Lankesteriana International Journal on Orchidology
ISSN: 1409-3871
lankesteriana@ucr.ac.cr
Universidad de Costa Rica
Costa Rica

Wilson, Mark; Baquero, Luis; Dupree, Katharine; Jiménez, Marco M.; LeBlanc, Cheryl M.; Merino, Gilberto; Portilla, Jose; Salas Guerrero, Marcos; Tobar Suárez, Francisco; Werner, Jon D.

THREE NEW SPECIES OF PLEUROTHALLIS (ORCHIDACEAE: PLEUROTHALLIDINAE) IN SUBSECTION MACROPHYLLAE- FASCICULATAE FROM NORTHERN SOUTH AMERICA

Lankesteriana International Journal on Orchidology, vol. 16, núm. 3, 2016, pp. 349-366
Universidad de Costa Rica
Cartago, Costa Rica

LANKESTERIANA 16(3): 349—366. 2016. doi: http://dx.doi.org/10.15517/lank.v16i3.27314

THREE NEW SPECIES OF *PLEUROTHALLIS* (ORCHIDACEAE: PLEUROTHALLIDINAE) IN SUBSECTION *MACROPHYLLAE-FASCICULATAE* FROM NORTHERN SOUTH AMERICA

Mark Wilson[1,10], Luis Baquero[2], Katharine Dupree[1], Marco M. Jiménez[3], Cheryl M. LeBlanc[4], Gilberto Merino[5], Jose Portilla[6], Marcos Salas Guerrero[7], Francisco Tobar Suárez[8] & Jon D. Werner[9]

[1] Department of Organismal Biology and Ecology, Colorado College, Colorado Springs, CO 80903, U.S.A.
[2] Jardin Botanico de Quito, Pasaje #34, Rumipampa E6-264 y Av Shyris, Interior Parque La Carolina, Quito, Ecuador
[3] Av. del Ejército y Juan Izquierdo, 190102, Zamora, Ecuador
[4] Department of Biology, Ball State University, Muncie, IN 47306, U.S.A.
[5] EquaflorA, Pedro Álvarez Cabral 1-69 Y Av. Don Bosco, Cuenca Ecuador
[6] Ecuagenera, Km. 2 1/1 Vía a Cuenca Sector Llampasay, Gualaceo, Ecuador
[7] Nature and Culture International, Chachapoyas, Peru
[8] Arupos, E2 y Av. Yaloman, Quito, Ecuador
[9] 8117 Northway SW, Lakewood, WA 98498, U.S.A.
[10] Author for correspondence: mwilson@coloradocollege.edu

Abstract. The history of the taxonomy of *Pleurothallis* R.Br. subsection *Macrophyllae-Fasciculatae* and recent descriptions in that group are summarized. The phylogenetic position of the group based on preliminary molecular data and the appropriateness of the proposed genera *Acronia* C.Presl. and *Zosterophyllanthos* Szlach. & Marg. for this group are discussed. Three new species from northern South America are described: *Pleurothallis rubrifolia* from southeastern Ecuador and northeastern Peru; *Pleurothallis nangaritzae* from southeastern Ecuador; and *Pleurothallis castanea*. Labellar micromorphology examined by scanning electron microscopy for *P. rubrifolia* and *P. nangaritzae* is discussed in relation to taxonomy and possible pollinator interactions.

Key words: *Acronia*, *Macrophyllae-Fasciculatae*, Pleurothallidinae, *Pleurothallis*, SEM, *Zosterophyllanthos*

Introduction. In his initial reorganization of the genus *Pleurothallis* R.Br., Luer (1986) retained section *Macrophyllae-Fasciculatae* of subgenus *Pleurothallis*, created by Lindley (1859). Subsequently, *Macrophyllae-Fasciculatae* was demoted to a subsection within section *Pleurothallis*, joining subsections *Acroniae*, *Antenniferae*, *Longiracemosae* and *Macrophyllae-Racemosae* (Luer 1988). However, a few years later Luer (2005) elevated subsections *Acroniae* and *Macrophyllae-Fasciculatae* to generic level under the resurrected name *Acronia* C.Presl., creating under it sections *Acronia*, *Amphigya* and *Macrophyllae-Fasciculatae*. Luer (2005) recognized 213 species in *Acronia* section *Macrophyllae-Fasciculatae* at that time.

In an alternate approach, Szlachetko and Margonska (2001) created the genus *Zosterophyllanthos* Szlach. & Marg. for *Pleurothallis* subsection *Macrophyllae-Fasciculatae*, based in part upon the bilobed stigma, a characteristic trait of this group. A total of 189 species were transferred to that genus (Kolanowska, Pérez-Escobar, Sánchez & Szlachetko 2011, Szlachetko & Kulak 2006 a, b, Szlachetko & Margonska 2001, Szlachetko, Veyret, Mytnik-Ejsmont, Sawicka, Rutkowski & Baranow 2012). Apart from *Pleurothallis allenii* L.O.Williams, species of *Pleurothallis* subsection *Acroniae* were not moved to the new genus, this being the major distinction between the taxonomies of Luer (2005) and the Szlachetko group (Szlachetko & Margonska 2001, Szlatcheko & Kulak 2006 a, b).

The molecular phylogenetic study of the

Received 31 October 2016; accepted for publication 5 December 2016. First published online: 8 December 2016.

Pleurothallidinae by Pridgeon, Solano & Chase (2001) included only three species from *Pleurothallis* subsection *Macrophyllae-Fasciculatae*, *Pleurothallis cardiantha* Rchb.f., *Pleurothallis cardiothallis* Rchb.f. and *Pleurothallis teaguei* Luer. In the phylogeny based on nrDNA ITS these species grouped closely with the type of genus *Pleurothallis*, *Pleurothallis ruscifolia* R.Br. Consequently, *Pleurothallis* subsection *Macrophyllae-Fasciculatae* was included in the circumscription of *Pleurothallis* (Pridgeon & Chase 2001, Pridgeon, Cribb, Chase & Rasmussen 2005). The ongoing phylogenetic studies of *Pleurothallis* by Wilson *et al*. (2011, 2013) and Wilson (unpubl. data), incorporating a much more extensive sampling of species from the subgenera included in this circumscription, support the inclusion of subsection *Macrophyllae-Fasciculatae* within *Pleurothallis*. In other words, the available evidence does not support the elevation of subsection *Macrophyllae-Fasciculatae* to the level of genus, either along with subsection *Acroniae* under genus *Acronia* (Luer 2005) or alone as genus *Zosterophyllanthos* (Kolanowska *et al*. 2011, Szlachetko & Kulak 2006 a, b, Szlachetko & Margonska 2001, Szlachetko *et al*. 2012)

In the decade or so since the revision of *Pleurothallis* subsection *Macrophyllae-Fasciculatae* (Luer 2005) ten new species have been described in this group: four under *Pleurothallis* (*Pleurothallis anthurioides* A.Doucette; *Pleurothallis adventurae* Karremans & Bogarín; *Pleurothallis gigiportillae* A.Doucette & J.Portilla; and *Pleurothallis oscarii* Archila & Chiron); five under *Acronia* (*Acronia barbosae* Luer & Thoerle; *Acronia miniatura* Luer, Thoerle & F.Werner; *Acronia rinkei* Luer; *Acronia rhinocera* Luer & Sijm; and *Acronia tobarii* Luer & Hirtz); and one under *Zosterophyllanthos* (*Zosterophyllanthos dariensis* Kolan. & Szlach). All these species described under *Acronia* and *Zosterophyllanthos* have subsequently been transferred to *Pleurothallis*. Depending on synonymy, there are currently between 223 and 297 species attributable to *Pleurothallis* subsection *Macrophyllae-Fasciculatae*.

While labellar micro-morphology has been examined in some Pleurothallidinae, such as in Brazilian *Octomeria* species (Cardoso-Gustafson 2014) and *Stelis* species (Ignowski 2015, Ignowski, de Brito, Bona & de Camargo Smidt 2015), labellar micro-morphology has not been examined to date in *Pleurothallis* subsection *Macrophyllae-Fasciculatae*. Of particular interest in the labellar micro-morphology of some Pleurothallidinae is the so-called "glenion", described by Luer (1986) as a "*well-demarcated, more or less circular structure, on the front surface of the lip just above the base and positioned beneath the stigma*". Luer (1986) speculated that "*in all likelihood it plays an important role in attracting the pollinator*" and Duque (2008) that "*perhaps the glenion facilitates the entry of the visitor to this area*". While in *Stelis* some progress has been made in the understanding of the morphology and function of the glenion at the base of the hypochile (Ignowski *et al*. 2015), almost nothing is known about the glenion of *Pleurothallis* subsection *Macrophyllae-Fasciculatae*.

In this paper we describe three new species of *Pleurothallis* from subsection *Macrophyllae-Fasciculatae* and present preliminary data on labellar micro-morphology and glenion structure.

Materials and Methods

Collections of plant material —. Material collected in Ecuador (collections #2020, #2095 and #2050) were made under investigation permit #018-2016-IC-FLO-FAU-DPAZCH-UPN-VS/MA granted to EcuaCorriente S.A. (ECSA). Specimens were moved under the transportation permit #UPN-VS-GM-025-2016 granted to and managed by Ecotono, Ecuador. Material from Peru was collected under a permit #N 292-2016-SERFOR/DGGSPFFS granted to Marcos Salas Guerrero by the Servicio Nacional Forestal y de Fauna Silvestre (SERFOR), Peru. Plants were also imported into the U.S.A. through purchases from Ecuagenera (Gualaceo, Ecuador), EquaflorA (Cuenca, Ecuador) and Mundiflora (Cuenca, Ecuador) and grown in the collections of Wilson and Werner. Material from these latter plants was used for the creation of herbarium specimens accessioned into the herbarium at Colorado College (COCO). Flowers were preserved in Kew Mix (5% formalin [37.6% formaldehyde], 53% methanol, 5% glycerol, 37% deionized water).

Morphology and taxonomic comparisons —. Living material of each collected species was examined by the first author in the collections of Ecuagenera, EquaflorA, and Mundiflora, as well as in the collection of imported plants at Colorado College. These materials were used for creation of the Lankester composite digital plates (LCDPs) and for morphological and taxonomic comparisons. Photographs were taken with a Canon EOS 40D using a Canon 100 mm f2.8 macro-lens and extension tubes as required. In order to determine novelty, these species were compared to a database of species descriptions, photographs and scans of types amassed by the first author over a 10-year period, as well as all pertinent literature, including but not limited to: Bennet and Christenson (1993); Dodson (2003); Dodson and Dodson (1980, 1982, 1991); Escobar (1994, 2006); Luer (1974, 1975a, b, 1976, 1977, 1986, 1988, 2005, 2009, 2011); Luer and Thoerle (2013); Schweinfurth (1959, 1970); and Zelenko and Bermudez (2009). Floras and other taxonomic materials from Colombia and Peru were included, because of the possibility that some of the species in the collections of Ecuagenera, EquaflorA and Mundiflora may be originally derived from those two countries and do not in fact occur naturally in Ecuador. Such appears to be the case with *Pleurothallis neorinkei* A.Doucette (from Colombia) Doucette *et al*. (2016) and *Pleurothallis papillingua* A.Doucette and J.Portilla (from Peru) (Wilson, unpubl. data). Species were compared in detail to those with which they may be confused, such as the *Pleurothallis cardiostola* Rchb.f. complex (Fig. 1–2), or have been confused, such as *Pleurothallis canidentis* Luer & R.Escobar.

Scanning electron microscopy —. Fresh-harvested flowers were preserved in Kew Mix. For scanning electron microscopy (SEM) flowers were dehydrated in successively higher concentrations of ethanol (80%, 95%, 100%, 100%) for 15 min each before being placed in freshly-opened 100% ethanol. Specimens were dehydrated in a critical point dryer (EMS 850) prior to mounting and sputter coating. Specimens were imaged using a Jeol JSM-6390LV scanning electron microscope with an accelerating voltage of 10-15 kV.

Results

The labellum or "lip" of *Pleurothallis rubrifolia* is quite unique, even when imaged with conventional macro-photography (Figs. 3c, 4b, 5b, 6). The "glenion", a small depression in the hypochile just in front of the anther, is oval in shape and is elevated significantly above the surrounding depression on a callus. In SEM (Fig. 7) the glenion appears to consist of three concentric layers of different cell types, surrounded by a depression with cells forming a smooth surface. The elevated areas of the lip consist of papillae which increase in packing density outward from the depression, creating another smooth surface. With conventional macro-photography the lip of *Pleurothallis nangaritzae* is observed to possess a bilobed glenion, a rare character in *Pleurothallis* subsection *Macrophyllae-Fasciculatae*, and a few papillae along the outer edges. In SEM, it is apparent that papillae cover a significant portion of the lip surface and surround a triangular area of smooth tissue, with the glenion at the base (see images under the Discussion). The cellular structure of the glenion itself was not visible due to a covering of dehydrated liquid, presumably from the secretions of the glenion. The lip of *Pleurothallis castanea* was not imaged.

Taxonomy

Pleurothallis rubrifolia Mk.Wilson, Tobar & Salas Guerr., ***sp. nov***. (Figs. 2-8).

TYPE: Ecuador. Vivero ECSA, Tundayme, Gualaquiza, Morona Santiago, elevation, 822 m, 78º25'52.18"W 3º34'3.14"S, Sept. 2016, *F. Tobar & M. Jiménez 2020* (holotype: QCNE!; isotype: QCA!).

Pleurothallis rubrifolia is superficially similar to the species of the *Pleurothallis cardiostola* complex, including the species *Pleurothallis adelphe* Luer & Hirtz, *Pleurothallis perforata* Luer & Hirtz (syn. *Acronia adelphe* (Luer & Hirtz) Luer) and *Pleurothallis lanigera* Luer & Hirtz and can be distinguished by several factors. *P. rubrifolia* can be distinguished from *P. perforata* by the absence of a circular cavity in the mesochile or "disc" of the lip; the abaxial surface of the leaf reddish in *P. rubrifolia* vs. green in all the *P.*

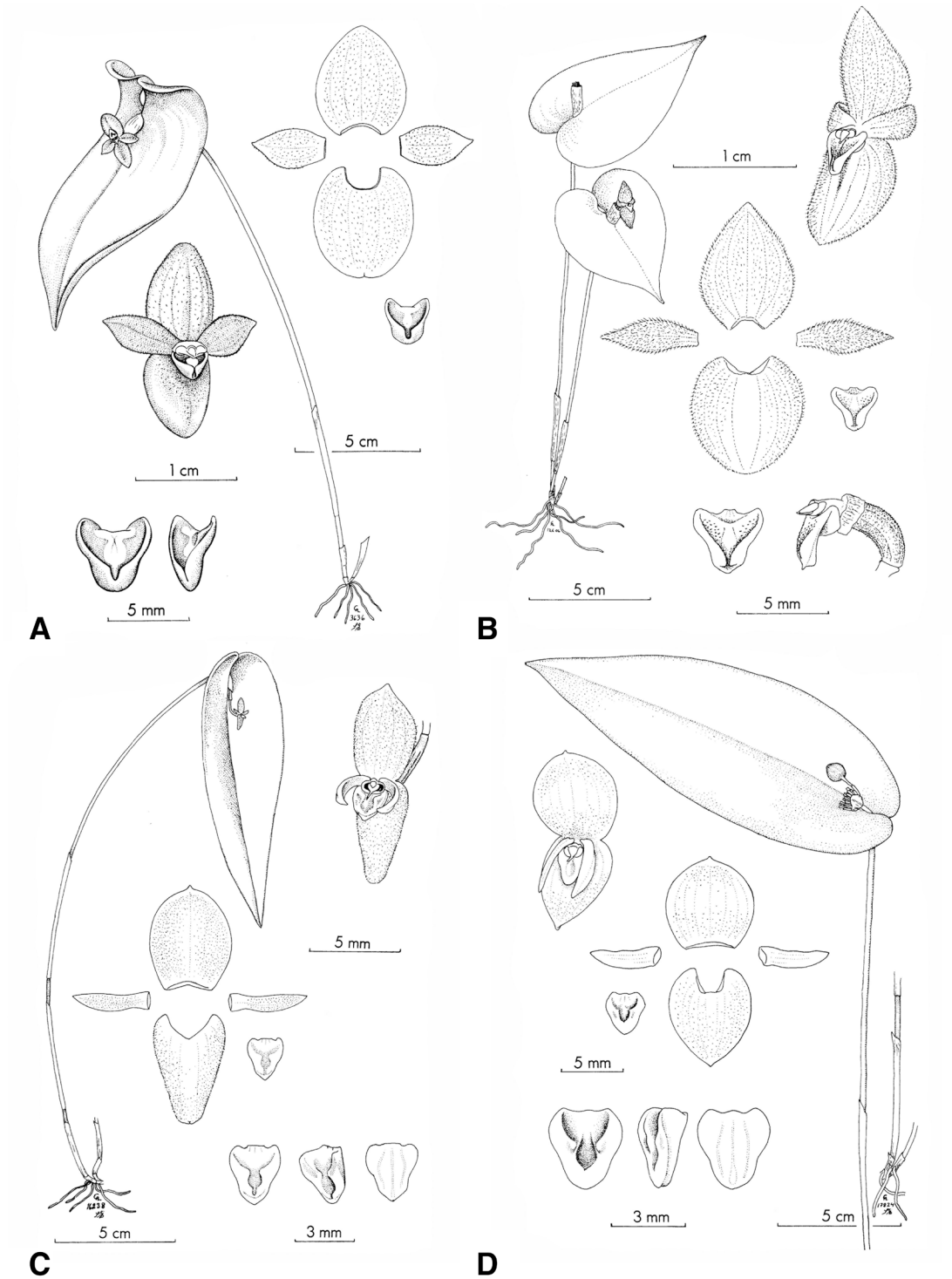

FIGURE 1. Drawings of *Pleurothallis cardiostola*-complex species: A. *Pleurothallis cardiostola*; B. *Pleurothallis lanigera*; C. *Pleurothallis adelphe*; D. *Pleurothallis perforata*. From Luer 2005. Courtesy of Missouri Botanic Gardens Press.

FIGURE 2. Comparison of *Pleurothallis castanea* (A) and *Pleurothallis lanigera* (B). Photographs by Mark Wilson.

cardiostola complex species; the mature leaf with a channel or depression towards the base in which the flower rests in *P. rubrifolia* vs. no depression in *P. cardiostola* complex species.

Plant medium in size, to ca. 29 cm tall, epiphytic, caespitose; *Roots* fibrous; *Ramicaul* terete, 7.2-19.0 cm long, enclosed by papyraceus basal sheath 3.0-3.8 cm long; *Leaves* sub-erect/ascendant, ovate, 8.3-11.5 × 3.9-5.8 cm, acute, cordate, slightly revolute along margins, coriaceous, adaxially mottled dark green, abaxially red-brown, channeled about midrib in basal half; *Inflorescence* one-flowered, from reclining spathaceous bract 11-13 mm long, pedicel 6-9 mm long; *Flower* 1.4-1.7 × 1.4-1.5 cm, resupinate, flower resting in depression formed by channel in leaf; *Dorsal sepal* yellow-brown with maroon-burgundy infused along veins to darker brown with extensive maroon-burgundy at base and along veins, ovate, subacute, entire along the margins, 6.5-8.0 × 6.0-7.5 mm, glabrous, 5-veined; *Synsepal* yellow-brown with maroon-burgundy infused along veins, ovate, obtuse, entire along the margins, 4.0-6.0 × 6.5-8.0 mm, glabrous, 7-veined; *Petals* yellow-brown to darker brown, moderately to heavily infused with maroon-burgundy along vein, oblanceolate, slightly falcate, acute, entire along the margins, 2.0-2.3 × 6.0-6.4 mm, glabrous, 1-veined; *Lip* brown to intense burgundy-brown, triangular, obtuse, entire along the margins, 3.0-4.0 × 3.5-4.5 mm, glenion oval with raised callus surrounded by a depressed area, central channel; *Column* burgundy-brown with pale edge, stout, 1.5-2.5 × 1.5 mm, bilobed stigma, apical anther, anther cap yellow, viscidium pale yellow; *Capsule* 4.6 cm long.

ADDITIONAL MATERIAL STUDIED: Ecuador. Natural forest near the waste dump in the northeast of project ECSA, Tundayme, Gualaquiza, Morona Santiago, elevation, 1466 m, 78º25’52.18”W 3º34’3.17”S, Sept. 2016, *F. Tobar & M. Jiménez* 2095 (paratype: QCNE!; paratype: QCA!). Plant flowered in cultivation at Ecuagenera as *Pleurothallis canidentis*, without collection data *M. Wilson & J. Portilla PL0971* (paratype: HA!). Plants purchased from Ecuagenera as *P. canidentis* and flowered in cultivation at Colorado

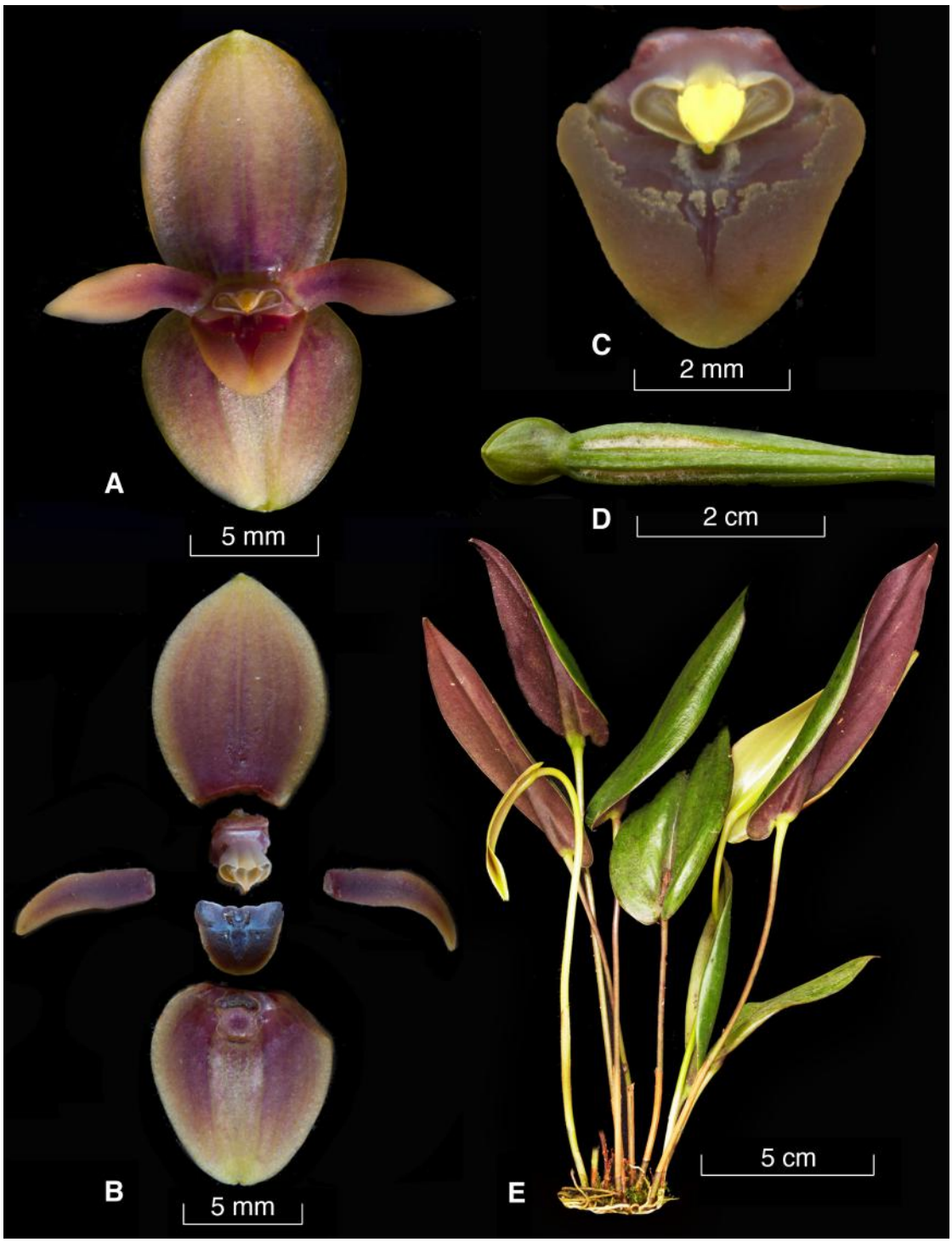

FIGURE 3. Lankester composite digital plate of *Pleurothallis rubrifolia*: A. Whole flower. B. Floral dissection. C. Lip and column. D. Partially dehiscent capsule. E. Whole plant illustrating red abaxial leaf surface. Prepared by Mark Wilson from the paratypes *Wilson* & *Portilla PL0748* and *Wilson* & *Portilla PL0971*.

FIGURE 4. *Pleurothallis rubrifolia in situ* near Tundayme, Ecuador: A. Whole plant among roots of Arecaceae. B. Flower. Photographs by Francisco Tobar.

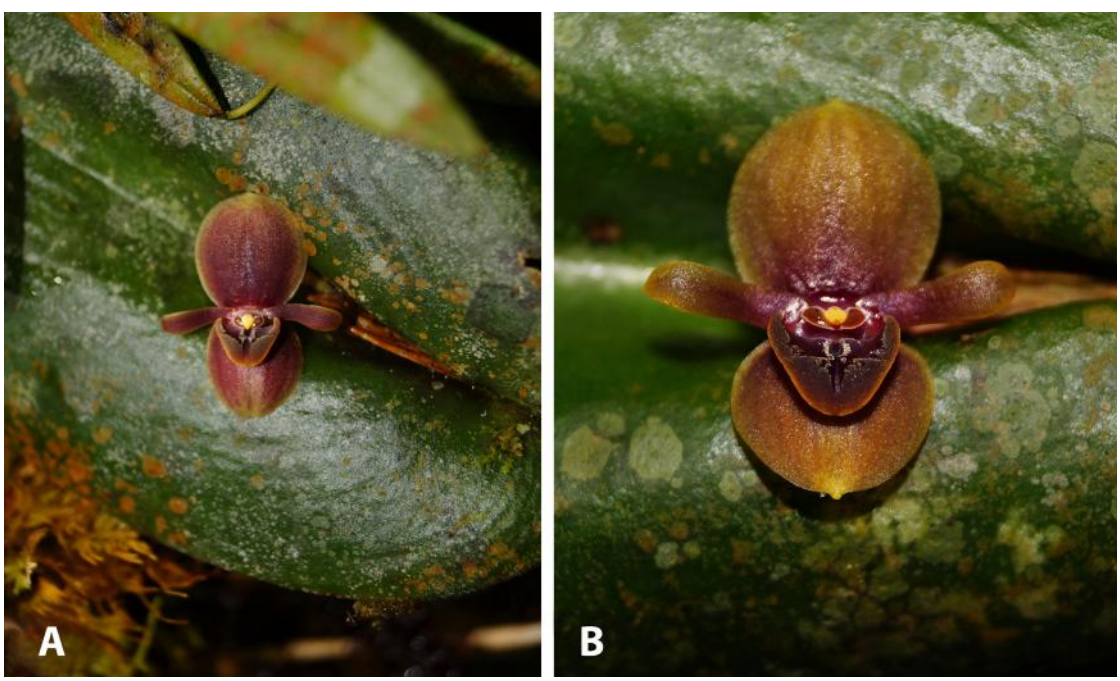

FIGURE 5. *Pleurothallis rubrifolia in situ* in Valle de Los Chilchos, Leimebamba. Peru. A. Flower on leaf. B. Flower detail. Photographs by Marco Salas.

College *M. Wilson & J. Portilla PL0177* and *PL0748* (paratypes: COCO!). Peru. Albazo, Valle de Los Chilchos, Leimebamba, Cachapoyas, *Salas Guerr. 0127* (paratype:USM!).

ETYMOLOGY: In reference to the unique red coloration on the abaxial leaf surface.

DISTRIBUTION AND HABITAT: *Pleurothallis rubrifolia* has been recorded for Tundayme, Ecuador (Fig. 13)

FIGURE 6. Lip and column detail for *Pleurothallis rubrifolia* (A. glenion; B. callus). Photograph by Mark Wilson.

and Leimebamba, Chachapoyas, Amazonas, Peru. In Ecuador, the species grows in very humid premontane and montane forests in the Cordillera del Cóndor from ~800-1700 m elevation, among the roots of Arecaceae. In Peru, it grows in very humid lower montane forest on the eastern slope of the Andes, from 1478-2015 m elevation, in association with plants from family Clusiaceae.

CONSERVATION STATUS*:* The type locality of *Pleurothallis rubrifolia* in Ecuador (Fig. 14) is within a conservation zone associated with EcuaCorriente copper-mining concession, Project Mirador, that may or may not be secure in the future. However, the abundance and breadth of distribution from southeastern Ecuador into northeastern Peru suggest that the species is not threatened *in situ* at this time. The species is widely distributed in collections in the U.S.A. and Europe under the name *Pleurothallis canidentis*, but the level of genetic diversity in these plants is probably very low, most of the plants originating from Ecuagenera, hence there is some concern regarding the *ex situ* conservation status of *P. rubrifolia*.

Pleurothallis rubrifolia is easily distinguished from *Pleurothallis canidentis*, with which it has been confused in the commercial trade, by the smaller plant size; slightly smaller leaf size; the lip brown-burgundy, triangular and planar in *P. rubrifolia* vs. red-brown or orange, oblong and convex in *P. canidentis*; the glenion raised, surrounded by callus in *P. rubrifolia* vs. slightly raised with no distinct surrounding callus in *P. canidentis*; and petals, dorsal sepal, synsepal yellow-brown to darker brown, moderately to heavily infused with maroon-burgundy along the veins in *P. rubrifolia* vs. dorsal sepal canary yellow, petals and synsepal red-brown in *P. canidentis*.

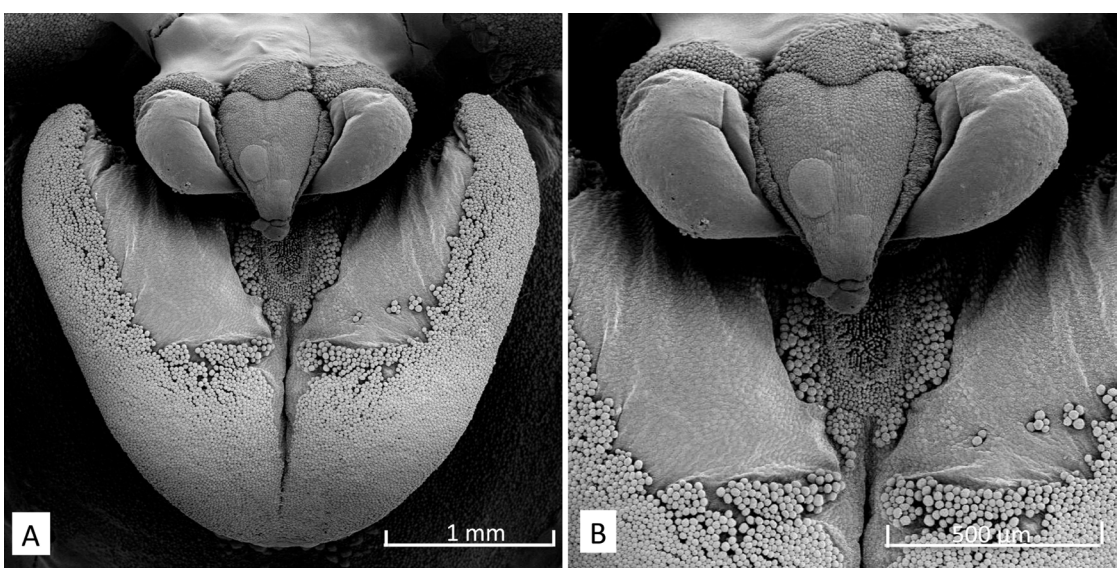

FIGURE 7. A–B. Scanning electron micrographs of lip and column of *Pleurothallis rubrifolia*. SEM images by Katy Dupree.

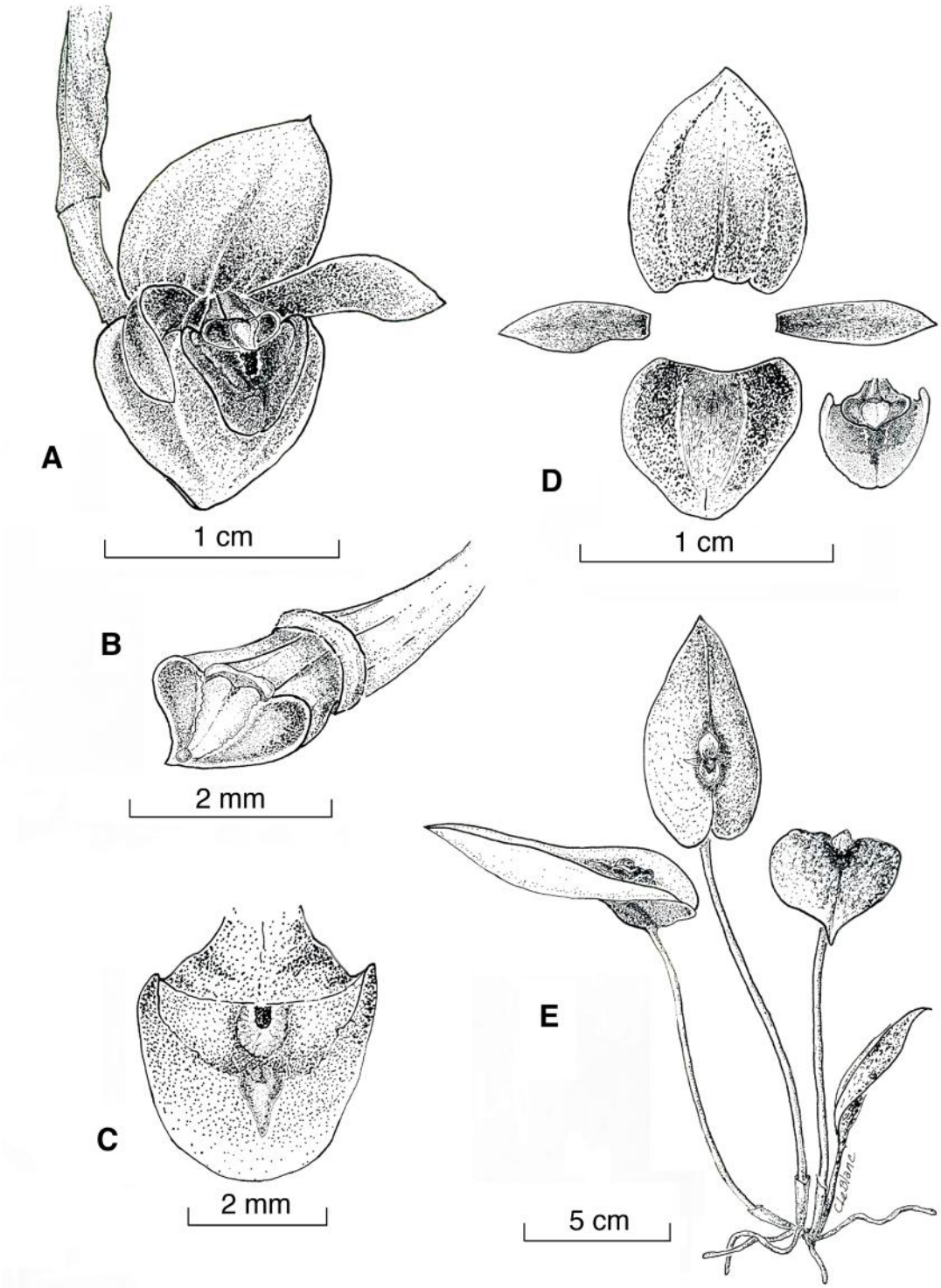

FIGURE 8. Drawing of *Pleurothallis rubrifolia*: A. Whole flower. B. Column (¾ view). C. Lip (top view); D. Floral dissection. E. Whole plant. Drawing by Cheryl Marie LeBlanc, prepared from the paratype *Wilson & Portilla PL0748.*

Pleurothallis castanea Mk.Wilson, G.Merino & J.D.Werner, ***sp. nov.*** (Figs. 2A, 9–10)

TYPE: Ecuador. Flowered in cultivation at EquaflorA, without collection data, October 20, 2016, *M. Wilson & G. Merino PL0981* (holotype: HA!).

Pleurothallis castanea can be distinguished from *Pleurothallis cardiostola* by the glabrous sepals and petals in *P. castanea* vs. cellular-glandular to coarsely pubescent in *P. cardiostola*; the longer sepals and petals in *P. castanea*; and the leaf ovate in *P. castanea* vs. ovate to lanceolate in *P. cardiostola*. *P. castanea* is also similar to *Pleurothallis lanigera* Luer & Hirtz, but differs in the sepals and petals, glabrous in *P. castanea* vs. markedly pubescent in *P. lanigera*.

Plant medium in size, to ~16-30 cm tall, caespitose; *Roots* fibrous; *Ramicaul* 13-29 cm long, enclosed by papyraceus basal-sheath 4 cm long and mid-sheath 4 cm long; *Leaves* deflexed, spreading, cordate, apex long acuminate, entire along the margins, 6.9-10.0 × 4.3-7.0 cm, glabrous, coriaceous, the blade slightly concave; *Inflorescence* one-flowered from sub-erect spathe 1.5 cm long; *Flower* non-resupinate, 2.8-3.0 × 1.8-2.5 cm; *Dorsal sepal* chestnut, broadly ovate, obtuse, slightly revolute along apical and lateral margins, 1.8 × 1.5 cm, glabrous, 9-veined; *Synsepal* chestnut, ovate, obtuse, shortly apiculate, slightly revolute along the apical and lateral margins, 1.8 × 1.5 cm, glabrous, 7-veined; *Petals* chestnut, obovate-unguiculate, truncate-rounded, 12 × 5 mm, glabrous, 3-veined; *Lip* chestnut, ovate-triangular, 1.0 × 1.0 cm, with a prominent broadly triangular depression, the surface of which is verrucose, the glenion a small and bilobed cavity in front of the anther; *Column* cream-beige suffused with pink at base, stout, 8 x 8 mm, with a bilobed stigma, anther apical, anther cap pale yellow, viscidium orange.

ADDITIONAL MATERIAL STUDIED: Ecuador. Flowered in cultivation at Ecuagenera, without collection data, *Mk.Wilson & J.Portilla PL0958* (paratype: COCO!). Purchased from EquaflorA as *Pleurothallis cardiostola* Rchb.f. and flowered in cultivation by Jon Werner in U.S.A., November 2016, *M. Wilson & J. D. Werner PL0980* (paratype: COCO!).

ETYMOLOGY*:* In reference to the color of the sepals and petals which resemble the color of a "chestnut", nut of European and North American trees of the genus *Castanea* Mill.

DISTRIBUTION AND HABITAT: At this time, *Pleurothallis castanea* is only known from live collections in Ecuador. When describing species from greenhouse collections which have no locality information or accompanying *in situ* observation one must consider the possibility of a greenhouse hybrid. We believe that the characteristics of this *Pleurothallis* are sufficiently distinct from the other species of the *Pleurothallis cardiostola* complex to make the possibility that this represents a hybrid between two species of the complex highly unlikely. Further, all the plants observed at Ecuagenera and EquaflorA were very consistent in morphology, which would not be the case were they seedlings from an unintentional or intentional greenhouse hybrid. We are convinced, therefore, that *P. castanea* represents a novel species and we will continue to seek field records to confirm that this species occurs *in situ* and to determine a distribution for the species. The species should not, however, be added to the flora of Ecuador at this time, since it is conceivable the species was obtained from Colombia or Peru and does not occur naturally in Ecuador.

CONSERVATION STATUS: In the absence of locality data we cannot assess the *in situ* conservation status of *P. castanea*. The *ex situ* conservation status is of concern, since while the species occurs in two collections in Ecuador, it is known from only one collection in the U.S. and it is quite likely that all of these plants originated from a single original plant.

Pleurothallis nangaritzae M.Jiménez, Tobar & Mk.Wilson, ***sp. nov.*** (Figs. 11–13).

TYPE: Ecuador: Near the Nangaritza River, Zamora-Chinchipe, Ecuador, 1500 m, October 16th, 2016, *F. Tobar and M. Jiménez 205* (holotype: QCNE!).

Pleurothallis nangaritzae is recognized by its large leaf size to flower size ratio; glossy, heavily veined leaf; broad petals; and papillate acute lip with shallowly bilobed glenion.

Plant small-to-medium in size, to ca. 15 cm tall, epiphytic, caespitose; *Roots* fibrous, slender; *Ramicaul* 10.2-12.1 cm long, enclosed by two sheaths, the upper

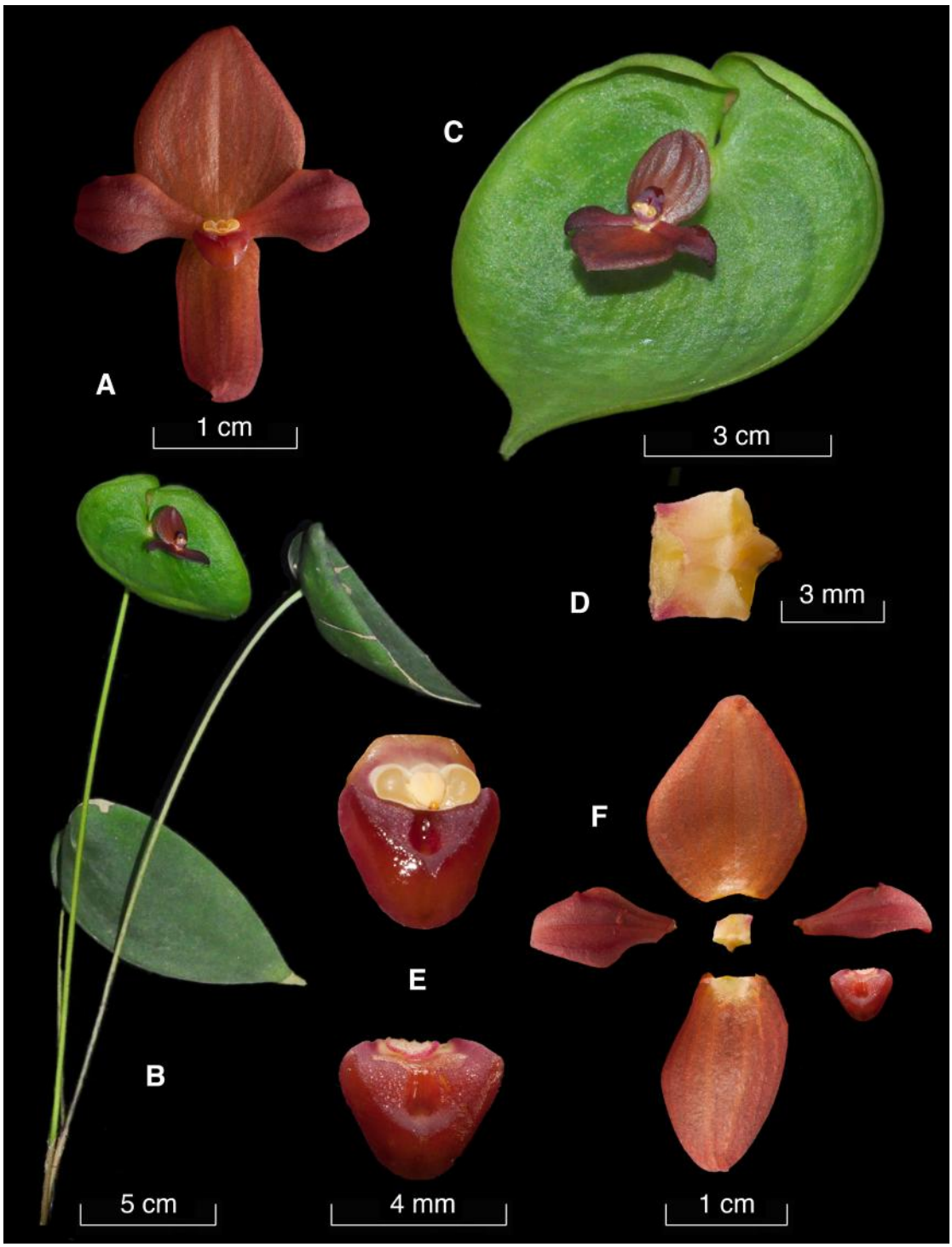

FIGURE 9. Lankester composite digital plate of *Pleurothallis castanea*: A. Whole flower. B. Whole plant. C. Leaf with flower. D. Lip with and without column. E. Column top view. F. Foral dissection. Prepared by Mark Wilson from the paratype *Wilson & Portilla PL0958*.

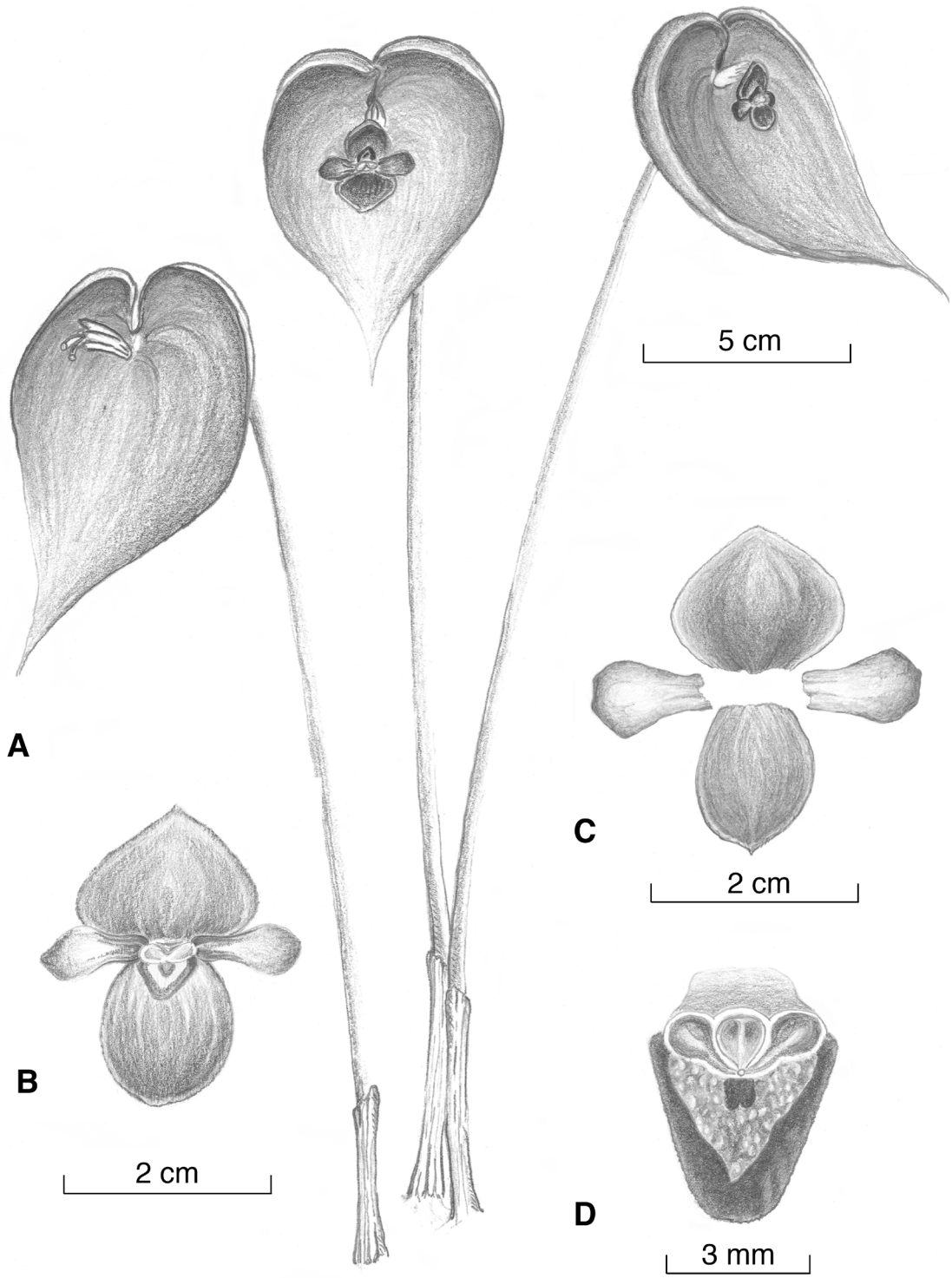

FIGURE 10. Drawing of *Pleurothallis castanea*: A. Whole plant. B. Whole flower. C. Floral dissection. D. Lip detail. Drawing by Jon Werner prepared from the paratype *Wilson & Werner PL0980*.

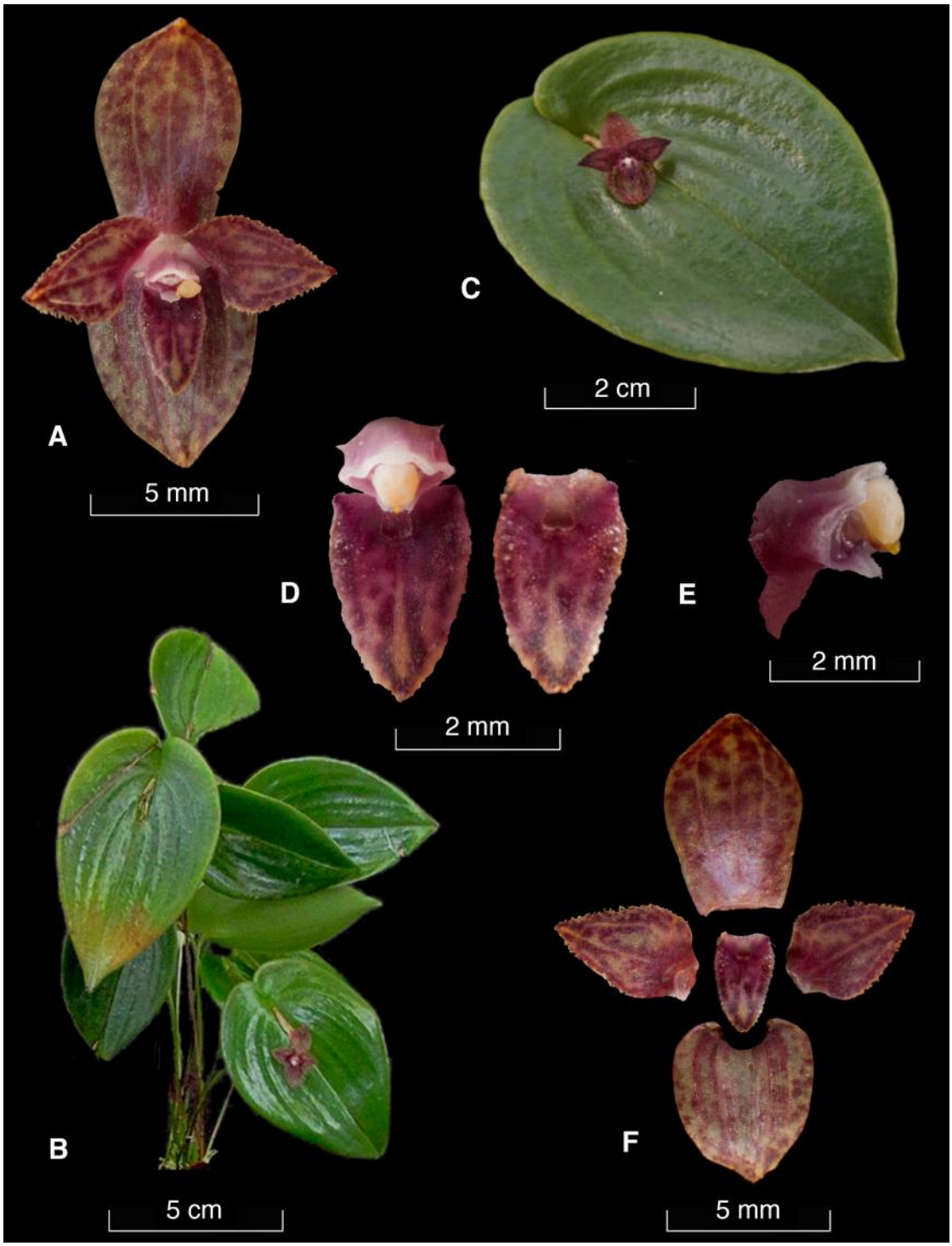

FIGURE 11. Lankester composite digital plate of *Pleurothallis nangaritzae*: A. Whole flower. B. Whole plant. C. Leaf with flower. D. Lip with and without column. E. Column side view. F. Floral dissection. Prepared by Mark Wilson from the paratype *Wilson* & *Werner PL0977*.

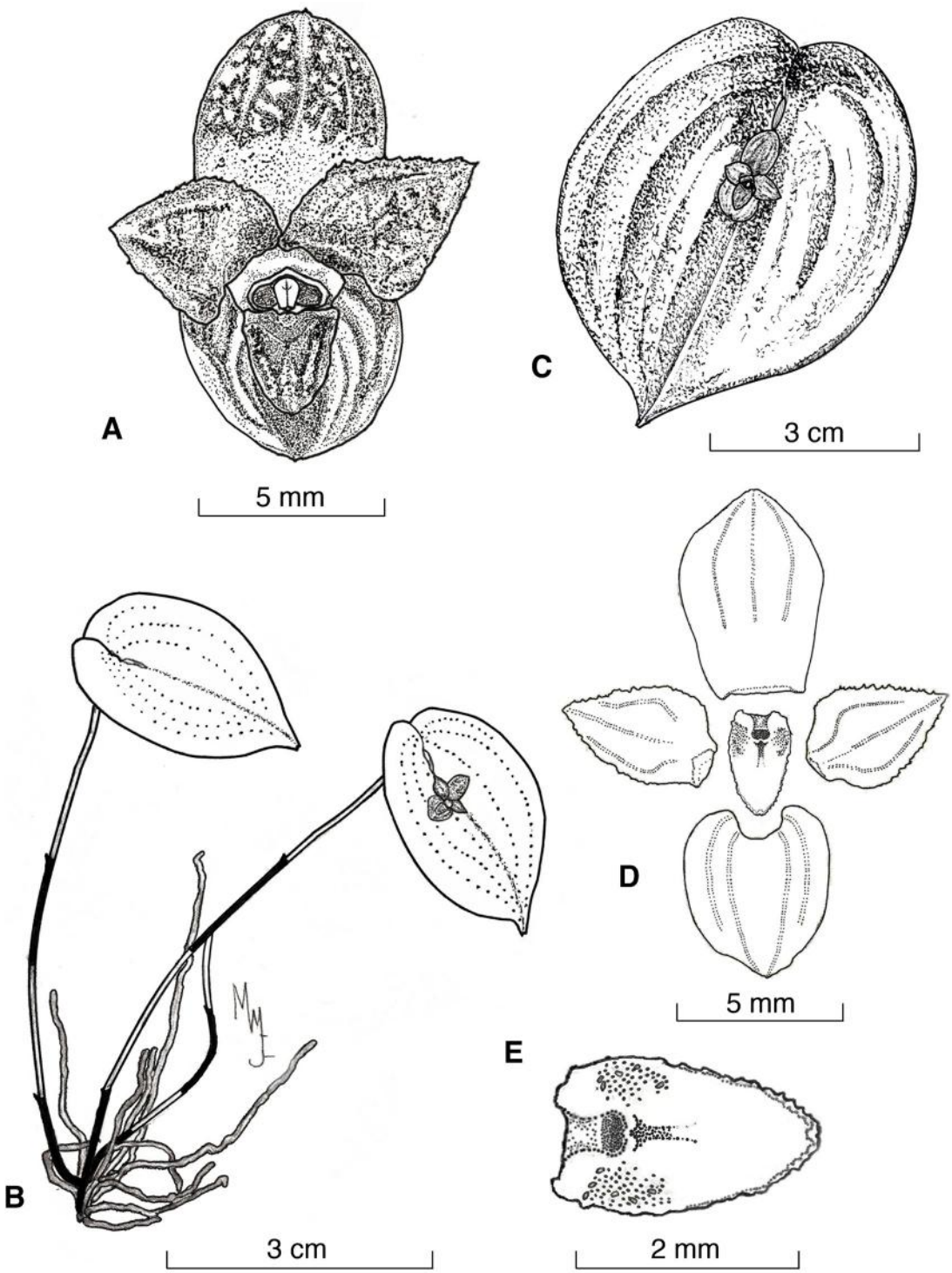

FIGURE 12. Drawing of *Pleurothallis nangaritzae*: A. Whole flower. B. Whole plant. C. Leaf with flower. D. Floral dissection. E. Lip. Drawings by Marco Jiménez and Luis Baquero prepared from holotype *Tobar and Jiménez 2050*.

sheath 0.85-1.3 cm long and the lower 2-4 mm long; *Leaves* deflexed, almost totally plain, ovate, acute, apiculate, shallowly cordate, 3.5-6.8 × 1.4-3.85 cm, glossy, coriaceous and heavily veined; *Inflorescence* one-flowered from reclining spathe 5-8 mm long, peduncle 2-3 mm long, pedicel 4-5 mm long, floral bract 3-4 mm long; *Flower* 10.7-13.3 × 7.8-10.0 mm, resupinate; *Dorsal sepal* beige with burgundy mottling, somewhat concave in apical half, elliptical-obovate to oblong-obovate, obtuse, entire along the margins, 5.0 × 3.0 mm, glabrous, 3-veined; *Synsepal* beige partially mottled with burgundy, slightly concave, ovate, obtuse, entire along the margins, 4.0 × 3.0 mm, glabrous, 5-veined; *Petals* beige mottled with burgundy, base entirely burgundy, ovate and shortly unguiculate, acute, marginally dentate, 4.5 × 3.2 mm, glabrous, 3-veined; *Lip* beige heavily mottled with burgundy, narrowly obovate, acute, marginally papillate-dentate, 3 × 2 mm, the glenion a small area in front of the anther, bilobed, surrounded by narrow callus; *Column* pink to pale burgundy with white along the edge of the clinandrium, stout, somewhat compressed dorsi-ventrally, 1.0 × 1.5 mm, with a bilobed stigma, anther apical, anther cap pale yellow, viscidium drop-like, orange.

ADDITIONAL MATERIAL STUDIED: Ecuador. Purchased from Mundiflora and flowered in cultivation by Jon Werner in U.S.A., *M. Wilson & J. D. Werner PL0977* (paratype: COCO!).

ETYMOLOGY*:* Named for the type locality near the Nangaritza River in Zamora Chinchipe Province, Ecuador.

DISTRIBUTION AND HABITAT: So far, *Pleurothallis nangaritzae* is known in the wild from only the type locality near the Nangaritza River, Province of Zamora Chinchipe, Ecuador (Fig. 13): it has not, to date, been reported outside this Province and may be endemic to that region. *P. nangaritzae* grows as an epiphyte adpressed to tree trunks in a lower montane forest at an elevation of ~1500 m and occurs sympatrically with orchids such as *Masdevallia strobelii* H.R.Sweet & Garay, *Maxillaria pachyacron* Schltr., *Oncidium tipuloides* Rchb.f. and *Pleurothallis cordata* Lindl.

CONSERVATION STATUS: The type locality of *Pleurothallis nangaritzae* occurs in an area in which a road has been opened and at this time cannot be considered secure. Whether the species occurs within the Bosque Protector Alto Nangaritza is unknown. The *ex situ* conservation status is also of concern, since while the species occurs in two collections in Ecuador, it is known from only one collection in the U.S. and likely all of these plants originated from a single original plant.

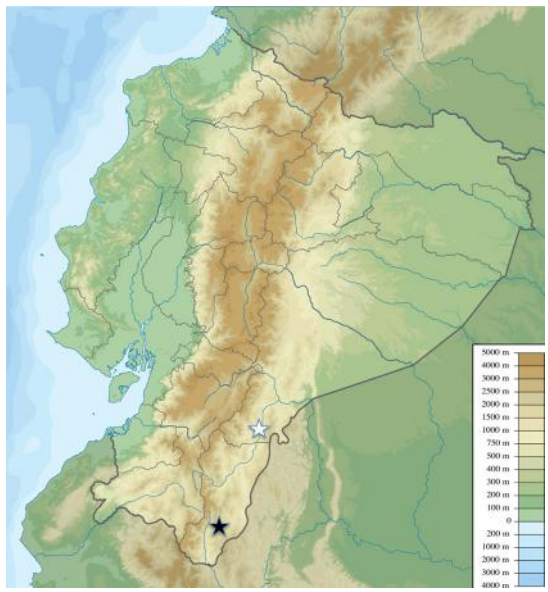

FIGURE 13. Collection locations of *Pleurothallis nangaritzae* (black star) and *Pleurothallis rubrifolia* (white star) in southeastern Ecuador (map from Wikimedia commons.)

Discussion

Pleurothallis subsection *Macrophyllae-Fasciculatae* is the most speciose group within genus *Pleurothallis* as circumscribed by Pridgeon *et al.* (2005), with between 223 and 297 species, depending on synonymy. The first author estimates that, even conservatively, only ~60-70% of the species in the subsection have been described. Hence, a significant amount of work will be required in this group in order to describe the extant biodiversity before it is lost to deforestation and climate change. Efforts should be directed to areas of high biodiversity and endemism which have received little attention by orchidologists to date: the northwest of Ecuador (Endara, Williams & Léon-Yánez 2009) and the southwest of Colombia, particularly the Department of Nariño (Orejuela Gärtner 2011), part of the Chocó bioregion; and

the southeast of Ecuador (Endara *et al*. 2009) and adjoining areas of Amazonas, Peru. Unfortunately, the description of new species is somewhat hampered by the large number of superficially similar species in this group.

We believe that the micro-morphology of the labellum and in particular the glenion, the structures with which the pollinator interacts directly, may be the most useful for distinguishing otherwise morphologically similar species in *Pleurothallis* subsection *Macrophyllae-Fasciculatae*. In this group, nearly all of which possess such a structure, the glenion is a small area of the hypochile, of distinct tissue structure, often depressed, but occasionally elevated on a callus, surrounded by tissue of completely different texture. While often mentioned in descriptions of species in the *Macrophyllae-Fasciculatae*, to our knowledge, it has not been examined in detail using SEM in this or any other group within *Pleurothallis sensu* Pridgeon *et al*. (2005). We hypothesize that it acts not just to attract the pollinator but that it serves to position the pollinator in the optimal position for pollinarium acquisition or deposition.

All three of the species described herein possess a glenion, but we were only able to obtain detailed images of the glenion of *Pleurothallis rubrifolia*. The glenion of *P. rubrifolia* was very distinctive, being somewhat elevated on a callus; apparently consisting of three cell types; and being surrounded by a smooth, somewhat depressed area of the hypochile/mesochile (Fig. 6–7). The glenion of *Pleurothallis nangaritzae* is bilobed, (Fig. 11b), a rare character in *Pleurothallis* subsection *Macrophyllae-Fasciculatae*, with few papillae along the outer edges. The papillae cover a large portion of the lip and surround a triangular area of smooth tissue, with the glenion at the base (Fig. 14). The *P. rubrifolia* glenion was quite different from that in *Stelis*, in which Ignowski (2015) observed the glenion to consist of a less well-defined area of tall, slender, loosely packed, papillate cells. Based upon the observations of Ignowski (2015) in *Stelis* and the preliminary observations here, the utility of the glenion in taxonomic discrimination of morphologically similar species and its specific role in the reproductive ecology of *Pleurothallis* subsection *Macrophyllae-Fasciculatae* deserves further study.

Although *Pleurothallis rubrifolia*, *P. castanea* and *P. nangaritzae* are present in hobbyist, commercial and botanic collections in North and South America, *ex situ* conservation is a very poor substitute for *in situ* conservation in tropical montane forests (Orejuela Gärtner 2011). These forests, however, are extremely vulnerable due to deforestation and climate change (Orejuela Gärtner 2011) and while modest orchid conservation efforts are underway through organizations such as the Orchid Conservation Alliance (OCA), EcoMinga in Ecuador and Salvamontes in Colombia, significantly more effort and funding will be required to conserve even a small fraction of the diversity of these species in the coming decades.

FIGURE 14. Scanning electron micrographs of lip and column of *Pleurothallis nangaritzae*. SEM image by Katy Dupree.

ACKNOWLEDGEMENTS. The authors are grateful to Colorado College for research funding for Wilson and Dupree and provision of greenhouse and herbarium facilities; to Dr. Ron Hathaway for assistance with SEM; to Ecuagenera, EquaflorA and Mundiflora for access to plant collections; to members of the Portilla family for their warm hospitality; to EcuaCorriente for the facilities provided under Project Mirador and for the use of their investigation permit allowing collection of the species described; to Ecotono for aid with the field logistics and the use of the transportation

permit for the species described; to Adam Karremans and Diego Bogarín for instruction in preparation of LCDPs; to the anonymous reviewers for extremely valuable suggestions to improve the species descriptions; and the Editors of Lankesteriana for other suggestions to improve the manuscript.

Literature Cited

Bennett, D. E. & Christenson, E. A. (1993). *Icones Orchidacearum Peruvianum*. St. Louis: Missouri Botanical Gardens Press.

Cardoso-Gustafson, P. (2014). Desenvolvimento floral em espécies de Pleurothallidinae (Orchidaceae) com ênfase nas estruturas secretoras. Ph.D. Thesis, Instituto de Botânica da Secretaria do Meio Ambiente, São Paulo, Brazil.

Dodson, C. H. (2003). *Native Ecuadorian orchids, vol. 4: Oncidium* to *Restrepiopsis*. Sarasota, FL, U.S.A.: Dodson Trust.

Dodson, C. H. & Dodson, P. M. (1980). Orchids of Ecuador, Series 1, Fascicles 1-4, *Icones Plantarum Tropicarum*. Sarasota, FL, U.S.A.: Marie Selby Botanic Gardens.

Dodson, C. H. & Dodson, P. M. (1982). Orchids of Ecuador, Series 1, Fascicles 5, *Icones Plantarum Tropicarum*. Sarasota, FL, U.S.A.: Marie Selby Botanic Gardens.

Dodson, C. H. & Dodson, P. M. (1991). Orchids of Ecuador, Series 2, Fascicles 5-6, *Icones Plantarum Tropicarum*. Sarasota, FL, U.S.A.: Marie Selby Botanic Gardens.

Doucette, A., Wilson, M., Portilla, J., Kay, A., Moreno, J. S., & Cameron, K. M. (2016). Two new species of *Pleurothallis* and a new name for *Acronia rinkei*. *Orquideología* 23(2): 123-139.

Duque, Ó. (2008). Orchidaceae *Stelis* Swartz compendium. Medellin, Colombia: Editorial Universidad de Antioquia.

Endara, L., Williams, N. H. & Léon-Yánez, S. (2009). Patrones de endemismo de orquídeas ecuatorianas: perspectivas y prioridades para la conservación. In: A. M. Pridgeon & J. P. Suárez, (Eds.) *Proceedings of the Second Scientific Conference on Andean Orchids* (63-70). Loja, Ecuador: UTPL.

Escobar, R. (1994). *Native Colombian orchids, vol. 3, Maxillaria-Ponthieva*. Medellín, Colombia: Compañia Litográfica Nacional S.A.

Escobar, R. (2006). *Native Colombian orchids, vol. 6, supplement: Leucochyle-Zootrophion*. Medellín, Colombia: Compañia Litográfica Nacional S.A.

Ignowski, H. (2015). *Stelis* Swartz (Orchidaceae) no estado do Paraná e estudos micro-morfológicos florais do gênero. Ph.D. Thesis, Universidade Federal do Paraná, Brazil.

Ignowski, H., Toscano de Brito, A. L. V., Bona, C. & de Camargo Smidt, E. (2015). Nomenclatural notes on *Stelis ciliaris* (Pleurothallidinae, Orchidaceae). *Phytotaxa* 218(1): 030-038. http://dx.doi.org/10.11646/phytotaxa.218.1.2

Kolanowska, M., Pérez-Escobar, O. A., Sanchez, E. P. & Szlachetko, D. (2011). *An illustrated field guide to the orchids of the Yotoco Forest Reserve (Colombia).*

Lindley, J. (1859). Folia Orchidaceae *Pleurothallis* 9-12.

Luer, C. A. (1974). Icones Pleurothallidinarum: *Pleurothallis* of Ecuador (Orchidaceae). *Selbyana* 1(1), 56-100.

Luer, C. A. (1975a). Icones Pleurothallidinarum (Orchidaceae): *Pleurothallis* of Ecuador II. *Selbyana* 1(2), 172-195.

Luer, C. A. (1975b). Icones Pleurothallidinarum (Orchidaceae): *Pleurothallis* of Ecuador III. *Selbyana* 1(3), 220-303.

Luer, C. A. (1976). Icones Pleurothallidinarum: Miscellaneous species of *Pleurothallis*. *Selbyana* 3(1-2), 38-201.

Luer, C. A. (1977). Icones Pleurothallidinarum (Orchidaceae): Miscellaneous species in the Pleurothallidinae. *Selbyana* 3(3-4), 203-407.

Luer, C.A. (1986). Icones Pleurothallidinarum III: Systematics of *Pleurothallis*. *Monographs in Systematic Botany from Missouri Botanical Garden* 20, 1–109.

Luer, C. A. (1988). A revision of some sections of subgenus *Pleurothallis*. *Lindleyana* 3(3), 133-149.

Luer, C. A. (2005). Icones Pleurothallidinarum XXVII: *Dryadella* and *Acronia* section *Macrophyllae-Fasciculatae*. *Monographs in Systematic Botany from Missouri Botanical Garden* 103, 1–311.

Luer, C. A. (2009). Miscellaneous new species in the Pleurothallidinae (Orchidaceae). *Selbyana* 30(1), 1-71.

Luer, C. A. (2011). Miscellaneous new species in the Pleurothallidinae (Orchidaceae) excluding species from Brazil. *Harvard Papers in Botany* 16(2), 311-360.

Luer, C. A. & Thoerle, L. (2013). Miscellaneous new species in the Pleurothallidinae (Orchidaceae). *Harvard Papers in Botany* 18(2), 173-196.

Orejuela Gärtner, J. E. (2011). *Orchids in the Mist: Orchids of the cloud forests of southwestern Colombia.* Cali, Colombia: El Color de Colombia Ediciones Artísiticas.

Pridgeon, A. M., Cribb, P.J., Chase, M. W. & Rasmussen, F. N. (2005). *Genera Orchidacearum. Vol. 4. Epidendroideae (Part one)*, (385-390). Oxford, U.K.: Oxford University Press

Pridgeon, A. M. & Chase, M. W. (2001). A phylogenetic reclassification of Pleurothallidinae (Orchidaceae). *Lindleyana* 16, 235–271.

Pridgeon, A. M., Solano, R. & Chase, M. W. (2001). Phylogenetic relationships in Pleurothallidinae (Orchidaceae): Combined evidence from nuclear and

plastid DNA sequences. *American Journal of Botany* 88, 2286–2308.

Schweinfurth, C. (1959). Orchids of Peru. *Fieldiana – Botany* 30(2), 261-531.

Schweinfurth, C. (1970). First Supplement to the Orchids of Peru. *Fieldiana – Botany* 33, 1-85.

Szlachetko, D. L. & Kulak, M. (2006a). Nouvelles combinaisons dans le genre *Zosterophyllanthos* Szlachetko & Margónska (Orchidaceae, Pleurothallidinae). *Richardiana* (3), 131-135.

Szlachetko, D. L. & Kulak, M. (2006b). Nouvelles combinaisons dans le genre *Zosterophyllanthos* Szlachetko & Margónska (Orchidaceae, Pleurothallidinae). *Richardiana* (4), 183-196.

Szlachetko, D. L. & Margonska, B. H. (2001). Genera et species orchidalium. *Polish Botanical Journal* 46(2), 113-121.

Szlachetko, D. L., Veyret, Y., Mytnik-Ejsmont, J., Sawicka, M., Rutkowski, P. and Baranow, P. (2012). *Orchids of French Guiana.* Liechtenstein: A. R. G. Gartner, Ruggell.

Wilson, M., Belle, C., Dang, A., Hannan, P., Kenyon, C., Low, H., Stayton, T. & Woolley, M. A. (2011). A phylogenetic analysis of the genus *Pleurothallis*, with emphasis on *Pleurothallis* subsection *Macrophyllae-Fasciculatae*, using nuclear ITS and chloroplast DNA sequencing. *Lankesteriana* 11(3), 369. http://dx.doi.org/10.15517/lank.v11i3.18304

Wilson, M., Belle, C., Dang, A., Hannan, P., Kellogg, L., Kenyon, C., Low, H., Mochizuki, A., Nguyen, A., Sheade, N., Shan, L., Shum, A., Stayton, T., Volz, C., Vosburgh, B., Wellman, H. & Woolley, M. A. (2013). Preliminary phylogenetic analysis of *Pleurothallis sensu lato* based upon nuclear and plastid sequences. *Lankesteriana* 13(1–2), 139. http://dx.doi.org/10.15517/lank.v0i0.11568

Zelenko, H. & Bermúdez, P. (2009). *Orchids: Species of Peru*. Quito, Ecuador: Imprenta Mariscal.