the upper lobes flushed with red almost to the apex, the lower lobes flushed at the base in the labeller side, the lip bright yellow, blotched with red at the base of the lobes, the column red-violet, the anther white. *Dorsal sepal* triangular-lanceolate, acuminate-attenuate, 3-veined, slightly convex, 7.2–7.5 × 3.2–3.4 mm, connate with the lateral sepals for about 1 mm. *Lateral sepals* triangular-lanceolate, subfalcate, acuminate-attenuate, 2-veined, connate at the base for about 1 mm. *Petals* transversely bilobed, 0.7 × 4.0 mm, erect, the upper lobe broader, 0.7 × 2.0 mm, oblong, rounded; the lower lobe 0.4 × 1.8 mm, ligulate-subfalcate, minutely rounded. *Lip* bilobed, broadly H-shaped in general outline, 1.3 × 1.9 mm, the lobes narrowly elliptic-subfalcate, rounded at the base, incurved at the minutely rounded, tomentose apices, erect, the basal margins completely encircling the column; connective short, transversely rectangular, emarginate in front, the frontal margin long-pubescent; the disc provided with two hemi-elliptic, diverging, low flaps, extending over

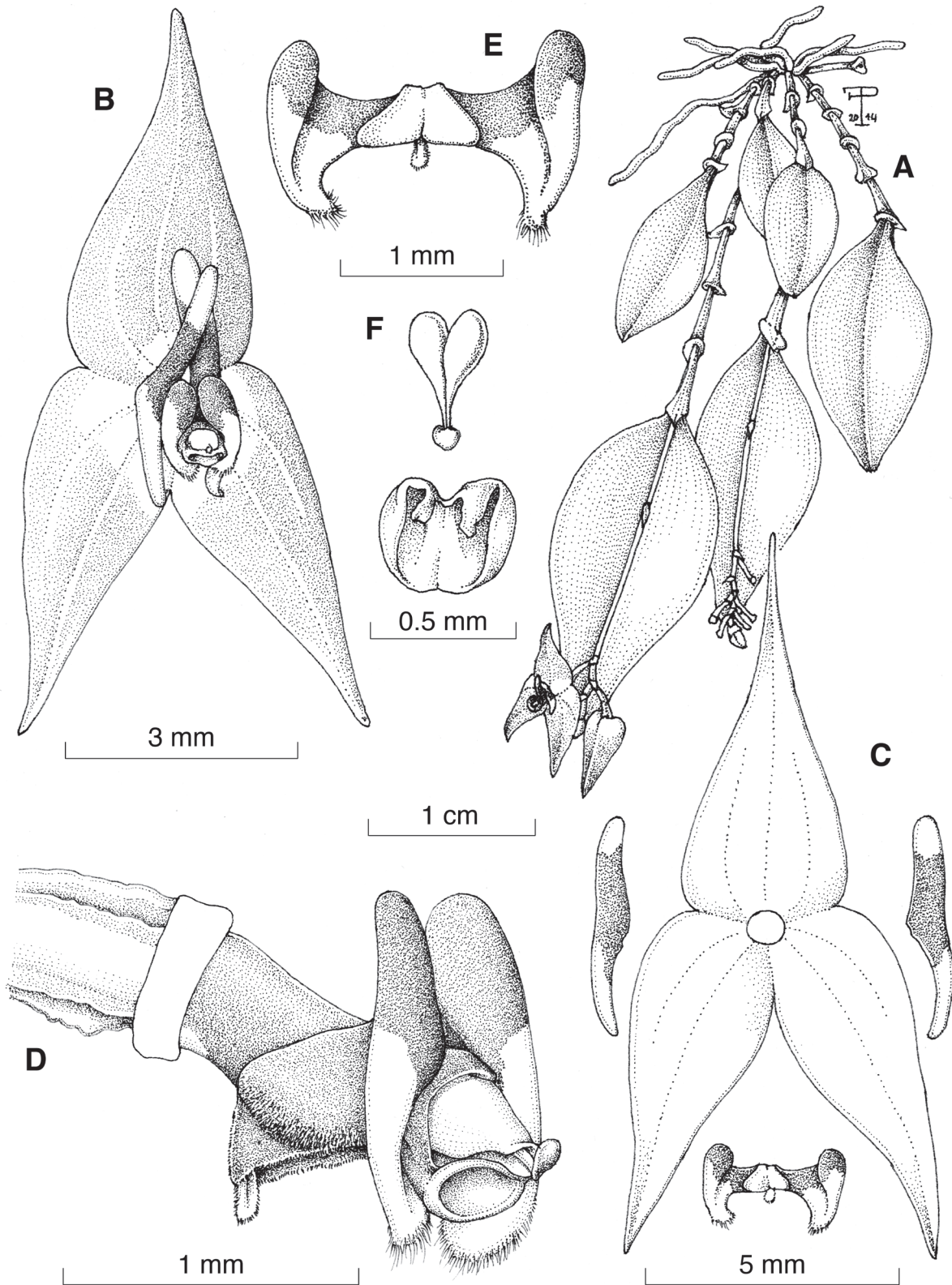


FIGURE 4. *Lepanthes queveriensis* Bogarín & Pupulin. A, habit; B, flower; C, dissected perianth; D, ovary, column and lip, three-quarters view; E, lip, spread; F, pollinarium and anther cap. Drawn by D. Bogarín and F. Pupulin from the holotype.



FIGURE 5. Flower of *L. queveriensis*. **A**, Bogarín 10843 (JBL); **B**, Bogarín 10854 (JBL). Photographs by D. Bogarín (A) and F. Pupulin (B).

the margin of the connective; appendix external, ligulate-subcylindric, sparsely hairy, slightly bent. *Column* terete, broadened at apex, ca. 2 mm long, the anther and the stigma apical. *Anther cap* cucullate, sub orbicular, 2-celled, about 0.5 mm long. *Pollinia* 2, obpyriform, the basal portion attenuate-subfilamentous; viscidium ovate, yellowish brown, apical.

**Paratype:** Costa Rica. Cartago: Paraíso, Orosi, Queverí, Finca Durman, Parque Nacional Tapantí-Macizo de La Muerte, camino al puente de hamaca sobre el Río Macho, 9°43'46.71"N, 83°51'27.53"W, 2115 m, epífita en bosque pluvial montano bajo, 21 Enero 2014, floreció en cultivo con número de accesión JBL-30046, preparado el 20 febrero 2014, D. Bogarín, M. Díaz, M. Fernández & F. Pupulin 10854 (JBL).

**Distribution:** Known only from the northern end of the Cordillera de Talamanca in Costa Rica, where it has been collected in the Caribbean watershed.

**Habitat and ecology:** Epiphytic on twigs of *Ocotea* sp. (Lauraceae) in understory vegetation. Plants were found growing with *L. cascajalensis* and *L. pelvis*. Flowering of cultivated plants has been recorded from January to July, but successive flowering is probably done year-round.

**Etymology:** Named after the locality of Queverí, at the northern end of the trail Queverí–Macho Gaff. Queverí is a

tributary of the Macho River. It is an indigenous Cabécar dialect probably meaning “the river of the brother.”

*Lepanthes queveriensis* is apparently related to the group of *L. cribbii* Pupulin (in Pupulin & Bogarín, 2004) / *L. falx-bellica* Pupulin & Bogarín (Pupulin and Bogarín, 2011) / *L. mentosa* Luer (Luer, 1987) / *L. monteverdensis* Luer (Luer, 1987), all characterized by the glabrous sheaths of the ramicaul, the ovate leaves, the narrow petals with subequal upper and lower lobes, and the rounded lateral lobes of the lip flanking the column to the apex and almost hiding it in lateral view. The new species differs from the other members of this eminently Costa Rican group by the inflorescences that reach the apex of the leaf, and distinctly surpass it when old, while they are shorter than the leaf in the other species. Furthermore, the margins of the sepals are ciliate in *L. cribbii* and *L. falx-bellica*, and irregularly dentate-erose in *L. mentosa* and *L. monteverdensis*, whilst in *L. queveriensis* they are entire.

To facilitate species comparisons, the protologues and digital images and/or illustrations of the types, as well as photographs of living flowers and botanical illustrations of the taxa discussed in the present paper, are available for download through the “List of species” page of the *Epidendra* website, <http://www.epidendra.org/taxones/index.html> (*Epidendra*, 2014).



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