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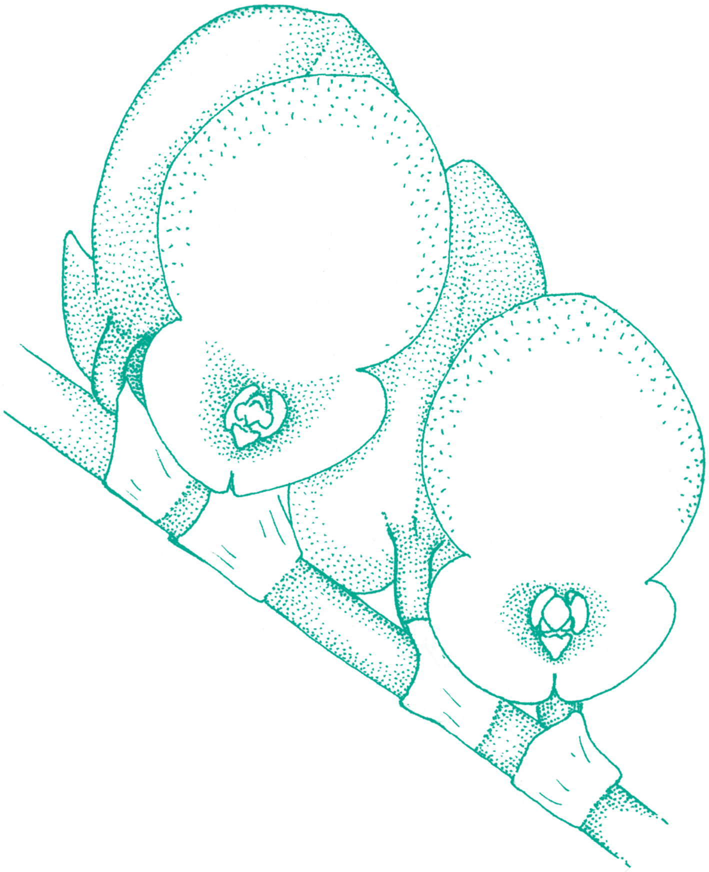

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Cover: *Stelis megaloglossa* Luer
(see page 156, Figure 28). Drawing by Carl A. Luer, inked by Stig Dalström.

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(Continued on the next page)

(Continued from page i)

OURATEA CATANIAPOENSIS, A NEW NAME FOR *O. MEGAPHYLLA* (OCHNACEAE)

GERARDO A. AYMARD C.[1,2]

Abstract. The new name *Ouratea cataniapoensis* (Ochnaceae) is proposed to replace the illegitimate homonym *O. megaphylla*. Chorological and taxonomic notes about these taxa also are provided.

Resumen. Se propone *Ouratea cataniapoensis* (Ochnaceae) como un nuevo nombre para reemplazar el homónimo ilegítimo *O. megaphylla* Sastre. Se incluye información corológica y taxonómica acerca de ambas especies.

Keywords: *Ouratea*, Amazonian, Ochnaceae, Peru, Venezuela

The Neotropical genus *Ouratea* Aublet, *nom. cons.*, (1775: 397) is distributed in Mesoamerica, the Caribbean, and South America. It is the most diverse genus in Ochnaceae, and is particularly diversified in the Guayana, Guiana, or Guyana Shield and the Amazon basin (Sastre, 1987b, 1988d, 1994a, 2003). The genus is notable for the wide disagreement in species numbers, ranging from 150 to 300 species (Sastre, 2004b; Berazaín-Iturralde, 2006; Fiaschi et al., 2010; Whitefoord, 2012; Amaral and Bittrich, 2014; Mabberley, 2017; Ulloa-Ulloa et al., 2017). This variation may be due to taxa that are not well established (Yamamoto et al., 2008) and the fact that many species were described in 12 different genera (e.g., *Cercouratea* Tiegh., *Gomphia* Schreb., *Isouratea* Tiegh. *Trichouratea* Tiegh.). Consequently, numerous new names and combinations have been proposed (Sastre, 1981, 1986b, 1988d, 1989, 2001; Sastre and Offroy, 2016). *Ouratea* is characterized by its remarkable leaves with the secondary veins subequal, strongly curved along the margin or unequal, some arcuate and ascending along the margin between smaller, fine, parallel, and straight veins; the petals are frequently yellow; the gynoecium is pseudo-apocarpic, with a gynobasic style and a usually fleshy, reddish carpophore (torus) derived from the enlargement of the basal portion of the carpels. This carpophore carries 1–10 seeds, and usually erect blackish mericarps, each with a single seed (Guédès and Sastre, 1981; Yamamoto, 1989; Sastre, 2003, 2004b).

Approximately 113 species of *Ouratea* have been described in the past seven decades (Cuatrecasas, 1950; Dwyer, 1967; Rizzini, 1976; Sastre, 1981, 1986a, 1987a,b, 1988a,b,c,d, 1991, 1993, 1994b, 1995b, 1996, 2001, 2004a, 2005, 2006, 2007b; Maguire and Steyermark, 1989; Whitefoord, 1992; Yamamoto, 1995; Berazaín-Iturralde, 2003; Salvador et al., 2006; Castañeda-Noa, 2008; Yamamoto et al., 2008; Sastre and Offroy, 2009; Chacon et al., 2011; Fraga and Machado-Saavedra, 2014). Among all these species, Sastre (1996) validly published *Ouratea megaphylla* for a taxon native to the junction of the Río Pachitea and the Río Yuyapichis, south of Pucallpa, Huânuco, in the Peruvian Amazon. Inexplicably, the same author published a new species from the Cataniapo river basin, Atures, in the Orinoquía of Venezuela, with the same epithet (Sastre, 2001). According to the International Code of Nomenclature (art. 54.1a; Turland et al., 2018), *Ouratea megaphylla* Sastre from Venezuela (Sastre, 2001) is an illegitimate homonym. The replacement name *O. cataniapoensis* Aymard is, therefore, proposed here.

Ouratea cataniapoensis Aymard, *nom. nov.*

Replaced synonym: *Ouratea megaphylla* Sastre, Novon 11: 113–115, f. 12. 2001, *non Ouratea megaphylla* Sastre, Ann. Naturhist. Mus.Wien, B. 98B: 573.1996. Fig. 1–2. TYPE: VENEZUELA. Amazonas. Atures: Puerto Ayacucho, río Cataniapo, entre la comunidad Las Pavas y el raudal Rabipelado, aprox. 6°25'N, 67°25'W, 11 April 1987 (fr), *A. Castillo 2341* (Holotype: P, Isotype: VEN).

Paratypes: VENEZUELA. Amazonas. Atures: Puerto Ayacucho, río Cataniapo, entre la comunidad Las Pavas y el raudal Buasaujaka, aprox. 6°25'N, 67°25'W, 13 August 1986 (fl), *A. Castillo 2111* (P, VEN); Atures: Puerto Ayacucho, río Cataniapo, entre el lugar de la futura represa y la comunidad de San Pedro de Cataniapo, aprox. 5°38'N, 67°11'W, 5 August 1980 (fr), *F. Guánchez 111* (MO, TFAV, VEN).

Etymology: the specific epithet refers to the Cataniapo River, the basin of which is the only locality where this species hitherto has been found.

Ouratea cataniapoensis is a treelet to small tree, 5–10 m tall, with coriaceous leaves, the largest ones 35–45 × 8–12.5 cm, and terminal, paniculate inflorescences, 20–30 cm long. The species is endemic to the lowland evergreen forests located in the Cataniapo river basin, Amazonas state, Venezuela (Sastre, 2003). Sastre (2001) described this Venezuelan taxon as *O. megaphylla* without realizing he had already occupied that epithet for a Peruvian species (Sastre, 1996). The homonymy was immediately reported in *Index Kewensis* record of IPNI (2018), but treatments of the genus for the Venezuelan Guayana (Sastre, 2003), the Guianas (Sastre,

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FIGURE 1. Holotype of *Ouratea megaphylla* Sastre (Venezuela). Based on *Castillo 2341* (P 00542322).

Leg: W. Morawetz
B. Wallnöfer
N° 17-27985
27 Sept. 1985

F L O R A of P E R U

Ouratea sp.

Loreto, SE of Pucallpa, next to the junction of the Rio Pachitea and the Rio Yuyapichis; village of Panguana and surroundings, ca. 260m above sea level, 9/37'S; 74/56'W. Primary rainforest in a distance of 10-2000m from the river Yuyapichis. Soils: white sands or brown latosols with rocky outcrops.

Slender treelet of about 4m; flowers whitish yellow; fruits red and black. (OCHN).

leg. W. MORAWETZ & B. WALLNÖFER, 27. Sept. 1985
no. 17-27985

HERBARIUM MUSEI PARISIENSIS

Ouratea megaphylla
Sastre sp. nov.

FIGURE 2. Isotype of *Ouratea megaphylla* Sastre (Perú). Based on *Morawetz & Wallnöfer 17-27985* (P 00758085).

2007a) and Ochnaceae for Venezuela (Sastre, 2008), and plant databases from the Amazon basin and the Americas (Cardoso et al., 2017; Ulloa-Ulloa et al., 2017), were not aware of this homonymy.

Both species are treelets to small trees, belong to the *Ouratea* group with large leaves (35–45 × 8–12.5 cm; e.g., *O. amplifolia* Sleumer, *O. gigantophylla* (Erhard) Engl., and *O. pulchrifolia* Ducke); longer, paniculate, terminal inflorescences; flowers always with 5 sepals and carpels; and fruits with the carpels born vertically. However, the Venezuelan taxon (*O. cataniapoensis*) differs from the Peruvian one by its coriaceous leaves, oblong to ovate, base obtuse, margin denticulate; petiole ca. 1 cm long; petals ovate; and fruits without persistent sepals, the latter a feature that defines the section *Caducae* (Sastre, 1995a or b). In contrast, *O. megaphylla* Sastre from Peru has membranous, elliptic leaves, base shortly attenuate, margin undulate-denticulate; petiole ca. 2 cm long; petals obovate; and fruits with persistent sepals, features of the section *Ouratea* (Sastre, 1995a). This is an element endemic to the lowland evergreen forests, located Southern of Pucallpa, Huânuco, in the Amazonian region of Peru (Sastre, 1996).

LITERATURE CITED

AMARAL, M. C. E. AND V. BITTRICH. 2014. Ochnaceae. Pages 253–268 in K. KUBITZKI, ED., *The Families and Genera of Vascular Plants*. Vol. 11. Springer, Berlin.

AUBLET, J. B. C. F. 1775. Histoire des Plantes de la Guiane Françoise. Vol. 1. P. F. Didot-Jeune, London & Paris.

BERAZAÍN-ITURRALDE, R. 2003. A new species of *Ouratea* (Ochnaceae) from Cuba. Willdenowia 33: 183–186.

———. 2006. Notes on the taxonomy and distribution of the Ochnaceae in the Greater Antilles. Willdenowia 36: 455–462.

CARDOSO, D., T. SARKINEN, S. ALEXANDER, A. M. AMORIN, V. BITTRICH, M. CELIS, D. C. DALY, P. FIASCHI, V. A. FUNK, L. L. GIACOMIN, R. GOLDENBERG, G. HEIDEN, J. IGANCI, C. L. KELLOFF, S. KNAPP, H. CAVALCANTE DE LIMA, A. F. P. MACHADO, R. M. DOS SANTOS, R. MELLO-SILVAR, F. A. MICHELANGELI, J. MITCHELL, P. MOONLIGHT, P. L. RODRIGUES DE MORAES, S. A. MORI, T. S. NUNES, T. D. PENNINGTON, J. R. PIRANI, G. T. PRANCE, L. P. DE QUEIROZ, A. RAPINI, R. RIINA, C. A. VARGAS-RINCÓN, N. ROQUE, G. SHIMIZU, M. SOBRAL, J. R. STEHMANN, W. D. STEVENS, C. M. TAYLOR, M. TROVÓ, C. VAN DEN BERG, H. VAN DER WERFF, P. L. VIANA, C. E. ZARTMAN, AND R. CAMPOSTRINI FORZZA. 2017. Amazon plant diversity revealed by a taxonomically verified species list. Proceedings of the National Academy of Sciences 114: doi.1706756114.

CASTAÑEDA-NOA, I. 2008. *Ouratea neuridessi* (Ochnaceae), a new species from central Cuba [Novitiae Florae Cubensis 26]. Willdenowia 38: 173–176.

CHACON, R. G., K .YAMAMOTO, AND T. BARBOSA-CAVALCANTI. 2011. *Ouratea lancifolia* R.G. Chacon & K. Yamam. (Ochnaceae), uma nova espécie do Cerrado, Brasil. Revista Brasileira de Botânica 34: 603–605.

CUATRECASAS, J. 1950. New and noteworthy Colombian trees. Tropical Woods 96: 37–47 [*Ouratea* on pages 43–44].

DWYER, J. D. 1967. Three new species of *Ouratea* from Panama. Phytologia 14: 339–440.

FIASCHI, P., C. N. FRAGA, AND K. YAMAMOTO. 2010. Neotropical Ochnaceae (incl. Quiinaceae). In W. MILLIKEN, B. KLIGARD, AND A. BARACAT, EDS., *Neotropikey—Interactive Key and Information Resources for Flowering Plants of the Neotropics*. Royal Botanic Gardens, Kew. Continuously updated, available at https://www.kew.org/science/tropamerica/neotropikey/families/Ochnaceae s.l. (incl. Quiinaceae).htm (accessed August 2018).

FRAGA, N. C. AND M. MACHADO-SAAVEDRA. 2014. A new cauliflorous white-flowered species of *Ouratea* (Ochnaceae) from the Brazilian Atlantic Forest. Phytotaxa 167: 119–126.

GUEDÉS, M. AND C. SASTRE. 1981. Morphology of the gynoecium and systematic position of the Ochnaceae. Botanical Journal of the Linnean Society 82: 121–138.

MABBERLEY, D. J. 2017. *Mabberley's Plant-Book. A Portable Dictionary of Plants, Their Classification and Uses*. 4th ed. Cambridge University Press, London.

MAGUIRE, B. AND J. A. STEYERMARK. 1989. *Ouratea* in the Guayana and adjacent Amazonian Hylaea. In *The Botany of the Guayana Highland*. Part XIII. Memoirs of the New York Botanical Garden 51: 56–102.

RIZZINI, C. T. 1976. Contribuição ao conhecimento das floras nordestinas. Rodriguésia 28(41): 137–193.

SALVADOR, G. S., E. P. SANTOS, AND A. C. CERVI. 2006. A new species of *Ouratea* Aubl. (Ochnaceae) from South America. Fontqueria 55: 293–296.

SASTRE, C. 1981. Ochnacées nouvelles du Brésil. Bulletin du Jardin Botanique National de Belgique 51: 397–413.

———. 1986a. Dos especies nuevas de *Ouratea* Aublet (Ochnaceae) de Colombia. Caldasia 15: 187–189.

———. 1987a. ["1986"]. Studies on the flora of the Guianas 23. Cinq espèces nouvelles d'*Ouratea* Aublet (Ochnaceae) des Guyanes. Bulletin du Muséum National d´Histoire Naturelle, Paris, Sér. 4, sect. B, Adansonia: Botanique, Phytochimie 8: 413–422.

———. 1987b. Studies on the flora of the Guianas 30. Considerations phytogeographiques sur les Ochnacees guyanaises. Compte Rende Sommaire Séances Société de Biogéographie 63 (3): 89–97.

———. 1988a. Sobre tres especies colombianas de *Ouratea* Aublet (Ochnaceae). Mutisia 68: 7–10.

———. 1988b. Species novae generis *Ouratea* Aublet (Ochnaceae). Phytologia 64: 247–248.

———. 1988c. Species novae Venezuelae generis *Ouratea* Aubl. (Ochnaceae). Phytologia 64(5): 365–366.

———. 1988d. Studies on the flora of the Guianas 34. Synopsis generis *Ouratea* Aublet (Ochnaceae). Bulletin du Muséum National d´Histoire Naturelle, sér. 4, sect. B, Adansonia: Botanique, Phytochimie 10: 47–67.

———. 1989. Las especies de *Ouratea* (Ochnaceae) de J. Chaffanjon. Ernstia 56: 23–24.

———. 1991. Duae novae species *Ourateae* (Ochnaceae) in Guianis collectae. Studies on the flora of the Guianas. 59. Candollea 46: 395–398.

———. 1992. Vicariance et distribution géographique de quelques Ochnacées des Guyanes. Compte Rende Sommaire Séances Société de Biogéographie 68: 35–45.

———. 1993. *Ouratea saulensis* (Ochnaceae), a new species from central French Guiana. Brittonia 45: 333–334.

———. 1994a. Paléoclimats, spéciation et taxonomie. Quelques exemples chez les Ochnacées néotropicales. Mémoires de la Société de Biogéographie, sér. 3, 4: 3–10.

———. 1994b. Three new taxa of *Ouratea* (Ochnaceae) from South America. Brittonia 46: 309–313.

———. 1995a. Novelties in the Neotropical genus *Ouratea* (Ochnaceae). Novon 5: 193–200.

———. 1995b. Ocnaceas de las sierras de Chiribiquete y de la Macarena (Colombia). Consideraciones taxonómicas y fitogeográficas. Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales 19(74): 499–507.

———. 1996. Two new species of *Ouratea* Aublet (Ochnaceae) in the "Hylea amazonica peruana". Annalen Naturhistorischen Museums in Wien 98B: 573–575.

———. 2001. New *Ouratea* species (Ochnaceae) from Venezuela and adjacent countries. Novon 11: 105–118.

———. 2003. Ochnaceae. Pages 124–161 in P. E. Berry, K. Yatskievych, and B. K. Holst, eds., *Flora of the Venezuelan Guayana*. Vol. 7. Missouri Botanical Garden, St. Louis.

———. 2004a. Une nouvelle espèce d'*Ouratea* (Ochnaceae) du Venezuela. Adansonia, sér. 3, 26(1): 129–131.

———. 2004b. Ochnaceae. Pages 274–275 in N. P. Smith, S. A. Mori, A. Henderson, D. W. Stevenson, and S. V. Heald, eds., *Flowering Plants of the Neotropics*. New York Botanical Garden and Princeton University Press, Princeton, N.J.

———. 2005. Une nouvelle espèce d'*Ouratea* (Ochnaceae) de l'Amazonie Brésilienne. Adansonia, sér. 3, 27: 85–88.

———. 2006. Deux nouvelles espèces d'*Ouratea* (Ochnaceae) des Guyanes. Adansonia, sér. 3, 28(1): 119–127.

———. 2007a. Ochnaceae. Pages 445–450 in V. Funk, T. Hollowell, P. Berry, C. Kelloff, and S. N. Alexander, eds., *Checklist of the Plants of the Guiana Shield (Venezuela: Amazonas, Bolivar, Delta Amacuro; Guyana, Surinam, French Guiana)*. Contributions from the United States National Herbarium, vol. 55.

———. 2007b. Six nouvelles espèces d'*Ouratea* (Ochnaceae) des Guyanes. Adansonia, sér. 3, 29(1): 77–91.

———. 2008. Ochnaceae. Pages 530–534 in O. Hokche, P. E. Berry, and O. Huber, eds., *Nuevo Catálogo de la Flora Vascular de Venezuela*. Fundación Instituto Botánico de Venezuela Dr. T. Lasser, Caracas, Venezuela.

——— and B. Offroy. 2009. Description de trois nouveaux *Ouratea* L. (Ochnaceae) du Paraguay, de Bolivie et d'Équateur. Considérations taxonomiques, nomenclatures et biogéographiques sur les espèces affines d'*O. superba* Engl. Adansonia, sér. 3, 31(1): 89–101.

———. 2016. Révision nomenclaturale des binômes du genre néotropical *Ouratea* Aublet (Ochnaceae) décrits par Van Tieghem. Adansonia, sér. 3, 38(1): 55–98.

Turland, N. J., J. H. Wiersema, F. R. Barrie, W. Greuter, D. L. Hawksworth, P. S. Herendeen, S. Knapp, W. H. Kusber, D.-Z. Li, K. Marhol, T. W. May, J. McNeill, A. M. Monro, J. Prado, M. J. Price, and G. F. Smith. 2018. *International Code of Nomenclature for: Algae, Fungi and Plants (Shenzhen code)*. Regnum Veg. 159. Koeltz Scientific Books, Königstein.

Ulloa-Ulloa, C., P. Acevedo-Rodríguez, S. G. Beck, M. J. Belgrano, R. Bernal, P. E. Berry, L. Brako, M. Celis, G. Davidse, S. R. Gradstein, O. Hokche, B. León, S. León-Yánez, R. E. Magill, D. A. Neill, M. H. Nee, P. H. Raven, H. Stimmel, M. T. Strong, J. L. Villaseñor Ríos, J. L. Zarucchi, F. O. Zuloaga, and P. M. Jørgensen. 2017. An integrated assessment of vascular plants species of the Americas. Science 358: 1614–1617.

Whitefoord, C. 1992. Eight new species of *Ouratea* (Ochnaceae) from Mesoamerica. Novon 2: 274–281.

———. 2012. Ochnaceae. *Flora Mesoamericana*. Vol. 3 (2): 1–26. Published on the Flora Mesoamericana website, Missouri Botanical Garden, St. Louis.

Yamamoto, K. R. 1989. Morfologia, anatomia e sistemática do gênero *Ouratea* Aubl.: Levantamento preliminar de características de importância taxonômica e avaliação das classificações vigentes. M.Sc. thesis, Programa de Pós Graduação em Biologia Vegetal. Universidade Estadual de Campinas, São Paulo.

———. 1995. *Ouratea hatschbachii* (Ochnaceae) Uma Nova Espécie de Grão-Mogol, Estado de Minas Gerais, Brasil. Boletim de Botânica 14: 34–36.

Yamamoto, K. R., R. G. Chacon, G. Proenca, C. Cavalcanti, and T. B. Graciano-Ribeiro. 2008. A distinctive new species of *Ouratea* (Ochnaceae) from the Jalapão Region, Tocantins, Brazil. Novon 18: 397–404.

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*ICONES STELIDARUM (*ORCHIDACEAE*) COLOMBIAE* VI[1]

CARLYLE A. LUER[2]

Abstract. Thirty-eight species of the genus *Stelis* (Orchidaceae) from Colombia, or species that can be expected to be found in Colombia, are described, three as new species (*S. dapidis*, *S. nostalgia*, and *S. peregrina*). Thirty-two species are illustrated, thirteen multiple times. Already existing illustrations are cited for six species. A lectotype is selected for *Pleurothallis pristis* and a neotype for *S. guatemalensis*.

Keywords: Colombia, Orchidaceae, Pleurothallidinae, *Stelis*

The following descriptions or illustrations are of known species of *Stelis* Sw. (Orchidaceae) attributed to Colombia that have not been illustrated specifically for this country but that otherwise can be expected to occur in Colombia. Included are those that have been published without an adequate illustration or that are now known to occur with multiple variations.

A large number of collections described by Rudolf Schlechter and Oscar Duque remain obscure. *Stelis paraguasensis* Luer is a frequent and variable taxon that may have a previous, unrecognized description.

Classifying the various types of lip is futile; far too many combinations of the variations of morphological features exist. In all species, the lip is more or less thicker in the basal half, the hypochile, and more or less concave in the forward half, the epichile. The thickened hypochile may be limited to a small callus at the base of a thin lip as in *Stelis tenuilabris* Lindl. The forward margin of the hypochile is commonly distinct and called the "bar" in the descriptions, below which the epichile is usually concave. Rarely, the bar extends beyond the edges to create lateral lobes as in *S. brevilabris* Lindl. The middle of the bar is often traversed by a "glenion," the central region that varies from a shallow depression to a deep cavity as in *S. triplicata* Lindl. The glenion may be absent, as in *S. eublepharis* Rchb.f., or it may extend into the dorsum as a cleft. The dorsum is often more or less callous. The bar in lips previously referred to as Type C, as in *S. argentata* Lindl., is convex as it extends forward from the base to near a thin apical margin. The bar is occasionally modified into a single, central callus as in *S. major* Rchb.f. The apical margin varies from thin to thick, entire to dentate, truncate to acute, acuminate, or abruptly apicululate as in *S. pardipes* Rchb.f.

Stelis allenii L. O.Williams, Ann. Missouri Bot. Gard. 29: 338. 1942. TYPE: PANAMA. Coclé: *P. Allen 2952* (Holotype: MO; Isotypes: AMES, K). Illustrated in Luer (2009a: 81, fig. 309).

Plant very large, epiphytic, caespitose; roots slender. Ramicauls erect, stout, 5–17 cm long, enclosed by a loose, tubular sheath near the middle and 2–3 other sheaths at the base. *Leaf* erect, thickly coriaceous, elliptical, subacute to obtuse, 7–22 cm long, 3–7 cm wide, cuneate below into a subsessile subpetiolate base. *Inflorescence* an erect, congested, distichous, many-flowered raceme with many flowers open simultaneously, 15–40 cm long including the peduncle 8–12 cm long, subtended by a spathe 1–2.5 cm long, from a node below the apex of the ramicaul; floral bracts cordate, inflated, acute, 17 mm long below to 5 mm long near the tip; pedicels 4–8 mm long; ovary 2–5 mm long; *sepals* glabrous, green suffused with purple to red-purple, the dorsal sepal erect, ovate, acute, 5–22 mm long, 5–9 mm wide, 5- to 11-veined, connate basally to the synsepal, the lateral sepals connate into a broadly ovate, shallowly concave synsepal, 5–16 mm long, 6–14 mm wide, 8- to 19-veined; *petals* purple, transversely cordate-ovate, 0.75–1 mm long, 1.5–2.5 mm wide, the apex rounded, broadly thickened, the base narrowly concave below a transverse carina; *lip* purple, transversely subquadrate, 1 mm long, 2 mm wide, 1.25 mm deep, the apex thick, broadly rounded with a thick, well-demarcated margin, concave below the bar with a large glenion, the dorsum with a low, obscurely 3-lobed callous, the base truncate, hinged to the base of the column; *column* stout, 1 mm long, 2 mm wide, the anther and the bilobed stigma apical.

Eponymy: named for Paul Hamilton Allen of the Missouri Botanical Garden, who first collected this species in Panama.

Stelis allenii occurs frequently in Panama and western Ecuador, but it has not yet been identified in Colombia. It is a robust, caespitose species with stout ramicauls clad in a large, loose sheath. The leaf is large and leathery with the base subsessile or shortly petiolate. The inflorescence is a tall, erect, congested raceme with large, prominent, purple, floral bracts. The size of the deep purple flowers varies on the same raceme from huge below to smaller above. The multi-veined dorsal sepal is triangular and acute, sometimes exceeding 2 cm in length. The synsepal is broad and shallowly concave. The petals are semilunate with a broadly rounded, thick margin. The lip is subquadrate-triangular, shallowly concave with a narrow glenion and with a thick, broadly rounded apex.

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Stelis allenii is similar to *S. maxima* Lindl., with which it has been confused. It might exist in herbaria under that name. *Stelis allenii* differs from the latter by a larger, caespitose, non-prolific habit; broader, subsessile leaves; and larger, inflated floral bracts. The petals and lip are similar, but with details variable.

Stelis aprica Lindl., Comp. Bot. Mag. 2: 353. 1836. TYPE: BRAZIL. Santa Catharina: without any other locality, *C. F. P. Martius s.n.* (Holotype: K). Illustrated in Luer (2009a: 204, fig. 352).

Synonyms: *Stelis minutiflora* Rchb.f. ex Hoffmanns., Linnaea 16: 237. 1842. TYPE: BRAZIL. Rio de Janeiro: without collector (Holotype: W). Etymology: from the Latin *minutiflorus*, "minutely flowered," referring to the inflorescence.

Stelis crassifolia Lindl., Edwards's Bot. Reg. 28: misc. 9. 1842. TYPE: "Imported from the West Indies in Aug 1841 by Sir C. Lemon" (Holotype: not preserved). Etymology: from the Latin *crassifolius*, "thick leaved," referring to the leaves.

Stelis miersii Lindl., Ann. Mag. Nat. Hist. 14: 397. 1843. TYPE: BRAZIL. Without locality, *J. Miers s.n.* (Holotype: K) Etymology: named for John Miers who collected this species.

Stelis microglossa Rchb.f. Linnaea 22: 821. 1849. TYPE: BRAZIL. Minas Gerais: Caldas, *A. F. Regnell ser. I, 423* (Holotype: W). Etymology: from the Greek *mikroglossa*, "a minute tongue," referring to the labellum.

Stelis micrantha Barb.Rodr., Gen. Sp. Orch. Nov. 2: 93. 1881, not Sw., 1799. TYPE: BRAZIL. Rio de Janeiro: "croissant sur les arbres des forêts de Petropolis à Rio de Janeiro. Fleurit en Mai et Juin." *J. Barbosa Rodrigues s.n.* (Holotype: lost). Etymology: from the Greek *mikrantha*, "a minute flower," referring to the size of the flower.

Stelis rodriguesii Cogn., Fl. Bras. 3(4): 360. 1896, replaced name for *S. micrantha* Barb. Rodr., not Sw. Etymology: named for J. Barbosa Rodrigues who collected the species.

Plant small to medium in size, epiphytic to lithophytic, caespitose-ascending; roots slender. Ramicauls erect, slender, 4–10 cm long, enclosed by 2–3 thin, tubular sheaths at the base. *Leaf* erect, thickly coriaceous, narrowly linear-elliptic, subacute to acute, 7–10 cm long, 0.5–0.8 cm wide, gradually narrowed below into the subpetiolate base. *Inflorescence* an erect, sublax, distichous, many-flowered raceme with many flowers open simultaneously, 8–10 cm long including the peduncle, with a few bracts, subtended by a spathe 0.5–1 cm long, from a node below the apex of the ramicaul; floral bracts thin, tubular, 1.5–2 mm long; pedicels 1 mm long; ovary 0.75–1 mm long; *sepals* yellow-green, glabrous or diffusely cellular, connate basally, broadly ovate, obtuse, the dorsal sepal 1–1.75 mm long, 1–1.5 mm wide, 3-veined, the lateral sepals 1–1.5 mm long, 1.5 mm wide, 3-veined, more or less antrorse; *petals* membranous, transversely elliptical, shallowly concave, 0.5–0.7 mm long, 0.5–0.8 mm wide, 1-veined, the apex broadly rounded, with a narrow margin; *lip* green, subquadrate, 0.6 mm long excluding the apiculum, 0.6 mm wide, 0.4 mm deep, concave below a shallowly cleft bar, the apex with an acute, triangular apiculum 0.3 mm long, the dorsum with a flat callus extending to the base from between the halves of the bar, microscopically pubescent toward the base, the base broadly truncate, hinged to the column; *column* stout, 0.6 mm long, 0.6 mm wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *apricus*, "growing in sunshine," referring to a habitat.

Additional specimens examined: COLOMBIA. Risaralda: Hda. Los Cristales, near Río Cauca, 1110 m, 11 November 2001, *P. Silverstone-Sopkin 8795* (CUVC), C. Luer illustr. 21256. Valle del Cauca: Zarzal, *P. Silverstone-Sopkin 5675* (CUVC, SEL), C. Luer illustr. 16958.

Additional distribution: Ecuador, Peru, and Bolivia.

Stelis aprica is frequent and widely distributed in southern Brazil. It is unknown from the Andes of Peru, but it is infrequent in Colombia and Ecuador. Collections of other species are often misidentified as *S. aprica*.

Lindley first used the epithet *crassifolia* in the genus *Stelis* in 1842 (see reference above) when he described a plant cultivated by Sir Charles Lemon, an amateur gardener, at Carclew House, Cornwall, England, which was thought to have been imported from the West Indies. No specimen was preserved. In his *Folia Orchidaceae* of *Stelis* in 1859, Lindley described an identical Colombian collection by I. F. Holton, and cultivated by Loddiges, as *S. crassifolia* in his herbarium. With little doubt, it was from the same source.

Stelis aprica is characterized by a small to medium-sized habit with narrowly linear leaves and a many-flowered raceme about as long with tiny flowers. The 3-veined sepals are obtuse and less than 2 mm long. The petals are subcircular and 1-veined. The lip is concave below a bifid bar with a prominent, acute, triangular apiculum, as found in *S. spathulata* Poepp. & Endl.

Stelis argentata Lindl., sensu lato, Bot. Reg. 28: Misc. 64. 1842. TYPE: GUYANA. Without any other locality, *R. H. Schomburgk 427* (Holotype: K). Illustrated in Luer (2009a: 204, fig. 353). Fig. 1; a vegetatively small variation shown in Fig. 2.

Synonyms: *Stelis heylidyana* H. Focke, Tijdschr. Wis-Natuurk. Wetensch. 2: 201. 1849. TYPE: SURINAM. "In arboribus sylvarum Surinamensium passim," *H. Heylidy s.n.* (Holotype: not located). Etymology: named for Henrici Heylidy, the collector.

Stelis leucopogon Rchb.f., Beitr. Orchid.-K. C. Amer. 95: t. 9, 1866. TYPE: COSTA RICA. Desengaño, *H. Wendland s.n.* (Holotype: W). Etymology: from the Greek *leucopogon,* "a white beard," referring to the pubescence.

Stelis endresii Rchb.f., Gard. Chron. 1373. 1870. TYPE: COSTA RICA. Without locality, *ex* A. R. Endres *ex Hort*. Hamburgh Botanical Garden

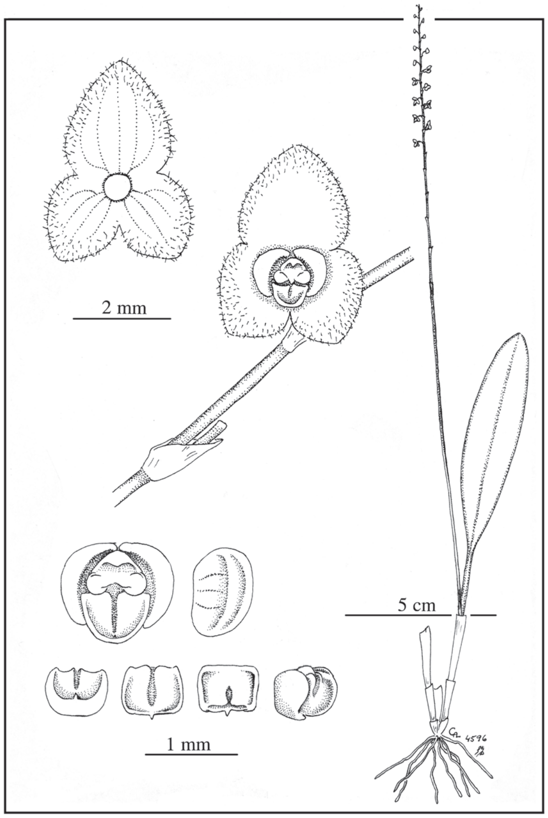

FIGURE 1. *Stelis argentata* Lindl.

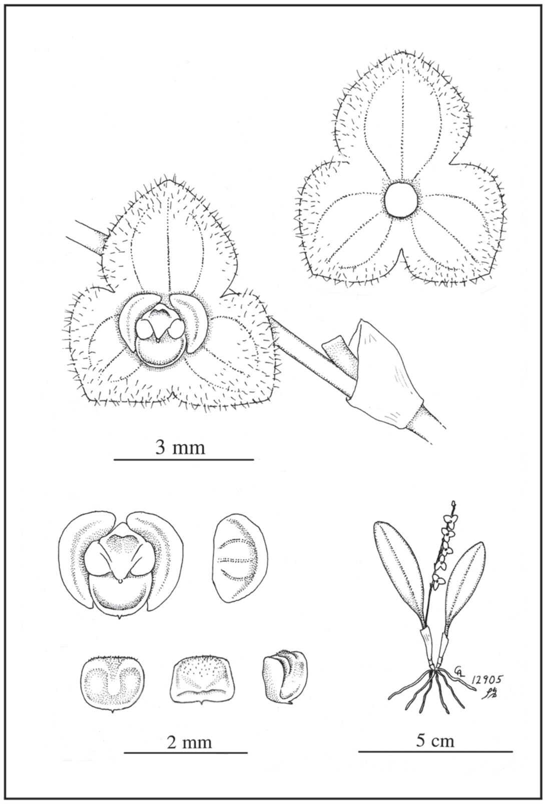

FIGURE 2. *Stelis argentata* Lindl.

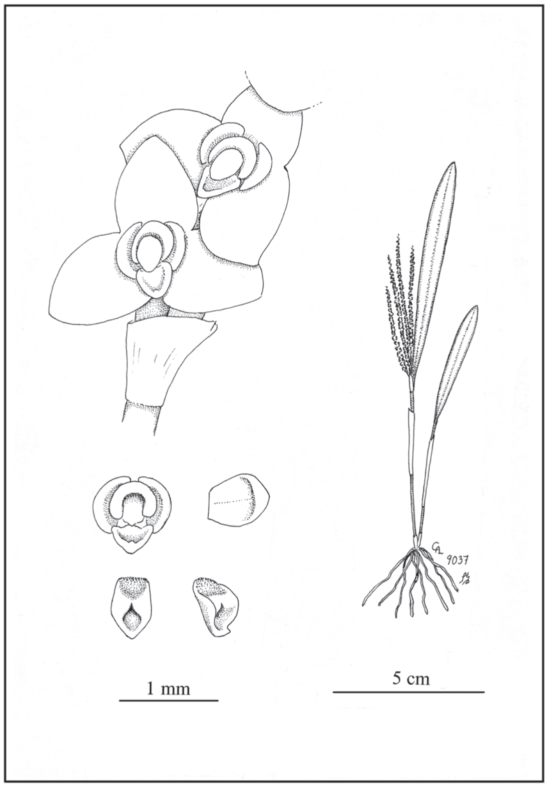

FIGURE 3. *Stelis braccata* Rchb.f. & Warsz.

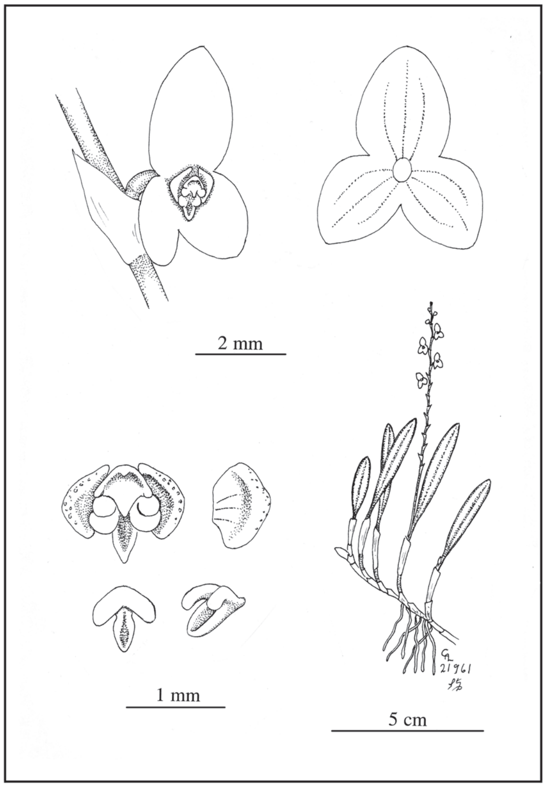

FIGURE 4. *Stelis brevilabris* Lindl.

(Holotype: W). Etymology: named for A. R. Endres who collected this species.

Stelis littoralis Barb. Rodr., Gen. Sp. Orch. Nov. 2: 85. 1882. TYPE: BRAZIL. Minas Gerais: Rio Parahybuna, Juiz de Fora, *J. Barbosa Rodrigues s.n.* (Holotype: lost). Etymology: from the Latin *littoralis*, "coastal," referring to the habitat.

Stelis yauaperyënsis Barb. Rodr., Vellosia ed. 2, 1: 120. 1891. TYPE: BRAZIL. Amazonas: Rio Yauapery, *J. Barbosa Rodrigues s.n.* (Holotype: lost). Etymology: named for Río Yauapery along which the species was collected.

Stelis parvibracteata Ames, Sched. Orchid. 7: 131. 1922. TYPE: PANAMA. Cana and vicinity, *R. S. Williams 972* (Holotype: AMES 10749). Etymology: from the Latin *parvibracteatus*, "with small bracts," referring to the floral bracts.

Stelis glandulosa Ames, Sched. Orchid. 3: 3. 1923. TYPE: COSTA RICA. Without locality, *ex* C. H. Lankester *ex Hort. Kewensis* (Holotype: AMES 22860). Etymology: from the Latin *glandulosus*, "glandular," referring to the pubescent sepals.

Stelis praesecta Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 175. 1923. TYPE: COSTA RICA. San Ramón, 1035 m, *A. M. Brenes 189* (Holotype: destroyed at B). Etymology: from the Latin *praesectus*, "cut off," referring to the apex of the lip.

Stelis violascens Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 176. 1923. TYPE: COSTA RICA. San Pedro de San Ramón, 1200 m, *A. M. Brenes 72* (Holotype: destroyed at B). Etymology: from the Latin *violascens*, "becoming violet," referring to the color of the flowers.

Stelis huebneri Schltr., Beih. Bot. Zentralbl. 42(2): 88. 1925. TYPE: BRAZIL. Amazonas, Taracua, *G. Hübner 173* (Holotype: destroyed at B). Etymology: named for George Hübner who collected this species.

Plant small to large, epiphytic, caespitose to ascending; roots slender. Ramicauls erect, stout, 1.5–6 cm long, enclosed by a tubular sheath near the middle and 2–3 others at the base. *Leaf* erect, coriaceous, elliptical, acute, subacute to obtuse, 2–11 cm long including the petiole 1–3 cm long, 1–3 cm wide, cuneate below into the petiole. *Inflorescence* an erect, subdense, distichous, subsecund, many-flowered raceme, 3–26 cm long including the peduncle 1–10 cm long, subtended by a spathe ca. 1 cm long, from an annulus below the apex of the ramicaul; floral bracts oblique, acute, 1.5–2.5 mm long; pedicels ca. 1.5 mm long; ovary 1–2.5 mm long; *sepals* yellow to purple, expanded, glabrous externally, shortly pubescent or cellular-glandular within, connate basally, broadly ovate, obtuse, 2–5 mm long, 3–5 mm wide, 3- to 5-veined; *petals* yellow or purple, transversely cuneate-obovate, shallowly concave, 0.5-1 mm long, 1–1.5 mm wide, 3-veined, the apex broadly rounded with the margin thickened; *lip* yellow or purple, thick, transversely subquadrate, 0.6 mm long, 0.8–1 mm wide, 0.4 mm deep, shallowly concave below a broad, convex bar with a narrow glenion, the apical margin, thin, with a minute apiculum, the base broadly truncate, hinged to the base of the column; *column* stout, ca. 0.5 mm long, 1 mm wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *argentatus*, "silvered," referring to the crystals in the floral parts.

Additional specimen examined: COLOMBIA. Cauca: La Cajamaria, 1600 m, 11 November 1883, *F.C. Lehmann 3346* (AMES). Antioquia: without data, flowered in cultivation at La Ceja by M. & O. Robledo, 9 Apr. 1988, *C. Luer 13097* (MO). Chocó: Baudo, 400 m, collected and cultivated by A. de Wilde 3876, 15 May 1993, *C. Luer 16850* (MO). Nariño: above Ricaurte, 1600 m, 3 November 1979, *C. Luer, J. Luer & A. Hirtz 4596* (SEL).

Additional distribution: Suriname, French Guyana, Brazil, Venezuela, Panama, Costa Rica, Nicaragua, Guatemala, Mexico, Peru.

This species complex is frequent and variable in its wide distribution through Central America and the Andes. It is allied to *Stelis superbiens* Lindl., differing mostly in a smaller size with more or less variously pubescent sepals. The habit of *S. argentata* sensu lato varies from small to large with an erect, congested inflorescence of widely spread flowers. The color varies from yellow through all shades of purple. The sepals are broadly ovate and either 3-veined or 5-veined. The 3-veined petals are not remarkably different from those commonly seen in the genus.

The lip of all of the species treated in synonymy is basically similar. Instead of a transverse bar that more or less divides the lip into a thick hypochile and a concave epichile, a broadly convex bar extends forward from the base nearly to the broadly rounded or subtruncate apex. A superficial, narrow glenion is commonly present. The apical margin is thin with an apex variable as seen in *S. superbiens* Lindl.

Stelis braccata Rchb.f. & Warsz., Bonplandia 2: 114. 1854. TYPE: COLOMBIA [as New Grenada]. Without locality, *J. von R. Warszewicz s.n.* (Holotype: W; Isotype: AMES). Luer (2009a: illustr. 6176, 205, fig. 355). Fig. 3.

Synonyms: *Stelis minimiflora* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 27: 31. 1924. TYPE: COLOMBIA. Nariño: Volcán Galeras, near Pasto, March 1922, 3500 m, *W. Hopp 171* (Holotype: destroyed at B). Etymology: from the Latin *minimiflorus*, "minute-flowered," referring to the small size of the flowers.

Stelis bracteata Schltr., Repert. Spec. Nov. Regni. Veg. Beih., 27: 26. 1924. TYPE: COLOMBIA. Nariño: between Pasto and Mocoa, 3300 m, May 1921, *W. Hopp 68* (Holotype: destroyed at B), *non Stelis bracteata* Schltr., 1923.

Stelis bractescens Garay, Bot. Mus. Leafl. Harvard Univ., 27: 185. 1979, replaced name for *S. bracteata* Schltr., 1924. Etymology: from the Latin *bracteata*, *bractescens*, referring to the prominent floral bracts.

Apatostelis braccata (Rchb.f & Warsz.) Garay, Bot. Mus. Leafl. 27: 187. 1979.

Apatostelis minimiflora (Schltr.) Garay, Bot. Mus. Leafl. 27: 189. 1979.

Plant small to medium in size, epiphytic, densely caespitose; roots slender, numerous. Ramicauls fascicled, erect, slender, 2–7 cm long, enclosed by a loose, tubular sheath near the middle and 2 sheaths about the base. *Leaf* erect, coriaceous, narrowly elliptical, acute to subacute, 3–7 cm long including an ill-defined petiole ca. 1 cm long, 0.5–0.8 cm wide, narrowly cuneate below into the petiole. *Inflorescence* 1 or 4, 4–5 cm long, racemes erect, congested, distichous, simultaneously several- to many-flowered, the peduncle ca. 2 cm long, from a spathe 5–6 mm long at a node below the apex of the ramicaul; floral bracts oblique, acute, 0.5–1 mm long; pedicels 0.5 mm long; ovary ca. 1 mm long; *sepals* expanded, more or less recurved, yellow, glabrous, broadly ovate, obtuse, connate basally to form a cup to accommodate the central apparatus, the dorsal sepal 1–1.2 mm long, 1 mm wide, 3-veined, the lateral sepals 1 mm long, 0.8 mm wide, 3-veined, occasionally minutely apiculate; *petals* yellow, thin, cuneate, with the apex broadly truncate, slightly thickened on the edge, 0.4–0.5 mm long, 0.5–0.6 mm wide, 1-veined; *lip* yellow, thick, oblong, obtuse, 0.5–0.6 mm long, 0.3 mm wide, 0.2 mm deep, concave below a thick curved bar, cellular-pubescent above the base, the base broadly truncate, hinged to the base of the column; *column* stout, ca. 0.5 mm long and wide, the anther and the stigma apical, the stigma narrowly transverse, or within the sides of the column, the foot obsolescent.

Etymology: from the Latin *braccatus*, "wearing trousers," could be referring to the cauline sheaths.

Additional specimens examined: COLOMBIA. Antioquia: El Retiro, flowered in cultivation by Padre Sergio, 20 November 1981, *C. Luer 6717* (SEL); Frontino, El Plateado, 2060 m, 5 May 1983, *C. Luer, J. Luer & R. Escobar 9037* (SEL); without collection data, flowered in cultivation in Brussels, 8 November 1912 (BR). Cundinamarca: near San Clemente, 2100 m, 20 April 1982, *C. Luer J. Luer & R. Escobar 7518* (SEL). Huila: Hacienda Meerenberg, 2300 mm, 18 November 1982, *C. Luer & R. Escobar 8484* (SEL).

Additional distribution: Venezuela, Ecuador.

Stelis braccata, widely distributed from coastal Venezuela into Ecuador, is distinguished by slender, densely fascicled ramicauls that are about as long as narrow leaves, and 2–5 slender, congested, several- to many-flowered racemes that vary in length. The sepals are glabrous, minute and broadly ovate, and the petals are 1-veined. The minute lip is about 0.5 mm long with a variable bar and apex.

Stelis brevilabris Lindl., Ann. Mag. Nat. Hist. 15, No. 96: 107. 1845. TYPE: COLOMBIA. Cauca: Páramo de Guanacas, 3300 m [10,000 ft], 1843, *T. Hartweg 1411* (Holotype: K; Isotypes: BR, F, G, LD, LE, W). Illustrated in Luer (2002: 85, fig. 99, as *Stelis serpens* Luer & Hirtz). Fig. 4.

Synonym: *Stelis serpens* Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot Gard. 88: 82, 2002. TYPE: ECUADOR. Loja: army road to TV tower east of Yangana, 2750 m, 22 November 1985, *C. Luer, J. Luer, A. Hirtz & W. Flores 10794* (Holotype: MO). Etymology: from the Latin *serpens*, "crawling," referring to the elongated rhizome.

Plant small to medium, epiphytic, repent, to 15 cm long or longer, rhizomes stout, 0.5–2 cm long between ramicauls; roots slender. Ramicauls ascending-erect, stout, 1.5–5 cm long, enclosed by a tubular sheath from below the middle and another 1–2 sheaths below and at the base. *Leaf* erect, coriaceous, elliptical, subacute to acute, 3–7 cm long including a petiole 0.5–1.5 cm long, the blade 0.5–1.2 mm wide, cuneate below into the petiole. *Inflorescence* an erect, congested, simultaneously flowered raceme 4–8 cm long, the peduncle 1–2 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, 3–4 mm long; pedicels 1–2 mm long; ovary 1 mm long; flowers light yellow; *sepals* glabrous to microscopically pubescent within, the dorsal sepal ovate, obtuse, 2.5–3.25 mm long, 1.6–2 mm wide, 3-veined, connate basally to the lateral sepals, the lateral sepals ovate, obtuse, oblique, 2–2.8 mm long, 1.3–2 mm wide, 3-veined; *petals* transversely ovate, broadly obtuse, shallowly concave, 0.6 mm long, 0.8–1 mm wide, 3-veined, thickened at the apex; *lip* 3-lobed, 0.6–0.8 mm long, 0.5–0.6 mm wide across the lateral lobes, the apical lobe ovate, concave, obtuse, the lateral lobes below the middle, obtuse, antrorse, overlapping the base of the midlobe, the base truncate, hinged to an obsolescent column-foot; *column* stout, ca. 0.5 mm long and wide, with the anther and the bilobed stigma apical.

Etymology: from the Latin *brevilabris*, "with short lip," referring to the labellum.

Additional specimens examined: COLOMBIA. Cundinamarca: Páramo de Chipaque 3100–3200 m, 26 September 1941, *R. E. Schultes 1042* (AMES, MO, SEL), C. Luer illustr. 21954; Zipaquirá, La Caldera, 3000 m, 19 June 1942, *G. Huertas G. 10* (AMES). Valle del Cauca: El Cerrito, between Tenerife and Páramo de Azúcar, 3450 m, 2 April 1993, *P. A. Silverstone-Sopkin 6542* (CUVC, MO). Putumayo: Laguna La Cocha, Ciudadela, near Páramo Bordoncillo, 2800–3000 m, 27 May 1940 *R. E. Schultes & M. Villarreal* (AMES); betweem La Cocha and Sibundoy, *L. A. Garay 11* (AMES), C. Luer illustr. 21961.

Stelis brevilabris was collected in the Páramo de Guanacas by T. Hartweg with his collection number 1411. It must have been abundant, because duplicate specimens were distributed among many herbaria. A single specimen of a different species, declared to be "scarce" and with the same collection data, was described by Lindley as *S. parvilabris* (1845: 385). Confusion arose. The single collection, *S. parvilabris*, is small and caespitose with loose racemes not longer than the leaves, while the abundant one, *S. brevilabris*, is larger and repent with racemes much longer than the leaves.

This species, widely distributed from the Eastern Cordillera of Colombia to Ecuador, is characterized by a long-repent habit, elliptical leaves about as long as the ramicauls, and a congested raceme longer than the leaf. The sepals are obtuse and 3-veined; the petals are 3-veined; and the lip is 3-lobed with a pair of obtuse lateral lobes overhanging the base of a concave, ovate, middle lobe. The lateral lobes appear to be modifications of the transverse bar.

A similar 3-lobed lip occurs in *Stelis inversa* Schltr. from Peru, but it differs florally and vegetatively. It is twice the size of collections from Colombia and Ecuador.

Stelis cochlearis Garay, Canad. J. Bot., 34: 352. 1956. TYPE: COLOMBIA. Antioquia: Sonsón, lithophytic, Balkerón de Sonsón, 2700 m, 20 August 1948, *W. Johnson & F. A. Barkley 18C804* (Holotype: US; Isotypes: AMES, MEDEL). Illustrated in Luer (2016a: 82, fig. 40, as *Stelis pinguis* Luer & R.Escobar) and Luer (2016b: 216, fig. 39, as *Stelis prionota* Luer & R.Escobar). Fig. 5.

Synonyms: *Stelis pinguis* Luer & R. Escobar, Harvard Pap. Bot. 21(1): 82, 2016. TYPE: COLOMBIA. Antioquia: road to Boquerón NW of Medellín, 2380 m, 22 April 1983, *C. Luer, J. Luer & R. Escobar 8747* (Holotype: SEL). Etymology: from the Latin *pinguis*, "fat, plump," referring to the leaves.

Stelis prionota Luer & R.Escobar, Harvard Pap. Bot. 21(2): 216. 2016. TYPE: COLOMBIA. Antioquia: Cerro Padre Amaya, 2400 m, coll. by E. Acevedo, flowered in cultivation at Colomborquídeas. 5 May 1993, *C. Luer 16696* (Holotype: MO). Etymology: from the Greek *prionotos*, "jagged like a saw," referring to the floral bracts in the raceme.

Plant medium in size to large, epiphytic, densely caespitose. Ramicauls erect, terete, stout, 3–5 mm thick, 3–9 cm long, with a tubular sheath from below the middle, and 1–2 other sheaths below. *Leaf* erect, thickly coriaceous, linear, subacute to obtuse, sessile, 7–13 cm long, the blade 1.5–1.7 cm wide, 0.3–0.5 cm thick, narrowed below into the ramicaul. *Inflorescence* 1–2 erect; 8–18 cm long, the racemes congested, distichous, many-flowered, large-bracted, with many flowers partially open simultaneously, the peduncle ca. 1 cm long, subtended by a spathe 0.8–1 cm long, from a node at the apex of the ramicaul; floral bracts oblique, conduplicate, acute, 8 mm long low in the raceme to 3 mm long above; pedicels 1.5 mm long; ovary 1 mm long; *sepals* dull rosy brown to yellow-green, thick, rigid, glabrous externally, pubescent within, concave, connate to near the middle, often spreading above, the dorsal sepal obovate, obtuse, 3.5 mm long, 2.5 mm wide, 3-veined, the lateral sepals ovate, oblique, obtuse, 3.25 mm long, 2.5 mm wide, 3-veined; *petals* thin, transversely ovate, broadly obtuse, slightly thickened on the margin, shallowly concave, without a transverse carina, 1.25 mm long, 1.5 mm wide, 3-veined; *lip* subhemispherical, 1.5 mm long, 1.5 mm wide, 1 mm deep, deeply concave below a thin bar with a broad cleft to a rounded callus on the dorsum, the apex obtuse, concave, the base broadly truncate, fixed to the base of the column; *column* stout, ca. 1.5 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: from the Latin *cochlearis*, "curved like a shell, or a spoon," referring to the lip.

Additional specimens examined: COLOMBIA. Tolima: Alto de Pozo, W of Ibagué, 2800 m, 20 April 1982, *C. Luer, J. Luer & R. Escobar 7474* (SEL). Putumayo: Valley of Sibundoy, Sibundoy, 2225–2300 m, 29 May 1946, *R. E. Schultes & M. Villarreal 7685* (AMES, SEL), C. Luer illustr. 21958.

This variable species is remarkable for thick, caespitose ramicauls and narrowly linear, succulent leaves that are surpassed by one or two, many-flowered racemes with large, conspicuous floral bracts, the flowers protruding from the margins. The sepals are fleshy, obtuse, 3-veined and connate to near the middle to form a cup for the central apparatus, and more or less spreading above the middle. The petals are thin and 3-veined. The lip is deeply concave below a thin, broadly cleft bar.

The flowers of the plant described as *Stelis cochlearis* were probably in very poor condition, because the published description and illustration are misleading, which led to its being redescribed more than once.

Stelis concinna Lindl., J. Bot. (Hooker). 1: 11. 1834. TYPE: ECUADOR. Los Ríos: *Col. F. Hall s.n.* (Holotype: K). Illustrated in Luer (2009a: 207, fig. 67ab). Fig. 6.

Synonyms: *Stelis flexuosa* Lindl., Ann. Mag. Nat. Hist. 12: 397. 1843. TYPE: PERU. Without locality, *A. Mathews 1910* (Holotype: K). Etymology: from the Latin *flexuosus*, "flexuous," referring to the zigzag rachis.

Stelis capillipes Rchb.f., Bonplandia 3: 240. 1855. TYPE: ECUADOR. "Valle de Lloa," *W. Jameson 265* (Holotype: W). Etymology: from the Latin *capillipes*, "capillary-footed," referring to the hair-like peduncle and rachis.

Stelis longihirta Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot. Gard. 88: 51, 2002. TYPE: ECUADOR. Morona-Santiago: cloud forest N of the pass N of Gualaquiza, 1700 m, *C. Luer, J. Luer, A. Hirtz, W. Flores & A. Embreee 11878* (Holotype: MO). Etymology: from the Latin *longihirtus*, "long-hairy," referring to the sepals.

Plant small, epiphytic, densely caespitose, roots slender. Ramicauls erect, slender, 5–20 mm long, with a close, tubular sheath above the middle and another sheath below at the base. *Leaf* erect, coriaceous, elliptical to narrowly elliptical, acute, petiolate, 1–5 cm long including a petiole 2–10 mm long, the blade 3–7 mm wide in dry state, cuneate below into the petiole. *Inflorescence* 1–3; 4–30 cm long, the raceme, flexuous, lax, distichous, successively many-flowered, with 2–8 flowers open simultaneously, the peduncle 1–5 cm long, from a node near the apex of the ramicaul; floral bracts oblique, acute, 0.6–1.5 mm long; pedicels 0.6–1.5 mm long; ovary 0.5 mm long; sepals purple with white or rose pubescence, *sepals* expanded, pubescent within, ovate, subacute, 3-veined, connate basally, 1.3–1.5 mm long, 1–1.3 mm wide; *petals* purple, subcircular, concave, thickened on the rounded apex, 0.5 mm long, 0.8 mm wide, 1- to 3-veined; *lip* purple, subquadrate, 0.4–0.5 mm long, 0.4–0.5 mm wide, 0.3–0.5 mm deep, concave below a shallowly sulcate bar, the apex rounded, the dorsum slightly convex, the base truncate, hinged to the base of the column; *column* clavate, ca. 0.5 mm wide and long, the anther and the bilobed stigma apical.

Etymology: from the Latin *concinnus*, "neat, elegant," referring to the plant.

Additional specimens examined: COLOMBIA. Antioquia: Urrao, Pabón, collected by M. Zapata, flowered

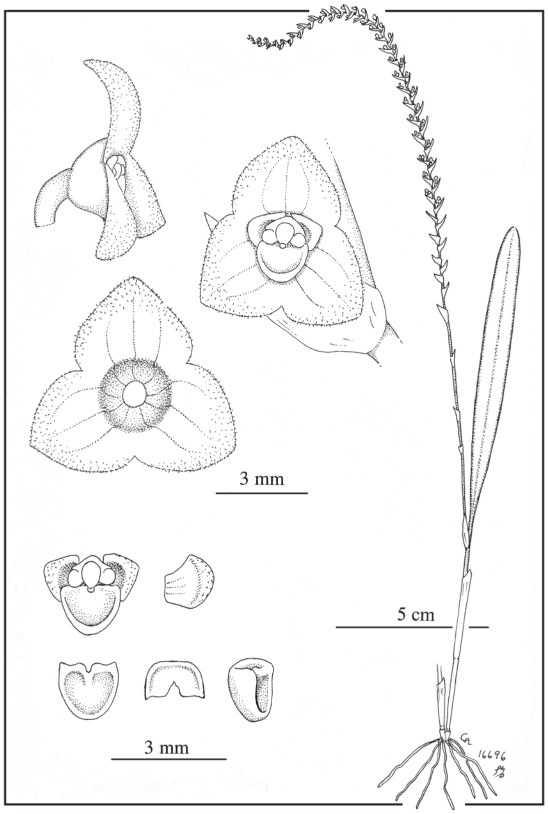

FIGURE 5. *Stelis cochlearis* Garay

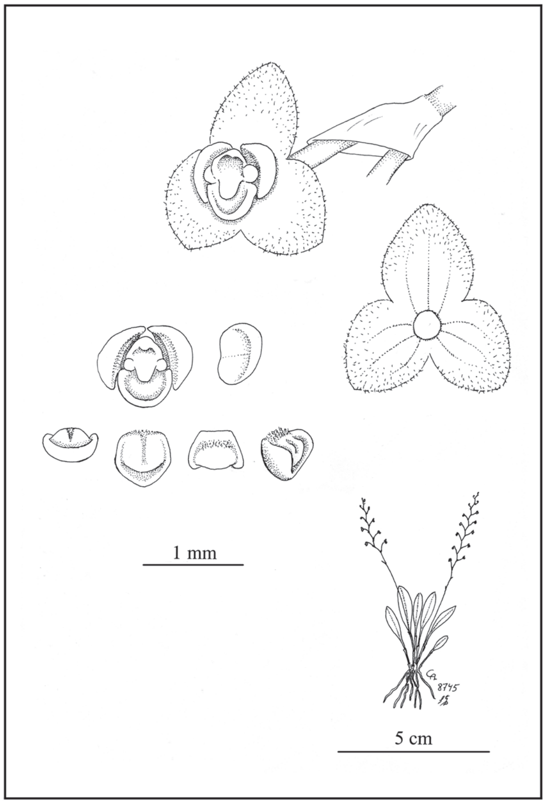

FIGURE 6. *Stelis concinna* Lindl.

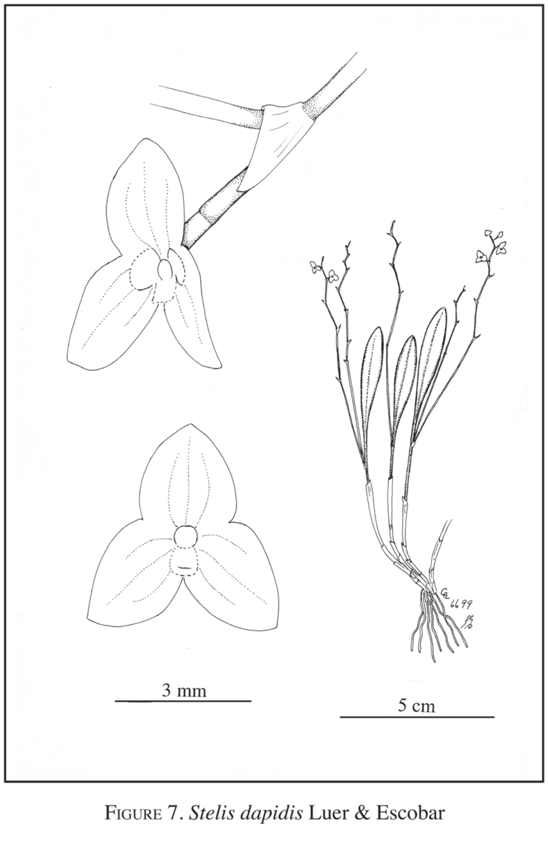

FIGURE 7. *Stelis dapidis* Luer & Escobar

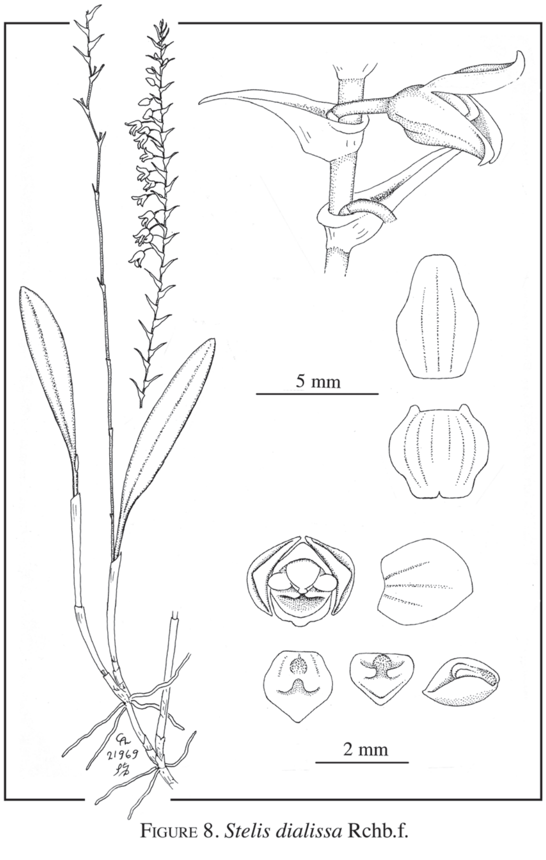

FIGURE 8. *Stelis dialissa* Rchb.f.

in cultivation at Colomborquídeas, 23 May 1995, *C. Luer 17593* MO; Sonsón, Quebrada Oscura, between La Ceja and Sonsón, 2250 m, 29 April 1983, *C. Luer, J. Luer & R. Escobar 8906* (SEL); Frontino, above Nutibara, Alto de Cuevas, 2050 m, 4 May 1983, *C. Luer, J. Luer & R. Escobar 9000* (SEL); Cocorná, El Viaha, along Río Cocorná, 1900 m, 24 April 1983 m, *C. Luer, J. Luer & R. Escobar 8818* (SEL); NE of Santa Rosa, above the Miraflores Dam, 13 May 1985, 2050 m. *C. Luer & R. Escobar 11375* (MO); near Medellín, collected by Ernst Zeller, 1980, flowered in cultivation near Ulm, Germany, 20 September 1981, *C. Luer 6505* (SEL). Norte de Santander: Páramo de Jurisdicciones, 2600 m, 10 May 1982, *C. Luer, J. Luer & R. Escobar 10218* (MO); Páramo de Jurisdicciones, 2600 m, coll. May 1982, flowered in cultivation at Colomborquídeas, 21 Apr. 1983, *C. Luer 8745* (SEL); Páramo de Jurisdicciones, 2570 m, 30 April 1982, *C. Luer, J. Luer & R. Escobar 7653* (SEL); Páramo de Jurisdicciones, 2670 m, 10 November 1981, *C. Luer, J. Luer & R. Escobar 6641* (SEL); Alto de Santa Inez, 2150 m, 13 May 1984, *C. Luer, J. Luer & R. Escobar 10353, 10354* (MO); at the pass N of Villacaro, 2850 m, collected 11 May 1984 by C. Luer, R. Escobar & D. Portillo, flowered in cultivation at Colomborquídeas, 11 May 1985, *C. Luer 11327* (MO). Nariño: above Ricaurte, 1859 m, 2 November 1979, *C. Luer, J. Luer & A. Hirtz 4548* (SEL). Putumayo: Laguna La Cocha, road to Sibundoy, near Páramo de Bordoncillo, 2800–3000 m, 27 May 1946, *R. E. Schultes & M. Villaarreal 7593* (AMES, SEL). C. Luer illustr. 21956. Cundinamarca: Las Gaques, Páramo de Guasca, 3250 m, 12 March 1939, *E.P. Killip 34080* (AMES, CO).

Additional distribution: Venezuela, Ecuador, Peru, Bolivia.

Stelis concinna is variable and relatively frequent in the Andes from Venezuela to Bolivia. Lindley first described it as *S. concinna* from a fragment collected by Hall, who was known to have collected around Quito. Reichenbach described *S. capillipes* from a collection near Quito by Jameson. It was identified by Lindley as the same as his *S. flexuosa*, which he had described from a Peruvian collection by Andrew Mathews. Lindley had both Mathews's collections and the Ecudorian collection by Jameson mounted on the same sheet.

One to three delicate, hair-like, flexible, flexuous racemes of tiny flowers are produced slowly and successively in many-flowered racemes with several flowers open simultaneously toward the tip. Great lengths accumulate in long-cultivated plants. The sepals are ovate, 3-veined, and purple with a variable white pubescence that is sometimes long-pubescent at the apex. The petals are subcircular, thin and 1-veined. The bar of the lip is variable, especially in the Eastern Cordillera of Colombia, where the usually entire callus is sometimes depressed centrally to resemble a horseshoe-shaped callus.

Stelis dapidis Luer & R. Escobar, *sp. nov.* TYPE: COLOMBIA. Norte de Santander: between Cucutilla and Pamplona, 2800 m, 13 November 1981, *C. Luer, J. Luer & R. Escobar 6699* (Holotype: SEL). Fig. 7.

This small species with densely fascicled ramicauls is unique with small, long-pedicellate flowers produced in flexuous, exceedingly lax, several-flowered inflorescences.

Plant small, epiphytic, ascending, roots slender. Ramicaul slender, densely fascicled, 3–4 cm long, with a close, tubular sheath from below the middle and another 1–2 sheaths below and about the base. *Leaf* erect, coriaceous, elliptical, acute, 4–5.5 cm long including a petiole ca. 1.5 cm long, the blade 0.5–0.7 cm wide in the dry state, acuminate below into the petiole. *Inflorescence* 1–2; 5–8 cm long, the raceme erect, flexuous, distantly few-flowered, 1–1.5 long cm between flowers, but 0.5 cm long near the tip, the peduncle ca. 3 cm long, from near the apex of the ramicaul; floral bracts oblique, acute, 1.5–2 mm long; pedicels 2.5–3 mm long; ovary 1 mm long; *sepals* light rose, expanded, similar, glabrous, ovate to subacute, 2.5 mm long, 2 mm wide, 3-veined, connate below the middle; *petals* white, 3-veined at the base; *lip* missing, but had been attached to a 3-veined column-foot, noted to have been white; *column* missing.

Etymology: from the Latin *dapis, dapidis*, "of a feast, or banquet" referring to the petals and lip that have been devoured by an uninvited guest.

The distinctive inflorescence of this small species is like no other known today. One or two weak, flexuous, distantly and successively flowered racemes of 5 or 6 small, long-pedicellate flowers are produced. Unfortunately, most of the petals, and all of the lip and column, except for a 3-veined column-foot, appear to have been eaten by a selective intruder. In spite of the missing information, this species from a remote locality is being given a specific name, for another collection that will be recognized in the future.

Stelis dialissa Rchb.f., Bonplandia 3: 71. 1855. TYPE: COLOMBIA. Cauca: Páramo de Guanacas above Popayán, 10,500 ft, *T. Hartweg 1413* (Holotype: W; Isotypes: BM, BR, G, K, LD, LE). Illustrated in Luer (2009a: 83, fig. 314). Fig. 8.

Synonyms: *Dialissa pulchella* Lindl., Ann. Mag. Nat. Hist. 15: 107. 1845, not *Stelis pulchella* Kunth. TYPE: COLOMBIA. Cauca: Páramo de Guanacas above Popayán, 10500 ft, 1843, *T. Hartweg 1413* (Holotype: W; Isotypes: BM, BR, G, K, LD, LE). Etymology: from the Latin *pulchellus*, "beautiful," referring to the plant.

Pleurothallis pristis F. Lehm. & Kraenzl., Bot. Jahrb. Syst. 26: 443. 1899. TYPE: COLOMBIA. Cauca: Páramo de Guanacas, 2900–3000 m, January 1886, *F. C. Lehmann 6032* (Holotype: destroyed at B; Lectotype here designated: AMES 14772). Etymology: from the Greek *pristis*, "a sawfish," referring to the appearance of the inflorescence.

Plant medium to large in size, epiphytic, scandent, long-repent, the rhizome 2.5–7 cm long between ramicauls, with 2 tubular sheaths; roots slender. Ramicauls ascending, slender, 4–7 cm long, enclosed by 2 loose, tubular sheaths. *Leaf* erect, coriaceous, narrowly elliptical, petiolate, acute, 5–9 cm long including the petiole 0.5–1.5 cm long, 1–2.5 cm wide, narrowly cuneate below into the petiole. *Inflorescence* an erect, subdense, distichous, many-flowered raceme with several to many flowers open simultaneously, 15–35 cm long including the peduncle 8–15 cm long, borne below the apex of the ramicaul; floral bracts acute, acuminate, 5–7 mm long; pedicels 2–2.5 mm long; ovary 3–4 mm long; *sepals* glabrous, variously purple, the dorsal sepal ovate, obtuse, convex, 4.5–5 mm long, 3 mm wide, 3-veined, connate 1.5–2 mm to the synsepal, the lateral sepals connate into a broadly ovate, concave, bifid synsepal, with obtuse, recurved apices, 3.5–4 mm long, 3.5–4 mm wide unexpanded, connate 3 mm, 6-veined; *petals* yellow, edged in purple, broadly obovate, obtuse, 2 mm long, 1.75–2 mm wide, 3-veined, the apex slightly thickened, shallowly concave; *lip* orange, ovate, obtuse, 1.6 mm long, 1.5 mm wide, 1 mm deep, concave below the bar, the bar prominent to either side of a central cleft, the dorsum with a low, rounded, cellular-pubescent callus toward the base, the base truncate, hinged to the tip of a short, thick column-foot; *column* stout, 1 mm long, 1.5 mm wide across the stigmatic lobes, the anther and the bilobed stigma apical.

Etymology: named for the unispecific genus *Dialissa*, from *Dialis*, pertaining to Dis (Dieus, Jupiter).

Additional specimens examined: COLOMBIA. Cauca: Páramo de Guanacas, *H. Karsten s.n.* (W); same area, *F. C. Lehmann s.n.* (W); above Pitayó, 3000 m, 29 October 1882, *F. C. Lehmann* (G); Páramo de Las Papas, laguna de Cusiyaco, 3375 m, 13 October 1958, *H. G. Barclay & P. Juajibioy 6068* (AMES, COL). Tolima: Mariquita, 10,000–11,000 ft, January 1843, *J. Linden 1275* (G, W). Nariño: between Ipiales and La Victoria, 3300 m, 4 November 1979, *C. Luer, J. Luer & A. Hirtz 4638* (SEL). Putumayo: Páramo de San Antonio del Bordoncillo, 3250 m, 4 January 1941, *J. Cuatrecasas* (AMES, COL); Valle de Sibundoy, 2800 m, 30 June 1953, *R. E. Schultes & I. Cabrera 20084* (AMES, COL), C. Luer Illustr. 21969.

Additional distribution: Ecuador.

Lindley described a Colombian collection by Hartweg in 1845 in a unispecific genus as *Dialissa pulchella*. At the same place and time, collections were also made that Lindley described as *Stelis brevilabris* and *S. parvilabris*. Ten years later, Reichenbach.f. transferred *Dialissa pulchella* to *Stelis* as *Stelis dialissa*, the specific epithet *pulchella* having been applied to a different species, *S. pulchella* by Kunth.

This species is one of the few pleurothallids that can be recognized dead or alive. It is a large species with a scandent, prolific habit and acute, petiolate leaves. The distinctive, long, many-flowered racemes with two opposing rows of long, pointed, floral bracts reminded Kränzlin of a sawfish, hence *Pleurothallis pristis* F. Lehm. & Kraenzl.

The unexpanded sepals are obtuse and connate below the middle. The petals are simple, 3-veined and broadly obovate. The lip is concave below a bilobed bar.

Stelis dispar C. Schweinf., Fieldiana 28: 177. 1951. TYPE: VENEZUELA. Mérida: near summit of Cerro San Isidro, above La Carbonera, 2430–2745 m, 22 April 1944, *J. A. Steyermark 56034* (Holotype: AMES; Isotype: F). Illustrated in Luer (2017a: 34, fig. 13). Fig. 9–10.

Synonym: *Stelis dendrophila* Luer & R. Escobar, TYPE: COLOMBIA. Santander: Bucaramanga, between Bucaramanga and Berlin, 2600 m, 28 April 1982, *C. Luer & R. Escobar 7619* (Holotype: SEL).

Plant medium in size, epiphytic, shortly repent with caespitose components, the rhizome slender, 0–10 mm between ramicauls; roots slender. Ramicauls erect, slender, 5–10 cm long, enclosed by a close, tubular sheath from below the middle and another 1–2 sheaths below and at the base. *Leaf* erect, coriaceous, elliptical, acute, 5–9 cm long, including a petiole 1–2 cm long, the blade 0.5–1.8 cm wide in the dry state, cuneate below into the petiole. *Inflorescence* 1–3; 5–12 cm long, the racemes erect, strict, distichous; floral bracts oblique, subacute, 2–3 mm long, 2 mm wide; pedicels 1.5 mm long; ovary 1 mm long; the peduncle 1–2 cm long, from a node below the apex of the ramicaul, with a spathe 5–8 mm long; *sepals* purple to green suffused with purple, glabrous, broadly ovate, obtuse, 3-veined, the dorsal sepal 2.5–3.5 mm long, 2.75–3.5 mm wide, the lateral sepals oblique, 2–2.5 mm long, 2.5–3 mm wide; *petals* transversely semilunate, 0.6 mm long, 1 mm wide, concave below the thick margin of the rounded apex, and concave below a thick transverse carina, 3-veined; *lip* subquadrate, 0.6–1 long, 0.6 mm wide, 0.5–0.6 mm deep, concave below a thick bar with a slightly notched bar, the apex rounded, the dorsum slightly convex, the base truncate, attached to the base of the column; *column* stout, ca. 1 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: from the Latin *dispar*, "unequal," referring to the sizes of the dorsal and lateral sepals.

Additional specimens examined: COLOMBIA. Norte de Santander: Alto de Santa Inéz, 2100 m, 13 May 1984, *C. Luer, J. Luer & R. Escobar 10305, 10306* (SEL).

This variable, medium-sized species is characterized by either a caespitose habit with fasciculated ramicauls, or a repent habit with ramicauls borne along a slender rhizome with only occasionally caespitose components. One or two racemes of medium-sized flowers surpass the tips of the leaves. The sepals are obtuse and 3-veined, the dorsal sepal being larger than the lateral sepals; the petals are thick and 3-veined; and the lip is concave below the bar.

Stelis eublepharis Rchb.f., Bonplandia 3: 240. 1855. TYPE: ECUADOR. Pichincha: Pululagua, *W. Jameson 264* (Holotype: K; Isotypes: AMES, BR, G, LE, W). Illustrated in Luer (2009a: 209, fig. 368). Fig. 11–12.

Synonym: *Stelis brueckmuelleri* Rchb.f. ex Hook.f., Bot. Mag. t. 6521. 1880. TYPE: COLOMBIA. Without collection data, *ex Hort*. J. Veitch & Sons (Holotype: K). Etymology: named in honor of a Herr Brückmüller, possibly a gardener who cultivated this species.

Plant small to medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 3–6 cm long, enclosed by a tubular sheath from below the middle, another sheath below the middle and another at the base. *Leaf* erect, coriaceous, narrowly elliptical-obovate, subacute to acute, petiolate, 6–10 cm long including the petiole 1.5–2.5 cm long, 0.9–2 cm wide, cuneate below into the petiole. *Inflorescence* single;

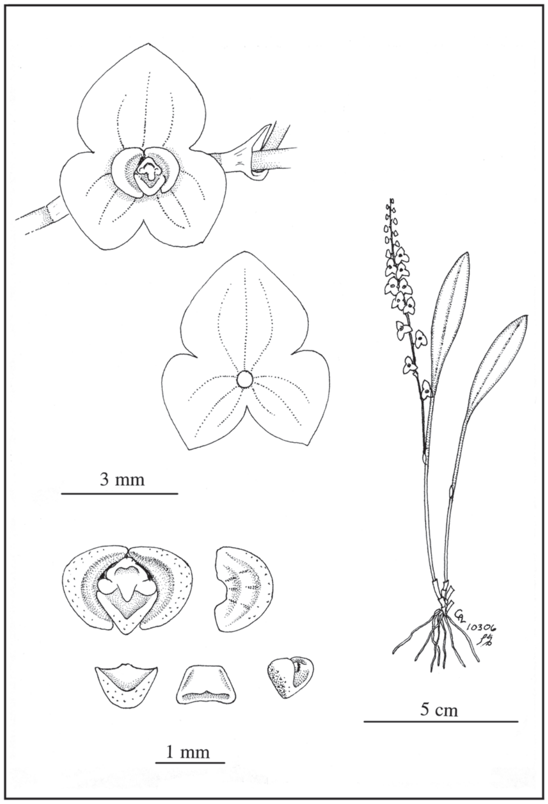

FIGURE 9. *Stelis dispar* Rchb.f.

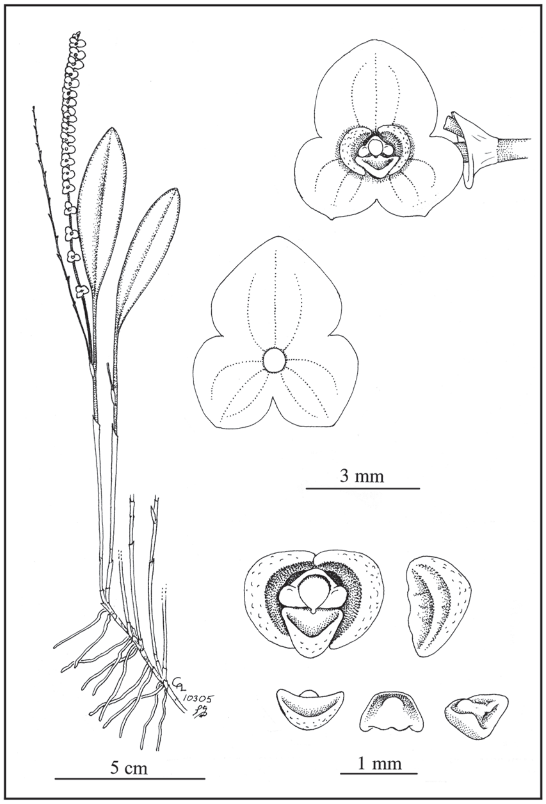

FIGURE 10. *Stelis dispar* Rchb.f.

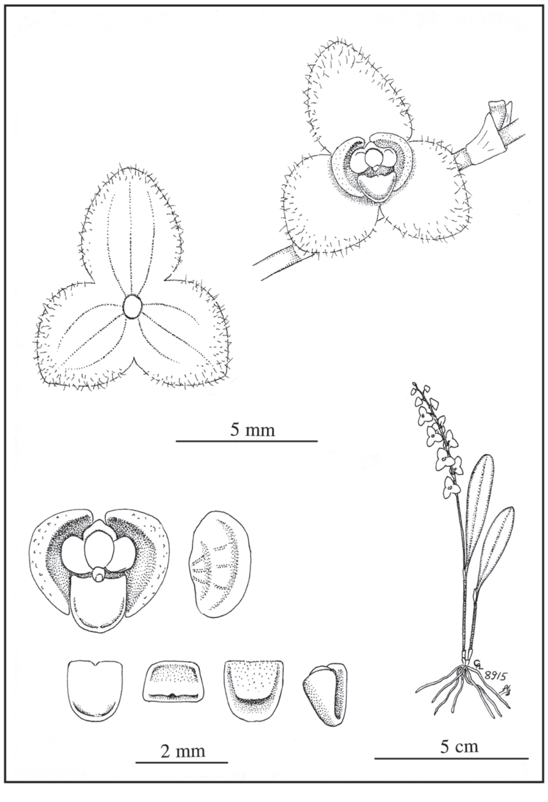

FIGURE 11. *Stelis eublepharis* Rchb.f.

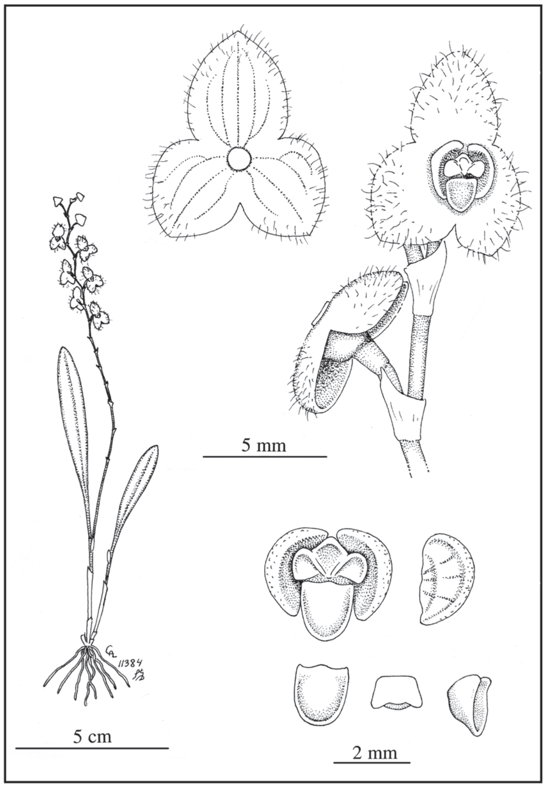

FIGURE 12. *Stelis eublepharis* Rchb.f.

5–13 cm tall, the raceme erect, distichous, subflexuous to strict, loosely several flowered (8–15); floral bracts oblique, acute, 2–4 mm long; pedicels 2–3 mm long; ovary 1.5–2 mm long; the peduncle 2–3 cm long, from a spathe 6–8 mm long at a node below the apex of the ramicaul; *sepals* white to greenish or yellowish white, occasionally suffused with rose, the pubescence white, glabrous externally, expanded, broadly ovate, subacute to obtuse, the dorsal sepal 4–6 mm long, 4–5 mm wide, 3- to 5-veined, the lateral sepals 3–5 mm long, 3–5 mm wide, 3- to 4-veined; *petals* light green, transversely semilunate, 1.5 mm long, 2 mm wide, 3-veined, shallowly concave, with a transverse callus, the apex broadly rounded with the edge thickened; *lip* light green, thickly subdiscoid, 1.2–1.8 mm long, 1.2–1.5 mm wide, 0.6 mm deep, the apex broadly rounded, shallowly concave, the dorsum more or less descending, more or less minutely pubescent, the base truncate, hinged to the base of the column; *column* stout, 1.5–2 mm long and wide, the anther and the stigma and bilobed stigma apical.

Etymology: from the Greek *eublepharis*, "truly eyelashed," referring to the ciliate sepals.

Additional specimens examined: COLOMBIA. Antioquia: Cañasgordas, W of pass, Boquerón de Toyo, 2120 m, 2 May 1983, *C. Luer, J. Luer, R. Escobar et al. 8915* (SEL); Frontino, El Plateado, near the gold mine, 2060 m, 5 May 1983, *C. Luer, J. Luer, R. Escobar et al. 9038* (SEL); Santa Rosa, Yarumalito, 2350 m, 15 May 1985, *C. Luer, J. Luer & R. Escobar 11384* (MO); Cocorná, collected and cultivated by *O. Duque s.n.* (MO), C. Luer illustr. 14327 (MO); Pabón, road to Santa Ana, 2050 m, 31 May 1995, *C. Luer, J. Luer & R. Escobar 17674* (MO); Santa Rosa, Yarumalito, coll. by E. Valencia, flowered in cultivation at Colomborquídeas, 23 May 1995, *C. Luer 17574* (MO); Boquerón de Toyo, flowered in cultivation at Colomborquídeas, 16 May 1993, *C. Luer 16917, 16918* (MO); without data, flowered in cultivation at Colomborquídeas, 16 Apr. 1983, *C. Luer 8717* (SEL). Risaralda: near Pereira, fl. in cult. by S. Tsubota, *C. Luer 16760* (MO). Norte de Santander: Páramo de Jurisdicciones, 2500 m, 10 November 1981, *C. Luer, J. Luer & R. Escobar 6623* (SEL); along river between Abrego and Sardinata, 1730 m, 12 November 1981, *C. Luer, J. Luer & R. Escobar 6679* (SEL); Paramo de Jurisdicciones, 2570 m, 30 April 1982, *C. Luer, J. Luer & R. Escobar 7654* (SEL); below Paramo de Jurisdicciones, 2600 m, 10 May 1984, *C. Luer, J. Luer & R. Escobar 10223* (MO). Santander: Bucaramanga, between Bucaramanga and Berlin, 2800 m, 27 Apr. 1982, *C. Luer, J. Luer & R. Escobar 7576* (SEL); between Bucaramanga and Berlin, 2550 m, 7 May 1984, *C. Luer, J. Luer & R. Escobar 10201* (MO).

Additional distribution: Venezuela, Ecuador.

Stelis eublepharis is the only species of the genus *Stelis* to be honored by a plate in *Curtis's Botanical Magazine*. It was featured with a painting of a plant cultivated at Kew without collection data, and described by Reichenbach as *S. brückmülleri*, which was later reduced to synonymy of the former. The earliest known collection of this species was made by Jameson in Pululagua crater near Quito, Ecuador.

Stelis eublepharis is a variable, frequent and widely distributed species found through the Andes of Venezuela, Colombia, and Ecuador. It is characterized by a several-flowered raceme of light greenish or light purplish flowers usually covered within by a very fine, long, white pubescence, but sometimes the pubescence is short, or sometimes limited to the margins. Both vegetatively and florally, it varies greatly. The dorsal sepal of Ecuadorian collections is 3-veined, while that of most Colombian collections is 5-veined. The bar of the lip of Ecuadorian collections is shallowly notched with a small glenion, and the dorsum is pubescent. The bar of the lip of Colombian collections is frequently smooth without a glenion, and the dorsum is glabrous.

Stelis flacca Rchb.f., Bonplandia 3: 240. 1855. TYPE: ECUADOR. Pichincha: western side of Pichincha, *W. Jameson 735* (Holotype: K; Isotypes: BM, BR, G, LE, W). Illustrated in Luer (2009a: 84, fig. 316). Four variations shown in Fig. 13–16.

Synonym: *Stelis alismifolia* Lindl., Folia Orch. *Stelis* 16(128). 1859. TYPE: ECUADOR. "Forests on the western side of Pichincha," *W. Jameson R.89* (Holotype: K; Isotype: W). Etymology: named for the vegetative similarity to *Alisma plantago* L., a member of the *Alismaceae*.

Plant medium to large, epiphytic, densely caespitose, roots slender. Ramicauls erect, slender, 5–15 cm long, enclosed by a close, tubular sheath near the middle and 2–3 other sheaths below and at the base. *Leaf* erect, coriaceous, elliptical, acute, long-petiolate, 5–12 cm long including the petiole 1.5–2.5 cm long, the blade 0.8–2.5 cm wide, cuneate below into the petiole. *Inflorescence* solitary; 7–18 cm long; the raceme erect, lax to subdensely several- to many-flowered, the peduncle 2–6 cm long, subtended by a spathe 5–8 mm long, from a node below the apex of the ramicaul; floral bracts infundibular, oblique, acute, 2.5–3 mm long; pedicels 1.5 mm long; ovary 1.5–2 mm long; flowers purple; *sepals* glabrous, the dorsal sepal erect, ovate, obtuse, 6–8 mm long, 5–6 mm wide, 5-veined, or 3-veined, connate to the synsepal for 1–2 mm, connate into a broadly ovate, deeply concave synsepal, 6–7 mm long, 6–7 mm wide expanded, 6- to 8-veined; *petals* purple to light yellow, transversely ovate, 0.75–1.5 mm long, 0.8–1.5 mm wide, 3-veined, concave within the broadly rounded apex with a thick margin, with a transverse callus; *lip* purple, thick, subovoid, 0.6–1 mm long, 0.8–1 mm wide, 0.5–0.75 mm deep, the apex obtuse, shallowly concave behind a broad margin, the bar tall, erect, rounded with a shallow glenion, the dorsum descending with a low, central, rounded callus, the base truncate, hinged to the base of the column; *column* stout, 0.8 mm long and wide, the anther and bilobed stigma apical.

Etymology: from the Latin *flaccus*, "limp or withered," for the appearance of the collected plant.

Additional specimens examined: COLOMBIA. Antioquia: Cocorná, quebradas around Río Cocorná, 24 Apr. 1983, *C. Luer, J. Luer & R. Escobar 8803* (SEL); El Retiro, above the Miraflores Dam, NE of Santa Rosa,

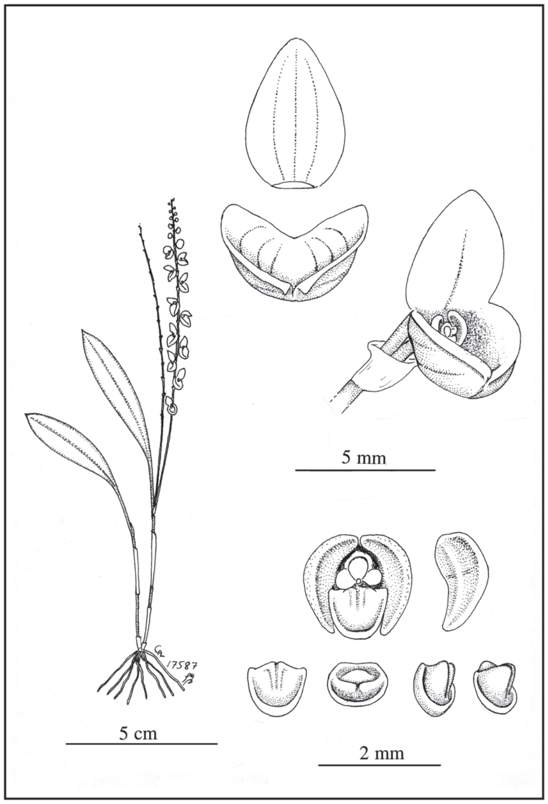

Figure 13. *Stelis flacca* Rchb.f.

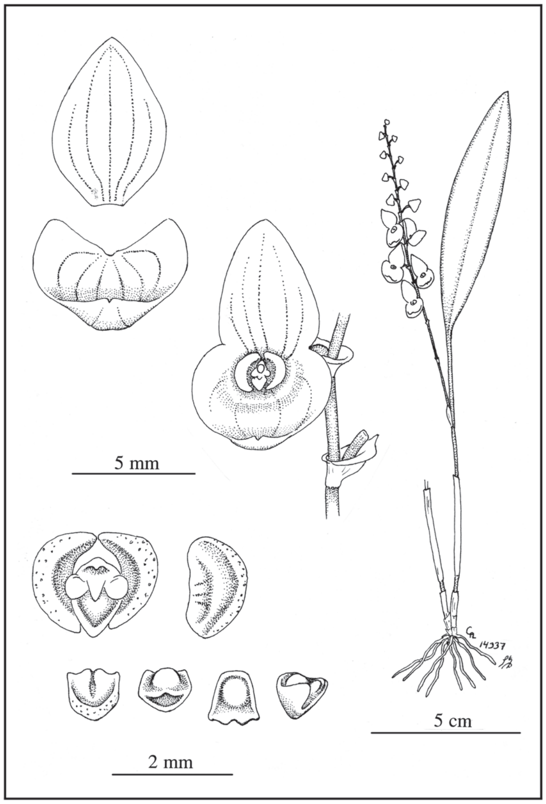

Figure 14. *Stelis flacca* Rchb.f.

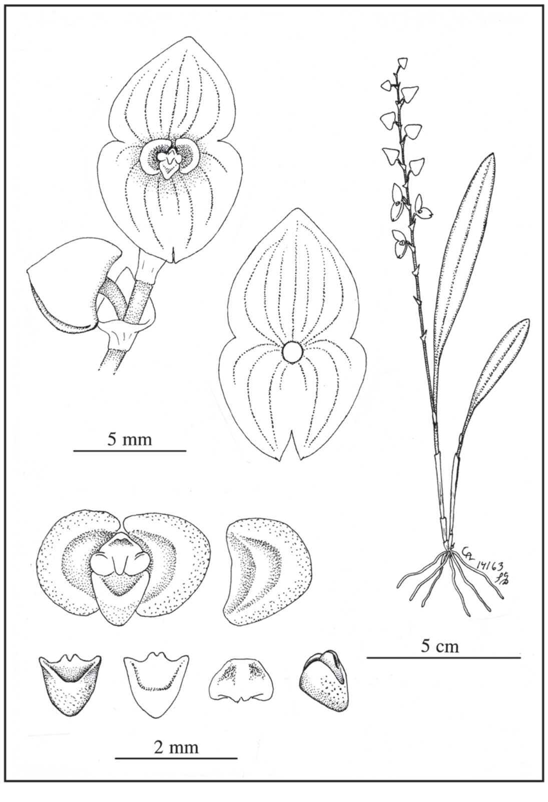

Figure 15. *Stelis flacca* Rchb.f.

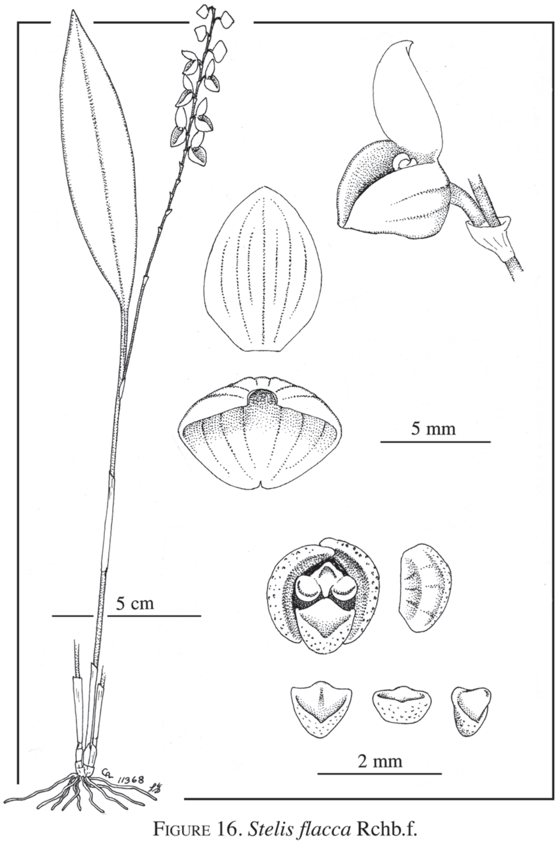

Figure 16. *Stelis flacca* Rchb.f.

2050 m, 15 May 1985, *C. Luer & R. Escobar 11368* (MO); Yarumal, road to El Cedro, 1850 m, 15 March 1989, *C. Luer, J. Luer, S. Dalström & W. Teague 14162, 14163* (MO); El Carmen, above San Lorenzo, 2500 m, *C. Luer, J. Luer & W. Teague 14337* (MO). Valle del Cauca: La Elsa, collected by J. L. Aguirre, flowered in cultivation at Colomborquídeas, 23 May 1995, *C. Luer 17587* (MO); without data, flowered in cultivation at Orquídeas del Valle, *C. Luer 18422* (MO).

This species is variable in its distribution through Ecuador and Colombia. Some Colombian collections are larger with stouter ramicauls and with larger, glabrous sepals with a 5-veined, or incompletely 7-veined dorsal sepal, but smaller collections are slender with a 3-veined dorsal sepal. The petals are similarly thick and 3-veined. The proportions of the lip of Colombian collections varies considerably from the lip of Ecuadorian collections. The bar and dorsal callus are less protruding and the anterior margin is not as broad.

Stelis grandiflora Lindl., Comp. Bot. Mag. 2: 353. 1836. TYPE: BRAZIL. Rio de Janeiro: Macahé, *J.-T. Descourtilz s.n.* (Holotype is Descourtilz's illustration at the Library of the Institut de France in Paris). Illustrated in Luer (2009a: 219, fig. 394, as *S. muscifera* Lindl.; 2009a: 229, fig. 419, as *S. tristyla* Lindl.). Four variations shown in Fig. 17–20.

Synonyms: *Stelis tristyla* Lindl., Bot. Reg. 24: misc. page 42, no. 69. 1838. TYPE: BRAZIL. Without locality, ex Hort. Loddiges Establishment (Holotype: K). Etymology: from the Greek *tristylos*, "three-pillared," referring to the three lobes of the column (two stigmas and the rostellum).

Stelis muscifera Lindl., Fol. Orchid. *Stelis* 2(6). 1859. TYPE: VENEZUELA. Aragua: Colonia Tovar, *A. Fendler 1460* (Holotype: K). Etymology: from the Latin *muscifer*, "fly-bearing," in allusion to the flowers.

Stelis megantha Barb.Rodr., Gen. Sp. Orch. Nov. 2: 83. 1882. TYPE: BRAZIL. Rio de Janeiro: Forests of Rodeio, J. Barbosa Rodrigues s.n. (Holotype: lost). Etymology: from the Greek *meganthos*, "large flower," referring to the flower.

Stelis zonata Rchb.f. Gard. Chron. N. S. 20: 556. 1883. TYPE: GUYANA [as Demerara]. Without locality, *ex Hort*. J. Veitch & Sons (Holotype: W). Etymology: from the Latin *zonatus*, "zoned," referring to the colored zones of the sepals.

Stelis bangii Rolfe, Mem. Torrey Bot. Club 4: 260. 1895. TYPE: BOLIVIA. La Paz: Yugas, M. Bang 458 (Holotype: K; Isotypes: AMES, GH, NY). Etymology: named for Miguel Bang, collector of the species.

Stelis amblyophylla Schltr., Repert. Spec. Nov. Regni Veg. Beih. 6: 33. 1919. TYPE: VENEZUELA. Distrito Federal: Caracas, *K. W. John s.n.* (Holotype: lost at B). Etymology: from the Greek *ambylophyllos*, "blunt-leaved," referring to the leaves.

Stelis trinitatis Ames, Sched. Orch. 2: 15. 1923. TYPE: TRINIDAD. Heights of Aripo, *W. E. Broadway 9886* (Holotype (AMES 22671; Isotypes: AMES, GH). Etymology: named for Trinidad, where the species was collected.

Stelis trinitensis Ames ex Broadway, Orchid Rev. 34: 134. 1926, *sphalm*. Ames.

Stelis macrochlamys Hoehne & Schltr., Album Secc. Bot. Mus. Paulista, S. Paulo 135. 1925, *nomen nudum*; Archiv. Bot. Estad. S. Paulo 1(3): 204. 1926. TYPE: BRAZIL. São Paulo: Matta do Governo, 23 December 1920, *F. C. Hoenhe s.n.* (Holotype: destroyed at B; lectotype selected by Barros, 2004: SP 4607). Etymology: from the Greek *macrochlamys*, "large mantle," referring to the cauline sheaths.

Stelis atrobrunnea Schltr., Repert. Spec. Nov. Regni Veg. 27: 40. 1929. TYPE: BOLIVIA. La Paz: Tipuani, Hacienda Simaco, 1400 m, *O. Buchtien 5068* (Holotype: destroyed at B). Etymology: from the Latin *atrobrunneus*, "dark brown," in allusion to the flowers.

Stelis casanaënsis Schltr., Repert. Spec. Nov. Regni Veg. 27: 40. 1929. TYPE: BOLIVIA. La Paz: Tipuani, Hacienda Simaco, 1400 m, *O. Buchtien 7219* (Holotype: destroyed at B). Etymology: named for Hacienda Casana where the species was collected.

Stelis trianguliflora Schltr., Repert. Spec. Nov. Regni Veg. 27: 48. 1929. TYPE: BOLIVIA. La Paz: Tipuani, Hacienda Simaco, 1400 m, *O. Buchtien 5066* (Holotype: destroyed at B). Etymology: from the Latin *trianguliforus*, referring to the shape of the flowers.

Plant small to large, epiphytic, caespitose; roots slender. Ramicauls erect, stout, 2–10 cm long, enclosed by a loose, tubular sheath from below the middle, and 2 others near and at the base. *Leaf* erect, coriaceous, elliptical, obtuse, 4–15 cm long, 1.5–5 cm wide, cuneate below into a petiole ca. 1 cm long. *Inflorescence* single; to 35 cm long, the raceme erect, congested, distichous, many-flowered, many flowers open simultaneously, floral bracts erect, more or less inflated, oblique, acuminate, more or less imbricating, from 6–12 mm long below to 4–6 mm long above; pedicels 2–7 mm long, within the floral bract; ovary 2–3 mm long; the peduncle 5–10 cm long, with a spathe 1–1.5 mm long, from a node below the apex of the ramicaul; flowers purple to brown; *sepals* glabrous, transversely ovate, obtuse, deeply connate, the dorsal sepal 3–9 mm long, 4–11 mm wide, 5(–7)-veined, sometimes with incomplete, accessory veins, the lateral sepals 2–6 mm long, 3.5–8 mm wide, 5(–7)-veined; *petals* brown to purple, broadly ovate, obtuse, 1–1.5 mm long, 1.5–2.5 mm wide, the margin broad, flat, often with minute crystals, with a transverse callus; *lip* purple, subquadrate, 0.6–1 mm long, 1–1.8 mm wide, 0.5–1 mm deep, shallowly concave below the bar with a shallow glenion, with the apex round with a thick margin, (rarely 2.5 mm long with a large glenion), the dorsum with a rounded callus, sometimes flanked on either side with an indistinct, smaller callus, the base broadly truncate, hinged to the base of the column; *column* stout, 1 mm long, 1–1.5 mm wide, the anther and the bilobed stigma apical, the foot obsolescent.

Etymology: from the Latin *grandiflorus*, referring to size of the flower, being one of the largest known.

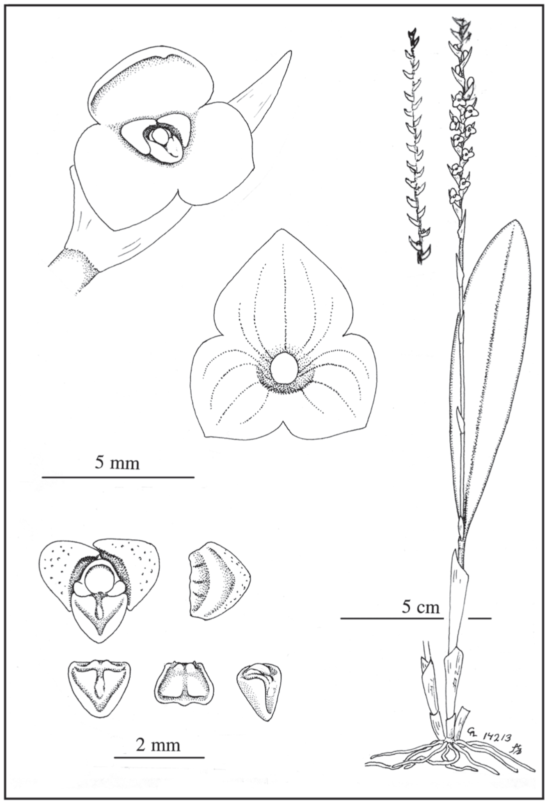

FIGURE 17. *Stelis grandiflora* Lindl.

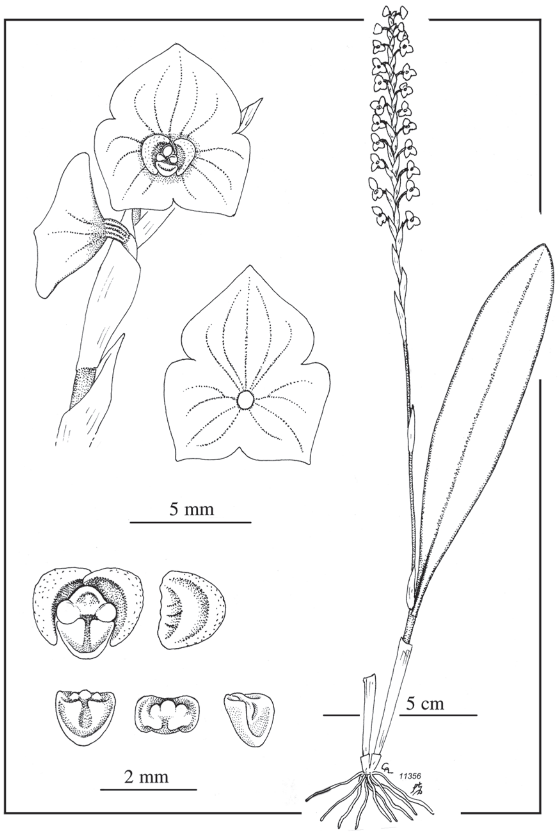

FIGURE 18. *Stelis grandiflora* Lindl.

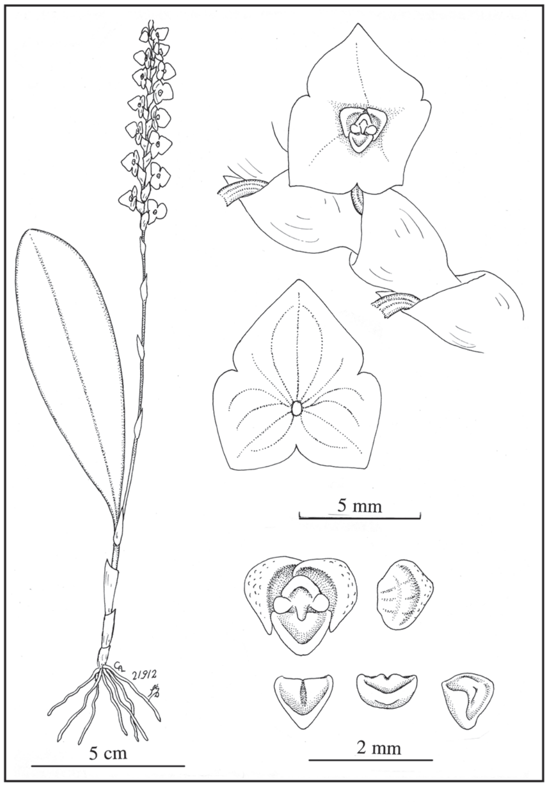

FIGURE 19. *Stelis grandiflora* Lindl.

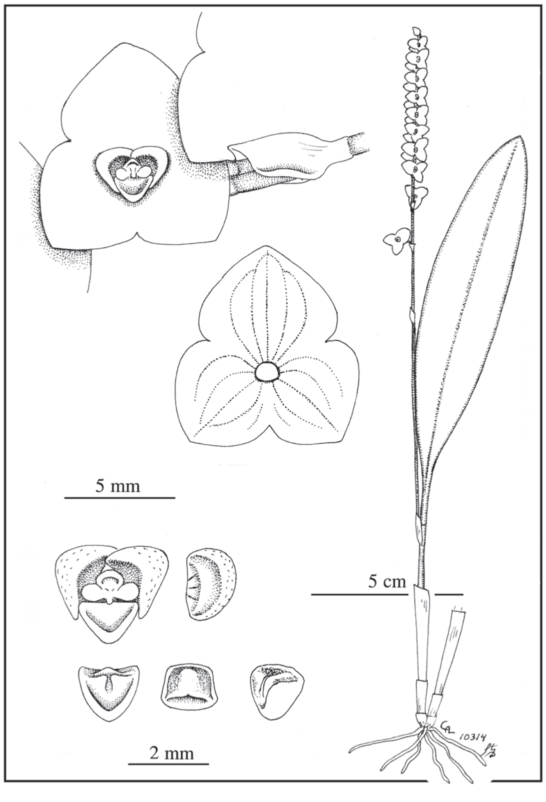

FIGURE 20. *Stelis grandiflora* Lindl.

Additional specimens examined: COLOMBIA. Antioquia: Yarumal, road to El Cedro, 1900 m, 17 March 1989, *C. Luer, J. Luer, S. Dalström & W. Teague 14213* (MO); El Santuario, 2300 m, R. Posada s.n., fl. in cult. at Colomborquídeas, 3 January 1992, *R. Escobar 5221* (MO), C. Luer illustr. 21912; E of Santo Domingo, 1920 m, 12 May 1985, *C. Luer & R. Escobar 11356* (MO); Pabón, road to Santa Ana, 2050 m, 31 May 1985, *C. Luer, J. Luer & R. Escobar 17669* (MO); Frontino, El Plateado, 2060 m, 5 May 1983, *C. Luer, J. Luer & R. Escobar 9040* (SEL). Norte de Santander: Alto de Santa Inéz, 2100 m, 13 May 1984, *C. Luer, J. Luer & R. Escobar 10314* (MO). Valle del Cauca: between Cali and Buenaventura, 1500 m, collected by Paul Desautels, flowered in cultivation at Colomborquídeas, 23 November 1981, *C. Luer 6763* (SEL).

Collections of this species complex are frequent in southern Brazil and not rare in its wide distribution from Trinidad and Guyana through the Andes, gathering numerous synonymous names. It was first recorded by Lindley from an 1835 illustration by Descourtilz near Macahé, now the district of Macaé de Cima, municipality of Nova Frigurgo, in the state of Rio de Janeiro, where recent collections have been made and illustrated.

Stelis grandiflora is greatly variable in size through its wide distribution from Venezuela through Colombia, Ecuador, and southern Brazil. It is still unreported from intervening Peru. The species is distinguished by a congested raceme of relatively large, expanded flowers. The floral bracts are conspicuous as they alternatingly overlap. The sepals are deeply connate to form a subcircular flower. The thick, obtuse petals and lip concave below the bar are unremarkable.

Stelis jamesonii Lindl., J. Bot. (Hooker) 1: 11. 1834. TYPE: ECUADOR. Azuay: "Cuenca," *W. Jameson s.n.* (Holotype: K). Ilustrated in Luer (2009a: 157, fig. 378). Fig. 21.

Synonym: *Stelis vittata* Lindl., Folia Orch. *Stelis* 13(96). 1859. TYPE: ECUADOR. Pichincha: valley of Lloa, *W. Jameson s.n.* (Holotype: K). Etymology: from the Latin *vittatus*, "striped longitudinally," referring to the sepals.

Plant small to medium in size, epiphytic, caespitose to ascending; roots slender. Ramicauls erect, occasionally prolific, 2–4 cm long, enclosed by a tubular sheath from below the middle and 2–3 sheaths below and at the base. *Leaf* erect, coriaceous, narrowly elliptical, subacute to narrowly obtuse, petiolate, 3–7 cm long including a petiole 1–2 cm long, 0.8–1 cm wide in the dry state, gradually narrowed below into the petiole. *Inflorescence* single; 7–15 cm long, the raceme erect, sublax, distichous, flexuous, long-pedicellate, many-flowered with many flowers open simultaneously; floral bracts oblique, acute, 3–4 mm long below, 2 mm long near the tip; pedicels 3–4 mm long; ovary 2 mm long; the peduncle 4–7 cm long, from a node below the apex of the ramicaul; *sepals* rose, mottled with purple, glabrous, broadly ovate, obtuse, slightly convex, connate below the middle, 3-veined, the dorsal sepal 3–4 mm long, 3–4 mm wide, the lateral sepals 2.5–4 mm long, 2.5–3.5 mm wide; *petals* yellow or purple, transversely obovate, concave, 1.5 mm long, 1.5 mm wide, 3-veined, the apex broadly rounded with the margin slightly thickened; *lip* yellow or purple, subobovate-discoid, 1–1.8 mm long, 1–1.8 mm wide, 0.5–0.75 mm deep, shallowly concave within the broadly rounded apical margin, surrounding a low, rounded callus extending forward from a densely short-pubescent callus at the base, the base truncate, hinged to the base of the column; *column* stout, ca. 1.5 mm long and wide, the anther and the bilobed stigma apical.

Etymology: named in honor of Dr. William Jameson who collected this species as well as many others.

Additional specimens examined: COLOMBIA. Cundinamarca: south of Bogotá, above Gutierrez, 2700 m, 19 May 1984, *C. Luer, J. Luer & R. Escobar 10370* (MO). Norte de Santander: between Cucutilla and Pamplona, 2800 m, 13 November 1981, *C. Luer, J. Luer & R. Escobar 6703* (SEL).

Additional distribution: Venezuela, Ecuador.

This caespitose species is widely distributed in the Andes north of Peru. It is characterized by slender ramicauls with narrowly elliptical leaves, and a long-pedunculate, flexuous, long-pedicellate inflorescence. Most distinctive is the shallow, concave lip with a low, central, longitudinal callus microscopically pubescent at the base.

Stelis jamesonii is similar to *S. lentiginosa* Lindl., but it is best distinguished by long pedicels.

Stelis lentiginosa Lindl., Folia Orch. *Stelis* 8(58). 1859. TYPE: ECUADOR. "Descent of the E Cordillera, at 12000," *W. Jameson s.n.* (Holotype: K). Illustrated in Luer (2009a: 215, fig. 384). Fig. 22.

Plant small, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 1–2 cm long, enclosed by a tubular sheath from below the middle and 2–3 sheaths below and at the base. *Leaf* erect, coriaceous, narrowly elliptical, acute to subacute, 2–2.5 cm long including a petiole 6–8 mm long, 5–6 mm wide in the dry state, gradually narrowed below into the petiole. *Inflorescence* single; 6–8 cm long, the raceme erect to arching, congested, distichous, subflexuous, many-flowered with many flowers open simultaneously; floral bracts oblique, acute, 2–3 mm long; pedicels 2 mm long; ovary 1 mm long; the peduncle 3–5 cm long, from a node below the apex of the ramicaul; *sepals* rose, light brown or yellow, suffused with rose, glabrous, ovate, obtuse, slightly convex, connate below the middle, 3-veined, the dorsal sepal 3 mm long, 2.2 mm wide, the lateral sepals 2.5 mm long, 2.5 mm wide; *petals* yellow or rose, subcircular, thin, concave, 1.2 mm long, 1.2 mm wide, faintly 3-veined, the apex broadly rounded; *lip* yellow or rose, subobovate-discoid, 1.2 mm long, 1 mm wide, 0.5 mm deep, shallowly concave within the broadly rounded apical margin, surrounding a low, rounded callus extending forward from a microscopically pubescent base, the base truncate, hinged to the base of the column; *column* clavate, ca. 1 mm long and wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *lentiginosus*, "covered with minute dots," probably referring to the microscopically pubescent base of the lip and column.

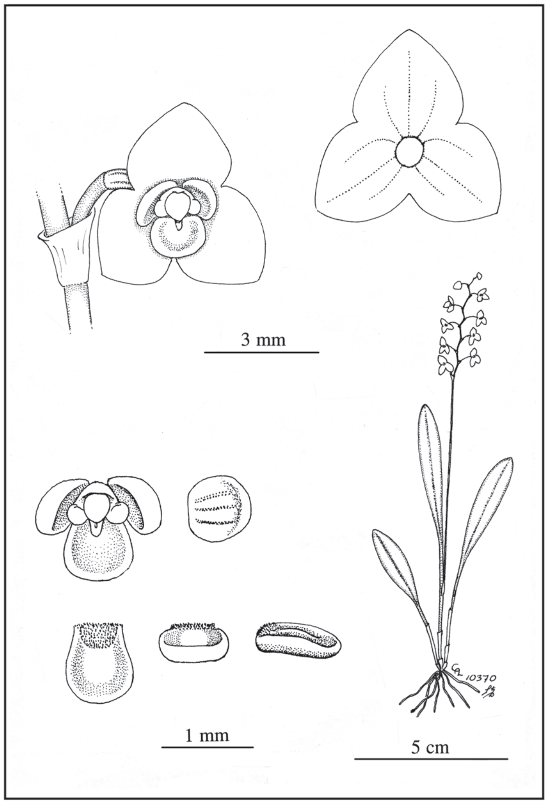

FIGURE 21. *Stelis jamesonii* Lindl.

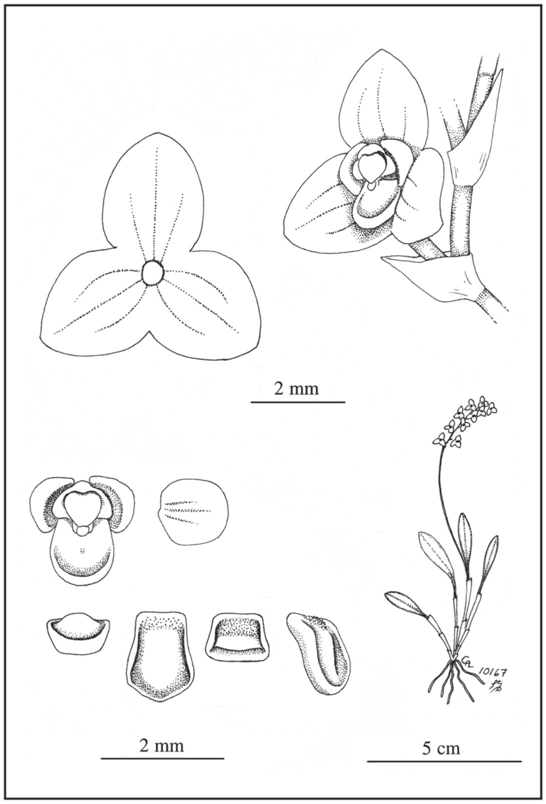

FIGURE 22. *Stelis lentiginosa* Lindl.

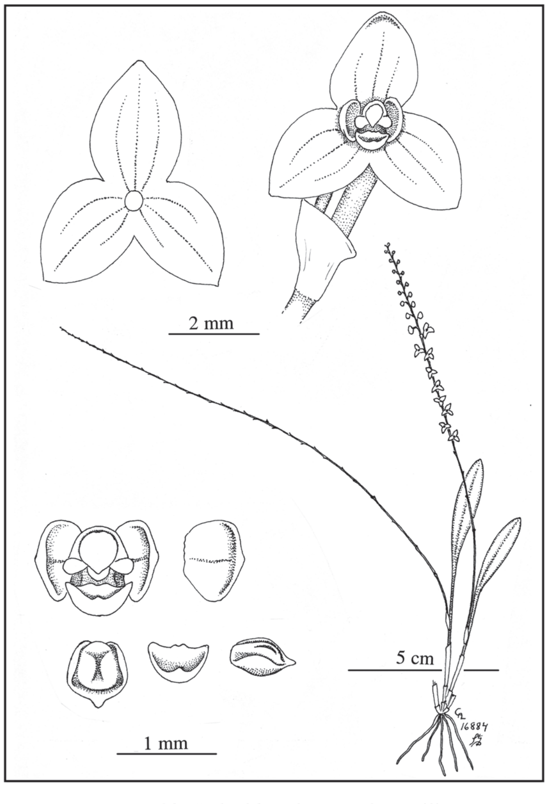

FIGURE 23. *Stelis liberalis* Luer & Portillo

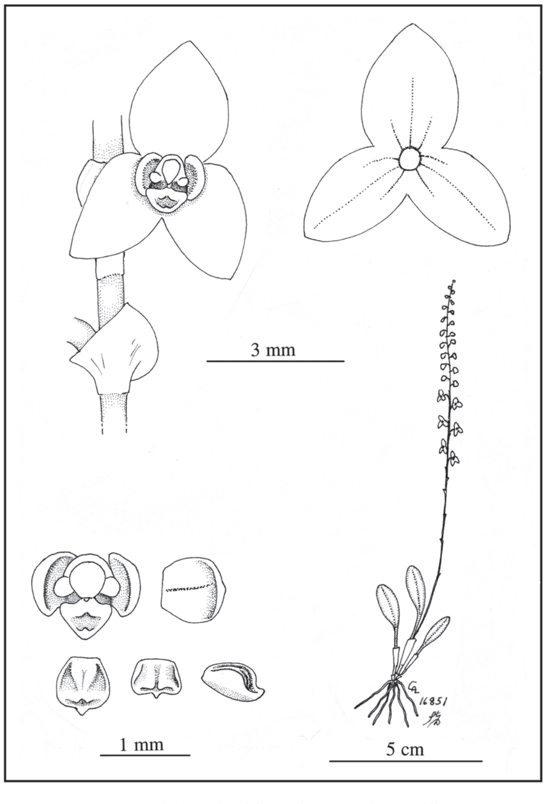

FIGURE 24. *Stelis liberalis* Luer & Portillo

Additional specimens examined: COLOMBIA. Cundinamarca: Bogotá, Quebrada del Chicó, 2800 m, 5 September 1943, *Martin Schneider Wc 126* (AMES); Santander: Bucaramanga. E of Bucaramanga, 2950 m, 7 May 1984, *C. Luer, J. Luer & R. Escobar 10167* (MO).

This uncommon little species is little more than a small variation of *Stelis jamesonii* Lindl. It is distinguished by a smaller, more delicate habit, and a shorter inflorescence with a congested raceme of flowers with short pedicels. The shallowly concave, subdiscoid lip is similar to that of *S. jamesonii*.

Stelis liberalis Luer & Portillo, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 159, 2004. TYPE: ECUADOR. Zamora-Chinchipe, above Zumba, 1000 m, flowered in cultivation at Ecuagenera, 5 March 2001, *C. Luer 19734* (Holotype: MO). Illustrated in Luer (2004: 186, fig. 166). Fig. 23–24.

Plant small, epiphytic, caespitose; roots slender. Ramicauls erect, 0.5–4 cm long, enclosed by a tubular sheath from below the middle and another 1–2 sheaths below and at the base. *Leaf* erect, coriaceous, elliptical, petiolate, subacute to obtuse, 2.5–6 cm long including the petiole ca. 1.5 mm long, narrowed below to the petiole. *Inflorescence* solitary, 12–20 cm long, the raceme erect, strict, many-flowered, laxly flowered below, becoming crowded above with many flowers open simultaneously, the peduncle 4–5 cm long, from a node below the tip of the ramicaul, with a spathe 5–12 mm long; floral bracts oblique, acute, 2 mm long, pedicels 1.5–2 mm long; ovary 1 mm long; *sepals* yellow, expanded, glabrous, ovate, subacute to obtuse, 3-veined, connate basally, the dorsal sepal 2.5–3.2 mm long, 2 mm wide, the lateral sepals 2–2.3 mm long, 2 mm wide; *petals* rose or yellow, thin, transversely ovate, concave, broadly rounded at the apex, slightly thickened on the margin, without a transverse callus, 0.5–0.75 mm long, 0.6–0.9 mm wide, 1-veined; *lip* subquadrate, 0.6–0.75 mm long, 0.6 mm wide, 0.3 mm deep, shallowly concave below a thick, shallowly notched bar, the apex broadly obtuse, with a small, obtuse apiculum, the dorsum convex centrally, the base hinged to the base of the column; *column* clavate, ca. 0.6 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: from the Latin *liberalis*, "free," referring to the shallowly connate sepals.

Additional specimens examined: COLOMBIA. Quindio, 1 de Mena, March 1993, flowered in cultivation at Colomborquídeas. 23 May, 1995, *C. Luer 17589* (MO). Risaralda: Pueblo Rico, 2100 m, collected and cultivated at his home above Pereira by *A. de Wilde 4491* (MO), C. Luer illustr. 16851. Valle del Cauca: Tuluá, Baragán, 2900 m, collected by Juan Filipe Posada, June 1992, flowered in cultivation at Colomborquídeas, 19 December 1992, *R. Escobar 5062* (MO), C. Luer 21913; Baragán, 3000 m, collected by Juan Filipe Posada, flowered in cultivation at Colomborquídeas, 16 May 1993, *R. Escobar 5129* (MO), C. Luer illustr. 16884. Santander: Bucaramanga, E of Bucaramanga, ca. 2700 m, 3 November 1981, *C. Luer & R. Escobar 6581* (SEL).

Collections with flowers answering the description of *Stelis liberalis* are found over a wide area in Colombia and Ecuador, but there is a marked, vegetative variation in size. A single, many-flowered raceme far exceeds a small, elliptical leaf. The sepals are yellow, glabrous, ovate, about 3 mm long, 3-veined, expanded and free nearly to the base. The petals are thin and 1-veined. The lip is concave below the bar and broadly obtuse with a small, obtuse apiculum.

Stelis longirepens Carnevali & J. L. Tapia, Orchids Venezuela ed. 2, 1146. 2000. TYPE: VENEZUELA. Carabobo: Municipio Autónomo Mora, cuenca hidrográfica del río Morón, 700–1100 m, 13–15 April 1991, *W. Diaz 125* (Holotype: VEN; Isotype: PORT). Illustrated in Romero-González and Carnevali (2000: 1029). Fig. 25.

Plant small, epiphytic, repent, the rhizome 3–8 mm long between ramicauls; roots slender. Ramicauls ascending, erect, slender, 5–8 mm long, enclosed by 2 tubular sheaths. *Leaf* erect, coriaceous, elliptical, subacute, 13–23 mm long with a petiole 3–5 mm long, the blade 4–5 mm wide in dry state, cuneate below to the base. *Inflorescence* solitary; 3–4 cm long, the raceme erect, lax, distichous, several-flowered with few flowers open simultaneously; floral bracts oblique, acute, 1.5 mm long; pedicels 1 mm long; ovary 0.5 mm long; the peduncle ca. 2 cm long, from a node at the apex of the ramicaul; *sepals* green, minutely pubescent, connate basally, broadly ovate, obtuse, 3-veined, the dorsal sepal 1.5 mm long, 2 mm wide, the lateral sepals oblique, 1.25 mm long, 1.75 mm wide; *petals* purple, transversely elliptical, concave, thickened on the obtuse margin, cellularly pubescent, with a transverse callus, 0.5 mm long, 0.75 mm wide, 3-veined; *lip* purple, subtriangular, 0.5 mm long, 0.66 mm wide, 0.5 mm deep, concave below the bar, the apex obtuse with thickened margin, the dorsum descending with the 3 veins slightly thickened, the base truncate, hinged to the base of the column; *column* clavate, ca. 0.5 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: from the Latin *longirepens*, "long-repent," referring to the habit.

Additional specimen examined: COLOMBIA. Cauca: Boca Caucana, coll. by J. L. Aguirre, flowered in cultivation at Colomborquídeas, 23 May 1995, *C. Luer 17604* (MO).

This tiny, repent species is apparently rare, known from two distant localities: the type-collection from Venezuela, and this collection from Colombia, where it is likely to occur. It is characterized by slender ramicauls borne along a proportionately stout rhizome. A loose, several-flowered raceme surpasses the leaf about twice its length. The sepals are obtuse and minutely pubescent; the petals are thick and 3-veined; and the lip is concave and obtuse.

Stelis lynniana Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 112: 5, 2007. TYPE: ECUADOR. without collection data, obtained from Ecuagenera, Gualaceo, flowered in cultivation at in Howell, Michigan, October 2003, by *Lynn O'Shaughnessy 02856* (Holotype: MO). Illustrated in Luer (2007: illustr. 20530, 8, fig. 208). Fig. 26.

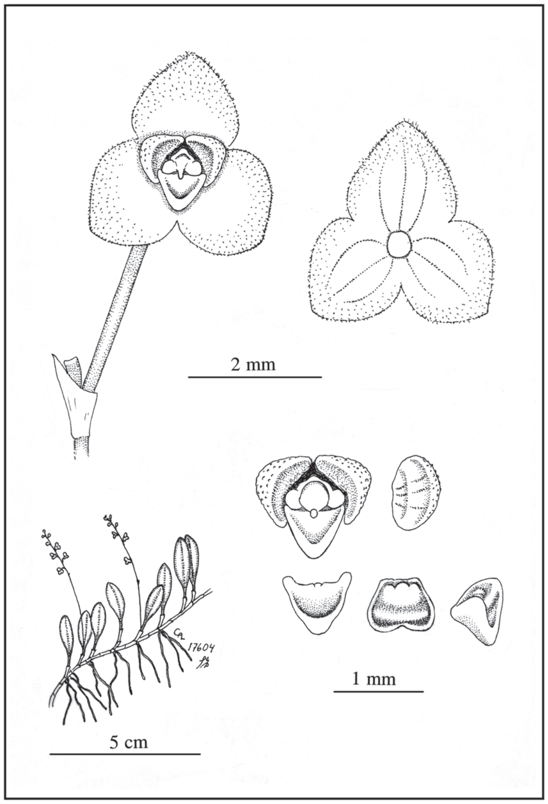

Figure 25. *Stelis longirepens* Carnevali & J.L.Tapia

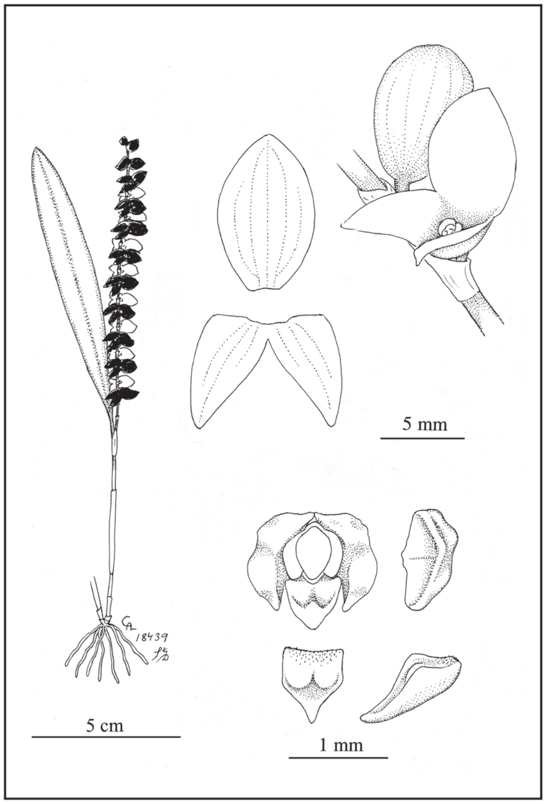

Figure 26. *Stelis lynniana* Luer

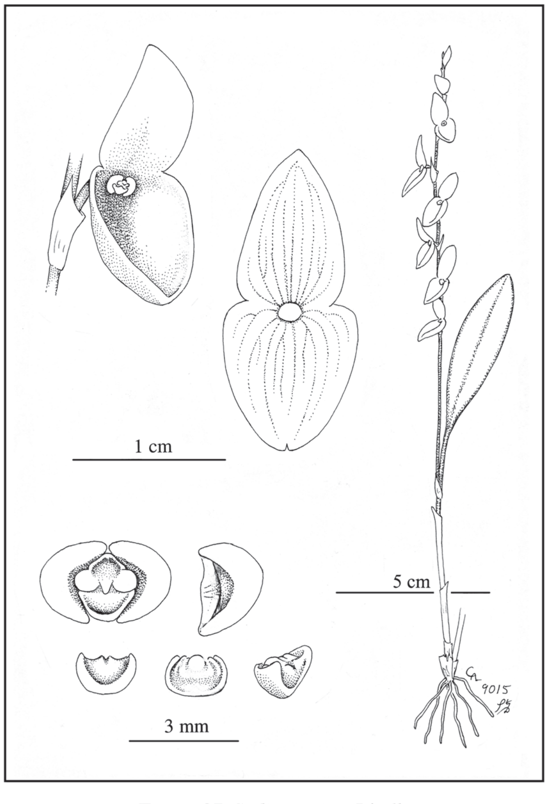

Figure 27. *Stelis maxima* Lindl.

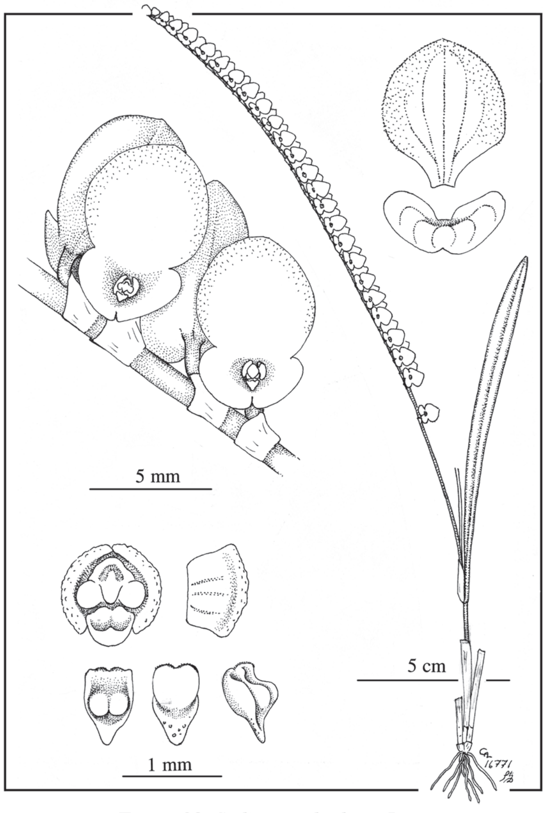

Figure 28. *Stelis megaloglossa* Luer

Synonym: *Stelis picea* Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot. Gard. 112: 7, 2007. TYPE: ECUADOR. Zamora-Chinchipe: Cordillera del Condor, near Paquisha, 1400 m, collected and cultivated by Ecuagenera, flowered in cultivation 11 January 2004, *A. Hirtz 8624* (Holotype: MO). Etymology: from the Latin *piceus*, "pitch black," referring to the flowers.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 4–6 cm long, enclosed by a tubular sheath from below the middle and 2 other sheaths about the base. *Leaf* erect, coriaceous, narrowly elliptical, acute, petiolate, 9–12 cm long including the petiole 2–2.5 cm long, 1.2–1.6 cm wide, cuneate below into the slender petiole. *Inflorescence* single, 11–13 cm tall, the raceme strict, congested, distichous, with many simultaneous, overlapping flowers, the peduncle 1.5–2 cm long, with a spathe ca.1 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, 4.5 mm long; pedicels 1.5 mm long; ovary 2 mm long; *sepals* purple-black, glabrous, the dorsal sepal broadly elliptical, obtuse, 8.5 mm long, 4.5 mm wide, 5-veined, connate to the lateral sepals 2 mm, the lateral sepals antrose, ovate, acute, 6 mm long, 3 mm wide, 3-veined; *petals* black, transversely subquadrate with thickened, oblique margins, shallowly concave, 0.6 mm long, 1 mm wide, 1-veined; *lip* black, subquadrate, 0.6 mm long, 0.5 mm wide, 0.5 mm deep, shallowly concave anteriorly within the acute, apical margin, the bar thick with a glenion, the dorsum flat, minutely pubescent below the middle, the base truncate, hinged to the obsolescent column-foot; *column* stout, 0.5 mm long, 0.5 mm wide, with the anther and bilobed stigma apical.

Etymology: named for Lynn O'Shaughnessy of Howell, Michigan, who successfully cultivates this species.

Additional specimen examined: COLOMBIA. Valle del Cauca: without data, flowered in cultivation at Orquídeas del Valle, Cali, 15 March 1987, *C. Luer 18439* (MO).

This species of section *Nexipous* is not rare in Ecuador, but it is known from Colombia by only a collection from Valle del Cauca and cultivated by Orquídeas del Valle. *Stelis lynniana* is characterized by a narrowly elliptical leaf that is about as long as or longer than the ramicaul, and an erect, congested raceme of shiny, purple-black flowers. The broadly elliptical, 5-veined dorsal sepal is larger than the antrorse lateral sepals; the petals are more or less quadrate with oblique margins and only one vein is visible. The lip is more or less subquadrate with a shallowly concave, acute, triangular apical lobe.

Stelis maxima Lindl., Ann. Mag. Nat. Hist. ser. 1, 15: 106. 1845. TYPE: ECUADOR. Tungurahua: at the foot of Mt. Tungurahua, 11000 ft, *T. Hartweg 1407* (Holotype: K; Isotypes: G, LD, LE, W). Illustrated in Luer (2009a: 86, fig. 324). A vegetatively small variation is shown in Fig. 27.

Synonym: *Steliopsis anneliesae* Brieger, Orchideen 8(29-32): 457. 1976, *nom illeg*. Etymology: named for Anne Liesa, wife of Friedrich Gustav Brieger (1900–1983).

Plant medium to large, epiphytic, ascending-caespitose; roots slender. Ramicauls erect, stout, occasionally prolific, 4–15 cm long, enclosed by 2–3 close, tubular sheaths. *Leaf* erect, coriaceous, elliptical, acute to subacute, 8–11 cm long, 1.5–2.5 cm wide, cuneate below into a petiole 1.5–2 cm long. *Inflorescence* an erect, distichous, many-flowered raceme with many flowers open simultaneously, 15–27 cm long including the peduncle 5–10 cm long, subtended by a spathe 1–2 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, 10 mm long below, 5 mm long above; pedicels 3–5 mm long; ovary 3–5 mm long; flowers purple; *sepals* glabrous, the dorsal sepal erect, ovate, subacute, 10–14 mm long, 7–10 mm wide, irregularly 11-veined, connate basally to the synsepal, the lateral sepals connate into a broadly ovate, concave synsepal, 10–12 mm long, 8–14 mm wide, irregularly 15-veined; *petals* purple, transversely semilunate, 1.5–2 mm long, 2.2–2.5 mm wide, 3-veined, the apex rounded, broadly thickened, concave below a transverse carina; *lip* purple, subquadrate, 1 mm long, 1.5–2 mm wide, 1 mm deep, concave below a botched bar, the apex broadly rounded with thick margin, the dorsum filled with an obscurely trilobed, microscopically pubescent callus, the base truncate, hinged to the base of the column; *column* stout, 1 mm long, 2 mm wide, the anther and the bilobed stigma apical.

Etymology: From the Latin *maximus*, "very large," referring to the flowers.

Additional specimens examined: COLOMBIA. Antioquia: Frontino, above Nutibara, Alto de Cuevas, 2050 m, 4 May 1983, *C. Luer, J. Luer & R. Escobar 9015* (SEL). Choco: San José del Palmar, Cerro del Torrá, 2500 m, 24 August 1988, *P. A. Silvestone-Sopkin 4700* (MO).

This usually large species is widely distributed in the Andes of Colombia and Ecuador. It is generally characterized by a robust habit with occasional prolific ramicauls, and with large, elliptical leaves and long-bracted racemes of large flowers that exceed the leaves several-fold. The sepals are between 10 and 15 mm long and multiveined. The semilunate petals are about as long as wide with a round, thick-margined apex. The lip is concave above a rounded apex with a relatively thin margin.

Stelis megaloglossa Luer, Phytologia 49(3): 231. 1981. TYPE: COLOMBIA. Nariño: E of Ricaurte, 1800 m, 1 November 1979, *C. Luer, J. Luer, K. Walter & A. Hirtz 4528* (Holotype: SEL). Illustrated in Luer (2007: 14, fig. 215, as *Stelis glossulicles* Luer & Hirtz). Fig. 28.

Synonym: *Stelis glossulicles* Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot. Gard. 112: 10, 2007. TYPE: ECUADOR. Imbabura: between Carolina and Buena Vista, 1800 m, November 2004, *A. Hirtz, F. Tobar & H. Simbaña 9155* (Holotype: MO). Etymology: named for the numerous large flowers similar to *Stelis glossura* Rchb.f.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 5–7 cm long, enclosed by a loose, tubular sheath below the middle, and another tubular sheath about the base. *Leaf* erect, coriaceous, narrowly linear, acute, subpetiolate, 11–12 cm long, excluding the petiole, 0.7–1 cm wide dry, narrowed below to the base. *Inflorescence* 1–2 erect, congested, distichous, many-flowered racemes with 2 opposite-facing rows, many open simultaneously, 15–23 cm long including the peduncle 3–4 cm long, subtended by a narrow spathe 1.5 cm long, from a node below the apex of the ramicaul; floral bracts tubular, obtuse, 1.5–2 mm long; pedicels 1 mm long; ovary 1 mm long; flowers dark purple; *sepals* glabrous externally, microscopically pubescent within, the dorsal sepal broadly ovate to suborbicular, 6 mm long, 5 mm wide, 5-veined, connate basally 1–2 mm, the lateral sepals connate to near the apex into a concave synsepal, 1.5 mm long, 4 mm wide expanded, 6-veined; *petals* transversely obovate, 0.6 mm long, 1 mm wide, 3-veined, the apex broadly obtuse with the margin irregularly thickened, without a transverse callus; *lip* thick, subquadrate, acute at the apex with the tip blunt, 0.8 mm long, 0.5 mm wide, 0.4 mm deep, the bar elevated, narrowly cleft between rounded halves that descend onto the dorsum, then ascend onto a thickened base, the base truncate, hinged to the base of the column; *column* semiterete, ca. 0.8 mm long and wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *megaloglossa*, "large tongue," referring to the appearance of the dorsal sepal. (Not to be confused with *Stelis megalocephala* Luer, a small plant endemic to Ecuador, published on the same page in Luer, 1981).

Additional specimen examined: COLOMBIA. Risaralda: between Pereira and Armenia, 2000 m, collected and cultivated by Carlos Llanos in Pereira, 10 May 1993, *C. Luer 16771* (MO).

This species occurs uncommonly in the Andes of Colombia and Ecuador. It is characterized by a narrow, linear leaf that is surpassed by a distinctive raceme of 2 congested rows of opposite facing, dark purple flowers with a conspicuous, rounded dorsal sepal much larger than a short, transverse synsepal.

Stelis nostalgia Luer, *sp. nov*. TYPE: VENEZUELA. without collection data, flowered in cultivation at Colomborquídeas, 23 May 1995, *C. Luer 17573* (Holotype: MO). Fig. 29.

This large species with a multiflowered raceme that equals an oblong, obtuse leaf is distinguished by short floral bracts and pedicels.

Plant large, presumably epiphytic, densely caespitose; roots slender. Ramicauls erect, stout, 5–8 cm long, enclosed by a loose, tubular sheath from below the middle, and 2 others near and at the base. *Leaf* erect, coriaceous, elliptical, obtuse to rounded at the tip, 12–15 cm long, 2–2.5 cm wide, cuneate below into a petiole 2–3 cm long. *Inflorescence* 1–2 racemes to 15 cm long, erect, congested, distichous, many-flowered, floral bracts tubular, obtuse, 2 mm long; pedicels 2 mm long; ovary 2 mm long; the peduncle 5–7 cm long, with a spathe 1.5–2 mm long, from a node below the apex of the ramicaul; *sepals* light yellow, cellular pubescent, elliptical, ovate, obtuse, 3-veined, connate below the middle, the dorsal sepal 3.2 mm long, 2.2 mm wide, the lateral sepals 2.5 mm long, 2 mm wide; *petals* yellow, transversely semilunate, 0.6 mm long, 1.2 mm wide, faintly 3-veined, the rounded margin slightly thickened, without a callus; *lip* brown, subquadrate, 0.6 mm long, 1 mm wide, 0.5 mm deep, shallowly concave below the bar with a shallow notch, the apex round with a thin margin, the dorsum slightly convex, the base truncate, hinged to the base of the column; *column* stout, ca. 1 mm long and wide, the anther and the bilobed stigma apical.

Etymology: from the Greek *nostalgios*, "nostalgic," referring to the presence of the plant in Colombia, away from its Venezuelan home.

This large species was being cultivated at Colomborquídeas, near Medellín, Colombia, without collection data, except that the plant was noted to have been from Venezuela. A many-flowered raceme more or less equaled an obtuse, oblong leaf. The small flowers with 3-veined, cellular-pubescent sepals, simple petals, and a lip concave below the bar are not unusual. The floral bracts and pedicels are unusually short. It is likely to occur in Colombia.

Stelis oblonga (Ruiz & Pav.) Willd., Sp. Pl. 4: 139. 1805.

Basionym: *Humboldtia oblonga* Ruiz & Pav., Syst. Veg. Fl. Peruv. et Chil. 236, 1798. TYPE: PERU. Huánuco: Muña, *J. A. Pavón s.n*. (Holotype: MA; Isotype: W). Illustrated in Luer (2002: 68, fig. 50, as *S. dodsonii* Luer). Fig. 30, and an unusual variation shown in Fig. 31.

Synonyms: *Stelis floribunda* Kunth, Nov. Gen. Sp. 1: 362. 1815. TYPE: COLOMBIA. Cauca: Andes of Popayán, near Poblazón, 1210 hex., November 1801, *A. de Humboldt & A. Bonpland s.n*. (Holotype: P). Etymology: from the Latin *floribundus*, "many-flowered," referring to the inflorescence.

Stelis fissa Lindl., Folia Orch. *Stelis* 5(28). 1859. TYPE: ECUADOR [as "PERU"]. Quito, *W. Jameson s.n*. (Holotype: K). Etymology: from the Latin *fissus*, "split," referring to the bracts on the specimen examined.

Stelis apiculata Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7: 84. 1920. TYPE: COLOMBIA. Without locality, 1909–1911, *M. Madero s.n*. (Holotype: destroyed at B), *non* Lindl. 1859. Etymology: from the Latin *apiculatus*, "apiculate," referring to the labellum.

Stelis insignis Ames, Sched. Orch. 1: 5. 1922, as *S. insigne*. TYPE: COLOMBIA. Huila: Río Paez valley, Tierra Adentro, 1600–1900 m, January 1906, *H. Pittier 1299* (Holotype: US 531497; Isotype: AMES 25099). Etymology: from the Latin *insignis*, "outstanding, noted," referring to the aspect of the species.

Stelis dodsonii Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 88: 42, 2002. TYPE: ECUADOR. Pichincha: west of Calacalí, and La Liberia, 2100 m, 4 April 1985, *C. Luer, J. Luer, A. Hirtz, C. Dodson & P. Dodson 11057* (Holotype: MO). Etymology: named for Calaway Homer Dodson, co-collector of this species.

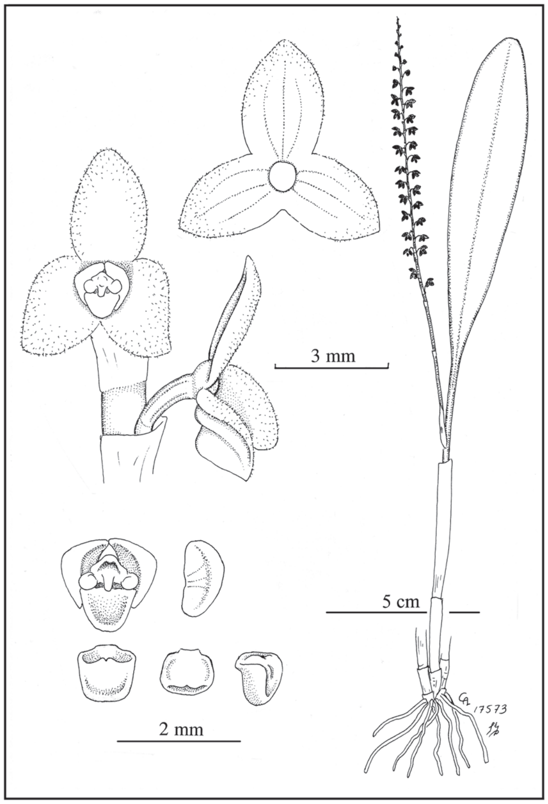

FIGURE 29. *Stelis nostalgia* Luer

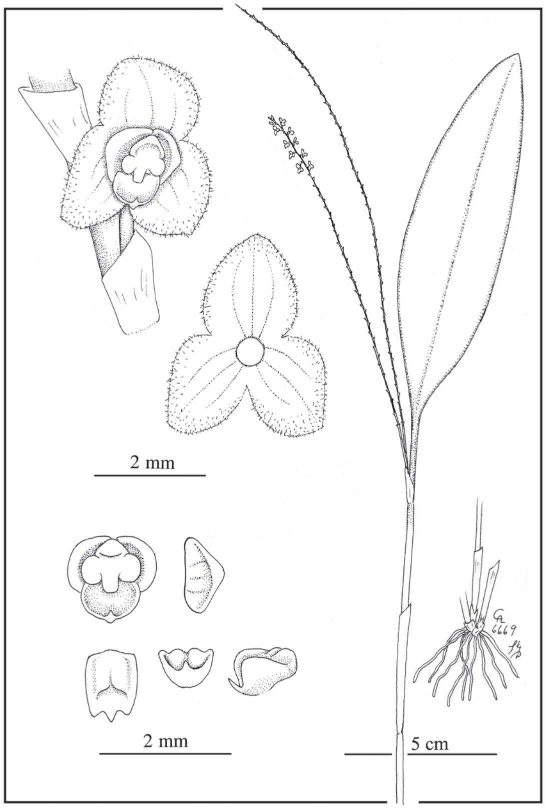

FIGURE 30. *Stelis oblonga* (Ruiz & Pav.) Willd.

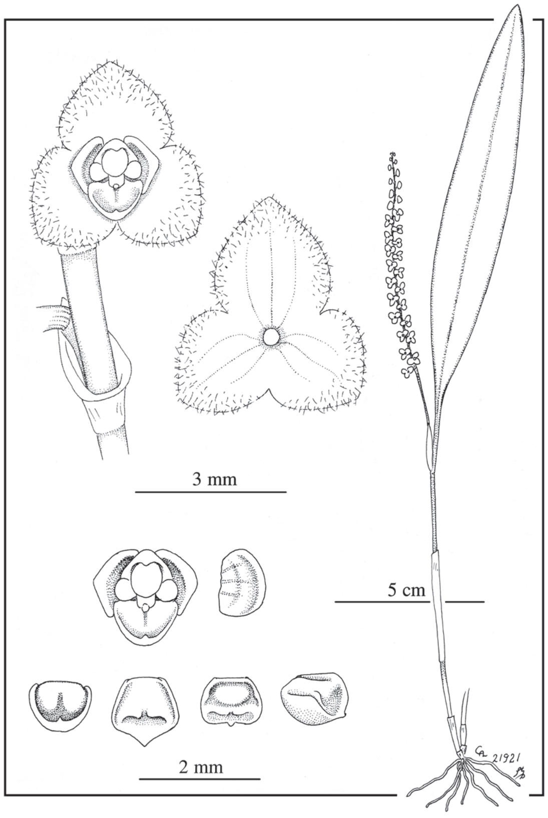

FIGURE 31. *Stelis oblonga* (Ruiz & Pav.) Willd.

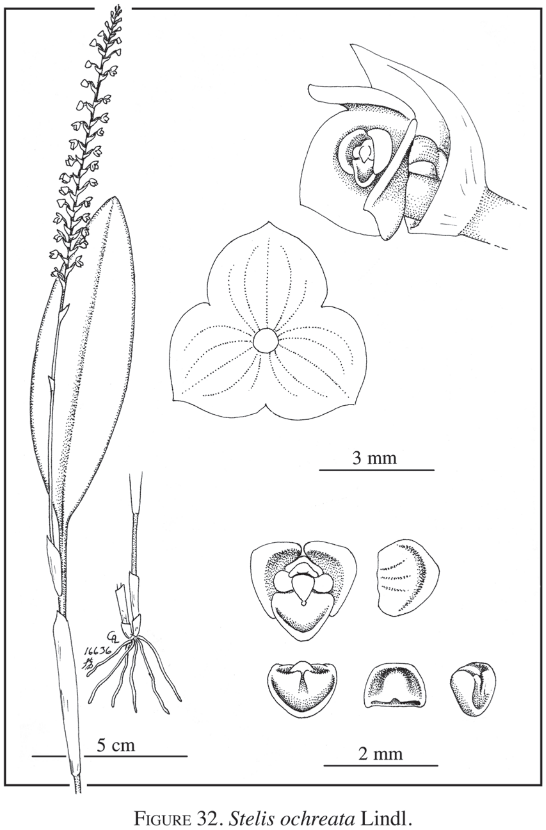

FIGURE 32. *Stelis ochreata* Lindl.

Plant medium in size to large, epiphytic, ascending-caespitose; roots slender. Ramicauls erect, stout to relatively slender, 10–28 cm long, with a close, tubular sheath near the middle and another 2 sheaths at the base. *Leaf* erect, coriaceous, elliptical-oblong, subacute to obtuse or rounded at the apex, petiolate, 6–16 cm long including the petiole 1.5–3 cm long, the blade 1.5–4.5 cm wide, cuneate below into the petiole. *Inflorescence* 1–5 erect, strict, distichous, simultaneously many-flowered racemes, 10–25 cm long including the peduncle 3–7 cm long, with a spathe 1–1.5 cm long, below the apex of the ramicaul; floral bracts oblique, acute, 1.5–3 mm long; pedicels 1–2 mm long; ovary 1–1.5 mm long; flowers greenish or yellowish white to purple or brown; *sepals* similar, glabrous externally, densely pubescence within, broadly ovate, broadly obtuse, connate below the middle, 3-veined, the dorsal sepal 2–3 mm long, 1.8–2.5 mm wide, the lateral sepals 1.8–2 mm long, 1.8-2.25 mm wide; *petals* transversely obovate, broadly obtuse, concave, 0.75–1 mm long, 1–1.5 mm wide, 3-veined, with the margin thickened; *lip* oblong-subquadrate, 0.75–1 mm long, 1–1.5 mm wide, 0.5 mm deep, concave below a cleft bar, the apex broadly obtuse to subtruncate, abruptly acuminate-apiculate, the dorsum slightly convex, the base truncate, hinged to the base of the column; *column* stout, 1 mm long, 1.25 mm wide, the anther and bilobed stigma apical.

Etymology: from the Latin *oblongus*, "oblong," referring to the leaf.

Additional specimens examined: COLOMBIA. Boyacá: between Arcabuco and Moniquira, 2500 m, 25 April 1982, *C. Luer, J. Luer & R. Escobar 7540* (SEL). Norte de Santander: between Abrego and Sardinata, 2300 m, 12 November 1981, *C. Luer, J. Luer & R. Escobar 6669* (SEL). Risaralda: Pueblo Rico, road to TV antenna, 2400 m, *C. Luer, J. Luer, R. Escobar & A. de Wilde 16832* (MO); Santa Rosa de Cabal, Ucumarí Regional Nature Reserve, 2250 m, *A. de Wilde 335* (MO), C. Luer illustr. 21918; between Salerno and Quindio, 3000 m, flowered in cultivation at Colomborquídeas 23 May 1995, *C. Luer 17583* (MO). Cauca: Tocotá, W of Cali, 1600–2000 m, no date, *F.C. Lehmann 6921* (AMES); Popayán, 1750 m, 15 February 1884, *F. C. Lehmann 3724* (AMES). Cundinamarca: Bogotá, Chapinero, 2700 m, 1939, *L. Uribe U. 384* (AMES).

Additional distribution: Ecuador, Peru.

This large species is widely distributed in the Andes from Colombia, through Ecuador into Peru. It is variable vegetatively, usually large with petiolate leaves broad, elliptical-oblong. Many small, crowded flowers are produced simultaneously on one to several racemes as long as or longer than the leaf. The internal pubescence of the 3-veined sepals varies from short to long, and the petals are thick and 3-veined. The lip is concave below a bar with the apex broadly obtuse to truncate and shortly acuminate-apiculate.

Stelis oblongifolia Lindl., Folia Orch. *Stelis* 12(89). 1859. TYPE: ECUADOR. Pichincha, *W. Jameson s.n.* (Holotype: K). Illustrated in Luer (2009a: 220, fig. 396).

Synonyms: *Stelis chachapoyebsis* Rchb.f. Bonplandia. 3: 225. 1855. TYPE: PERU. Chachapoyas, *A. Mathews s.n.* (Holotype: W). Etymology: named for Chachapoya where the species was collected.

Stelis superposita Schltr., Repert. Spec. Nov. Regni Veg. 14: 124. 1915. TYPE: ECUADOR. "Oyacali," *A. Sodiro 8* (Holotype: lost at B). Etymology: from the Latin *superpositus*, "superposed," referring to the prolific habit.

Stelis coturcoënsis Repert. Spec. Nov. Regni Veg. Beih. 8: 52. 1921. TYPE: ECUADOR. Riobamba: "In monte Coturco prope Pifo," 3200 m, *L. Mille 13* (Holotype: destroyed at B). Etymology: named for Mt. Coturco where the species was collected.

Plant medium in size to large, epiphytic, scandent; roots slender. Ramicauls ascending, slender, prolific, 15–20 cm long below to 3–6 cm long above, enclosed by a tubular sheath near the middle and another sheath at the base. *Leaf* erect, coriaceous, elliptical-oblong, subacute to obtuse, petiolate, 5–10 cm long including the petiole 1–2 cm long, 1.5–2.5 cm wide, cuneate below into the petiole. *Inflorescence* an erect, congested, distichous, many-flowered, raceme with many flowers open simultaneously, 10–17 cm long including the peduncle 2–3 cm long, from a node below the apex of the ramicaul; floral bracts infundibular, 2–4 mm long; pedicels 1–2 mm long; ovary 1–2 mm long; *sepals* purple, yellow to white, glabrous externally, minutely cellular-glandular within, broadly ovate, obtuse, connate below the middle, the dorsal sepal 4–4.5 mm long, 3–4 mm wide, 3-veined, the lateral sepals 3–4 mm long, 2.5–3.5 mm wide, 3-veined; *petals* suffused with purple, transversely ovate, 0.6–1.25 mm long, 1–1.9 mm wide, 3-veined, with the apex broadly obtuse with a thick, flattened margin, the base broadly truncate; *lip* suffused with purple, thick, subquadrate, 0.6–1.4 mm long, 0.6–1.3 mm wide, the apex obtuse, concave anteriorly with a long glenion, the dorsum with 1 or 3 low, rounded calli, the base truncate, hinged to the base of the column; *column* stout, 0.75–1 mm long, 0.8–1.2 mm wide, the anther and the stigma apical, the stigma bilobed.

Etymology: from the Latin *oblongifolius*, "with oblong leaves," referring to the leaves.

Additional specimens examined: COLOMBIA. Cauca: Popayán, Páramo de Barbillas, 3070 m, 27 July 1978. *C. Luer, J. Luer & R. Escobar 3046* (SEL). Nariño: near Laguna La Cocha, 25 July 1960, *L. A. Garay 36* (AMES).

This large, variable, widely distributed species is characterized by a prolific habit; oblong-elliptical leaves; and a much longer, crowded inflorescence. The sepals are broadly obtuse, about 4 mm long, and 3-veined; the petals are transverse and 3-veined with a thick margin; and the lip is subquadrate, obtuse, and shallowly concave with a prominent glenion. The calli on the dorsum are variable.

Stelis ochreata Lindl., Folia Orch. *Stelis* 2(8). 1859. TYPE: ECUADOR. Without collection data, *W. Jameson s.n.* (Holotype: K). Luer (2009: 216, fig. 385, 385a,b, as *Stelis lindenii* Lindl.). Fig. 32.

Plant large, epiphytic, densely caespitose, roots slender. Ramicauls erect, stout, 6–13 cm long, with a loose, tubular sheath from below the middle and another 2 sheaths at the base. *Leaf* erect, coriaceous, elliptical-ovate, acute, petiolate, 8–15 cm long including the petiole 1.5 cm long, 2.5–3.3 cm wide when dry, cuneate below into the petiole. *Inflorescence* single; 20–32 cm tall, the raceme erect, strict, distichous, congested, many-flowered with many flowers open simultaneously, floral bracts oblique, acute, 5–7 mm long; pedicels 2 mm long; ovary 1.5 mm long; the peduncle ca. 10 cm long, with a spathe 2 cm long, at a node below the apex of the ramicaul; flowers purple; *sepals* similar, sensitive, glabrous, fleshy, more or less antrorse, transversely ovate, broadly obtuse, connate to near the middle, 2.5 mm long, 3.5 mm wide, 5-veined; *petals* transversely ovate, 1.25 mm long, 1.5 mm wide, 3-veined, the apex broadly rounded with the margin thickened, and with a transverse carina, the dorsum with a low, rounded callus; *lip* subquadrate, 1 mm long, 1.2 mm wide, 1 mm deep, the anterior surface shallowly concave below the bar with a small glenion, with the apex broadly rounded, the dorsum with a low rounded, central callus, the base truncate, hinged to the base of the column; *column* stout, ca. 1 mm long and wide, the anther and bilobed stigma apical.

Etymology: from the Latin *ochreatus*, “ochreate, sheathed,” referring to the basal bracts of the peduncle.

Additional specimens examined: COLOMBIA. Antioquia: Near Santa Bárbara, 1900 m, flowered in cultivation at Finca Alberto Neumann, 4 May 1983, *C. Luer 16636* (MO). Cauca: “La Galera,” Micay valley, 1500–1800 m, 1 July 1922, *E. P. Killip 7906* (AMES, NY). El Valle: “Mozambic,” N of La Cumbre, 16 September 1922, *E. P. Killip 11280* (AMES, NY).

This variable species occurs frequently in Ecuador, where it was mistakenly identified as the variable *Stelis lindenii* Lindl. of western Venezuela and Colombia. In Luer (2009a: 162), *S. ochreata* was erroneously listed in the synonymy of *S. lindenii*.

Stelis ochreata is a large plant with a long, single raceme of many small flowers. The sepals are fleshy, 5-veined, connate to near the middle, and more or less antrorse. The petals are thick and 3-veined, and the lip is concave below a bar.

Stelis paraguasensis Luer, Selbyana 30(1): 23, 2009. TYPE: COLOMBIA. Valle del Cauca: El Cairo, Cerro del Inglés, Serranía Paraguas, 2200 m, 6 November 1997, *P. A. Silverstone-Sopkin 7955* (Holotype: CUVC). Illustrated in Luer (2009b: C. Luer illustr. 21255, 68, fig. 44). Four variations shown in Fig. 33–36.

Plant medium in size to large, epiphytic, densely caespitose, roots slender. Ramicauls erect, slender, elongated, 8–18 cm long, with a close, tubular sheath near the middle and another below and at the base. *Leaf* erect, coriaceous, ovate, acute, 5–9 cm long including a petiole 1.5–2 cm long, the blade 1.4–2.2 cm wide in dry state, cuneate below into the petiole. *Inflorescence* 2–5 simultaneous; 5–10 cm long, the racemes erect, strict, congested, distichous, many-flowered; floral bracts tubular, acute, 1.5–2 mm long; pedicels 1–1.5 mm long; ovary 1–1.5 mm long; the peduncle ca. 1 cm long, with a spathe ca. 1 cm long, from a node below the apex of the ramicaul; *sepals* glabrous to pubescent, purple externally, sometimes blue within, connate below the middle, the sepals broadly ovate, obtuse, the dorsal sepal 2–3 mm long, 2–3 mm wide, the lateral sepals 1.75–2.5 mm long, 2–2.75 mm wide, 3- to 5-veined; *petals* yellow-green to rose, transversely ovate or semilunate, the apical margin thick, broadly obtuse to rounded, concave below with a transverse carina, 0.8–1 mm long, 1–1.25 mm wide, 3-veined; *lip* rose to purple, subquadrate, 0.5–0.8 mm long, 0.6–1 mm wide, 0.5–0.75 mm deep, the apex obtuse with a thick margin, concave below a cleft bar that is continuous with a smooth, central, suborbicular callus on the dorsum, the base truncate, hinged to the base of the column; *column* clavate, ca. 1 mm wide and long, anther and bilobed stigma apical.

Etymology: named for the Serranía de los Paraguas where the species was collected.

Additional specimens examined: Valle del Cauca: Alto de Los Galapagos, 2050 m, 13 May 1993, *C. Luer, J. Luer & R. Escobar 16808* (MO); Alto de Las Galápagos, at the pass between Valle del Cauca and Chocó, 2050 m, 13 May 1993, *C. Luer, J. Luer, R. Escobar & A. de Wilde 16898* (MO). Antioquia: Yarumal, road to El Cedro, 1850 m, 15 March 1989, *C. Luer, J. Luer, S. Dalström & W. Teague 14174* (MO); Yarunal, road to Briceño, Quebrada El Oro, 1850 m, 16 March 1989, *C. Luer, J. Luer, S. Dalström & W. Teague 14185* (MO); Sonsón. between La Ceja and Sonsón, 2400 m, 29 April 1983, *C. Luer, J. Luer & R. Escobar 8879* (SEL); Sonsón, Tres Cruces pass, E of Sonsón, 2750 m, 30 April 1983, *C. Luer, J. Luer & R. Escobar 8890, 8895* (SEL); La Unión, between La Unión and Mesopotamia, 2400 m, 8 April 1988, *C. Luer, J. Luer & R. Escobar 13062* (MO).

This species from the Western and Central Cordilleras of Colombia is distinguished by slender ramicauls that are distinctly longer than the leaves, and a few many-flowered racemes about as long as the leaves. The color of the floral parts varies from yellow to purple; the inner surface of the sepals varies from glabrous to pubescent. The sepals are either 3-veined or five-veined. All combinations of color, the integument and venation occur. The petals are thick and 3-veined below a transverse carina. The lip is rounded at the apex, and a cleft bar is continuous into a central, suborbicular callus on the dorsum.

Although, as conceived, this species is frequent and exceedingly variable in a wide distribution, no other name can be applied. Most distinctive are the ramicauls longer than the leaf, and the central, solitary, round callus on the dorsum of a cleft bar of the lip.

Stelis pardipes Rchb.f., Beitr. Orch. Centr.-Amer. 96. 1866. TYPE: COSTA RICA. Heredia: *H. Wendland 899* (Holotype: W). Illustrated in Luer (2009a: 88, fig. 330 and 330a). Fig. 37–38.

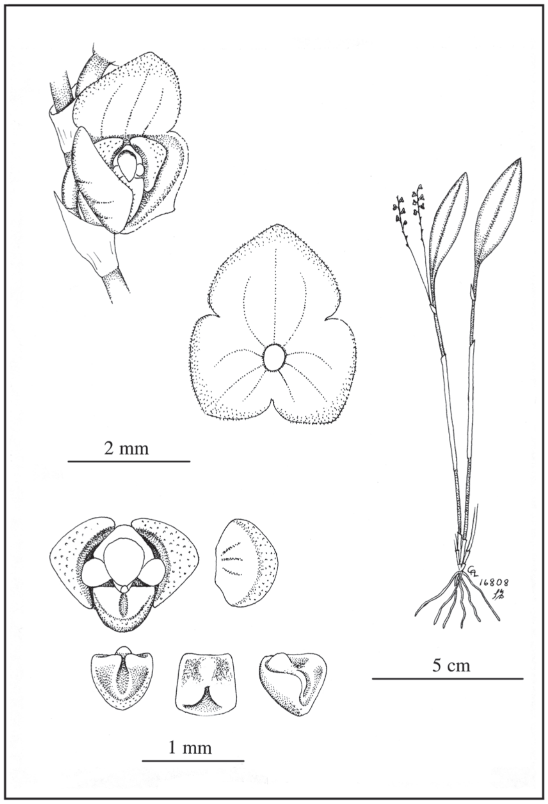

FIGURE 33. *Stelis paraguasensis* Luer

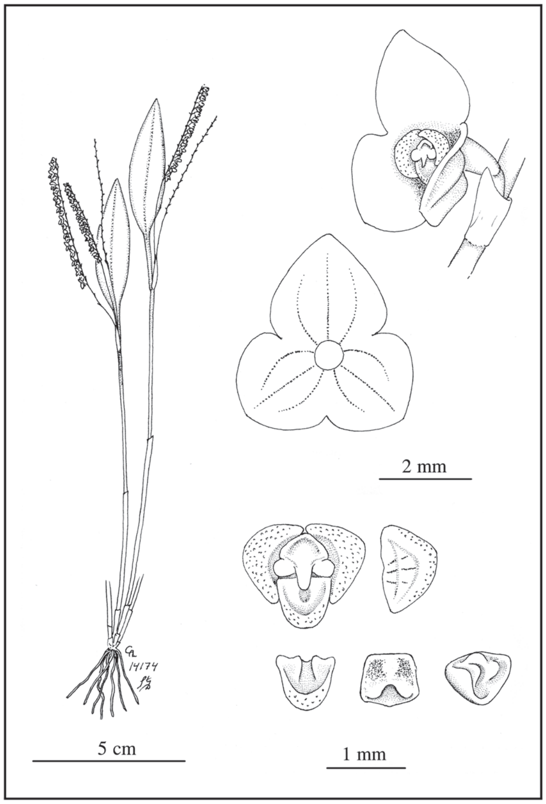

FIGURE 34. *Stelis paraguasensis* Luer

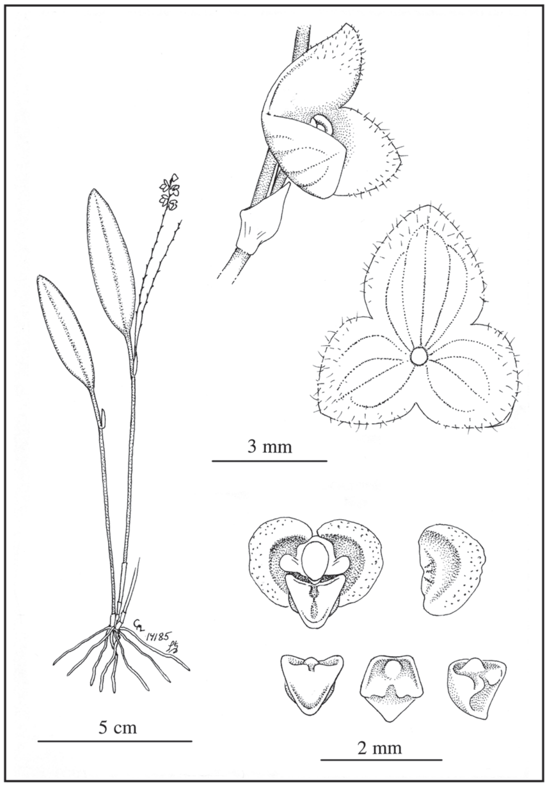

FIGURE 35. *Stelis paraguasensis* Luer

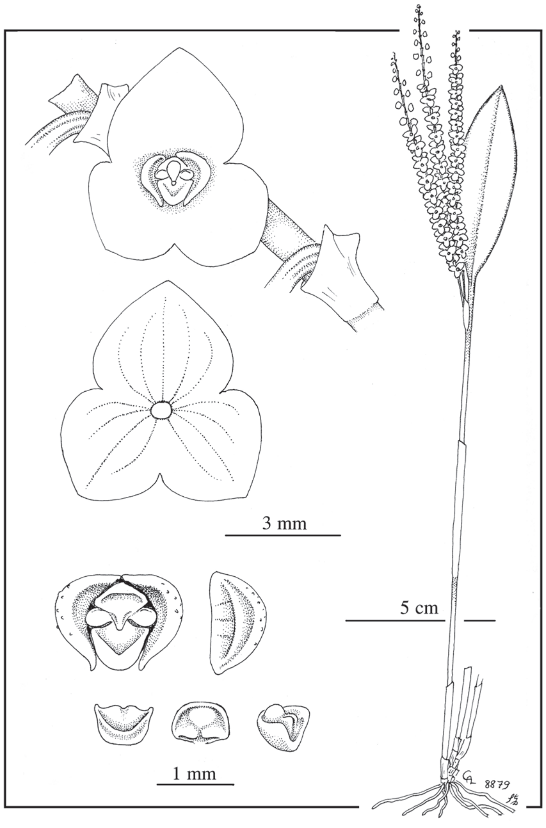

FIGURE 36. *Stelis paraguasensis* Luer

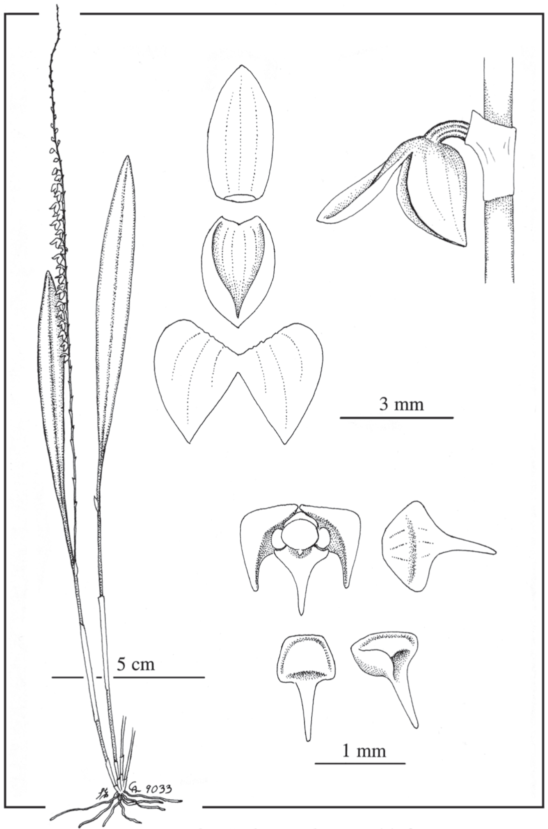

FIGURE 37. *Stelis pardipes* Rchb.f.

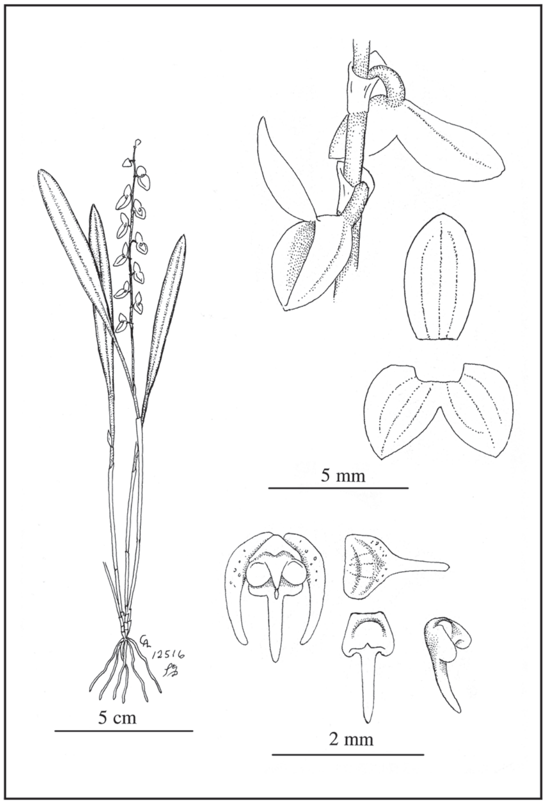

FIGURE 38. *Stelis pardipes* Rchb.f.

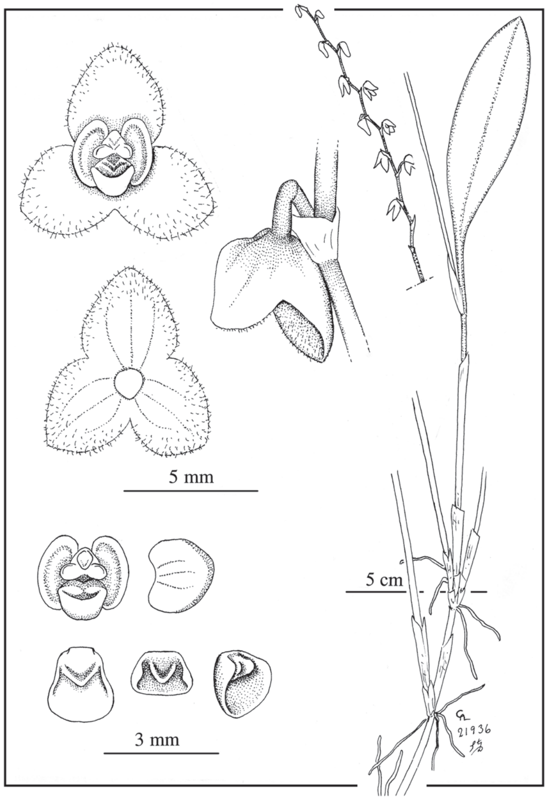

FIGURE 39. *Stelis peregrina* Luer

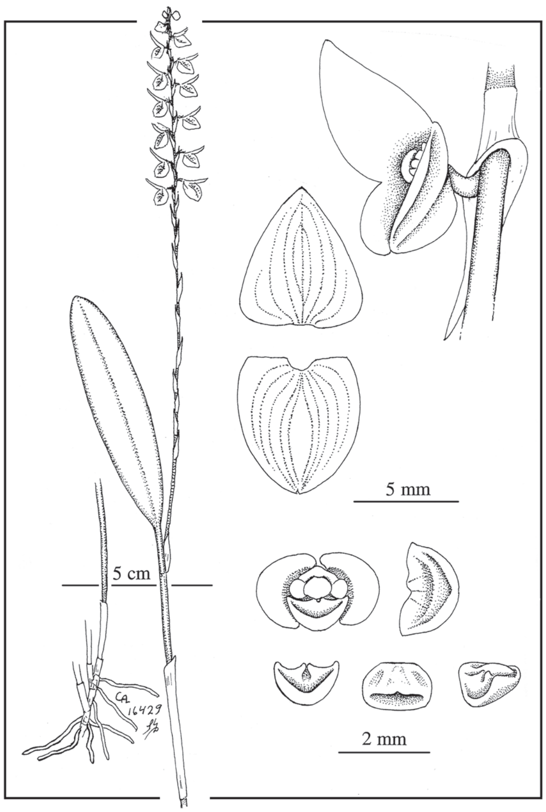

FIGURE 40. *Stelis purpurea* (Ruiz & Pav.) Willd.

Synonyms: *Stelis guatemalensis* Schltr., Bull. Herb. Boiss. 7: 541. 1899. TYPE: GUATEMALA. Huehuetenango, *E. G. Seler 2316* (Holotype: destroyed at B; Neotype, here designated: drawing of type, AMES 23720). Etymology: named for Guatemala, the country where the species was first identified.

Stelis longicuspis Schltr., Repert. Spec. Nov. Regni Veg. 9: 28. 1910. TYPE: COSTA RICA. La Palma, 1459 m, November 1898, *A. Tonduz 12650* (Holotype: destroyed at B). Etymology: from the Latin *longicuspis*, "with a long tooth," referring to the petals and lip.

Stelis patula Schltr., Repert. Spec. Nov. Regni Veg. 10: 359. 1912. TYPE: GUATEMALA. "... bei Coban und Pansamala," 1350–1400 m, *H. von Türckheim 698* (Holotype: destroyed at B). Etymology: from the Latin *patulus*, "spreading," referring to the sepals.

Stelis albertii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 170. 1923. TYPE: COSTA RICA: Without locality, *A. M. Brenes 118* (Holotype: destroyed at B). Etymology: named for Albert M. Brenes who collected this species.

Stelis vagans Schltr., Repert. Spec. Nov. Regni Veg. 27: 48. 1929, *non* Ames 1922. TYPE: BOLIVIA. La Paz: Tipuani, Hacienda Simaco, 1400 m, *O. Buchtien 5063* (Holotype: destroyed at B). Etymology: from the Latin *vagans*, "wandering," referring to a variation of the rhizome.

Stelis triseta Lindl. var. *pardipes* (Rchb.f.) C. Schweinf., Bot. Mus. Leafl. Harvard Univ. 15: 24. 1951.

Plant small to large, epiphytic, densely caespitose to ascending; roots slender. Ramicauls erect, slender, 10–20 cm long, nonprolific, enclosed by a tubular sheath near the middle and 2–3 other sheaths at the base. *Leaf* erect, coriaceous, narrowly elliptical-oblong, with the apex subacute to acute, 7–12 cm long including the petiole 1–2.5 cm long, 1.5–3 cm wide, narrowly cuneate below into the petiole. *Inflorescence* 1–3 erect, 15–25 cm tall, racemes congested to subcongested, distichous to subsecund, many-flowered with many flowers open simultaneously, the peduncle 1–6 cm long, from a node below the apex of the ramicaul, with a spathe 1–2.5 mm long; floral bracts thin, tubular, 2–4 mm long; pedicels 1–3 mm long; ovary 1.5–3 mm long; flowers light green, yellow, rose, to purple or brown; *sepals* glabrous to microscopic-pubescent within, the dorsal sepal erect, elliptical, obtuse, slightly convex, 3–5 mm long, 2–3 mm wide, 3-veined, connate basally to the synsepal, the lateral sepals connate into an ovoid, deeply concave synsepal, 2–5 mm long, 2.5–6 mm wide expanded, 6-veined; *petals* green to purple, transversely triangular to oblong, obtuse, with the margin thickened, contracted into an apiculum, 0.5–1.3 mm long including the apiculum, 0.9–1.5 mm wide, concave below the middle, 3-veined, the base broadly truncate; *lip* green to purple, thick, subquadrate, 0.6–1.5 mm long including the apiculum, 0.5–1 mm wide, 0.4 mm deep, the apex abruptly acute, acuminate into a narrowly triangular process, the bar with a shallow cavity on the anterior surface, the dorsum with a low indistinctly lobed callus, the base truncate, hinged to the base of the column; *column* stout, ca. 0.5 mm long and wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *pardipes*, "a foot spotted like a leopard," referring to spots seen on juvenile cauline sheaths.

Additional specimens examined: COLOMBIA. Antioquia: Frontino, above Frontino toward Nutibara, 1900 m, 5 May 1983 *C; Luer, J. Luer & R. Escobar 9033* (SEL). Quindio: at the pass between Salento and Tocha, 3300 m, 10 May 1993, *C. Luer, J. Luer & R. Escobar 16747* (MO). Tolima: La Linea, terrestrial on road to TV antenna, between Ibague and Armenia, 3500 m, 20 October 1982, *C. Luer & R. Escobar 8496* (SEL). Cauca: above Monchique W of Popayan, 2750 m, 26 July 1978, *C. Luer, J. Luer & R. Escobar 2985* (SEL). Nariño: above Ricaurte, 1950 m, 2 November 1979, *C. Luer, J. Luer & A. Hirtz 4565* (SEL); collected near Ricaurte, flowered in cultivation at La Planada Orquideario, 25 January 1987, *C. Luer 12316* (MO); E of Ricaurte, above abandoned Magnesium mine, 1800 m, 1 November 1979, *C. Luer, J. Luer & A. Hirtz 4518* (SEL). Putumayo: between La Cocha and Sibundoy, 2700 m, 5 August 1979, *C. Luer, J. Luer & R. Escobar 3109* (SEL).

Additional distribution: Mexico, Panama, Colombia, Ecuador, Peru, Bolivia.

Described by Reichenbach.f. in 1866 from a Costa Rican collection, this species is frequent and variable with a wide distribution through Central America and the Andes into Bolivia. A very similar plant from Guatemala was described as *Stelis guatemalensis* by Schlechter in 1899, the only differences being the degree of development of a process at the tips of the sepals and lip. After reviewing numerous collections, it is concluded that these variations occur throughout the distribution.

Vegetatively, the plants are usually slender and caespitose to shortly ascending with narrow leaves. One or two long, erect inflorescences bear numerous, simultaneous, small flowers. The lateral sepals are variously connate, or adherent to their apices into a deeply concave synsepal. The petals are broadly triangular with the thickened apex obtuse, and with the tip contracted into a short or long process. Specimens with the process nearly absent to shorter than the body of the lip have been identified as *Stelis guatemalensis* Schltr.

Stelis pardipes should not be confused with the common, prolific *S. triseta* Lindl. with surprisingly similar, individual flowers.

Stelis peregrina Luer, *sp. nov.* TYPE: COLOMBIA. Putumayo: Santiago San Antonio de Bellavista, Páramo de Bordoncillo, 3240 m, 19 March 1999, *S. M. Pasmiño & M. R. Posso 40* (Holotype: MO; Isotype: PSO). C. Luer illustr. 21936. Fig. 39.

This large species is remarkable for a stout, repent rhizome; stout ramicauls; compressed peduncle, medium-sized, nutant flowers with pubescent, 3-veined sepals and petals; and a lip with a central, "V-shaped" callus.

Plant large, epiphytic, ascending-repent with caespitose components; rhizome stout, 3 mm thick, 3–4 cm between ramicauls, roots coarse. Ramicauls erect, stout, 8–12 cm long, enclosed by a tubular sheath from below the middle and 2–3 other sheaths below and about the base. *Leaf* erect, coriaceous, elliptical, subacute, 8–11 cm long including a petiole ca. 2 cm long, the blade ca. 1.5–2.3 cm wide, cuneate below into the petiole. *Inflorescence* single, the raceme ca. 10 cm long, erect, loose, subflexuous, distichous, the peduncle ca. 8 cm long, compressed; floral bracts oblique, acute, 2.5–3 mm long; pedicels 1.5–2 mm long, acutely deflexed on the ovary, the ovary 1.5 mm long; spathe slender, 2–2.5 cm long, from a node near the apex of the ramicaul; *sepals* "color cafe," antrorse, shortly pubescent, ovate, subacute to obtuse, connate below the middle, 3-veined, the dorsal sepal 4 mm long, 3.5 mm wide, the lateral sepals 3.5 mm long and wide; *petals* yellow, thin, subcircular, concave, with the margin slightly thickened, 1.5 mm long and wide, 3-veined; *lip* yellow, subpyriform, 1.3 mm long, 1.3 mm wide, 1 mm deep, concave below the middle, thin and subcircular above the middle, expanded and more or less erect below the middle, with an erect, "V-shaped" callus in the center, the base truncate, hinged to the base of the column; *column* stout, clavate, ca. 1 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: from the Latin *peregrina*, "a stranger," referring to a strange combination of several morphological features.

This large species is distinguished by a thick, ascending, repent rhizome with caespitose components; a compressed peduncle with a loose, subflexuous raceme; flowers nutant on acutely deflexed ovaries; shortly pubescent, 3-veined sepals; thin, 3-veined petals; and a pyriform lip concave and subcircular below a central, "V-shaped" callus.

Stelis purpurascens A.Rich. & Galeotti, Ann. Sci. Nat. Bot. ser. 3: 3: 18. 1845. TYPE: MEXICO. Veracruz: Mirador, *J. J. Linden 211* (Lectotype, selected by Solano Gómez, 1993: W; Isolectotypes: BR, K). Illustrated in Luer (2007: 78, fig. 297, as *Stelis thermatica* Luer & Dodson).

Synonyms: *Stelis thecoglossa* Rchb.f., Beitr. Orch. Centr.-Am., 93. 1866. COSTA RICA. Desengaño, *H. Wendland s.n.* (Holotype: W). Etymology: from the Greek *thecoglossa*, "encased, or sheathed, tongue," referring to the lip.

Stelis bourgeavii Schltr., Repert. Spec. Nov. Regni Veg. 9: 284. 1911. MEXICO. "Im tale von Cordova, Trinidad," *E. Bourgeau 1914* (Holotype: lost at B). Etymology: named for Eugené Bourgeau, French botanist, who collected this species.

Stelis curvata Schltr., Repert. Spec. Nov. Regni Veg. 10: 358. 1912. GUATEMALA. Cubilguitz, 350 m, *H. von Türckheim II 1889* (Holotype: destroyed at B). Etymology: from the Latin *curvatus*, "curved," referring to leaves and raceme.

Stelis carioi Schltr., Repert. Spec. Nov. Regni Veg. 15: 202. 1918. GUATEMALA. "Bei Guatemala," *C. Bernoulli & R. Cario s.n.* (Holotype:destroyed at B). Etymology: named for Oscar Richard Cario, German physician, co-collector of this species.

Stelis fulva Schltr., Beih. Bot. Centralbl. 36(2): 388, 445. 1918. GUATEMALA. Cubilguitz, 350 m, *H. von Turckheim 4064* (Holotype: destroyed at B). Etymology: from the Latin *fulvus*, "dull yellow-grey," referring to colors of the flowers.

Stelis maxonii Schltr., Beih. Bot. Centralbl. 36(2): 389. 1918. PANAMA. Chiriqui, *W. R. Maxon 5697* (Holotype: destroyed at B, drawing at AMES). Etymology: named for William R. Maxon who collected this species.

Stelis purpusii Schltr., Beih. Bot. Centralbl. 36(2): 391. 1918. MEXICO. Zacuapam, *C. A. Purpus 2111* (Holotype: destroyed at B). Etymology: named for C. A. Purpus who collected this species.

Stelis alfaroi Ames & C. Schweinf., Sched. Orchid. 8: 4. 1925. COSTA RICA. La Fuente, 1200 m, *A. Alfaro s.n.* (Holotype: AMES 29011). Etymology: named for Anastasio Alfaro who collected this species.

Stelis thermatica Luer & Dodson, Monogr. Syst. Bot. Missouri Bot. Gard. 53, 2007. ECUADOR. Esmeraldas: lowland around Esmeraldas, 1000 m, September 1980, *C. Luer, J. Luer, C. and P. Dodson 6839* (Holotype: SEL). Etymology: from the Greek *thermaticus*, "heat tolerant," referring to locality.

Plant medium in size to large, epiphytic, shortly ascending to caespitose; roots slender. Ramicaul erect, slender to stout, 5–22 cm long, enclosed by a tubular sheath near the middle, and 2–3 other sheaths below and at the base. *Leaf* erect, elliptical-obovate to narrowly elliptical-obovate, subacute to obtuse, petiolate, 9–12 cm long including the petiole 2–3 cm long, the blade 1–6 cm wide, cuneate below into the petiole. *Inflorescence* an erect, distichous, many-flowered raceme with many flowers open simultaneously, 10–22 cm long including the peduncle 1–5 cm long, subtended by a spathe 1–2 cm long, from a node below the apex of the ramicaul; floral bracts tubular, oblique, acute, 3–8 mm long, 4 mm wide; pedicels 1–3 mm long; ovary 2–2.5 mm long; *sepals* expanded, sensitive, yellow to green, variously suffused with purple, glabrous externally, cellular-pubescent to pubescent within, connate basally, transversely ovate, obtuse, 3- to 5-veined, the dorsal sepal 2–3.5 mm long, 2.75–4 mm wide, the lateral sepals 2–3 mm long, 2.75–3.5 mm wide; *petals* purple, transversely cuneate-obovate, shallowly concave, 1 mm long, 1–1.3 mm wide, the apex broadly rounded, thickened; *lip* purple, ovoid, 1 mm long, 1–1.4 mm wide, 1 mm deep, shallowly concave below the bar with a glenion, the apex obtuse to rounded with the margin thickened, the dorsum more or less convex with a low callus, the base broadly truncate, hinged to the base of the column; *column* stout, 1 mm long, 1.5 mm wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *purpurascens*, "becoming purple," referring to the color of the flowers.

This low-altitude species is frequent and variable in its wide distribution through Central America, where local variations have been described numerous times. Although well-known from Panama, and from a recent collection from coastal Ecuador, *Stelis purpurascens* has not yet been identified from Colombia, where it is likely to occur.

Vegetatively, plants vary from small to large and robust with a well-developed ramicaul. The inflorescences are elongate, but often not surpassing the leaves. Numerous sensitive flowers are produced simultaneously in a congested, distichous raceme. The color varies through all shades of purple to green. The sepals are minutely pubescent, broadly ovate and obtuse. The petals are cuneate with thickened margins. The lip is ovoid and obtuse with the margin thickened. A glenion descends from the bar from the dorsum beneath the column.

Stelis purpurea (Ruiz & Pav.) Willd., Sp. Pl. 4: 140. 1805.

Basionym: *Humboltia purpurea* Ruiz & Pav., Syst. Veg. Fl. Peruv. et Chil. 235, 1798; Fl. Peruv. Chil. Prodr. 121, t. 27, 1794, *non* Vahl, 1794. TYPE: PERU. Huánuco: *H. Ruiz & J. A. Pavón s.n.* (Holotype: MA). Illustrated in Luer (2009a: 90, fig. 105a). Fig. 40–41.

Synonyms: *Stelis macrocarpa* Kunth, Nov. Gen. Sp. 1: 363. 1816. TYPE: COLOMBIA. Nariño: mountains of Pasto, between village of Yenoi, forest La Trocha and villa Tiendala, 1360 hex., December 1801, *A. Humboldt & A. Bonpland s.n.* (Holotype: P). Etymology: from the Greek *macrocarpos*, "large fruit," referring to the capsules.

Stelis connata C.Presl, Rel. Haenk. 1: 103. 1827. TYPE: PERU. "Huanocco," *T. Haenke s.n.* (Holotype: PRC). Etymology: from the Latin *connatus*, "connate," referring to the lateral sepals.

Stelis cupuligera Rchb.f. & Warsz., Bonplandia 2: 114. 1854. TYPE: PERU. Without locality, *J. von R. Warszewicz s.n.* (Holotype: W). Etymology: from the Latin *cupuliger*, "cup bearing," referring to the bilabiate flowers.

Stelis dubia Lindl., Folia Orch. *Stelis* 8(55). 1859. TYPE: ECUADOR [as PERU]. "Western declivity of the Andes," *W. Jameson s.n.* (Holotype: K). Etymology: from the Latin *dubius*, "doubtful," because of a mistaken similarity to *S. nanegalensis*.

Stelis melanoxantha Rchb.f., Bonplandia 3: 71. 1855. TYPE: COLOMBIA: Norte de Santander: Aspasica, *H. Wagener s.n.* (Holotype: W). Etymology: from the Greek *melano-xantha*, "very dark, yellow," referring to dark purple flowers, yellow at the base.

Stelis acutissima Lindl., Folia Orch. *Stelis* 14(108). 1859. TYPE: ECUADOR. "Western side of Pichincha," *W. Jameson s.n.* (Holotype: K). Etymology: from the Latin *acutissimus*, "very acute," referring to the floral bracts.

Stelis densiflora Lindl., Folia Orch. *Stelis* 16(118). 1859. TYPE: PERU. Chachapoyas, *A. Mathews s.n.* (Holotype: K). Etymology: from the Latin *densiflorus*, "densely flowered," referring to the raceme.

Stelis abrupta Rchb.f., Linnaea 41: 7. 1877. TYPE: COLOMBIA. Antioquia, Medellin, *B. Roezl s.n.* (Holotype: W, drawing at AMES). Etymology: from the Latin *abruptus*, "terminated abruptly," referring to the truncate lip.

Stelis endocharis Rchb.f., Linnaea 41: 8. 1877. TYPE: COLOMBIA. Without data, *B. Roezl s.n.* (Holotype: W). Etymology: from the Greek *endocharis*, "pretty inside," referring to the flowers.

Stelis hemicardia Rchb.f., Linnaea 41: 8. 1877. TYPE: COLOMBIA. Medellin, *B. Roezl s.n.* (Holotype: W). Etymology: from the Greek *hemicardia*, "half-a-heart," referring to the bilabiate flowers.

Stelis rusbyi Rolfe, Mem. Torrey Bot. Club. 4: 261. 1895. TYPE: BOLIVIA. Yungas, *H. H. Rusby 2758* (Holotype: K; Isotypes: AMES, GH, NY). Etymology: named for Henry Hurd Rusby, American medical botanist, who collected this species.

Stelis macrantha Rolfe, Bull. N.Y. Bot, Gard 4: 450. 1907. TYPE: BOLIVIA. Without locality, *M. Bang 1816a* (Holotype: K; Isotypes: AMES, GH, NY). Etymology: from the Greek *makranthos*, "big flowered," referring to the flowers.

Stelis huancabambae Kraenzl., Bot. Jahrb. Syst. 54, Beibl. 117: 20. 1916. TYPE: PERU. Cajamarca, Jaën, "Cordillere östlich von Huancabamba," 2400–2500 m, *A. Weberbauer 6112* (Holotype: destroyed at B). Etymology: named for the community of Huancabamba, near where the species was collected.

Stelis saxicola Schltr., Repert. Spec. Nov. Regni Veg. 10: 452. 1912. TYPE: BOLIVIA. Unduavi, 2800 m, *O. Buchtien 2610* (Holotype: destroyed at B). Etymology: from the Latin *saxicola*, "growing on rocks," referring to the habitat.

Stelis caucae Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7: 85. 1920. TYPE: COLOMBIA. Cauca: West-Cordillera of Cali, 2000 m, *F.C. Lehmann 6923* (Holotype: K; Isotype: LE). Etymology: named for the department of Cauca where the species was collected.

Stelis pachyphylla Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7: 91. 1920. TYPE: COLOMBIA. Antioquia: *M. Madero s.n.* (Holotype: destroyed at B). Etymology: from the Greek *pachyphyllon*, "thick-leaf," referring to the foliage.

Stelis cordibractea Schltr., Repert. Spec. Nov. Regni Veg. Beih. 8: 51. 1921. TYPE: ECUADOR. Chimborazo: "Auf Bäumen in lichten Wäldern der obersten Wald-region an den Westhängen des Chimborazo," 3000–3500 m, *F. C. Lehmann 8212* (Holotype: destroyed at B). Etymology: from the Latin *cordibracteus*, "with cordate bracts," referring to the bracts.

Stelis phaeantha Schltr., Repert. Spec. Nov. Regni Veg. Beih. 9: 68. 1921. TYPE: PERU. Junin: Yanagu, "östlich von Huacapistana," 2300–2400 m, *A. Weberbauer 2128* (Holotype: destroyed at B).

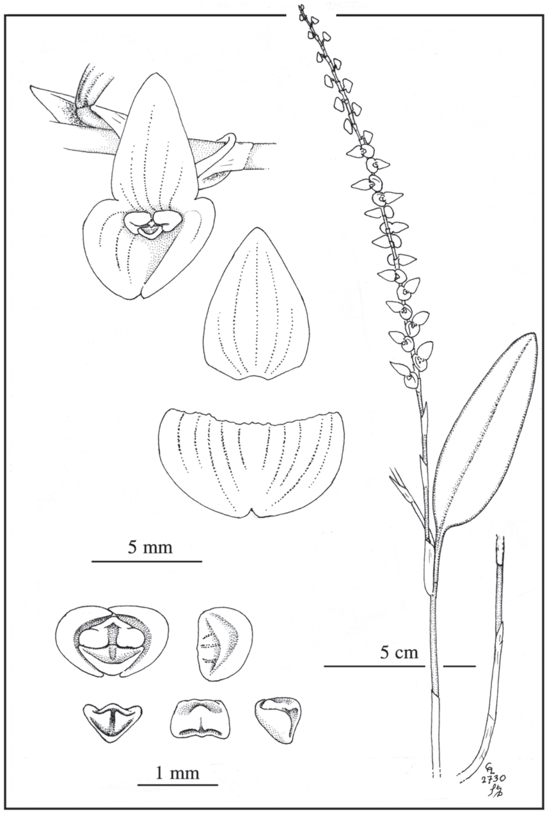

FIGURE 41. *Stelis purpurea* (Ruiz & Pav.) Willd.

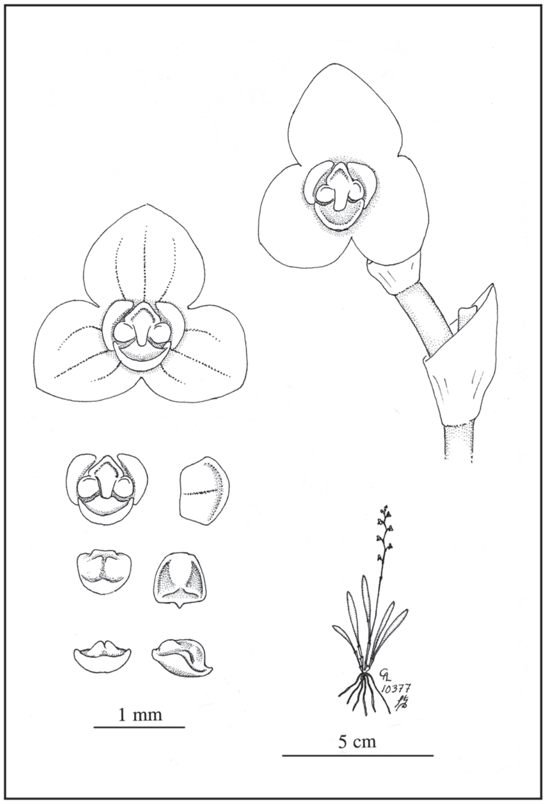

FIGURE 42. *Stelis pusilla* Kunth

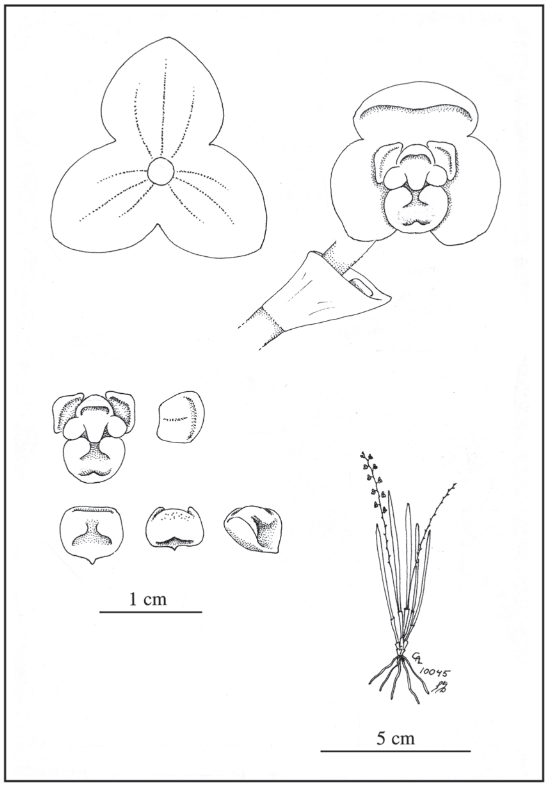

FIGURE 43. *Stelis pusilla* Kunth

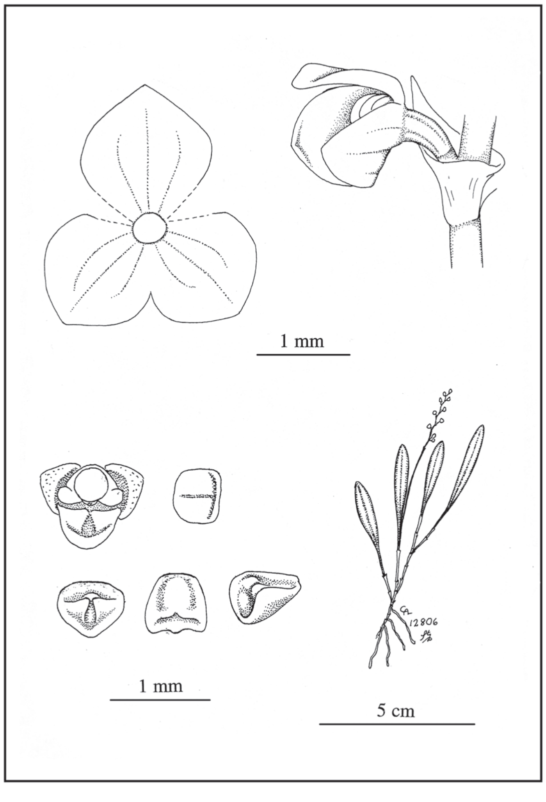

FIGURE 44. *Stelis pusilla* Kunth

Etymology: from the Greek *phaeanthos*, "darkly colored flower," referring to the flowers.

Stelis robusta Schltr., Notizbl. Bot. Gart. Berlin-Dahlem 7: 270. 1918. TYPE: COLOMBIA. Putumayo: between Pasto and Mocoa, 3300 m, May 1921, *W. Hopp 56* (Holotype: destroyed at B). Etymology: from the Latin *robustus*, possibly referring to the large, robust plants.

Stelis robusta Schltr., Repert. Spec. Nov. Regni Veg. Beih. 27: 38. 1924, *non* Schltr. 1918. TYPE: COLOMBIA [as COSTA RICA]: based on the same type as *S. robusta* Schltr. 1918.

Stelis robustior Garay, Bot. Mus. Leafl. Harvard Univ. 27(7–9): 185. 1979, replaced name for *S. robusta* Schltr. 1924 *non* Schltr. 1918. Etymology: from the Latin *robustus*, "robust," referring to the habit.

Stelis yungasensis Schltr., Repert. Spec. Nov. Regni Veg. 27: 49. 1929. TYPE: BOLIVIA. La Paz: Yungas, "Polo-Polo bei Coroico," O. Buchtien 3699 (Holotype: destroyed at B). Etymology: named for the Yungas of Bolivia where the species was collected.

Stelis repanda Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot. Gard. 88: 22, 2002. TYPE: ECUADOR. Zamora-Chinchipe: east of the pass east of Loja, 2150 m, 26 March 1985, *C. Luer, J. Luer, A. Hirtz, and W. Flores 10957* (Holotype: MO). Etymology: from the Latin *repandus*, "repand," referring to the wavy margins of the floral bracts.

Stelis alpina Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 121, 2004. TYPE: ECUADOR. Carchi: west of of the passof Tulcán, 3400 m, 26 March 1991, *C. Luer, J. Luer, J. del Hierro & A. Hirtz* 15094 (Holotype: MO). Etymology: from the Latin *alpinus*, "of a high altitude," referring to the habitat.

Plant medium to large in size, epiphytic, shortly ascending-repent to densely caespitose; roots slender. Ramicaul stout, erect, up to 40 cm long, enclosed by a loose, tubular sheath near the middle and 2–3 other sheaths below and at the base. *Leaf* erect, coriaceous, elliptical, petiolate, with the apex subacute to obtuse, 6–17 cm long including the petiole 0.5–2.5 cm long, 1–5 cm wide, cuneate below into the petiole. *Inflorescence* 1–3 erect, distichous, subdensely many-flowered racemes with many flowers open simultaneously, 18–35 cm long including the peduncle 5–13 cm long, subtended by a spathe 1–2 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, from 12 mm long below to 5 mm long above, more or less undulate; pedicels 3–6 mm long; ovary 2–3 mm long; flowers nutant, bilabiate, purple, yellow, yellow-green, or purple with yellow petals and lip; *sepals* glabrous externally, microscopically pubescent within, purple, yellow-green, or yellow-green, variously suffused with shades of purple, the dorsal sepal erect, ovate-triangular, acute, 5–10 mm long, 5–6 mm wide, 5(–7)-veined, connate to the synsepal for 1 mm, the lateral sepals connate into a broadly ovate, concave synsepal, 5–6.5 mm long, 5–7 mm wide unexpanded, 6(–8)-veined; *petals* purple to yellow, transversely semilunate, 1–1.25 mm long, 2–2.25 mm wide, concave below the broadly rounded apex with the margin thickened and flattened, the base transversely truncate; *lip* purple or yellow, thick, subquadrate, 0.9–1.2 mm long, 1.2–1.5 mm wide, 0.9–1 mm deep, the apex thick, broadly rounded, shallowly concave below the bar with a glenion, the dorsum with a low, more or less trilobed callus, the base truncate, hinged to the base of the column; *column* stout, 1 mm long, 1.2–1.5 mm wide, the anther and the stigma apical, the stigma bilobed.

Etymology: from the Latin *purpureus*, "purple," referring to the color of the flowers.

Additional specimens examined: COLOMBIA. Antioquia: Cerro Padre Amaya, 2900 m, 16 January 1979. *C. Luer, J. Luer & R. Escobar 3699* (SEL). Boyacá: between Arcabuco and Moniquira, 2500 m, 25 Apr. 1982, *C. Luer, J. Luer & R. Escobar 7546, 7547* (SEL). Tolima: Alto de Pozo, W of Ibagué, 3000 m, 20 April 1982, *C. Luer, J. Luer & R. Escobar 7485, 7486* (SEL); southern slope of Mt. Tolima, N of Ibague, 2930 m, 21 Apr. 1982, *C. Luer, J. Luer & R. Escobar 7507* (SEL). Nariño: SE of Ipiales toward Victoria, 3000-3200 m, 22 February 1978, *C. Luer, J. Luer & A. Hirtz 2727,2730* (SEL); at the pass between Salento and Tocha, 3300 m, 10 May 1993, *C. Luer, J. Luer & R. Escobar 16742* (MO). Putumayo: Laguna La Cocha, Ciudadela, near Páramo Bordoncillo, 2800–3000 m, 27 May 1946, *R. E. Schultes & M. Villarreal 7574* (AMES); páramo between La Cocha and Sibundoy, 3000 m, 26 January 1987, *C. Luer, J. Luer, R. Escobar et al. 12537* (MO).

This species is frequent and variable in its wide distribution in the Andes. Apparently because he had no access to an authentic specimen of *Stelis purpurea* (Ruiz & Pav.) Willd., Lindley described three specimens of this species as *S. acutissima, S. densiflora,* and *S. dubia*. No specimen in his herbarium was identified by him as *S. purpurea*. Variations and combinations of variations account for the multitude of synonymous names.

Stelis purpurea is usually a robust species characterized by a very shortly repent to a densely caespitose habit with 1 to 3 many-flowered racemes that usually far exceed the elliptical, petiolate leaves. Occasionally one ramicaul will produce another. The floral bracts are long and acute, often undulate. The flowers are variable in size, some large specimens equaling those of *S. maxima* Lindl. The color varies among all shades of purple to yellow-green. The 5-veined (occasionally 7-veined) dorsal sepal is ovate-triangular, more or less acute, 6–10 mm long, and the lateral sepals are connate into a concave synsepal. The petals are proportionately large with broadly rounded, thick margins. The apex of the lip is also rounded and thick, and often on the dorsum a low, rounded or trilobulated callus, fits beneath the column.

Stelis pusilla Kunth, Nov. Gen. Sp. 1: 361. 1816. TYPE: ECUADOR, *Kingdom of Quito*, 7380 ft., *A. de Humboldt & A. Bonpland s.n.* (Holotype: P). Illustrated in Luer (2009a: 223, fig. 405 and 405c). Five variations shown in Fig. 42–46.

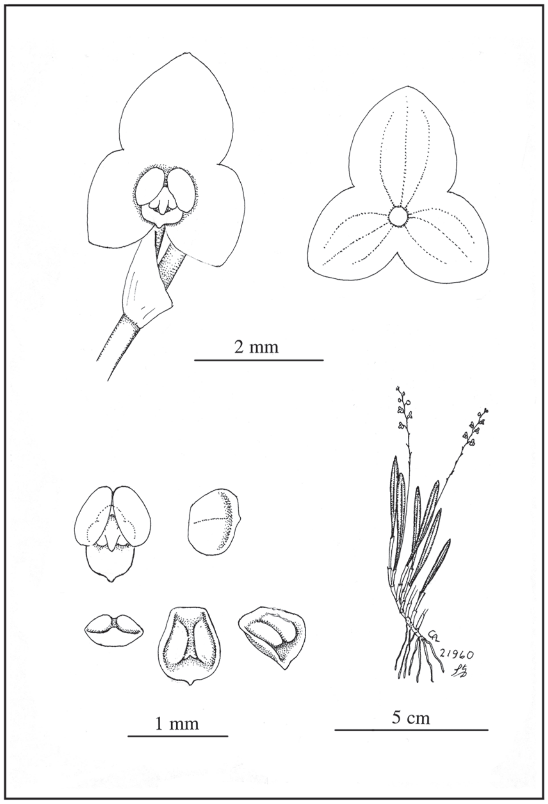

Figure 45. *Stelis pusilla* Kunth

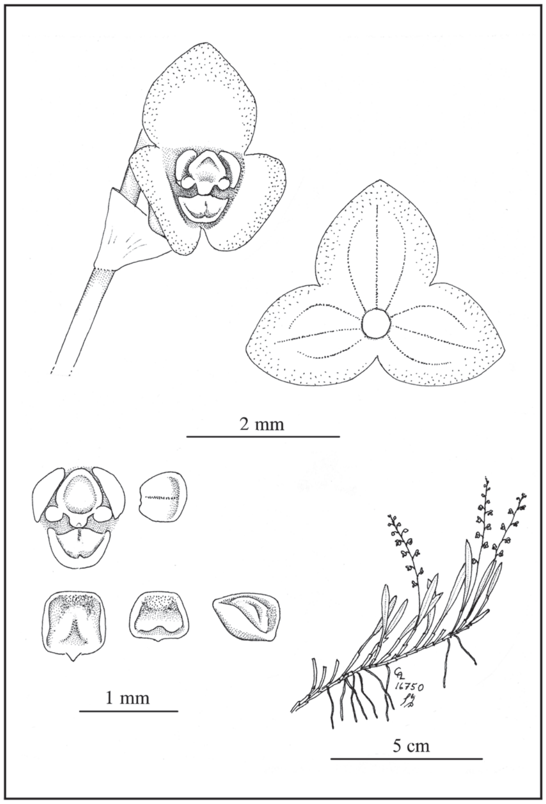

Figure 46. *Stelis pusilla* Kunth

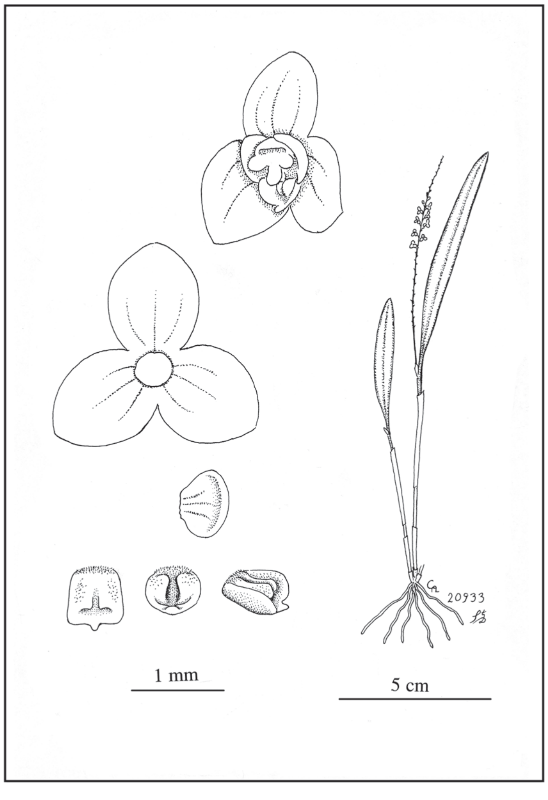

Figure 47. *Stelis schomburgkii* Fawc. & Rendle

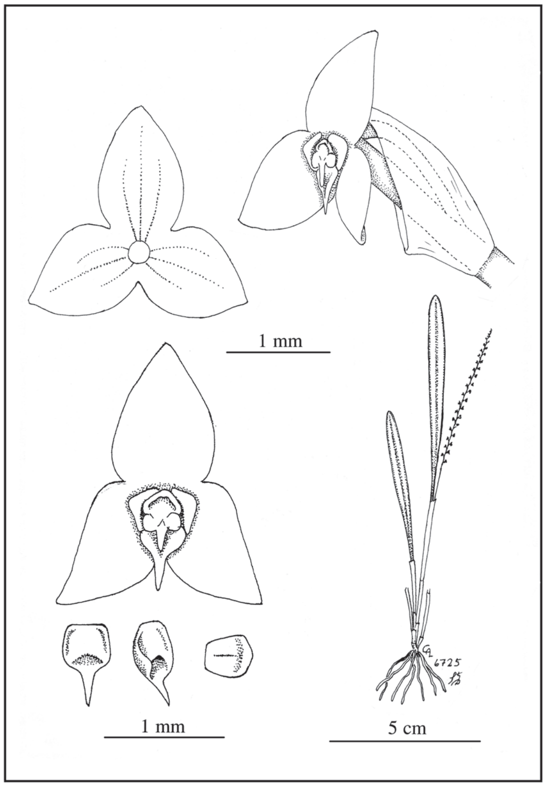

Figure 48. *Stelis spathulata* Poepp. & Endl.

Synonyms: *Stelis herbiola* Lindl., Folia Orchid. *Stelis* 10(73). 1859. TYPE: COLOMBIA. Quindio: without specific locality, ca. 1854, *I. F. Holton s.n.* (Holotype: K). Etymology: from the Latin *herbiolus*, "a little herb," referring to the size of the plant.

Stelis apiculata Lindl., Fol. Orchid. *Stelis* 11(76). 1859. TYPE: ECUADOR ["PERU"]. "Forests of Papallada in the E. Andes," *W. Jameson s.n.* (Holotype: K). Etymology: from the Latin *apiculatus*, "apiculate," referring to the labellum.

Stelis megahybos Schltr., Repert. Spec. Nov. Regni Veg. 14: 122. 1915. TYPE: ECUADOR. "In silvis subandinus vulcani Pululahua," *A. Sodiro 13* (Holotype: destroyed at B). Etymology: from the Greek *megahybos*, "with a large projection," referring to the callus of the lip.

Stelis callicentrum Schltr., Repert. Spec. Nov. Regni Veg. 15: 52. 1917. TYPE: ECUADOR. "Ad arbores in silvis catenae orientalis andium," 3200 m, *A. Mille s.n.* (Holotype: destroyed at B). Etymology: from the Latin *callicentrum*, "central callus," referring to the labellum.

Stelis tenuis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7: 94. 1920. TYPE: COLOMBIA. Cauca: Páramo de Guanacas, 2800–3200 m, 9 January 1886, *F. C. Lehmann 6039* (AMES), C. Luer illust. 21072 (Holotype: destroyed at B; Isotypes: K, LE). Etymology: from the Latin *tenuis*, "thin," referring to the leaves.

Plant small to very small, epiphytic, caespitose to ascending; roots slender. Ramicauls ascending-fasciculate, erect, slender, 1–4 cm long, enclosed by a tubular sheath and 2–3 others below. *Leaf* erect, coriaceous, narrowly elliptical, acute, 2–4 cm long including the petiole ca. 0.5–1 cm long, 0.3–0.8 cm wide, gradually narrowed below into the petiole. *Inflorescence* an erect, sublax, distichous, few- to many-flowered raceme with a few to many flowers opening simultaneously, 2–10 cm long including the peduncle 0.5–4 cm long, from an annulus below the apex of the ramicaul; floral bracts infundibular, 1–2 mm long; pedicels 1 mm long; ovary 0.75 mm long; *sepals* expanded, connate basally, white, yellow, green, rose, light brown, glabrous to microscopically pubescent, ovate, obtuse, dorsal sepal 1–1.75 mm long, 1–1.75 mm wide, 3-veined, the lateral sepals 1–1.75 mm long, 1–1.5 mm wide, 3-veined; *petals* yellow or white, translucent, transversely cuneate, 0.5–0.6 mm long, 0.6–0.7 mm wide, 1-veined, shallowly concave below the broadly obtuse, subtruncate, thickened, apical margin; *lip* yellow or white, thick, subquadrate, 0.75–0.6 mm long, 0.6 mm wide, 0.3 mm deep, the apex obtuse with a small, obtuse apiculum, concave below the bar, the dorsum with a low, indistinctly bilobed callus, minutely pubescent at the base, hinged to the base of the column; *column* stout, ca. 0.6 mm long, 0.6 mm wide, the foot obsolescent, the anther and the bilobed stigma apical.

Etymology: from the Latin *pusillus*, "very small," referring to the habit.

Additional specimens examined: COLOMBIA. Antioquia: Quirama, Río Negro, 2200 m, 13 July 1973, *R. E. Schultes s.n.* (COL, MO); Yarumal, Raton Pelado, above Yamural, 2650 m, 1 May 1984, *C. Luer, J. Luer & R. Escobar 10045* (MO). Cundinamarca: S of Bogotá, above Gutierrez, 2700 m, 19 May 1984, *C. Luer, J. Luer & R. Escobar 10377* (MO). Santander: Bucaramanga, E of Bucaramanga toward Berlin, 3300 m, 7 May 1984, *C. Luer, J. Luer & R. Escobar 10178* (MO). Quindio: at the pass between Salento and Tocha, 3300 m, 10 May 1993, *C. Luer, J. Luer, R. Escobar & A. de Wilde 16750* (MO). Tolima: Alto de Pozo, near the pass, 3300 m, W of Ibaqué, 20 April 1982, *C. Luer, J. Luer & R. Escobar 7482* (SEL). Cauca: Páramo de Guanacas, between Totoro and Inza, 3150 m, 15 November 1982, *C. Luer & R. Escobar 8386* (MO); Popayán, Páramo de Barbillas, SE of Popayán, 3070 m, 27 July 1978, *C. Luer, J. Luer & R. Escobar 3027* (SEL). Valle del Cauca: El Cerrito, between Tenerife and Páramo de Azúcar, 3450 m, 2 April 1993, *P.A. Silverstone-Sopkin 6542A* (CUVC, MO). Cauca: headwaters of Río Lopez, 2500–3000 m, June 1906, *H. Pittier 1059* (AMES), C. Luer illustr. 21960. Nariño: Barbacoas to Pasto, 8000 ft, 5 October 1878, *F. C. Lehmann s.n.* (W); Montaña Aranda, above Pasto, 9500 ft., 10 November 1878, *F. C. Lehmann s.n.* (W). Putumayo: Santiago, San Antonio de Bellavista, 3240 m, 18 March 1999, *S. M. Pasmiño & M. R. Posso 040* (MO, PSO), C. Luer illustr. 21936.

Additional distribution: Venezuela, Haiti, Dominican Republic, Ecuador, Peru, Bolivia.

Stelis pusilla sensu lato is common, variable, and widely distributed in the Andes, often blanketing roadcuts. It is most commonly characterized by a caespitose habit, but depending on the habitat, the rhizome ascends and branches, often forming large, tangled masses. When clusters are pulled apart, rhizomes of various lengths are found. Larger plants with similar inflorescences but with long-repent rhizomes and larger flowers were described as *S. polyclada* by Lindley. Variations have acquired many names, some of which could be regarded as specific.

The ramicauls of *Stelis pusilla* are shorter than the narrow leaves they bear, and the inflorescences are usually longer than the leaves. The flowers are small with glabrous, ovate, obtuse, 3-veined sepals 1–1.5 mm long. The colors of the flowers vary from white to yellow or light green, or rarely rose or buff. The petals are thin and 1-veined with a narrowly thickened margin. The lip is subquadrate with a small, obtuse apiculum on the apical margin, and the bar is variously cleft. The apiculum is sometimes almost absent.

Stelis schomburgkii Fawc. & Rendle, J. Bot. 48: 108. 1910. TYPE: VENEZUELA: Roraima expedition, ca. 1844, *R. Schomburgk 1025* (Holotype: K). Illustrated in Dunsterville and Garay (1966: 289, as *Stelis aprica* Lindl.). C. Luer illustr. 20933. Fig. 47.

Plant medium in size, epiphytic, densely caespitose; roots slender. Ramicauls erect, slender, 4–7 cm long, with a tubular sheath from below the middle and 1–2 sheaths below and at the base. *Leaf* erect, coriaceous, narrowly elliptical, acute, 7–8 cm long including a petiole ca. 1 cm long, the blade 0.6 cm wide in the dry state, gradually narrowed to the petiole. *Inflorescence* single, 7–8 cm long; the raceme erect, congested, many-flowered, secund, the peduncle ca. 2 cm long, subtended by a slender spathe 5–6 mm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, 1 mm long; pedicels 1 mm long; ovary 1 mm long; *sepals* similar, glabrous to sparsely pubescent, connate basally, elliptical-subcircular, obtuse, 1.25 mm long, 1.75 mm wide, 3-veined; *petals* transversely obovate, shallowly concave, without a transverse callus, 0.4 mm long, 0.6 mm wide, 3-veined, the apex broadly rounded with the margin thickened; *lip* subquadrate, 0.6 mm long, 0.6 mm wide, 0.25 mm deep, concave below a cleft bar, the apex truncate, with an obtuse apiculum between marginal angles, the dorsum slightly convex, minutely short-pubescent at the base, the base broadly truncate, hinged to the base of the column; *column* stout, ca. 0.8 mm long and wide, the anther and the stigma apical, the stigmatic lobes appear to have been expanded.

Etymology: named for Robert Hermann Schomburgk, collector of the species.

This species was collected during the Roraima expedition in the Guayana highlands, most likely in Venezuela (Steyermark, 1981). It is related to the widely distributed *Stelis foetida* O. Duque. *Stelis schomburgkii* is similar but smaller, with narrower leaves and smaller flowers with nearly circular sepals. The lip is more quadrate, being no longer than wide. The truncate apex is also subtridentate with the central apiculum being short and obtuse. The illustration and description provided here were made from the type collection of *Schomburgk 1025* at K. It had been reduced to the synonymy of *S. aprica* Lindl. in Dunsterville and Garay (1966: 288). No collection of *S. schomburgkii* is known from Colombia, where it is likely to occur.

Stelis sesquipedalis Lindl., Orch. Linden. 3. 1846. TYPE: VENEZUELA. Mérida: Sierra Nevada, 9000 ft, August 1842, *J. J. Linden 632* (Holotype: K). Illustrated in Dunsterville and Garay (1966: 305).

Synonym: *Stelis ephippium* Luer & R. Escobar, Harvard Pap. Bot. 22(1): 39, 2017, *nom. invalid*. TYPE: COLOMBIA. Norte de Santander: Alto de Santa Inéz, 2100 m, 13 May 1984, *C. Luer, J. Luer & R. Escobar 10323* (MO). Etymology: from the Latin *ephippium*, "a saddle" in allusion to the shape of the lip (see comment in Luer, 2018: 19).

Plant large, epiphytic, densely caespitose. Ramicauls erect, stout, 4–5 cm long, with a loose tubular sheath from below the middle, another 2 sheaths below and at the base. *Leaf* erect, coriaceous, elliptical, obtuse to rounded at the tip, 7–12 cm long including a petiole 1.5–2 cm long, the blade 2–2.7 cm wide in the dry state, cuneate below to the petiole. *Inflorescence* single; 20–25 cm tall, the raceme erect, congested, distichous, many-flowered; floral bracts oblique, acute, 3–4 mm long; pedicels 2 mm long; ovary 1–1.5 mm long; the peduncle 7–8 cm long, subtended by a spathe ca. 1 cm long, from a node below the apex of the ramicaul; *sepals* dark purple, glabrous, the dorsal sepal ovate, acute, 5 mm long, 3 mm wide, 3-veined with an incomplete lateral pair, the lateral sepals broadly ovate, oblique, obtuse, 3 mm long, 3.5 mm wide, 3- to 4-veined; *petals* yellow with purple edge, transversely ovate, 1.2 mm long, 2 mm wide, 3-veined, concave below a thick, rounded apex, with a transverse carina; *lip* yellow with purple edge, subquadrate, 1.75 mm long, 1.4 mm wide, 1 mm deep, concave below a thick, protruding, rounded, solid callus, with a superficial glenion on the anterior surface, the apex rounded, the dorsum filled with the thick, erect, ovoid callus that extends from the base to include the bar, to within the space within the apical margin, the base truncate, hinged to the base of the column; *column* stout, ca. 1.5 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: from the Latin *sesquipedalis*, "a foot and a half," alluding to the height of the plant.

Additional specimens examined: COLOMBIA. Santander: Alto de Santa Inéz, ca. 2500 m, coll. by E. Valencia, flowered in cultivation at Colomborquídeas 23 May 1995, *C. Luer 17600* (SEL); Alto de Santa Inéz, ca. 2500 m, probably coll. by E. Valencia, flowered in cultivation at Colomborquídeas, 16 May 1993, *C. Luer 16878* (SEL).

A collection of *Stelis sesquipedalis* from Páramo La Negra, Mérida, Venezuela, by G. C. K. Dunsterville (see citation above) and also illustrated by Elmer Smith (Garay, 1980: plate 46) was identified as the Peruvian *S. lanceolata* Lindl. No material from the type of *S. lanceolata* is available, but a photograph of an isotype at B shows the plant to be slender with a narrow, acute leaf. In addition to westernmost Venezuela, similar plants found in the adjacent Eastern Cordillera of Colombia have been redescribed as *S. ephippium* Luer & R. Escobar.

This handsome species is characterized by large, elliptical leaves with shorter ramicauls and a long, multiflowered raceme with a proportionately small spathe. The sepals are unequal and dark purple, the dorsal sepal being ovate, acute and 3-veined, or incompletely 5-veined, with the lateral sepals being broadly ovate and obtuse. An erect, ovoid, shallowly channeled callus fills the middle of the lip. The large callus suggests a saddle, the callus rising in the center, being the horn thereof.

Stelis silverstonei Luer, Orquideología 22(1): 62, 2001. TYPE: COLOMBIA. Chocó: San José del Palmar, Cerro del Torrá above the heliport, 1920–1950 m, 8 August 1988, *P. Silverstone-Sopkin 4147* (Holotype: CUVC). Illustrated in Luer (2016a: C. Luer illustr. 13221, fig. 5, as *Stelis caespitula* Luer & R. Escobar).

Synonym: *Stelis caespitula* Luer & R. Escobar, Harvard Papers in Bot. 21(1): 63, 2016. TYPE: COLOMBIA. Antioquia: El Retiro, above Colomborquídeas, coll. by W. Teague, 17 April 1988, *C. Luer 13221* (Holotype: MO). Etymology: from the Latin *caespitulus*, "small-caespitose," referring to the tiny habit.

Plant very small, epiphytic, densely caespitose; roots slender. Ramicauls erect, slender, 3–4 mm long, enclosed by a tubular sheath and another sheath at the base. *Leaf* erect, coriaceous, elliptical, acute, 8–20 mm long, 2.5–4 mm wide, cuneate below to the base. *Inflorescence* single; 4–8 cm long; the raceme erect, sublax, distichous, many-flowered with most flowers open simultaneously; the peduncle ca. 2 cm long, from a node at the apex of the ramicaul; floral bracts oblique, acute, 1–1.5 mm long; pedicels 1 mm long; ovary 0.5 mm long; *sepals* yellow, more or less suffused with purple, microscopically cellular, connate in lower third, broadly ovate, obtuse, 3-veined, the dorsal sepal 1.2–2 mm long, 1.5 mm wide, the lateral sepals oblique, 1.2–1.4 mm long, 1–1.2 mm wide; *petals* yellow or green, thin, obcuneate, broadly obtuse, slightly thickened on the margin, without a transverse callus, 0.4 mm long, 0.6 mm wide, 1-veined; *lip* yellow or green, ovoid, acute, 0.6 mm long, 0.6 mm wide, 0.3 mm deep, with a thick, broadly channeled, ovoid callus from the base to near the tip, the base broadly truncate, hinged to the base of the column; *column* clavate, ca. 0.7 mm long and wide, the anther and the stigmatic lobes apical.

Etymology: named for Dr. Phillip Silverstone-Sopkin of the University Del Valle, Cali, Colombia, collector of this species.

Additional specimens examined: COLOMBIA. Antioquia: El Retiro, above Colomborquídeas, 2280 m, 26 April 1983, *C. Luer & J. Luer 8837* (SEL).

This tiny, caespitose species has been found in two areas of the Western Cordillera of Colombia. A many-flowered raceme with little, yellowish flowers exceeds the leaf by at least twice its length. The sepals are 3-veined, and the petals are thin and 1-veined. The lip is filled with a tall, widely cleft callus that extends from the base to the acute apex.

The original illustration and description of *Stelis silverstonei* were made from an old, wilted flower that persisted on a depauperate plant.

Stelis spathulata Poepp. & Endl., Nov. Gen. Sp. Pl. 1: 46. 1836. TYPE: PERU. Huanuco: *E. Poeppig s.n.* (Holotype: W). Illustrated in Luer (2009a: 226: fig. 412). Fig. 48.

Synonyms: *Stelis tricuspis* Schltr., Repert. Spec. Nov. Regni Veg. 3: 276. 1907. COSTA RICA. La Uruca, *H. Pittier 949* (Holotype: destroyed at B). Etymology: from the Latin *tricuspis*, "sharply three-toothed," referring to the labellum.

Stelis cuspidata Ames, Sched. Orch. 3: 2. 1923. COSTA RICA. Without locality, *ex* C. H. Lankester *ex Hort. Kewensis* (Holotype: AMES 22858). Etymology: from the Latin *cuspidatus*, "sharply pointed," referring to the labellum.

Plant small, epiphytic, caespitose; roots slender. Ramicauls fasciculate, erect, slender, 1–2.5 cm long, enclosed by 2–3 loose, tubular sheaths. *Leaf* erect, coriaceous, narrowly obovate, obtuse to rounded at the apex, 2–4 cm long including an indistinct petiole 1–1.5 cm long, 0.4–0.8 cm wide, narrowly cuneate below into the subpetiolate base. *Inflorescence* an erect, dense, distichous, many-flowered raceme, with many flowers open simultaneously, 5–8 cm long including the peduncle less than 1 cm long, from a node below the apex of the ramicaul; floral bracts infundibular, oblique, acute, 3–3.5 mm long, imbricating, enclosing the pedicels, ovaries and much of the flower; pedicels 0.75 mm long; ovary 1 mm long; *sepals* similar, greenish white to pale yellow-green, glabrous, more or less cellular-glandular near the apices, connate basally, ovate, acute, 1.5 mm long, 1 mm wide, 3-veined, the lateral sepals parallel, oblique; *petals* greenish white, cuneate-obovate, shallowly concave, 0.5 mm long, 0.4 mm wide, 1-veined, the apex truncate, thickened and cellular-glandular externally; *lip* greenish white, ovoid-trilobed, 0.6 mm long, 0.5 mm wide, 0.3 mm deep, the lateral margins obtusely angled, the apex abruptly narrowly triangular, the disc with a pair of slightly convex, cellular-glandular, callous plates with rounded, apical margins, concave between on the anterior surface, the base broadly truncate, hinged to the base of the column; *column* stout, 0.5 mm long, the anther and the bilobed stigma apical.

Etymology: from the Latin *spathulatus*, "spathulate," referring to the leaves.

Additional specimens examined: COLOMBIA. El Valle: La Cumbre, 1400–1700 m, 11 September 1922, *E. P. Killip 11173* (AMES, NY); El Valle: Hoya del Río Sanquinini, La Laguna, 1250 m, 19 December 1943, *J. Cuatrecasas 15630* (AMES). Chocó: near San José Palmar, 600 m, collected by J. Posada, flowered in cultivation at Colomborquídeas, 20 November 1981, *C. Luer 6725* (SEL). Cauca: Meseta de Popayán, cultivated in Popayán by Amalia Lehmann de Sarria, 16 November 1982, *C. Luer 8461* (SEL). Valle del Cauca: Yotoco, W of Buga, 1500 m, 1 May 1995, *P. Silverstone-Sopkin 7536* (CUVC, MO).

Additional distribution: Ecuador, Venezuela, Panama, Costa Rica.

This little species is widely distributed from Costa Rica through much of the Andes. It is characterized by densely fasciculated, more or less ascending ramicauls with very narrowly obovate leaves and a longer, slender raceme of tiny flowers subtended by proportionately long, imbricating floral bracts that contain the pedicel, ovary and lower half of the tiny flowers. The sepals are acute with the laterals antrorse. The 1-veined petals are truncate at the thickened apex. The lip is tridentate with a longer, pointed middle lobe. The lip is similar to that of *Stelis hymenantha*, which is most easily distinguished from *S. spathulata* by short floral bracts that do not engulf the sepals.

Stelis superbiens Lindl., Folia Orch. *Stelis* 8(57). 1859. TYPE: COLOMBIA. "New Grenada," *W. Purdie s.n.* (Holotype: K; Isotype: GH). Illustrated in Luer (2009a: 226, fig. 414). Fig. 49–51.

Synonyms: *Stelis nanegalensis* Lindl., Folia Orch. *Stelis* 8(54). 1859. TYPE: ECUADOR. "Forests of Nanegal, and Western declivity of Pichincha," *W. Jameson s.n.* (Holotype: K). Etymology: named for Nanegal in Ecuador, where the plant was collected.

Stelis koehleri Schltr., Repert. Spec. Nov. Regni Veg. 10: 386. 1912. TYPE: PERU. Chanchamayo, Río Blanco, Hacienda Santa Teresa, on coffee trees, 1400 m, *E. Köhler s.n.* (Holotype: destroyed at B). Etymology: named for E. Köhler who collected the species.

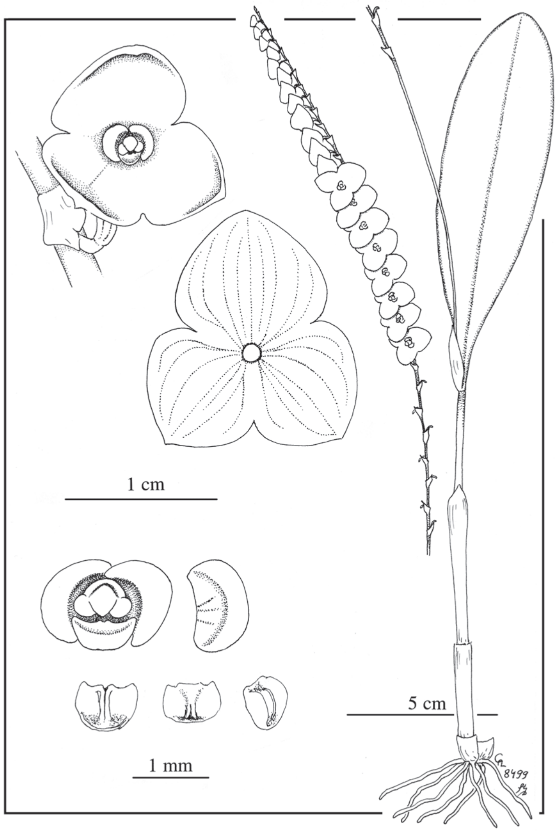

FIGURE 49. *Stelis superbiens* Lindl.

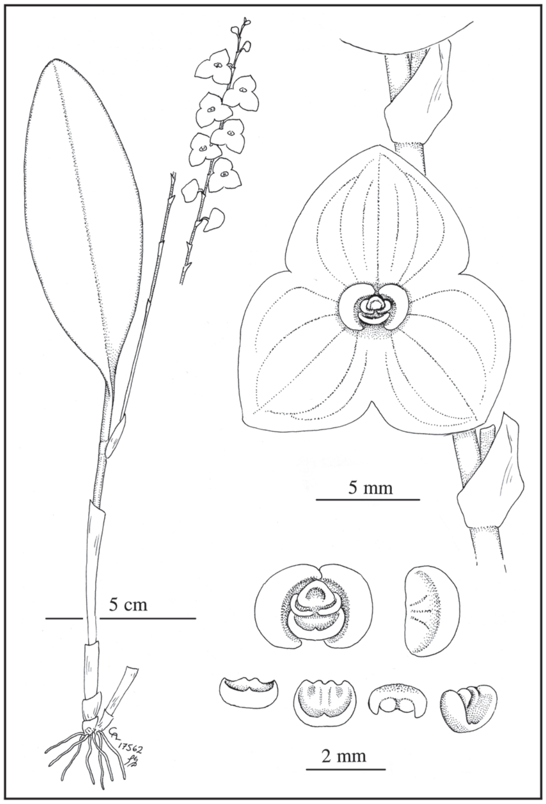

FIGURE 50. *Stelis superbiens* Lindl.

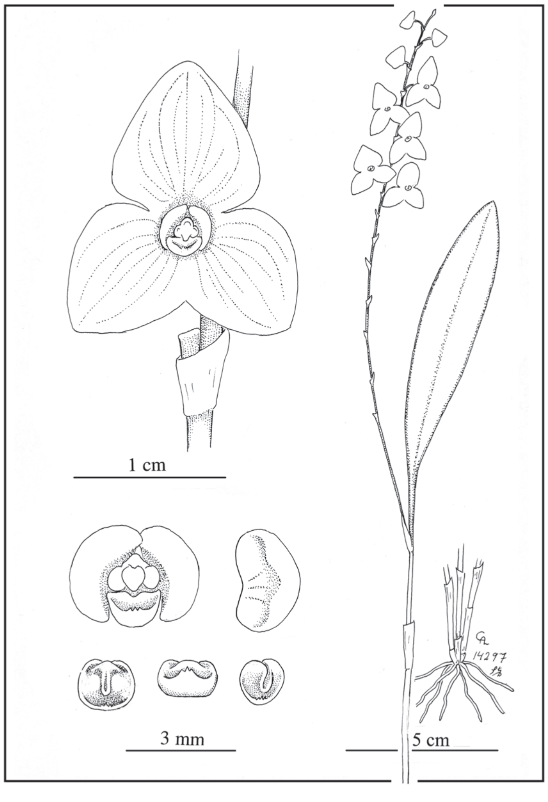

FIGURE 51. *Stelis superbiens* Lindl.

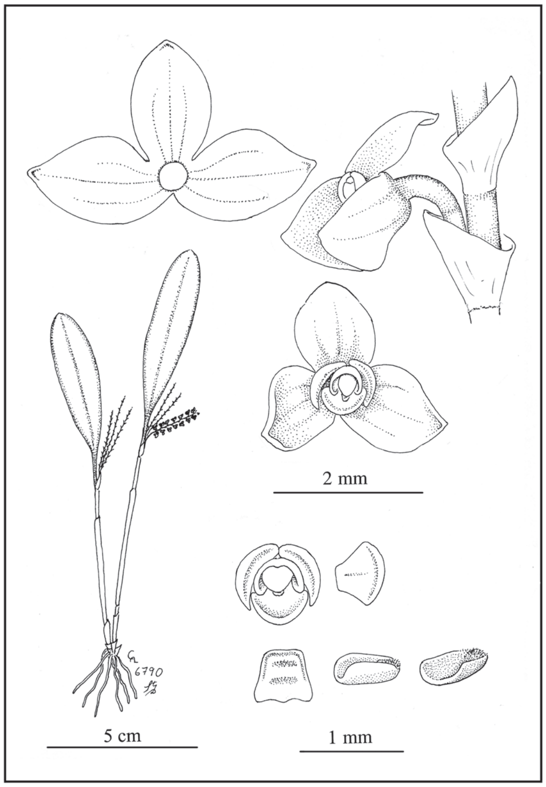

FIGURE 52. *Stelis tenuilabris* Lindl.

Stelis vulcanica Schltr., Repert. Spec. Nov. Regni Veg. 14: 125. 1916. TYPE: ECUADOR. "In crateri vulcani Pulalagua," *A. Sodiro 19* (Holotype:destroyed at B). Etymology: from the Latin *vulcanicus*, "volcanic," referring to Pulalagua Crater.

Stelis convallarioides Garay, Canad. J. Bot. 34: 351. 1956. TYPE: COLOMBIA. Choco: Tutunendo, 20 km. N of Quibdo, 80 m, 19–20 May 1931, *W. A. Archer 2143* (Holotype: US). Etymology: from the Latin *convallarioides*, "like a *Convallaria*, a genus of the *Liliacea*," without apparent reason.

Plant medium in size to large, epiphytic, caespitose; roots slender. Ramicauls erect, stout, 5–17 cm long, enclosed by a loose, tubular sheath near the middle and 2–3 other sheaths below and at the base. *Leaf* erect, coriaceous, elliptical to obovate-oblong, subacute to obtuse, 10–16 cm long including the petiole 1–2 cm long, the blade 2–4 cm wide, cuneate below into the petiole. *Inflorescence* an erect, subdense, distichous, many-flowered raceme with several to many flowers open simultaneously, 10–30 cm long including the peduncle 2–10 cm long, with a few bracts, subtended by a spathe 1–2 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, 3–5 mm long; pedicels 3–4 mm long; ovary 3–6 mm long; *sepals* expanded, yellow, green, or purple, glabrous externally, pubescent or cellular-glandular within, connate to near the middle, transversely ovate, obtuse, the dorsal sepal 5–10 mm long, 6–10 mm wide, 5- to 9-veined, the lateral sepals 5–10 mm long, 6–10 mm wide, 5- to 7-veined; *petals* yellow or purple, transversely cuneate-obovate, shallowly concave, 1–1.25 mm long, 1.6–2 mm wide, the apex broadly rounded with the margin thickened; *lip* yellow or purple, thick, transversely subquadrate, 1 mm long, 1.3–1.5 mm wide, 0.7–1 mm deep, concave inside the apical margin, the margin thin, minutely apiculate to triapiculate, the disc transversely callous, the callus (bar) curved with a long, narrow glenion, the base broadly truncate, hinged to the base of the column; *column* stout, 1 mm long, 1.5 mm wide, the anther and the stigma apical, the stigma bilobed.

Etymology: from the Latin *superbiens*, "superb," referring to the fine qualities of the species.

Additional specimens examined: COLOMBIA. Antioquia: Parque Nacional Las Orquídeas, 1300 m, 30 March 1988, *A. Cogollo et al. 2827* (JAUM, MO); Dabeiba, Chimiado, fl. in cult. by M. & O. Robledo at La Ceja, *C. Luer 14297* (MO); Yarumal, road to El Cedro, 1650 m, 15 March 1989. *C. Luer, J. Luer, S. Dalström & W. Teague 14164* (MO); Alejandria, 1600 m, collected by M. Zapata, fl. in cult. at Colomborquídeas, 12 December 1992, *R. Escobar 5011A* (MO); Hda. Normandia, collected by Pacho Lopez, fl. in cult. by Colomborquídeas, 23 May 1995, *C. Luer 17562* (MO). Risaealda: Belén de Umbria, trail to Alto de Serna, 2300 m, flowered at El Jordan, 12 September 1992, *A. de Wilde 3942* (MO); Pueblo Rico, road to TV tower, 2400 m, 14 May 1993, *C. Luer, J. Luer, R. Escobar et al. 16828* (MO). Chocó: Cajanania, 1600 m, 11 November 1883, *F.C. Lehmann 3346* (AMES); Urrao, road to Carmen de Atrato, 2500 m, collected by E. Valencia, May 1993, flowered in cultivation at Colomborquídeas, 23 May 1995 *C. Luer 17577* (MO). Valle del Cauca: Yotoco. W of Buga, 1600 m, 29 April 1995, *P. Silverstone-Sopkin 7473* (CUV, MO). Nariño: above Ricaurte, 1800 m, flowered in cultivation at La Planada Orquideario, 25 January 1987, *C. Luer 12514* (MO). Without data, flowered in cultivation at Colomborquídeas, 22 November 1981, *C. Luer 6718* (SEL); Without data, flowered in cultivation at Cota by Helmuth Schmidt-Mumm, 22 November 1982, *C. Luer 8499* (SEL).

Additional distribution: Panama, Costa Rica, Guatemala, Mexico, Venezuela, Ecuador, Peru, Bolivia.

This spectacular species is widely distributed through the Andes, but less spectacular populations occur from Central America to Bolivia. It is distinguished by a large leaf and a long, erect inflorescence of large, flat, widely spread flowers. The color varies from yellow, green, to purple. The sepals are glabrous or microscopically pubescent, broadly ovate, obtuse, 5-veined, and shallowly connate. The petals are large and 3-veined with a thickened margin. The lip is proportionately small, and with the margin minutely apiculate. This apiculum varies without respect to any morphological character. It varies from a mere, minute, simple point (rarely absent), minutely tridentate, to an acute, triangular apiculum accompanied by acute points at either side, producing a triapiculate process.

Stelis tenuilabris Lindl., Folia Orch. *Stelis* 4(20). 1859. TYPE: VENEZUELA. Aragua: near Colonia Tovar, *A. Fendler 1471* (Holotype: K; Isotypes AMES, BR, G, GOET). Illustrated in Dunsterville and Garay (1959: 413, as *Stelis alata* Lindl.). Fig. 52.

Synonyms: *Stelis alata* Lindl., Folia Orch. *Stelis* 18(2–3). 1859. TYPE: VENEZUELA. Without data, *A. Fendler 2154* (Holotype: K). Etymology: from the Latin *alatus*, "winged," referring to a winged dorsal sepal.

Stelis canaliculata Rchb.f., Gard. Chron. 1718. 1872. TYPE: COLOMBIA. Cundinamarca: "Bogotá," without collection data, flowered in cultivation at Hillfield House, Reingate, 1872, *W. Saunders 2707* (Holotype: W). Etymology: from the Latin *canaliculatus*, "channeled," referring to the midline groove of the leaf.

Stelis myriantha Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7: 90. 1920, *non* Lindl. 1859. TYPE: COLOMBIA. Cauca: La Ceja near Inza, 1800–2200 m, *F. C. Lehmann 6920* (Holotype: destroyed at B). Etymology: from the Greek *myrianthos*, "many-flowered," referring to the inflorescence.

Apatostelis alata (Lindl.) Garay, Bot. Mus. Leafl. 27: 187. 1979.

Stelis abbreviata Luer & Hirtz, Monogr. Syst. Bot. Missouri Bot. Gard. 112: 16. 2007. TYPE: ECUADOR. Napo: Reventador, 1300 m, 14 September 1994, *A. Hirtz, W. & J. Coeck 9044* (Holotype: MO).

Plant small to medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 3–9 cm long, enclosed by tubular sheaths. *Leaf* erect, coriaceous, narrowly elliptical, subacute to acute, 5–8 cm long including a petiole ca. 1 cm long, 1–1.5 cm wide, narrowly cuneate below into the petiole. *Inflorescence* 2–20 (*fide* Schlechter), simultaneous, erect, congested, distichous, few- to many-flowered racemes, 2–4 cm long, from a node below the apex of the ramicaul, subtended by a spathe 5–6 mm long; floral bracts, oblique, obtuse, 1.5 mm long, pedicels 1 mm long; ovary 1 mm long; flowers yellow or green; *sepals* nearly free, glabrous, ovate, acute, 1.5–2 mm long, 1–1.5 mm wide, 3-veined; *petals* thin, cuneate, 0.5 mm long, 0.5 mm wide, 1-veined, with the apex subtruncate, thickened along the margin, shallowly concave; *lip* cuneate-subquadrate, 0.5 mm long, 0.6–0.8 mm wide, with the apex thin, broad, subtruncate, shallowly concave below a low bar, the base truncate, hinged to the base of the column; *column* stout, 0.5 mm long and wide, the anther and stigma apical.

Etymology:: from the Latin *tenuilabris*, "with thin lip," referring to the labellum.

Additional specimens examined: ECUADOR: Pastaza: near Mera, 1100 m, 4 April 1956, *E. Asplund 20125* (AMES, S); near Mera, 1000 m, March 1976, *C. Luer, J. Luer & P. Taylor 921* (SEL); same collection, flowered in cultivation 23 December 1981, *C. Luer 6790* (MO); east of Mera, 1100 m, 28 March 1984, *C. Luer, S. Dalström, T. Höijer & J. Kuijt 9783* (MO); Morona-Santiago: new road west of Macas toward Guamote, 1900 m, 16 January 1989, *C. Luer, J. Luer & A. Hirtz 13938* (MO).

This species, known from the Andes of Venezuela to Ecuador, was collected by Fendler near Colonia Tovar, Venezuela, and described by Lindley as *Stelis tenuilabris* in his *Folia Orchidacea* (see reference above). After the printing type had been set, an additional collection by Fendler, but without collection data, was added as a note, in which it was described as *S. alata* (Lindley, 1859: 18, No. 2–3).

Vegetatively variable, *Stelis tenuilabris* is characterized by narrow, acute leaves; a few to many racemes shorter than the leaves; small flowers with ovate, acute leaves; 1-veined petals; and a distinctive lip that is thin and shallowly concave below a low, transverse callus above the middle. This lip is well-demonstrated by *S. alata* in Elmer Smith's illustration (Garay, 1980: plate 88, *sub Apatostelis* Garay), and G. C. K. Dunsterville's drawing (cited above).

Much of *Stelis polybotrya* Lindl. is similar, but the lip is concave below a thick bar with a glenion.

Stelis triplicata Lindl., Folia Orchid. *Stelis* 2(5). 1859. TYPE: ECUADOR. Pichincha: Cordillera near Pacha, *W. Jameson 1357* (Holotype: K). Illustrated in Luer (2009a: 228, fig. 418). Fig. 53.

Plant large, epiphytic, caespitose; roots slender. Ramicauls erect, stout, 8–12 cm long, enclosed by a large, loose, tubular sheath from below the middle and 2 others below. *Leaf* erect, thickly coriaceous, elliptical, obtuse, 9–17 cm long, 3–5 cm wide, cuneate below into a subpetiolate or petiolate base 2.5 cm long. *Inflorescence* an erect, congested, distichous, many-flowered raceme with flowers overlapping, 20–40 cm long including the peduncle ca. 10 cm long, with a spathe 1.5–2.5 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acuminate, imbricating, 10–12 mm long below to 6 mm long above; pedicels 4–7 mm long, within the floral bract; ovary 2–3 mm long; flowers purple to orange-brown; *sepals* glabrous, transversely ovate, obtuse, deeply connate, the dorsal sepal 5–9 mm long, 6.5–11 mm wide, 7-veined, the lateral sepals 4–9 mm long, 6–8 mm wide, 5- to 6-veined; *petals* triangular, obtuse, 1.5 mm long, 2.5 mm wide, with a transverse callus, the margin broad, flat; *lip* subquadrate, 0.9–1.5 mm long, 1.3–1.5 mm wide, 1 mm deep, shallowly concave below a thick bar with a relatively large glenion, the apex obtuse with a broad margin, the dorsum with a broad, low, minutely pubescent callus, the base broadly truncate, hinged to the base of the column; *column* stout, 1 mm long, 1.5 mm wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *triplicatus*, "three-plicate," referring to plicate corners between the sepals, undoubtedly an artifact caused by drying and hydration of an old, or wilted flower.

Additional specimens examined: COLOMBIA. Antioquia: without collection data, flowered in cultivation at La Ceja, 17 October 1977, by Marta and Oscar Robledo, *C. Luer 2079* (SEL).

This large species, uncommonly found in Colombia and Ecuador, is distinguished by a large, robust habit, and a long, congested raceme of large, alternating floral bracts from which large flowers protrude. The flowers from the original Jameson collection were undoubtedly old, because wrinkles are drawn by Lindley on the type-sheet, and Elmer Smith (Garay, 1980: plate 47) drew the wrinkles as well. The sepals of freshly pickled flowers are not wrinkled. The sepals are large and transversely ovate with the dorsal sepal multiveined, and the petals are thick and obtusely triangular. The lip is concave below the bar and obtuse, not remarkably distinct. The lip illustrated by Elmer Smith (Garay, 1980: plate 47) is elongated and protruding. A similar elongated lip was found on one specimen collected by Stig Dalström as illustrated in Luer (2009a: 228, fig. 418a).

Stelis triseta Lindl., Folia Orch. *Stelis* 17(126). 1859. TYPE: BOLIVIA. La Paz: Yungas, 1846, *T. C. Bridges s.n.* (Holotype: K). Illustrated in Luer (2004: 115, fig. 312).

Plant medium to large, epiphytic, prolific or scandent; roots slender. Ramicauls erect to ascending, slender, prolific, 3–15 cm long, enclosed by a tubular sheath from below the middle and 1–2 sheaths at the base. *Leaf* erect, coriaceous, narrowly elliptical, acute, petiolate, 4–10 cm long including the petiole 0.5–1.5 cm long, the blade 1–2 cm wide, cuneate below into the petiole. *Inflorescence* an erect, congested, distichous, many-flowered raceme with many flowers open simultaneously, 4–17 cm long including the peduncle 1–5 cm long, from a node below the apex of the ramicaul; floral bracts oblique, acute, 2.5–3 mm long; pedicels 1–1.5 mm long; ovary 1.5–2 mm long; *sepals* green, yellow, rose to purple, glabrous, the dorsal sepal erect, elliptical, obtuse, 3–4 mm long, 2–3 mm wide, 3- to 5-veined, connate basally to

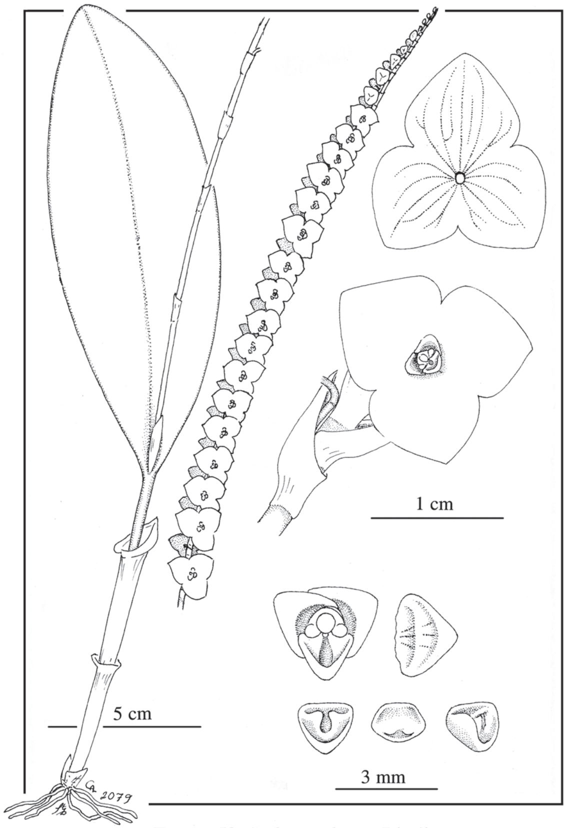

FIGURE 53. *Stelis triplicata* Lindl.

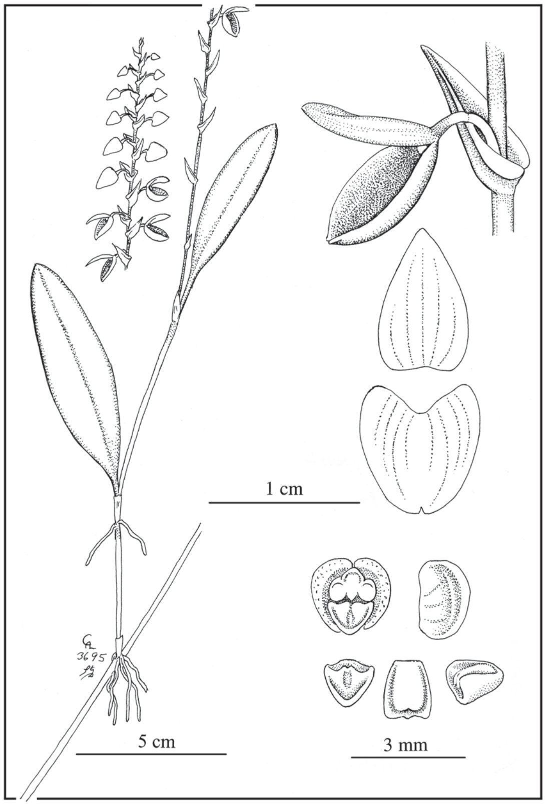

FIGURE 54. *Stelis truncata* Lindl.

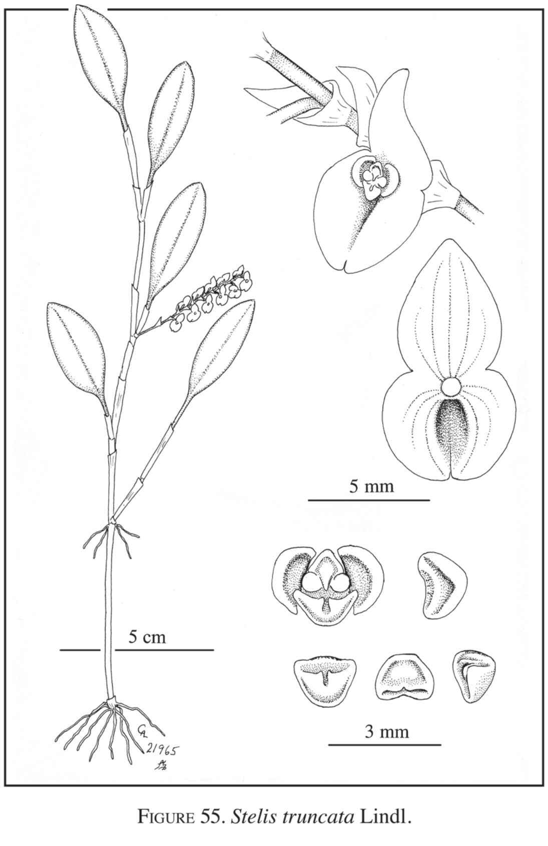

FIGURE 55. *Stelis truncata* Lindl.

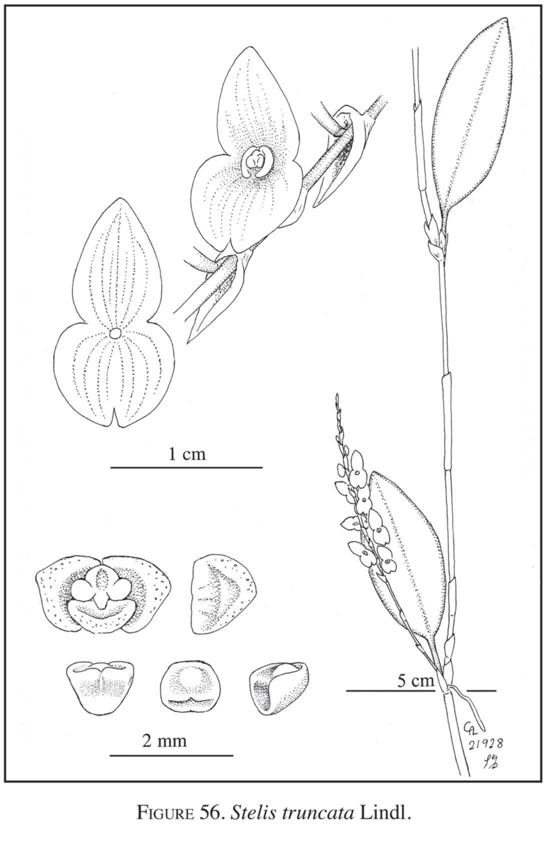

FIGURE 56. *Stelis truncata* Lindl.

the synsepal, the lateral sepals connate into an ovoid, deeply concave synsepal, 2.5–3.5 mm long, 3.5 mm wide expanded, 6-veined; *petals* transversely oblong, the obtuse apex long-apiculate, 1–1.5 mm long including the apiculum, 1–1.5 mm long with the apiculum, 1–1.5 mm wide, concave below the thickened margin, 3-veined; *lip* thick, subquadrate, 0.5–0.75 mm long, 0.6 mm wide, the obtuse apex abruptly contracted into a narrowly triangular apiculum, 0.5–0.75 mm long, the dorsum broad, with a rounded callus to obscurely tricallous, with a shallow cavity on the anterior surface at the base of the apiculum, the base truncate, hinged to the base of the column; *column* stout, 0.75 mm long, 1 mm wide, the anther and bilobed stigma apical.

Etymology: from the Latin *triseta*, "three-bristled," referring to the aristate petals and lip.

Additional specimens examined: COLOMBIA. Antioquia: Yarumal, 30 km N of Santa Rosa de Osa, 2580 m, 14 March 1989, *C. Luer, J. Luer, S. Dalström & W. Teague 14148* (MO). Boyacá: between Arcabuco and Moniquirá, 2500 m, 25 April 1982, *C. Luer, J. Luer & R. Escobar 7558* (SEL).

Additional distribution: Venezuela, Ecuador, Peru, Bolivia.

Stelis triseta is frequent in its wide distribution through the Andes. The flowers are similar to those of the also frequent and variable, but always caespitose, *S. pardipes* Rchb.f., from which it is easily distinguished by the prolific or scandent habit. Both species are characterized by small, bilabiate flowers with the tips of the sepals and petals setiform of variable lengths.

In Luer (1909b), collections of *Stelis triseta* were erroneously considered to be variations of the twice-larger *S. bicornis* Lindl. Following Dunsterville and Garay (1965: 298–299, as *S. biserrula* Lindl.), small variations of *S. bicornis*, or *S. triseta*, were erroneously considered to be *S. biserrula* Lindl. *Stelis bisserula* was poorly described, because the Jameson's collection from Ecuador has only buds. A dissection of two buds hydrated in ammonia revealed the dorsal sepal to be 5-veined, and the petals totally devoid of an apiculum. All specimens seen of the Ecuadorian *S. triseta* have 3-veined sepals, and petals with an apiculum. In Luer (2009a: 53), the description of *S. biserrula* applies to *S. triseta*. *Stelis biserrula* is illustrated and described as *S. propagans* Luer & Hirtz in Luer (2004: 128 and 137, fig. 119, respectively). Neither *S. bicornis* nor *S. biserrula* are known from Colombia.

Stelis truncata Lindl., Comp. Bot. Mag. 2: 353. 1836. TYPE: PERU. Chachapoyas, *A. Mathews s.n.* (Holotype: K). Illustrated in Luer (2009a: 91, fig. 339). Fig. 54–56.

Synonyms: *Stelis fruticulus* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7: 88. 1920. TYPE: COLOMBIA. Antioquia: Alto de Alegrias, 2500–2800 m, October, *F. C. Lehmann 8214* (Holotype: destroyed at B; Isotypes: AMES, K, LE, NY). Etymology: from the Latin *fruticulus*, "a little shrub," referring to the habit. *Stelis virgulata* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 27: 40. 1924. TYPE: COLOMBIA. Nariño: between Pasto and Mocoa, 3000 m, May 1921, *W. Hopp 44* (Holotype: lost at B). Etymology: from the Latin *virgulatus*, "with little twigs," referring to the prolific habit.

Plant large, epiphytic, caespitose below, prolific above; roots slender. Ramicauls erect, stout, prolific, 5–15 cm long, with a tubular sheath below the middle and 1–2 sheaths at the base. *Leaf* erect, coriaceous, elliptical, acute, 5–11 cm long including the petiole 0.5–2 cm long, the blade 1–4 cm wide in the dry state, cuneate below into the petiole. *Inflorescence* an erect, strict, congested, simultaneously many-flowered raceme, 5–23 cm long including the peduncle 2–8 cm long, from a node below the apex of the ramicaul, subtended by a narrow spathe 10–18 mm long; floral bracts oblique, acute, 9 mm long below, 4 mm long above; pedicels 2–4 mm long; ovary 1.5–2 mm long; flowers yellow-green, orange, to purple; *sepals* glabrous, the dorsal sepal ovate, acute, 6–9 mm long, 4–6 mm wide, 5-veined, the lateral sepals ovate, oblique, connate to near the middle, or near the apex into a variably concave, bifid synsepal, 4–8 mm long, 5–8 mm wide, 8-veined; *petals* lunate, broadly rounded, with a slightly roughened, apical margin, 1.5 mm long, 2 mm wide, 3-veined; *lip* subovoid, shallowly concave below a bar with a glenion, the apex obtuse, 0.75–1 mm long, 1–1.5 mm wide, 1 mm deep, the dorsum with a broad, low, rounded callus, the base broadly truncate, hinged to the base of the column; *column* stout, ca. 1.5 mm long and wide, the anther and the bilobed stigma apical.

Etymology: from the Latin *truncatus*, "truncate," referring to the labellum.

Additional specimens examined: COLOMBIA. Antioquia; Cerro Padre Amaya, 2900 m, 16 January 1979, *C. Luer, J. Luer & R. Escobar 3695* (SEL). Santander: Bucaramanga, E of Bucaramanga toward Berlin, 2500 m, 3 November 1981, *C. Luer & R. Escobar 6569* (SEL). Putumayo: Laguna La Cocha, Ciudadela, near Páramo de Bordoncillo, 2800–3000 m, 27 May 1946, *R. E. Schultes & M. Villarreal 7576* (AMES, MO. SEL); between Laguna La Cocha and Páramo Tábano, 2800–3000 m, 1 June 1946, *R. E. Schultes & M. Villarreal 7777, 7849* (AMES. MO, SEL); Sibundoy, 2800 m, 30 June 1953, *R. E. Schultes & I. Cabrera 20097* (AMES). Santiago, San Antonio de Bellavista, Páramo de Bordoncillo, 3240 m, *S. M. Pasmiño & M. R. Posso 012* (PSO, MO), C. Luer illustr. 21928; N side of Laguna de la Cocha, 3200 m, 8 April 1958, *D. S. Correll Co496* (AMES), C. Luer illustr. 21965. Chocó: San José del Palmar, Cerro del Torrá, 2500 m, 17 August 1988, *P. A. Silverstone-Sopkin 4508* (CUVC, MO), C. Luer illustr. 21981.

Additional distribution: Ecuador, Bolivia.

This large, robust, widely distributed species is obviously related to the common and variable *Stelis purpurea* (Ruiz & Pav.) Willd., but it is easily distinguished from the latter by the prolific habit. The plant is long-scandent with stout, superposed ramicauls with elliptical, petiolate leaves. The flowers are similar, easily falling within the variations found in *S. purpurea*. The dorsal sepal is ovate, subacute, 5-veined and about 1 cm long. The lateral sepals are connate into a synsepal, but the depth of the synsepal is variable. The petals are 3-veined and thick with a transverse carina. The lip is concave below a bar with a glenion.

LITERATURE CITED

Barros, F. 2004. Taxonomic and nomenclatural notes on Brazilian Orchidaceae. Pages 7–22 in K. S. Manilal and C. Sathish Kumar, eds., *Orchid Memories—A Tribute to Gunnar Seidenfaden*. Mentor Books & Indian Association for Angiosperm Taxonomy, Calcutta.

Dunsterville, G. C. K. and L. A. Garay. 1959. *Venezuelan Orchids Illustrated*. Vol. I. Andre Deutsch Limited, London.

———. 1965. *Venezuelan Orchids Illustrated*. Vol. III. Andre Deutsch Limited, London.

———. 1966. *Venezuelan Orchids Illustrated*. Vol. IV. Andre Deutsch Limited, London.

Garay, L. A. 1980. Systematics of the genus *Stelis* Sw. Botanical Museum Leaflets 27(7–9): 167–204, plates 43–97.

Lindley, J. 1845. A century of new genera and species of Orchidaceous plants [in several parts]. The Annals and Magazine of Natural History 15(100): 383–386.

———. 1859. *Folia Orchidacea*, *Stelis* Swartz. J. Mattews, London.

Luer, C. A. 1981. Miscellaneous new species and combinations in the Pleurothallidinae (Orchidaceae). Phytologia 49(3): 197–240.

———. 2002. Icones Pleurothallidinarum XXIV. Monographs in Systematic Botany from the Missouri Botanical Garden 88: 1–122.

———. 2004. Icones Pleurothallidinarum XXVI. Monographs in Systematic Botany from the Missouri Botanical Garden 95: 1–265.

———. 2007. Icones Pleurothallidinarum XXIX. Monographs in Systematic Botany from the Missouri Botanical Garden 112: 1–130.

———. 2009a. Icones Pleurothallidinarum XXX. Monographs in Systematic Botany from the Missouri Botanical Garden 115: 1–265.

———. 2009b. Miscellaneous new species in the Pleurothallidinae. Selbyana 30, 1: 1–71.

———. 2016a. *Icones Stelidarum (Orchidaceae) Colombiae*. Harvard Papers in Botany 21(1): 59–92.

———. 2016b. *Icones Stelidarum (Orchidaceae) Colombiae* II. Harvard Papers in Botany 21(2): 193–225.

———. 2017a. *Icones Stelidarum (Orchidaceae) Colombiae* III. Harvard Papers in Botany 22(1): 27–60.

———. 2017b. *Icones Stelidarum (Orchidaceae) Colombiae* IV. Harvard Papers in Botany 22(2): 81–112.

———. 2018. *Icones Stelidarum (Orchidaceae) Colombiae* V. Harvard Papers in Botany 23(1): 19–45.

Romero-González, G. A. and G. Carnevali Fernández-Concha. 2000. *Orchids of Venezuela, an Illustrated Field Guide*. 2nd ed. Armitano Editores, Caracas.

Solano Gómez, R. 1993. El género *Stelis* Sw. (Orchidaceae: Pleurothallidinae) en México. Orquídea (Mexico City) 13(1-2): 1–112.

Stafleu, A. and R. S. Cowan. 1981. *Taxonomic Literature*. 2nd ed. Vol. 3. Bohn, Scheltema & Holkema, Utrecht, and W. Junk, The Hague.

Steyermark, J. A. 1981. Erroneous citations of Venezuelan localities. Taxon 30(4): 816–817.

ERRATUM

In previous issues of *Icones Stelidarum Colombiae*, the date of publication of John Lindley's *Folia Orchidacea, Stelis*, may have followed what was given on the title page, "Nov. 1, 1858." Nonetheless, according to Stafleu and Cowan (1981: 57), this portion of Lindley's work was published most likely in February 1859.

NOTES ON THE NOMENCLATURE OF NEOTROPICAL CAPPARACEAE: AN ANSWER TO *GLOBAL FLORA*

Xavier Cornejo[1]

Abstract. The 90 new combinations on Neotropical Capparaceae published in *The Global Flora* (Plant Gateway, 2018) are here discussed and clarified. On the basis of morphologic and molecular studies, the name of *Morisonia* L. cannot be applied in a broad sense for all Neotropical Capparaceae. Therefore, the names proposed by Christenhusz and Byng are placed in synonymy here.

Keywords: Capparaceae, Neotropics, nomenclature

The Global Flora, Vol. 4, published by Plant Gateway (2018), provides 3,286 new combinations, 90 belonging to Neotropical Capparaceae discussed in this note. All are regarded here as inconsistent, erratic, and without nomenclatural value.

Plant Gateway (2018) presents an incomplete list of Capparaceae in which the great morphological diversity of the former *Capparis* s.l. from the New World has been dramatically reduced to a single genus, *Morisonia* L., without any discussion about morphology and without providing a new generic circumscription of the proposed *Morisonia* sensu Christenhusz and Byng (Plant Gateway, 2018).

Regarding morphology, *Morisonia* is characterized by the calyx totally fused around the corolla in bud, at anthesis rupturing more or less irregularly into 2–4 sepaloid segments, and the filaments adnate at base to form an ascending "skirt," which eventually falls off as a unit, leaving an undulating scar inserted on, and surrounding, the short gynophore. As none of the remaining species of Neotropical Capparaceae present those characters, on the basis of morphology the use of *Morisonia* as proposed by Christenhusz and Byng is impossible (Plant Gateway, 2018). Thus, *Morisonia* represents a highly polymorphic genus, composed of species that exhibit "a great diversity of types of calyces and corollas, with different aestivation, several types of nectaries, fruits and embryos" (Cornejo and Iltis, 2008c) and, therefore, an unnatural and hard to understand genus. Accepting *Morisonia*, we would go back—without solving anything—to the same old problem of a single generic name as was *Capparis* s.l. in the Neotropics. The morphological characters of *Morisonia* provided here make evident that the study of the types and original descriptions of those names and of the morphology of the species of Capparaceae were ignored by Christenhusz and Byng (Plant Gateway, 2018).

Furthermore, the introductory paragraph of Capparaceae (Plant Gateway, 2018: 139) claims that "many of these genera will still not be monophyletic," citing only Tamboli et al. (2018). Contradictorily, Tamboli et al. (2018), states: "Efforts for renaming the New World Capparis taxa have been done by Cornejo and Iltis (2006, 2008a,b,c, 2010; Iltis and Cornejo 2007, 2011), and their efforts are greatly supported by previous phylogenetic analysis (Cardinal-McTeague et al., 2016) and in this analysis." The only exception was the barely polyphyletic condition of *Capparidastrum* (Cardinal-McTeague et al., 2016; not mentioned in Tamboli et al., 2018), which was subsequently solved with the establishment of *Neocapparis* (Cornejo, 2017), providing stable, natural, and morphologically and molecularly well-defined genera of Capparaceae in the New World.

Another erroneous statement written in the same introductory paragraph (Plant Gateway, 2018: 139) was that "not all taxa have been transferred from *Capparis*." However, what they have done is transfer names from some synonyms that have no nomenclatural value, generating more confusion and increasing superfluous names as new synonyms.

The nomenclatural proposal on Neotropical Capparaceae by Christenhusz and Byng presented in *The Global Flora*, Vol. 4 (Plant Gateway, 2018), has neither morphological nor molecular support. Therefore, none of those combinations have nomenclatural value and they are relegated to synonymy herein.

Anisocapparis speciosa (Griseb.) Cornejo & Iltis, J. Bot. Res. Inst. Texas 2(1): 65. 2008.
Basionym: *Capparis speciosa* Griseb., Abh. Königl. Ges. Wiss. Göttingen 24: 18. 1879.
Synonyms: *Capparis speciosa* Griseb. var. *normalis* Kuntze, Rev. Gen. Pl. 3: 7. 1898. *Morisonia speciosa* (Griseb.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Atamisquea emarginata Miers ex Hook. & Arn., Bot. Misc. 3(8): 143. 1833.
Synonym: *Morisonia atamisquea* (Kuntze) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Belencita nemorosa (Jacq.) Dugand, Caldasia 2 (9): 371. 1944.
Basionym: *Capparis nemorosa* Jacq., Enum. Syst. Plant 24. 1760.

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Synonyms: *Morisonia nemorosa* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Belencita hagenii Karst., en C. Koch, Berliner Allg. Gartenzeitung 25(4): 25, t. 1. 1857. *Morisonia hagenii* (Karst.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Calanthea pulcherrima (Jacq.) Miers, Proc. Roy. Hort. Soc. London 4: 161. 1864.
Basionym: *Capparis pulcherrima* Jacq., Enum. Syst. Pl. 24. 1760.
Synonyms: *Linnaeobreynia pulcherrima* (Jacq.) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia pulcherrima* (Jacq.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Calanthea stenosepala (Urb.) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 119. 2008.
Basionym: *Capparis stenosepala* Urb., Symb. Antill. 5: 529. 1908.
Synonym: *Morisonia stenosepala* (Urb.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Caphexandra heydeana (Donn. Sm.) Iltis & Cornejo, Harvard Pap. Bot. 16(1): 67. 2011.
Basionym: *Capparis heydeana* Donn. Sm., Bot. Gaz. 18(6): 197. 1893.
Synonym: *Morisonia heydeana* (Donn. Sm.) Christenh. & Bing, The Global Flora 4:141 (2018), ***syn. nov.***

Capparicordis crotonoides (Kunth) Iltis & Cornejo, Brittonia 59: 248. 2007.
Basionym: *Capparis crotonoides* Kunth, Nov. Gen. et Sp. 5: 95, tab. 437. 1821.
Synonyms: *Quadrella crotonoides* (Kunth) J. Presl, in Berchtold & J. Presl, Přir. Rostlin 2: 260. 1825. *Colicodendron crotonoides* (Kunth) Hutch., Gen. Fl. Plants 2: 309. 1967. *Morisonia crotonoides* (Kunth) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Capparicordis tweediana (Eichler) Iltis & Cornejo, Brittonia 59(3): 251. 2007.
Basionym: *Capparis tweediana* Eichler in Martius Fl. Bras. 13(1): 273. 1865.
Synonyms: *Colicodendron tweedianum* (Eichler) Hutch., Gen. Fl. Pl. 2: 309. 1967. *Morisonia tweediana* (Eichler) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparicordis yunckeri (Standl.) Iltis & X. Cornejo, Brittonia 59(3): 253. 2007.
Basionym: *Capparis yunckeri* Standl., Field Mus. Nat. Hist., Bot. Ser. 9(4): 291. 1940.
Synonym: *Morisonia yunckeri* (Standl.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparidastrum bonifazianum (Cornejo & Iltis) Cornejo & Iltis, Harvard Pap. Bot. 13: 233. 2008.
Basionym: *Capparis bonifaziana* Cornejo & Iltis, Novon 15: 397. 2005.
Synonym: *Morisonia bonifaziana* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Capparidastrum coimbranum (Cornejo & Iltis) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 233. 2008.
Basionym: *Capparis coimbrana* Cornejo & Iltis, Britttonia 57: 156. 2005.
Synonym: *Morisonia coimbrana* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Capparidastrum cuatrecasanum (Dugand) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 233. 2008.
Basionym: *Capparis cuatrecasana* Dugand, Caldasia 1: 41. 1941.
Synonym: *Morisonia cuatrecasana* (Dugand) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Capparidastrum discolor (Donn. Sm.) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 233. 2008.
Basionym: *Capparis discolor* Donn. Sm., Bot. Gazette 24: 389. 1897.
Synonym: *Morisonia discolor* (Donn. Sm.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Capparidastrum frondosum (Jacq.) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 232. 2008.
Basionym: *Capparis frondosa* Jacq., Enum. Syst. Pl. 24. 1760.
Synonyms: *Pleuteron frondosa* (Jacq.) Raf., Sylva Tellur. 109. 1838. *Uterveria frondosa* (Jacq.) Bertol., Horti Bonon. Pl. Nov. 2: 8. 1839. *Morisonia frondosa* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparis elegans Mart., Fl. 22 (Beibl. 1): 24. 1839. *Capparidastrum elegans* (Mart.) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia elegans* (Mart.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum grandiflorum Cornejo & Iltis, Harvard Pap. Bot. 15(1): 155. 2010.
Synonym: *Morisonia grandiflora* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum humile (Hassl.) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 234. 2008.
Basionym: *Capparis humilis* Hassl., Repert. Spec. Nov. Regni Veg. 12: 252. 1913.
Synonym: *Morisonia humilis* (Hassl.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum macrophyllum (Kunth) Hutch., Gen. Fl. Pl. 2: 310. 1967.
Basionym: *Capparis macrophylla* Kunth, Nov. Gen. Sp. 5: 91. 1821.
Synonym: *Morisonia macrophylla* (Kunth) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum megalospermum Cornejo & Iltis, Harvard Pap. Bot. 15: 159. 2010.
Synonym: *Morisonia megalosperma* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum mollicellum (Standl.) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 234. 2008.
Basionym: *Capparis mollicella* Standl., Proc. Biol. Soc. Wash. 37: 44. 1924.
Synonym: *Morisonia mollicella* (Standl.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum osmanthum (Diels) Cornejo & Iltis, Harvard Pap. Bot. 13: 234. 2008.
Basionym: *Capparis osmantha* Diels, Notzbl. 14: 332. 1939.
Synonym: *Morisonia osmantha* (Diels) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Capparidastrum petiolare (Kunth) Hutch., Gen. Fl. Plants 2: 310. 1967.
Basionym: *Capparis petiolaris* Kunth, Nov. Gen. Sp. 5: 91. 1821.
Synonym: *Morisonia petiolaris* (Kunth) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparidastrum quiriguense (Standl.) Cornejo & Iltis, Harvard Pap. Bot. 13(2): 234. 2008.
Basionym: *Capparis quiriguensis* Standl. Proc. Biol. Soc. Wash. 37: 52. 1924.
Synonym: *Morisonia quiriguensis* (Standl.), Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparidastrum sola (J. F. Macbr.) Cornejo & Iltis, Harvard Pap. Bot. 11: 17. 2006.
Basionym: *Capparis sola* J. F. Macbr., Candollea 5: 359. 1934.
Synonym: *Morisonia sola* (J. F. Macbr.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparidastrum sprucei (Eichl.) Hutch., Gen. Fl. Pl. 2: 310. 1967.
Basionym: *Capparis sprucei* Eichl. in Mart., Fl. Bras. 13(1): 281. 1865.
Synonym: *Morisonia sprucei* (Eichl.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparidastrum tafallanum Cornejo, Iltis & Cerón, Harvard Pap. Bot. 19(2): 189. 2014.
Synonym: *Morisonia tafallana* (Cornejo, Iltis & Cerón) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Capparidastrum tuxtlense Cornejo & Iltis, Brittonia 62(2): 120. 2010.
Synonym: *Morisonia tuxtlense* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Colicodendron bahianum Cornejo & Iltis, J. Bot. Res. Inst. Texas 2(1): 76. 2008.
Synonym: *Morisonia bahiana* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Colicodendron martianum Cornejo, Harvard Pap. Bot. 15(1): 103. 2010.
Synonym: *Morisonia martiana* (Cornejo) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Colicodendron scabridum (Kunth) Seem., Bot. Voy. Herald, 78. 1852.
Basionym: *Capparis scabrida* Kunth, Nov. Gen. Sp. 5: 95. 1821.
Synonyms: *Octanema scabrida* (Kunth) Raf., Sylva Tellur. 112. 1838. *Destrugesia scabrida* (Kunth) Gaudich., Voy. Bonite, Bot. 4: 38. 1866. *Colicodendron scabridum* (Kunth) Hutch., Gen. Fl. Pl. 2: 309. 1967, *hom. illeg*. *Morisonia scabrida* (Kunth) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Colicodendron valerabellum Iltis, T. Ruiz & G.S. Bunting, J. Bot. Res. Inst. Texas 2(1): 82. 2008.
Synonym: *Morisonia valerabella* (Iltis, T. Ruiz & G.S. Bunting) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Colicodendron yco Mart., Flora 22, Bleibl. 1: 25. 1839.
Synonyms: *Capparis yco* (Mart.) Eichler in Martius, Fl. Bras. 13: 272. 1865. *Morisonia yco* (Mart.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Cynophalla amplissima (Lam.) Iltis & Cornejo, Rodriguésia 61: 154. 2010.
Basionym: *Capparis amplissima* Lam., Encycl. 1: 607. 1783 (1785).
Synonym: *Morisonia amplissima* (Lam.) Christenh. & Bing, The Global Flora 4:139. 2018, ***syn. nov.***

Cynophalla declinata (Vell.) Iltis & Cornejo, Harvard Pap. Bot. 13(1): 118. 2008.
Basionym: *Capparis declinata* Vell., Fl. Flum. 5: 230, tab. 3. “1827” [1832, effective date of publication].
Synonym: *Morisonia declinata* (Vell.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Cynophalla didymobotrys (Ruiz & Pav. ex DC.) Cornejo & Iltis, Harvard Pap. Bot. 11: 17. 2006.

Basionym: *Capparis didymobotrys* Ruiz & Pav. ex DC., Prodr. Syst. Nat. Reg. Veg. 1: 253. 1824.

Synonyms: *Capparis didymobotrys* Ruiz & Pav. ex E. A. López, Ann. Inst. Bot. A. J. Cavanilles 16: 380, tab. 429b. 1958, *nom. illeg. Morisonia didymobotrys* (Ruiz & Pav. ex DC.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Cynophalla ecuadorica (Iltis) Iltis & Cornejo, Harvard Pap. Bot. 13: 118. 2008.

Basionym: *Capparis ecuadorica* Iltis, Selbyana 2: 303. 1978.

Synonym: *Morisonia ecuadorica* (Iltis) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Cynophalla hastata (Jacq.) J. Presl, Přir Rostlin 2: 275. 1825.

Basionym: *Capparis hastata* Jacq., Enum. Syst. Pl. 23. 1760.

Synonyms: *Pleuteron hastata* (Jacq.) Raf., Sylva Tellur. 109. 1838. *Cynophalla flexuosa* f. *hastata* (Jacq.) Dugand, Caldasia 2: 52. 1941. *Morisonia hastata* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Cynophalla heterophylla (Ruiz & Pav. ex DC.) Iltis & Cornejo, Harvard Pap. Bot. 13: 118. 2008.

Basionym: *Capparis heterophylla* Ruiz & Pav. ex DC., Prodr. 1: 250. 1824.

Synonyms: *Capparis heterophylla* Ruiz & Pav. ex E. A. López, Ann. Inst. Bot. A. J. Cavanilles 16: 381. 1958, *hom. illeg. Morisonia heterophylla* (Ruiz & Pav. ex DC.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Cynophalla linearis (Jacq.) J. Presl, Přir Rostlin 2: 275. 1825.

Basionym: *Capparis linearis* Jacq., Enum. Syst. Pl. 24. 1760.

Synonyms: *Pleuteron linearis* (Jacq.) Raf., Sylva Tellur. 109. 1838. *Uterveria linearis* (Jacq.) Bertol., Horti Bonon. Pl. Nov. 2: 10. 1839. *Morisonia linearis* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Cynophalla mattogrossensis (Pilger) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 118. 2008.

Basionym: *Capparis mattogrossensis* Pilger, Revista Mus. Paul. Univ. Sao Paulo 13: 1250. 1923.

Synonym: *Morisonia mattogrossensis* (Pilger) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Cynophalla mollis (Kunth) J. Presl, Přir. Rostlin 2: 275. 1825.

Basionym: *Capparis mollis* Kunth, Nov. Gen. et Sp. Pl. 5: 89. 1821.

Synonyms: *Capparis guayaquilensis* Kunth, Nov. Gen. Sp. Pl. 5: 89. 1821, ***syn. nov.*** *Cynophalla guayaquilensis* (Kunth) Iltis, Harvard Pap. Bot. 13: 118. 2008, ***syn. nov.*** *Morisonia guayaquilensis* (Kunth) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Cynophalla polyantha (Tr. & Pl.) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 118. 2008.

Basionym: *Capparis polyantha* Tr. & Pl., Ann. Sci. Nat. Bot., sér. 6, 17: 76. 1862.

Synonym: *Morisonia polyantha* (Tr. & Pl.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Cynophalla retusa (Griseb.) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 119. 2008.

Basionym: *Capparis retusa* Griseb., Abh. Königl. Ges. Wiss. Göttingen 24: 18. 1879.

Synonyms: *Capparis cynophallophora* var. *retusa* (Griseb.) Kuntze, Rev. Gen. Plant. 2: 7. 1898. *Morisonia retusa* (Griseb.), Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Cynophalla sclerophylla (Iltis & Cornejo) Iltis & Cornejo, Harvard Pap. Bot. 11: 17. 2006.

Basionym: *Capparis sclerophylla* Iltis & Cornejo, Novon 15: 429. 2005.

Synonym: *Morisonia sclerophylla* (Iltis & Cornejo) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Cynophalla sessilis (Banks ex DC.) J. Presl, Přir. Rostlin 2: 275. 1825.

Basionym: *Capparis sessilis* Banks ex DC., Prodr. 1: 249. 1824.

Synonym: *Morisonia sessilis* (Banks ex DC.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Cynophalla tarapotensis (Eichler) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 119. 2008.

Basionym: *Capparis tarapotensis* Eichler in Mart., Fl. Bras. 13, pt.1: 284. 1865.

Synonym: *Morisonia tarapotensis* (Eichler) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Cynophalla verrucosa (Jacq.) J. Presl, Přir. Rostlin 2: 275. 1825.

Basionym: *Capparis verrucosa* Jacq., Enum. Syst. Pl. 23. 1760.

Synonyms: *Uterveria verrucosa* (Jacq.) Bertol., Pl. Nov. Hort. Bonon. 2: 8. 1839. *Morisonia verrucosa* (Jacq.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Hispaniolanthus dolichopodus (Helwig) Cornejo & Iltis, Harvard Pap. Bot. 14(1): 12. 2009.
Basionym: *Capparis dolichopoda* Helwig, Arkiv Bot. 22A(10): 11. 1929.
Synonym: *Morisonia dolichopoda* (Helwig) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Mesocapparis lineata (Dombey ex Persoon) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 115. 2008.
Basionym: *Capparis lineata* Dombey ex Persoon, Ench. 2: 60. 1807.
Synonym: *Morisonia lineata* (Dombey ex Persoon) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Monilicarpa brasiliana (Banks ex DC.), Cornejo & Iltis, J. Bot. Res. Inst. Texas 2(1): 71. 2008.
Basionym: *Capparis brasiliana* Banks ex DC., Prodr. 1: 249. 1824.
Synonyms: *Capparidastrum brasilianum* (Banks ex DC.) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia brasiliana* (Banks ex DC.), Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Monilicarpa tenuisiliqua (Jacq.) Cornejo & Iltis, J. Bot. Res. Inst. Texas 2(1): 70. 2008.
Basionym: *Capparis tenuisiliqua* Jacq., Enum. Pl. Carib. 24. 1760.
Synonyms: *Pleuteron tenuis* Raf., Sylva Tellur. 109. 1838. *Uterveria tenuisiliqua* (Jacq.) Bertol., Pl. Nov. Hort. Bonon. 2: 8. 1839. *Capparidastrum tenuisiliquum* (Jacq.) Hutch., Genera Flowering Pl 2: 310. 1967. *Morisonia tenuisiliqua* (Jacq.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Neocalyptrocalyx longifolium (Mart.) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 111. 2008.
Basionym: *Colicodendron longifolium* Mart., Flora 22, Bleib. 1(2): 26. 1839.
Synonym: *Morisonia longifolia* (Mart.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Neocapparis pachaca (Kunth) Cornejo, Harvard Pap. Bot. 22(2): 115. 2017.
Basionym: *Capparis pachaca* Kunth, Nov. Gen. et Sp. Pl. 5: 93. 1821.
Synonym: *Morisonia pachaca* (Kunth) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Neocapparis quina (J. F. Macbr.) Cornejo, Harvard Pap. Bot. 22: 118. 2017.
Basionym: *Capparis quina* J. F. Macbr., Candollea 5: 357. 1934.
Synonyms: *Capparidastrum quina* (J. F. Macbr.) Cornejo & Iltis, Harvard Pap. Bot. 13: 235. 2008. *Morisonia quina* (J. F. Macbr.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Preslianthus detonsus (Triana & Planch.) Iltis & Cornejo, Harvard Pap. Bot. 16: 70. 2011.
Basionym: *Capparis detonsa* Triana & Planch., Ann. Sci. Nat. Bot. ser. 4, 17: 80. 1862.
Synonym: *Morisonia detonsa* (Triana & Planch.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Preslianthus panamensis (Iltis) Iltis, Harvard Pap. Bot. 18(2): 147. 2013.
Basionym: *Capparis panamensis* Iltis, Ann. Missouri Bot. Gard. 68: 681. 1981 [1982].
Synonym: *Morisonia panamensis* (Iltis) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Preslianthus pittieri (Standl.) Iltis & Cornejo, Harvard Pap. Bot. 16: 70. 2011.
Basionym: *Capparis pittieri* Standl., J. Wash. Acad. Sci. 17(10): 253. 1927.
Synonym: *Morisonia pittieri* (Standl.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Quadrella alaineana Cornejo & Iltis, J. Bot. Res. Inst. Texas 4: 75. 2010.
Synonym: *Morisonia alaineana* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Quadrella angustifolia (Kunth) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 129. 2010.
Basionym: *Capparis angustifolia* Kunth, Nov. Gen. Sp. Pl. 5: 46 t. 438. 1821.
Synonyms: *Octanema angustifolia* (Kunth) Raf., Sylva Tellur. 112. 1838. *Colicodendron angustifolium* (Kunth) Hutch., Gen. Fl. Pl. 2: 309. 1967. *Morisonia angustifolia* (Kunth) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Quadrella antonensis (Woodson) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 125. 2010.
Basionym: *Capparis antonensis* Woodson, Ann. Missouri Bot. Gard. 35: 90. 1948.
Synonym: *Morisonia antonensis* (Woodson) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Quadrella asperifolia (K. Presl) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 126. 2010.
Basionym: *Capparis asperifolia* K. Presl, Reliq. Haenk. 2: 86. 1835.
Synonyms: *Linnaeobreynia asperifolia* (K. Presl) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia asperifolia* (K. Presl) Christenh. & Bing, The Global Flora 4: 139 (2018), ***syn. nov.***

Quadrella calciphila (Standl. & Steyerm.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 126. 2010.
Basionym: *Capparis calciphila* Standl. & Steyerm., Field. Mus. Bot. 23: 158. 1944.
Synonym: *Morisonia calciphila* (Standl. & Steyerm.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Quadrella cynophallophora (L.) Hutch., Gen. Fl. Pl. 2: 309. 1967.
Basionym: *Capparis cynophallophora* L., Sp. Pl. ed. 1, 504. 1753; ed. 2: 721. 1762.
Synonym: *Morisonia cynophallophora* (L.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.*** *non Capparis cynophallophora* Jacq., Select. Stirp. Amer. t. 98. 1763, which is *C. flexuosa* (L.) L., = *Cynophalla flexuosa* (L.) J. Presl, 1825.

Quadrella domingensis (Spreng. ex DC.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 129. 2010.
Basionym: *Capparis domingensis* Spreng. ex DC. Prodr. 1: 253. 1824.
Synonym: *Morisonia domingensis* (Spreng. ex DC.) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Quadrella dressleri Cornejo & Iltis, J. Bot. Res. Inst. Texas 4: 77. 2010.
Synonym: *Morisonia dressleri* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.***

Quadrella ferruginea (L.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 130. 2010.
Basionym: *Capparis ferruginea* L., Syst. Nat., ed. 10, 1071. 1759.
Synonyms: *Linnaeobreynia ferruginea* (L.) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia ferruginea* (L.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella filipes (Donn. Sm.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 126. 2010.
Basionym: *Capparis filipes* Donn. Sm., Bot. Gaz. 23: 2. 1897.
Synonym: *Morisonia filipes* (Donn. Sm.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella gonaievensis (Helwig) Hutch., Gen. Fl. Pl. 2: 308. 1967.
Basionym: *Capparis gonaïvensis* Helwig, Ark. Bot. 22A: 10. 1929.
Synonym: *Morisonia gonaievensis* (Helwig) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella incana (Kunth) Iltis & Cornejo, Novon 17: 452. 2007.
Basionym: *Capparis incana* Kunth, Nov. Gen. & Sp. 5: 94. 1821.
Synonyms: *Octanema incana* (Kunth) Raf., Sylva Tellur. 112. 1838. *Linnaeobreynia incana* (Kunth) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia incana* (Kunth) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella indica (L.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 126. 2010.
Basionym: *Breynia indica* L., Sp. Pl. 1:503. 1753.
Synonyms: *Capparis breynia* L. Syst. Pl. ed. 10:1071. 1759, *nom. illeg*. *Quadrella breynia* (L.) J. Presl, Přir. Rostlin 2: 261. 1825. *Pleuteron breynia* (L.) Raf., Sylva Tellur. 109. 1838. *Uterveria breynia* (L.) Bertoloni, Pl. nov. H. Bonon. 2: 10. 1839. *Morisonia breynia* (L) Christenh. & Bing, The Global Flora 4: 139. 2018, ***syn. nov.*** *Capparis indica* (L.) Druce, Bot. Exch. Club Soc. Brit. Isles 3: 415. 1914. *Linnaeobreynia indica* (L.) Hutch., Gen. Fl. Pl. 2: 311. 1967, *nom. illeg*.

Quadrella isthmensis (Eichler) Hutch., Gen. Fl. Pl. 2: 308. 1967.
Basionym: *Capparis isthmensis* Eichler in Martius, Fl. Bras. 13: 269. 1865.
Synonym: *Morisonia isthmensis* (Eichler) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella jamaicensis (Jacq.) J. Presl, Přir. Rostlin 2: 261. 1825.
Basionym: *Capparis jamaicensis* Jacq., Enum. Pl. Carib. 23. 1760.
Synonym: *Morisonia jamaicensis* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella lindeniana Cornejo & Iltis, J. Bot. Res. Inst. Texas 4(1): 83. 2010.
Synonym: *Morisonia lindeniana* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella lundellii (Standl.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 127. 2010.
Basionym: *Capparis lundellii* Standl., Carnegie Inst. Wash. Publ. 461: 57. 1935.
Synonym: *Morisonia lundellii* (Standl.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella mirifica (Standl.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 127. 2010.
Basionym: *Capparis mirifica* Standl. in Woodson & Schery, Ann. Missouri Bot. Gard. 27: 311. 1940.
Synonym: *Morisonia mirifica* (Standl.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella morenoi Cornejo & Iltis, J. Bot. Res. Inst. Texas 4: 86. 2010.
Synonym: *Morisonia morenoi* (Cornejo & Iltis) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella odoratissima (Jacq.) Hutch., Gen. Fl. Pl. 2: 308. 1967.
Basionym: *Capparis odoratissima* Jacq., Hort. Schoenbr. 1: 57, tab. 110. 1797.
Synonym: *Morisonia odoratissima* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Quadrella pringlei (Briquet) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 127. 2010.
Basionym: *Capparis pringlei* Briquet, Ann. Conserv. & Jard. Bot. Genève 17: 390. 1914.
Synonyms: *Linnaeobreynia pringlei* (Briquet) Hutch., Gen. Fl. Pl. 2: 310. 1967. *Morisonia pringlei* (Briquet) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Quadrella quintanarooensis Iltis & Cornejo, J. Bot. Res. Inst Texas 4: 104. 2010.
Synonym: *Morisonia quintanarooensis* (Iltis & Cornejo), Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Quadrella siliquosa (L.) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4: 98. 2010.
Basionym: *Capparis siliquosa* L., Syst. Nat. ed. 10(2): 1071. 1759, *p.p.*
Synonyms: *Pleuteron siliquosa* (L.) Raf., Sylva Tellur. 109. 1838. *Morisonia siliquosa* (L.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Quadrella singularis (R. Rankin) Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 131. 2010.Basionym: *Capparis singularis* R. Rankin, Willdenowia 34: 263. 2004.
Synonym: *Morisonia singularis* (R. Rankin) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Quadrella steyermarkii (Standl.) Iltis & Cornejo, Iltis & Cornejo, J. Bot. Res. Inst. Texas 4(1): 128. 2010.
Basionym: *Capparis steyermarkii* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 140. 1940.
Synonym: *Morisonia steyermarkii* (Standl.) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Sarcotoxicum salicifolium (Griseb.) Cornejo & Iltis, Harvard Pap. Bot. 13(1): 107. 2008.
Basionym: *Capparis salicifolia* Griseb., Abh. Königl. Ges. Wiss. Göttingen 24: 17. 1879.
Synonyms: *Colicodendron salicifolium* (Griseb.) Hutch., Gen. Fl. Pl. 2: 309. 1967. *Morisonia salicifolia* (Griseb.), Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Steriphoma paradoxum subsp. **paradoxum** (Jacq.) Endl., Flora 15(2): 396. 1832.
Basionym: *Capparis paradoxa* Jacq., Pl. Hort. Schoenbr. 1: 58, tab. 111. 1797.
Synonyms: *Morisonia paradoxa* (Jacq.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***
Stephania elliptica DC., Prodr. 1: 253. 1824, ***syn. nov.*** *Steriphoma ellipticum* (DC.) Spreng., Syst. Veg. ed. 16, 139. 1827, ***syn. nov.*** *Morisonia stephania* Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Steriphoma paradoxum subsp. **macranthum** (Standl.) Cornejo, Harvard Pap. Bot. 18(2): 147. 2013.
Basionym: *Steriphoma macranthum* Standl., Contr. US Nat. Herb. 20(6): 183. 1919.
Synonym: *Morisonia macrantha* (Standl.) Christenh. & Bing, The Global Flora 4: 141. 2018, ***syn. nov.***

Steriphoma peruvianum Spruce ex Eichler, Fl. Bras. 13(1): 267. 1865.
Synonym: *Morisonia peruviana* (Spruce ex Eichler) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

Steriphoma urbanii Eggers, Bot. Centralblatt 73: 67, 69 (by error 51). 1868.
Synonym: *Morisonia urbanii* (Eggers) Christenh. & Bing, The Global Flora 4: 142. 2018, ***syn. nov.***

LITERATURE CITED

CARDINAL-MCTEAGUE, W. M., K. J. SYTSMA, AND J. C. HALL. 2016. Biogeography and diversification of Brassicales: A 103 million year tale. Molec. Phylogen. Evol. 99: 204–224. doi:10.1016/j.ympev.2016.02.021

CORNEJO, X. 2017. *Neocapparis*: generic status and new name for *Capparidastrum* subgenus *Pachycarpum* (Capparaceae). Harvard Pap. Bot. 22(2): 113–119.

——— AND H. H. ILTIS. 2006. New combinations in Capparaceae *sensu stricto* for flora of Ecuador. Harvard Pap. Bot. 11: 17–18.

——— AND ———. 2008a. *Anisocapparis* y *Monilicarpa*: dos nuevos géneros de Capparaceae de América del Sur. J. Bot. Res. Inst. Texas 2: 61–74.

——— AND ———. 2008b. New combinations in South American Capparaceae. Harvard Pap. Bot. 13: 117–120.

——— AND ———. 2008c. The reinstatement of *Capparidastrum* (Capparaceae). Harvard Pap. Bot. 13: 229–236. doi:10.3100/1043-4534-13.2.229

——— AND ———. 2010. Nota Científica/Short Communication: Lectotypification and a new combination in *Cynophalla* (Capparaceae). Harvard Pap. Bot. 61: 153–155.

ILTIS, H. H. AND X. CORNEJO. 2007. Studies in the Capparaceae XXX: *Capparicordis*, a new genus from the Neotropics. Brittonia 59: 245–254. doi:10.1663/0007-196X(2007)59[245:SITCXC]2.0.CO;2

———. 2011. Two new genera and three new combinations in Neotropical Capparaceae. Harvard Pap. Bot. 16: 65–75. doi:10.3100/025.016.0110

PLANT GATEWAY. 2018. *A Practical Flora to Vascular Plant Species of the World*. Vol. 4 of *The Global Flora*. Special ed., GLOVAP, Nomenclature, Part 1. Bradford, United Kingdom.

TAMBOLI, A. S., P. B. YADAV, A. A. GOTHE, S. R. YADAV, AND S. P. GOVINDWAR. 2018. Molecular phylogeny and genetic diversity of the genus *Capparis* (Capparaceae) based on plastid DNA sequences and ISSR markers. Plant Syst. Evol. 304: 205–217.

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LECTOTYPIFICATION OF *GUSTAVIA PUBESCENS* (LECYTHIDACEAE)

Xavier Cornejo[1]

Abstract. An amended authorship and lectotypification are proposed for *Gustavia pubescens* (Lecythidaceae), a treelet endemic to western Ecuador, and its IUCN conservation criteria are assessed.

Keywords: Ecuador, endemic, *Gustavia pubescens*, lectotypification, Lecythidaceae

Gustavia pubescens (Lecythidaceae) is a few-branched to unbranched treelet known from a dozen collections gathered from scattered populations in few moist and wet forests of western Ecuador. The species was originally published by Otto Karl Berg (1854) who provided, in the protologue, a citation of page 306 and plate 551, both borrowed from the then-unpublished manuscript of Flora Huayaquilensis (Tafalla, 1989). In the formal publication, the type locality reads "Habitat ad Guayaquil in Ecuador." Berg credits Hipolito Ruiz as the author and collector of the type ("*specimen Ruizianum in hb. Berol*…."). As the type specimen has not been found in B, it is most likely that that historical collection was destroyed in the fire in the Berlin Botanical Museum during WWII (Robert Vogt, pers. comm.). The species has been cited as *Gustavia pubescens* Ruiz & Pav. ex O. Berg, but the selection of a lectotype has not been established (Mori in Prance and Mori, 1979).

In the herbarium of the Real Jardín Botánico de Madrid (MA), there is a specimen determined by R. Knuth that reads: ¨*Gustavia pubescens sp. nov*. Vulgo Membrillo de Montaña. F. H., D. 306, Ic. 551. Año de 1800." The number of the description and plate are correctly cited in the protologue. However, Hipolito Ruiz and Jose Pavon did not collect in Guayaquil (at that time the colonial name for most of present-day coastal Ecuador), and the date of collection of the MA specimen does not match the itinerary of Ruiz and Pavon. In addition, they returned to Spain in 1788 and in 1789 were assigned to the "Oficina Botanica" of Madrid for the study of the floras of the conquered overseas territory. They never went back to America (Steele, 1964; Miller, 1970). I conclude that neither Hipolito Ruiz nor Jose Pavon can be regarded as collectors of *Gustavia pubescens*.

Specimens attributable to Tafalla were gathered between 1799 and 1803 in coastal Ecuador for the *Flora Huayaquilensis*. These specimens can be recognized by the annotation "F.H." (Ibañez et al., 2006), and this annotation is written on the label of an old collection of *Gustavia pubescens* archived at MA. The locality of the collection matches that mentioned in the original publication and supports the idea that Juan Tafalla is the collector. Moreover, Eduardo Estrella credits Tafalla for the authorship of the name, description 306, and plate 551 of *G. pubescens* in *Flora Huayaquilensis*. *Gustavia spathulata* was later added by Ruiz and Pavon for the same species (Tafalla, 1989). It is now known that Tafalla, during the time he spent collecting plants in coastal Ecuador, sent several shipments of his manuscripts, corresponding specimens, and plates for the *Flora Huayaquilensis* to Ruiz and Pavon in Madrid (Tafalla, 1989). They made Tafalla's material available for Otto Berg in Berlin without crediting Tafalla ("Ruiz inedit" in Berg, 1856). The correct authorship for this species follows:

Gustavia pubescens Tafalla ex O. Berg, Linnaea 27:443 (1856). Ecuador: Los Ríos/Guayas: Hacia Guayaquil, 1800, *J. Tafalla s.n.* Type: B, destroyed; Lectotype, here designated: MA-813633.

Gustavia spathulata Ruiz & Pavon, *nomen*.

It is worth mentioning that plate 551 of *Gustavia pubescens* in the *Flora Huayaquilensis* (Tafalla, 1989), drawn at natural size, displays a terminal leafy branch bearing flowers with elongate pedicels 8–11 cm long. Other collections of *G. pubescens* usually have flowers with pedicels 5 to 7 cm long and to 10 cm in fruit. An exception is documented by a recent specimen (*Cornejo et al. 9249*, GUAY) that has pedicels 8–9 cm in flower and to 15 cm long in fruit in Cerro Cachari (1˚46'S, 79˚27'W), province of Los Ríos. That locality harbors the only known and islolated population of *G. pubescens* that matches the long-pedicellate flowers as seen and illustrated by Tafalla and his team during his historical expedition in 1800.

It is suggested that this species be assigned the IUCN conservation status of vulnerable, VU C1,2a(i) (IUCN, 2017).

Literature Cited

Ibañez, N., J. M. Monserrate, and I. Soriano. 2006. Collections from the Royal Spanish Expeditions to Latin America in the Institut Botànic de Barcelona (BC), Spain. Willdenowia 36: 595–599.

Berg, O. B. 1854. *Revisio Myrtacearum Americae hucusque cognitarum s. Klotzschii "Flora Americae aequinoctialis" exhibens Myrtaceas*. Linnaea 27: 1–472.

IUCN. 2017. Standards and Petitions Subcommitee. Guidelines for using the IUCN Red List Categories and Criteria, ver. 13. https://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf, (accessed September 23, 2018).

Miller, H. S. 1970. The Herbarium of Aylmer Bourke Lambert: Notes on its acquisition, dispersal, and present whereabouts. Taxon 19: 489–553.

Prance, G. T. and S. A. Mori. 1979. Lecythidaceae –Part I. The actinomorphic-flowered New World Lecythidaceae (*Asteranthos, Gustavia, Grias, Allantoma & Cariniana*). Fl. Neotrop. Monograph. 21: 1–270.

Steele, A. R. 1964. *Flowers for the King: The Expedition of Ruiz and Pavón and the Flora of Peru*. Duke University Press, Durham.

Tafalla, J. 1989. *Flora Huayaquilensis. Sive descriptiones et icones plantarum Huayaquilensium secundum systema Linnaeanum digestae*. Eduardo Estrella, ed. Instituto ad Conservandam Naturam/CSIC, XIII-CVI, Madrid.

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A TAXONOMIC SYNOPSIS OF ACANTHACEAE JUSS. NATIVE TO PARAÍBA STATE, BRAZIL

Fernanda Kalina da Silva Monteiro,[1] Anderson Silva Pinto,[2]
Francisco Carlos Pinheiro da Costa,[3] and José Iranildo Miranda de Melo[2,4]

Abstract. We present here a taxonomic synopsis of the native representatives of the family Acanthaceae in Paraíba State, northeastern Brazil. Fertile material was collected during monthly excursions between November 2014 and November 2015. We also analyzed specimens deposited in the Lauro Pires Xavier (JPB) and the Jayme Coelho de Moraes (EAN) herbaria, as well as consulted the REFLORA—Virtual Herbarium of the Flora and Fungi from Brazil and the *Species Link* databank. Taxonomic identifications were based on morphological analyses and consulting the literature. A total of 24 species belonging to 10 native genera were encountered, 11 species being reported for the first time for Paraíba State in this work. The most representative genera were *Ruellia* L. (8 spp.), *Justicia* L. (6 spp.), *Harpochilus* Nees (2 spp.), and *Hygrophila* R. Br. (2 spp.); the other genera were represented each by a single species. A key to the species, illustrations, and data concerning their geographic distributions, flowering, and fruiting are included. Additionally, a lectotype is designated for *Beloperone thunbergioides* and a neotype for *Hygrophila costata* and *Justicia imbricata*.

Keywords: Asterids, Brazilian northeast, Eudicotyledons, Lamiales, taxonomy

Acanthaceae Juss. comprise approximately 240 genera and 3,250 species with predominately tropical distribution, although with representatives in temperate regions (Wasshausen and Wood, 2004). Engler and Diels (1936) placed Acanthaceae in the order Tubiflorae, while Cronquist (1981) later positioned it in the order Scrophulariales; according to the APG IV (2016) these taxa are all currently positioned in Lamiales.

Scotland and Vollesen (2000) divided Acanthaceae into three subfamilies: Nelsonioideae, Thunbergioideae, and Acanthoideae, with the latter composed of two tribes—Acantheae and Ruellieae; Ruellieae, in turn, is composed of the subtribes Andrographiinae, Barleriinae, Justiciinae, and Ruelliinae. McDade et al. (2000) subdivided the subfamily Acanthoideae into four tribes: Acantheae, Barlerieae, Justiceae, and Ruellieae; the latter comprises the genus *Ruellia* L., contained within the subtribe Ruellinae, which comprises approximately 400 species (Tripp, 2007).

Brazil is one of the principal centers of diversity of the family Acanthaceae (Souza and Lorenzi, 2012), with species distributed in the Atlantic Forest (45%), Cerrado (25%), and Amazon region (15%); the remaining taxa (15%) are found in the other regions of that country (Kameyama, 1990). Forty genera are known to occur in all of the phytogeographical domains of Brazil, with four them being endemic; eight species distributed among five genera are known to Paraíba State (BFG, 2015).

The principal work dealing with the Brazilian species of Acanthaceae was published by Nees Von Esenbeck (1847) in *Flora Brasiliensis* (with 343 species, many of them new to science at the time, distributed among 57 genera, and 31 illustrations). However, no key to the species identification was provided in this monograph.

The only studies addressing the taxonomy of the family Acanthaceae in northeastern Brazil were published by Silva et al. (2010) and Côrtes and Rapini (2013), the former focusing on the states of Alagoas and Sergipe, and the latter on Bahia State. There have been no specific studies published concerning Paraíba State, although representatives of that family have been mentioned in phytosociological studies and floristic lists, for example, Lourenço and Barbosa (2003), Agra et al. (2004), Barbosa et al. (2004, 2011), and Lima and Barbosa (2014).

We present here a taxonomic synopsis of native representatives of the family Acanthaceae in Paraíba State, northeastern Brazil, including a key to the identification of the species, illustrations, geographical data, other information relative to enlarging our knowledge of the Brazilian phanerogamic flora, and, principally, the taxonomy and distribution of the Acanthaceae in Paraíba.

Materials and Methods

Study Area

Paraíba State (06°02'12"–08°19'18"S x 34°45'54"–38°45'45"W) is located in northeastern Brazil, bordering Rio Grande do Norte State to the north, Pernambuco State to the south, the Atlantic Ocean at Ponta do Seixas to the east, and Ceará State to the west. The state comprises 223 municipalities and has a total area of 56,469 km² (one of the smallest states in Brazil). Paraíba can be divided into

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four Mesorregions: Mata, Agreste, Borborema, and Sertão (Anuário Estatístico da Paraíba, 2015). Fig. 1.

The landscape of Paraíba State includes coastal plains, high plains, mountains, and valleys; its vegetation is quite varied, ranging from Atlantic Forest to herbaceous Caatinga (thorny deciduous dryland vegetation). While rather dry overall, the state possesses many perennial and intermittent rivers including the Paraíba, Piancó, Piranhas, Taperoá, Mamanguape, Curimataú, Gramame, and Peixe rivers. The regional climate is warm tropical humid along the coast and hot tropical dry (semiarid) in the interior (Portal Brasil, 2015).

Field and Laboratory Procedures

Fertile plant specimens (with flowers and/or fruits) were harvested during monthly excursions undertaken between November 2014 and November 2015. The collections were incorporated into the ACAM herbarium, *Campus* I, of the State University of Paraíba (UEPB). We also analyzed specimens deposited in the Lauro Pires-Xavier (JPB) and the Jayme Coelho de Moraes (EAN) herbarium on *Campi* I and II of the Federal University of Paraíba (UFPB), and viewed specimens online using the REFLORA—Virtual Herbarium of the Flora and Fungi from Brazil and the *Species Link* databank.

The morphological studies were principally based on specimens collected in Paraíba State during the present study, complemented by the analyses of exsiccates deposited in the above-mentioned herbarium and, when necessary, consulting the nomenclatural types and original descriptions.

Taxonomic identifications were based on morphological analyses supported by the specialized literature: Ezcurra (1993), Kameyama (1995), Braz et al. (2002), Wasshausen and Wood (2004), Vilar (2009) and Braz and Azevedo (2016). A key was subsequently prepared for identifying the species. Also presented here is a list of the materials examined; commentaries concerning taxonomic affinities based on morphological characteristics (both vegetative and reproductive); and data concerning geographical distributions, flowering, and fruiting; as well as illustrations of the diagnostic characteristics of the native species recorded for the state. The descriptions of the morphological structures are based on the terminology used by Hickey (1973), Radford et al. (1974), Rizzini (1977), Payne (1978), Radford et al. (1974), and Harris and Harris (2001).

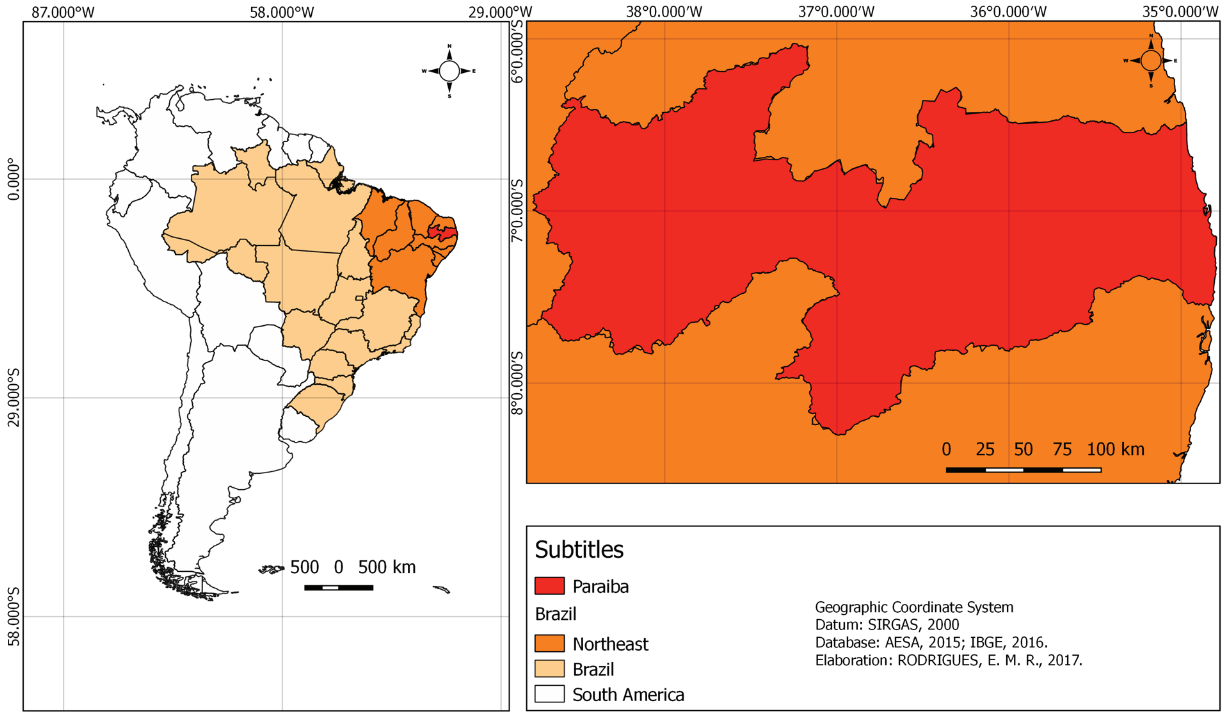

FIGURE 1. Location of the study area, Paraíba State, northeastern Brazil (prepared by: E.M. Rodrigues).

RESULTS AND DISCUSSION

Twenty-four species belonging to 10 genera of Acanthaceae were recorded for Paraíba State, including *Ruellia* L. (eight spp.), *Justicia* L. (six spp.), *Harpochilus* (two spp.), and *Hygrophila* R. Br. (two spp.); the other genera (*Avicennia* L., *Aphelandra* R. Br., *Dicliptera* Juss., *Elytraria* Michx., *Lepidagathis* Willd., and *Nelsonia*) were each represented by a single species. Eleven species were recorded for the first time in the study area: *Avicennia germinans* (L.) L., *Aphelandra nuda* Nees, *Hygrophila costata* Nees and T. Nees, *Justicia asclepiadea* (Nees) Wassh. & C. Ezcurra, *J. comata* (L.) Lam., *J. thunbergioides* (Lindau) Leonard, *Lepidagathis alopecuroidea* (Vahl) R.Br. ex Griseb., *Nelsonia canescens* (Lam.) Spreng., *R. inundata* Kunth, *R. ochroleuca* Mart. *ex* Nees, and *R. simplex* Wright.

Acanthaceae Juss., Gen. Pl.: 102-103. 1789.
Type species: *Acanthus mollis* L., Sp. Pl. 2: 639, as 939. 1753. TYPE: Habitat in Italiae, Siciliae humentibus, duris [Lectotype designated by Brummitt (BM [not seen]).

Herbs, less frequently vines or shrubs, rarely trees (*Avicennia*), with simple leaves, generally opposite, rarely alternate or spiraled (Nelsonioideae), decussate, without stipules, with cystoliths. Inflorescences in dichasia, spiciform, glomerules, panicles, racemes and thyrsoids, or with solitary flowers; generally 1 bract and 2 bracteoles per flower, foliaceous or petalloid, bracteoles sometimes partially covering the corolla tube. Flowers generally showy, bisexual, zygomorphic, with two whorls; sepals generally 5, free or fused, calyx sometimes very reduced; sepals and petals connate, with corolla varying from 5-lobate, bilabiate, or more rarely unilabiate, lobes imbricate or convolute. Stamens 2 or 4, didynamous, sometimes with staminodes, epipetalous, anthers rimose or poricidal (*Mendoncia*); annular nectariferous disk at base of ovary, ovary superior, 2-locular, rarely 1-locular, generally 2–10 ovules per locule, overlapping, in a single line, rarely in two lines, or 2 collateral ovules, placentation axillary, rarely pseudo-parietal, style filiform, stigma generally 2-lobed. Capsule loculicide, almost always explosively dehiscent, with each seed held within a hook-shaped lignified projection derived from the funicle (retinacule) (absent in *Thunbergia*), rarely a drupe (*Mendoncia*), uniseminate indehiscent and fleshy (*Avicennia*); seeds 2–10, generally flat, orbicular (Durkee, 1986; Braz et al., 2002; Kameyama, 2006; Judd et al., 2009).

Acanthaceae comprises approximately 3,250 species within approximately 240 genera, distributed predominantly in the tropics, with few representatives in temperate regions (Cronquist, 1981; Scotland and Vollesen, 2000), with the greatest concentrations of species in southeastern Asia, Malaysia, India, Madagascar, tropical Africa, Central America, Mexico, the Andes, and Brazil (Daniel, 1999). According to the "Flora do Brasil 2020," the family is represented by 39 genera and 445 species in Brazil associated with all of the regions and phytogeographical domains of that country.

Identification Key to the Species of Acanthaceae Native to Paraíba State

1a. Plants arboreal . . . . *Avicennia germinans*
1b. Plants herbaceous, subshrubs to shrubs. 2
2a. Corolla clearly bilabiate 3
2b. Corolla inconspicuously bilabiate 15
3a. Herbs; corolla 5-lobate 4
3b. Shrubs to subshrubs; corolla 2-lobate 9
4a. Inflorescences spiciform or falciform; stamens 4; ovary oblong 5
4b. Inflorescences spiciform, secundiflorous or not; stamens 2; ovary ellipsoidal to cylindrical. 7
5a. Inflorescences spiciform, not secundiflorous; stamens enclosed; corolla bluish purple or white to violet. 6
5b. Inflorescences falciform, secundiflorous; stamens exserted; corolla red . . . . *Aphelandra nuda*
6a. Bracteoles linear-oblanceolate; 4-seeded . . . . *Lepidagathis alopecurioidea*
6b. Bracteole elliptic; 8- to16-seeded . . . .*Nelsonia canescens*
7a. Bracts foliaceous, ovate; stigma rhomboidal; ovary ellipsoidal . . . .*Elytraria imbricata*
7b. Bracts never foliaceous, triangular; stigma bilobed; ovary cylindrical. 8
8a. Herbs erect; branches subquadrangular; corolla purplish white; capsule fusiform . . . .*Justicia comata*
8b. Herbs prostrate; branches tetrangular; corolla purple to lily-colored; capsule ellipsoidal . . . . *Justicia laevilinguis*
9a. Branches cylindrical; flowers with 4 bracts; corolla resupinate . . . . *Dicliptera mucronifolia*
9b. Branches subquadrangular; flowers with 2 bracts; corolla not resupinate 10
10a. Inflorescences axillary or terminal; ovary piriform; capsule clavate 11
10b. Inflorescences spiciform; ovary cylindrical; capsule of other shape. 12
11a. Leaf blade oblong to elliptic or ovate to obovate; inflorescences in axillary thyrsus; corolla greenish . . . . *Harpochilus neesianus*
11b. Leaf blades ovate, velvety; inflorescences in terminal spikes; corolla pale yellow . . . .*Harpochilus paraibanus*
12a. Bracts elliptic to lanceolate; capsule ovate to oblong 13
12b. Bracts ovate to elliptic or triangulate; capsule ellipsoidal. 14
13a. Corolla lilac with white stripes . . . . *Justicia asclepiadea*
13b. Corolla red . . . . *Justicia aequilabris*
14a. Corolla white-purple; unequal and overlapping thecae. . . . .*Justicia glaziovii*
14b. Corolla pink; oblique and mutic theca . . . .*Justicia thunbergioides*
15a. Plants subshrubs to shrubs. 16
15b. Plants herbaceous 18
16a. Branches cylindrical; stamens exserted; capsule clavate; seeds 4. . . . . *Ruellia asperula*
16b. Branches tetrangular; stamens enclosed; capsule ellipsoidal; seeds 8–10 17
17a. Inflorescences in terminal panicles; corolla tubular, pink; ovary elliptic; stigma filiform . . . .*Ruellia cearensis*
17b. Inflorescences racemose; corolla hypocrateriform to infundibuliform; ovary oblong; stigma bilobed . . . . *Ruellia ochroleuca*
18a. Bracteoles absent; flowers solitary; capsule oblong 19
18b. Bracteoles present; flowers united in thyrsus, multiple dichasia or panicles; capsules of other shape. 20

Identification Key to the Species of Acanthaceae Native to Paraíba State cont.

19a. Leaf blade with star-shaped trichomes on adaxial face; seeds 3 . . . . *Ruellia bahiensis*
19b. Leaf blade with simple trichomes on adaxial face; seeds 6 . . . . *Ruellia geminiflora*
20a. Bracteoles elliptic; pedicel 0.9–15 cm long; corolla pink; capsule clavate . . . . *Ruellia inundata*
20b. Bracteoles lanceolate; flowers sessile; corolla blue to lily-colored; capsule ellipsoidal 21
21a. Corolla blue; ovary ellipsoidal; seeds 12–20, orbicular . . . . *Ruellia simplex*
21b. Corolla lily-colored; ovary oblong; seeds 4–10, suborbicular to oval 22
22a. Herb decumbent; petiole 3–4 mm long; capsule ellipsoidal 2.8 cm long . . . . *Hygrophila costata*
22b. Herb erect; petiole 0.5–2.9 cm long; capsule ellipsoidal 0.9–1.2 cm long 23
23a. Stamens exserted; ovary oblong; capsule mucronate . . . . *Ruellia paniculata*
23b. Stamens enclosed; ovary cylindrical; capsule without mucron . . . . *Hygrophila paraibana*

1. Avicennia germinans (L.) L., Sp. Pl., ed. 3, 2: 891. 1764. Fig. 2A; 3A–E.

Basionym: *Bontia germinans* L., Syst. Nat. (ed. 10) 2: 1122. 1759. TYPE: JAMAICA. Without any other locality, 1753, *P. Browne 263*. [Lectotype: designated by Stearn, Kew Bull. 13: 35 (1958).]

Distribution and phenology: distributed along the coasts of Africa, Asia, Australia, and Brazil (Tropicos, 2018). In Brazil, this taxon occurs from the states of Amapá to Santa Catarina (Flora do Brasil 2020, under construction). Recorded here for the first time in the study area. Encountered with flowers in January and April and fruits in January, March, and May. Associated with the Littoral Mesorregion, in mangrove swamp areas.

Additional selected material examined: BRAZIL. **Paraíba:** João Pessoa, Mangabeira, 05 January 1990, (fr), *O.T. Moura 592* (JPB); *Ibid*, Jacarapé, 20 March 1984, (fr), *O.T. Moura 181* (JPB); *Ibid,* Mangue do Jacarapé, 17 April 1990, (fl), *O.T. Moura 418* (JPB); Rio Tinto, Sema IV, 19 May 1988, (fl, fr), *L.P. Felix s.n.* (EAN 8243); Santa Rita, Ilha Stuart, 28 January 1994, (fl, fr), *L.P. Felix and O.T. Moura 6426* (EAN).

Avicennia germinans can be easily recognized as it is the only arboreal species of the genus, the only one found in mangrove swamps, and the only representative of the genus with a white corolla and coriaceous petals.

2. Aphelandra nuda Nees, Fl. Bras. 9: 89. 1847. TYPE: Brazil. Crecit Pernambuci, nec non in Serra dos Orgãos, prov. Sebastianopolitanae, *G. Gardner 1111*. (Holotype: G[00236214]).

Distribution and phenology: distributed in Brazil and Peru (Tropicos, 2018). In Brazil has only previously been reported from Pernambuco State (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers and fruits in May, August, September, and October. Associated with the Littoral Mesorregion.

Additional selected material examined: BRAZIL. **Paraíba:** Cabedelo, Mata do Amém, 15 October 1999, (fl), *A.F. Pontes 230* (JPB); *Ibidem,* Mata do Amém, 24 September 1999, (fl, fr), *A.F. Pontes 164* (JPB); Conde, APA de Tambaba, 22 August 2008, (fl), *P.C. Gadelha-Neto 2418, I.B. Lima and J.R. Lima* (JPB); João Pessoa, 15 August 1994, (fr), *O.T. Moura 38* (JPB); *Ibid,* Mata Ciliar do Rio Cabedelo, Mangabeira, 12 May 2011, (fl), *L.A. Pereira 254 and E.C.O. Chagas* (JPB).

Aphelandra nuda is characterized by an intense red corolla with only 4 stamens, and by its terminal inflorescences with sessile flowers.

3. Dicliptera mucronifolia Nees, Fl. Bras. 9: 161. 1847. TYPE: BRAZIL. Crescit in prov. Piauhiensi, *E. Gardner 2462*. (Holotype: G, not seen; Isotype: K000529513; Photo F[26553]). Fig. 2B.

Distribution and phenology: in Brazil, this taxon is found within the semiarid regions of the states of Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, and Minas Gerais, reaching São Paulo, Espírito Santo, and Rio Grande do Sul (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers and fruits between January and November in the Agreste, Borborema, Sertão, and Littoral Mesorregions.

Additional specimens examined: BRAZIL. **Paraíba:** Araruna, Parque Estadual Pedra da Boca, 27 September 2002, (fl), *Rita Lima et al. 1654* (JPB); Areia, Mata do Pau-Ferro, 05 November 2010, (fl, fr), *L.L. Barreto 67* (EAN); Cabedelo, Ilha do Stuart, Estuário do Rio Paraíba do Norte, 27 October 1993, (fr), *O.T. Moura 1119* (JPB); *Ibid*, Mata do Amém, 01 October 1999, (fr), *A.F. Pontes and M. Costa-Santos 186* (JPB); Caldas Brandão, 16 May 1985, (fr), *M.F. Agra and L.M. Batista 597* (JPB); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 09 August 2015, (fl, fr), *F.C.P. Costa et al. 102* (ACAM); Gurjão, 28 July 2007, (fl), *M.C. Pessoa 166, J.R. Lima and I.B. Lima* (JPB); João Pessoa, Bica, 03 January 1987, (fl), *L.P. Felix and J.V. Dorneles 1252* (EAN); *Ibid*, Buraquinho, 29 August 1947, (fl, fr), *L.P. Xavier* (JPB 1498); *Ibid*, Mata do Buraquinho, 28 November 1969, (fl, fr), *L.P. Xavier* (JPB 2727); Maturéia, Pico do Jabre, 10 June 2004, (fl, fr), *L.P. Felix et al. 10469* (EAN); *Ibid*, Pico do Jabre, 29 July 2014, (fl), *J.M.P. Cordeiro and E.M. Almeida 320* (EAN); Salgadinho, Serra de São Bento, 08 August 2008, (fl), *R.A. Pontes 408* (JPB); São Gonçalo, Fazenda Lamarão, 08 April 1995, (fr), *P.C. Gadelha-Neto and H.M. Moreira 235* (JPB); São Mamede, 11–13 July 2007, (fl), *M.F. Agra, D.A. Barbosa and N. Porto 6941* (JPB); Sousa, Vale dos Dinossauros, 06 August 2004, fl., *P.C. Gadelha-Neto 1219* (JPB); Taperoá, 2003, (fr), *C.F.C. Ramalho s.n.* (EAN 11446); *Ibid*, 2003, (fr), *C.F.C. Ramalho 806* (EAN); Vieirópolis, Serra da Arara, 02 September 2008, (fl, fr), *P.C. Gadelha-Neto 2442* (JPB).

Dicliptera mucronifolia is characterized by its pink to lily-colored corolla, bilabiate, with only 2 stamens, and by its inflorescences in fascicles with greenish white mucronate bracts.

4. Elytraria imbricata (Vahl) Pers., Syn. Plant. 1: 23. 1805. Fig. 2C.

Basionym: *Justicia imbricata* Vahl, Eclog. Amer. 1: 1. 1797. TYPE: MEXICO. *Sessé & Mociño 5131* (Neotype, here designated: MA [604997]).

Distribution and phenology: distributed in the United States, Mexico, Venezuela, Peru, Guatemala, Honduras, Nicaragua, Costa Rica, El Salvador, Panama, Columbia, the Caribbean, Belize, Bolivia, Argentina, Vietnam, the Philippines, and Brazil (Tropicos, 2018). In Brazil, it can be found in all of the states and phytogeographical domains (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers in August and December and with fruits in August and October, in the Agreste and Sertão Mesorregions.

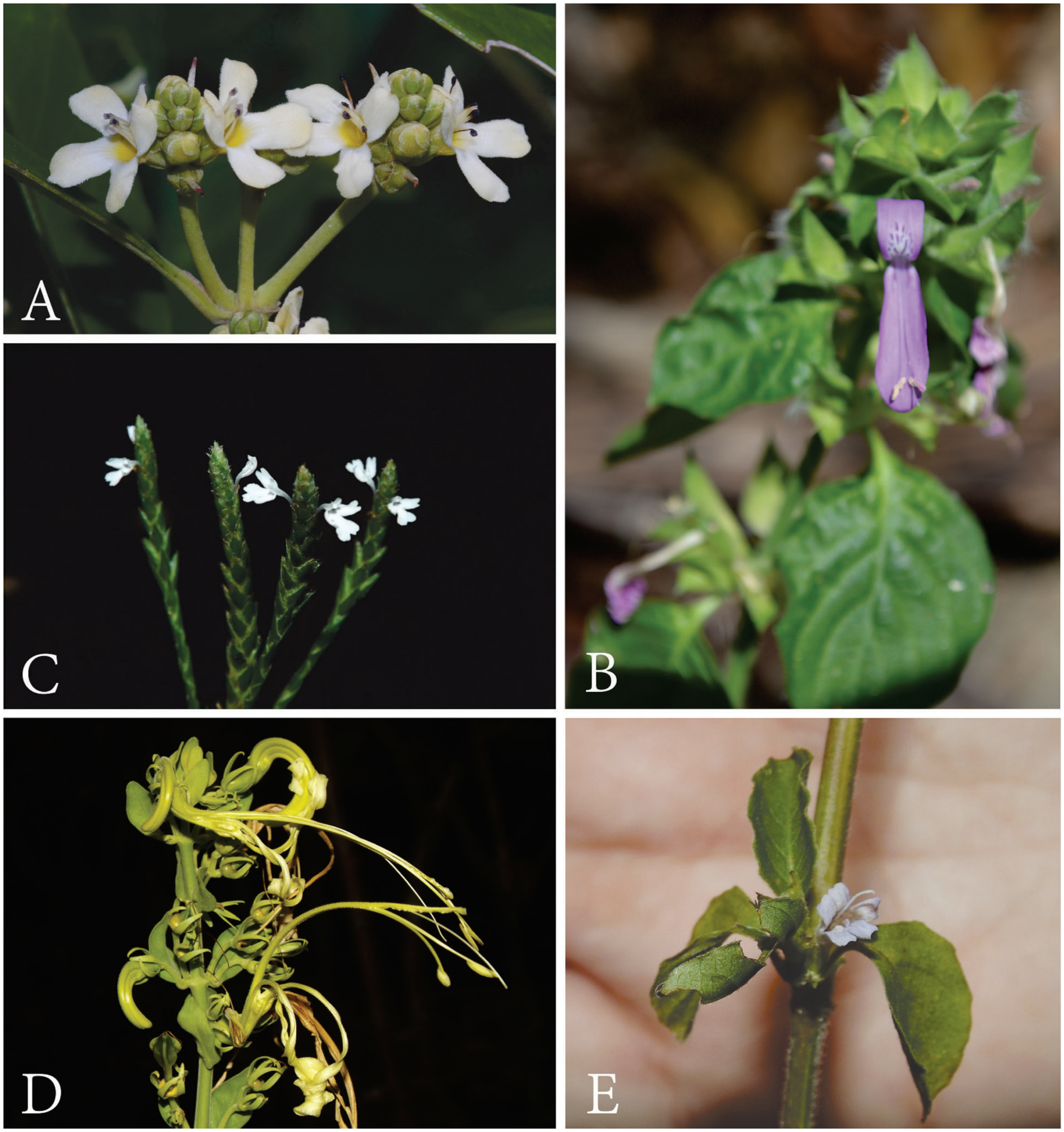

FIGURE 2. **A**, *Avicennia germinans* (L.) L.; **B**, *Dicliptera mucronifolia* Nees; **C**, *Elytraria imbricata* (Vahl) Pers.; **D**, *Harpochilus neesianus* Nees; **E**, *Hygrophila costata* Nees. Photographs: A, H. Galliffet; B, A. N. T. Bandeira; C–E, F. K. S. Monteiro.

Additional selected material examined: BRAZIL. **Paraíba:** Alhandra, 08 October 1993, (fr), *O.T. Moura 1105* (JPB); Araruna, Parque Estadual Pedra da Boca, 08 December 2003, (fl, fr), *M.C. Pessoa 74 and J.R. Lima* (JPB); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa, A.N.T. Bandeira and F.M. Sobreira 102* (ACAM).

The prototype does not mention type material, and as there is no record of an original material, according to Article 9.13 of the ICN (International Code of Nomenclature) a neotype should be selected to represent this species. For this reason, we chose the material collected by Sessé & Mociño in MA as the neotype for *Justicia imbricata*, as this material is considered to be in consonance with the protologue.

Elytraria imbricata is principally recognized by its spiciform and imbricate inflorescences, with white and bilabiate flowers, as well as by its herbaceous habit.

5. Harpochilus neesianus Mart. *ex* Nees, Fl. Bras. 9: 146, t. 24. 1847. TYPE: BRAZIL, in paludosis ad Ilhabira, prov. Bahiensis, *J.S. Blanchet 2884* (Holotype: P[00719947]). Fig. 2D; 3F–L.

Distribution and phenology: in Brazil, it is distributed in the states of Bahia, Pernambuco, and Paraíba, in the Caatinga domain (Flora do Brasil 2020, under construction). Was encountered in the study area with flowers and fruits between May and September, and recorded in the Agreste, Borborema, and Sertão Mesorregions.

Additional selected material examined: BRAZIL. **Paraíba:** Pocinhos, 05 August 2005, (fl, fr), *C.M.L. Neves and F.X. Oliveira s.n.* (EAN 18936); *Ibid*, Parque das Pedras, 15 May 2003, (fr), *A. Almeida, L.P. Felix and S. Pitrez 390* (EAN); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl, fr), *J.M.P. Cordeiro, L.P. Felix and E.M. Almeida 297* (EAN); São João do Tigre, APA das Onças, Serra do Paulo, 17 May 2008, (fl), *M.C. Pessoa 380 and J.R. Lima* (JPB); *Ibid*, Serra do Jatobá, 22 February 2002, (fl), *M.R. Barbosa 2225, M.F. Agra and J.R. Lima* (JPB); *Ibid*, Serra do Jatobá, 8-11 March 2002, (fr), *M.F. Agra et al. 5711* (JPB); Remígio, 20 September 1959, (fl), *J.C. Moraes s.n.* (EAN 2242).

Harpochilus neesianus can be recognized principally by its showy chiropterophilous flowers with yellowish corollas (Vogel et al., 2004), with curved buds and exserted stamens; its fruits are also showy. This species is a common element on rocky outcrops.

6. Harpochilus paraibanus F.K.S. Monteiro, J.I.M. Melo & E.M.P. Fernando, Phytotaxa 358(3): 291. 2018. TYPE: BRAZIL. **Paraíba**, Passagem, Serra do Aba, 17 April 2016, *E.M.P. Fernando 392* (Holotype: [ACAM 1897]; Isotypes: ACAM, CSTR, RB).

Distribution and phenology: this species was recently described by Monteiro et al. (2018) and is distributed only in Paraíba State, northeastern Brazil. It was encountered with flowers in April and with fruits in June to November.

Additional specimens examined: BRAZIL. **Paraíba:** Mãe D'Água, 13 April 2017, *E.M.P. Fernando 560* (CSTR); Passagem, Serra do Aba, 28 July 2014, *E.M.P. Fernando 138* (CSTR); *Ibidem*, 28 November 2015, *E.M.P. Fernando 469* (CSTR); *Ibidem*, 15 June 2016, *F.K.S. Monteiro et al. 35* (ACAM, IPA); *Ibidem*, 06 April 2017, *F.K.S. Monteiro 38* (ACAM).

Harpochilus paraibanus can be recognized by its cylindrical branches, spikes terminal, and flowers with corolla pale yellow.

7. Hygrophila costata Nees, Pl. Hort. Bonn. Icon. 2: 7–8, pl. 3. 1824. TYPE: BRAZIL. Bahia, in humilis. *W.J. Burchell 5657* (Neotype, here designated: K [K000534056]). Fig. 2E; 4A–F.

Distribution and phenology: this species is distributed throughout Central and South America and in the United States in North America (Tropicos, 2018). In Brazil, it is encountered in the states of Acre, Bahia, Ceará, and the entire central-western, southeastern, and southern region (Flora do Brasil 2020, under construction). It is reported here for the first time in the study area, where it was encountered with flowers and fruits in September, in the Agreste Mesorregion.

Additional selected material examined: BRAZIL. **Paraíba:** Campina Grande, Universidade Estadual da Paraíba, *Campus* I, 15 September 2015, (fl, fr), *F.K.S. Monteiro and A.S. Pinto 20* (ACAM).

Hygrophila costata can be recognized by its thyrsoid inflorescences and diminutive flowers, and its location in humid and seasonally flooded sites.

8. Hygrophila paraibana Rizzini, Bol. Mus. Nac. Rio de Janeiro new ser. no. 8, 24, tab. 9. 1947. TYPE: BRAZIL. Escola Agronômica do Nordeste, Areia, Paraíba, 27 October 1944, *J.M. Vasconcellos 305* (Holotype: RB[00533824]). Fig. 5A.

Distribution and phenology: this species is endemic to Paraíba State (Flora do Brasil 2020, under construction) and was encountered with flowers in August and September and with fruits from September to November, in the Agreste Mesorregion.

Additional material examined: BRAZIL. **Paraíba:** Areia, Rio do Canto, 04 October 2012, (fr), *A.C. Oliveira 14* (EAN); *Ibidem*, 23 September 2010, (fl, fr), *A.C. Araújo s.n.* (EAN 15879); *Ibidem*, Engenho Gameleira, 22 November 2007, (fr), *L.P. Felix 12043* (EAN); João Pessoa, 06 August 1981, (fl), *O.T. Moura s.n.* (JPB 4759).

Hygrophila paraibana is characterized by having yellowish bracts and flowers with lily-colored corollas with white and orange spots on the lower lip.

9. Justicia aequilabris (Nees) Lindau, Nat.Pflanzenfam. 4(3b): 350. 1895. Fig. 5B.

Basionym: *Orthotactus aequilabris* Nees, Fl. Bras. (Martius) 9: 131, t. 134. 1847. TYPE: BRAZIL, loco no accuratius indicato, *F. Sellow 174* (Holotype: B, destroyed; Isotype: K[000529235]).

Distribution and phenology: this species is encountered in Bolivia, Brazil, and Paraguay (Tropicos, 2018). In Brazil, it is distributed throughout the country and is associated with

FIGURE 3. **A–E**. *Avicennia germinans* (L.) L. **A–B**, reproductive branches; **C**, fruits; **D**, opened corolla showing ovary and stamens; **E**, seed. **F–L**. *Harpochilus neesianus* Nees. **F**, flower; **G–H**, opened corolla showing gynoecium; **I**, detail of the apex of upper lobe corolla and stamens; **J**, reproductive branches; **K**, seed; **L**, fruit. Drawing by Josicleide Fidelis; A–E, based on Holotype; F–L, based on *J.M.P. Cordeiro, L.P. Felix,* and *E.M. Almeida 29* (EAN).

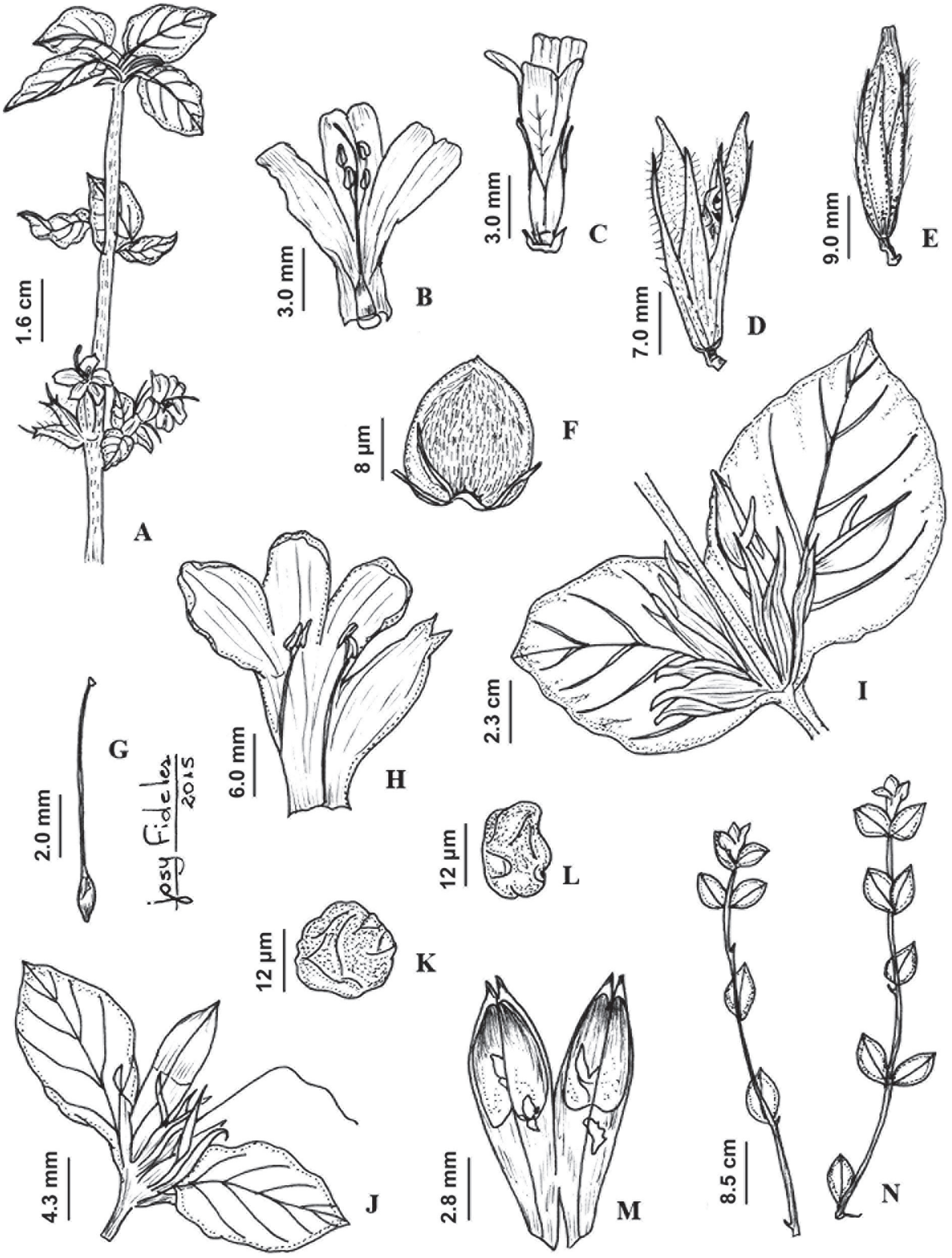

FIGURE 4. **A–F**. *Hygrophila costata* Nees. **A**, habit; **B–C**, detail of the corolla; **D–E**, detail of the fruit; **F**, seed. **G–N**. *Justicia thunbergioides* (Lindau) Leonard. **G**, detail of the gynoecium; **H**, detail of the open corolla; **I–J**, detail of bracts and fruits; **K–L**, seeds; **M**, detail of fruit; **N**, habit. Drawing by Josicleide Fidelis, A–F from *F.K.S. Monteiro* and *A.S. Pinto 20* (ACAM); G–N from *F.C.P. Costa et al. 109* (ACAM).

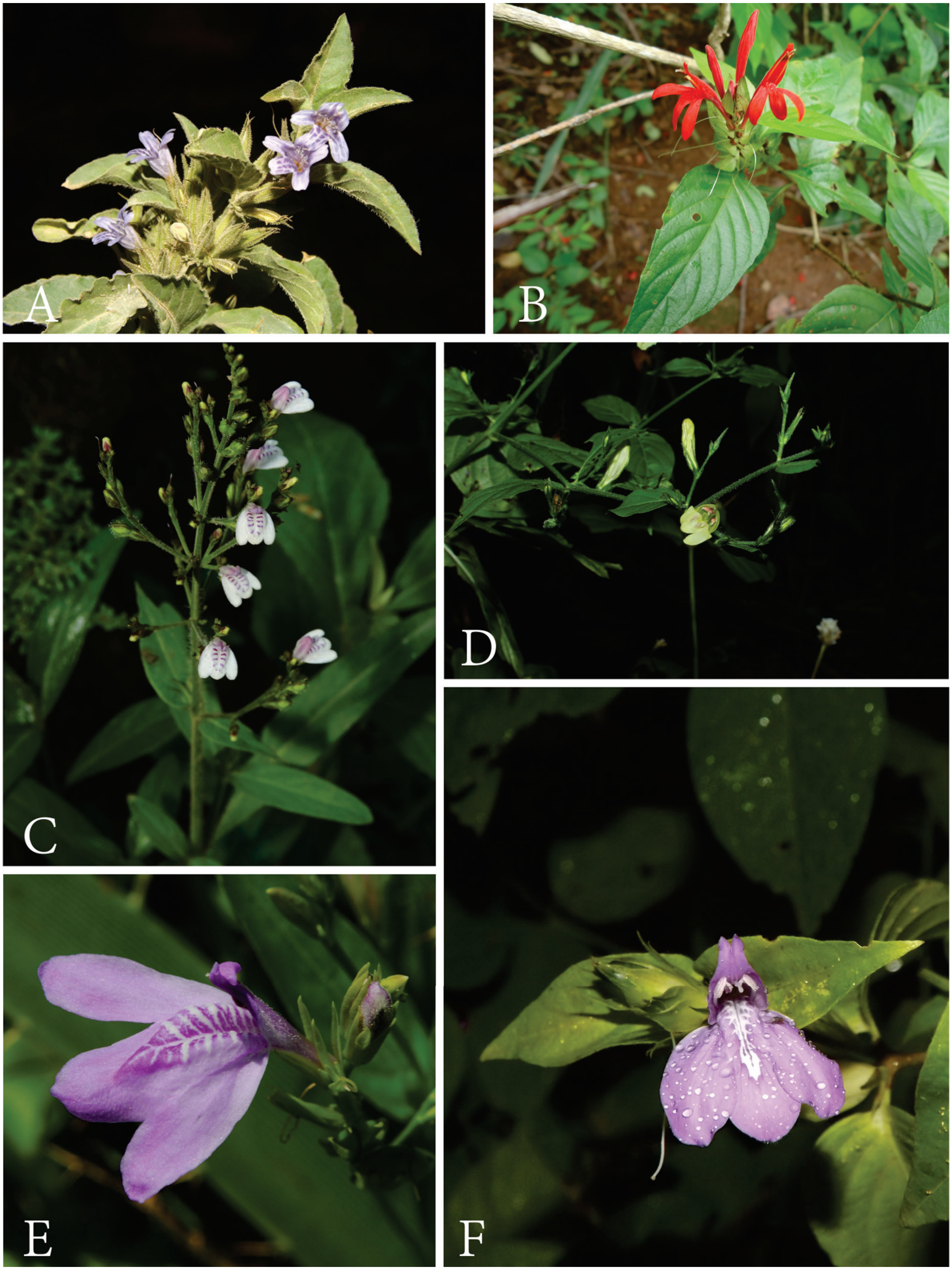

FIGURE 5. **A**, *Hygrophila paraibana* Rizzini; **B**, *Justicia aequilabris* (Nees) Lindau; **C**, *Justicia comata* (L.) Lam.; **D**, *Justicia glaziovii* Lindau; **E**, *Justicia laevilinguis* (Nees) Lindau; **F**, *Justicia thunbergioides* (Lindau) Leonard. Photographs: A and F, F. K. S. Monteiro; B, T. S. Silva; C, H. Galliffet; D, F. C. P. Costa; E, A. González.

all of the phytogeographical domains (Flora do Brasil 2020, under construction). In the study area, it was encountered with flowers in April, May, September, and October in the Agreste, Borborema, and Sertão Mesorregions.

Specimens examined: BRAZIL. **Paraíba:** Areia, 16 October 2014, (fl), *L.P. Felix 15135* (EAN); Campina Grande, Distrito de São José da Mata, 07 July 1993, (fl), *L.P. Felix 5841* (EAN); Lagoa Seca, Cachoeira do Pinga, 30 April 2015, (fl), *F.K.S. Monteiro, T.S. Silva and S.M. Pordeus 11* (ACAM); Maturéia, Pico do Jabre, 10 June 2004, (fl), *L.P. Felix et al. 465* (EAN); Nova Floresta, 09 June 1993, (fl), *L.P. Felix 5875* (EAN); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl), *J.M.P. Cordeiro, L.P. Felix and E.M. Almeida 302* (EAN); São João do Tigre, Serra do Paulo, 23 August 2013, (fl), *L.P. Felix 14304* (EAN).

Justicia aequilabris can be easily recognized by its spiciform inflorescences, green bracts that are sometimes purplish at the apex, and by its showy, red, bilabiate corolla.

10. Justicia asclepiadea (Nees) Wassh. & C. Ezcurra, Candollea 52(1): 172. 1997.

Basionym: *Simonisia asclepiadea* Nees, Fl. Bras. 9: 144, t. 145. 1847. TYPE: BRAZIL. Mato Grosso, Chapada, *L.Riedel 1063* (Holotype: LE[not seen]; Isotype: GZU[000250365]).

Distribution and phenology: it is distributed throughout Bolivia and Brazil, being found in the states of Bahia, Goiás, Mato Grosso, Mato Grosso do Sul, and Piauí, often associated with rupestrian vegetation and gallery forests (Flora do Brasil 2020, under construction; Tropicos, 2018). In the study area it is associated with rocky outcrops; the flowering period is in March.

Additional selected material examined: BRAZIL. **Paraíba:** Passagem, Serra do ABA, 06 March 2016, (fl), *E.M.P. Fernando 429* (CSTR).

Justicia asclepiadea is easily recognized by inflorescences in secondary laurel spurts, linear bracts, and large purple corollas.

11. Justicia comata (L.) Lam., Encycl., Botanique 1: 632. 1785. Fig. 5C.

Basionym: *Dianthera comata* L., Syst. Nat. (ed. 10) 2: 850. 1759. TYPE: JAMAICA. Sloan. jam. t. 103 f. 2 [Lectotype: *R. Brown s.n.* (Linn. Herb. 29.2), designated by Graham].

Distribution and phenology: widely distributed throughout the tropical Americas, from southern Mexico and Costa Rica to Bolivia, Paraguay, northern Argentina, and northeastern Brazil (Ezcurra, 2002). In Brazil, it is encountered in the states of Acre, Amazonas, Amapá, Pará, Rondônia, Bahia, Rio Grande do Norte, Mato Grosso do Sul, Mato Grosso, Minas Gerais, Paraná, and Rio Grande do Sul (Flora do Brasil 2020, under construction). It was found in the study area flowering and fruiting in August.

Additional selected material examined: BRAZIL. **Paraíba:** João Pessoa, Jardim Botânico, 11 August 2004, (fl), *R.A. Pontes and N.T. Lima 78* (JPB); *Ibidem*, Mata do Buraquinho, Lago dos Buritis, 01 August 2006, (fl), *R.A. Pontes 370* (JPB).

Justicia comata has a grass-like aspect and is characterized by its paniculiform inflorescence with diminutive flowers with purplish white corollas.

12. Justicia glaziovii Lindau, Bull. Herb. Boissier 3: 483. 1895. TYPE: BRAZIL. Rio de Janeiro, Fev. 1882, *A.F.M. Glaziou 13073* (Holotype: B, destroyed; Photo: F8830; Lectotype: designated by Graham (1988); Isolectotype: R[000011240]). Fig. 5D.

Distribution and phenology: widely distributed in eastern Bolivia and Northeast Paraguay (Ezcurra, 2002). In Brazil it occurs in the states of Bahia, Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, and Rio Grande do Norte (Flora do Brasil 2020, under construction). It is usually found on the edges of forests or Caatingas, also occurring outside the limits of the semiarid regions (Côrtes and Rapini, 2013). It was found in the study area flowering and fruiting in August.

Additional selected material examined: BRAZIL. **Paraíba:** Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.K.S. Monteiro et al. 13* (ACAM).

Justicia glaziovii is characterized by a white corolla with lilac macules in the lower lobe. A striking characteristic of the species is its oblique anthers and prolongation of the connective.

13. Justicia laevilinguis (Nees) Lindau, Bot. Jahrb. Syst. 19, Beibl., 48: 20. 1894. Fig. 5E.

Basionym: *Rhytiglossa laevelinguis* Nees, Fl. Bras. 9(7): 120. 1847. TYPE: BRAZIL. Brasilia, *F. Sellow s.n, s.d* (Holotype: B[100629468]).

Distribution and phenology: this species is distributed in Argentina, Bolivia, Brazil, Columbia, French Guiana, Mexico, Paraguay, Suriname, Uruguay, and Venezuela (Tropicos, 2018). In Brazil, it is encountered in the states of Amazonas, Pará, Rondônia, Bahia, Ceará, Minas Gerais, and São Paulo and throughout the central-western and southern regions of that country in the Amazonian, Atlantic Forest, and Pantanal domains (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers in January and with fruits in November and January, in the Littoral Mesorregion.

Additional selected material examined: BRAZIL. **Paraíba:** Itapororoca, Lagoa dos Macacos, 22 January 1988, (fl), *L. P. Felix and J.V. Dornelas 1514* (EAN); Sapé, 03 November 1987, (fr), *L.P. Felix and E.C. Silva 1827* (EAN); *Ibidem*, 28 January 1995, (fl, fr), *O.T. Moura 1497* (JPB).

Justicia laevilinguis can be easily recognized by having flowers united in secundiflorous spikes, corolla with upper lip bilobate, purple to lily-colored, with white spots in the center.

14. Justicia thunbergioides (Lindau) Leonard, Contr. Sci. Los Angeles County Mus. 32: 10. 1959. Fig. 4G–N; 5F.

Basionym: *Beloperone thunbergioides* Lindau, Bull. Herb. Boissier, sér. 2, 5(4): 372–373. 1905. TYPE: BRAZIL. Mato Grosso do Sul, Corumbá, 3–7 April 1903, *G.O.A. Malme 3026* (Holotype: B, destroyed; Photo: F8949) (Lectotype, here designated: S[05-391]).

Distribution and phenology: this species has been reported from Bolivia and Brazil (Tropicos, 2018). In Brazil, it is distributed throughout the central-western region and in the states of Alagoas, Bahia, Pernambuco, Minas Gerais, and São Paulo (Flora do Brasil 2020, under construction). It is being reported here for the first time in the study area, where it was encountered with flowers in June and August and fruits in August.

Additional selected material examined: BRAZIL. **Paraíba:** Campina Grande, 27 June 2012, (fl), *E.M. Almeida et al. 570* (EAN); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al. 109* (ACAM); São João do Tigre, Serra do Paulo, 23 August 2013, (fl), *L.P. Felix 14300* (EAN); *Ibidem*, Serra do Paulo, 03 August 2011, (fr), *S. Nascimento1330* (EAN).

Justicia thunbergioides is characterized by having generally solitary flowers, sometimes united into secundiflorous spikes, and by having a pink to lily-colored corolla with white spots on the central lobe.

The specimen located at the Berlin Herbarium (B) was destroyed during World War II, and the material of *Beloperone thumbergioides* deposited at the Stockholm Herbarium (S) is a duplicate of the holotype. For this reason, a lectotype is being proposed for *Beloperone thumbergioides*, Basionym of *J. thunbergioides*.

15. Lepidagathis alopecurioidea (Vahl) R.Br. *ex* Griseb., Fl. Brit. W. I. 453. 1864 [1862].

Basionym: *Ruellia alopecuroidea* Vahl, Eclog. Amer. 2: 49. 1798. TYPE: CARIBBEAN. Montserrat, West Indies, *J. Ryan 22196* (Holotype: C, lost; Isotype: GZU[000250101]).

Distribution and phenology: occurs in Belize, Brazil, Columbia, the Guyana, northern Mexico, Peru, Trinidad and Tobago, and Venezuela (Tropicos, 2018). In Brazil, it is found in the states of Amazonas, Pará, Goiás, and Mato Grosso (Flora do Brasil 2020, under construction). It is reported here for the first time in the study area, where it was found with flowers in August, October, and December.

Additional selected material examined: BRAZIL. **Paraíba:** João Pessoa, Jardim Botânico, 17 October 2003, (fl), *R.A. Pontes, T.M.G. Veloso and P.C. Gadelha-Neto s.n.* (JPB 33301); *Ibidem*, Jardim Botânico, 05 December 2003, (fl), *R.A. Pontes s.n.* (JPB 33304); *Ibid*, Mata do Buraquinho, 30 August 2006, (fl), *R.A. Pontes 381* (JPB).

Lepidagathis alopecurioidea can be easily recognized by usually having a well-ramified stem and inflorescences in terminal spikes, with white to violet flowers.

16. Nelsonia canescens (Lam.) Spreng., Syst. Veg. [Sprengel] 1: 42. 1825 [1824]. Fig. 6A.

Basionym: *Justicia canescens* Lam., Tabl. Encycl. 1(1[1]): 41. 1791. TYPE: SENEGAL. Ex Guinea, 1789, *D. Roussillon 53* (Isotype: P[00435347]).

Distribution and phenology: *Nelsonia canescens* occurs in southern Africa, in many parts of the American continent and East and South of Asia (Tropicos, 2018). In Brazil it is found in the states of Acre, Amazonas, Bahia, Goiás, Maranhão, Minas Gerais, and Pará (Flora do Brasil 2020, under construction). In the study area, the period of flowering and fruiting occurred in April.

Additional selected material examined: BRAZIL. **Paraíba**: Bananeiras, Cachoeira do Roncador, 30 April 2015, (fl, fr), *F.K.S. Monteiro et al. 12* (ACAM).

Nelsonia canescens is easily recognized by its inflorescences in dense cylindrical spikes with minute flowers.

17. Ruellia asperula (Mart. *ex* Ness) Lindau, Nat. Pflanzenfam. 4(3b): 311. 1895. Fig. 6B.

Basionym: *Stephanophysum asperulum* Mart. & Nees, Fl. Bras. 4: 52. 1847. TYPE: BRAZIL. in silvis prov. Bahiensis ad Villa d Cachoeirá, January 1819, *Martius, C.F.P. von, s.n.* (Holotype: M[0186682]).

Distribution and phenology: in Brazil, occurs in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Rio Grande do Norte, Sergipe, and Minas Gerais, in the Caatinga biome (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers and fruits between April and December, in the Agreste, Borborema, Mata Paraibana, and Sertão Mesorregions, where it has been recorded with flowers in April, June, July, August, September, October, and December, and fruiting from August to October and in December.

Additional selected material examined: BRAZIL. **Paraíba:** Araruna, Parque Estadual Pedra da Boca, 18 October 2003, (fl, fr), *M.C. Pessoa 08 and J.R. Lima* (JPB); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al. 104* (ACAM); Desterro, 10 June 2004, (fl), *L.P. Felix 10414* (EAN); Itapororoca, 28 July 1993, (fl), *L.P. Felix 5961* (EAN); Maturéia, Pico do Jabre, 20–23 December 1997, (fl, fr), *M.F. Agra, R. Pontes and W. Barros 4443* (JPB); Remígio, 10 April 1977, (fl), *P.C. Fevereiro et al. 318/589* (EAN); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl), *J.M.P. Cordeiro et al. 294* (EAN); São José dos Cordeiros, RPPN Fazenda Almas, 07 September 2002, (fl, fr), *M.R. Barbosa et al. 2574* (JPB).

Ruellia asperula is principally recognized by having sticky branches and leaves, and red corollas, and by forming large clumps.

18. Ruellia bahiensis (Nees) Morong, Ann. New York Acad. Sci.7: 192. 1893.

Basionym: *Dipteracanthus bahiensis* Nees, Fl. Bras. 9: 39. 1847. TYPE: BRAZIL. In aridis argillosis prope Moritiba prov. Bahiensis, s.d., *J.S. Blanchet 466* (Holotype: P[00650155]).

Distribution and phenology: this species has been recorded for Argentina and Brazil (Tropicos, 2018). In Brazil, it is found in the states of Alagoas, Bahia, Ceará, Pernambuco, Rio Grande do Norte and Espírito Santo, associated with Caatinga vegetation (Flora do Brasil 2020, under construction). It was encountered in the study area in the Agreste and Borborema Mesorregions, with flowers and fruits in March, April, July, October, and November, and fruits in April, July, October, and November.

Additional selected material examined: BRAZIL. **Paraíba:** Areia, Mata do Pau Ferro, 20 March 2015, (fl), *F.K.S. Monteiro et al. 07* (ACAM); *Ibidem,* CCA-UFPB, 21 November 2007, (fl, fr), *M.P. Nicomedes et al. 01* (EAN); *Ibidem*, Mangabinha, 02 Out 2012, (fl, fr), *L.P. Felix 13984* (EAN); Natuba, 14 April 2015, (fl, fr), *F.K.S. Monteiro et al. 09* (ACAM); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl, fr), *J.M.P. Cordeiro et al. 301* (EAN); São João do Tigre, 01 April 2011, (fl, fr), *L.P. Felix 13651* (EAN).

Ruellia bahiensis is similar to *R. geminiflora* in having lily-colored corollas, oblong capsules, and herbaceous habits. *Ruellia bahiensis* differs from the latter by having solitary flowers and star-shaped trichomes on the abaxial face of the leaf blade versus axillary inflorescences and simple trichomes in *R. geminiflora*.

19. Ruellia cearensis Lindau, Notizbl. Königl. Bot. Gart. Berlin 6: 195. 1914. TYPE: BRAZIL. Ceará. Serra de Maranguape. October 1910, *E. H. Ule 9113* (Isotype: US[01106454]). Fig. 6C.

Distribution and phenology: this species is endemic to Brazil, occurring in the states of Alagoas, Bahia, Ceará, Paraíba, and Pernambuco (Flora do Brasil 2020, under construction). In the study area in the Littoral Mesorregion, it was encountered flowering in September.

Additional specimen examined: BRAZIL. **Paraíba:** João Pessoa, Bacia Hidrográfica do Rio Timbó, 06 September 2005, (fl), *N.T. Amazonas 46 and T. Grisi* (JPB).

Ruellia cearensis can be easily recognized by its subshrub habit and by its pink, tubular corolla.

20. Ruellia geminiflora Kunth, Nov. Gen. Sp. 2: 240. 1817. TYPE: COLOMBIA. Ibague, crescit locis temperatis, siccis prope Santa Ana et Ibague Novo-Granaensium, s.d., *Humboldt & Bonpland 1801* (Holotype: P[00670076]). Fig. 6D.

Distribution and phenology: this species is found in Argentina, Belize, Bolivia, Brazil, the Caribbean, Colombia, Costa Rica, Ecuador, El Salvador, Guiana, French Guiana, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, and Venezuela (Tropicos, 2018). In Brazil, it is distributed throughout the states in the central-western, southeastern, and southern regions of the country and in the states of Amapá, Pará, Tocantins, Bahia, Ceará, Maranhão, and Pernambuco (Flora do Brasil 2020, under construction). In the study area, it was found in the Agreste and Sertão Mesorregions, with flowers in January, March, April, September, and October, and fruits in April, September, and October.

Additional selected material examined: BRAZIL. **Paraíba:** Araruna, fl., 13 April 2002, *M.R. Barbosa et al. 2394* (JPB); Areia, 16 August 2014, (fl, fr), *L.P. Felix 15134* (EAN); *Ibidem*, Mata do Pau Ferro, (fl, fr), 23 September 2010, *L.L. Barreto 59* (EAN); 28 July 2011, (fl, fr), *S.A.A. Lima 76* (EAN); Bananeiras, Cachoeira do Roncador, 30 April 2015, (fl, fr), *F.K.S. Monteiro et al. 09* (ACAM); Campina Grande, Universidade Estadual da Paraíba, 11 March 2015, (fl), *F.K.S. Monteiro and A.S. Pinto 03* (ACAM); Lagoa Seca, Fazenda Ipuarana, 06 January 2001, (fl), *C.E. Lourenço 69* (JPB); Taperoá, 2003, (fl, fr), *C.F.C. Ramalho 737/949* (EAN).

Ruellia geminiflora is similar to *R. bahiensis* as both produce lily-colored corollas and oblong capsules, and have herbaceous habits. They can be distinguished, however, as *R. bahiensis* has axillary inflorescences and 6 seeds, whereas *R. bahiensis* produces solitary terminal flowers and 3 seeds.

21. Ruellia inundata Kunth, Nova Gen. & Sp. 2: 239. 1817. TYPE: COLOMBIA. S.loc. Crescit in ripa fluminis Magdalenae prope Mompox et Badillas, s.d., *Humboldt & A. Bonpland 3711* (Holotype: P[00670075]). Fig. 6E; 7A–F.

Distribution and phenology: this species occurs in Brazil, Columbia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and Venezuela (Tropicos, 2018). In Brazil, it can be found in the states of Piauí, Bahia and Minas Gerais (Flora do Brasil 2020, under construction). It was recorded here for the first time in the study area associated with the Sertão Mesorregion, producing flowers in April, August and October and fruits in August and October.

Additional specimens examined: BRAZIL. **Paraíba:** Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al. 108* (ACAM); Nazarezinho, 23 April 1982, (fl), *M.A. Sousa et al. 1189* (JPB); Sapé, RPPN Fazenda Pacatuba, (fl, fr), 10 October 2010, *J.L. Viana et al. 28* (JPB).

Ruellia inundata is morphologically similar to *R. paniculata,* as both have herbaceous habits and infundibuliform corollas. *Ruellia inundata* differs, however, by having a pink corolla and clavate capsules, whereas *R. paniculata* produces a lily-colored corolla and elliptic capsules.

22. Ruellia ochroleuca Mart. *ex* Nees, Fl. Bras. 9: 56, t. 5. 1847. TYPE: BRAZIL. Pernambuco, September 1837, *G. Gardner 900* (Lectotype: designated by Tripp, E. A. & L. A. McDade K[0005342490]). Fig. 6F; 7G–L.

Distribution and phenology: occurs in Brazil, Costa Rica, Guatemala, Honduras, and Nicaragua (Tropicos, 2018). In Brazil, it is known from the states of Alagoas, Bahia, and Pernambuco in areas of Caatinga vegetation (Flora do Brasil 2020, under construction). It is reported here for the first time in the Agreste Mesorregion, with flowers in August and September and fruits in August and September.

Additional selected material examined: BRAZIL. **Paraíba:** Areia, Mata do Pau Ferro, 09 September 2010, (fl, fr), *L.L. Barreto 56* (EAN); João Pessoa, Mata do Buraquinho, 29 August 1947, (fl), *L.P. Xavier s.n.* (JPB 1515); Lagoa Seca, Sítio Conceição, 20 August 2015, (fl, fr), *F.K.S. Monteiro and A.S. Pinto 15* (ACAM).

Ruellia ochroleuca can be easily recognized by its ovate leaf blade, hirsute on the adaxial face, and by its greenish to white ventricose corolla.

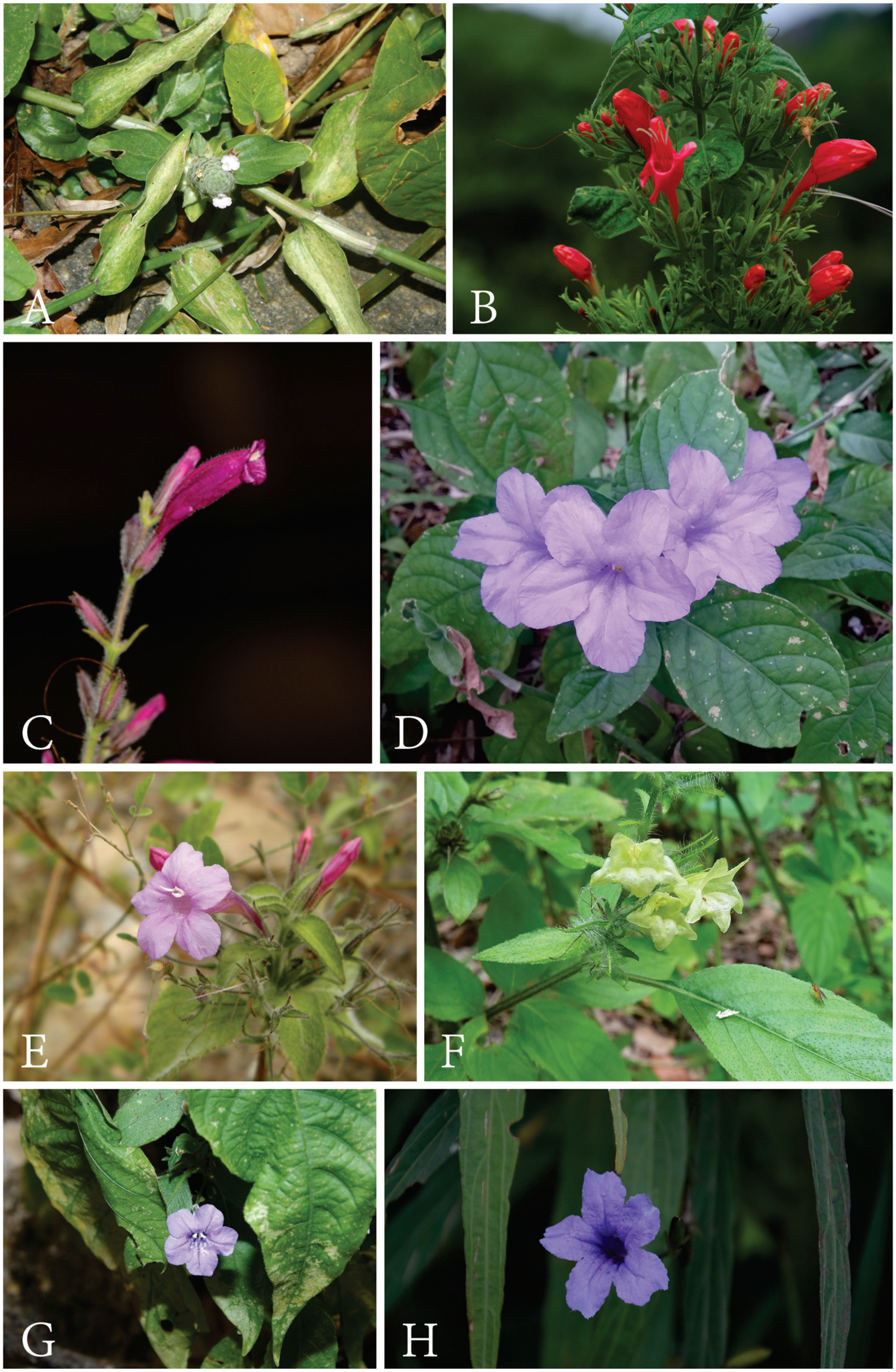

FIGURE 6. **A**, *Nelsonia canescens* (Lam.) Spreng.; **B**, *Ruellia asperula* (Mart. ex Ness) Lindau; **C**, *Ruellia cearensis* Lindau; **D**, *Ruellia geminiflora* Kunth; **E**, *Ruellia inundata* Kunth; **F**, *Ruellia ochroleuca* Mart. ex Nees; **G**, *Ruellia paniculata* L.; **H**, *Ruellia simplex* Wrigth. Photographs: A, D, and F–G, F. K. S. Monteiro; B and H, S. L. Costa; C, A. Popovkin.

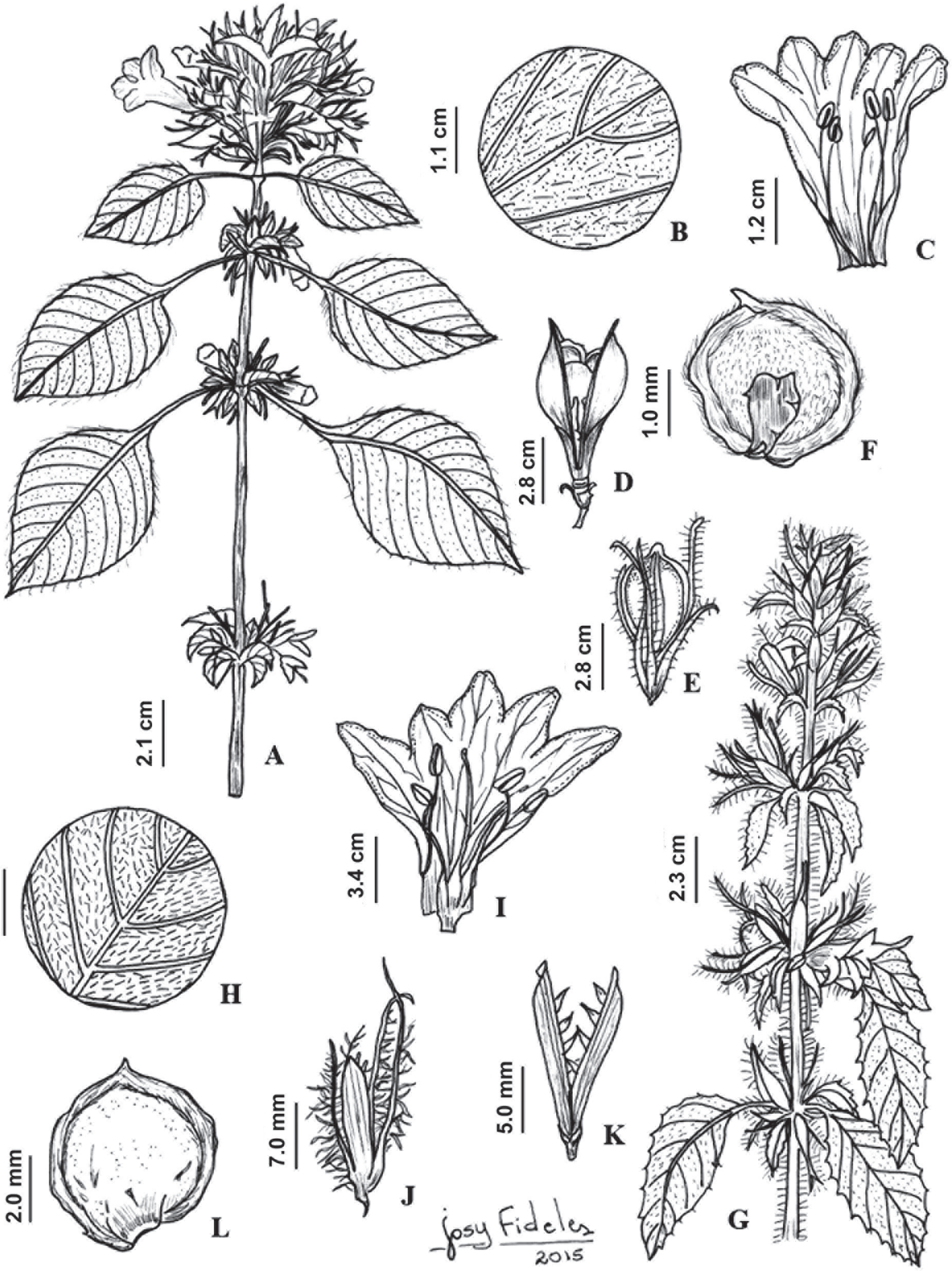

FIGURE 7. **A–F**. *Ruellia inundata* Kunth. **A**, habit; **B**, detail of the adaxial face of the leaf blade; **C**, corolla open; **D–E**, fruit; **F**, seed. **G–L**. *Ruellia ochroleuca* Mart *ex* Nees. **G**, habit; **H**, detail of the adaxial face of the leaf blade; **I**, detail of the opened corolla, **J–K**, fruit; **L**, seed. Drawing by Josicleide Fidelis; A–F from *F.C.P. Costa et al. 108* (ACAM); G–L from *F.K.S. Monteiro* and *A.S. Pinto 15* (ACAM).

23. Ruellia paniculata L., Sp. Pl. 2: 635. 1753. TYPE: JAMAICA. *Sloan 59*, *s.d.* (Holotype: BM[000589553]). Fig. 6G.

Distribution and phenology: occurs in Belize, Bolivia, Brazil, the Caribbean, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, and Venezuela (Tropicos, 2018). In Brazil, it has been recorded in the states of Goiás, Minas Gerais and Rio de Janeiro, and throughout the northeastern region of that country, except in Sergipe State (Flora do Brasil 2020, under construction). In the study area, it was encountered in the Agreste, Borborema, and Sertão Mesorregions, with flowers in March, May, August, September, and October, and fruits in March, August, September, and October.

Additional specimens examined: BRAZIL. **Paraíba:** Cabaceiras, 21 October 2007, (fr), *G.A. Costa et al. 13* (JPB); Campina Grande, Universidade Estadual da Paraíba, *Campus* I, (fl, fr), 11 March 2015, *F.K.S. Monteiro and A.S. Pinto 03* (ACAM); *Ibidem*, (fl, fr), 07 October 2015, *F.K.S. Monteiro and A.S. Pinto 20* (ACAM); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al. 101* (ACAM); Junco do Seridó, 14 August 2011, (fl, fr), *E.M. Almeida et al. 1221* (EAN); Maturéia, Pico do Jabre, 17–20 November 1997, (fr), *M.F. Agra and P.C. Silva 5436* (JPB); Mogeiro, 17 September 1941, (fr), *D. Maia s.n.* (JPB 265); Natuba, Estrada entre a cidade de Natuba and Umbuzeiro, 31 September 2010, (fl, fr), *R.A. Pontes 600 and C.E.S. Diniz* (JPB); Picuí, 01 May 2007, (fl, fr), *P.C. Gadelha-Neto et al. 1711* (JPB).

Ruellia paniculata can be easily recognized by its paniculiform inflorescences, lily-colored corolla, and mucronate, ellipsoidal fruits.

24. Ruellia simplex Wright, Anales Acad. Ci. Med. Habana (6) 41: 321. 1870. TYPE: CUBA. En sabanas abajas y frangosas ca. del Hato "El Salado," jurisdiccion de San Cristóbal y Palacios, 21 December 1860, *C. Wright 3642* (Holotype: GH[00094208]). Fig. 6H.

Distribution and phenology: occurs in Argentina, Brazil, Paraguay, and Uruguay (Tropicos, 2018). In Brazil, it has been reported from the states of Pernambuco, Rio Grande do Norte, Goiás, Mato Grosso, Mato Grosso do Sul, São Paulo, and Rio Grande do Sul (Flora do Brasil 2020, under construction). It was recorded here for the first time in the study area, in anthropogenically impacted sites in the Agreste Mesorregion, flowering and fruiting in February and July.

Additional selected material examined: BRAZIL. **Paraíba:** Campina Grande, anthropic area, 10 July 2015, (fl, fr), *F.K.S. Monteiro and A.S. Pinto 06* (ACAM); Fagundes, anthropic area, 20 February 2015, (fl, fr), *F.K.S. Monteiro et al. 02* (ACAM).

Ruellia simplex can be recognized principally by its narrowly lanceolate leaf blade, and flowers with purple to blue corollas.

Literature Cited

Agra, M. F, M. R. V. Barbosa, and W. D. Stevens. 2004. Levantamento Florístico Preliminar do Pico do Jabre, Paraíba, Brasil. Pages 123–38 in K. C. Porto, J. J. P. Cabral, and M. Tabarelli (organizadores), *Brejos de Altitude em Pernambuco e Paraíba: história natural, ecologia e conservação*. Ministério do Meio Ambiente, Brasília.

Anuário Estatístico da Paraíba: Caracterização Territorial. http://www.ideme.pb.gov.br/. (accessed October 7, 2015).

APG IV. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society 181: 1–20.

Barbosa, M. R. V, M. F. Agra, E. V. S. B. Sampaio, J. P. Cunha, and L. A. Andrade. 2004. Diversidade Florística da Mata de Pau Ferro, Areia, Paraíba. Pages 111–122 in K. C. Porto, J. J. P. Cabral, and M. Tabarelli (organizadores), *Brejos de altitude em Pernambuco e Paraíba: história natural, ecologia e conservação*. Ministério do Meio Ambiente, Brasília.

Barbosa, M. R. V, W. W. Thomas, E. L. P. Zárate, R. B. Lima, M. F. Agra, I. B. Lima, M. C. R. Pessoa, A. R. B. Lima, M. F. Agra, I. B. Lima, M. C. R. Pessoa, A. R. L. Lourenço, G. C. Delgado Júnior, R. A. S. Pontes, E. C. O. Chagas, J. L. Viana, P. C. Gadelha Neto, C. M. L. R. Araújo, A. A. M. Araújo, G. B. Freitas, J. R. Lima, F. O. Silva, L. A. F. Vieira, L. A. Pereira, R. M. T. Costa, R. C. Duré, and M. G. V. Sá. 2011. Checklist of the Vascular Plants of the Guaribas Biological Reserve, Paraíba, Brazil. Revista Nordestina de Biologia 20: 79–106.

Braz, D. M., R. M. Carvalho-Okano, and C. Kameyama. 2002. Acanthaceae da Reserva Florestal Mata do Paraíso, Viçosa, Minas Gerais. Revista Brasileira de Botânica 25: 495–504.

——— and I. H. F. Azevedo. 2016. Acanthaceae da Marambaia, Estado do Rio de Janeiro, Brasil. Hoehnea 43: 497–516. Côrtes, A. L. A., and A. Rapini. 2013. Justicieae (Acanthaceae) do Semiárido do Estado da Bahia, Brasil. Hoehnea 40: 253–292.

BFG. 2015. Growing knowledge: an overview of Seed Plant diversity in Brazil. Rodriguésia 66: 1085–1113.

Cronquist, A. 1981. An integrated system of classification of flowering plants. Columbia University Press, New York.

Daniel, T. F. 1999. Nuevos registros estatales de Acanthaceae en México. Boletín del Instituto de Botánica 7: 51–59.

Durkee, L. H. 1986. Flora Costaricensis: Acanthaceae. Fieldiana Botany, New Series, 18: 1–87.

Engler, A. and L. Diels. 1936. Syllabus der Pflanzenfamilien. Verlag von Gebrüder Borntraeger, Berlin.

Ezcurra, C. 1993. Systematics of *Ruellia* (Acanthaceae) in Southern South America. Annals of the Missouri Botanical Garden 80: 787–845.

———. 2002. El género *Justicia* (Acanthaceae) en Sudamérica Austral. Annals of the Missouri Botanical Garden, 89: 225–280.

Flora do Brasil 2020 under construction. Acanthaceae. Jardim Botânico do Rio de Janeiro; Available at http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB33 (accessed October 5, 2018).

Graham, V. A. W. 1988. Delimitation and infra-generic classification of Justicia (Acanthaceae). Kew Bulletin 34: 551–624.

Harris, J. G. and M. W. Harris. 2001. *Plant Identification Terminology: An Illustrated Glossary*. 2d ed. Spring Lake Pub., Spring Lake, Utah.

Hickey, L. J. 1973. Classification of the architecture of dicotyledonous leaves. American Journal of Botany 60: 17–33.

Judd, W. S, C. S. Campbell, E. A. Kellogg, P. F. Stevens, and M. J. Donoghue. 2009. *Sistemática Vegetal: Um Enfoque Filogenético*. 3d ed. Artmed, Porto Alegre.

Kameyama, C. 1990. A família Acanthaceae na Serra do Cipó, Minas Gerais, Brasil. Dissertation, Universidade de São Paulo, São Paulo.

———. 1995. Flora da Serra do Cipó, Minas Gerais: Acanthaceae. Boletim de Botânica da Universidade de São Paulo 14: 181–206.

———. 2006. Flora da reserva Ducke, Amazonas, Brasil: Acanthaceae. Rodriguésia 57 (2): 149–154.

Lima, I. B. and M. R. V. Barbosa. 2014. Composição Florística da RPPN Fazenda Almas, no Cariri Paraibano, Paraíba, Brasil. Revista Nordestina de Biologia 23: 49–67.

Lourenço, C. E. L. and M. R. V. Barbosa. 2003. Flora da Fazenda Ipuarana, Lagoa Seca, Paraíba (Guia de Campo). Revista Nordestina de Biologia 17: 23–58.

McDade, L. A, S. E. Masta, M. L. Moody, and E. Waters. 2000. Phylogenetic relationships among Acanthaceae: Evidence from two genomes. Systematic Botany 25: 106–121.

Monteiro, F. K. S., E. M. P. Fernando, M. F. A. Lucenaand, and J. I. M. Melo. 2018. A new species of northeastern Brazilian endemic genus *Harpochilus* (Acanthaceae). Phytotaxa 358: 289–294.

Nees Von Esenbeck, C. G. 1847. Acanthaceae. Pages 6–163 in C. F. P. von Martius, ed., *Flora Brasiliensis*. F. Fleischer, Lipsiae.

Payne, W. W. 1978. A glossary of plant hair terminology. Brittonia 30: 239–255.

Portal Brasil. Estados Brasileiros – Paraíba. http://www.portalbrasil.net/estados_rn.htm/ (accessed October 4, 2015).

Radford, A. E., W. C. Dickison, J. R. Massey, and C. R. Bell. 1974. *Vascular Plant Systematics*. Harper and Row, New York.

Rizzini, C. T. 1977. Sistematização terminológica da folha. Rodriguésia 29: 103–125.

Scotland, R. W. and K. Vollesen. 2000. Classification of Acanthaceae. Kew Bulletin 55(3): 513–589.

Silva, M. J, J. I. M. Melo, and M. F. Sales. 2010. Flora da região de Xingó, Alagoas e Sergipe: Acanthaceae A. Juss. Revista Caatinga 23: 59–67.

Souza, V. C. and H. Lorenzi. 2012. *Botânica Sistemática: guia ilustrado para identificação das famílias de Fanerógamas nativas e exóticas no Brasil, baseado em APG III*. 3d ed. Nova Odessa, Instituto Plantarum.

Stearn, W. T. 1958. A Key to West Indian Mangroves. Kew Bulletin 13: 33–37.

Tripp, E. A. 2007. Evolutionary relationships within the species-rich genus *Ruellia* (Acanthaceae). Systematic Botany 32: 628–649.

Tropicos. 2018. Tropicos.org: Nomenclatural, bibliographic, and specimen data accumulated in MBG's electronic databases. Missouri Botanical Garden. http://www.tropicos.org (accessed April 4, 2018).

Vilar, T. S. 2009. Acanthaceae Juss. no Distrito Federal, Brasil. 2009. Dissertation, Universidade de Brasília, Brasília.

Vogel, S., I. C. Machado, and A. V. Lopes. 2004. *Harpochilus neesianus* and other novel cases of chiropterophily in Neotropical Acanthaceae. Taxon 53: 55–60.

Wasshausen, D. C. and J. R. I. Wood. 2004. Acanthaceae of Bolivia. Contributions from the United States National Herbarium 49: 1–152.

NEW COMBINATIONS IN *EUPLOCA* (HELIOTROPIACEAE) FROM SOUTH AMERICA

José Iranildo Miranda de Melo[1] and Márcio Gleisson Medeiros Gonçalves[2]

Abstract. Four new combinations in *Euploca* from South America (Heliotropiaceae), all them endemic to Peru, are proposed in this paper: *Euploca lobbii*, *Euploca oxyloba*, *Euploca polyanthella*, and *Euploca toratensis*.

Resumen. En este trabajo se proponen cuatro nuevas combinaciones en *Euploca* de Sudamérica (Heliotropiaceae), todas ellas endémicas de Perú: *Euploca lobbii*, *Euploca oxyloba*, *Euploca polyanthella* y *Euploca toratensis*.

Keywords: Boraginales, diversity, flora, nomenclature, taxonomy

Ivan Murray Johnston (1898–1960) studied Boraginaceae in their traditional concept during almost four decades (from the 1920s to the 1950s) at the Gray Herbarium (currently an integral part of the Harvard University Herbaria). For this reason, the Arnold Arboretum (A) and especially the Gray Herbarium (GH) still house the main collections of this family, including types and other historical specimens obtained around the world but mainly in the Neotropical region.

During a detailed study of the collections in the Gray Herbarium (GH), conducted between October and November 2015, all the type specimens belonging to Boraginaceae subfam. Heliotropioideae (= Heliotropiaceae) were reviewed and compiled. However, in the past 15 years some phylogenies have been published treating the various genera and subfamilies of Boraginaceae s.l., resulting in several nomenclatural proposals, including Diane et al. (2003). On the basis of that publication, currently all the genera subordinated to the subfamily Heliotropioideae (Boraginaceae) are relegated to Heliotropiaceae (Boraginales), represented by four genera: *Euploca* Nutt., *Heliotropium* L., *Ixhorea* Fenzl (endemic to Argentina), and *Myriopus* Small (BWG, 2016).

Euploca was reestablished by Diane et al. (2003) to accommodate the species belonging to *Heliotropium* sect. *Orthostachys* R.Br. and the representatives of the genera *Hilgeria* Förther and *Schleidenia* Endl. *Euploca* is one of the most diverse genera of the family, encompassing approximately 100 species, including several endemic to South America, one of the main centers of diversification of the genus. New combinations were proposed recently (Feuillet, 2016; Feuillet and Hasle, 2016, 2017; Luebert and Frohlich, 2016; Melo 2017a,b; Melo and Fernández-Alonso, 2015) in American species of *Euploca*; nonetheless, several taxa from this region of the world still require nomenclature changes.

Considering the current morphological characterization of *Euploca* and the knowledge of its current representation in South America, four species originally described under *Heliotropium*, all them endemic to Peru, are here transfer to *Euploca* (Heliotropiaceae sensu BWG, 2016; Diane et al., 2016). The JSTOR Global Plants Platform (2018) was also consulted to complement the information about type specimens. Acronyms of herbaria were based on Thiers (continuously updated). The numbers assigned to herbarium specimens below correspond to barcodes attached when they were imaged for the Global Plant Initiative (GPI), a project generously financed by the Mellon Foundation.

Euploca lobbii (I.M. Johnst.) J.I.M. Melo, *comb. nov.*
Basionym: *Heliotropium lobbii* I.M. Johnst., Contr. Gray Herb. 81: 54. 1928. TYPE: PERU. Amazonas: Chacapoyos, s.d., *W. Lobb s.n.* (Holotype: K [000583564]; Isotype: GH [00097645]).

Distribution: Peru.

Euploca oxyloba (I.M. Johnst.) J.I.M. Melo, *comb. nov.*
Basionym: *Heliotropium oxylobum* I.M. Johnst., Contr. Gray Herb. 81: 57. 1928. TYPE: PERU. Bridge of Apurimac, dry hills, January 1867, 8–9000 feet, *R. Pearce s.n.* (Holotype: K [000583560]; Isotypes: BM [611734], GH [00097726]).

Distribution: Peru.

Euploca polyanthella (I.M. Johnst.) J.I.M. Melo, *comb. nov.*
Basionym: *Heliotropium polyanthellum* I.M. Johnst., Contr. Gray Herb. 81: 56. 1928. TYPE: PERU. Cajamarca, Taen, between Shumba and Taen, 700–800 m, 25 April 1912, *A. Weberbauer 6184* (Holotype: F [548715], not seen; Isotypes: G [00177378], G [00236517], fragment; GH [00097734]; MSB [002925], photo and fragment; US [00110877]).

Distribution: Peru.

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Euploca toratensis (I.M. Johnst.) J.I.M. Melo, *comb. nov.* Basionym: *Heliotropium toratense* I.M. Johnst., Contr. Gray Herb. 81: 55. 1928. TYPE: PERU. Moquegua, Torata, Open mixed formation, 17–18 March 1925, 22-2300 feet, *A. Weberbauer 7407* (Holotype: F [552638]; Isotypes: G [00177393], fragment, G [000177394]; GH [00097748]; K [000583563]; S [06-4195]).

Distribution: Peru.

LITERATURE CITED

BORAGINALES WORKING GROUP (BWG). 2016. Familial classification of the Boraginales. Taxon 65(3): 502–522. https://doi.org/10.12705/653.5

DIANE, N., H. FÖRTHER, AND H. H. HILGER. 2003. A systematic analysis of Heliotropiaceae (Boraginales) based on trnL and ITS1 sequence data. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 125: 19–51. Available at http://dx.doi.org/10.1127/0006-8152/2003/0125-0019 (accessed April 29, 2018).

———, H. H. HILGER, H. FÖRTHER, M. WEIGEND, AND F. LUEBERT. 2016. Heliotropiaceae. Pages 203–211 in J. W. KADEREIT & V. BITTRICH, EDS., *Flowering Plants. Eudicots, The Families and Genera of Vascular Plants*. Vol. 8. Springer International Publishing, Switzerland.

FEUILLET, C. 2016. Two new combinations in *Euploca* Nutt. (Heliotropiaceae, Boraginales) and a conspectus of the species of the Guiana Shield area. Phytokeys 61: 101–124. Available at https://doi.org/10.3897/phytokeys.61.6260 (accessed April 29, 2018).

——— AND R. R. HASLE. 2016. New combinations from *Heliotropium* to *Euploca* (Boraginales: Heliotropiaceae). Phytoneuron 5: 1–3. Available at http://www.phytoneuron.net/2016Phytoneuron/5PhytoN-Euploca.pdf (accessed April 29, 2018).

——— AND ———. 2017. New combinations for *Heliotropium powelliorum* and *Heliotropium pringlei* in the genus *Euploca* (Boraginales: Heliotropiaceae). Phytoneuron 5: 1–3. Available at http://www.phytoneuron.ney/2017Phytoneuron/05PhytoN-EuplocaCombinations.pdf (accessed April 29, 2018).

JSTOR: JOURNAL STORAGE. 2018. In *Global Plants*. Available at https://plants.jstor.org (accessed May 3, 2018).

LUEBERT, F. AND M. W. FROHLICH. 2016. Four new combinations in Argentinian Heliotropiaceae. Darwiniana, nueva serie 4: 192–194. Available at http://dx.doi.org/10.14522/darwiniana.2016.42.717 (accessed April 29, 2018).

MELO, J. I. M. 2017a. New combinations in *Euploca* (Heliotropiaceae) from Mexico. Revista Mexicana de Biodiversidad 88(3): 759–760. Available at http://www.revista.ib.unam.mx/index.php/bio/article/view/1877/1558 (accessed April 29, 2018).

———. 2017b. New combinations in *Euploca* Nutt. (Heliotropiaceae) from Mexico and Central America. Harvard Papers in Botany 22(2): 125–126. Available at https://huh.harvard.edu/files/herbaria/files/22_2_125_miranda_demelo.pdf (accessed April 29, 2018).

——— AND J. L. FERNÁNDEZ-ALONSO. 2015. A new combination and new synonym in the Neotropical Heliotropiaceae. Phytotaxa 222: 162–164. Available at http://dx.doi.org/10.11646/phytotaxa.222.2.11 (accessed April 29, 2018).

THIERS, B. (continuously updated). *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. Available at http://sweetgum.nybg.org/ih/ (accessed April 29, 2018).

MACARANGA STOLONIFERA SP. NOV. (EUPHORBIACEAE), A BIZARRE UNDERSTORY DWARF FROM PAPUA NEW GUINEA

WAYNE TAKEUCHI[1]

Abstract. *Macaranga stolonifera sp. nov.* is a taxonomic oddity instantly distinguished by its diminutive stature, monocaulous architecture, and stoloniferous habit. In marked contrast to other Papuasian congeners, the new species is found only in dark understories of mature growth forest. This latest addition to the euphorbiaceous flora of New Guinea is described and diagnostically depicted with in situ photos.

Keywords: new species, Southern Escarpment, Strickland River, Western Province

East Malesian *Macaranga* Thouars are usually found in successional habitats associated with anthropogenic disturbance or ecologically comparable processes (e.g., forest fires, landslips, windthrows). Because of their visual prominence, the light-demanding taxa are generally well-represented in Papuasian collections, and the local conspectus was apparently approaching a complete enumeration (Takeuchi, 2007). However, the discovery of another new *Macaranga*, the third in recent years from the Southern Escarpment, suggests that a comprehensive inventory is probably still beyond our reach.

MATERIALS AND METHODS

Taxonomic descriptions are based on the attributes of dried specimens. Characters determined in situ from living plants are reported as "field characters."

Silica-dried leaf samples from *W. N. Takeuchi & D. Ama 26856* have been inserted with the A, K, and L duplicates. The LAE sheet for *W. N. Takeuchi & D. Ama 26873* has ethanol preserved flowers in a leakproof vial.

TAXONOMY

Macaranga stolonifera W. N. Takeuchi, *sp. nov.* TYPE: PAPUA NEW GUINEA. Western Province: Strickland River, primary growth hill forest, 06°17'05"S, 142°05'33"E, 122 m, 4 August 2013, *W. N. Takeuchi & D. Ama 26856* (Holotype: A; Isotypes: CANB, K, L, LAE). Fig. 1–4.

The new species is distinguished from all congeners by its diminutive stature, monoaxial (or 1- to 2-branched) architecture, and stoloniferous habit.

Subshrubs 0.25–0.5(–1) m tall, monoaxial or with 1(–2) branches, dioecious. *Stolons* cylindrical, 3–5(–8) mm diam., straight, spreading, woody, adventitiously rooting at the nodes, surfaces crustaceous, dull brown to fuliginous, longitudinally wrinkled. *Stems* terete, 30–95 × 0.1–0.6(–0.9) cm, erect, firm, brunnescent, lenticels absent; indument velutinous, obscuring apical surfaces, persisting, pale brown, hairs hyaline, not septate; abscission scars lenticular-rotund, crateriform, 3–6.5 × 2–5 mm, inconspicuous; internodes 0.5–4(–6) cm long. *Branches* (when present) like the stem in appearance, obliquely ascending, 17.5–29.5 × 0.1–0.4 cm. *Leaves* spirally inserted; stipules 2, opposed, linear-lanceolate, 2.5–5 × 0.1–0.4 mm, scalelike, papery, persisting through 5 or more nodes, hairs as the stem; petioles cylindrical, never planoconvex, (15–)25–65(–75) × 0.5–2(–3) mm, hirtellous, slightly expanded at the poles, geniculate, not articulated; leaf-blades elliptic (or subpandurate), chartaceous, (8.0–)10.5–23.8 × 4.0–10.7(–12.2) cm, adaxially gray, abaxially yellow green, bifacially dull; lamina base obtuse, subtruncate, or notched, margins entire (or laxly denticulate), apex 0.5–2.5 cm acuminate; indument: upper surface hirtellous on veins, minutely lepidote; lower side acicular-hairy, scales glandular, peltate, initially white with dark centers, 0.3–0.4 mm diam., reducing to < 0.1 mm diam. with age due to peripheral erosion (only the black centers remaining); venation brochidodromous or eucamptodromous; secondaries 5–13 per side above a basal nervation, 8–37(–43) mm apart, at the lamina center with divergence angles of 50–75(–85)° from midribs, straight or gradually curved, usually closing by commissural loops; tertiary nerves scalariform, reticulum irregular; midribs and laterals bifacially prominent, all higher order nerves distinctly raised on both sides. *Staminate inflorescence* (immature) paniculate, longer than broad, 35–68 × 4–25 mm, axillary, single, divaricately branched, densely hirtellous on all exterior surfaces; peduncle 2–16 × 0.8–1.2 mm; lateral branches 1–4, to 15 × 0.5 mm; primary (axial) bracts subulate, ca. 1 × 0.2 mm; bracteoles triangular, ca. 1 × 0.5 mm, aglandular, completely hidden by the indument. *Staminate flowers* congested, glomerate, ca. 10–15 per cluster, subglobose in bud, sessile or nearly so, anthers 4-locular. *Pistillate inflorescence* unknown. *Infructescence* from apical or subapical axils, solitary (or 2 together), unbranched, ascending, 5.5–11.7 cm long; peduncle 45–110 × 0.7–1.2 mm, hirtellous, compressed; bracts acuminate, 5.5–6 × 0.7–1 mm, papery, hairy; fruiting pedicel columnar, ca. 1 × 1.5 mm, stiff. *Fruits* 9–12 × 14–16 mm, bilocular, usually crowded into a single terminal cluster, up to 4

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FIGURE 1. *Macaranga stolonifera* W. N. Takeuchi. Habit. Miniature monocauls ca. 25 cm tall in forest floor litter. From *W. Takeuchi & D. Ama 26856*.

together; exocarp black, hirtellous and copiously spinose; spines subulate, 2–4 mm long, pliant, plumose, bearded at the top, hairs acicular, irritant; seeds ca. 5 mm diam., conspicuously ridged, black.

Additional specimens examined: PAPUA NEW GUINEA. Western Province: Strickland River, primary growth hill forest, 06°16'15"S, 142°06'14"E, 148 m, 5 August 2013, *W. N. Takeuchi & D. Ama 26873* (A, K, L, LAE); 06°16'37"S, 142°06'30"E, 153 m, 7 August 2013, *W. N. Takeuchi & D. Ama 26907* (A, L, LAE).

Field characters: subshrubs 0.25–1 m tall, monocaulous (or sparingly branched), stoloniferous; stems green, indument orange brown; leaf-flush brownish-green, mature blades thin, papery, quickly withering when collected, upper side dark dull green, lower side pale green with pink veins, abaxial glands pallid or yellow; infructescence axes green; fruits globose, furnished with red cylindrical spines.

Distribution: widely dispersed through low-lying hills (100–150 m) along the Strickland River in Western Province (Fig. 5).

Habitat and ecology: restricted to densely shaded understories in mature growth forest. Locally common (or dominant) in colline and riverine communities but excluded from the alluvial flood plain.

Phenology: flowering and fruiting in August.

Despite the new taxon's surprising features, its 4-celled anthers, alternate leaves, and absence of stellate hairs are collectively diagnostic for the generic assignment. Any similarity to *Mallotus* Lour. (as presently circumscribed) is superficial and misleading. When *Macaranga stolonifera* was first encountered in the field, the collectors were skeptical of the presumptive identity, but that is where the characters point.

Although an infrageneric phylogeny has not been established for *Macaranga*, the Papuasian taxa were treated within seven informal assemblages by Whitmore (1980a, 2008). The new species is referable to the *Dioica* Group on the latest formulation (in Whitmore, 2008), but it is doubtful whether a close connection actually exists to the congeners there. Owing to its unique attributes, *M. stolonifera* has no discernable affinity.

Macaranga in New Guinea are tall shrubs or trees represented primarily by heliophilic plants from secondary environments (Whitmore, 1980b). The discovery of a monocaulous dwarf adapted to dark understories is an astonishing addition to the regional conspectus. Umbrageous forest specialists like *M. stolonifera* are rarely seen in east Malesia and may represent a reversion to the ancestral ecology (cf. Welzen et al., 2014).

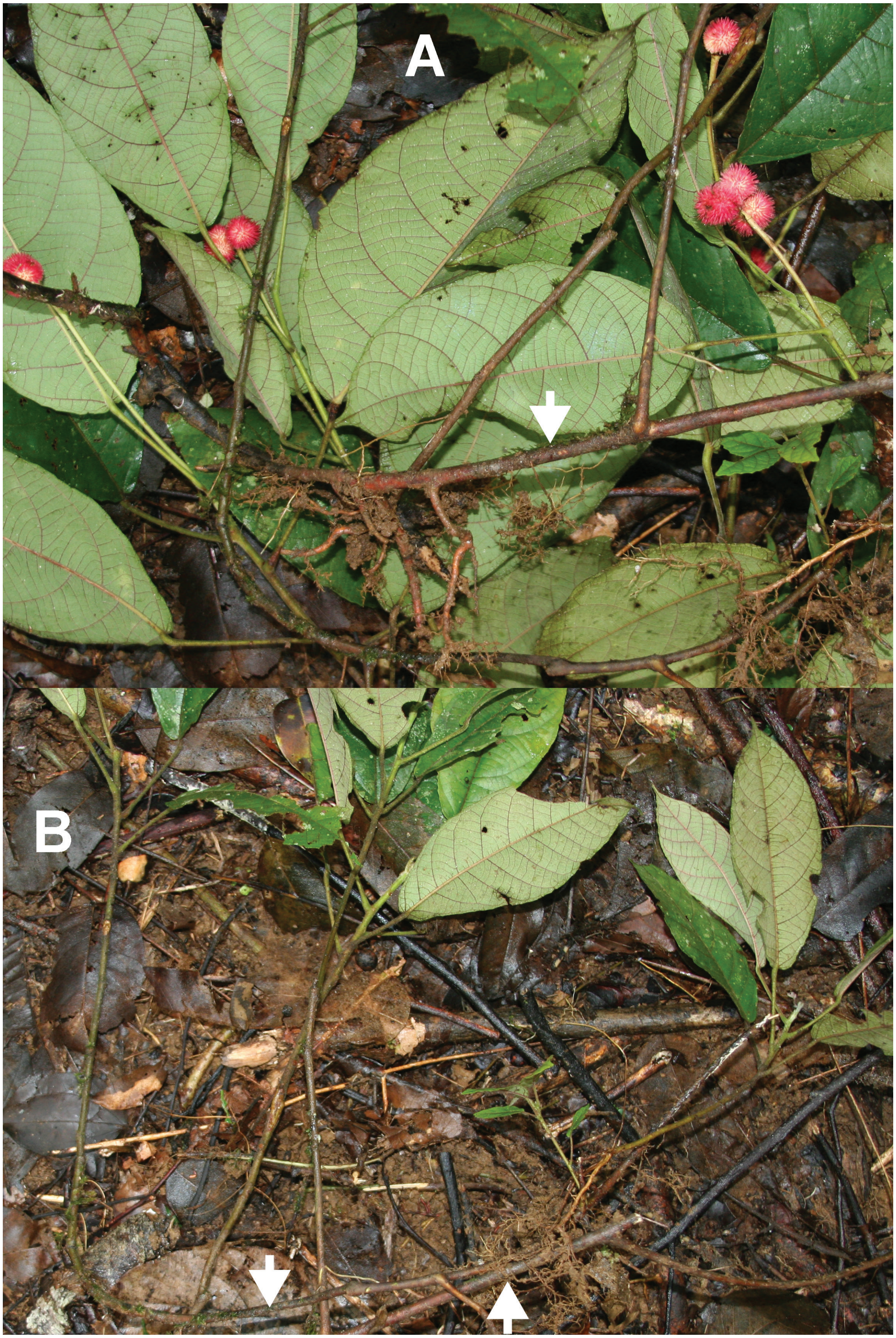

FIGURE 2. *Macaranga stolonifera* W. N. Takeuchi. Uprooted plants, connecting stolons indicated by white arrows. **A**, fertile stems; **B**, sterile stems. A from *W. Takeuchi & D. Ama 26873*; B from *W. Takeuchi & D. Ama 26856*.

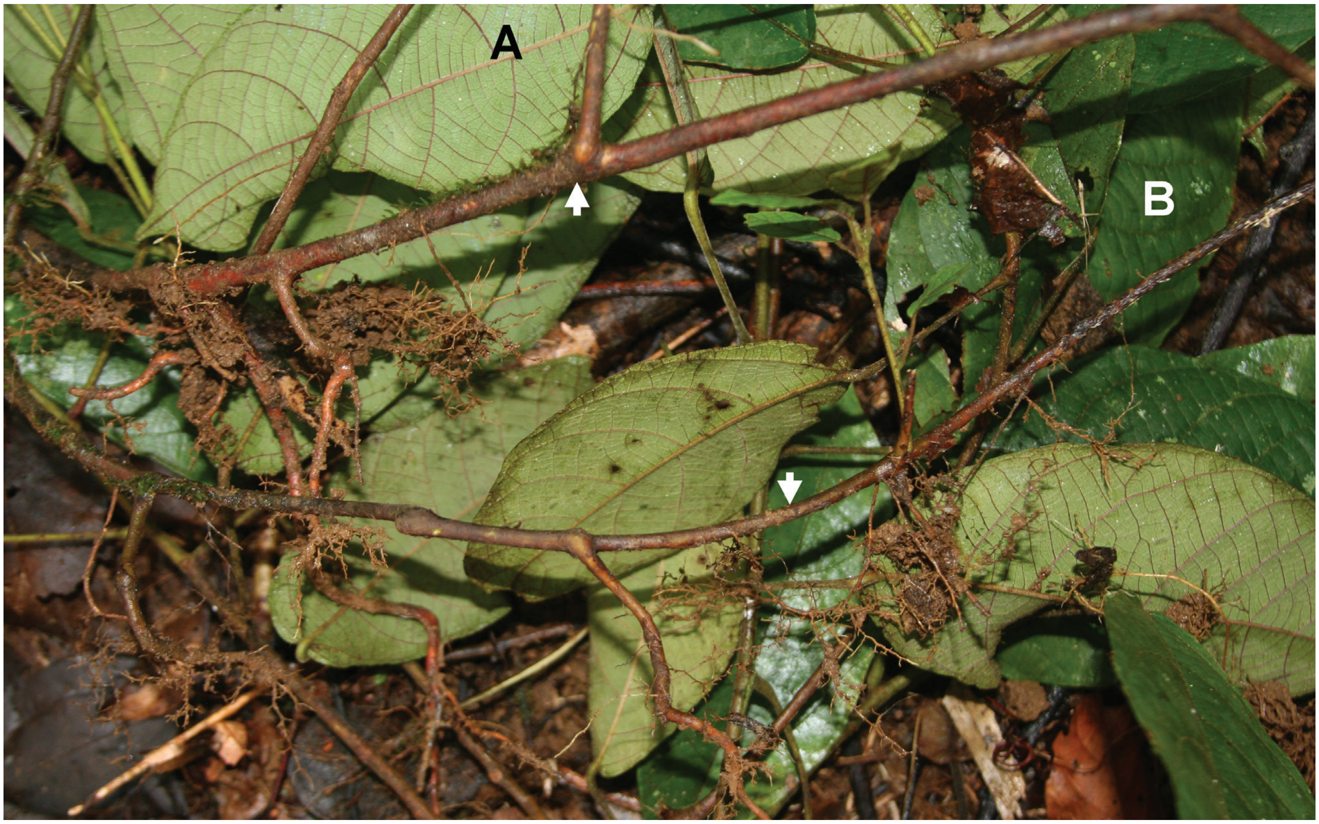

FIGURE 3. *Macaranga stolonifera* W. N. Takeuchi. Vegetative structures. Stolons (white arrows) and subsurface nodes. **A**, abaxial leaf surfaces; **B**, adaxial leaf surfaces. From *W. Takeuchi & D. Ama 26873*.

FIGURE 4. *Macaranga stolonifera* W. N. Takeuchi. Infructescence. **A**, side view; **B**, oblique apical view. A from *W. Takeuchi & D. Ama 26873*; B from *W. Takeuchi & D. Ama 26856*.

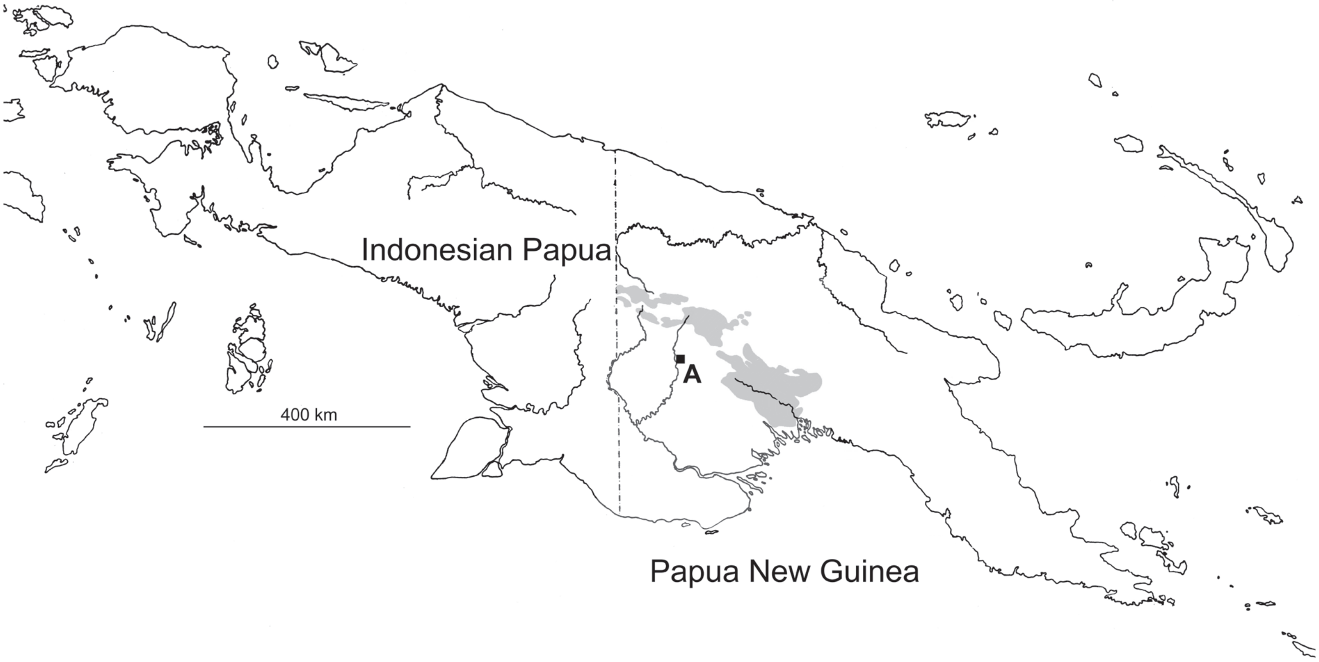

FIGURE 5. Island of New Guinea. **A**, type locality for *Macaranga stolonifera* W. N. Takeuchi, shown in relation to the southern karst (shaded areas).

LITERATURE CITED

TAKEUCHI, W. 2007. Additions to the flora of the Kaijende Highlands, Papua New Guinea: *Macaranga daviesii* (Euphorbiaceae), a new calciphilous species from the Paiela limestone. Harvard Pap. Bot. 12: 389–394.

WELZEN, P. C. VAN, J. S. STRIJK, J. H. A. VAN KONIJNENBURG–VAN CITTERT, M. NUCETE, AND V. S. F. T. MERCKX. 2014. Dated phylogenies of the sister genera *Macaranga* and *Mallotus* (Euphorbiaceae): Congruence in historical biogeographic patterns? PLoS ONE 9: 1–14.

WHITMORE, T. C. 1980a. *Macaranga*. Pages 123–162 in H. K. AIRY SHAW, *The Euphorbiaceae of New Guinea*, Kew Bull., addit. ser. 8. Royal Botanic Gardens, Kew.

———. 1980b. *Macaranga* in New Guinea and the Bismarck Archipelago. Studies in *Macaranga* VIII. Kew Bull. 34: 599–606.

———. 2008. *The Genus Macaranga, a Prodromus*. Royal Botanic Gardens, Kew.

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A NEW SPECIES OF *EUGENIA* (MYRTACEAE) FROM THE ISLAND OF ANGUILLA

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Abstract. *Eugenia walkerae*, a new species from the island of Anguilla, is described and illustrated. This species is known only from five herbarium collections, and additional fieldwork is needed to determine its current conservation status. It resembles the Puerto Rican endemic *E. woodburyana*, and its seeds are comparable to those described for certain species of *Eugenia* from southern Africa. This is the second species of seed plant currently recognized as endemic to Anguilla.

Keywords: endemic, Lesser Antilles, systematics, taxonomy

In the Flora of the Lesser Antilles, McVaugh (1989) included a brief description of a Myrtaceous plant unknown as to genus and species from the island of Anguilla. The description was based on two sterile collections made by the French botanist Père Casimir Le Gallo in 1955. As reported by Howard and Kellogg (1987), efforts to relocate this distinctive species at the same locality in 1985 were unsuccessful; however, 10 years later, two additional collections of the same species in flower and fruit were made by Mary Morris Walker. An undivided, globular embryo and a single axillary flower that lacks a prolonged hypanthium but has a 4-lobed, open calyx persistent on the mature fruit indicate that the plant in question is a species of *Eugenia* L. Since it is distinct from all others known to me from the Antilles, it is here described as a new species.

Eugenia walkerae J. A. Flickinger, *sp. nov.* TYPE: ANGUILLA. Katouche Valley, 12 February 1995, (flower, fruit), *M. Walker 95-016* (Holotype: A). Fig. 1.

Eugenia ramulis minute hispidis, caeterum glabra; foliis obovatis v. ellipticis, 8.5–18 mm longis × 5–12 mm latis, apice rotundato v. retuso, basi late cuneata v. convexa, margine incrassato, recurvato, nervis lateralibus inconspicuis, crasse coriaceis, dicoloribus, subtus conspicue glandulosis; floribus solitariis ex axillis foliorum, pedicellis 2.5 mm longis, alabastris 3.5 mm longis × 2.5 mm latis, lobis calycis inaequalibus, majoribus rotundatis, minoribus triangularibus; baccis ellipsoidalibus, 6–7 mm diametro, glandulosis; embryone glanduloso, maculam fuscatam praebenti.

Shrub, glabrous except for the young twigs; hairs simple, pale; new growth arising from axillary buds, with a few pairs of decussate, rounded to triangular, dark bud scales at base, slightly flattened, hispidulous, brown; older twigs terete, glabrescent, glandular-verrucose, becoming smooth and developing a lightly fissured, gray bark. *Leaves* opposite, petiolate, glabrous even when young; petioles semiterete, 1–2 mm long × 1 mm wide, leaving a U-shaped bundle scar upon abscission; blades obovate to elliptical, 8.5–18 mm long × 5–12 mm wide, ca. 1.5 times as long as wide, apex rounded to retuse, base broadly cuneate or convex, margin incrassate, recurved, pale and decurrent into petiole, coriaceous, discolorous, drying light brown below, darker above; venation brochidodromous, midvein plane above, slightly prominent proximally below, lateral veins obscure, 4–6 pairs, departing from the midvein at an angle of 45–60°, forming an arching marginal vein ca. 1 mm from the margin; adaxial surface slightly impressed-punctate to plane; abaxial surface prominently and conspicuously glandular. *Inflorescences* axillary on new growth, solitary, 1-flowered. *Flowers* pedicellate; pedicels terete, 2.5 mm long × 0.3 mm wide, sparsely glandular; bracteoles free, ovate, 0.7 mm long in bud, glandular, ciliate, persistent, 1 mm long × 1 mm wide in fruit; buds obovoid, 3.5 mm long × 2.5 mm wide; calyx 4-lobed, open in bud, glandular, ciliate, larger lobes rounded, concave, 1.4 mm long × 1.9 mm wide in fruit, smaller lobes triangular, 0.8 mm long × 1.2 mm wide in fruit, rounded at apex; petals glandular. *Fruits* prolate ellipsoidal to spheroidal, 6–7 mm diam. when dry, crowned by the persistent, erect calyx lobes, glandular, ripening black; pericarp thin and fleshy with longitudinally oriented fibers and a membranous endocarp; 1-seeded. *Seeds* rounded; seed coat yellow-brown, more or less smooth on exterior surface, mottled brown on interior surface, with a hard outer palisade layer, a fibrous middle layer, and a series of inner periclinal layers appearing whitish in cross section; embryo ellipsoidal, 6 mm long × 5 mm diam., undivided, surface yellow-gray, wrinkled, glandular, with a dark spot near one end and a slightly raised stripe 0.5–1 mm wide running lengthwise from the end opposite the spot along the side opposite the same for somewhat greater than 1/2 the length of the embryo.

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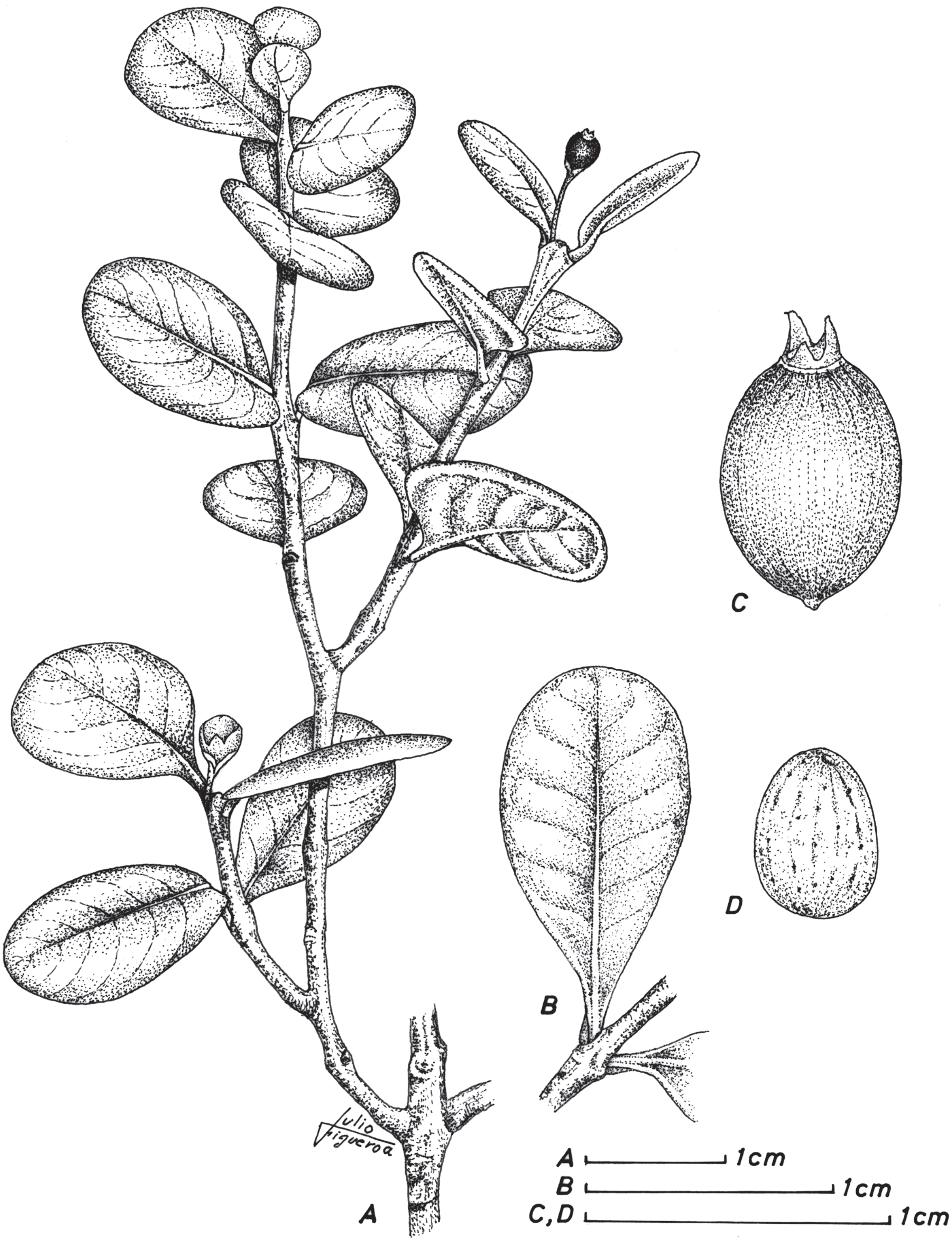

FIGURE 1. *Eugenia walkerae* J. A. Flickinger. **A**, habit; **B**, leaf; **C**, mature fruit; **D**, embryo. From *M. Walker 95-016* (A).

Eponymy: *Eugenia walkerae* is named for the collector of the type specimen, Mary Morris Walker (1923–2012), in recognition of her contributions to the botany of Anguilla through the Anguilla Flora Project (Walker et al., 2005).

Additional specimens examined: ANGUILLA. S rim of Katouche Valley near Governor's House, 4 February 1995, (fruit), *M. Walker 95-04* (A). The Valley, plateau calcaire, près de la chapelle catholique, alt. 15 m, 5 September 1955, (sterile), *C. Le Gallo 2480* (NY [photograph]). The Valley, plateau calcaire, à l'ouest de la chapelle catholique, alt. 15–20 m, 5 September 1955, (sterile), *C. Le Gallo 2483* (WAG [two sheets, photographs]). The Valley, plateau calcaire, alt. 20 m, 5 September 1955, (sterile), *C. Le Gallo 2493* (NY [photograph]).

Phenology: Collected with flowers and fruits in February.

Habitat and distribution: *Eugenia walkerae* is endemic to Anguilla, where it has been found in two separate areas (Fig. 2). The Le Gallo collections were made at low elevation on limestone in The Valley, the island's capital, whereas Walker's collections are from the nearby Katouche Valley. On a note included in the fragments folder of *Walker 95-04* (A), two question marks appear to indicate uncertainty as to the exact locality. The Katouche Valley supports dry evergreen forest vegetation restricted to a few sheltered sites on the island (Walker et al., 2005).

Conservation status: The current status of this species in the wild is unknown. As a single-island endemic with few collections, it is likely of conservation concern; however, the Katouche Valley is being preserved for eco-tourism (O. Hodge, pers. comm.).

The dimensions of the petioles and leaf blades given above are based on physical examination of Walker's two collections. These differ only slightly from the dimensions of the Le Gallo collections reported by McVaugh (1989), which were subsequently confirmed from images of the specimens.

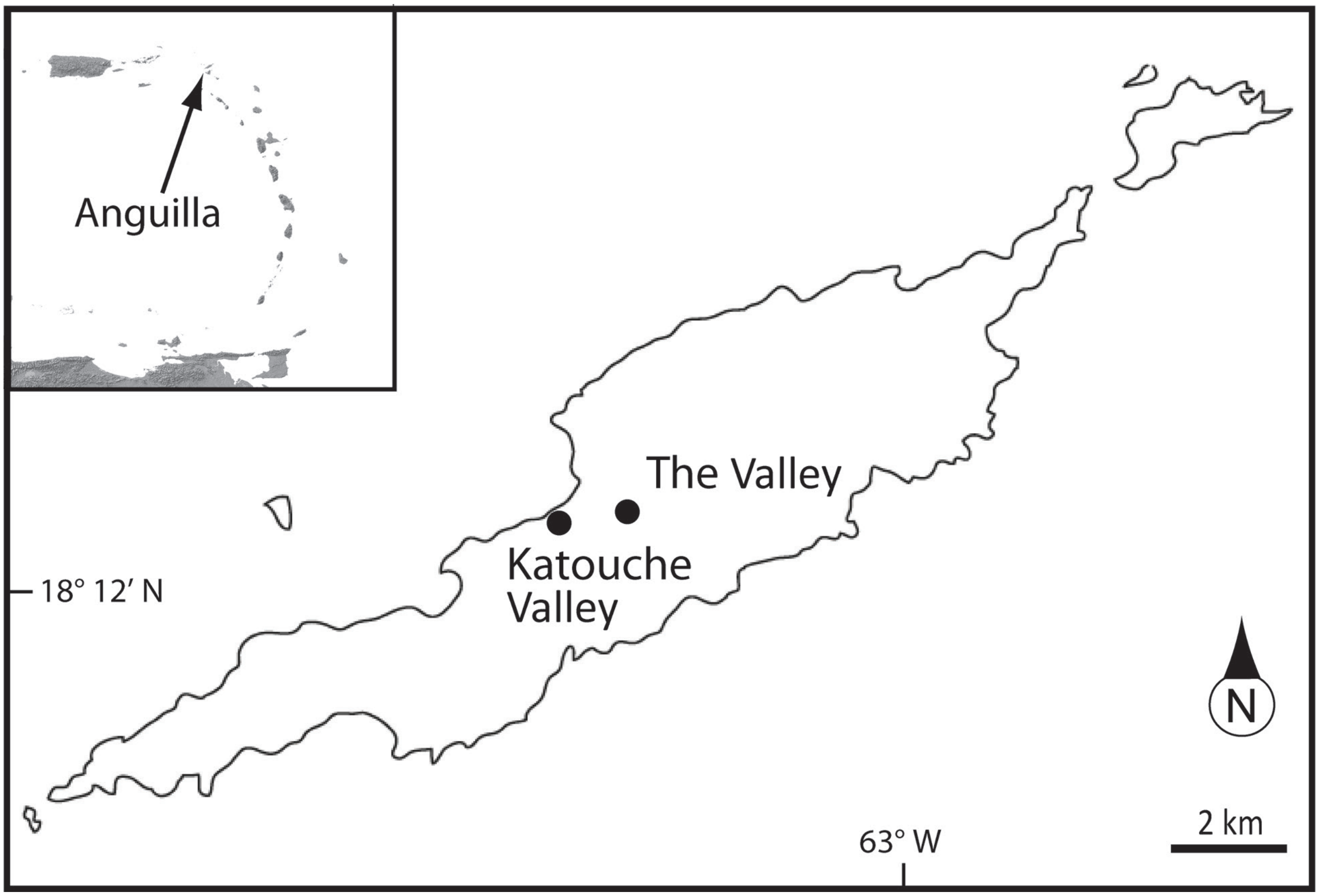

FIGURE 2. Map of collection sites for *Eugenia walkerae* J. A. Flickinger on Anguilla.

Among its congeners in the region, *Eugenia walkerae* resembles *E. woodburyana* Alain of western Puerto Rico in its coriaceous leaves drying darker above and hispidulous twigs. The leaves of *E. woodburyana* are generally larger and more elliptical, and the venation is prominulous. Hairs are also found at least on the petiole and along the margins of the leaves, as well as on the flowers and fruits. In flower, *E. woodburyana* differs in its short axillary racemes of 2–4 flowers with calyx lobes more or less equal in size and a ridged hypanthium. Its fruits are much larger (2 cm diam.) and 8-winged.

Comparison of the seeds of *Eugenia walkerae* with the detailed descriptions available for seeds of species of *Eugenia* native to southern Africa allows for interpretation of some of the features described above. Seed coats of southern African species develop from the outer integument and possess a mesophyll-derived layer consisting of "haphazardly arranged fibre-like sclereids" (van Wyk and Botha, 1984), which corresponds well with the fibrous middle layer observed in *E. walkerae* seeds. The outer palisade layer of the seed coat described above is characteristic of species of group X in southern Africa. In contrast, most group Y species possess an epidermal layer that is poorly differentiated from the mesotesta (van Wyk and Botha, 1984). The embryo of *E. walkerae*, though undivided, also more closely resembles that of group X species in having a glandular surface and possessing a dark spot that probably marks the location of the radicle (van Wyk, 1980). The significance of the raised stripe is unclear. More detailed descriptions of seed and embryo characters, especially for Neotropical species, may prove useful in the classification of this large genus.

Howard and Kellogg (1987) accept only a single endemic species of spermatophyte for the flora of Anguilla, their newly described *Rondeletia anguillensis* R. A. Howard & E. A. Kellogg. The description of *Eugenia walkerae* thus brings the total number of endemics to two. Previously, one other species of Myrtaceae was recognized as endemic to Anguilla, *Myrtus anguillensis* Urb. This taxon is now generally referred to *Mosiera longipes* (O. Berg) Small (Govaerts et al., 2018), a Caribbean species at the edge of its range in the Leeward Islands.

LITERATURE CITED

GOVAERTS, R., M. SOBRAL, P. ASHTON, F. BARRIE, B. K. HOLST, L. R. LANDRUM, K. MATSUMOTO, F. F. MAZINE, E. NIC LUGHADHA, C. PROENÇA, L. H. SOARES-SILVA, P. G. WILSON, AND E. J. LUCAS. 2018. *World Checklist of Myrtaceae*. The Board of Trustees of the Royal Botanic Gardens, Kew; http://www.kew.org/wcsp/ (accessed May 1, 2018).

HOWARD, R. A. AND E. A. KELLOGG. 1987. Contributions to a flora of Anguilla and adjacent islets. J. Arnold Arbor. 68: 105–131.

MCVAUGH, R. 1989. Myrtaceae. Pages 463–532 in R. A. HOWARD, ED. *Fl. Lesser Antilles* 5. Arnold Arboretum, Harvard University, Jamaica Plain.

VAN WYK, A. E. 1980. A note on the seed morphology of the genus *Eugenia* L. (Myrtaceae) in southern Africa. J. S. African Bot. 46: 115–119.

——— AND R. BOTHA. 1984. The genus *Eugenia* (Myrtaceae) in southern Africa: Ontogeny and taxonomic value of the seed. S. African J. Bot. 3: 63–80.

WALKER, M. M., O. HODGE, F. HOMER, AND W. JOHNSON. 2005. *A Guide to Common Plants of Anguilla*. Anguilla National Trust and BioDiversity Conservation Inc., The Valley.

STUDIES IN *FERNANDEZIA* RUIZ & PAV. (ORCHIDACEAE: ONCIDIINAE)

Paul Ormerod[1]

Abstract. Literature and herbarium studies of the Neotropical orchid genus *Fernandezia* Ruiz & Pav. reveal that a number of previously recognized taxa should be synonymized, while at the same time it is necessary to propose several new taxa (45 species and 11 varieties). *Fernandezia distichoides* (*Pachyphyllum distichum*) and *F. pectinata* are lectotypified, and *F. vaginata* is neotypified. An infrageneric subdivision is proposed for *Fernandezia,* in which six sections are recognized. Section *Capitata* is transferred from *Pachyphyllum, Orchidotypus* is reduced to sectional level (as it was in *Pachyphyllum*), and three new sections are proposed, namely, section *Breviconnata,* section *Gracillima,* and section *Lamellata*.

Keywords: *Fernandezia,* new species, sections, synonymy, typification

The genus *Fernandezia* was proposed by Ruíz and Pavón (1794) to accommodate some monopodial orchids with an obtuse labellum. Their rather broad concept of the genus included species of *Dichaea* Lindl. and *Maxillaria* Ruiz & Pav. Unfortunately, while discussing an aberrant taxon that had an acute labellum, *F. laxa* Ruiz & Pav., they inadvertently validated it, and this entity (which is a species of *Dichaea* Lindl.) is the nomenclatural type of *Fernandezia*. Therefore, the choice of *F. subbiflora* Ruiz & Pav. (a name published in 1798 but illustrated in 1794) as lectotype by Dunsterville and Garay (1972) is superfluous. It will therefore be necessary to conserve the type of *Fernandezia* to continue its usage as currently interpreted. Of the eight species named in 1798, only *F. subbiflora* Ruiz & Pav. and *F. denticulata* Ruiz & Pav. belong to the current concept of the genus.

For a long time *Fernandezia* contained only a few (about 6 or 7), attractive, red to orange-flowered species, until Chase and Whitten (2011) merged *Pachyphyllum* Kunth (about 40 species) with it on the basis of molecular data. The justification for this merger was published by Neubig et al. (2012), and it showed that species of *Pachyphyllum* were interdigitated with those of *Fernandezia*. However, Kolanowska and Szlachetko (2014) preferred to recognize five separate genera, namely *Fernandezia* Ruiz & Pav.*,* *Orchidotypus* Kraenzl., *Pachyphyllum* Kunth, *Raycadenco* Dodson, and a new genus *Valdiviesoa* Szlach. & Kolan. With the exception of *Raycadenco*, which seems best treated as a sister genus, I have followed Chase and Whitten's broad concept of *Fernandezia*.

I agree with the criticism of the molecular clade of Neubig et al. (2012) by Kolanowska and Szlachetko (2014), who pointed out that seven of the taxa sampled were unidentified. Another problem is that two of the names used (*F. hartwegii* [Rchb.f.] Garay & Dunsterv. and *F. tica* Mora-Retana & J.B. Garcia) are in my opinion (Ormerod 2016) respectively synonyms of *F. myrtillus* (Rchb.f.) Garay & Dunsterv. and *F. sanguinea* (Lindl.) Garay & Dunsterv. These two latter entities were also quite often confused with each other in the literature and herbarium. Furthermore, another name used, *F. cuencae* (Rchb.f.) M.W. Chase, has been misapplied in the herbarium to at least two different species; I have not seen modern material of it. It is evident more species that have been confidently identified are required for a broader sampling base, including the use of more coding regions.

However, the problems with the taxa sampled in Neubig et al. (2012) are not their fault but rather a reflection of the history of confused taxonomy in *Fernandezia* sensu lato, where many names were misapplied, there was a large amount of unidentified herbarium material, and about half of the species of the genus were undescribed.

In this paper my intention is to try and resolve the identities of a number of previously established taxa, thus requiring some new synonymy. A large number of new taxa are also described, particularly from Peru and Bolivia, where it is evident active speciation has occurred. After examining most of the species in the genus it would seem prudent to propose some infrageneric divisions to aid in species placement and identification.

A number of taxonomic issues remain, and they bear mentioning. *Fernandezia distichoides* M.W. Chase (*Pachyphyllum distichum* Kunth) is the type species of *Pachyphyllum* Kunth. The name is frequently misapplied, part of the problem being that the type material in Paris appears to be a mixture of three or four species. Taxa in this group are difficult to distinguish. Three other species, *F. dalstroemii* (Dodson) M.W. Chase, *F. hagsateri* (Dodson) M.W. Chase, and *F. theodorii* M.W. Chase (*Pachyphyllum hartwegii* Rchb.f.), also pose problems because of their conservative floral morphology.

Fernandezia sensu lato may be recognized by its monopodial habit, short, axillary inflorescences, small flowers (sepals 1–12 mm long), relatively simple, barely lobed lip, often bearing a medial thickening that terminates in a bilobed callus or two lamellae, broadly winged column, often with a cryptic anther, and two pollinia with variously developed viscidia and tegula.

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Taxonomic Treatment

Infrageneric Division

Fernandezia section ***Breviconnata*** Ormerod, *sect. nov.*

Type species: *Pachyphyllum breviconnatum* Schltr.

Leaves flat, often twisted basally to lie in a 180° plane; peduncle often biflorous; flowers often with sepals and petals united basally, dorsal sepal and petals often recurved, lateral sepals often upcurved, labellum short to long clawed, blade ovate-lanceolate, narrowly elliptic to subpandurate, column shortly stalked, with suborbicular wings in the upper half.

Distribution: about eight species in Peru and Bolivia.

The core group of species in this section contains *Fernandezia breviconnata* (Schltr.) M.W. Chase and five new species, *F. bilineata, F. chaparensis, F. cymbiformis, F. mercadoi,* and *F. solomonii*. These all agree in habit and leaf shape (elliptic with tapered ends), short 2- to 3-flowered inflorescences, flowers with a recurved dorsal sepal and petals, upcurved lateral sepals, and ovate-lanceolate to an subpandurate lip. I also consider *F. parvifolia* (Lindl.) M.W. Chase to belong here, though its habit is a little different, the leaves oblong to oblong-obovate, the sepals straight, and the lip oblong to elliptic. Another outlier is *F. luerorum* Ormerod from Bolivia, which has a short but seemingly multiflowered raceme, flowers with splayed (vs. upcurved) lateral sepals, and an unusual column widened both dorsally and ventrally.

Fernandezia section ***Capitulum*** (D.E. Bennett & E.A. Christenson) Ormerod, *comb. nov.*

Basionym: *Pachyphyllum* Kunth section *Capitulum* E.A. Christenson, J. Bot. Res. Inst. Texas 2, 1: 288. 2008.

Type species: *Pachyphyllum ecallosum* E.A. Christenson.

Heterotypic synonym: *Valdiviesoa* Szlach. & Kolan., Plant Syst. Evol. 300, 5: 107. 2014.

Type species: *Pachyphyllum debedoutii* P. Ortiz.

Distribution: three species found in Bolivia, Peru, Ecuador, Colombia, and Venezuela.

This section was originally proposed by Christenson on the basis of the premise that the flowers were in a capitulum, instead of a raceme. However, I consider the inflorescence to have a very short, often biflorous raceme, a feature also found in taxa of the *F. breviconnata* (Schltr.) M.W. Chase group. All three species in section *Capitulum* share the short raceme, flowers with papillose-denticulate margins to the sepals and petals, an ovate-suborbicular lip that bears a Y-shaped callus with the ends vanishing into the surface, and a column with downward-directed lobe-like wings.

Kolanowska and Szlachetko (2014) provided a revision of the group under the generic name *Valdiviesoa,* but they overlooked *Pachyphyllum ecallosum*. I think further studies are called for, especially since all three species are very similar florally.

In this paper only *Fernandezia ecallosa* and a new variety are treated.

Fernandezia section **Fernandezia** sensu lato

Type species (to be conserved): *Fernandezia subbiflora* Ruiz & Pav.

Distribution: 34 species in Costa Rica, Panama, Venezuela, Colombia, Ecuador, Peru, and Bolivia.

This group is the most diverse florally and would benefit from further molecular sampling to determine the true relationships of taxa in it. The classic red- to orange-flowered species commonly associated with the generic name *Fernandezia* belong here, namely, *F. ionanthera* (Rchb.f. & Warsc.) Schltr., *F. maculata* Garay & Dunsterv., *F. myrtillus* (Rchb.f.) Garay & Dunsterv., *F. sanguínea* (Lindl.) Garay & Dunsterv., and *F. subbiflora* Ruiz & Pav. It is possible the white-flowered *F. transversalis* Ormerod is also a member of this group. Another interesting plant is the rare Costa Rican species *F. costaricensis* (Ames & C. Schweinf.) M.W. Chase, which has small greenish-white flowers with a sigmoid labellum, shaped much like that of *F. sanguinea,* which has orange flowers that are two to three times larger. Also of interest is the peculiar *F. piesikii* (Szlach., Mytnik & Rutk.) M.W. Chase, a vegetative giant (leaves to 10 cm long) in a genus of plants with leaves rarely more than 3 cm long. The other accepted taxa in this group all have small (sepals 1.0–4.5 mm long), white to greenish flowers, with the lip usually widest basally, and adorned with two fleshy conical to ellipsoid calli. These taxa are *F. crystallina* (Lindl.) M.W. Chase, *F. cuencae* (Rchb.f.) M.W. Chase, *F. dalstroemii* (Dodson) M.W. Chase, *F. denticulata* Ruiz & Pav., *F. distichoides* M.W. Chase, *F. falcifolia* (Rchb.f.) M.W. Chase, *F. hagsateri* (Dodson) M.W. Chase, *F. lycopodioides* (Schltr.) M.W. Chase, *F. micrantha* (Schltr.) M.W. Chase, *F. putumayoensis* (Szlach., Kolan. & Oledr.) Molinari & Mayta, *F. squarrosum* (Lindl.) M.W. Chase, and *F. theodorii* M.W. Chase.

The new taxa are *Fernandezia callacallae, F. camposii, F. cuprea, F. espinosae, F. hamiltonii* (+ var. *jaenensis*), *F. harlingii, F. kosnipatae, F. militaris, F. rubescens, F. rubicunda, F. salliquensis, F. tintasensis, F. transversalis, F. vargasii,* and *F. yahuarcochae*.

Fernandezia section **Gracillima** Ormerod, *sect. nov.*

Type species: *Pachyphyllum gracillimum* C. Schweinf.

Leaves flat, often twisted to lie in a 180° plane; inflorescence three or more flowered; flowers campanulate, sepals united basally to halfway, up to 3 mm long, column sessile, widest in lower half.

Distribution: about six species in Peru and Bolivia.

Fernandezia gracillima (C. Schweinf.) M.W. Chase, and the new taxa *F. nunezii, F. pastinaca,* and *F. unduaviae,* resemble *F. breviconnata* and its allies vegetatively. They differ in having smaller flowers that do not have a recurved dorsal sepal or petals, nor upcurved lateral sepals (which also lack a lamellate carina on the midvein); the column is usually sessile and is broadest in the lower half or in the middle. I place *F. vanderwerffii* here even though it has dissimilar habit, but it does agree in floral characters. Another taxon, *F. tenuis* (Schltr.) M.W. Chase has little ligulate leaves but in floral characters it seems to belong here. Both *F. gracillima* and *F. tenuis* had been placed in section *Orchidotypus* because of the connate sepals but differ from those entities in column shape.

Fernandezia section **Lamellata** Ormerod, *sect. nov.*
Type species: *Pachyphyllum pectinatum* Rchb.f.

Leaves flat to conduplicate; labellum often narrowed to base but can be oblong to elliptic, with two lamellate keels, these either elongated or abbreviated; column stalked, often with suborbicular wings.

Distribution: 29 species in Peru and Bolivia.

This group of species has obviously speciated in the Andes of Peru and Bolivia. Leaf form varies from flat to conduplicate, coriaceous to fleshy. Obviously the plants have some vegetative similarity to various species in section *Fernandezia,* but generally the lip is narrower in the basal half and adorned above with lamellae, whereas in section *Fernandezia* the lip is usually broader in the basal half, and the calli of the lip are thick and fleshy.

The nine established taxa are *Fernandezia capitata* (Kraenzl.) M.W. Chase, *F. cardenasii* (L.B. Sm. & S.K. Harris) M.W. Chase, *F. cyrtophylla* (Schltr.) M.W. Chase, *F. herzogii* (Schltr.) M.W. Chase, *F. minor* (Schltr.) M.W. Chase, *F. pectinata* (Rchb.f.) M.W. Chase, *F. pseudodichaea* (Rchb.f.) M.W. Chase, *F. serra* (Rchb.f.) M.W. Chase, and *F. tajacayaensis* (D.E. Bennett & E.A. Christenson) M.W. Chase. The 20 new species and 9 new varieties are *F. amboroensis* (+ var. *obovata*)*, F. angusta* (+ var. *erythromitra*)*, F. barnettiae, F. carabayana, F. crassapex, F. cuneata, F. diazii, F. dorriana, F. ichneumonea, F. jordaniae* (+ var. *trullata*)*, F. mandonii, F. minor* var. *boekeorum* and var. *breviflora, F. pandurata, F. pectinata* var. *punoensis, F. pseudominor, F. quadrangularis, F. scimitaris, F. shoveliformis* (+ var. *inversa*)*, F. steinbachii, F. teranii, F. tinquiana,* and *F. weberbaueri* (including varieties *platychila* and *tricrucensis*).

Fernandezia section ***Orchidotypus*** (Kraenzl.) Ormerod, *comb. nov.*
Basionym: *Orchidotypus* Kraenzl., Bot. Jahrb. Syst. 37: 383. 1906.
Type species: *Orchidotypus muscoides* Kraenzl.
Homotypic synonym: *Pachyphyllum* Kunth section *Orchidotypus* (Kraenzl.) E.A. Christenson, J. Bot. Res. Inst. Texas 2, 1: 287. 2008.

Distribution: eight species in Mexico, Guatemala, Costa Rica, Panama, Venezuela, Colombia, Ecuador, and Peru.

This group of species may be recognized by the small size of the plants (to 6 cm tall), short, 1- to 2-flowered inflorescences, and tiny campanulate flowers (sepals 1.2–2.7 mm long), with connate sepals and petals, a broadly clawed lip with well separated lamellae, and a shortly stalked column. One exception to floral size is *Fernandezia pastorelliae* Trujillo, which has 10-mm-long sepals. A recent synopsis of the Colombian species was given by Szlachetko et al. (2014), but in my opinion the authors misapplied the name *Orchidotypus bryophytus* (Schltr.) Senghas to material of *O. schultesii* (L.O. Williams) Senghas, while what they called *O. schultesii* is rather *O. vaginatus* (Schltr.) Senghas. Notes on this can be found under the relevant taxa.

The following key is arranged using the sections above, but in the following order (basically from those with the least species to the most): Sections *Capitata, Orchidotypus, Gracillima, Breviconnata, Fernandezia,* and *Lamellata.*

KEY TO THE SECTIONS AND SPECIES OF *FERNANDEZIA* TREATED HERE

A. Section **Capitata.** Labellum with callus tips vanishing into its surface.
  1A. Labellum with apical margin minutely papillose; column 1.0–1.3 mm wide laterally . . . . *F. ecallosa* var. *ecallosa*
  1B. Labellum with apical margin entire; column 1.8 mm wide laterally . . . . *F. ecallosa* var. *cundinamarcae*
B. Section **Orchidotypus.** Sepals and petals connate; base of lateral sepals not broadly oblique; column widest in upper half.
  1A. Leaf sheaths with margins fimbriate-denticulate; lateral sepals to 1.9 mm long; blade of labellum pentagonal-suborbicular . . . . *F. antioquiensis*
  1B. Leaf sheaths with margins entire to shortly denticulate; lateral sepals 1.9–2.9 mm long; blade of labellum obovate to ovate-elliptic 2
  2A. Lateral sepals 1.9 mm long; sepals with free parts elliptic . . . . *F. vaginatus*
  2B. Lateral sepals 2.2–2.9 mm long; sepals with free parts triangular . . . . *F. schultesii*
C. Section **Gracillima.** Sepals and petals connate basally to halfway; lateral sepals to 3 mm long with a broadly oblique base, sometimes thickened medially but not lamellate carinate; column widest medially.
  1A. Leaves narrowly oblong to oblong; sepals and petals connate about halfway; labellum pentagonal . . . . *F. vanderwerffii*
  1B. Leaves ovate-elliptic, attenuate both ends; sepals and petals connate in lower third or not; labellum oblong to trullate 2
  2A. Labellum ovate-elliptic; column narrowly stalked . . . . *F. pastinaca*
  2B. Labellum oblong to trullate; column broadly stalked 3
  3A. Labellum trullate . . . . *F. nunezii*
  3B. Labellum oblong to oblong-elliptic . . . . *F. unduaviae*
D. Section **Breviconnata.** Sepals and petals connate in basal part; lateral sepals (3.0–)3.4–8.8 mm long, usually lamellate carinate.
  1A. Leaves oblong to oblong-oblanceolate; sepals and petals forward-pointing, straight 2
  1B. Leaves ovate-elliptic, attenuate both ends; dorsal sepal and petals recurved; lateral sepals upcurved to splayed 3
  2A. Labellum oblong to narrowly elliptic, 1.0–1.3 mm wide . . . . *F. parvifolia* var. *parvifolia*
  2B. Labellum elliptic, 1.8 mm wide . . . . *F. parvifolia* var. *cajamarcae*
  3A. Lateral sepals splayed; labellum with claw longer than blade, blade ovate-elliptic bearing a single callus; column widened dorsally and ventrally at apex . . . . *F. luerorum*
  3B. Lateral sepals parallel, upcurved; labellum with claw shorter than blade, blade ovate-lanceolate to subpandurate and bearing two lobe-like calli; column widened ventrally 4
  4A. Labellum subpandurate 5
  4B. Labellum oblong to ovate-lanceolate 7

Key to the Sections and Species of *Fernandezia* Treated Here cont.

5A. Labellum with large lamellae about 1/4 length of blade; column 2.1 mm long . . . . . *F. cymbiformis*

5B. Labellum lamellae twice as small; column 3.1–3.2 mm long 6

6A. Dorsal sepal oblong; petals 1.8 mm wide; labellum subacuminate, calli obliquely angled . . . . . *F. solomonii*

6B. Dorsal sepal ligulate-oblanceolate; petals 1.2 mm wide; labellum narrowly triangular in upper half, calli parallel . . . . . *F. bilineata*

7A. Petals with claw 1/3 length; labellum ovate-lanceolate . . . . . *F. mercadoi*

7B. Petals with claw 1/5 to 1/6 length; labellum oblong . . . . . *F. chaparensis*

E. Section **Fernandezia.** Labellum with fleshy calli arising from a thickened medial ridge (see discussion above about exceptions).

1A. Labellum obovate, or wider in apical half 2

1B. Labellum wider in lower half, or similar width throughout 4

2A. Labellum with a transversely elliptic blade in upper half . . . . . *F. transversalis*

2B. Labellum more or less obovate 3

3A. Sepals 3.5–4.1 mm long; labellum 4.0 × 2.3 mm . . . . . *F. salliquensis*

3B. Sepals 2.0–2.6 mm long; labellum 2.7 × 1.5 mm . . . . . *F. espinosae*

4A. Leaves semitubular, rigid . . . . . *F. militaris*

4B. Leaves flat to conduplicate, texture softer 5

5A. Sepals 1.0–1.7 mm long 6

5B. Sepals (1.8)–1.9–4.1 mm long 8

6A. Flowers globular with broadly elliptic to subcircular tepals; column wings semi-elliptic, forward pointing . . . . . *F. falcifolia*

6B. Flowers not globular, tepals ovate, elliptic to oblong; column wings truncate or barely produced 7

7A. Stems sublaxly leafy; leaf sheaths smooth; sepals 1.0–1.5 mm long; petals oblong . . . . . *F. micrantha*

7B. Stems densely leafy; leaf sheaths subverrucose-rugulose; sepals 1.5–1.7 mm long; petals oblong-oblanceolate . . . . . *F. camposii*

8A. Column angled down dorsally . . . . . *F. callacallae*

8B. Column straight or slightly curved dorsally 9

9A. Stems up to 12 mm across leaf sheaths; column 2.95–3.00 mm long . . . . . *F. tintasensis*

9B. Stems up to 8 mm across leaf sheaths; column 1.1–2.3 mm long 10

10A. Labellum upper part ("epichile") transversely elliptic, distinctly broader than long 11

10B. Labellum upper part ("epichile") ovate, deltate, to subcircular, hardly broader than long, more often longer than broad 12

11A. Leaves oblong-elliptic, 10.0–15.0 × 4.5–6.5 mm; petals widest basally; column wings slightly narrowed toward base . . . . . *F. cuprea*

11B. Leaves ligulate, 8.0–10.0 × 2.5–4.0 mm; petals widest apically; column wings distinctly narrowed towards base . . . . . *F. yahuarcochae*

12A. Column 1.1–1.3 mm long 13

12B. Column 1.5–2.3 mm long 14

13A. Labellum ovate-deltate; column 0.7 mm wide laterally, wings obtuse, forward-pointing, produced . . . . . *F. rubescens*

13B. Labellum subpandurate; column 0.9–1.0 mm wide laterally, wings obliquely truncate, slightly produced . . . . . *F. denticulata*

14A. Labellum widely ovate, upper part triangular; column shortly and broadly clawed, truncate, wings transverse rectangular . *F. rubicunda*

14B. Labellum ovate, ovate-lanceolate, to oblong; column usually sessile, if shortly clawed then not truncate, wings deltate to elliptic . . . 15

15A. Column 1.5 mm long; labellum 1.15–1.30 mm wide . . . . . *F. crystallina*

15B. Column (1.4)–1.7–2.3 mm long; labellum 1.3–2.0 mm wide 16

16A. Stem laxly leafy; column widest basally, wings angling up from base to apex . . . . . *F. kosnipatae*

16B. Stem rarely laxly leafy, usually sublaxly to densely leafy; column either narrowest basally, or wings straight (i.e., 180˚ line) 17

17A. Lower margins of column straight (i.e., basal and apical width equal) 18

17B. Lower margins of column angling back toward base (i.e., column widest apically) 21

18A. Column wings obliquely truncate, apex of clinandrium relatively large . . . . . *F. harlingii*

18B. Column wings shortly produced, rounded, apex of clinandrium smaller 19

19A. Leaves thinly coriaceous to fleshy 20

19B. Leaves thin but firm (edges often revolute); labellum upper part straight; column wings about 1/3 width of apex . . . . *F. putumayoensis*

20A. Leaves oblong to elliptic, usually 6–10 × 3–6 mm; labellum upper part usually deflexed to recurved . . . . . *F. crystallina*

20B. Leaves ligulate, 15–18 × 5 mm; labellum upper part straight . . . . . *F. squarrosa*

21A. Sepals 2.0–2.6 mm long; labellum 1.4 mm wide . . . . . *F. hamiltonii* var. *jaenensis*

21B. Sepals 2.75–3.70 mm long; labellum 1.8–2.1 mm wide 22

22A. Leaves 5.0–17.0 × 4.0–5.5 mm spread, sides upcurved; labellum lower half divided longitudinally by a narrow medial thickening . . . . . *F. hamiltonii* var. *hamiltonii*

22B. Leaves 12.0–31.0 × 7.0–9.5 mm spread, sides weakly upcurved; labellum lower half divided longitudinally by a broader thickening . . . . . *F. vargasii*

F. Section **Lamellata.** Labellum usually narrowed in basal half, base not wider than upper part, bearing short to long lamellae; column usually stalked, often with suborbicular wings.

1A. Labellum blade subquadrate . . . . . *F. quadrangularis*

1B. Labellum blade otherwise shaped 2

2A. Labellum cuneate to rectangular 3

2B. Labellum otherwise shaped 4

3A. Sepals 2.30–2.65 mm long; labellum 2 × 1 mm . . . . . *F. cuneata*

3B. Sepals 2.8–3.8 mm long; labellum 2.7–3.0 × 1.0–1.6 mm . . . . . *F. mandonii*

4A. Labellum subpandurate 5

Key to the Sections and Species of *Fernandezia* Treated Here cont.

4B. Labellum otherwise shaped 6

5A. Labellum apex obtusely apiculate; lamellae small, subquadrate, well separated. . . . . . *F. pandurata*

5B. Labellum apex broadly rounded; lamellae transverse ligulate, approximate . . . . . . *F. diazii*

6A. Labellum with a long rectangular claw terminating in a pentagonal blade; lamellae large, overlapping nexus of claw and blade if spread out . . . . . . *F. pseudodichaea*

6B. Labellum with claw absent, short, or cuneate, blade shaped otherwise; lamellae rarely overlapping edges 7

7A. Labellum oblong, of equal width throughout, broadly rounded. . . . . . *F. pseudominor*

7B. Labellum otherwise shaped, if oblong then either narrowed toward base or apex 8

8A. Labellum blade forming an acute to right angle with claw 9

8B. Labellum blade forming an obtuse angle with claw, or simply the base cuneate or rounded in each side 11

9A. Labellum subsessile, oblong-lanceolate, acute; lamellae paired, short . . . . . . *F. scimitaris*

9B. Labellum with a short subquadrate claw, blade broadly rounded; lamellae parallel to slightly divergent, more or less elongate. 10

10A. Sepals 3.2–3.5 mm long; labellum 3.4–3.5 × 1.8 mm; column 2 mm long . . . . . . *F. shoveliformis* var. *shoveliformis*

10B. Sepals 1.8 mm long; labellum 2.0 × 1.2 mm; column 1.15 mm long . . . . . . *F. tinquiana*

11A. Labellum ovate-lanceolate, upper 1/3 thickened . . . . . . *F. crassapex*

11B. Labellum otherwise shaped, upper 1/3 not thickened, except along midvein below 12

12A. Labellum elliptic, same width apically and basally 13

12B. Labellum otherwise shaped, sometimes oblong-elliptic but then more tapered apically or basally 14

13A. Petals obovate-oblong to unevenly ovate-elliptic, noticeably thickened along midvein; column wings not much broader than basal part of column . . . . . . *F. minor* var. *boekeorum*

13B. Petals oblong to elliptic, not noticeably thickened along midvein; column wings almost as much broader again than basal part of column . . . . . . *F. minor* var. *breviflora*

14A. Labellum oblong-oblanceolate 15

14B. Labellum otherwise shaped 21

15A. Sepals to 2.8 mm long 16

15B. Sepals 2.9–4.6 mm long 18

16A. Labellum lamellae abbreviated, subquadrate to suborbicular . . . . . . *F. teranii*

16B. Labellum lamellae elongate or with drawn out bases. 17

17A. Leaf sheaths broad, covering stem; labellum lamellae within confines of blade when spread . . . . . . *F. carabayana*

17B. Leaf sheaths narrow, semitubular, internodes partially exposed; labellum lamellae overlapping edge of blade when spread . . . . . . *F. angusta* var. *erythromitra*

18A. Leaves thick and fleshy, conduplicate 19

18B. Leaves thin coriaceous, flat 20

19A. Petals oblong-oblanceolate; labellum lamellae obliquely lanceolate in profile in apical half, gradually decreasing in height toward the base; carinae below labellum apex deltate, obtuse, forward-pointing . . . . . . *F. ichneumonea*

19B. Petals oblong; labellum lamellae rectangular to obliquely trapezoid in profile in upper half, suddenly decreasing in height toward base; carina below labellum apex semi-elliptic, rounded, not forward-pointing . . . . . . *F. minor* var. *minor*

20A. Column constricted basally; column wings downward directed . . . . . . *F. weberbaueri* var. *weberbaueri*

20B. Column stalked but not constricted; column wings slightly forward directed . . . . . . *F. weberbaueri* var. *tricrucensis*

21A. Labellum oblong-cuneate; lamellae drawn out basally and overlapping edges when spread . . . . . . *F. angusta* var. *angusta*

21B. Labellum otherwise shaped; lamellae rarely spreading over edges, if so then bases not long drawn out 22

22A. Labellum oblong, slightly tapered each end. 23

22B. Labellum otherwise shaped 26

23A. Leaf sheaths with distinctly outcurved apices; labellum lamellae elongate. . . . . . *F. amboroensis* var. *amboroensis*

23B. Leaf sheaths not distinctly outcurved apically; labellum lamellae abbreviate 24

24A. Leaf sheaths oblong-lanceolate in profile; petals high carinate on outside in upper half . . . . . . *F. dorriana*

24B. Leaf sheaths subrectangular to broad triangular in profile; petals not high carinate 25

25A. Petals oblong-oblanceolate. . . . . . *F. pectinata* var. *pectinata*

25B. Petals obliquely elliptic . . . . . . *F. pectinata* var. *punoensis*

26A. Labellum trullate . . . . . . *F. jordaniae* var. *trullata*

26B. Labellum otherwise shaped 27

27A. Sepals 3.00–3.75 mm long 28

27B. Sepals 1.5–2.4 mm long 29

28A. Labellum oblong-elliptic, subpandurate; lamellae rather short . . . . . . *F. shoveliformis* var. *inversa*

28B. Labellum obovate-oblanceolate; lamellae elongate . . . . . . *F. weberbaueri* var. *platychila*

29A. Sepals fleshy, obtuse; labellum lamellae abbreviated. . . . . . *F. jordaniae* var. *jordaniae*

29B. Sepals thinner, acute to subacute; labellum lamellae elongate. 30

30A. Petals obovate-oblanceolate, midvein thickly carinate in upper half; labellum obovate-oblanceolate; lamellae obliquely triangular in upper part . . . . . . *F. amboroensis* var. *obovata*

30B. Petals elliptic to obovate-elliptic, midvein not thick carinate; labellum lamellae not raised apically 31

31A. Sepals 1.5–1.8 mm long; labellum lamellae parallel, apices decurrent on blade. . . . . . *F. barnettiae*

31B. Sepals 2.1–2.4 mm long; labellum lamellae divergent, apices truncate. . . . . . *F. steinbachii*

Fernandezia amboroensis Ormerod, *sp. nov.*
TYPE: BOLIVIA. Santa Cruz: Prov. Florida, Parque Nacional Amboro, 8 km by air NE of Mairana, 5.5 km N of Campamento "La Yunga" park station, 2300 m, 29 March 2002, *M. Nee, M. Sundue, M. Mendoza & A. Arbelaez de Churchill 52044* (Holotype: NY). Fig. 1.

Similar to *Fernandezia barnettiae* Ormerod but with oblong (vs. elliptic) leaves, leaf sheath tips curving outward (vs. close to stem), and labellum lamellae with erect ensiform tips (vs. running into blade).

Epiphytic *herb. Roots* terete, 0.40–0.75 mm thick. *Stems* simple, densely leafy, 3–10 cm long, ca. 0.08 cm thick. *Leaves* oblong, acute, minutely denticulate near apex, coriaceous, subsessile, 7–8 × 3–4 mm; leaf sheaths ovate-lanceolate laterally, curving away from stem, margins entire, surface smooth, striate. *Inflorescence* 12–15 mm long; peduncle ca. 7 mm long; rachis sublaxly 6–8 flowered, 5–8 mm long; floral bracts deltate, acute, 2 × 1.5 mm. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 2.1 mm long. *Dorsal sepal* oblong, subacute, fleshy, 1.7 × 0.8 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, midvein carinate, 2 × 0.85 mm. *Petals* broadly oblong-oblanceolate, acute, apex thickened dorsally, 1.5 × 0.75 mm. *Labellum* broadly oblong-oblanceolate, subacute, carinate below tip, 1.7 × 0.8 mm; medially with 2 parallel lamellate, which each terminate in an erect, ensiform blade. *Column* each side with a low semicircular wing, 1.1 mm long, 0.75–0.80 mm wide laterally.

Distribution: Bolivia.

Habitat: on tree branches in disturbed cloud forest, with *Dicksonia sellowiana, Prunus oleifolia* var. *bangii,* and *Ceroxylon parvum,* along trails, on and near ridge top.

Etymology: named after the type locality, the Amboro National Park.

This species appears to be most similar to *Fernandezia barnettiae* but differs in having oblong (vs. elliptic) leaves, leaf sheaths that have the tips distinctly curving away from the stem, labellum lamellae that end in raised ensiform tips (vs. running into the blade of the lip), and a column with wings that are widest medially rather than apically.

Fernandezia amboroensis var. ***obovata*** Ormerod, *var. nov.*
TYPE: BOLIVIA. Cochabamba: near Siberia, between Comarapa and Cochabamba, 2500–2600 m, 18 January 1983, *C. Luer, J. Luer, E. Besse & R. Vasquez 8530 p.p.* (Holotype: SEL, upper rhp). Fig. 2.

Differs from the typical variety in the flowers having more strongly carinate petals and the labellum more distinctly clawed (obovate-oblanceolate vs. broadly oblong-oblanceolate).

Epiphytic *herb. Roots* terete, to 0.7 mm thick. *Stems* with 3–8 branches, leafy, to 13.5 cm long, 0.08 cm thick. *Leaves* ovate-elliptic, acute, margins minutely denticulate toward tip, coriaceous, 9 × 4 mm; leaf sheaths smooth, striate, margins entire. *Inflorescences* to 15 mm long; peduncle 5.5 mm long; rachis up to 8 flowered, 9.5 mm long; floral bracts deltate, acute, to 2 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 2.5–2.8 mm long. *Dorsal sepal* oblong, subacute, concave, weakly carinate, 1.80 × 0.75 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, carinate, 1.95 × 0.80–0.85 mm. *Petals* obovate, subacute, midvein thickly carinate in upper half, 1.55–1.60 × 0.90 mm. *Labellum* obovate-oblanceolate, obtuse, 1.70 × 0.85 mm; claw with a narrow midline that divides and raises up into 2 parallel, apically triangular, frontally truncate lamellae. *Column* each side with a weakly developed, rounded wing each side, 1 mm long, 0.75 mm wide laterally.

Distribution: Bolivia.

Habitat: cloud forest, 2500-2600 m.

Etymology: named after the shape of the lip.

This variety can be distinguished from typical *Fernandezia amboroensis* by its thickly carinate petals and obovate-oblanceolate lip. The type material is a mixture—the other specimen on the sheet belongs to *F. dorriana*.

Fernandezia angusta Ormerod, *sp. nov.*
TYPE: BOLIVIA. La Paz: Prov. Nor Yungas, Sacramento Valley of the Rio Coroico, 10 km NE of Chuspipata on Coroico road, 2450 m, 29 January 1984, *A. Gentry & J.C. Solomon 44800* (Holotype: MO). Fig. 3.

Similar to *Fernandezia cuneata* Ormerod but with smaller flowers (sepals 2.0–2.3 vs. 2.30–2.65 mm long) and an oblong-oblanceolate (vs. cuneate) labellum.

Epiphytic *herb. Roots* terete, 0.6 mm thick. *Stems* simple, sublaxly leafy, 5.0–6.5 cm long, ca. 0.1 cm thick. *Leaves* ligulate, acute, coriaceous, conduplicate, margin minutely denticulate toward apex, 5–10 × 3 mm; leaf sheath tubular, apices shortly curved outward, smooth, striate, not fully covering internodes, ca. 3.0–3.5 mm long. *Inflorescence* 7 mm long; peduncle 5 mm long; rachis densely, simultaneously 5 flowered, 2 mm long; floral bracts ovate-lanceolate, acute, to 1.3 mm long. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 3.4 mm long. *Dorsal sepal* ligulate, acute, 2.0 × 0.6 mm. *Lateral sepals* obliquely ligulate-lanceolate, acute, 2.3 × 0.7 mm. *Petals* narrowly oblong-ligulate, acute, 1.95 × 0.55 mm. *Labellum* oblong-oblanceolate, subacute, carinate below tip, 1.95 × 0.80 mm; lamellae 2, divergent from base of lip, very low until raised up apically into more or less semicircular flaps. *Column* shortly stalked, each side an obliquely suborbicular wing, 1.75 mm long, 0.8 mm wide laterally.

Distribution: Bolivia.

Habitat: dense ridgetop cloud forest, 2450 m.

Etymology: from the Latin *angustus,* narrow, in reference to the uniformly narrow sepal and petals.

This is a neat little plant, easily recognized by its combination of small size, narrow leaves, simultaneously (not sequentially) 5-flowered inflorescences, subequal, narrow sepals and petals. It seems to be most closely related to *Fernandezia cuneata,* but with longer (5–10 vs. 3–6 mm), ligulate (vs. oblong-lanceolate) leaves, longer, more exserted inflorescence peduncles (5 vs. 3–4 mm), smaller flowers, and an oblong-oblanceolate (vs. cuneate) lip in which the keels do not overlap the edges.

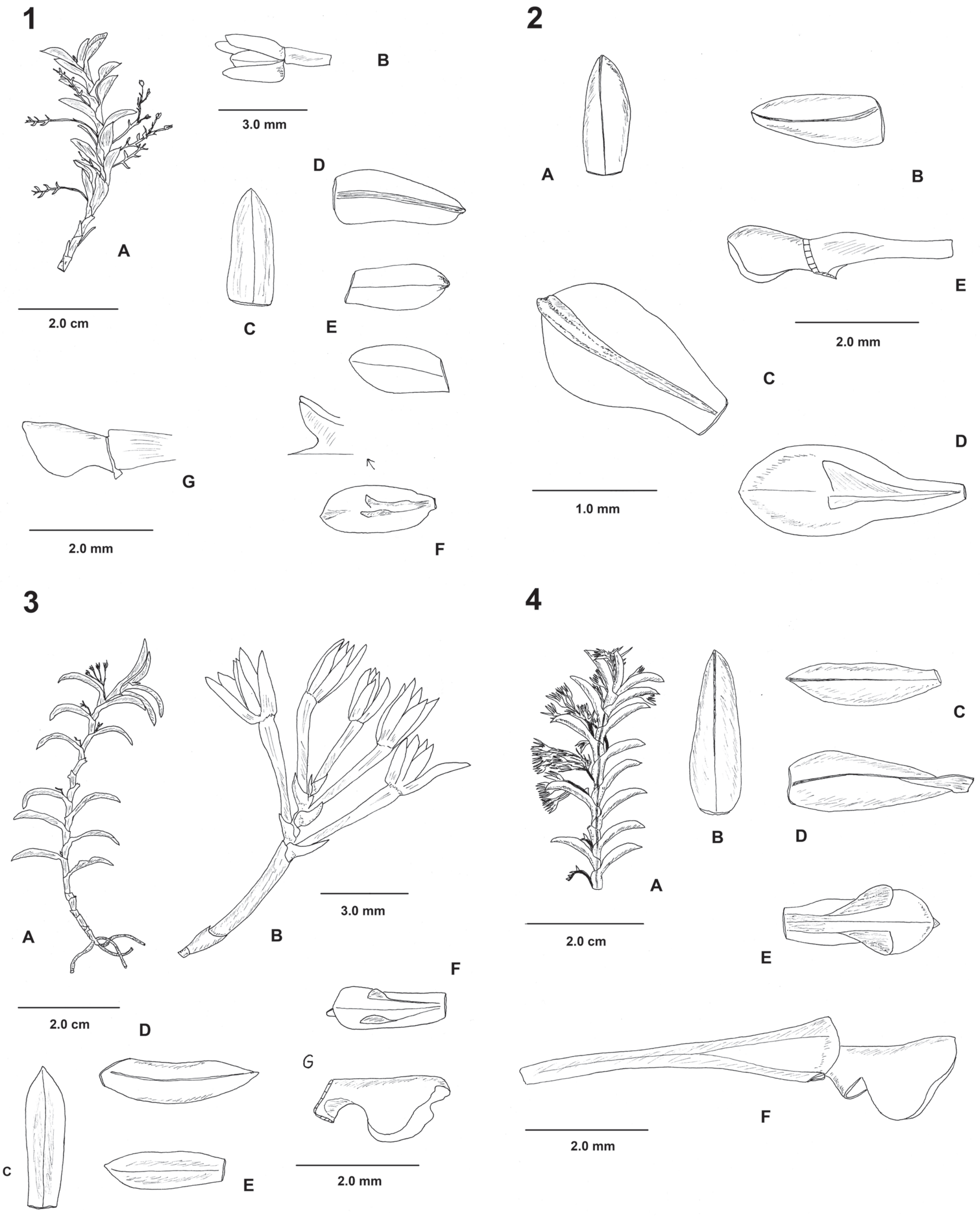


FIGURE 1–4. **1**, *Fernandezia amboroensis* Ormerod var. *amboroensis*. **A**, stem; **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petals; **F**, labellum; **G**, column. Drawn from holotype. **2**, *Fernandezia amboroensis* Ormerod var. *obovata* Ormerod. **A**, dorsal sepal; **B**, lateral sepal; **C**, petal; **D**, labellum; **E**, column. Drawn from holotype. **3**, *Fernandezia angusta* Ormerod var. *angusta*. **A**, plant; **B**, inflorescence; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **4**, *Fernandezia angusta* Ormerod var. *erythromitra* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype.

Fernandezia angusta var. ***erythromitra*** Ormerod, *var. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Chapare, between Chapare and Villa Tunari, near KM 1000, 1850 m, 17 January 1984, *C. Luer, J. Luer & R. Vasquez 9396* (Holotype: SEL). Fig. 4.

Differs from the typical variety in the flowers having longer (2.5–3.3 vs. 2.0–2.3 mm) sepals with distinct carinae on the apex of the lateral sepals,

Epiphytic *herb*. *Roots* terete, to 0.7 mm thick. *Stems* simple, sublaxly leafy, 7–12 cm long, 0.15–0.20 cm wide across leaf sheaths, 0.05–0.10 cm thick. *Leaves* ligulate-lanceolate, acute, coriaceous, margins minutely denticulate toward apex, 5–7 mm long, 1.0–1.5 mm wide laterally; leaf sheaths tubular, striate, smooth, margins minutely denticulate, not fully covering internodes. *Inflorescence* 8–10 mm long; peduncle ca. 4-6 mm long; rachis 3–6 flowered, 4 mm long; floral bracts deltate, acute, 1.7–2.5 mm long. *Flowers* white, anther cap red. *Pedicellate ovary* clavate, triquetrous, 3–4 mm long. *Dorsal sepal* narrowly oblong-lanceolate to ligulate, acute, midvein low carinate, 2.50–3.10 × 0.75–0.90 mm. *Lateral sepals* obliquely lanceolate, acute, high carinate near apex, 2.7–3.3 × 0.8–1.2 mm. *Petals* oblong-ligulate to oblong, subacute to acute, 2.2–2.8 × 0.7–0.9 mm. *Labellum* oblong-oblanceolate, acute, carinate below tip, 2.2–2.5 × 0.8–1.0 mm; lower of labellum medially thickened, dividing and raising up into 2 flap-like, oblique-based, obtuse lamellae that over-reach the labellum edges. *Column* shortly stalked, each side with a suborbicular wing, 1.7–1.9 mm long, 1.0–1.2 mm wide laterally.

Distribution: Bolivia.

Additional specimen examined: BOLIVIA. Cochabamba: Prov. Chapare, along road to Tablas, 2500 m, 9 February 1980, *C. Luer, J. Luer & R. Vasquez 5165* (SEL).

Habitat: cloud forest (type), 1850-2500 m.

Etymology: from the Classical Greek *eruthros,* red, and *mitra,* originally a headband, but later a cap, in reference to the red anther cap.

I had originally considered this plant to be a separate species, but it agrees well in habit and floral characters with *Fernandezia angusta,* differing in having longer sepals with high keels on the apices of the lateral ones.

Fernandezia antioquiensis (Szlach., Kolan. & Mystk.) Molinari, Richardiana 15: 268. 2015.
Basionym: *Orchidotypus antioquiensis* Szlach., Kolan. & Mystk., Polish Bot. J. 59, 2: 169. 2014.
TYPE: COLOMBIA. Antioquia: Municipio Urrao, Paramo de Frontino, Sitio Llano Grande, 3420 m, 11 September 1986, *F.J. Roldan, O. Marulanda & M. Escobar 390* (Holotype: COL, not seen). Fig. 5.

Distribution: Colombia.

Additional specimens examined: COLOMBIA. Cundinamarca: Choconta, El Sisga, high part of the La Represa, 2700–2900 m, 14 January 1962, *H. Garcia-Barriga 17384* (AMES, NY); Paramo de Guasca, 3355 m, 8 May 1958, *R.E. Schultes, E.W. Smith & H. Blohm s.n.* (AMES).

Among the taxa in the *Orchidotypus* group with glabrous leaves, this species is notable for the relatively prominent fimbriate-denticulate margins of the leaf sheaths. The flowers have a suborbicular-pentagonal (illustrated as ovate-elliptic in the protologue) labellum “midlobe.” One collection (*Garcia-Barriga & Jaramillo 19784*) cited in the protologue I find to be *F. vaginata* (see there for further comment).

Fernandezia barnettiae Ormerod, *sp. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Carrasco, Serrania Siberia, 20–35 km W of Comarapa (Dept. Santa Cruz), on the old Cochabamba to Santa Cruz road (Highway 4), 2000 m, 14–15 January 1990, *L.J. Dorr & L.C. Barnett 7026 p.p.* (Holotype: GH). Fig. 6.

Similar to *Fernandezia steinbachii* Ormerod but not as tall (stems to 10.5 vs. to 19.5 cm), flowers with a shorter (1.5 vs. 5.0 mm) pedicellate ovary, labellum narrower (0.8 vs. 1.2–1.3 mm) and bearing parallel (not divergent) keels.

Epiphytic (?) *herb*. *Roots* terete, 0.6–0.8 mm thick. *Stems* often with several basal branches (these 4–6 cm long), subdensely leafy, to 10.5 cm long, 0.1 cm thick. *Leaves* elliptic, acute, margins minutely denticulate near apex, 5.5–8.0 × 5.0 mm; leaf sheaths semitubular, exposed part 3.5–4.5 mm long. *Inflorescence* to 8.5 mm long; peduncle 4 mm long; rachis to 4.5 mm long, up to 6 flowered; floral bracts widely ovate, acute, ca. 1.6 × 1.6 mm. *Flower* color not known. *Pedicellate ovary* weakly clavate, triquetrous, 1.5 mm long. *Dorsal sepal* ovate-elliptic, acute, 1.50 × 0.75 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, midvein carinate toward tip, 1.80 × 0.75 mm. *Petals* obovate-elliptic, subacute, 1.6 × 0.8 mm. *Labellum* elliptic from a broadly clawed base, subacute, weakly carinate below tip, 1.9 × 0.8 mm; lamellae 2, parallel, starting at base of lip and ending at apical 1/3. *Column* broadly stalked, each side apically with an apical, obliquely suborbicular wing, 1.1 mm long, 1.0–1.1 mm wide laterally.

Distribution: Bolivia.

Eponymy: named after Lisa C. Barnett (1959-), specialist in the Sterculiaceae and one of the collectors of the type.

As noted below, the type sheet of this species also contains the holotype of *Fernandezia dorriana*. Discussion on how these two taxa differ is given under the latter taxon. *Fernandezia barnettiae* is however more closely to *F. steinbachii*, which occurs higher up in the same region. The former is a much smaller plant than *F. steinbachii,* has slightly smaller flowers, with a much shorter pedicellate ovary (1.5 vs. 5.0 mm), and a narrower lip (0.8 vs. 1.2–1.3 mm) with parallel (not divergent) keels.

Fernandezia bilineata Ormerod, *sp. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Chapare, along road to Villa Tunari, 2840 m, 13 & 16 January 1981, *C. Luer, J. Luer, E. Besse & R. Vasquez 5615* (Holotype: SEL). Fig. 7.

Related to *Fernandezia mercadoi* Ormerod but the flowers with an oblanceolate-ligulate (vs. ligulate) dorsal sepal, thicker, unclawed petals, and the labellum wider (vs. narrower) in the upper half.

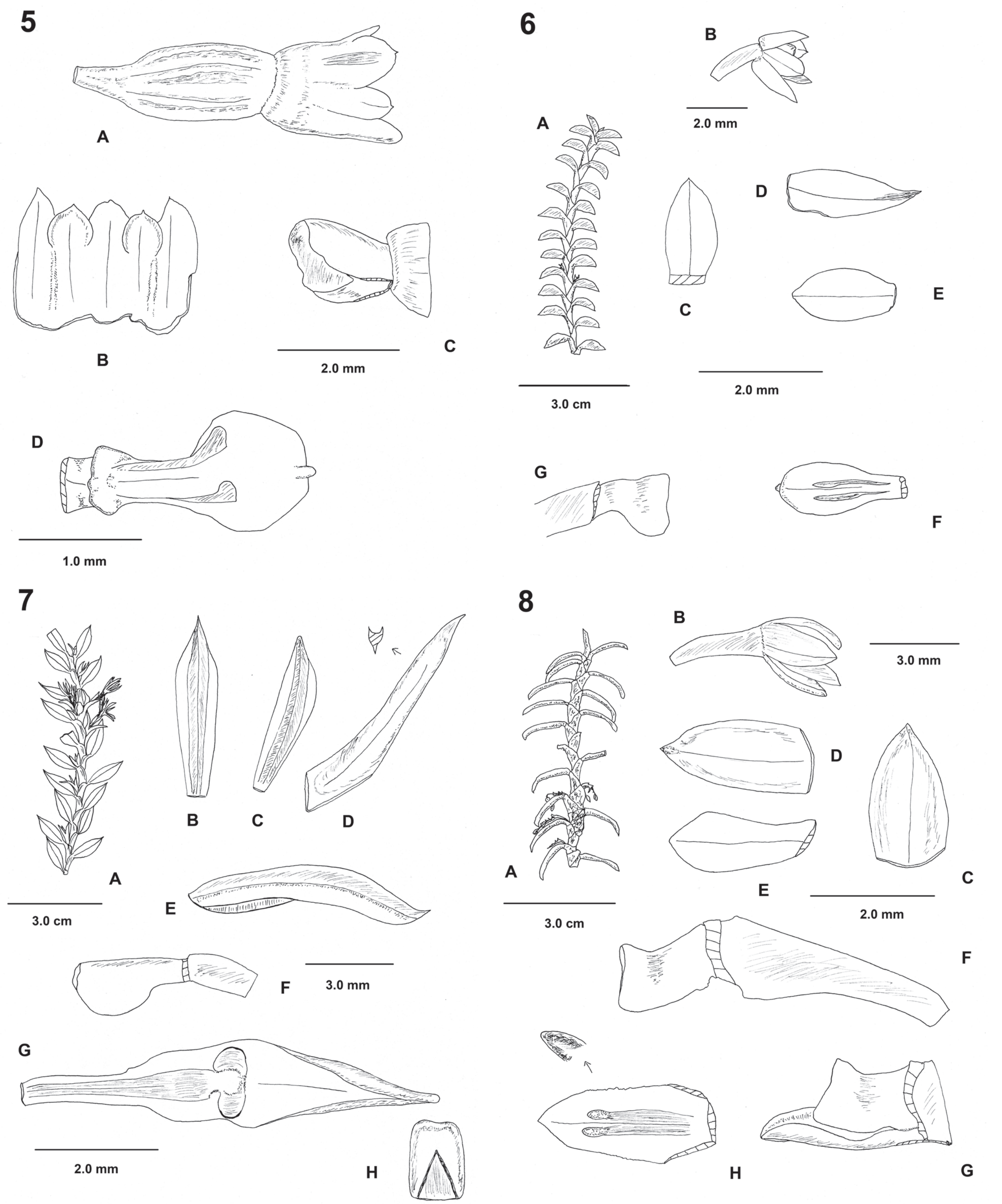


FIGURE 5–8. **5**, *Fernandezia antioquiensis* (Szlach., Kolan. & Mystk.) Molinari. **A**, flower; **B**, tepals (lateral sepal, petal, dorsal sepal, petal, lateral sepal); **C**, column; **D**, labellum. Drawn from *Schultes et al*. (AMES). **6**, *Fernandezia barnettiae* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **7**, *Fernandezia bilineata* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D–E**, lateral sepal (inside and lateral views); **F**, column; **G**, labellum; **H**, anther cap. Drawn from holotype. **8**, *Fernandezia callacallae* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, column; **G**, labellum and column; **H**, labellum. Drawn from holotype.

Epiphytic *herb*. *Roots* terete, 0.5–0.7 mm thick. *Stems* simple, sinuous to subsinuous, subdensely leafy, 18–21 cm long, 0.20 cm wide across leaf sheaths, 0.05–0.10 cm thick. *Leaves* oblong, apiculate, coriaceous, 9.0–13.0 × 3.0-3.5 mm, apiculus 0.8 mm long; leaf sheaths tubular, smooth, 4.5–5.0 mm long. *Inflorescence* 5.0–5.5 mm long; peduncle stout, ca. 3 mm long; sheathing bract subapical, ovate-lanceolate, acute, to 6 × 2–4 mm; rachis biflorous, 2.0–2.5 mm long; floral bracts lanceolate, acute, 3.0–5.0 × 1.5 mm. *Flowers* white with two purple lines on the lip. *Pedicellate ovary* clavate, triquetrous, ca. 3 mm long. *Dorsal sepal* ligulate-oblanceolate, acute, midline thickly carinate, 5.4 × 1.2 mm. *Lateral sepals* obliquely lanceolate, acute, highly and thickly carinate, joined basally for ca. 1.8 mm, 7.5 × 1.6 mm. *Petals* obliquely ligulate-oblanceolate, subacute, midline broadly low carinate, 4.8 × 1.2 mm. *Labellum* clawed, oblong-lanceolate, more or less sublobulate medially, upper margins involute, carinate below apex, claw ligulate, 2 mm long, blade 4.2 × 1.4 mm, in total 6.2 × 1.4 mm; callus of two elliptic to deltate, obtuse, parallel lobules just below upper half of blade. *Column* stalked, each side with a broad transverse wing, 3.1 mm long, 1.6–1.7 mm wide laterally.

Distribution: Bolivia.

Habitat: cloud forest, 2840 m.

Etymology: from the Latin compound *bi-,* meaning two, and *linea,* line, in reference to the two purple lines on the labellum.

As note above in the diagnosis this species is related to its Bolivian congener *Fernandezia mercadoi*. It is also similar to another Bolivian entity, *F. solomonii,* but differs from that in the flowers having a ligulate-oblanceolate (vs. narrowly oblong) dorsal sepal, narrower (1.2 vs. 1.8 mm) and thicker petals, and a narrower (1.4 vs. 2.0 mm) lip that is less distinctly subpandurate with calli spreading at right angles (vs. obliquely).

Fernandezia callacallae Ormerod, *sp. nov.*

TYPE: PERU. Amazonas: Prov. Chachapoyas, Cerros Calla Calla, E side, 19 km above Leimebamba, on road to Balsas, 3100 m, 6 June 1964, *P.C. Hutchison & J.K. Wright 5557* (Holotype: F; Isotypes: AMES, NY). Fig. 8.

Usage synonym: *Pachyphyllum falcifolium auct. non* Rchb.f., C. Schweinf., Fieldiana, Bot. 33: 79–80. 1970 *p.p.*

Related to *Fernandezia falcifolia* (Rchb.f.) M.W. Chase but the flowers with larger (2.0–2.3 vs. 1.1–1.2 mm), ovate-elliptic to elliptic (vs. suborbicular) sepals, and the column with an incurved (vs. rounded) back, and a truncate (vs. rounded) apex.

Epiphytic *herb*. *Roots* terete, 0.75–1.50 mm thick. *Stems* weakly flexuous, 2–3 branched (branches to 7.5 cm long), densely leafy throughout, 10.5–33.5 cm long, to 0.35 cm across leaf sheaths, to 0.15 cm thick. *Leaves* linear-ligulate, subacute, fleshy, semiterete, 6–13 mm long, 1.0–1.3 mm wide laterally; leaf sheaths deltate, truncate, surface smooth, striate. *Inflorescence* to 8.5 mm long; peduncle ca. 4 mm long; rachis few flowered, 3.0–4.5 mm long; floral bracts ovate-deltate, acute, to 1 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 3 mm long; capsule yellow. *Dorsal sepal* ovate-elliptic, acute, concave, thin, 2.0–2.3 × 1.20–1.35 mm. *Lateral sepals* obliquely elliptic, subacute to acute, concave, 2.2–2.3 × 1.15 mm. *Petals* oblong to oblong-oblanceolate, obtuse to subacute, 1.8–2.0 × 0.9 mm. *Labellum* oblong to ovate-oblong, obtuse to subacute, 2.2–2.7 × 1.15–1.40 mm; lower 2/3 divided by a low thickening that ends in 2 parallel, oblongoid to ellipsoid calli. *Column* rectangular in profile, incurved dorsally, 1.4–1.5 mm long, 0.9–1.0 mm wide laterally.

Distribution: Peru.

Additional specimen examined: PERU. Amazonas: Prov. Chachapoyas, Leimebamba to Lajasbamba trail, no altitude, 28 June 1977, *J.D. Boeke 2045* (MO, SEL).

Etymology: named after the Cerros Calla Calla, the type locality.

This species is allied to *Fernandezia falcifolia* (Rchb.f.) M.W. Chase from Ecuador, sharing with it a similar habit and lip shape. However, its flowers are twice as large with not so rounded segments, and the longer column has an incurved (vs. rounded) back with a truncate (vs. rounded) apex. According to the collectors of the type, the plant is a "rare epiphyte in masses."

Fernandezia camposii Ormerod, *sp. nov.*

TYPE: PERU. Amazonas: Luya Prov., Camporredondo, Cerro Huicsocunga, 2800–3000 m, 7 August 1988, *J. Campos 716* (Holotype: MO). Fig. 9.

Similar to *Fernandezia denticulata* Ruiz & Pav. but the leaves more narrowly pointed, leaf sheaths subverruculose-rugulose (vs. smooth), and flowers with oblong-obovate (vs. elliptic) petals.

Lithophytic *herb*. *Roots* terete, white, to ca. 1.2 mm thick. *Stems* caespitose, densely leafy, simple or with up to 4 branches (these to 7 cm long), 14–15 cm long, 0.3–0.4 cm wide across leaf sheaths. *Leaves* ovate-lanceolate, acute, margins entire to minutely laxly denticulate, fleshy, 8–15 mm long, 2–3 mm wide laterally; leaf sheaths triangular, truncate, margin minutely denticulate, surface subverruculose-rugulose. *Inflorescence* to 6 mm long, up to 6 flowered; floral bracts ovate-deltate, acute, to 2 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 2 mm long. *Dorsal sepal* elliptic, subacute, fleshy, concave, 1.5–1.6 × 0.8–0.9 mm. *Lateral sepals* obliquely oblong-elliptic, subacute, concave, midvein carinate, carina rounded apically, 1.7 × 0.75–0.80 mm. *Petals* oblong-obovate, obtuse, 1.40 × 0.85 mm. *Labellum* ovate, obtuse, slightly constricted medially, lower half 0.8 × 1.0 mm, upper half 0.70 × 0.85 mm, in total 1.5 × 1.0; lower half divided by a medial ridge, terminating medially in 2 fleshy, conical calli. *Column* stout, 0.95 mm long, apex 0.95 mm wide laterally.

Distribution: Peru.

Eponymy: named after J. Campos, collector of the type.

This species appears to be a member of the *Fernandezia distichoides* complex and is possibly related to two similarly small-flowered entities in that group, namely, *F. denticulata* and *F. harlingii*. From both of those taxa it differs in having more narrowly pointed leaves, subverruculose-rugulose (vs. smooth to striate) leaf sheaths, and flowers with oblong-obovate (vs. oblong to elliptic) petals.

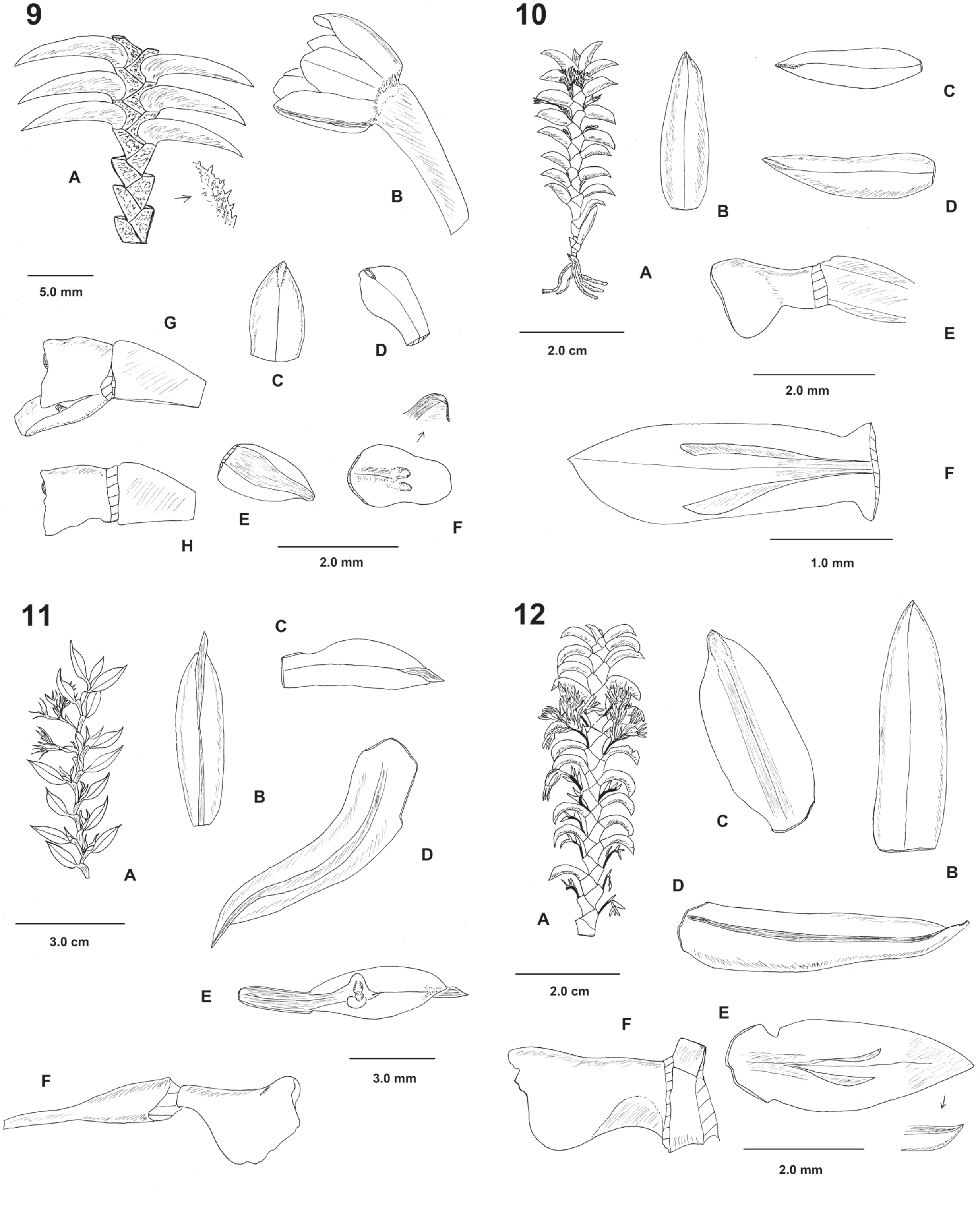


Figure 9–12. **9**, *Fernandezia camposii* Ormerod. **A**, stem fragment (leaf sheath margin arrowed); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column and labellum; **H**, column. Drawn from holotype. **10**, *Fernandezia carabayana* Ormerod. **A**, plant; **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, column; **F**, labellum. Drawn from holotype. **11**, *Fernandezia chaparensis* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype. **12**, *Fernandezia crassapex* Ormerod. **A**, stem; **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype.

Fernandezia carabayana Ormerod, *sp. nov.*

TYPE: PERU. Puno: Prov. Carabaya, Ackapampa to Juro-Juro, 3500 m, 31 December 1947, *C. Vargas C. 7038* (Holotype: AMES; Isotype: K, not seen). Fig. 10.

Usage synonym: *Pachyphyllum pectinatum auct. non* Rchb.f., C. Schweinf., Fieldiana, Bot. 30, 4: 980. 1961 *p.p.*

Related to *Fernandezia ichneumonea* Ormerod but leaves acute (vs. long-apiculate), flowers with oblong-lanceolate (vs. oblong-oblanceolate) petals, and an oblong-oblanceolate (vs. oblanceolate) labellum.

Lithophytic *herb*. *Roots* terete, 0.5–0.8 mm thick. *Stems* simple to 2 branched (branches 2–3 cm long), densely leafy, 4–6 cm long, 0.2 cm wide across leaf sheaths, 0.1 cm thick. *Leaves* oblong-lanceolate, acute, fleshy, conduplicate, margins minutely denticulate towards apex, 6–7 mm long, 1.2–2.0 mm wide laterally; leaf sheaths smooth, striate, margins minutely denticulate. *Inflorescence* to 6 mm long; peduncle ca. 3 mm long; rachis few-flowered, 2.5–3.0 mm long; floral bracts deltate, acute, to 1.7 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 3.0–3.3 mm long. *Dorsal sepal* oblong-lanceolate, subacute, concave, 2.2 × 0.75 mm. *Lateral sepals* obliquely lanceolate, acute, carinate near apex, 2.7 × 0.8 mm. *Petals* narrowly oblong-lanceolate, acute, 2.2 × 0.7 mm. *Labellum* oblong-oblanceolate, acute, carinate below tip, 2.20 × 0.85–0.90 mm; lower 1/5 of lip divided by a low, thickened midline that divides into 2 divergent lamellae. *Column* broadly stalked, each side with an obliquely suborbicular wing, 1.4 mm long, 1.2 mm wide laterally.

Distribution: Peru.

Habitat: on rocks, 3500 m.

Etymology: named after the Province of Carabaya, the type locality.

In Peru this taxon is most closely related to *Fernandezia ichneumonea* but does not have long-apiculate leaves, flowers have petals that are not widened toward the apex, and the lip is not so markedly narrowed toward the base.

Fernandezia chaparensis Ormerod, *sp. nov.*

TYPE: BOLIVIA. Cochabamba: Prov. Chapare, road between Cochabamba and Villa Tunari, 2800 m, 18 January 1983, *C. Luer, J. Luer, R. Vasquez, T. Mulder, D. Mulder & A. Vogel 12884* (Holotype: K; Isotype: MO, not seen). Fig. 11.

Related to *Fernandezia mercadoi* Ormerod but the flowers with a prominently apiculate (vs. acute) dorsal sepal, and petals with a shorter, broader claw.

Epiphytic *herb*. *Roots* terete, 0.5–0.7 mm thick. *Stems* flexuous, 3 branched (branches 11.0–11.5 cm long), sublaxly leafy, to 46 cm long, 0.10–0.15 cm thick. *Leaves* oblong-lanceolate, acute to subacuminate, thinly coriaceous, margins minutely denticulate near the apex, 9.0–13.0 × 3.2–4.0 mm; leaf sheaths tubular, margins minutely denticulate, surface smooth. *Inflorescence* to 7 mm long; peduncle 3 mm long; rachis 2–3 flowered, to 4 mm long; floral bracts widely ovate, acute, to 5 × 3 mm. *Flowers* greenish-white, with a red dot on the lip. *Pedicellate ovary* clavate, triquetrous, 5.5 mm long. *Dorsal sepal* narrowly oblong, acute, midvein carinate, prominently so at apex, gently upcurved, 6.0 × 1.2 mm. *Lateral sepals* obliquely ligulate-lanceolate, acute, subsigmoid, high carinate, basal 2.5 mm joined to lip, ca. 7.5 × 2.0 mm. *Petals* oblong-lanceolate from a shortly and broadly clawed base, acute, midvein carinate near apex, gently upcurved, 5.0 × 1.5 mm. *Labellum* narrowly oblong from a clawed base, carinate below tip, acute, claw ligulate, 2.2 mm long, blade 4.8 × 1.8 mm, in total 7.0 × 1.8 mm; callus of 2 semiprostrate, semicircular to semielliptic lobes joined by a transverse, bicallose thickening in lower half of lip blade. *Column* each side with broad, obliquely semicircular wing from a shortly clawed base, 3.8 mm long, 2 mm wide laterally.

Distribution: Bolivia.

Additional specimen examined: BOLIVIA. Cochabamba: Prov. Chapare, along the road to Villa Tunari, 2900 m, 22 January 1980, *C. Luer, J. Luer & R. Vasquez 4878* (SEL).

Habitat: roadside forest, 2800–2900 m.

Etymology: named after the type locality, Chapare Province.

Fernandezia chaparensis is a member of the *F. breviconnata* complex. It differs from the Peruvian *F. breviconnata* in having a narrower dorsal sepal, more distinctly carinate and apiculate near the apex, the calli of the lip joined (vs. separate) by a fleshy bicallose process, and the column with wider wings. The differences with its Bolivian congener *F. mercadoi* are mentioned above in the diagnosis, and further discussed under the latter taxon.

Fernandezia crassapex Ormerod, *sp. nov.*

TYPE: PERU. Cusco: Prov. Quispicanchis, edge of roadside between Marcapata and Abra Hualla Hualla, 3340 m, 15 October 1976, *D.C. Wasshausen & F. Encarnacion 829* (Holotype: US; Isotypes: MO, NY). Fig. 12.

Similar to *Fernandezia minor* (Schltr.) M.W. Chase var. *boekeorum* Ormerod but flowers with an ovate-lanceolate (vs. ovate-elliptic to elliptic) labellum much thickened in the upper 1/3.

Epiphytic *herb*. *Roots* terete, numerous, 0.4–0.8 mm thick. *Stems* simple to 1–3 branched (branches 2.5–6.5 cm long), laxly to densely leaved, 10.5–24.0 cm long, 0.10–0.25 cm thick. *Leaves* oblong-lanceolate, apiculate, margins minutely denticulate, conduplicate, fleshy, 7–9 mm long, 1.8–2.0 mm wide laterally; leaf sheaths smooth, striate, apices shortly spreading away from stem, margins denticulate. *Inflorescence* to 10 mm long; peduncle to 5 mm long; rachis with up to 6 flowers at once, to 5 mm long; floral bracts deltate, acute, to 2 mm long. *Flowers* greenish white. *Pedicellate ovary* clavate, triquetrous, 3.8–4.0 mm long. *Dorsal sepal* oblong-lanceolate, subacute, concave, 3.8 × 1.2 mm. *Lateral sepals* obliquely ligulate-lanceolate, subacute, carinate, 4.2 × 1.1 mm. *Petals* elliptic, acute, midline broadly thickened, 3.05 × 1.15 mm. *Labellum* ovate-lanceolate, acute, upper third (1.2–1.3mm) much thickened, 3.7 × 1.7 mm; lower part of lip divided by a broad thickening that divides into 2 weakly divergent lamellae. *Column* each side with a broad low, rounded wing, 2 mm long, 1.65 mm wide laterally.

Distribution: Peru.

Habitat: cloud forest near a rocky outcrop, 3340 m.

Etymology: from the Latin *crassus,* thick, and *apex,* summit, in reference to the thickened upper 1/3 of the labellum.

Among the Peruvian taxa in the *Fernandezia pectinata* alliance, this one has the largest flowers (sepals to 4.2 mm long), with a distinctive ovate-lanceolate lip that is much thickened in the upper 1/3. It most closely resembles *F. minor* var. *boekeorum* but that has a thinner, ovate-elliptic to elliptic lip.

Fernandezia crystallina (Lindl.) M.W. Chase, Phytotaxa 20: 29. 2011.

Basionym: *Pachyphyllum crystallinum* Lindl., Orch. Linden.: 18. 1846. TYPE: VENEZUELA. Merida, 3050 m, August 1843, *J. Linden 686* (Holotype: K-L, image seen). Fig. 13–14.

Heterotypic synonyms: *Pachyphyllum pasti* Rchb.f., Bonplandia 3: 239. 1855. TYPE: COLOMBIA. Narino: Volcan Pasto, 3660 m, 1849, *W. Jameson 439* (Holotype: W-R 19266; Isotypes: BM, BR, K, TCD, images seen).

Fernandezia pasti (Rchb.f.) M.W. Chase, Phytotaxa 20: 30. 2011.

Pachyphyllum micrangis Schltr., Rep. Sp. Nov. Regni Veg., Beih. 7: 203. 1920 *syn. nov.* TYPE: COLOMBIA. Cauca: without locality, 3000 m, *M. Madero s.n.* ([Holotype: B, destroyed; drawing AMES]. Lectotype [Christenson 2008: 286]: t.73, f.282 [in Schltr. 1929]).

Fernandezia micrangis (Schltr.) M.W. Chase, Phytotaxa 20: 30. 2011.

Pachyphyllum stuebelii Schltr., Rep. Sp. Nov. Regni Veg., Beih. 7: 204. 1920. TYPE: COLOMBIA. Tolima: Volcan Tolima, paramo, above 4000 m, November 1868, *A. Stuebel 213* ([Holotype: B, destroyed; drawing AMES]. Lectotype [Christenson 2008: 287]: t. 73, f.283 [in Schltr. 1929]).

Fernandezia stuebelii (Schltr.) M.W. Chase, Phytotaxa 20: 31. 2011.

(?) *Pachyphyllum bucarasicae* Kraenzl., in Engl., Pflanzenr. IV, 50, 83: 25. 1923 *syn. nov.* TYPE: COLOMBIA. Santander: near Bucarasica, 3300 m, December, *W. Kalbreyer 918* (Holotype: B, destroyed).

(?) *Fernandezia bucarasicae* (Kraenzl.) M.W. Chase, Phytotaxa 20: 29. 2011.

Pachyphyllum peperomioides Kraenzl., in Engl., Pflanzenr. IV, 50, 83: 27. 1923 *syn. nov.* TYPE: COLOMBIA. Narino: near La Vega, 3300 m, 2 June 1878, *F.C. Lehmann s.n.* (Holotype: W-R 6340, image seen).

Fernandezia peperomioides (Kraenzl.) M.W. Chase, Phytotaxa 20: 30. 2011.

Pachyphyllum foreroi Szlach. & Kolan., Nord. J. Bot. 32, 6: 745. 2014 *syn. nov.* TYPE: COLOMBIA. Caldas: road between Manizales and the Hotel Termales del Ruiz, 3000–3500 m, 8 June 1966, *E. Forero, M. Murillo & N. Montenegro 513* (Holotype: COL, image seen).

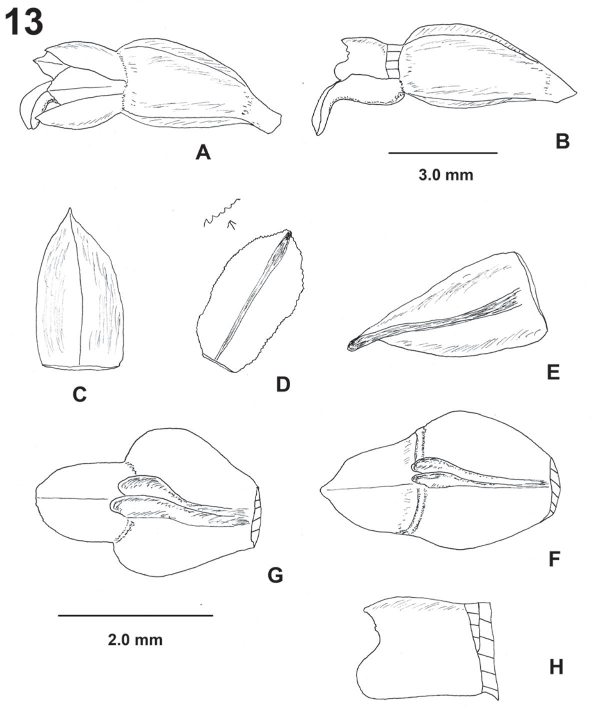
Fernandezia foreroi (Szlach. & Kolan.) Molinari & Mayta, Richardiana 16: 43. 2015.

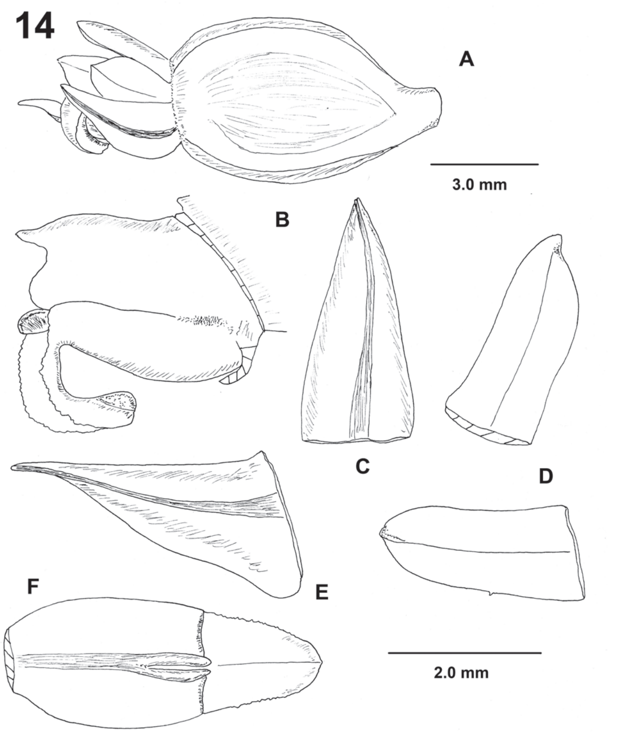
Pachyphyllum longipedicellatum Szlach., Kolan. & Oledr., Ann. Bot. Fenn. 51: 225. 2014 *syn. nov.* TYPE: COLOMBIA. Putumayo: Alto Cuenca of the Rio Putumayo, ridge of the Cordillera between El Encano and Sibundoy, paramo San Antonio del Bordoncillo, 3250 m, 4 January 1941, *J. Cuatrecasas 11698B* (Holotype: COL, image seen).

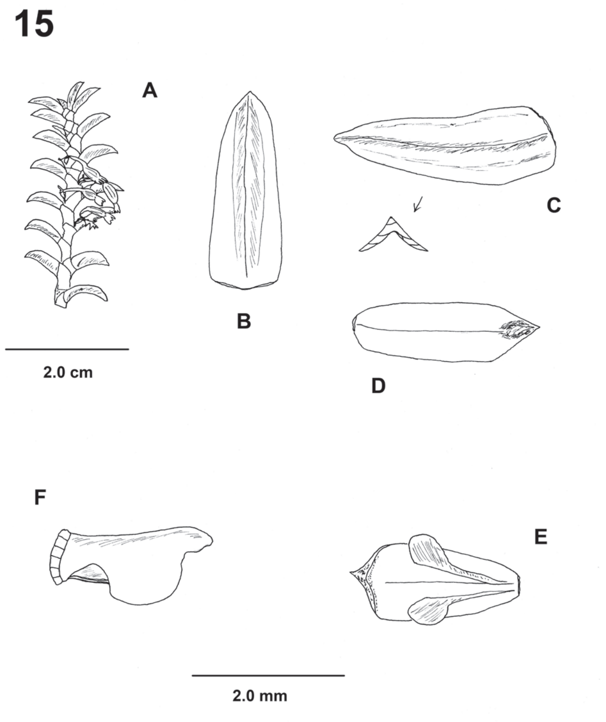
Fernandezia longipedicellata (Szlach., Kolan. & Oledr.) Molinari & Mayta, Richardiana 16: 43. 2015.

Distribution: Costa Rica, Panama, Venezuela, Colombia, Ecuador, Peru, Bolivia.

Additional specimens examined: COSTA RICA. Limon: Cordillera de Talamanca, Atlantic slope, Valle de Silencio, along the Rio Terbi, 0.5–1.5 km W of the Costa Rican/Panamanian border, 2300–2400 m, 9 September 1984, *G. Davidse, G. Herrera Ch. & M.H. Grayum 28782* (MO). Puntarenas/Limon: on border, Cordillera de Talamanca, Cerro Nai, on the continental divide, 3130 m, 27 March 1984, *G. Davidse, G. Herrera Ch. & R.H. Warner 26130* (MO). Puntarenas: Canton de Perez Zeledon, Parque Internacional La Amistad, Cordillera de Talamanca, Sendero Herradura to Uran, 3000–3800 m, 8 April 1995, *R. Aquilar & O. Garrote 3991* (MO). San Jose: along Interamerican Highway, ca. 25 km SW of road to La Cima, and 4.1 km NW of Cerro Asuncion, E end of abandoned section of road, 3180–3220 m, 11 September 1979, *W.D. Stevens 14280* (MO, SEL). San Jose/Cartago: Cerro de la Muerte, 3100 m, 16 September 1943, *C.H. Lankester 1508* (AMES, SEL). Cartago: KM 66.5 S of Cartago, near area of paramo on clay road, no altitude, 7 July 1986, *J.T. Atwood 86-8* (SEL). PANAMA. Chiriqui: “La Chumbada” above Guadalupe, 1900–2400 m, 18-21 October 1980, *R.L. Dressler 5928* (MO). VENEZUELA. Merida: without locality, *J.K. Moritz 1076* (BM); Distrito Sucre, Santa Cruz de Mora to Canagua, 34.4 km from turn off from paved road in Guayabal, 2800 m, 15 December 1984, *A.L. Weitzman & N.M. Holbrook 190* (AMES). Trujillo: Distrito Carache, Paramo Turmal, SE of Pico Jabon, 2900 m, 27 May 1988, *L.J. Dorr, L.C. Barnett, R. Rivero & W. Diaz 5296* (AMES); Paramo de Guaramacal, between Bocono and Guaramacal, 2800 m, 24 February 1971, *J.A. Steyermark 104821* (AMES, K); Bocono to Guaramacal road, 2135–2440 m, *G.C.K. Dunsterville & E. Dunsterville 656* (AMES). Sucre: Cerro Turumuquire, 2200–2500 m, 6 May 1945, *J.A. Steyermark 62568* (AMES). COLOMBIA. Santander: W slope of Paramo Rico, 3300–3600 m, 15-19 June 1927, *E.P. Killip & A.C. Smith 17777A* (AMES). Norte de Santander: SE of Pamplona, no altitude, 30 June 1945, *M. de Garganta F. 1031* (F). Antioquia: Medellin, El Boqueron, 2300 m, 9 August 1967, *L.A. Garay 986* (AMES); San Felix, 3330 m, July 1944, *H.T. Albert 2055* (AMES); Municipio Urrao, Inspeccion Jaipera, Vereda El Chuscal, Paramo de Frontino, Sitio Llanogrande, 3000–







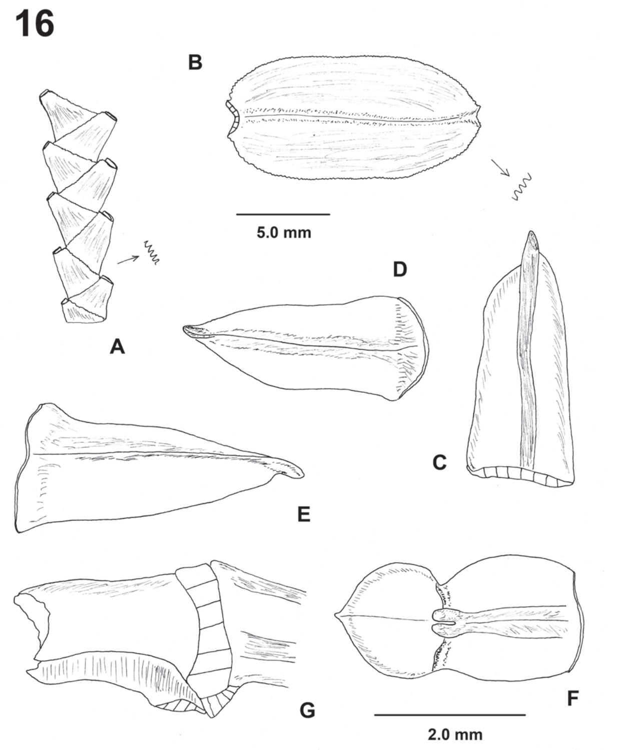


FIGURE 13–16. **13**, *Fernandezia crystallina* (Lindl.) M.W. Chase. Typical form. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F–G**, labellums; **H**, column. **A–F**, H, from *Pennell 9275* (AMES); G from *Pennell 9786* (AMES). **14**, *Fernandezia crystallina* (Lindl.) M.W. Chase. *Pasti* form. **A**, flower; **B**, labellum and column; **C**, dorsal sepal; **D**, petals; **E**, lateral sepal; **F**, labellum. Drawn from *Steyermark 53467* (AMES). **15**, *Fernandezia cuneata* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from holotype. **16**, *Fernandezia cuprea* Ormerod. **A**, stem fragment (minus leaves, no scale); **B**, leaf; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype.

3390 m, 4 April 1989, *R. Callejas, J. Betancur, O. Escobar & J. Quintero 7501* (MO, NY); Municipio Urrao, on trail to Paramo de Frontino from finca La Quince, 3200–3600 m, 19 November 1988, *G. McPherson 13163* (MO); Paramo Frontino, near Llano Grande, 3450 m, 26 October 1976, *J.D. Boeke & J.B. McElroy 248* (MO, NY, SEL). Caldas: San Felix, high valley, 3330 m, July 1944, *Brother Tomas 2055* (US); Cordillera Central, "Pinares," above Salento, 2600–2800 m, 2–10 August 1922, *F.W. Pennell 9275* (AMES); Cordillera Central, summit to "Cucarronera," New Quindio trail, no altitude, 14 August 1922, *E.P. Killip 9786* (AMES). Cundinamarca: Macizo de Bogota, Paramo de Palccio (Hacienda La Siberia), El Tablon, 3350 m, 14 December 1959, *J. Cuatrecasas, M.T. Murillo & R. Jaramillo M. 21653* (US); Cordillera Oriental, 45 km S of Bogota, 10 km W of Gutierrez, Rio Blanco valley, N side of Quebrada San Roque, 2725 m, 27 July 1944, *M.L. Grant 9719* (US); Cordillera Oriental, Cerro Negro, Hato Grande, ridge E of Munchindote, 15 km E of Gachete, 3000 m, 13 June 1944, *M.L. Grant 9433* (US); Los Gaques, 3260 m, 13 March 1939, *A.H.G. Alston 7488* (BM); Paramo de Guasca, 3300–3500 m, 12 March 1939, *E.P. Killip 34117* (AMES); Paramo de Guasca, no altitude, 1919, *Brother Ariste-Joseph A411* (AMES); Paramo de Guasca, no altitude, 3 November 1956, *M. Ospina-Hernandez 13* (AMES); near Sueva, ca. 15 km W of Gachata, 2745 m, 5 July 1961, *L.A. Garay, C.E. McClennen & A. Kapuler 151* (AMES); Mt. Chuscal, W of Zipaquira, 3200–3300 m, 22 October 1917, *F.W. Pennell 2594A* (AMES, F, MO); 20 km E of Pacho, 3100 m, 1 August 1967, *L.A. Garay 963* (AMES); Quebrada del Chico, 3000 m, 4 November 1943, *M. Schneider 106* (AMES). Meta: confluence of Rio Arroz and Rio del Nevado, S slope of Paramo de Sumapaz, 2650 m, 31 August 1943, *F.R. Fosberg 20928* (US). Choco: Municipio San Hose del Palmar, Cerro del Torra, 2700–2800 m, 21 August 1988, *P. Silverstone-Sopkin, W.N. Paz, R.T. Gonzales, J.E. Ramos, L.H. Ramos & A. Henao 4686* (MO). Valle: Cordillera Central, W slope, Hoya del Rio Bugalagrande, Barragan: Paramo de Bavaya, Corrales, 3450–3520 m, 18–20 March 1946, *J. Cuatrecasas 20137* (F). Cauca: Paramo de Guanacas, 3000–3200 m, 3 August 1966, *L.A. Garay 924* (AMES); Paramo de Paletaria, 3000 m, 30 July 1961, *L.A. Garay, C.E. McClennan & A. Kapuler 349* (AMES); Tierra Adentro, Rio Palo basin, headwaters of Rio Lopez, 2500–3000 m, January 1906, *H. Pittier 1063* (AMES); above Monchique, W of Popayan, 2750 m, 26 July 1978, *C. Luer, J. Luer, J. Kuhn & R. Escobar 2993* (SEL); ca. 28 km E of Totoro, 3075 m, 6 May 1984, *J.L. Luteyn, R. Callejas & J.J. Pipoly 10186* (NY); Municipio Purace, Parque Nacional Purace, along road between Popayan and Neiva, at KM's 147–148, 3300 m, 6 December 1980, *T.B. Croat 51969* (MO); Volcan Purace, ca. 1–2 km W of the Alto de San Rafael, 3300 m, 31 March 1972, *A.M. Cleef 2749* (SEL); Mecizo Colombiano, paramo de Las Papas, around the laguna of Cusiyaco, 3530 m, 11 October 1958, *H.G. Barclay & P. Juajibioy 6015* (AMES, MO); Paramo de Barbillas, SE of Popayan, 3070 m, 27 July 1978, *C. Luer, J. Luer, J. Kuhn & R. Escobar 3017 p.p.* (SEL); W slopes of the Paramo de Moras, 3000 m, 29 October 1882, *F.C. Lehmann 2043* (BM); near Pitayo, 3000–3400 m, 16 March 1884, *F.C. Lehmann 3750* (BM). Narino: "Provincia Pastoensi," 3660 m, October, *W. Jameson 393* (BM, GH, K); without locality, 50 leagues (= 240 km) N of Quito (Ecuador), *W. Jameson s.n.* (GH); Cordillera Oriental, S side of Volcan Dona Juana, 3400–3600 m, 16 December 1944, *J. Ewen 16622* (AMES, BM, US); Municipio de la Cruz, Estivaciones del Volcan Dona Juana, 3550–3600 m, 29 October 1964, *L.E. Mora 3292* (AMES); NE ridge of Volcan Gualcala, 18 km SE of Piedrancha, 3600 m, 4–6 October 1943, *F.R. Fosberg 21136* (US); near crater lake on E slope of Volcan Galeras, 3200 m, 21 January 1979, *C. Luer & J. Luer 3747* (SEL); above Pueblo de Cumbal, Paramo de Cumbal, 3500 m, 4 July 1956, *S. Vogel 261* (AMES). Putumayo: Cordillera Portachuelo, along main road from Pasto to Mocoa, between Santiago and Pepino, 1900–2400 m, 2 August 1961, *L.A. Garay, C.E. McClennan & A. Kapuler 465* (AMES). ECUADOR. Carchi: Paramo W of Tulcan, 3800 m, 24 February 1992, *S. Dalstrom 1544* (SEL); Tulcan to Tufino, to Maldonado road, KM 50, 3100 m, 2 July 2000, *A. Alvarez & M. Alvarez 2628* (MO, NY); Tulcan to Maldonado, KM 39.2, 3620 m, 29 April 1993, *C.H. Dodson, E. Hagsater, N. Williams & A. Embree 19043* (MO); road to Tulcan and Maldonado, 3200 m, 16 March 1991, *A. Hirtz, C. Luer, J. Luer, J. del Hierro, F. Navarro, M. Navarro & X. Hirtz 5225* (SEL); Tulcan to El Angel road, ca. 30 km SW of Tulcan, near El Voladero, 3500 m, 23 February 1974, *G. Harling & L. Andersson 12098* (AMES, MO); El Angel, 3750 m, 15 July to 15 October 1983, *A. Hirtz 1161* (SEL); Maldonado to Tulcan road, near KM 35, 3100–3400 m, 3 October 1981, *L. Werling & S. Leth-Nissen LW 216* (MO); Tulcan to Maldonado, 3000 m, 4 April 1984, *S. Dalstrom & T. Hoijer 731* (SEL); Tulcan to Maldonado road, KM 45, 3600 m, 1 August 1985, *C.H. Dodson & A. Embree 16131* (MO, SEL); Tulcan to Maldonado road, 50–53 km from Tulcan, 3200–3500 m, 1 August 1976, *B. Ollgaard & H. Balslev 8315* (AMES, F, MO, NY, SEL); Tulcan to Maldonado, KM 55, 3500 m, November 1985, *Luther, E. Besse & Halton 870* (SEL); Huaca, Parroquia Mariscal Sucre, Estacion Biologica Guandera, 3300–3500 m, 4 January 2001, *A. Alvarez & E. Narvaez 2827* (NY). Imbabura: NE of Volcan de Cayambe, along trail to Rio Boqueron, 3810 m, 16 May 1944, *W.B. Drew E-236* (AMES); 10 km N of Ibarra, Hacienda Yura Cruz, 3700–3800 m, 25 May 1973, *L. Holm-Nielsen, S. Jeppesen, B. Lojtant & B. Ollgaard 6486* (AMES, MO, SEL); Paramo de Adjanda, above Otavalo, 3400–3600 m, July 1886, *F.C. Lehmann 6225* (K). Napo: slopes above Laguna Porjuantag, no altitude, 6 February 1953, *G.W. Prescott Exped. 549 p.p.* (NY); near Lake Porjuantag, no altitude, 10 February 1953, *G.W. Prescott Exped. 344* (NY); San Miguel (Salcedo) to Puerto Nuevo (Napo) road, 54 km from San Miguel, 3200–3300 m, 29 September 1976, *B. Ollgaard & H. Balslev 9819* (NY); Papallacta, on lava, 3100–3300 m, 15–16 June 1968, *G. Harling, G. Storm & B. Strom 10345* (AMES); Playon de San Francisco, El Mirador, no altitude, 16 August 1978, *J.D. Boeke & J. Jaramillo A. 2729* (MO, NY, SEL). Pichincha: NW side of the Volcan Atacazo, 3900–4180 m, 29 November 1985, *V. Zak 712* (GH, K, MO); Atacaso, 3500 m, 15 July to 15 October 1983, *A. Hirtz 1057* (MO, SEL); road from Olmedo toward Laguna San Marcos, N slopes of Volcan Cayambe, 3700 m, 28 October 1983, *H. Balslev & W.C. Steere 4471* (NY); Reserva Ecologica Cayambe-Coca, area of the road toward Laguna de San Marcos, 3300–3500 m, 17 June 2000, *A. Alvarez & G. Alvarez 2604* (NY); Yanacocha road, on the NW slope of the Cerro Pichincha, no altitude, 30 September 1982, *H. Balslev & W.C. Steere 3252* (NY); Cayambe, Laguna San Marcos, 3420 m, 29 December 1999, *B. Cuamacas & E. Gudino 515* (MO); along the old road between Quito and Chiriboga, a few km W of the pass, 3400 m, 6 February 1979, *C. Luer, J. Luer & R. Escobar 3848* (SEL). Cotopaxi: Volcan Cotopaxi, along the road and at Limpio Punga, 3500–3850 m, 23 March 1984, *S. Laegaard 51852* (K). Tungurahua: Llanganetes Range, Patate to Lieto to El Triunfo, 3000 m, 5 October 1984, *A. Hirtz 1994* (MO); without locality, 3000 m, 12 October 1984, *A. Hirtz 1994* (MO); Tunguragua (presumably on the volcano), 4265 m, *Sutton-Hayes 1* (BM); Tunguragua, *R. Pearce s.n.* (K). Chimborazo: road from San Miguel de Pungala to Alao, KM 15, Sitio Pucara, 3050 m, 12 July 2000, *A. Alvarez, L. Suin & J.C. Valenzuela 2667* (NY). Canar/Morona-Santiago: pass between Gualaceo to Limon, 3200 m, 16 January 1986, *S. Dalstrom & T. Hoijer 1045* (SEL). Azuay: Gualaceo to General Plaza (Limon) road, 0–5 km W of the pass, 3200–3450 m, 10 June 1979, *B. Lojtant & U. Molau 14487* (MO, NY); between Huagrarancha and Loma de Galapagos, 3140–3505 m, 9 July 1943, *J.A. Steyermark 53467* (AMES, F); Sigsig to Gualaquiza, KM 25.6, at the pass on military post road, KM 3.3 from pass to military post, 3200–3300 m, 11 January 2000, *P.M. Jorgensen, C. Ulloa, E. Narvaez & M. Lara 1783* (MO); Cuenca to Gualaquiza, near Ave Maria Pass, 3300 m, 16 February 1986, *A. Embree 011* (MO). Morona-Santiago: 0–4 km E of below the pass on the Alao to Huamboya trail, 3650–3950 m, 5 January 1988, *U. Molau, B. Eriksen & B.B. Klitgaard 2372* (MO); Gualaceo to Loma de la Virgen to Limon Indanza road, KM 27, 3300 m, 19 July 2000, *A. Alvarez, L. Suin & J.C. Valenzuela 2737* (MO, NY); Gualaceo to El Limon road, from the pass towards El Limon, 3200–3400 m, 8 February 1989, *H. van der Werff & W. Palacios 10538* (MO); Gualaceo to Macas road, E of the pass, 2450 m, 23 October 1984, *P.M. Jorgensen, S. Laegaard & W.C. Steere 56247* (MO); E of pass on road from Cuenca to Limon, 2800–3100 m, 20 November 1989, *C.H. Dodson, N. Williams, E. Hagsater & M. Whitten 17725* (AMES, K, MO, SEL); Cuenca to Limon road via Gualaceo, 3400 m, 16 February 1996, *A. Hirtz, C. Luer, J. Luer & A. Embree 2760* (MO); Cuenca to Limon, KM 55, 2800 m, 29 November 1984, *C.H. Dodson, P.M. Dodson, S. Jaramillo & M. Barahona 15481* (AMES, MO); above Sigsig, 2850 m, 6 May 1981, *J. Kuhn, L. Kuhn, C. Luer & J. Luer 57* (MO). Loja: Jimbura to Zumba road, KM 24 at the pass, 3480–3600 m, 6 November 2000, *P.M. Jorgensen, C. Ulloa & J. Caranqui 2267* (MO); above Jimbura, 3350 m, 21–22 March 1984, *C. Luer, S. Dalstrom, T. Hoijer & J. Kuijt 9640* (SEL); Villonaco, 2900 m, 5 October 1946, *R. Espinosa 737* (AMES); ex Saraguro, cult. Ecuagenera Gualaceo Facility, 3800 m, 11 July 2002, *A. Hirtz 8418* (SEL). Zamora-Chinchipe: Cerro Colorado, S of Nambija, 2500 m, 17–20 February 2002, *A. Hirtz, D. Neill, T. Delings, C. Cole, M. Manzanares, A. Egas & W. Quishpe 7992* (SEL). Without locality: *F.C. Lehmann 6865* (AMES). PERU. Amazonas: Prov. Bagua, Cordillera Colan, E of La Peca, ridge W of peaks, 2925 m, 28 August 1978, *P. Barbour 3258* (F, MO, SEL). Pasco: Prov. Oxapampa, Distrito Huancabamba, Santa Barbara, above Lanturachi, 3300–3500 m, 2 July 1985, *R.B. Foster 10460* with *B. d'Achille & A. Brack* (AMES); Santa Barbara, 3200–3300 m, 3 August 1984, *D.N. Smith 8171* (MO). Cajamarca: Prov. Jaen, Sallique, Localidad El Paramo, 3200 m, 23 June 1988, *J. Campos, C. Diaz & T. Guevera 5066* (F, MO); same data, *J. Campos, C. Diaz & T. Guevera 5089* (MO); Prov. Chota, forest of El Pargo, between Llama and Huambos, 3090 m, 15 August 1994, *S. Leiva G., P. Chuna & J. Cadle 1535* (F, GH); El Pargo, 16 km E of Tunas Pampa, ca. 42 km E of Llama on road to Huambos, 3000 m, 18 September 1991, *A. Gentry, C. Diaz & R. Ortiz 74908* (MO, SEL). Ayacucho: Prov. La Mar, E massif of the Cordillera Central, opposing the Cordillera Vilcabamba, between Tambo San Miguel, Ayna, and Hacienda Luisiana, Punccu Camp, ca. 4.5 km walking distance SW from Hacienda Luisiana and the Apurimac River, ca. 30 km from Hacienda Santa Rosa, ca. 10 km from Tambo, 3220 m, 24 August 1968, *T.R. Dudley 12061* (MO). Cusco: Prov. Urubamba, near Wenner Gren ruins, 3400–3600 m, 5–6 August 1942, *R.D. Metcalf 30756* (AMES, MO); same data, *R.D. Metcalf 30775* (AMES, GH, MO); Urubamba, on Puyupata to Sayacmarca trail, 3000 m, 5 August 1942, *C. Vargas C. 2895* (AMES). BOLIVIA. La Paz: Prov. Nor Yungas, 1.2 km E of Cotapata, on road between Unduavi and Chuspipata, 3100 m, 26 June 1986, *J.C. Solomon 15343* (MO, NY, SEL). Prov. Sud Yungas, E of Unduavi, 3100 m, 22 January 1984, *C. Luer, J. Luer & R. Vasquez 9419* (SEL); along Rio Unduavi, 3200 m, 28 January 1980, *C. Luer, J. Luer, R. Vasquez & R. Nara 4976* (SEL). Prov. Larecaja, Cocopunco, 3050 m, 24–29 March 1926, *G.H. Tate 336* (NY).

This species essentially has two races, one of which is mostly distributed from Costa Rica, Panama, and central and eastern Colombia to Venezuela, and complies with typical *Fernandezia crystallina* (see Fig. 13) in having small flowers (sepals 2.0–2.5 mm long). The occasional plant reaches to southern Ecuador (*Espinosa 737*). The other race (the *"pasti"* form, see Fig. 14) is most common in western Colombia, down the Andes through Ecuador and Peru to Bolivia, it has larger flowers (sepals 3–4 mm long and more). The two races agree in all floral characters, and occasional specimens with flowers intermediate in size do exist. In the *"pasti"* form there is quite some variation in labellum shape, which can vary from perfectly oblong to trilobed, but as is typical of the species the upper half or "midlobe" is decurved. There also occurs in the Province of Chota, Peru, a small-flowered variant of the *"pasti"* form (*Leiva et al. 1535; Gentry et al. 74908*), which I at one stage considered a separate species. However, all the deviating floral measurements are accounted for in the broader variability of *F. crystallina*.

Having become familiar with the vegetative variation (which is presumably linked to habitat and exposure in some cases) of the species I see no reason to recognize taxa such as *Pachyphyllum peperomioides* (elliptic leaves), *P. longipedicellatum* (linear, canaliculate leaves), *P. micrangis* (fleshy curved leaves), and *P. stuebelii*. All florally agree with the species as I understand it.

In regard to *Pachyphyllum bucarasicae* from eastern Colombia, it cannot be known for certain that it is a synonym because the type is now lost. The description perfectly matches typical *Fernandezia crystallina* in vegetative and floral characters except for two points that require explanation. The leaf sheaths are said to be entire, but likely the margins were recurved and thus the true edge was not observed, since plants with strongly denticulate leaf margins do not have entire leaf sheath edges. The lip is said to be linear, sigmoid, and 0.5 mm wide. This seems unlikely since the petals are said to be 1 mm wide. After study of many species in the genus I find the lip is always around the same width as the petals, and never drastically half their width. Therefore, I suspect faulty observation or poor rehydration of the flower. Importantly the lip is said to be deflexed, another typical feature of *F. crystallina*. For these reasons I consider *Pachyphyllum bucarasicae* to be a synonym of *F. crystallina*.

I could not find separating characters for the recently described *Fernandezia foreroi*. The type is from the Department of Caldas in Colombia and agrees well vegetatively with specimens I have seen from there, except that the flowers are said to be about 3 mm long (sepals 2.0–2.4 mm long in material I studied), like in the *"pasti"* form. Among the paratypes cited for it is *Schneider 106* (COL) from La Rambla, however the specimen with this number in AMES is from Quebrada del Chico. Schneider sometimes gave the same number to what he thought was the same species. His specimen in AMES is typical *F. crystallina*.

Pachyphyllum longipedicellatum was recognized due to its narrow, canaliculate leaves, flowers with a long pedicellate ovary (5.5 mm long), and erose margins (not illustrated) of the lip. The type sheet of this taxon contains a mixture (the other specimens form the holotype of *P. putumayoensis*), and the type of *P. longipedicellatum* is in the upper half of the sheet between two specimens of *P. putumayoense*. However, on the lower lefthand side of the sheet is a typical specimen of *Fernandezia crystallina* with flat leaves that has been misidentified as *F. putumayoensis*. The specimen chosen as type of *P. longipedicellatum* is in my opinion a plant found in an exposed area. The elongate pedicellate ovary (5.5 mm) could not be confirmed. Flowers that I measured from the image had a 3.5-mm-long pedicellate ovary. The floral characters of *P. longipedicellatum* therefore match *F. crystallina* in sepal, petal, and lip shape (including the recurved "epichile"). The column appears to have collapsed down a little; its shape as illustrated is not representative of the genus.

Fernandezia cuneata Ormerod, *sp. nov.*
TYPE: BOLIVIA. La Paz: Prov. Nor Yungas, 8.7 km below Chuspipata on road to Yolosa, 2400 m, 23 January 1983, *J.C. Solomon 9321* (Holotype: MO). Fig. 15.

Related to *Fernandezia angusta* Ormerod var. *angusta* but with shorter (5–6 vs. 5–10 mm), oblong-lanceolate (vs. ligulate) leaves, shorter (3–4 vs. 5 mm) infloresecence peduncles mostly hidden (vs. exposed) in the leaf sheaths, and flowers with a cuneate (vs. oblong-oblanceolate) labellum.

Epiphytic *herb*. *Roots* terete, 0.8 mm thick. *Stems* weakly flexuous, 5–6 branched (branches 3–4 cm long), sublaxly leafy, 8 cm long, 0.10–0.17 cm thick, 0.2 cm across leaf sheaths. *Leaves* oblong-lanceolate, acute, minutely denticulate near apex, fleshy, conduplicate, 5–6 × 3.2–3.4 mm; leaf sheaths obliquely obcuneate in lateral view, margin recurved, minutely denticulate, surface smooth, striate. *Inflorescence* 5–7 mm long; peduncle 3–4 mm long, mostly hidden in leaf sheath; rachis few-flowered, 2–3 mm long ca. 2.5 mm long. *Dorsal sepal* oblong-lanceolate, acute, thickened along midvein, 2.3 × 0.8 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, thickened along midvein, 2.65 × 0.90–0.95 mm. *Petals* oblong, acute, thickened below apex, 2.15 × 0.75 mm. *Labellum* cuneate, subacute, carinate below tip, 2 × 1 mm; lower 2/3 of lip with divergent lamellae that overlap the sides of the lip, apices flap-like, semicircular to subquadrate. *Column* shortly clawed, each side with semicircular wing, 1.6 mm long, 0.8 mm wide laterally.

Distribution: Bolivia.

Habitat: cloud forest with little disturbance, 2400 m.

Etymology: from the Latin *cuneatus,* wedge-shaped, in reference to the lip shape.

As noted above this species seems closely related to *Fernandezia angusta*, differing from the typical variety of that entity in having shorter, oblong-lanceolate (vs. ligulate) leaves, inflorescences with slightly shorter peduncles that are mostly hidden (vs. exposed) by the leaf sheaths, slightly larger flowers, and a cuneate (vs. oblong-oblanceolate) lip.

Fernandezia cuprea Ormerod, *sp. nov.*
TYPE: ECUADOR. Loja: Cordillera de Las Lagunitas, Amaluza to Jimbura to Zumba road, KM 36, 3390 m, 22 November 1994, *P.M. Jorgensen, C. Ulloa, S. Leon, H. Vargas & P. Lozano 739* (Holotype: MO). Fig. 16.

Related to *Fernandezia kosnipatae* Ormerod but with shorter (10–15 vs. 17–26 mm) elliptic (vs. oblong) leaves, and flowers with a transversely elliptic (vs. suborbicular-subquadrate) front part of the labellum.

Terrestrial *herb*. *Roots* terete, 0.8–1.5 mm thick. *Stems* simple, densely leafy, 8–21 cm long, 0.5–0.8 cm wide across leaf sheaths, to 0.3 cm thick. *Leaves* elliptic, subacute, coriaceous, margins minutely denticulate, carinate below tip, drying a coppery color, 10.0–15.0 × 4.5–6.5 mm; leaf sheaths with exposed part triangular, margins minutely denticulate, smooth, dorsal edge 7.5 mm long. *Inflorescence* 10–12 mm long; peduncle 5 mm long; rachis secund, densely 3–5 flowered, 5–7 mm long; floral bracts deltate, acute, to 3 mm long. *Flowers* white and light green. *Pedicellate ovary* clavate, triquetrous, 4 mm long; capsule green. *Dorsal sepal* oblong, bluntly apiculate, fleshy, midvein thickly carinate, 3.0 × 1.3 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, fleshy, midvein carinate, 3.40 × 1.30–1.75 mm wide. *Petals* oblong-lanceolate, subacute, midline thickened, 2.9 × 1.1 mm. *Labellum* elliptic-subpandurate, apiculate, lower part 1.8 × 1.8 mm, upper part transversely elliptic, 1.1 × 1.6 mm, in total 2.9 × 1.8 mm; lower half of lip divided by a thick midline ending in 2 parallel, fleshy, oblong, obtuse calli. *Column* rectangular in profile, 2 mm long, 0.8–1.0 mm wide laterally.

Distribution: Peru.

Habitat: shrubby vegetation and surrounding paramo and subparamo, 3390 m.

Etymology: from the Latin *cuprum,* copper, in reference to the color the leaves dry.

This species is related to the Peruvian *Fernandezia kosnipatae,* both drying a reddish to brownish color. From the latter it may be distinguished by its more compact habit, densely leaved stems, elliptic (vs. oblong) leaves, and flowers in which the lip has a transversely elliptic (vs. suborbicular-subquadrate) upper half or "midlobe."

Fernandezia cymbiformis Ormerod, *sp. nov.*
TYPE: PERU. Amazonas: between Leimebamba and Balsas, 3050 m, 25 August 1980, *C. Luer, J. Luer, W. Koeniger & H. Koeniger 5425* (Holotype: SEL). Fig. 17.

Related to *Fernandezia solomonii* Ormerod but flowers with less oblique, narrower (1.0 vs. 1.8 mm) petals, a narrower (1.1 vs. 2.0 mm), almost evenly (vs. strongly unequally) pandurate labellum, and a shorter (2.1 vs. 3.2 mm) column.

Epiphytic *herb*. *Roots* terete, ca. 1 mm thick. *Stems* simple, subdensely leafy, 10.5 cm long, 0.18–0.20 cm wide across leaf sheaths, 0.06 cm thick. *Leaves* oblong, subacute, coriaceous, 7.0–9.5 × 3.0–4.0 mm; leaf sheaths tubular, truncate, margins entire, not fully covering internodes, 3.5–4.5 mm long. *Inflorescence* 6.0–6.5 mm long; peduncle mostly hidden in leaf sheath, ca. 4 mm long; rachis few-flowered, 2.0–2.5 mm long; floral bracts deltate, acute, to 3 × 2 mm. *Flowers* cream. *Pedicellate ovary* clavate, triquetrous; capsule triquetrous, 7 mm long (including pedicel 1 mm long). *Dorsal sepal* ligulate, subacute, midvein low carinate, 3.7 × 1.0 mm. *Lateral sepals* obliquely lanceolate, acute, midvein carinate, joined to each other and petals for *c.* 1 mm, 4.8 × 1.2 mm. *Petals* obliquely oblong-ligulate, acute, midline thickened, 3.5 × 1.0 mm. *Labellum* clawed, subpandurate, joined to synsepal for *c.* 0.9 mm, claw ligulate, 1.15 × 0.25 mm, blade 2.75 mm long (lower part 0.9 mm wide, upper part cymbiform 1.1 mm wide), in total 3.9 × 0.9–1.1 mm; callus of two relatively large semi-elliptic, parallel lamellae. *Column* shortly and broadly stalked, each side with a suborbicular wing, 2.1 mm long, ca. 1.3 mm wide laterally.

Distribution: Peru.

Habitat: cloud forest, 3050 m.

Etymology: from the Latin *cymbe*, boat, and *forma*, shape or form, in reference to the shape of the upper half of the labellum.

Among taxa in the *Fernandezia breviconnata* (Schltr.) M.W. Chase group this species has the smallest flowers and shortest column. It appears to be most similar to *F. solomonii* from Bolivia, but the flowers have narrower petals, and an almost evenly pandurate lip with larger, parallel (not oblique) calli.

Fernandezia denticulata Ruiz & Pav., Syst. Veg. Fl. Peruv. Chil. 1: 240. 1798.
TYPE: PERU. Huanuco: Pillao, *H. Ruiz & J. Pavon s.n.* (Holotype: MA, image seen; Isotype: BM). Fig. 18.
Homotypic synonym: *Pachyphyllum denticulatum* (Ruiz & Pav.) Schltr., Rep. Sp. Nov. Regni Veg., Beih. 9: 180. 1921.

Lithophytic and epiphytic *herb*. *Roots* terete, 0.7–0.8 mm thick. *Stems* simple, densely leafy, 7–17 cm long, 0.3–0.4 cm wide across leaf sheaths, ca. 2 mm thick. *Leaves* ligulate, subacute, weakly curved, shallowly canaliculate, margins minutely denticulate, fleshy, 8 mm long, ca. 2 mm wide laterally; leaf sheaths broadly deltate-infundibuliform, margins minutely denticulate, smooth, striate. *Inflorescence* to 7 mm long; peduncle ca. 3 mm long; rachis up to 5 flowered, to 4 mm long; flora ca. 3 mm long. *Dorsal sepal* ovate, subacute, concave, 1.9 × 1.1 mm. *Lateral sepals* obliquely ovate-elliptic, subacute, midvein carinate, most notably in upper 1/3, 1.9 × 1.0 mm. *Petals* elliptic, subacute, margins minutely denticulate, midvein low carinate, 1.75–1.80 × 0.90 mm. *Labellum* subpandurate, subacute, lower part 1.10 × 1.15 mm, upper part 0.8 × 0.8 mm, in total 1.90 × 1.15 mm; lower half divided by a low thick ridge that ends apically in 2 parallel, oblongoid calli. *Column* stout, 1.2–1.3 mm long, ca. 0.9–1.0 mm wide.

Distribution: Peru.

The above description is based on the BM isotype and is provided to augment knowledge of the species. Despite study of numerous Peruvian specimens, no later collections were found, perhaps indicating that the plant is a local endemic.

Fernandezia diazii Ormerod, *sp. nov.*
TYPE: PERU. Cajamarca: Prov. Cutervo, KM 10 from San Andres towards Socota, on property of Senor Vitelo Diaz, 2500 m, 19 April 1988, *C. Diaz & S. Baldeon 2812* (Holotype: MO). Fig. 19.

An isolated species of section *Lamellata* characterized by having flowers with obovate-oblanceolate petals, a pandurate labellum with 2 elongate lamellae, and a relatively long-stalked column.

Epiphytic *herb*. *Roots* terete, 0.3–0.7 mm thick. *Stems* simple or occasionally one branched (branch to 3.4 cm long), flexuous, laxly leafy, 6.5–12.5 cm long, 0.17 cm wide across leaf sheaths, 0.05 cm thick. *Leaves* ligulate, subacute, often shortly decurved near apex, 10.0–15.0 × 2.0–2.4 mm; leaf sheaths often not fully covering stem, smooth. *Inflorescence* to 8.5 mm long; peduncle 5.0–5.5 mm long; rachis 4–5 flowered, to 3 mm long; floral bracts lanceolate-deltate, acute, to 1.7 mm long. *Flowers* greenish-white. *Pedicellate ovary* clavate, triquetrous, 3.3 mm long. *Dorsal sepal* oblong-ligulate, obtuse, midvein low carinate near the apex, 1.95 × 0.75–0.80 mm. *Lateral sepals* obliquely

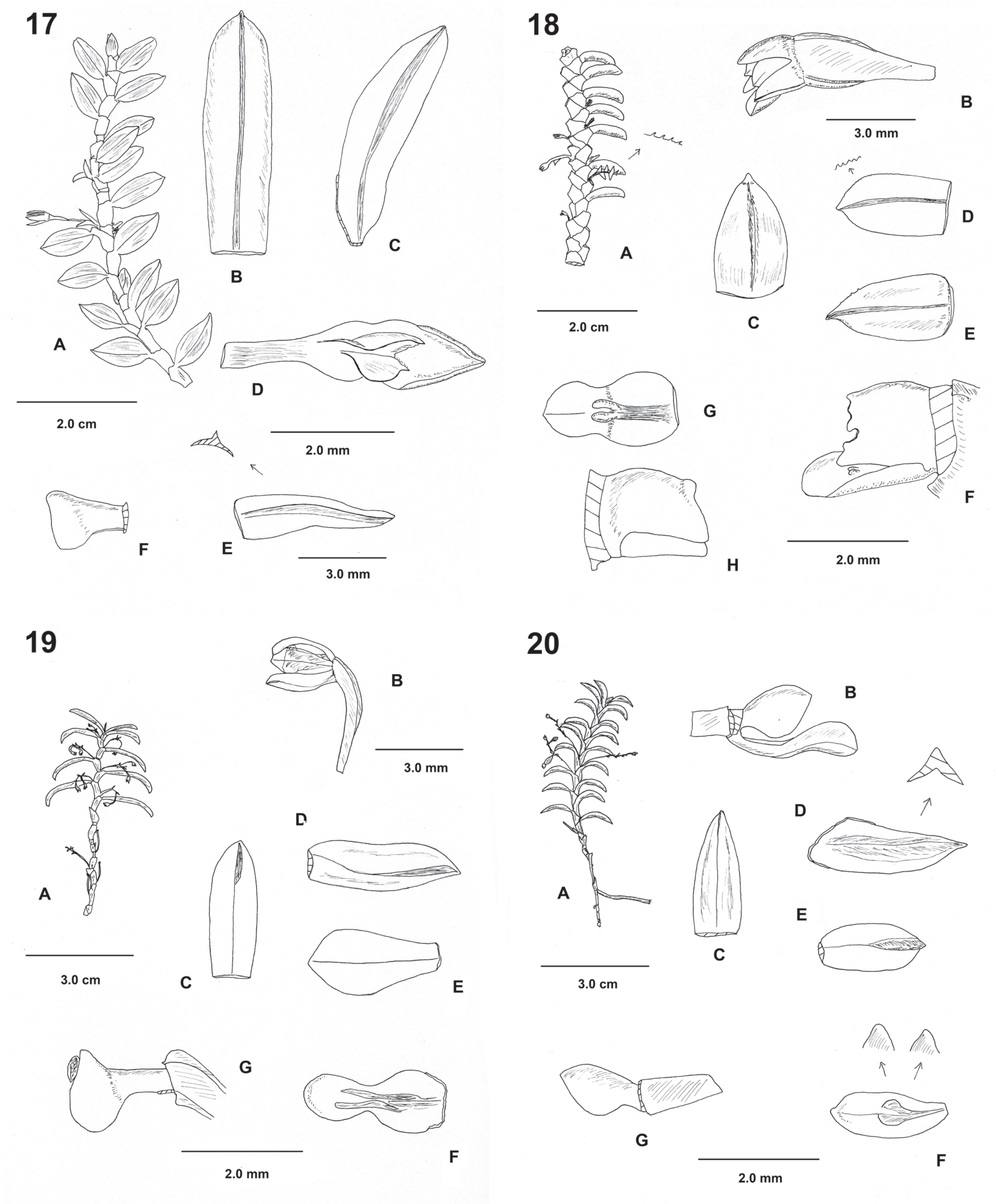


FIGURE 17–20. **17**, *Fernandezia cymbiformis* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, labellum; **E**, lateral sepal; **F**, column. Drawn from holotype. **18**, *Fernandezia denticulata* Ruiz & Pav. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum and column; **G**, labellum; **H**, column. Drawn from isotype (BM). **19**, *Fernandezia diazii* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **20**, *Fernandezia dorriana* Ormerod. **A**, plant; **B**, labellum and column; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype.

oblong-ligulate, acute, midvein carinate toward apex, 2.20 × 0.75 mm. *Petals* obovate-oblanceolate, subacute, 1.95 × 1.00 mm. *Labellum* pandurate, obtuse, lower part 1.10 × 0.95–1.00 mm, upper part 0.9–1.0 × 0.8 mm, in total 2.10 × 0.95–1.00 mm; lower half divided by a low, thick ridge that diverges into 2 lamellae on the upper half of the lip. *Column* clawed, expanded each side into a broad semicircular wing, 1.5 mm long, 1.2 mm wide laterally.

Distribution: Peru.

Eponymy: named after Camilo Diaz, Peruvian biologist and botanist, and collector of the type.

This species resembles *Fernandezia callacallae* and *F. falcifolia* in habit, but its floral characters (stalked column, lamellae on lip) indicate it belongs in section *Lamellata*. It may be recognized by a suite of characters such as the obovate-oblanceolate petals and pandurate, rounded lip.

Fernandezia distichoides M.W. Chase, Phytotaxa 20: 30. 2011.

Basionym: *Pachyphyllum distichum* Kunth, Nov. Gen. Sp. 1: 339. 1816.

TYPE: ECUADOR. Near Loja and Gonzanam, 1955 m (1070 hexap.), July 1802, *A.J.A. Bonpland & F.W.H.A. von Humboldt 2123 p.p.* (Lectotype, here chosen: P 00669643 righthand plant, image seen).

Distribution: Ecuador.

The type material of this taxon comprises four sheets kept in Paris. At least three species appear to be present on these sheets, but only sheet 00669643 has material (on the righthand side) matching the illustration in the protologue (Kunth 1816). The lefthand plant on this sheet has laxer, shorter, more pointed leaves, I believe it represents *F. hamiltonii,* newly described below.

While *Fernandezia distichoides* likely occurs in Peru I have preferred not to accredit specimens to it until a more detailed study can be made to ascertain the specific limits of the taxon.

Fernandezia dorriana Ormerod, *sp. nov.*

TYPE: BOLIVIA. Cochabamba: Prov. Carrasco, Serrania Siberia, 20–35 km W of Comarapa (Dept. Santa Cruz), on the old Cochabamba to Santa Cruz road (Highway 4), 2000 m, 14–15 January 1990, *L.J. Dorr & L.C. Barnett 7026 p.p.* (Holotype: GH; Isotypes: MO, NY). Fig. 20.

Related to *Fernandezia jordaniae* Ormerod var. *jordaniae* but the flowers with acute (vs. obtuse) sepals, petals with a thick carina (vs. absent) on the petals, and the labellum sessile (vs. clawed).

Epiphytic (?) *herb*. *Roots* terete, 0.4–1.2 mm thick. *Stems* simple, sublaxly leafy, 6–18 cm long, 0.05–0.10 cm thick. *Leaves* oblong-lanceolate to lanceolate, acute, fleshy, margins minutely denticulate near the apex, 8 × 4 mm; leaf sheaths semitubular, margins entire to occasionally denticulate, surface smooth, 5 mm long. *Inflorescence* 12–14 mm long; peduncle 7–8 mm long; rachis 5–8 flowered, 5–6 mm long; floral bracts deltate, acute, 2.0–2.5 × 1.6 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 2.8–3.9 mm long. *Dorsal sepal* oblong to oblong-lanceolate, acute, fleshy, 1.70–1.85 × 0.75–0.80 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, midvein thickly carinate, 2.05–2.20 × 0.75–0.90 mm. *Petals* oblong to oblong-obovate, acute, midvein high carinate on outside in upper half, 1.65–1.75 × 0.75 mm. *Labellum* oblong to rhombic from a cuneate base, obtuse, carinate below tip, 1.7–1.8 × 0.8–0.9 mm; lower half with a low, narrow, median thickening dividing midway on the lip into 2 triangular lamellae. *Column* each side medially dilated into a low broad wing, 1 mm long, 0.7–0.9 mm wide laterally.

Distribution: Bolivia.

Additional specimens examined: BOLIVIA. Cochabamba: near Siberia, between Comarapa and Cochabamba, 2500–2600 m, 18 January 1983, *C. Luer, J. Luer, E. Besse & R. Vasquez 8530 p.p.* (SEL). Santa Cruz: La Siberia, 2550 m, 3 December 1978, *R. Vasquez 203* (SEL).

Eponymy: named after Laurence J. Dorr (1953–), specialist in the Malvales based at US and one of the collectors of the type.

The holotype of this species is a mixed collection; the other specimen present represents the holotype of *Fernandezia barnettii,* described above. The isotypes in MO and NY, however, have only material of *F. dorriana* on them. From *F. barnettii, F. dorriana* may be distinguished by its fleshier, oblong-lanceolate (vs. elliptic) leaves, strongly keeled lateral sepals and petals, and lip with calli raised into triangular flaps (vs. 2 long lamellae). However, its closest ally appears to be *F. jordaniae* var. *jordaniae* from the same region, a taxon with a similar habit and floral size. The two seem to differ in details of the sepals (acute vs. obtuse), petals (carinate vs. ecarinate), and labellum (sessile vs. clawed).

Fernandezia ecallosa (D.E. Bennett & E.A. Christenson) M.W. Chase, Phytotaxa 20: 30. 2011.

Basionym: *Pachyphyllum ecallosum* D.E. Bennett & E.A. Christenson, Icon. Orch. Peruv.: t.738. 2001.

TYPE: PERU. Huancavelica: Prov. Taycaja, Distrito Huachocolpa, Capcasoro, 3400 m, 15 June 1999, *M. Leon M. 3067* (Holotype: MOL [including two samples in spirit], not seen). Fig. 21G.

Leaves ligulate, acute, upper margin shortly fimbriate-denticulate, upper surface rugose, often secund, 7–16 × 1.8–3.5 mm. *Flowers* green with tips of petals becoming yellow as the capsule develops. *Dorsal sepal* oblong, obtuse, slightly thickened in upper 1/3 along midvein, upper half with minutely denticulate-papillose margins, 3 × 1.2 mm. *Lateral sepals* obliquely oblong-ligulate, apex irregular, upper half with denticulate margins, thickened along midvein, weakly curved, 2.6–2.8 × 0.95–1.00 mm. *Petals* oblong, apex irregular, upper half with denticulate margins, thickened along midvein, 2.8 × 1.2 mm. *Labellum* ovate, acute, upper half with minutely papillose margins, 2 × 1.5 mm; lower half divided by an obscure ridge that diverges apically into 2 short, parallel, decrescent ridges. *Column* short, broad, each side with a short, suborbicular, downward-pointing wing, 1 × 1 mm.

Distribution: Peru.

Additional specimen examined: PERU. San Martin: Distrito Huallaga, valley of the Rio Apisoncho, 30 km above Jucusbamba, 3600 m, 12 August 1965, *A.C. Hamilton & P.M. Holligan 1261* (K).

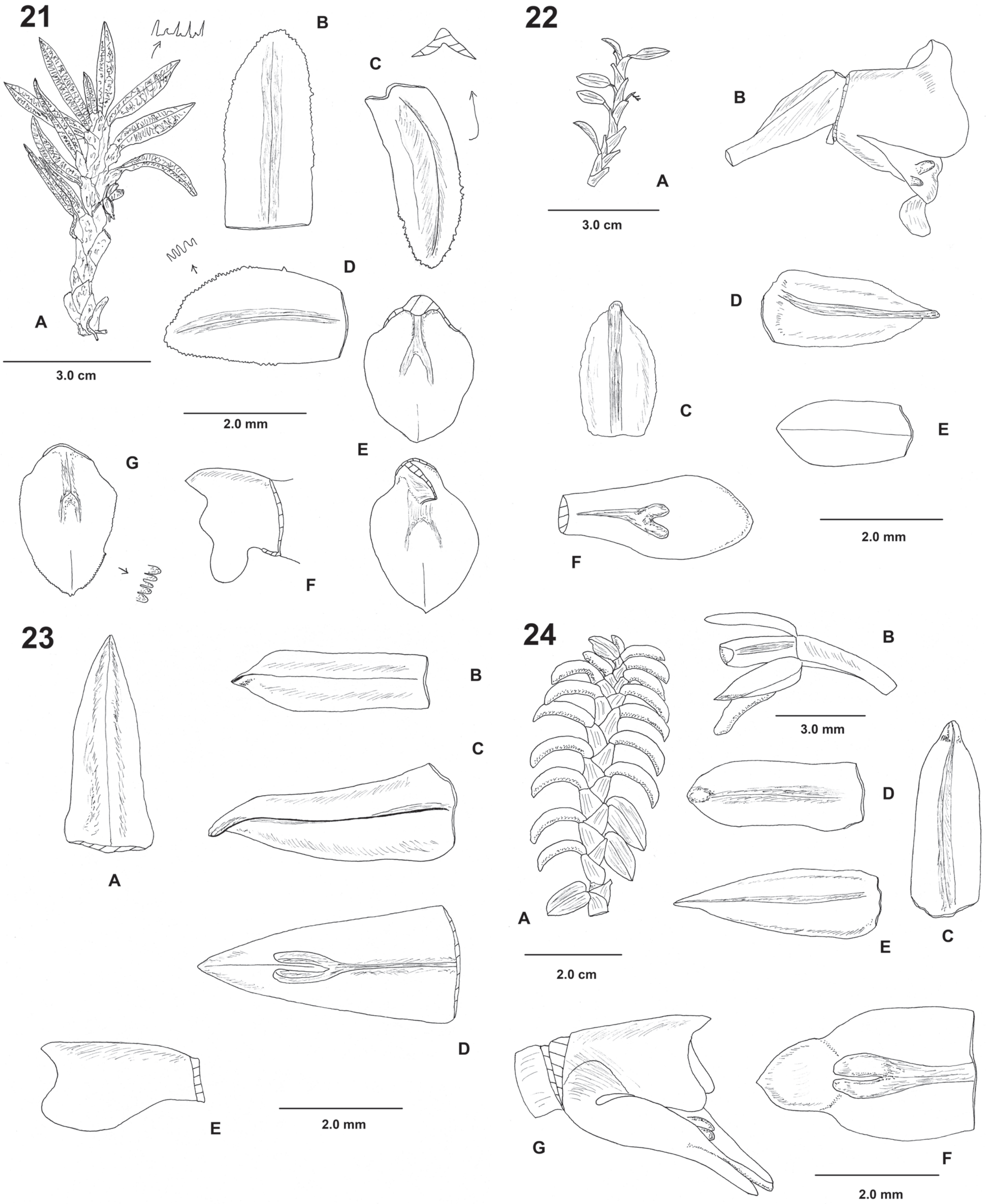


FIGURE 21–24. **21**, **A–F**, *Fernandezia ecallosa* (D.E. Benn. & E.A. Chr.) M.W. Chase var. *cundinamarcae* Ormerod. **A**, plant; **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column (no scale). **G**, *Fernandezia ecallosa* var. *ecallosa*. **G**, labellum. A–F from holotype; G from *Hamilton & Holligan 1261* (K). **22**, *Fernandezia espinosae* Ormerod. **A**, stem (upper part); **B**, flower minus tepals; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum. Drawn from holotype. **23**, *Fernandezia hamiltonii* Ormerod var. *hamiltonii*. **A**, dorsal sepal; **B**, petal; **C**, lateral sepal; **D**, labellum; **E**, column. Drawn from *Luer et al. 2543* (SEL). **24**, *Fernandezia hamiltonii* Ormerod var. *hamiltonii*. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, labellum and column. Drawn from holotype.

This species is closely related to *Fernandezia tortuosa* (Foldats) M.W. Chase but with much more strongly rugose surfaces on the leaves, which tend to not be so narrowed toward the apex. Christenson (2008) recorded *F. tortuosa* from Peru, but judging from a photograph of the specimen (Cusco: Machu Picchu, Winay Wayna, 3100 m, 2 June 1998, *W. Nauray & Acuriol 181* [CUZ, photo.: F]), it appears more likely to be *F. ecallosa*. *Fernandezia tortuosa* does occur in nearby Ecuador, however, and has also been reported for Bolivia (Kolanowska and Szlachetko, 2014).

The above short description based on the cited specimen is provided to augment the protologue, since the taxon was only known from the type.

Fernandezia ecallosa var. ***cundinamarcae*** Ormerod, *var. nov.*

TYPE: COLOMBIA. Cundinamarca: Highlands of Bogota, Paramo de Pradera, 2800–3200 m, March 1892, *F.C. Lehmann 8831* (Holotype: K; Isotype: K). Fig. 21A–F.

Differing from *Fernandezia ecallosa* (D.E. Bennett & E.A. Christenson) M.W. Chase var. *ecallosa* in the flowers having a labellum with entire (vs. minutely papillose) margins, and broader (1.8 vs. 1.0–1.3 mm) column wings.

Epiphytic *herb*. *Roots* terete, to 1 mm thick. *Stems* densely leafy, to 12 leaved, 5.0–6.5 cm long, to 0.8 cm wide across leaf sheaths, 0.3 cm thick. *Leaves* lanceolate, apex oblique, acute to subacute, upper margins fimbriate-denticulate, upper surface rugose, 10.0–17.5 × 2.5–5.0 mm; leaf sheaths with shortly denticulate margins. *Inflorescence* 11.5 mm long; peduncle compressed, 10 mm long; rachis very short, probably 2 flowered; primary floral bracts paired, ovate-oblong, acute, 5 × 4 mm. *Flowers* yellowish to greenish yellow. *Pedicellate ovary* not seen unfertilized; capsule ellipsoid, rounded triangular in section, 5 × 4 mm. *Dorsal sepal* oblong-elliptic, apex irregular, upper half with minutely papillose-denticulate margins, slightly thickened along midvein, 2.9 × 1.2 mm. *Lateral sepals* obliquely oblong, obtuse, weakly curved, thickened along midvein, upper third to half with minutely denticulate margins, 2.8 × 1 mm. *Petals* elliptic, apex irregular, upper half with minutely papillose-denticulate margins, slightly thickened along midvein, 2.8 × 1.5 mm. *Labellum* broadly ovate, subacute to obtuse, 2 × 1.75 mm; lower half divided by a low, narrow ridge (this rarely united to the column) that diverges apically in two, i.e., Y-shaped. *Column* short and broad, each side with a broadly elliptic, downward-pointing wing, 1 × 1.8 mm.

Distribution: Colombia.

Additional specimen examined: COLOMBIA. Cundinamarca: W of Zipaquira, Mt. Chuscal, 3200–3300 m, 22 October 1917, *F.W. Pennell 2595* (US).

Etymology: named after the type locality, the Department of Cundinamarca.

This taxon differs from the typical Peruvian entity in having entire lip margins, and much broader column wings (1.8 vs. 1.0–1.3 mm).

Fernandezia espinosae Ormerod, *sp. nov.*

TYPE: ECUADOR. Loja: Horta-Naque, 2500 m, 9 September 1946, *R. Espinosa 1024* (Holotype: AMES). Fig. 22.

Related to *F. crystallina* (Lindl.) M.W. Chase but the flowers with an entire (vs. trilobed to entire) oblong-obovate (vs. oblong to ovate-elliptic) labellum.

Epiphytic *herb*. *Roots* terete, 0.5–1.0 mm thick. *Stems* 1–3 branched apically (branches 5–12 cm long), sublaxly leafy, 12–30 cm long, 0.2–0.4 cm wide across leaf sheaths, to 0.15 cm thick. *Leaves* oblong, acute, thinly coriaceous, 8.0–10.0 × 2.5–4.0 mm; leaf sheaths deltate, smooth. *Inflorescence* to 7.5 mm long; peduncle to 5 mm long; rachis 3–4 flowered, 2.0–2.5 mm long; floral bracts ovate-lanceolate, acute, up to 2 mm long. *Flowers* lemon yellow, white on the edges. *Pedicellate ovary* clavate, triquetrous, 2.1 mm long. *Dorsal sepal* elliptic, subacute, midvein thickly carinate, 2.00 × 1.15–1.20 mm. *Lateral sepals* obliquely oblong-elliptic, subacute, midvein thickly carinate, 2.6 × 1.0 mm. *Petals* oblong-elliptic, subacute, 2.00 × 0.95 mm. *Labellum* oblong-obovate, subacute, 2.7 × 1.5 mm; lower half divided by a narrow ridge that divides apically into 2 divergent, fleshy calli. *Column* more or less rectangular, each side apically with a forward-pointing, rounded wing, ca. 1.7 mm long, 1.65 mm wide laterally.

Distribution: Ecuador.

Eponymy: named after Dr. Reinaldo Espinosa (1898–1950) from the University of Loja, who collected the type.

This species shares its habit and small flowers with the type form of *Fernandezia crystallina* but differs from it in having an oblong-obovate lip. The column was somewhat distorted from pressing in the flower studied, so that the apical part of the clinandrium was upturned. It appears in reality to be forward-pointing as in most other *Fernandezia*.

Fernandezia falcifolia (Rchb.f.) M.W. Chase, Phytotaxa 20: 30. 2011.

Basionym: *Pachyphyllum falcifolium* Rchb.f., Linnaea 41: 32. 1876.

TYPE: ECUADOR. Loja, September, *W. Jameson s.n.* (Holotype: W-R, image seen; Isotype: AMES). Fig. 34G–I.

Epiphytic *herb*. *Roots* terete, thin. *Stems* caespitose, wiry, to 100 mm long, to 2 mm wide across leaf sheaths. *Leaves* linear, acute, fleshy, falcate, to 8 mm long, ca. 0.75 mm wide laterally; leaf sheaths tubular, obliquely truncate, not covering all of stem, smooth. *Inflorescence* few flowered. *Flowers* yellow. *Pedicellate ovary* triquetrous; capsule triquetrous, shortly pedicellate, 2.8 mm long. *Dorsal sepal* ovate, obtuse, midvein low carinate, 1.3 × 1.0 mm. *Lateral sepals* obliquely ovate, subacute, midvein low carinate, 1.65 × 1.15 mm. *Petals* elliptic to obovate-elliptic, subacute to obtuse, 1.10–1.15 × 0.70–0.85 mm. *Labellum* oblong-lanceolate, oblong, to subpandurate, obtuse, lower part elliptic, ca. 1.1 × 0.9 mm, upper part ovate-elliptic, ca.. 0.70–0.75 × 0.40–0.50 mm, in total 1.70–1.85 × 0.70–0.90 mm; lower half divided by a low thickening that ends in 2 fleshy calli. *Column* short, stout, 0.9–1.0 mm long, ca. 0.8 mm wide laterally.

Distribution: Ecuador.

Additional specimens examined: ECUADOR. Azuay: E cordillera, 4–5 km N of Sevilla de Oro, 2745–3050 m, 14 August 1945, *W.H. Camp E-4680* (AMES, NY); E cordillera, 1–8 km N of Sevilla de Oro, 2440–2745 m, 27 July to 12 August 1945, *W.H. Camp E-4444* (AMES, NY).

Zamora-Chinchipe: few kilometers E of "El Tiro" Pass, between Loja and Zamora, 2600 m, 22 October 2004, *F.A. Werner 1241* (MO); "El Tiro" Pass, ca. 15 km from Loja, 2900 m, 8 July 2004, *F.A. Werner 1078* (MO).

The above description is supplied to augment knowledge of the species. It is closest to *Fernandezia callacallae* from Peru (see discussion under the latter) but is also similar to *F. micrantha*. This species probably occurs in Peru, but I did not confirm records from there. One collection previously recorded by Schweinfurth (1970) is referred here to *F. callacallae,* described above.

Fernandezia hamiltonii Ormerod, *sp. nov.*
TYPE: PERU. San Martin: Distrito Huallaga, valley of Rio Apisoncho, 30 km above Jucusbamba, 3500 m, 12 August 1965, *A.C. Hamilton & P.M. Holligan 1259* (Holotype: K; Isotype: AMES). Fig. 23–24.

Related to *Fernandezia distichoides* M.W. Chase but with more laxly leaved stems, shorter (5–17 vs. to 30 mm long) leaves, and smooth (vs. rugulose) leaf sheaths.

Epiphytic *herb*. *Roots* terete, thick and fleshy, 0.5–2.0 mm thick. *Stems* simple, sublaxly many- leaved, 3–31 cm long, 0.3–0.6 cm wide across leaf sheaths, 0.20–0.25 cm thick. *Leaves* ligulate in lateral view, acute, minutely denticulate along margins, slightly curved, fleshy, 5–17 mm long, 2.0–2.5 mm wide laterally; leaf sheaths deltate in lateral view, truncate, margins denticulate, surface smooth. *Inflorescence* to 6.5 mm long; peduncle ca. 2.5 mm long; rachis arched, 6 flowered, to 4 mm long; floral bracts deltate, acute, margins denticulate, to 2.5 × 2.0 mm. *Flowers* green, yellow to yellowish. *Pedicellate ovary* clavate, triquetrous, 3.2–3.5 mm long. *Dorsal sepal* oblong-lanceolate, acute, midvein low carinate, 3.00–3.15 × 1.10–1.40 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, midvein low carinate, 2.9–3.7 × 1.0–1.6 mm. *Petals* oblong, obtuse, thickened along midvein, 2.7–2.9 × 0.9–1.0 mm. *Labellum* elliptic in lower 2/3, apical 1/3 subquadrate to elliptic, acute, lower part 2.00 × 1.95–2.00 mm, upper part 1.20–1.40 × 1.10–1.15 mm, in total 3.20–3.40 × 1.95–2.00 mm, or more rarely ovate-lanceolate and 3.8 × 2.0 mm; lower part divided by low ridge that divides apically into 2 parallel, conical calli. *Column* cuneate in profile, each side at apex with an obtuse, forward-pointing wing, 2.0–2.1 mm long, 1.1–1.3 mm wide laterally.

Distribution: Ecuador; Peru.

Additional specimens examined: ECUADOR. Loja: pass 54 km N of Loja, 3000 m, 12 February 1978, *C. Luer, J. Luer & M. Portilla 2453* (SEL). PERU. San Martin: Distrito Huallaga, valley of Rio Apisoncho, 30 km above Jucusbamba, 2800 m, 6 September 1965, *A.C. Hamilton & P.M. Holligan 1291* (K).

Habitat: epiphyte growing among moss on trunks of small trees, in upper limit of montane forest (type), growing 5 ft (= ca. 1.5 m) above ground on tree trunk (*Hamilton & Holligan 1291*), cloud forest (*Luer et al. 2543*), 2800–3500 m.

Eponymy: named after A. C. Hamilton (1945–), one of the collectors of the type.

The collection *Hamilton & Holligan 1291* from Peru is reported as having pink flowers, but no trace of any such color can be detected in the well-preserved material at hand. The specimen from Ecuador has larger flowers than those from Peru and a simple ovate-lanceolate (almost triangular) lip (see Fig. 23). The latter shape agrees with the depiction of the lip in the protologue of *Pachyphyllum distichum* (Kunth, 1816), however that taxon (now *Fernandezia distichoides*) differs in having densely leafy stems, longer (to 30 vs. 5–17 mm), fleshier leaves, and strongly rugulose (vs. smooth) leaf sheaths.

Fernandezia hamiltonii seems to have been first collected in Ecuador by Humboldt and Bonpland in July 1802, as evidenced by the specimen (lefthand plant) present on the lectotype of *Pachyphyllum distichum* in Paris.

Fernandezia hamiltonii var. ***jaenensis*** Ormerod, *var. nov.*
TYPE: PERU. Cajamarca: Prov. Jaen, Sallique, Localidad de Lanchal: La Cocha, 2960 m, 16 June 1998, *C. Diaz, J. Campos, T. Guevera & E. Tineo 9602* (Holotype: GH; Isotypes: GH; MO, not seen). Fig. 25.

Differing from *Fernandezia hamiltonii* Ormerod var. *hamiltonii* in having smaller (sepals 2.2–2.6 vs. 2.9–3.7 mm long) flowers and a narrower (1.40 vs. 1.95–2.00 mm) labellum.

Roots terete, 0.5–1.5 mm thick. *Stems* single or caespitose, simple or branching (branches 2.0–3.5 cm long), densely leafy, 5–35 cm long, 0.3–0.6 cm wide across leaf sheaths. *Leaves* narrowly oblong, acute to subacute, fleshy, to 13 × 4 mm; leaf sheaths dilatate in lower half, slightly narrowed in upper half, truncate, smooth. *Inflorescence* to 9 mm long; peduncle ca. 5 mm long; rachis to 5 flowered, to 4 mm long; floral bracts deltate, acute, to 2 mm long. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, ca. 3 mm long; capsule triquetrous, 4 mm long (incl. 1-mm-long pedicel). *Dorsal sepal* oblong-lanceolate, subacute, 2.2 × 1 mm. *Lateral sepals* obliquely lanceolate, acute, carinate, 2.6 × 1.1 mm. *Petals* oblong, obtuse to subacute, 2.30 × 0.85 mm. *Labellum* ovate-lanceolate, subacute, slightly constricted midway, lower part 1.7 × 1.4 mm, upper part 1.2 × 0.9 mm, in total 2.9 × 1.4 mm; lower half divided by a broad low thickening that ends apically in 2 thick, conical to ellipsoid, obtuse calli. *Column* each side with an apical, forward-pointing, elliptic, obtuse wing, 1.9 mm long, 1.2–1.3 mm wide apically.

Distribution: Peru.

Etymology: named after the Province of Jaen, the type locality.

This variety differs from typical *Fernandezia hamiltonii* in having the leaf sheaths sublobulate midway (vs. in the lower 1/3), smaller flowers (sepals 2.2–2.6 vs. 2.9–3.7 mm), and a narrower lip (1.40 vs. 1.95–2.00 mm).

Fernandezia harlingii Ormerod, *sp. nov.*
TYPE: ECUADOR. Loja: Loma de Loro, 6 km SE of Saragure, on road to Loja, 3200 m, 11 February 1985, *G. Harling & L. Andersson 21904* (Holotype: AMES). Fig. 26.

Related to *Fernandezia denticulata* Ruiz & Pav. but the flowers having a labellum with larger calli, and the column with a broad apical extension.

Epiphytic and terrestrial (on road cutting) *herb*. *Roots* terete, emitted from base of stem, to 0.8 mm thick. *Stems*

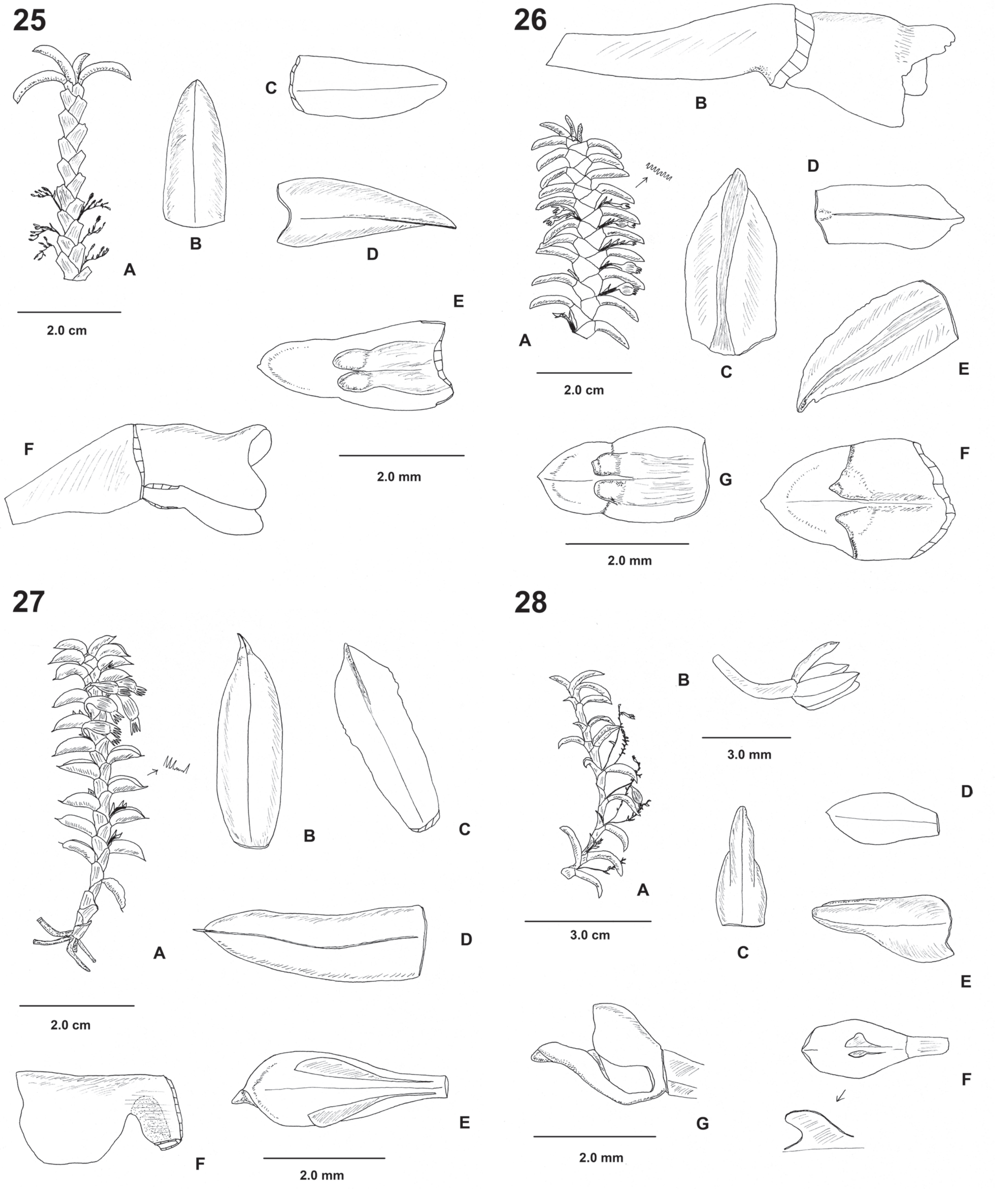


FIGURE 25–28. **25**, *Fernandezia hamiltonii* Ormerod var. *jaenensis* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype. **26**, *Fernandezia harlingii* Ormerod. **A**, stem (upper part); **B**, column; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F–G**, labellums. A–F from holotype; G from *Madison et al. 7470* (MO). **27**, *Fernandezia ichneumonea* Ormerod. **A**, plant; **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype. **28**, *Fernandezia jordaniae* Ormerod var. *jordaniae*. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, labellum and column. Drawn from holotype.

densely leafy, simple to 3–4 branched apically, 10.0–20.5 cm long, 0.35 cm wide across leaf sheaths, 0.15 cm thick. *Leaves* oblong-lanceolate, weakly falcate, acute, margins minutely denticulate, 6–10 mm long, 1.3–2.2 mm wide laterally; leaf sheaths triangular, truncate, margins minutely denticulate, surface finely transversely rugulose. *Inflorescence* ca. 6 mm long; peduncle 2.5 mm long; rachis 5–6 flowered, ca. 3.5 mm long; floral bracts deltate-cymbiform, acute, to 3 mm long. *Flowers* green, or with green sepals, white petals and lip. *Pedicellate ovary* clavate, triquetrous, 3.5 mm long. *Dorsal sepal* ovate-elliptic, acute, carinate medially, 2.2–2.8 × 1.05–1.20 mm. *Lateral sepals* obliquely oblong-lanceolate, acute to subacute, medially carinate, 2.20–2.75 × 1.05–1.25 mm. *Petals* oblong, acute to subacute, 2.0–2.1 × 0.8–1.0 mm. *Labellum* ovate to ovate-elliptic, acute to subacute, lower half 1.4 × 1.6–1.8 mm, upper half 1.00–1.35 × 1.2-1.6 mm, in total 2.40–2.75 × 1.6–1.8 mm; lower half divided by a ridge that diverges into 2 conical to subquadrate, medial calli. *Column* 1.8 mm long, apex 1 mm wide laterally.

Distribution: Ecuador.

Additional specimen examined: ECUADOR. Loja: Cordillera de Sabanilla, ca. 15 km S of Yangana, 2480 m, 31 December 1980, *M.T. Madison, D. Madison, L. Besse & A. Besse 7470* (MO).

Habitat: moist montane scrub, on road cut (type), and wet montane forest (*Madison et al. 7470*), 2480–3200 m.

Eponymy: named after Gunnar Harling (1920–2010), collector of the type. He was the founder and Chief Editor of *The Flora of Ecuador* series, and participated in several expeditions to Ecuador.

This species appears to be most similar to *Fernandezia denticulata* from Peru, sharing with it a similar habit and small flowers with similarly shaped segments. However, *F. harlingii* differs in having flowers with a larger labellum (2.40–2.75 × 1.60–1.80 vs. 1.90 × 1.15 mm) with larger calli, and a column with a prominent apical extension of the clinandrium.

The collectors of the second specimen noted it to have cleistogamous flowers but this was not evident in the one that was studied, though it did have smaller measurements.

Fernandezia ichneumonea Ormerod, *sp. nov.*
TYPE: PERU. Cusco: Prov. Quispicanchi, between Abra Walla Walla and Marcapata, 210 km from Cusco, 2800-4600 m, 21–25 April 1988, *P. Nunez, F. Loaysa & W. Loaysa 9038* (Holotype: SEL; Isotypes: F, MO, NY). Fig. 27.

Related to *Fernandezia weberbaueri* Ormerod var. *weberbaueri* but the leaves with an apiculus to 2 mm (vs. to 1 mm) long, the flowers with a subacuminate (vs. acute) dorsal sepal, and narrower (1.3 vs. 1.5–1.6 mm wide) column wings.

Epiphytic *herb*. *Roots* terete, 0.4–0.8 mm thick. *Stems* simple or rarely branched (branch to 3.5 cm long), densely leafy, 4.5–19.0 cm long, to 0.2 cm thick. *Leaves* oblong-lanceolate, apiculate, margins minutely denticulate, to 8.5 mm long, ca. 2 mm wide laterally, apiculus to 2 mm long; leaf sheaths deltate, truncate, margin minutely denticulate, surface smooth, striate. *Inflorescence* to 6 mm long; peduncle to 3 mm long; rachis up to 3 flowered, to 3 mm long; floral bracts deltate, acute, to 2.2 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, trialate, 2.8–3.0 mm long. *Dorsal sepal* oblong, subacuminate, 3.15 × 1 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, carinate medially near apex, carina apiculate, 3.5 × 1 mm. *Petals* oblong-oblanceolate, acute, carinate medially near apex, 3 × 1 mm. *Labellum* oblanceolate, subacute, carinate below apex with an obtuse carina, 3.1 × 1.2 mm; carinae 2, lamellate, divergent, ending in upper 2/3 of lip. *Column* with broad semicircular wings, 2 mm long, 1.3 mm wide laterally.

Distribution: Peru.

Etymology: from the Classical Greek *ichneumon,* used for a small wasp in some cases, in reference to prominent stinger-like apiculi on the tips of the leaves and lateral sepals.

This species is closely allied to *Fernandezia weberbaueri* var. *weberbaueri,* coming from the same province in Peru. It appears to differ in being a stouter plant with broader leaf sheaths, in having conduplicate (vs. flat) leaves with a longer apiculus (2 vs. 1 mm long), fewer-flowered (up to 3 vs. up to 5 flowers) inflorescences, flowers with a subacuminate (vs. acute) dorsal sepal, and narrower column wings.

Fernandezia jordaniae Ormerod, *sp. nov.*
TYPE: BOLIVIA. Santa Cruz: Prov. Caballero, road to Siberia, 26 km from Comarapa, around the Campamento, 2600 m, 15 April 2003, *C.G. Jordan & I.G. Vargas 394* (Holotype: MO). Fig. 28.

Related to *Fernandezia dorriana* Ormerod but the flowers with obtuse (vs. acute) sepals, obovate-oblong (vs. oblong-elliptic) petals without a thick carina, and a clawed (vs. sessile) labellum.

Epiphytic (?) *herb*. *Roots* terete, 0.5 mm thick. *Stems* simple, sublaxly leafy, 4–9 cm long, 0.10–0.15 cm thick. *Leaves* oblong, acute, minutely denticulate near apex, coriaceous, 8-10 × 3.5–4.2 mm; leaf sheaths obliquely oblong-lanceolate in lateral view, smooth, striate, margin revolute, minutely denticulate. *Inflorescence* 17 mm long; peduncle 10 mm long; rachis sublaxly 7 flowered, 7 mm long; floral bracts deltate, acute, 2 × 1.6 mm. *Flowers* white. *Pedicellate ovary* triquetrous, 2.8–3.0 mm long. *Dorsal sepal* ovate-lanceolate, obtuse, fleshy, concave on lower inside half, 1.75–1.80 × 0.8 mm. *Lateral sepals* obliquely ovate-lanceolate, obtuse, fleshy, concave on lower inside 1/3, 2 × 0.95–1.00 mm. *Petals* obovate-oblong, acute, 1.75 × 0.8 mm. *Labellum* elliptic-oblanceolate, obtuse, carinate below tip, 2 × 0.9 mm; lower half divided by a linear ridge that diverges into low lamellae that are raised apically into obliquely subquadrate terminations. *Column* shortly and broadly stalked, each side with a low, broad, semicircular wing, 1.1 mm long, 0.8 mm wide laterally.

Distribution: Bolivia.

Habitat: Very wet "yungueno" forest on a montane ridge, 2600 m.

Eponymy: named after Claudia G. Jordan, co-collector of the type.

Among those taxa in the broad *Fernandezia pectinata* alliance, this species may be recognized by its flat leaves, long inflorescence peduncles, and very fleshy flowers with obtuse sepals. Its closest ally appears to be *F. dorriana* from the same region, the latter differing in having more oblong petals with a thick carina, and a sessile (not clawed) lip.

Fernandezia jordaniae var. ***trullata*** Ormerod, *var. nov.*
TYPE: BOLIVIA. Santa Cruz: Manuel M. Caballero, near Siberia, above Comarapa, 2500 m, 1–2 December 1978, *C. Luer, J. Luer, L. Kuhn, J. Kuhn & F. Fuchs et al. 3596* (Holotype: SEL). Fig. 29.

Differs from the typical variety in having thinner sepals, trullate labellum and a sessile column.

Epiphytic (?) *herb*. *Roots* terete, 0.4–0.8 mm thick. *Stems* 2–4 branched (branches 2.0–5.5 cm long), sublaxly leafy, 14–17 cm long, 0.1 cm thick. *Leaves* oblong-lanceolate, acute, laxly minutely denticulate towards apex, 9.5 × 3.5 mm; leaf sheaths smooth, striate, half spreading away from stem, exposing internodes. *Inflorescence* to 16 mm long; peduncle 6–7 mm long; rachis 7–10 flowered, 5–9 mm long; floral bracts deltate, acute, to 1.8 mm long. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 2.5 mm long. *Dorsal sepal* oblong-lanceolate, obtuse, concave, 1.75 × 0.75 mm. *Lateral sepals* obliquely lanceolate, acute, midvein thickly carinate in upper half, 2.1 × 0.8 mm. *Petals* oblong-oblanceolate, acute, 1.65 × 0.80 mm. *Labellum* trullate, obtuse, carinate below tip, 1.7 × 0.9 mm; lower 1/3 of lip divided by a weakly thickened midline that raises apically into 2 parallel, triangular to elliptic lamellae. *Column* sessile, each side with a low, rounded wing, 0.9 mm long, 0.8 mm wide laterally.

Distribution: Bolivia.

Habitat: cloud forest, 2500 m.

Etymology: from the Latin *trullatus,* trowel shaped, in reference to the labellum shape.

This variety differs from typical *Fernandezia jordaniae* in having thinner sepals, a trullate lip, and sessile column.

Fernandezia kosnipatae Ormerod, *sp. nov.*
TYPE: PERU. Cusco: Prov. Paucartambo, Kosnipata: forest ridge of Accanacu, Manu National Park and Pillahuata forests, 1900 m, 20 March 1991, *P. Nunez & N. Alanya 13221* (Holotype: MO). Fig. 30.

Related to *F. dalstroemii* (Dodson) M.W Chase but the plant with more laxly leaved stems, and the inflorescences with more (6 vs. 3) flowers.

Epiphytic *herb*. *Roots* terete, to 1 mm thick. *Stems* 2–3 branched (branches to 6.5 cm long), flexuous, laxly leafy, 34 cm long, 0.3 cm thick, 0.4 cm wide across leaf sheaths. *Leaves* oblong to weakly oblong lanceolate, apiculate, coriaceous, drying brownish, 17–26 × 4.5–9.5 mm; leaf sheaths obliquely ovate in lateral view, truncate, surface smooth, striate, not fully enclosing stem, 8 mm long dorsally. *Inflorescence* ca. 10 mm long; peduncle ca. 4 mm long; rachis pectinate, up to 6 flowered, to 6 mm long; floral bracts broad ovate, acute, to 2.5 × 2.0 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, ca. 3 mm long; capsule triquetrous, ca. 8 mm long (incl. 2 mm long pedicel). *Dorsal sepal* broadly oblong-lanceolate, acute, midvein broadly carinate, 3.6 × 1.5 mm. *Lateral sepals* obliquely lanceolate, acute, midvein carinate, 4.1 × 1.7 mm. *Petals* broadly oblong-lanceolate, acute, weakly ridged medially, 3.00–3.15 × 1.2 mm. *Labellum* subpandurate, acute, lower half 2.2 × 2.0 mm, upper half 1.70 × 1.65 mm, in total 3.9 × 2.0 mm; lower half divided by a ridge that ends in 2 parallel conical calli. *Column* almost rectangular in lateral view, 2.1–2.3 mm long, 1.2 mm wide laterally.

Distribution: Peru.

Etymology: named after the Kosnipata District, the type locality.

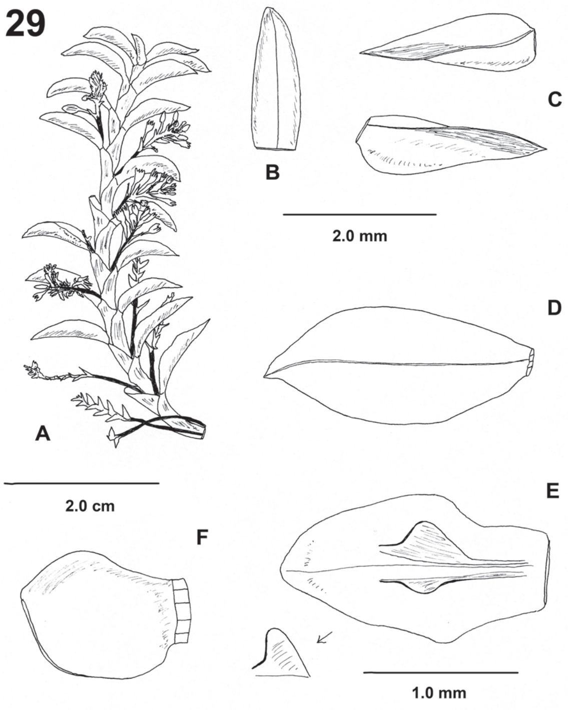
This species appears to be related to the Ecuadorian *Fernandezia dalstroemii* (Dodson) M.W. Chase but differs from it in drying a brownish (vs. greenish) color, being more laxly leaved, and having more flowers (6 vs. 3). Though it seems unlikely that *F. kosnipatae* is related closely to *Pachyphyllum dalstroemii* Dodson, when consulting the protologue of that taxon one notes that the type specimen (*S. Dalstroem & T. Hoijer 802* [SEL, image seen]) shows a rather different plant to that figured. Furthermore, I am extremely doubtful about the floral details depicted, such as oblong-oblanceolate petals, an oblong-oblanceolate lip, and an obliquely clavate column. These are quite rare characters (but see *F. espinosae* and *F. salliquensis,* which have such a lip shape) outside of certain groups in southern Peru and Bolivia. The oblong-oblanceolate lip can be seen in herbarium material but disappears once the lip is spread. However, spreading the lip would lead to breaking it if spirit material (which seems to be the case) was at hand.

Fernandezia luerorum Ormerod, *sp. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Chapare, along road to Villa Tunari, 2840 m, 13 & 16 January 1981, *C. Luer, J. Luer, E. Besse & R. Vasquez 5616* (Holotype: SEL). Fig. 31.

A singular entity with flat, oblong leaves, flowers with reflexed dorsal sepal and petals, basally united, splayed forward lateral sepals, a long-clawed lip with an elliptic blade that bears a single lobulate callus, and a dolabriform column.

Epiphytic (?) *herb*. *Roots* terete, ca. 1 mm thick. *Stems* simple, laxly leafy throughout, 6.2 cm long, ca. 0.08 cm thick. *Leaves* oblong to oblong-obovate, apiculate, 5.5–7.0 × 2.0–3.0 mm; leaf sheaths tubular, slightly inflated toward apex, somewhat truncate, smooth, ca. 3.5 mm long, 1.5 mm wide across apex. *Inflorescence* 6 mm long; peduncle 3 mm long; rachis successively flowered, 5–6 flowered, 3 mm long; floral bracts ovate-lanceolate, acute, 2.0–3.0 × 0.5–0.7 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 5 mm long. *Dorsal sepal* oblong-ligulate, acute, midvein carinate near apex, reflexed, joined to petals for 0.8 mm, ca. 4.5 × 1.3 mm. *Lateral sepals* obliquely ligulate, acute, midvein carinate and ending in a deltate apiculus, joined to each other basally for ca. 3 mm, after this divergent and splayed forward, 7.0 × 1.8 mm. *Petals* obliquely oblong, acute, reflexed, joined basally to dorsal sepal for 0.8 mm, 4.5 × 1.7 mm. *Labellum* long-clawed with an elliptic, acute blade, claw linear, ca. 3.3 mm long, blade ca. 2.8 × 1.6 mm, in total 6.2 × 1.6 mm; callus on basal 1/3 of lip blade, fleshy,

29



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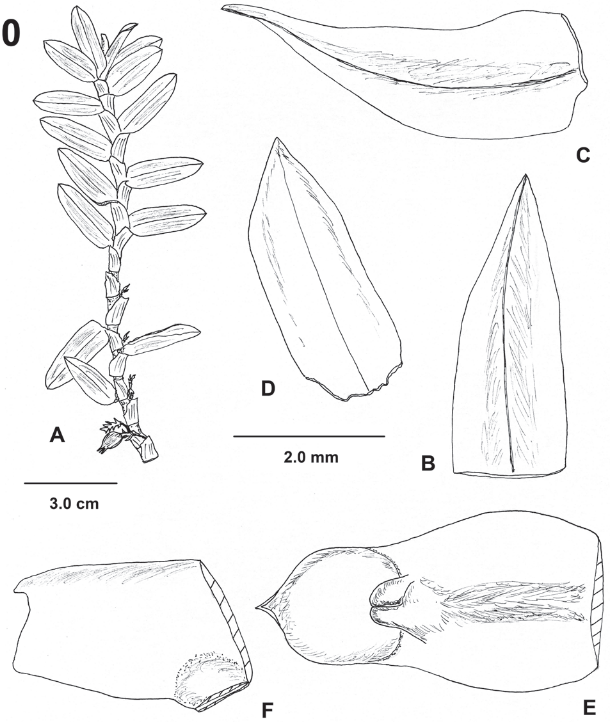

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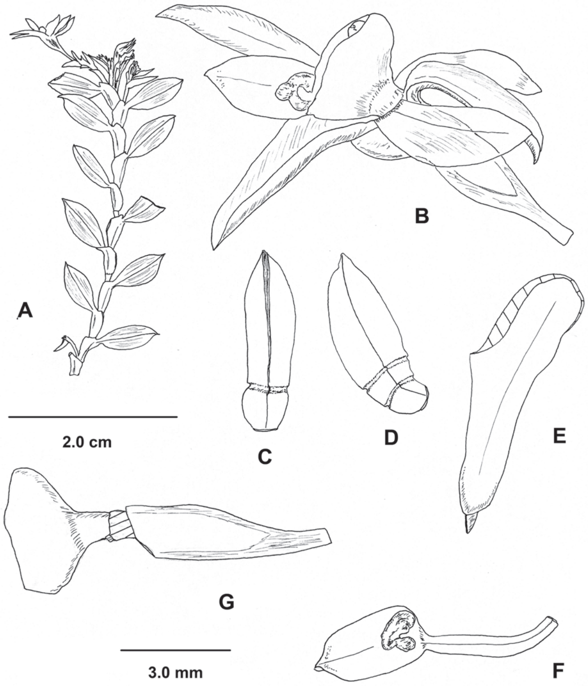

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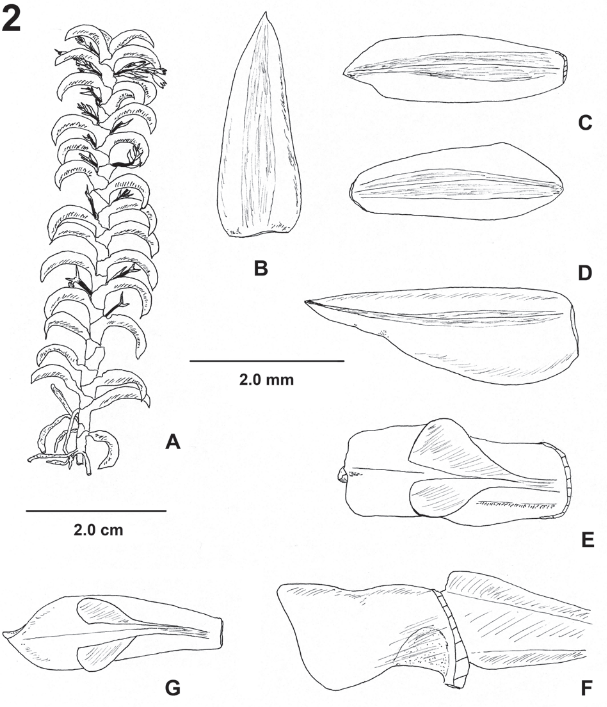


FIGURE 29–32. **29**, *Fernandezia jordaniae* Ormerod var. *trullata* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepals; **D**, petal; **E**, labellum; **F**, column. Drawn from holotype. **30**, *Fernandezia kosnipatae* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from holotype. **31**, *Fernandezia luerorum* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype. **32**, *Fernandezia mandonii* Ormerod. **A**, plant; **B**, dorsal sepal; **C**, petals; **D**, lateral sepal; **E**, labellum; **F**, column. *Fernandezia pectinata* (Rchb.f.) M.W. Chase. **G**, labellum. A–F from holotype; G from isolectotype.

in a rough inverted V-shape, at base each side with a deltate to elliptic, obtuse lobe. *Column* dolabriform, 2.5 mm long, 3 mm wide laterally.

Distribution: Bolivia.

Eponymy: named after Carl and Jane Luer, who helped collect the type of this species, along with so many other species of orchids throughout the Andean countries.

This rather singular species of the *Fernandezia breviconnata* (Schltr.) M.W. Chase complex may be distinguished from other members of that group by its flowers that have the lateral sepals splayed forward (rather than curved upward), by its relatively long clawed labellum with a short blade (vs. a short claw and relatively long blade), and column that is widened both dorsally and ventrally (vs. ventrally only).

Fernandezia mandonii Ormerod, *sp. nov.*

TYPE: BOLIVIA. La Paz: Prov. Larecaja, near Sorata, Mt. Chilieca, 3100 m, October 1859, *G. Mandon 1152 p.p.* ([Holotype: AMES 76407 [= GH 6731], two lower left plants; Isotypes: G, S, P, images seen). Fig. 32A–F.

Related to *Fernandezia pectinata* (Rchb.f.) M.W. Chase but with larger flowers (sepals 2.8–3.8 vs. 2.0–2.4 mm long) and a cuneate (vs. oblong-oblanceolate) labellum.

Epiphytic *herb*. *Roots* terete, 0.8–1.0 mm thick. *Stems* simple, densely leafy, 6.5–9.5 cm long, 0.2–0.3 cm wide across leaf sheaths, 0.1–0.2 cm thick. *Leaves* lanceolate, acute, canaliculate, fleshy, margins minutely denticulate near apex, 8-9 mm long, 1.7–2.5 mm wide laterally; leaf sheaths with minutely denticulate margins, dorsal exposed edge 3 mm long. *Inflorescences* to 9 mm long; peduncle ca. 4 mm long; rachis up to 5 flowered, to 5 mm long; floral bracts deltate, acute, ca. 2.6 mm long. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 2.5–3.0 mm long. *Dorsal sepal* lanceolate to ligulate-lanceolate, acute to subacute, carinate, 2.80–3.15 × 0.95–1.00 mm. *Lateral sepals* obliquely lanceolate, acute, carinate, 3.2–3.8 × 1.2–1.5 mm. *Petals* ligulate-oblanceolate, acute, 2.65–3.00 × 0.80–1.00 mm. *Labellum* narrowly cuneate, apiculate, 2.7–3.0 × 1.0–1.6 mm; lower 1/3 divided by low parallel lamellae that raise and diverge on the middle of the lip. *Column* each side with an obliquely suborbicular low wing, 1.7–1.9 mm long, 1.0–1.3 mm wide laterally.

Distribution: Bolivia.

Additional specimen examined: BOLIVIA. La Paz: Gran Poder, small gold mine ca. 40 km N of Sorata, narrow wooded valley below Tacacoma, 3170 m, 3 June 1950, *W.M.A. Brooke 6433* (BM, NY).

Eponymy: named after Gilbert Mandon (1799–1866), a French mining engineer and botanist. He was director of a mine at Tipuani from 1848–1861 and collected over 1800 plants between Tipuani and Sorata during this time.

The collection *Mandon 1152* was originally thought to contain two elements. One is a taxon with coriaceous flat leaves, and flowers with a clawed lip expanding into a pentagonal blade. That entity became the type of *Pachyphyllum pseudodichaea* Rchb.f. The other plant had conduplicate, fleshy leaves, and flowers with a cuneate to oblong-oblanceolate lip. This second entity became the type of *Pachyphyllum pectinatum* Rchb.f. However, it is now evident that this second entity is a mixture of two distinct species, one with a cuneate lip (here described as *F. mandonii*) and one with an oblong-oblanceolate lip (the lectotype of *F. pectinata*).

Fernandezia mercadoi Ormerod, *sp. nov.*

TYPE: BOLIVIA. Cochabamba: Prov. Carrasco, Parque Nacional Carrasco, *c.* 2 km from the Monte punk-selvercas entrance, 3100 m, 15 September 1995, *M. Mercado MM 309* (Holotype: MO). Fig. 33.

Related to *Fernandezia chaparensis* Ormerod but the dorsal sepal acute (vs. apiculate), petals with a narrower, longer claw (vs. shorter and broader), and the column with longitudinally broader wings.

Epiphytic *herb*. *Roots* terete, 0.5–1.3 mm thick. *Stems* flexuous, 4–5 branched (branches 8.0–9.5 cm long), 0.08–0.15 cm thick. *Leaves* oblong-lanceolate, apiculate, upper margins minutely denticulate, thinly coriaceous, 11.5–16.0 × 3.5–5.0 mm, shortly petiolate (petiole 1–2 mm long); leaf sheaths tubular, smooth, margins often recurved, minutely denticulate, 4.5-5.0 mm long. *Inflorescence* ca. 5.5 mm long; peduncle ca. 4.5 mm long; rachis 2–3 flowered, ca. 1 mm long; floral bracts lanceolate, acute, to 4.5 × 2.4 mm. *Flowers* yellow. *Pedicellate ovary* clavate, triquetrous, 4.5 mm long. *Dorsal sepal* ligulate, acute, carinate, gently upcurved, 5 × 1 mm. *Lateral sepals* obliquely ligulate-lanceolate, high carinate, gently upcurved, 6.0 × 1.9 mm. *Petals* obliquely oblong-lanceolate from a clawed base, acute, gently upcurved, basally joined to sepals, 4.8 × 1.2 mm. *Labellum* ovate-lanceolate from a clawed base, claw 2.5 mm long, blade 4.0 × 1.8 mm, in total 6.5 × 1.8 mm; lower half medially thickened and ending in 2 semi-elliptic lamellae. *Column* clawed, each side dilated into a semicircular wing, ca. 3.2 mm long, 2 mm wide laterally, claw 0.8 mm wide.

Distribution: Bolivia.

Eponymy: named after M. Mercado, Bolivian botanist and collector of the type.

Fernandezia mercadoi is a member of the *F. breviconnata* (Schltr.) M.W. Chase complex; it differs from the latter in having a ligulate (oblong-elliptic) dorsal sepal and clawed (vs. sessile) petals. Another similar taxon is its Bolivian congener *F. chaparensis,* but the latter has a prominent apiculus on the dorsal sepal, more shortly, broadly clawed petals, and longitudinally wider column wings.

Fernandezia micrantha (Schltr.) M.W. Chase, Phytotaxa 20: 30. 2011.

Basionym: *Pachyphyllum micranthum* Schltr., Rep. Sp. Nov. Regni Veg., Beih. 7: 204. 1920.

TYPE: COLOMBIA. Cauca: without locality, *M. Madero s.n.* ([Holotype: B, destroyed; drawing AMES]. Lectotype (designated by Christenson 2008: 286]: t. 73, f. 282 [in Schlechter, 1929]). Fig. 34A–F.

Heterotypic synonyms: *Pachyphyllum nubivagum* L.O. Williams, Lilloa 3: 483. 1938 *syn. nov.*

TYPE: COLOMBIA. Santander: W slope of Paramo de las Puentes, above La Baja, 3300–3400 m, 25-31 January 1927, *E.P. Killip & A.C. Smith 18161* (Holotype: AMES).

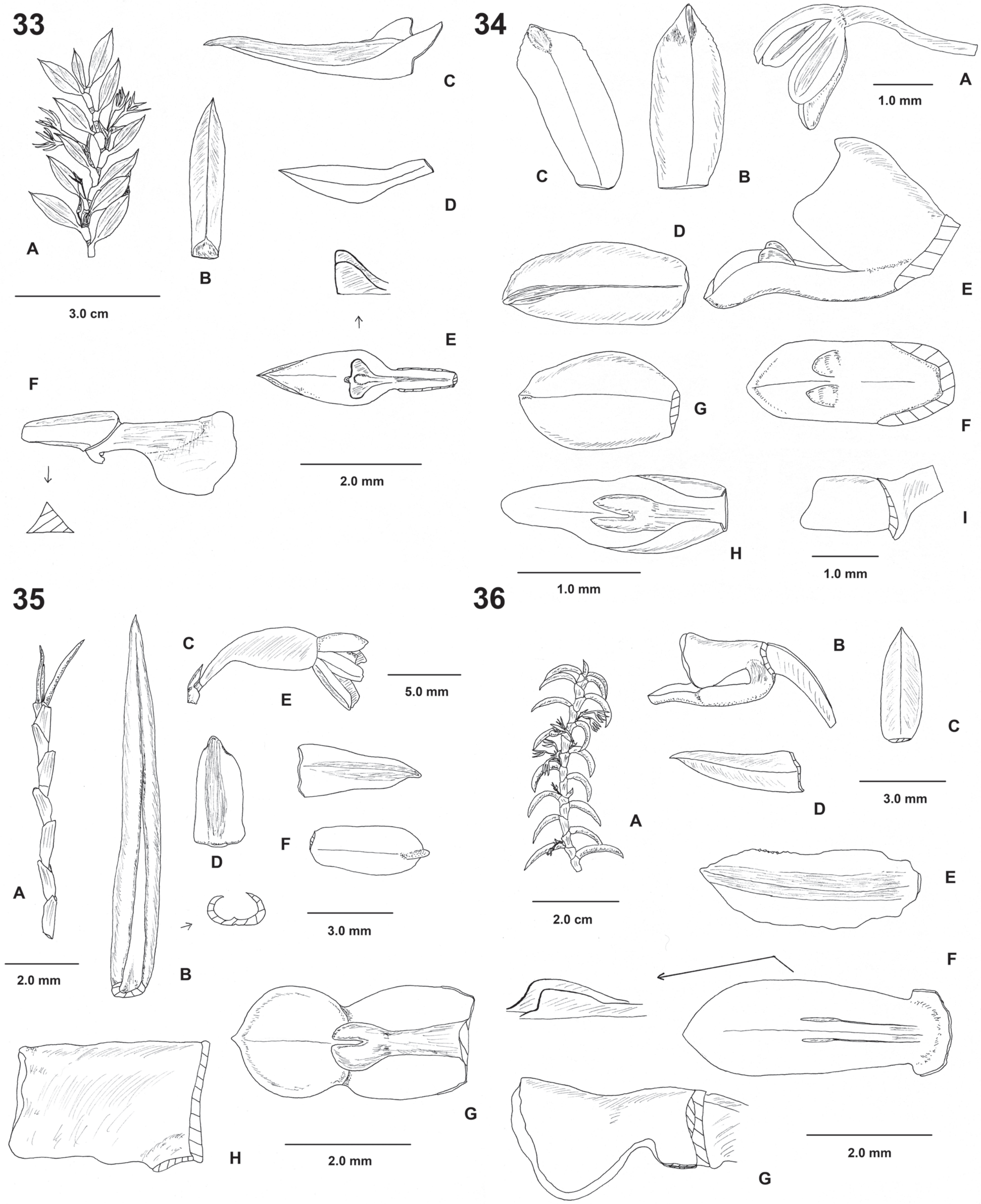


FIGURE 33–36. **33**, *Fernandezia mercadoi* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from holotype. **34**, **A–F**. *Fernandezia micrantha* (Schltr.) M.W. Chase. **A**, flower; **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum and column; **F**, labellum. **G–I**. *Fernandezia falcifolia* (Rchb.f.) M.W. Chase. **G**, petal; **H**, labellum; **I**, column. A–F from *Luer & Escobar 6572* (SEL); G–I from *Werner 1241* (MO). **35**, *Fernandezia militaris* Ormerod. **A**, stem (upper part); **B**, leaf; **C**, flower; **D**, dorsal sepal; **E**, lateral sepal; **F**, petal; **G**, labellum; **H**, column. Drawn from holotype. **36**, *Fernandezia minor* (Schltr.) M.W. Chase var. *minor*. **A**, stem (upper part); **B**, labellum and column; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from *Solomon 8663* (MO).

Fernandezia nubivaga (L.O. Williams) M.W. Chase, Phytotaxa 20: 30. 2011.

Pachyphyllum idroboi Szlach. & Kolan., Nord. J. Bot. 32, 6: 748. 2014 *syn. nov.* TYPE: COLOMBIA. Cauca: Macizo Colombiano, Paramo de Las Papas, La Hoyola, 2910 m, 18 September 1958, *J.M. Idrobo, P. Pinto & H. Bischler 3436* (Holotype: COL, image seen).

Fernandezia idroboi (Szlach. & Kolan.) Molinari & Mayta, Richardiana 16: 43. 2015.

Distribution: Colombia; Ecuador; Peru.

Additional specimens examined: COLOMBIA. Santander: W slope of Paramo Rico, 3300–3600 m, 15–19 June 1927, *E.P. Killip & A.C. Smith 17777* (AMES); Paramo de Romeral, 3800–4100 m, 29–30 January 1927, *E.P. Killip & A.C. Smith 18569* (AMES); E slope of Paramo de Coloradas, above La Baja, 3900 m, 27 January 1927, *E.P. Killip & A.C. Smith 18387* (AMES); vicinity of Las Vegas, 2600–3000 m, 21–23 December 1926, *E.P. Killip & A.C. Smith 15875* (AMES). Norte de Santander: Paramo de Jurisdicciones, 3400 m, 30 April to 1 May 1982, *C. Luer, J. Luer, R. Escobar & D. Portillo 7662* (SEL). Santander del Sur: E of Bucuramanga, towards Berlin, 3250 m, 3–5 November 1981, *C. Luer & R. Escobar 6572* (SEL); same data, 8 November 1981, *C. Luer, J. Luer & R. Escobar 6616* (SEL); between Bucuramanga and Berlin, 3200 m, 27–28 April 1982, *C. Luer, J. Luer, R. Escobar & D. Portillo 7610* (SEL). Antioquia: Medellin, El Boqueron, 2300 m, 9 August 1967, *L.A. Garay 996* (AMES). Valle: Cordillera Central, W slope, Hoya del Rio Bugalagrande, Barragan: Paramo de Bavaya, Corrales, 3400–3550 m, 9 April 1946, *J. Cuatrecasas 20548* (AMES, F, US). Cauca: Paramo de Barbillas, SE of Popayan, 3070 m, 27 July 1978, *C. Luer, J. Luer, J. Kuhn & R. Escobar 3017 p.p.* (SEL); Paramo de Paletaria, 3000 m, 30 July 1961, *L.A. Garay, C.E. McClennan & A. Kapuler 465* (AMES). ECUADOR. Zamora-Chinchipe: without locality, *leg. L. Mendoza in A. Hirtz 7178* (SEL). PERU. Cajamarca: Prov. Contumaza, Las Quinuas to El Mojon, 3200 m, 14 June 1981, *A. Sagastegui, E. Garcia, S. Lopez & J. Mostacero 10107* (MO, NY, SEL).

This is a neat little species with falcate, fleshy leaves generally 5-7 mm long, and tiny flowers about 1 mm long, with a simple oblong to oblong-lanceolate lip. In Schlechter's drawing of the type the calli of the lip are shown as divaricate when usually they are parallel. I have noticed that when the lip rehydrates poorly, the calli can tend to spread in a V, also the lip shape can be falsely subpandurate.

I could not find any characters justifying the separation of *Pachyphyllum nubivagum,* and Williams did not offer any in the protologue. Nor could any discriminating characters be found for *P. idroboi,* which was not compared with *P. micranthum* or *P. nubivagum*. The shape of the lip depicted for *P. idroboi* I believe to be erroneous, in part because of poor rehydration and difficulty in working with the tender, small flowers.

Specimens from Ecuador and Peru represent new distributional records for those countries.

Fernandezia militaris Ormerod, *sp. nov.*

TYPE: PERU. Amazonas: Luya Prov., Distrito Camporedondo, Tullanya, Cerro Hiucsocunga, 3320 m, 8 December 1996, *R. Vasquez & R. Rojas 22012* (Holotype: MO). Fig. 35.

Similar to *Fernandezia theodorii* M.W. Chase florally but the plant much more laxly leaved, and the leaves lanceolate and semitubular (vs. narrowly oblong and V-shaped in section).

Roots terete, 1.0–1.2 mm thick. *Stem* simple to 3 branched (branches immature, to 2.5 cm long), flexuous, laxly leafy, 15.0–40.5 cm long, to 0.5 cm across leaf sheaths, to 0.2 cm thick. *Leaves* lanceolate, acute, semitubular, rigid, 15–20 mm long, 2 mm wide laterally; leaf sheaths tubular-infundibuliform, smooth, striate, not fully covering internodes, 9–12 mm long. *Inflorescence* to 13.5 mm long; peduncle ca. 6.5 mm long; rachis up to 10 flowered, to 7 mm long; floral bracts broadly ovate, acute, to 3 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous; capsule triquetrous, 9 mm long (incl. 3 mm long pedicel), one side 4.5 mm wide. *Dorsal sepal* oblong, subacute, midvein broadly and thickly low carinate, 3.3 × 1.5 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, midvein broadly and thickly carinate, 3.75 × 1.75 mm. *Petals* oblong, subacute, 3.75 × 1.60 mm. *Labellum* subpandurate, acute, lower part elliptic, 2.00 × 1.75 mm, upper part circular, acute, 1.8 × 1.7 mm, in total 3.80 × 1.75 mm; lower part divided by a thick medial ridge ending midway in 2 thick, semi-elliptic, parallel calli. *Column* rectangular in lateral view, 2.5 mm long, 1.75 mm wide laterally.

Distribution: Peru.

Habitat: in "Jalca" vegetation, the smallest trees of which 1.5 m tall (type), 3320 m.

Etymology: from the Latin *militaris,* relating to soldiers or war, in reference to the ranks of sharp, sword-like leaves.

The relationships of this species are unclear. It is quite distinct in its unique habit, with laxly leaved stems, and rigid, semitubular leaves. Details of the flowers resemble *Fernandezia theodorii* M.W. Chase, a more densely leaved plant, with broader, fleshier leaves. The collectors did not record what surface the plant was growing on.

Fernandezia minor (Schltr.) M.W. Chase, Phytotaxa 20: 30. 2011 as *minus*.

Basionym: *Pachyphyllum minus* Schltr., Rep. Sp. Nov. Regni Veg. 10: 460. 1912.

TYPE: BOLIVIA. La Paz: near Unduavi, 3200 m, November 1910, *O. Buchtien s.n.* ([Holotype: B, destroyed]. Lectotype [designated by Christenson 2008: 287]: t. 60, f. 239 [in Schlechter, 1930]). Fig. 36.

Epiphytic *herb*. *Roots* terete, 0.4–0.6 mm thick. *Stems* simple or branching (branches 1.5–7.5 cm long), densely leafy, 5–10 cm long, 0.08–0.10 cm thick. *Leaves* lanceolate, acute, margins minutely denticulate near apex, fleshy, conduplicate, 7–15 × 1.8–4.5 mm; leaf sheaths with entire to sparsely denticulate margins. *Inflorescence* 4.5–5.5 mm long; peduncle 3 mm long; rachis 3 flowered, 1.5–2.5

mm long; floral bracts deltate, acute, margins minutely denticulate, to 2 mm long. *Flowers* white. *Pedicellate ovary* clavate, 3 mm long. *Dorsal sepal* oblong, acute, 3.10–3.65 × 1.20–1.40 mm. *Lateral sepals* obliquely lanceolate to oblong-lanceolate, acute, 3.5–4.2 × 1.1–1.2 mm. *Petals* oblong, acute, 2.75–3.30 × 1.00–1.10 mm. *Labellum* oblong-oblanceolate, subacute, free part 3.2 × 1.2–1.6 mm; lower half of lip with 2 low lamellae that are highest in the middle of the lip. *Column* shortly clawed, each side with a semicircular wing, 2.0–2.6 mm long, 1.2–1.6 mm wide laterally.

Distribution: Bolivia.

Additional specimens examined: BOLIVIA. La Paz: Prov. Sud Yungas: 3.1 km SE of Unduavi bridge, below on old road, 3000 m, 6 November 1982, *J.C. Solomon 8663* (MO). Cochabamba: NE of Cochabamba, towards Villa Tunari, 2500 m, 26–30 November 1978, *C. Luer, J. Luer, J. Kuhn & F. Fuchs et al. 3554 p.p.* (SEL).

Habitat: in cloud forest with 4–8 m tall trees (*Solomon 8663*), 3000–3200 m.

This species was only known from the type (now lost), and a later floral analysis (Schlechter, 1930). I have therefore provided a description and illustration based on the specimens cited above to augment knowledge of it. The collection from Cochabamba had slightly smaller flowers (the lesser measurements in the description), but in lip shape agrees fully with the La Paz specimen.

Fernandezia minor **var.** ***boekeorum*** Ormerod, *var. nov.*
TYPE: PERU. Puno: Prov. Carabaya, 10 km S of Ollachea, no altitude, 13 August 1980, *J.D. Boeke & S. Boeke 3002* (Holotype: NY; Isotypes: MO, SEL). Fig. 37.

Related to *Fernandezia minor* var. *breviflora* but with obovate-elliptic to unevenly elliptic (vs. oblong to elliptic) petals distinctly thickened along the midvein.

Lithophytic *herb*. *Roots* terete, 0.5-1.0 mm thick. *Stems* with up to 4 branches (these to 2.65 cm long), densely leafy, 3.0–12.5 cm long, ca. 0.3 cm wide across sheaths, 0.2 cm thick. *Leaves* oblong-lanceolate, acute to apiculate, fleshy, margins minutely denticulate, 6.5–7.0 mm long, 2 mm wide laterally; leaf sheaths deltate, truncate, margins minutely denticulate, revolute, surface smooth, striate. *Inflorescence* to 8 mm long; peduncle 4–5 mm long; rachis 2–5 flowered, 1.5–4.0 mm long; floral bracts deltate, acute, to 2 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, ca. 2.5 mm long. *Dorsal sepal* oblong to ovate-lanceolate, acute, low carinate medially, 2.7–3.0 × 1 mm. *Lateral sepals* obliquely lanceolate to ovate-lanceolate, acute, thickly to narrowly carinate medially, 3.00–3.30 × 0.95–1.20 mm. *Petals* elliptic-obovate to unevenly ovate-elliptic, acute, low ridged medially, 2.20–2.80 × 1.15–1.20. *Labellum* ovate-elliptic to elliptic, acute, carinate below tip, 2.75–2.80 × 1.30 mm; lower 1/4 of lip divided by a narrow ridge that diverges into 2 lamellate carinae that terminate about halfway. *Column* with 2 low semicircular wings, 1.8 mm long, 1.0–1.1 mm wide laterally.

Distribution: Peru.

Additional specimen examined: PERU. Puno: Prov. Sandia, fields and houses around Ura-ayllu, 3400 m, 5 February 1986, *B. Bennett 2118* (NY).

Habitat: in deep moss on rocks (type), on rocks in old field (*Bennett 2118*), 3400 m.

Eponymy: named after Jef and Susanne Boeke, collectors of the type.

This variety is closest to *Fernandezia minor* var. *breviflora* but has differently shaped petals distinctly thickened along the midvein.

Fernandezia minor **var.** ***breviflora*** Ormerod, *var. nov.*
TYPE: BOLIVIA. La Paz: Unduavi Valley, 2000–2600 m, 1925, *Brother Julio 451* (Holotype: US). Fig. 38.

Differing from typical *Fernandezia minor* in having an elliptic (vs. oblong-oblanceolate) labellum.

Epiphytic (?) *herb*. *Roots* terete, 0.4–0.8 mm thick. *Stems* stout, densely leafy, occasionally branching (branches 6–7 cm long), 3–12 cm long, 0.1–0.2 cm thick. *Leaves* oblong-lanceolate, acute, conduplicate, margin minutely denticulate near the apex, stiffly coriaceous, 8.0–9.7 × 4–5 mm; leaf sheaths smooth, striate, margins recurved, entire, 4.5 mm long. *Inflorescence* to 6.5 mm long; peduncle ca. 4 mm long; rachis 3–4 flowered, 2.0–2.5 mm long; floral bracts deltate, acute, ca. 2.8 × 2.0 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 2.7–3.5 mm long. *Dorsal sepal* oblong-lanceolate, acute, carinate, 2.7–3.3 × 1.1–1.3 mm. *Lateral sepals* obliquely lanceolate, acute, carinate, 3.00–3.75 × 1.00–1.75 mm. *Petals* oblong to oblong-elliptic, acute to subacute, 2.45–2.80 × 0.95–1.20 mm. *Labellum* elliptic, acute to obtuse, 2.75–2.90 × 1.30–1.85 mm; midline of lip narrowly thickened before diverging into 2 lamellae. *Column* shortly stalked, each side with an obliquely semicircular wing, 1.65–1.90 mm long, 1.0–1.3 mm wide laterally.

Distribution: Bolivia.

Additional specimen examined: BOLIVIA. Cochabamba: valley below Pelechuco, 3050–3355 m, October 1864, *R. Pearce s.n.* (BM).

Etymology: from the Latin *brevis,* short, and *flora,* flower, in reference to the short appearance of the labellum.

This taxon differs from typical *Fernandezia minor* in having an elliptic (vs. oblong-oblanceolate) lip. The collection by Pearce has slightly smaller flowers; these form the lesser floral measurements in the description.

Fernandezia nunezii Ormerod, *sp. nov.*
TYPE: PERU. Cusco: Prov. Paucartambo, Pillahuata, Tres Cruces, about 130 km Cusco on the road toward Pilcopta, 2000 m, 4 April 1987, *P. Nunez 7805* (Holotype: MO; Isotype: NY). Fig. 39.

Related to *F. unduaviae* Ormerod but the labellum with the claw half as long, and the rectangular (vs. oblong-elliptic to elliptic) blade with right-angled (vs. tapered) bases.

Epiphytic *herb*. *Roots* terete, ca. 0.7 mm thick. *Stem* simple to 4 branched (branches 1.5–7.0 cm long), flexuous, sublaxly leafy, 15 cm long, 0.07–0.10 cm thick. *Leaves* oblong to elliptic, subacuminate, margins minutely denticulate near apex, 7.0–13.0 × 3.5–3.7 mm; leaf sheaths

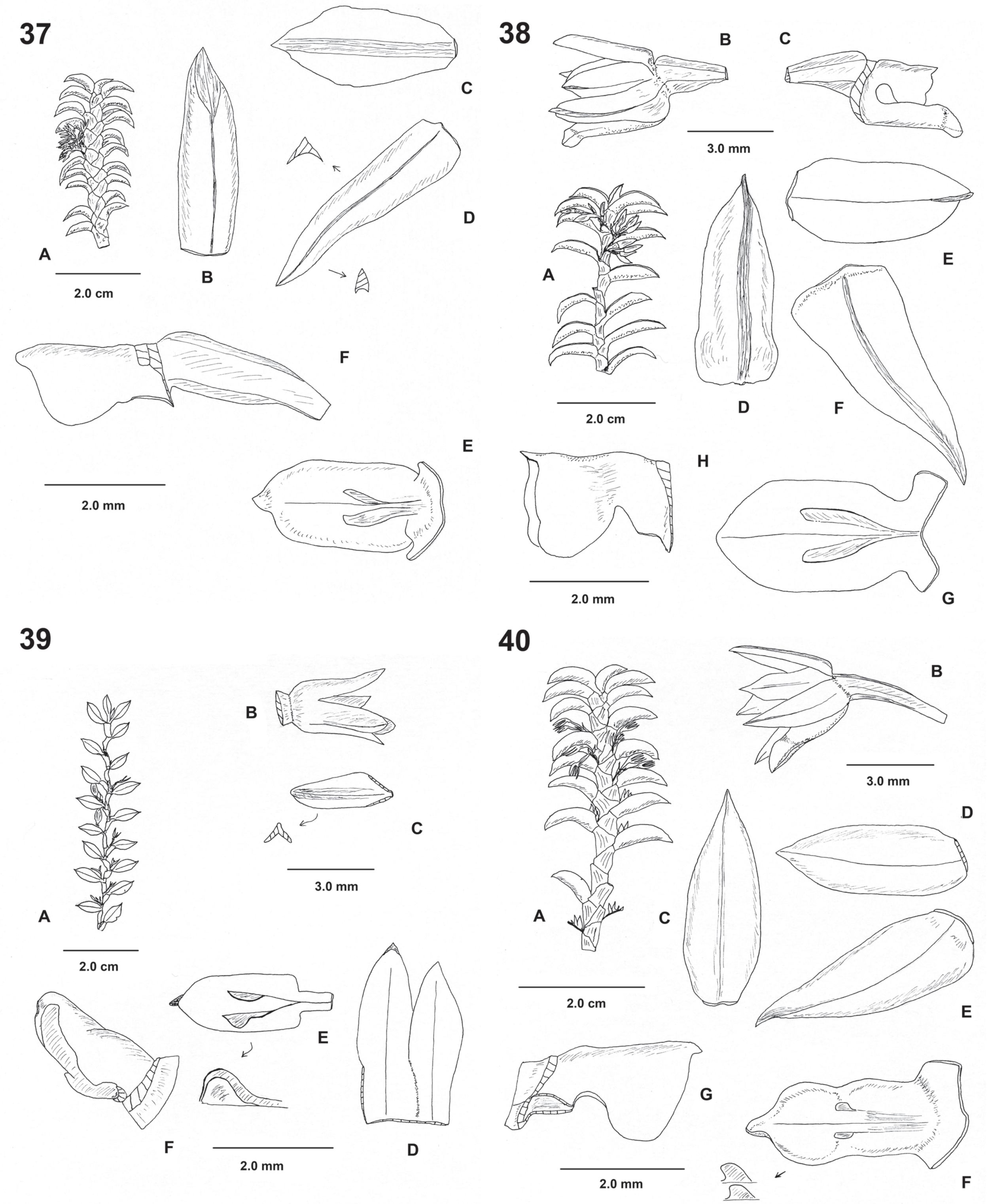


FIGURE 37–40. **37**, *Fernandezia minor* (Schltr.) M.W. Chase var. *boekeorum* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype. **38**, *Fernandezia minor* (Schltr.) M.W. Chase var. *breviflora* Ormerod. **A**, stem (upper part); **B**, flower; **C**, labellum and column; **D**, dorsal sepal; **E**, petal; **F**, lateral sepal; **G**, labellum; **H**, column. Drawn from holotype. **39**, *Fernandezia nunezii* Ormerod. **A**, stem (upper part); **B**, flower; **C**, lateral sepal; **D**, dorsal sepal and petal; **E**, labellum; **F**, column. Drawn from holotype. **40**, *Fernandezia pandurata* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype.

semitubular, smooth, 4 mm long below leaf articulation. *Inflorescence* 5 mm long; peduncle 3 mm long; rachis 2 flowered, 2 mm long; floral bracts deltate, acute, to 2.8 × 2.0 mm. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, ca. 3 mm long. *Dorsal sepal* narrowly oblong, subacute, midvein low carinate, joined to petals and lateral sepals for 0.75 mm, 2.5 × 0.9 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, midvein carinate, joined to each other and dorsal sepal for 0.75 mm, 3 × 1 mm. *Petals* narrowly oblong-rhombic, acute, joined to dorsal sepal for 0.75 mm, low carinate, 2.3 × 0.9 mm. *Labellum* rectangular from a short claw, subacute, carinate below tip, claw ca. 0.5 mm long, blade 1.95 × 1.00 mm, in total ca. 2.3 × 1.0 mm; midvein on claw diverging on blade into 2 low lamellae that are raised apically into deltate to semi-elliptic lobes. *Column* each side at middle with an obliquely semicircular wing, 2 mm long, 0.95 mm wide.

Distribution: Peru.

Eponymy: named after Percy Nunez, Peruvian botanist and collector of the type.

Fernandezia nunezii is related to its Peruvian congener *F. gracillima* (C. Schweinf.) M.W. Chase but differs from the latter in having a narrowly clawed, rectangular (vs. broadly clawed, suborbicular) lip. Its other close relative is the Bolivian *F. unduaviae,* which differs in the lip having a twice-as-long claw, and tapered bases to the oblong-elliptic to elliptic blade.

The isotype in NY is a mixed collection, also containing material of *F. weberbaueri* var. *tricrucensis*.

Fernandezia pandurata Ormerod, *sp. nov.*

TYPE: BOLIVIA. Cochabamba: Prov. Chapare, Pampatambo, no altitude, 8 November 1979, *R. Vasquez 202 p.p.* (Holotype: SEL). Fig. 40.

Related to *Fernandezia scimitaris* Ormerod but flowers with a pandurate (vs. ovate-lanceolate) labellum, and well-separated (vs. united) calli.

Epiphytic (?) *herb*. *Roots* terete, 0.3–0.8 mm thick. *Stems* simple, sublaxly leafy, 4.3–6.3 cm long, 0.25–0.30 cm wide across leaf sheaths, ca. 0.15 mm thick. *Leaves* oblong-lanceolate, apiculate, coriaceous, margins minutely denticulate, 6–8 mm long, 2.0–2.2 mm wide laterally; leaf sheaths semitubular, striate, smooth, margins recurved, minutely denticulate. *Inflorescence* to 11 mm long; peduncle 4 mm long; rachis 3–4 flowered, 3–7 mm long; floral bracts deltate, acute, 2.5 × 1.0 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 3.0–3.8 mm long. *Dorsal sepal* oblong-lanceolate, acute, low carinate, 3.20 × 1.15 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, carinate, especially near apex, 3.4 × 1.2 mm. *Petals* oblong-lanceolate, acute, 2.8 × 1.1 mm. *Labellum* pandurate, apex an obtuse lobule, lower part ca. 2.0 × 1.1 mm; upper part ca. 1.1 × 1.2 mm, in total ca. 3.1 × 1.1–1.2 mm; lower half of lip divided by a low, thickened midline that ends in 2 subquadrate, well-separated lamellate calli. *Column* shortly and broadly stalked, each side with a suborbicular wing, 2 mm long, 1.5 mm wide laterally.

Distribution: Bolivia.

Etymology: from the Late Latin *pandura,* itself from the Classical Greek *pandoura,* a kind of lute-like musical instrument, but now meaning violin shaped (i.e., constricted in the middle), in reference to the shape of the labellum.

This taxon is closely related to *Fernandezia scimitaris* but does not have the curved leaves of that taxon, and the flowers have a pandurate (vs. ovate-lanceolate) lip. The dorsal sepal also appears humped at the base because its carina is not in the direct line of the one on the ovary, whereas in *F. scimitaris* the dorsal sepal and ovary carina are in line. The holotype is a mixture of two species, the other specimen on the sheet forms the type of *F. scimitaris*.

Fernandezia parvifolia (Lindl.) M.W. Chase, Phytotaxa 20: 30. 2011 as *parviflora*.

Basionym: *Pachyphyllum parvifolium* Lindl., in W.J. Hook., Icon. Plant. 2: t.177. 1837.

TYPE: PERU. Amazonas: Prov. Chachapoyas, without locality, *A. Mathews 1836* (Holotype: K). Fig. 41G.

Epiphytic *herb*. *Roots* terete, to 0.7 mm thick. *Stems* simple to occasionally branched (branches to 8.5 cm long), flexuous, 3.5–15.7 cm long. *Leaves* oblong to oblong-elliptic, acute, thinly coriaceous, 8.0–9.5 × 3.3–4.5 mm; leaf sheaths tubular, smooth. *Inflorescence* 6 mm long; peduncle ca. 4 mm long; rachis few flowered, to 2 mm long; floral bracts deltate, acute, 2.2 × 1.5 mm. *Flowers* green. *Pedicellate ovary* clavate, triquetrous, ca. 3 mm long. *Dorsal sepal* ligulate to narrowly oblong, acute, midvein carinate, 3.0–3.4 × 0.9–1.0 mm. *Lateral sepals* obliquely ligulate-lanceolate, acute, high carinate, partly joined to the other lateral sepal for 0.75–2.00 mm, 3.50–4.00 × 0.95–1.20 mm. *Petals* narrowly oblong to ligulate-oblanceolate, acute, 2.8–3.5 × 0.9–1.0 mm. *Labellum* oblong to elliptic from a clawed base, obtuse, carinate below tip, claw to 1.2 mm long, in total 2.75–3.70 × 1.00–1.30 mm; lower half with a low medial thickening that ends in 2 obliquely subquadrate calli. *Column* clavate-cuneate in lateral view, 1.9–2.1 mm long, 0.9–1.6 mm wide laterally.

Distribution: Peru.

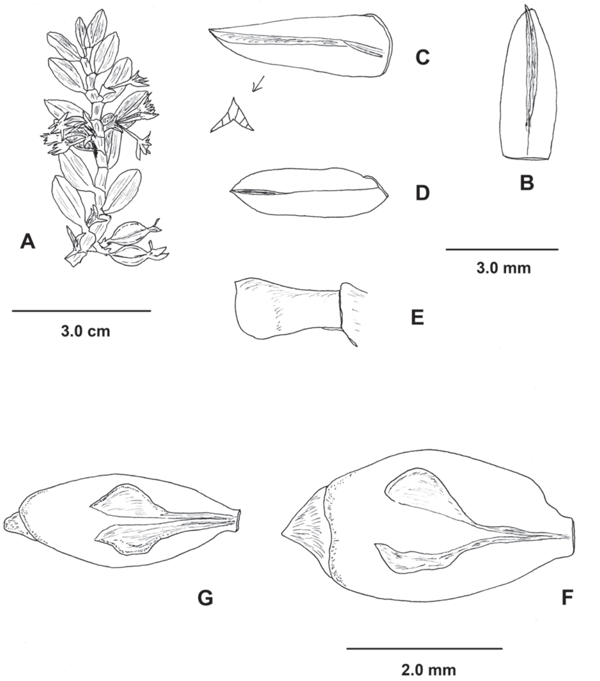
Additional specimens examined: PERU. Amazonas: Prov. Chachapoyas, Chachapoyas to Cajamarca road, Calla Calla, 20 km from Leimebamba, 3320 m, 4 September 1983, *D.N. Smith & S. Vasquez S. 5017* (F, MO); Cerros Calla Calla, 18 km above Leimebamba, on the road to Balsas, 3100 m, 8 June 1964, *P.C. Hutchison & J.K. Wright 5607* (AMES); S side of Molinopampa to Diosan Pass, 2700–3100 m, 8 August 1962, *J.J. Wurdack 1639* (GH).

The illustration in the protologue did not depict the labellum. Examination of the holotype and later collections show this to be oblong to elliptic with 2 medially placed calli.

Fernandezia parvifolia var. ***cajamarcae*** Ormerod, *var. nov.*

TYPE: PERU. Cajamarca: Prov. Jaen, Sallique, Quebrada grande, road between La Cocha and Tablon, 2770–2900 m, 30 June 1998, *C. Diaz, T. Guevara & E. Tineo 9795* (Holotype: MO). Fig. 41A–F.

41



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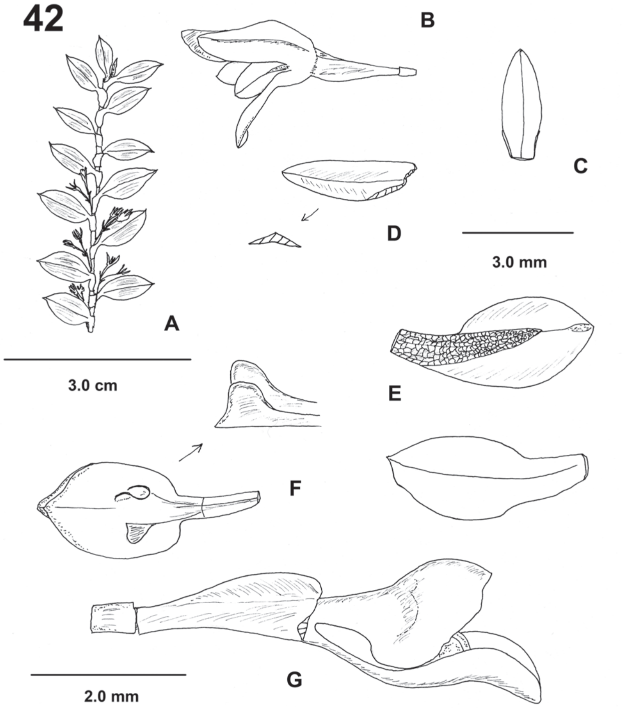

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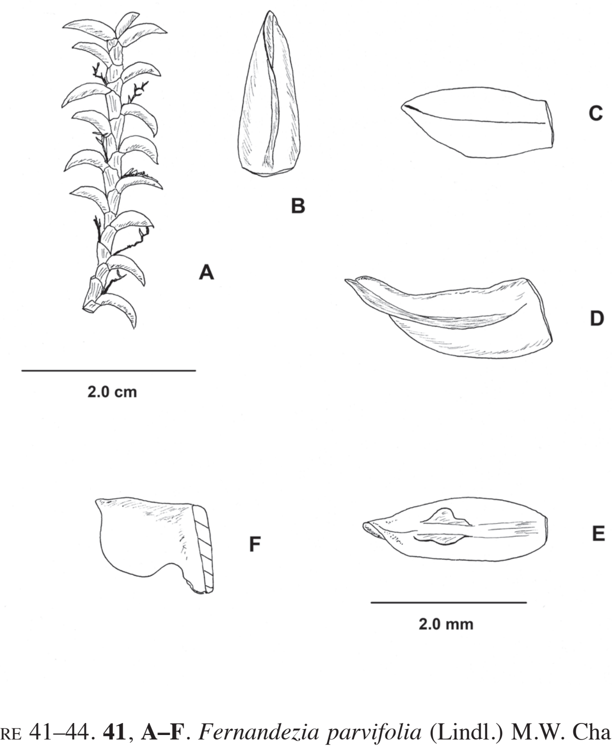

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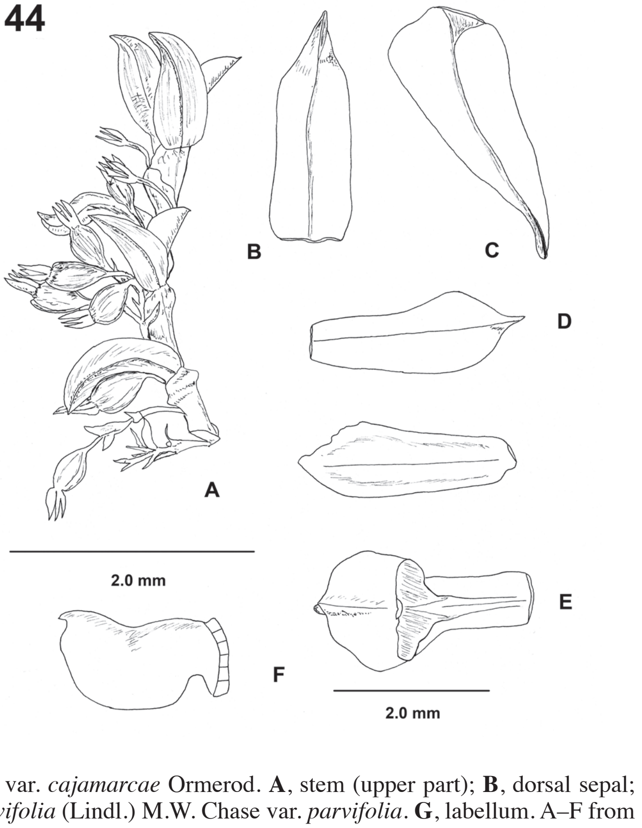

Figure 41–44. **41**, **A–F**. *Fernandezia parvifolia* (Lindl.) M.W. Chase var. *cajamarcae* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, column; **F**, labellum. **G**. *Fernandezia parvifolia* (Lindl.) M.W. Chase var. *parvifolia*. **G**, labellum. A–F from holotype; G from *Smith & Vasquez 5017* (MO). **42**, *Fernandezia pastinaca* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petals (outside and inside); **F**, labellum; **G**, labellum and column. Drawn from holotype. **43**, *Fernandezia pectinata* (Rchb.f.) M.W. Chase var. *punoensis* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, column. Drawn from holotype. **44**, *Fernandezia pseudodichaea* (Rchb.f.) M.W. Chase. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petals; **E**, labellum; **F**, column. Drawn from isotype (AMES).

Differing from typical *Fernandezia parvifolia* in having a much broader labellum (1.95 vs. 1.00–1.30 mm).

Epiphytic *herb*. *Roots* terete, ca. 1 mm thick. *Stems* flexuous, simple to occasionally branched (branches 2–3 cm long), sublaxly leafy, 13–14 cm long, ca. 0.1 cm thick. *Leaves* oblong, acute, margins near apex finely denticulate, 10–12 × 3.5–5.5 mm; leaf sheaths tubular, smooth, margins finely denticulate, not fully enclosing internodes, ca. 4 mm long. *Inflorescence* 5 mm long; peduncle 4 mm long; rachis 3 flowered, 1 mm long; floral bracts broadly ovate, acute, 3.0 × 3.5 mm. *Flowers* green. *Pedicellate ovary* clavate, trigonous, 4.75 mm long. *Dorsal sepal* narrowly oblong-lanceolate, acute, midvein carinate, 3.75 × 1.20 mm. *Lateral sepals* obliquely ligulate-lanceolate, acute, carinate, joined to other lateral sepal for 0.75 mm, 4.75 × 1.80 mm. *Petals* oblong, subacute, midvein carinate toward tip, 3.5–3.7 × 1.2 mm. *Labellum* elliptic, acute, 3.75 × 1.95 mm; lower half divided by a narrow ridge that ends in 2 semi-elliptic to trapezoid calli. *Column* clavate-cuneate in lateral view, 2.75 mm long, 1.2–1.3 mm wide laterally.

Distribution: Peru.

Habitat: in disturbed forest, 2770–2900 m.

Etymology: named after the Department of Cajamarca, the type locality.

Variety *cajamarcae* differs from typical *Fernandezia parvifolia* in having a broader labellum, and longer (2.75 vs. 2.00 mm) column.

Fernandezia pastinaca Ormerod, *sp. nov.*
TYPE: BOLIVIA. Santa Cruz: Prov. Manuel M. Caballero, 1.5 km to the SE of the town of Siberia, 2970 m, 29 November 2002, *E. Calzadilla, I. Vargas, C. Jordan & D. Rocabado 56* (Holotype: MO). Fig. 42.

Related to *Fernandezia nunezii* Ormerod and *F. unduaviae* Ormerod but the labellum ovate-elliptic (vs. oblong-elliptic to rectangular), and column narrowly (vs. broadly) clawed.

Epiphytic *herb*. *Roots* terete, 0.6–1.2 mm thick. *Stems* weakly flexuous, occasionally branched (branches 4.0–12.5 cm long), sublaxly leafy, to 24.5 cm long, 0.07–0.08 cm thick. *Leaves* ovate-lanceolate, acute, margins minutely denticulate near apex, 5–9 × 3–4 mm; leaf sheaths semitubular, margins entire, not fully covering internodes. *Inflorescence* 5 mm long; peduncle 3 mm long; rachis 3 flowered, 2 mm long; floral bracts deltate, acute, 2.0 × 1.6 mm. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, ca. 2 mm long. *Dorsal sepal* oblong, acute, thinly fleshy, basal 0.8 mm joined to lateral sepals, 2.8 × 1.1 mm. *Lateral sepals* obliquely lanceolate, subacute, fleshy, 3.0–3.3 × 1.1–1.5 mm. *Petals* elliptic from a clawed base, subacute, outside of claw and midvein thickened, 2.5 × 1.0 mm (incl. claw of 0.85 mm long). *Labellum* ovate-elliptic from a clawed base, subacute, claw ligulate, 0.9 mm long, blade 1.80–1.95 × 1.20 mm; in lower half midvein diverging into 2 widely separated, semi-elliptic lamellae. *Column* with a narrowly clawed base that expands each side into an obliquely semicircular wing, 2 mm long, ca. 1 mm wide.

Distribution: Bolivia.

Habitat: very humid "yungueno" forest on a mountain ridge, 2970 m.

Etymology: from the Latin *pastinaca,* stingray, in reference to the shape of the labellum.

Fernandezia pastinaca is most closely related to *F. nunezii* and *F. unduaviae* but may be distinguished from them by its ovate-elliptic (vs. oblong-elliptic to rectangular) lip, and narrowly (vs. broadly) stalked column.

A flowerless collection (*I.G. Vargas 6902* [MO]) from Laguna Brava in the Province of Manuel M. Caballero probably also belongs here.

Fernandezia pectinata (Rchb.f.) M.W. Chase, Phytotaxa 20: 30. 2011.
Basionym: *Pachyphyllum pectinatum* Rchb.f., Xenia Orch. 3: 22. 1878.
TYPE: BOLIVIA. La Paz: Prov. Larecaja, near Sorata, Mt. Chilieca, 3100 m, October 1858, *G. Mandon 1152 p.p.* (Lectotype here designated: W-R 19256 [specimens with sepals 2.0–2.4 mm long, oblong-oblanceolate lips, image seen]; drawing W-R 19257; Isotypes: AMES 76407, lower rhp, AMES 54448, BM; G, GOET, MICH, NY, S, images seen). Fig. 32G.

Distribution: Bolivia.

As noted above under *Fernandezia mandonii,* the collection *Mandon 1152* from Mt. Chilieca is a mixture of two taxa. I have reserved the name *F. pectinata* for those plants with smaller flowers (sepals 2.0–2.4 mm long) and an oblong-oblanceolate (vs. rectangular-cuneate) lip.

Fernandezia pectinata var. ***punoensis*** Ormerod, *var. nov.*
TYPE: PERU. Puno: Distrito Sandia, N side of Rio Awi to Awi Valley, between Aripo and Ura-ayllu, 3100 m, 8 April 1986, *B. Bennett 2781* (Holotype: NY). Fig. 43.

Differs from the typical species in having thinner (1 vs. 3 mm) stems, and an oblong (vs. oblong-oblanceolate) lip.

Epiphytic *herb*. *Roots* terete, 0.6–1.0 mm thick. *Stems* simple to occasionally 2–3 branched (branches to 5.5 cm long), sublaxly leafy, 6–14 cm long, ca. 1 mm thick. *Leaves* oblong-lanceolate, acute, conduplicate, margins minutely denticulate toward apex, 6 mm long, 1.0–1.5 mm wide laterally; leaf sheaths tubular, margins minutely denticulate, smooth, striate. *Inflorescences* to 8.4 mm long; peduncle 4.2 mm long; rachis flexuous, up to 6 flowered, 4.2 mm long; floral bracts ovate-lanceolate, acute, to 1.9 mm long. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous; young capsule triquetrous, 4.8 mm long (incl. pedicel of 1.3 mm), one side 2 mm wide. *Dorsal sepal* lanceolate, acute, midvein thinly carinate, 2.00 × 0.75–0.80 mm. *Lateral sepals* obliquely lanceolate, acute, midvein high lamellate, 2.4 × 0.9 mm. *Petals* obliquely ovate-elliptic, acute, midvein shortly carinate near the apex, 1.90 × 0.85 mm. *Labellum* oblong, subacute, carinate below tip, 2.1 × 0.8 mm; calli 2, lamellate, remote, parallel, in upper half of lip, deltate, rounded to truncate. *Column* shortly stalked, each side with a low broad wing, ca. 1 mm long, 0.75 mm wide laterally.

Distribution: Peru.

Habitat: high elevation grassland and shrubland, 3100 m.

Etymology: named after the type locality, the south Peruvian Department of Puno.

I have treated this plant as a variety of *Fernandezia pectinata* because it agrees in flower size (sepals 2.0–2.4

mm long), and has a somewhat similar lip. However, when compared side by side the two look rather different, since variety *punoensis* is a more slender, laxer leaved plant, and its lip calli are parallel (vs. weakly divergent) and more even (vs. oblique based) in shape. The shape of the column is not fully certain, since this organ was affected by the fertilization process.

Fernandezia pseudodichaea (Rchb.f.) M.W. Chase, Phytotaxa 20: 30. 2011.

Basionym: *Pachyphyllum pseudodichaea* Rchb.f., Xenia Orch. 3: 22. 1878.

TYPE: BOLIVIA. La Paz: Prov. Larecaja, near Sorata, Lancha de Cochipata, 3200 m, May 1860, *G. Mandon 1152 p.p.* (Holotype: W-R 19258, image seen; Isotypes: AMES 76407; G, P, S, images seen). Fig. 44.

Lithophytic *herb*. *Roots* terete, many emitted from leafless section of stem, ca. 0.9 mm thick. *Stem* simple, sublaxly leafy, 17.5 cm long, 0.05–0.10 cm thick. *Leaves* ovate-oblong, acute, upper margins laxly and minutely denticulate, coriaceous, 9.0–10.0 × 4.2 mm; leaf sheaths semitubular, truncate, margins recurved, laxly and minutely denticulate. *Inflorescences* to 8.5 mm long; peduncle 4 mm long; rachis 4–5 flowered, to 4.5 mm long; floral bracts deltate, acute, ca. 2.1 mm long. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, ca. 3 mm long. *Dorsal sepal* oblong, acute, carinate towards tip, 2.75–2.80 × 1.00 mm. *Lateral sepals* obliquely ovate-lanceolate, acute, midvein narrowly carinate, 3.2 × 1.5 mm. *Petals* ligulate-oblanceolate, acute, 2.5–2.7 × 0.9 mm. *Labellum* claw rectangular, dilating into a suborbicular-pentagonal blade, claw 1.2 × 0.7 mm, blade 1.5 × 1.4 mm, in total 2.70–2.75 × 1.40 mm; claw of lip with 2 low medial lamellae that suddenly raise up into parallel, triangular, frontally truncate, apically rounded flat lobes that are situated on the base of the blade, each lobe can be spread to the edge of the lip or just over it. *Column* shortly constricted basally, each side with a low transverse wing, 1.7 mm long, 1 mm wide laterally.

Distribution: Bolivia.

Mandon assigned his number 1152 to this plant, collected almost two years after the specimens from Mt. Chilieca, which represent the types of *Fernandezia mandonii* and *F. pectinata*. It is easily distinguished from those two taxa by its flat leaves, flowers with a broadly clawed lip terminated by a pentagonal blade, and large pair of lamellae. I have provided a description and illustration of *F. pseudodichaea* based on the isotype in AMES.

Fernandezia pseudominor Ormerod, *sp. nov.*

TYPE: BOLIVIA. La Paz: Prov. Sud Yungas, along Rio Unduavi, 2900 m, 29 January 1980, *C. Luer, J. Luer, R. Vasquez & R. Nara 5003* (Holotype: SEL, lhp). Fig. 45.

Related to *Fernandezia minor* (Schltr.) M.W. Chase but flowers with an oblong, obtuse (vs. oblong-oblanceolate, subacute) labellum.

Epiphytic *herb*. *Roots* terete, 0.6–1.0 mm thick. *Stems* simple, sublaxly leafy, 12 cm long, 0.15 cm thick. *Leaves* oblong to oblong-lanceolate, acute, coriaceous, conduplicate, margins minutely denticulate, ca. 8 mm long, 1.5–2.0 mm wide laterally; leaf sheaths smooth, striate, margins minutely denticulate. *Inflorescence* ca. 8 mm long; peduncle ca. 4 mm long; rachis about 4 flowered, 4 mm long; floral bracts deltate, acute, to 2 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 3.0–3.5 mm long. *Dorsal sepal* oblong-lanceolate, acute, 3.1 × 0.95 mm. *Lateral sepals* obliquely lanceolate, acute, 3.8 × 1.1 mm. *Petals* oblong, acute, midvein thickly carinate near tip, 2.75 × 0.80 mm. *Labellum* oblong, obtuse, shallowly cucullate, 2.7 × 0.9 mm; from near base 2 slightly divergent lamellae that raise up in their apical 1/3. *Column* shortly stalked, each side with a suborbicular wing, 1.75 mm long, 1 mm wide laterally.

Distribution: Bolivia.

Habitat: cloud forest, 2900 m.

Etymology: named for its resemblance to *Fernandezia minor,* literally false minor.

This species appears to be closely related to *Fernandezia minor,* but it differs in having flowers with a narrower (0.9 vs. 1.20-1.85), oblong (vs. oblong-oblanceolate), obtuse (vs. subacute) labellum.

Fernandezia putumayoensis (Szlach., Kolan. & Oledr.) Molinari & Mayta, Richardiana 16: 43. 2015.

Basionym: *Pachyphyllum putumayoense* Szlach., Kolan. & Oledr., Ann. Bot. Fenn. 51: 223. 2014.

TYPE: COLOMBIA. Putumayo: Alto Cuenca of the Rio Putumayo, ridge of the Cordillera between El Encano and Sibundoy, paramo de San Antonio del Bordoncillo, 3250 m, 4 January 1941, *J. Cuatrecasas 11698A* (Holotype: COL, image seen; Isotypes: AMES; US not seen). Fig. 46.

Distribution: Colombia.

Additional specimens examined: COLOMBIA. Caldas: La Vega, Rio Azul, W slopes of Paramo de Chili, 3690 m, 11 December 1944, *H. St. John 20894* (AMES). Risaralda: Municipio de Santa Rosa de Cabal, royal road between Termales de Santa Rosa and Hacienda La Sierra, 3370 m, 23 February 1986, *J. Wolf 751* (SEL); same area, Hacienda La Sierra, 3670 m, 24 March 1986, *J. Wolf 856* (SEL). Valle: Cordillera Occidental: Los Farallones, ridge of the cordillera, scrub of the Paramo and cerro La Torre, 3750 m, 10 October 1944, *J. Cuatrecasas 17854* (F, GH). Cauca: Volcan de Purace, 3000 m, 7 November 1948, *S.Y. Agredo, J.A. Molina & F.A. Barkley "18 Ca.125"* (US).

This is a rather characteristic species, its stems are often densely beset with little suborbicular to almost squarish, thinly and stiffly coriaceous leaves, the latter set on broadly triangular leaf sheaths. Thus the plant somewhat resembles a *Dichaea* Lindl. Apart from the distinctive leaves, it may be recognized by the relatively small-lobed, apical column wings. In the protologue it is said to have well-separated calli on the lip, but I find in the AMES isotype and other collections these are close together as in other species. However, the calli do tend to split medially when the lip is pressed flat for drawing.

The variation of the species may eventually include two other essentially identical Colombian collections (Cauca, *J. Cuatrecasas 14783* [F, GH]; Valle, *J. Cuatrecasas 17924* [F, GH]), which differ in having broader, more rounded

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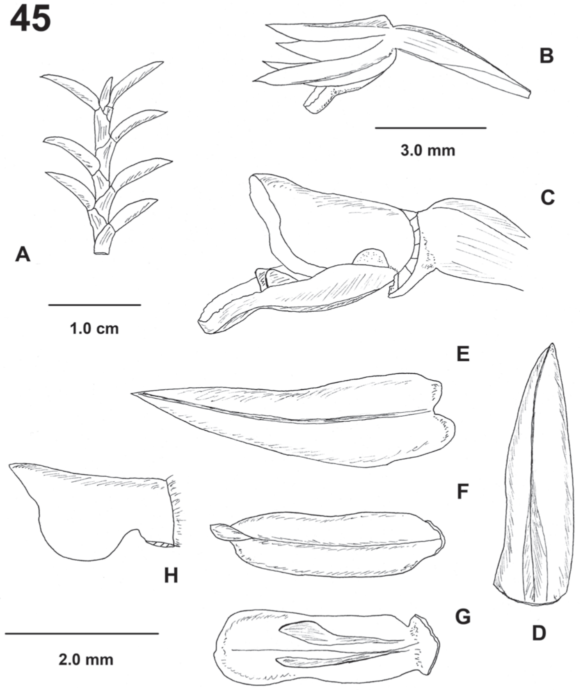

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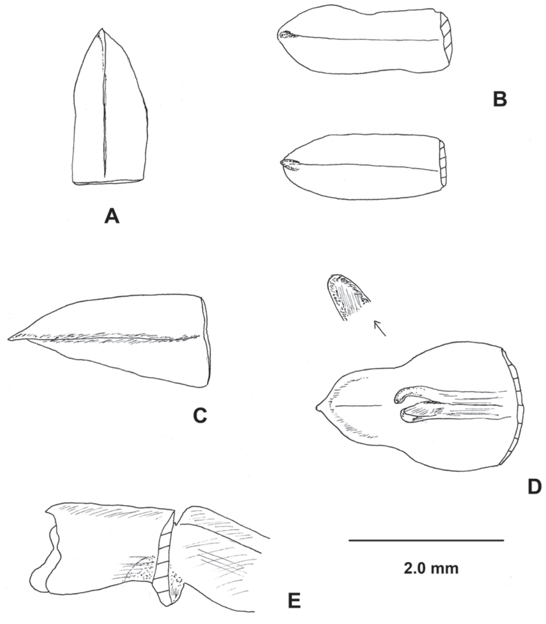

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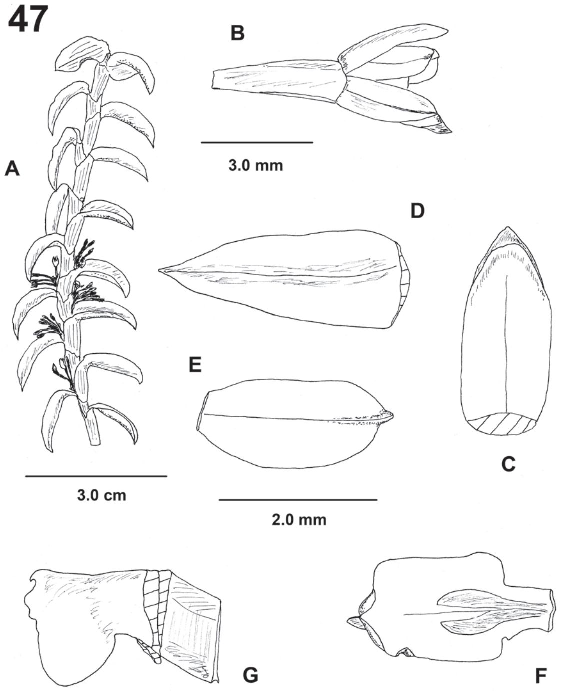

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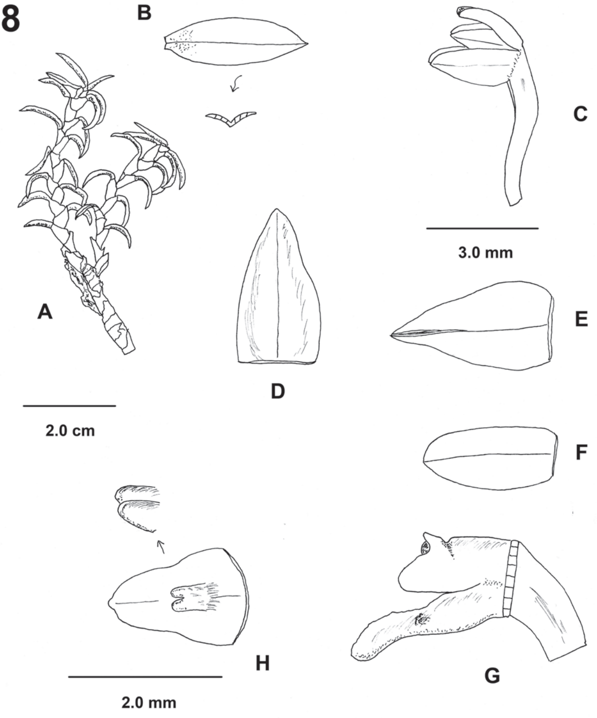

FIGURE 45–48. **45**, *Fernandezia pseudominor* Ormerod. **A**, stem (upper part); **B**, flower; **C**, labellum and column; **D**, dorsal sepal; **E**, lateral sepal; **F**, petal; **G**, labellum; **H**, column. Drawn from holotype. **46**, *Fernandezia putumayoensis* (Szlach., Kolan. & Oledr.) Molinari & Mayta. **A**, dorsal sepal; **B**, petals; **C**, lateral sepal; **D**, labellum; **E**, column. Drawn from isotype (AMES). **47**, *Fernandezia quadrangularis* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **48**, *Fernandezia rubescens* Ormerod. **A**, stem (upper part); **B**, leaf (no scale); **C**, flower; **D**, dorsal sepal; **E**, lateral sepal; **F**, petal; **G**, labellum and column; **H**, labellum. Drawn from holotype.

column wings. The first one (*Cuatrecasas 14783*) also differs in having the lip widest medially (vs. in basal half), and has denticulate petals. These aspects remind strongly of *Fernandezia crystallina,* giving the suspicion of a natural hybrid with that taxon. The second collection is in fruit, but florally agrees well with *F. putumayoensis* except for the broader column wings.

Another two Colombian collections (Caldas, *F.W. Pennell 10517* [US]; Cauca, *H. Antonio C. 70* [F]) probably belong to *F. putumayoensis*, but the material at hand was insufficient for positive identification.

Fernandezia quadrangularis Ormerod, *sp. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Sacaba, Cerro San Benito, 2900 m, 15 November 1921, *J. Steinbach 5938* (Holotype: K). Fig. 47.

Related to *Fernandezia steinbachii* Ormerod but flowers with a quadrangular (vs. broadly elliptic) labellum.

Epiphytic (?) *herb. Roots* terete, several on old parts of stem, to 1 mm thick. *Stems* simple to 1 branched (branch 10 cm long), laxly leafy, 20.5 cm long, ca. 0.2 cm thick. *Leaves* oblong, acute, margins minutely denticulate, to 12 × 5 mm; leaf sheaths tubular, margin oblique, entire, exposed dorsal edge 4–5 mm long. *Inflorescences* ca. 10 mm long; peduncle mostly hidden in leaf sheath, ca. 6 mm long; rachis 4 flowered, ca. 4 mm long; floral bracts broadly ovate, acute, 2–3 × 2–3 mm. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 3.5–4.0 mm long. *Dorsal sepal* oblong-elliptic, acute, fleshy, 2.5 × 1.0 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, 2.95 × 1.20 mm. *Petals* oblong-elliptic, subacute, midvein carinate at apex, 2.1 × 1.0 mm. *Labellum* subquadrate from a shortly clawed base, subacute, carinate below tip, claw broad cuneate, 0.8 mm long, blade 1.8 × 1.5 mm, in total 2.5 × 1.5 mm; on claw 2 low lamellae that broaden and diverge slightly on the lower half of the blade. *Column* shortly and broadly stalked, each side with an obliquely suborbicular wing, 1.5 mm long, 1 mm wide laterally.

Distribution: Bolivia.

Etymology: from the Latin *quadrangulus,* four cornered, in reference to the lip shape.

This taxon is probably related to *Fernandezia steinbachii,* but the flowers have a subquadrate (vs. broadly elliptic) lip. Another similar species is *F. tinquiana,* but it too has a broadly elliptic lip, and also smaller (sepals 1.8 mm long) flowers.

Fernandezia rubescens Ormerod, *sp. nov.*
TYPE: PERU. Amazonas: Prov. Bagua, Cordillera Colan, SE of La Peca, third camp, 2455m, 6 October 1978, *P. Barbour 3770 p.p.* (Holotype: MO; Isotype: SEL). Fig. 48.

Related to *F. rubicunda* Ormerod but with smaller flowers (sepals 1.8–1.9 vs. 3.3–3.5 mm) and with rounded, forward projecting (vs. truncate) column wings.

Epiphytic *herb. Roots* terete, 1 mm thick. *Stems* simple or branching (branches 3–11 cm long), densely leafy, 11–24 cm long, 0.1–0.4 cm thick. *Leaves* oblong-ligulate, acute, thinly fleshy, 6.0–7.5 × 2.0–3.0 mm; leaf sheaths smooth, striate. *Inflorescence* to 7 mm long; peduncle slender, 3 mm long; rachis up to 6 flowered, to 4 mm long; floral bracts deltate-lanceolate, acute, to 1.8 mm long. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 3.0–3.3 mm long. *Dorsal sepal* ovate, subacute, 1.8 × 1.0 mm. *Lateral sepals* obliquely ovate, acute, low carinate, 1.9 × 1.0–1.1 mm. *Petals* oblong, subacute, 1.7 × 0.9 mm. *Labellum* ovate-subpandurate, obtuse, lower part ca. 0.90 × 1.10–1.15 mm, upper part 0.85–0.90 × 0.70–0.75 mm, in total 1.70 × 1.10–1.15 mm; lower half of lip divided medially by a low thick ridge that ends in a pair of parallel, conical to ellipsoid calli. *Column* each side with an apical, forward-pointing, obtuse wing, 1.1–1.2 mm long, 0.7 mm wide laterally.

Distribution: Peru.

Additional specimen examined: PERU. Amazonas: Prov. Bagua, Cordillera Colan, SE of La Peca, third camp, 2440 m, 25 September 1978, *P. Barbour 3564* (MO).

Habitat: humid cloud forest (type), elfin bog (*Barbour 3564*), 2440–2455 m.

Etymology: from the Latin, *rubescens,* to redden or blush, in reference to the reddish color of the dried specimens.

This species appears to be closely related to *Fernandezia rubicunda,* under which the differences are discussed. The type of *F. rubescens* is a mixed collection; the other specimen forms the type of *F. transversalis*. The isotype in SEL is, however, not a mixed collection.

Fernandezia rubicunda Ormerod, *sp. nov.*
TYPE: PERU. Amazonas: Prov. Bagua, Cordillera Colan, E of La Peca, ridge W of peaks, ridgetop with pajonal, 3140 m, 25 August 1978, *P. Barbour 3200* (Holotype: MO; Isotype: SEL). Fig. 49.

Related to *Fernandezia rubescens* Ormerod but with larger flowers (sepals 3.3–3.5 vs. 1.8–1.9 mm) and truncate (vs. rounded and projecting forward) column wings.

Epiphytic (?) and lithophytic *herb. Roots* terete, 0.8–2.0 mm thick. *Stems* simple to 6–10 branched above (branches 5–9 cm long), densely leafy, 6.5–33.0 cm long, 0.2–0.4 cm wide across leaf sheaths, 0.15–0.30 cm thick. *Leaves* oblong to elliptic, acute, coriaceous, margins denticulate near apex, base shortly conduplicate, 7.0–10.0 × 2.4–3.5 mm; leaf sheaths somewhat lobed in lower half, rectangular above in lateral view, truncate, smooth, striate. *Inflorescence* to 9 mm long; peduncle to 5 mm long; rachis 3–5 flowered, ca. 4 mm long; floral bracts ovate-lanceolate, acute, to 2 mm long. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 3 mm long. *Dorsal sepal* oblong-lanceolate, acute, midvein carinate, 3.3 × 1.3–1.4 mm. *Lateral sepals* obliquely lanceolate, acute, carinate, 3.5 × 1.5–1.6 mm. *Petals* oblong, subacute, midvein thickly low carinate, 2.90 × 1.15 mm. *Labellum* ovate, acute, concave, 2.9 × 2.0 mm; lower half divided by a thick ridge that ends in 2 parallel, fleshy, conical calli. *Column* each side with a low broad wing, 1.8 mm long, 1.2 mm wide laterally.

Distribution: Peru.

Additional specimen examined: PERU. Amazonas: Prov. Bagua, Cordillera Colan, E of La Peca, ridge W of peaks, 3140 m, 25 August 1978, *P. Barbour 3154* (MO, SEL).

Habitat: humid elfin forest, on thick moss mats (type), on exposed boulder (*Barbour 3154*), 3140 m.

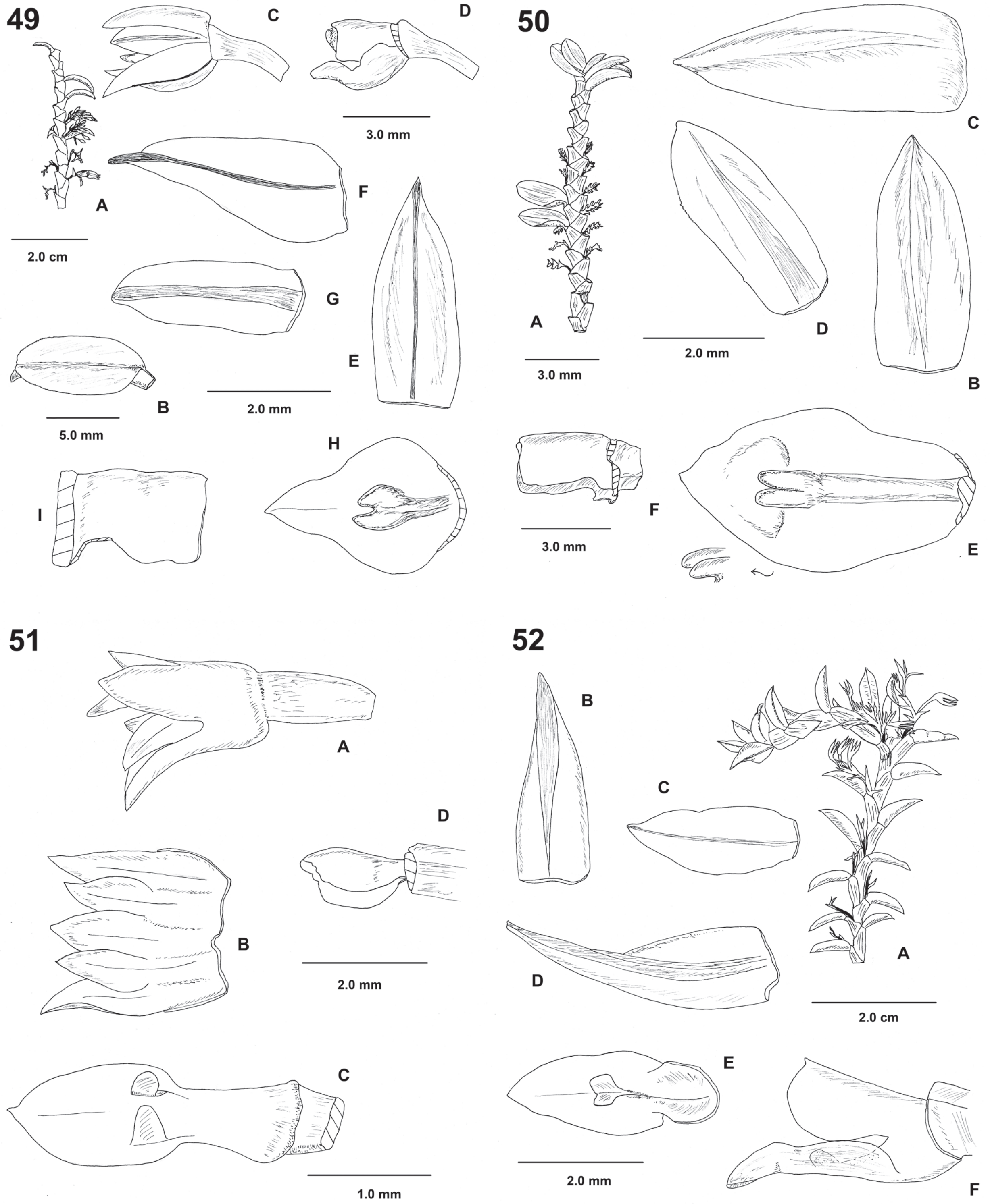

FIGURE 49-52. **49**, *Fernandezia rubicunda* Ormerod. **A**, stem (upper part); **B**, leaf; **C**, flower; **D**, labellum and column; **E**, dorsal sepal; **F**, lateral sepal; **G**, petal; **H**, labellum; **I**, column. Drawn from holotype. **50**, *Fernandezia salliquensis* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from holotype. **51**, *Fernandezia schultesii* (L.O. Williams) Carnevali & Dorr. **A**, flower; **B**, tepals (lateral sepal, petal, dorsal sepal, petal, lateral sepal); **C**, labellum; **D**, column. A–C from *Garcia-Barriga 17422* (AMES); D from holotype. **52**, *Fernandezia scimitaris* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum; **F**, labellum and column. Drawn from holotype.

Etymology: from the Latin *rubicundus,* reddish, in reference to the color of the dried specimens.

The closest relative of this species appears to be its sister species *Fernandezia rubescens,* which occurs lower down on the same mountain range. *Fernandezia rubicunda* differs from *F. rubescens* in having larger flowers (sepals 3.3–3.5 vs. 1.8–1.9 mm), and truncate (vs. rounded and projecting forward) column wings.

Fernandezia salliquensis Ormerod, *sp. nov.*

TYPE: PERU. Cajamarca: Prov. Jaen, Sallique, Quebrada grande, route between La Cocha and Tablon, 2770–2900 m, 30 June 1998, *C. Diaz, J. Campos, T. Guevara & E. Tineo 9791* (Holotype: MO). Fig. 50.

Similar to *Fernandezia distichoides* M.W. Chase but the flowers with an obovate (vs. ovate) labellum.

Epiphytic *herb*. *Roots* terete, 0.5–1.0 mm thick. *Stems* simple, densely leafy, 9–21 cm long, 0.7 cm wide across leaf sheaths, 0.3 cm thick. *Leaves* oblong to weakly ovate-oblong, shortly apiculate, coriaceous, margins minutely denticulate, drying brownish-red, 17–21 × 5.5–9.5 mm; leaf sheaths deltate, truncate, margins minutely denticulate. *Inflorescence* to 15 mm long; peduncle 6 mm long; rachis pectinate, up to 7 flowered, 9 mm long; floral bracts deltate, acute, 3 × 2 mm. *Flowers* green. *Pedicellate ovary* clavate, trialate, 3.5 mm long. *Dorsal sepal* broadly oblong-lanceolate, obtuse, midvein thickly low carinate, 3.5 × 1.5 mm. *Lateral sepals* obliquely and broadly oblong-lanceolate, subacute, midvein carinate, carina thickest apically, 3.9–4.1 × 1.65. *Petals* oblong, subacute, midvein low carinate, 3.1 × 1.2 mm. *Labellum* obovate-elliptic, acute, 4 × 2.3 mm; lower half divided by a thick ridge that terminates in 2 parallel, oblongoid, slightly curved calli. *Column* rectangular in lateral view, 2.8 mm long, 1.7 mm wide laterally.

Distribution: Peru.

Etymology: named after the Sallique District, the type locality.

The relationships of this species are not clear. It resembles somewhat *Fernandezia distichoides* M.W. Chase in having rather broad leaf sheaths, and pectinate inflorescences, but the leaves are not so fleshy, and the lip is obovate (vs. ovate).

Fernandezia schultesii (L.O. Williams) Carnevali & Dorr, Smithsonian Contr. Bot. 100: 159. 2014.

Basionym: *Pachyphyllum schultesii* L.O. Williams, Caldasia 1, 3: 15. 1941. TYPE: COLOMBIA. Cundinamarca: SE of Bogota, Paramo de Chipaque, 3200 m, 25 September 1941, *R.E. Schultes 1020* (Holotype: AMES). Fig. 51.

Homotypic synonym: *Orchidotypus schultesii* (L.O. Williams) Senghas, in Schltr., Die Orchideen ed. 3, I/B (31): 1923. 1995.

Heterotypic synonym: (?) *Orchidotypus vareschii* Foldats, Acta Biol. Venez. 2, 4: 28. 1957. TYPE: VENEZUELA. Tachira: Paramo el Batallon, 3200 m, *V. Vareschi 4527B* (Holotype: VEN, not seen).

Usage synonym: *Orchidotypus bryophytus auct. non* (Schltr.) Senghas, Szlach., Kolan. & Mystk., Polish Bot. J. 59, 2: 168, f.4. 2014 *p.p.*

Distribution: Ecuador; Colombia; Venezuela (?).

Additional specimens examined: ECUADOR. Azuay: Gualaceo to Limon road, KM 13, 3200–3300 m, 4 March 1985, *G. Harling & L. Andersson 22704 p.p.* (AMES). COLOMBIA. Cundinamarca: Choconta, El Sisga, 2700–2800 m, 21 February 1962, *H. Garcia-Barriga 17422* (AMES). Boyaca: road from Guateque to Santa Maria, between Santa Maria and Piedra Campana, "800–1200 m," 10–12 March 1960, *H. Garcia-Barriga 17209* (AMES, NY).

As noted under *Fernandezia vaginata,* this taxon may be distinguished from the latter by its larger flowers, with triangular free parts of the sepals, and ovate-lanceolate petals. The two Colombian specimens cited above were referred to *Orchidotypus bryophytus* by Szlachetko et al. (2014), but that taxon differs in having falcate, recurved leaves, smaller (sepals barely 2 mm long) flowers, and a narrowly rhombic lip lamina. I have seen no material matching *F. bryophyta* (Schltr.) M.W. Chase; it should be regarded as a species awaiting rediscovery.

Fernandezia scimitaris Ormerod, *sp. nov.*

TYPE: BOLIVIA. Cochabamba: Prov. Chapare, Pampatambo, no altitude, 8 November 1979, *R. Vasquez 202 p.p.* (Holotype: SEL). Fig. 52.

Related to *Fernandezia teranii* Ormerod but flowers with longer sepals (3.15–3.90 vs. 1.90–2.50 mm), and labellum with calli basally joined to form a V (vs. parallel and separate).

Epiphytic (?) *herb*. *Roots* terete, ca. 0.8 mm thick. *Stems* simple, sublaxly leafy, 7.5 cm long, 0.05 cm thick. *Leaves* narrowly oblong-lanceolate, acute, margins minutely denticulate toward apex, rigid, subfalcate, conduplicate, 6–8 mm long, 1.5–2.5 mm wide laterally; leaf sheaths semitubular, smooth, margins minutely denticulate. *Inflorescence* to 10 mm long; peduncle ca. 5 mm long; rachis up to 5 flowered, to 5 mm long; floral bracts deltate, acute, to 2.7 mm long. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, ca. 3.5 mm long. *Dorsal sepal* oblong-lanceolate, acute, thickly carinate, 3.15 × 1.10 mm. *Lateral sepals* obliquely lanceolate, acute, strongly carinate, 3.9 × 1.3 mm. *Petals* oblong-lanceolate, acute, midline slightly thickened, carinate near apex, 2.75 × 1.00 mm. *Labellum* ovate-lanceolate, acute, low carinate under tip, ca. 2.2 × 1.4 mm (but 3 mm long if including 0.9-mm-long basal part united to column); callus in middle of lip, of two subquadrate lamellae united basally to form a V. *Column* shortly and broadly stalked, each side with an oblique, broadly suborbicular wing, 1.75 mm long, 0.9 mm wide.

Distribution: Bolivia.

Etymology: from the Italian *scimitarra,* itself possibly from the Persian *shamshir,* a curved sword usually broadening in its upper part, in reference to the shape of the lateral sepals.

This species appears to be related to its Bolivian congener *Fernandezia teranii* but has much larger flowers, and the lobes of calli on the lip are joined to form a V-shape, rather than being parallel and separate. The type material is a mixture; the other specimen on the righthand part of the sheet forms the type material of *F. pandurata*.

Fernandezia shoveliformis Ormerod, *sp. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Chapare, 23.8 km N of Colomi (junction of the road to Candelaria), on the road to Chapare, then 2.2 km NW (left) on side road, upper Rio Cayani, 2700 m, 19 October 1985, *J.C. Solomon 14381* (Holotype: NY; Isotype: MO). Fig. 53.

Similar to *Fernandezia minor* (Schltr.) M.W. Chase but flowers with the labellum distinctly clawed (vs. sessile) and the blade with right-angled (vs. obtuse angled) corners.

Epiphytic *herb*. *Roots* terete, ca. 1 mm thick. *Stems* with 1–3, often basal branches (these 1.5–7.0 cm long), subdensely leafy, 5.5–13.0 cm long, 0.1–0.2 cm thick, 0.2–0.3 cm wide across leaf sheaths. *Leaves* oblong-lanceolate, acute, margins minutely denticulate toward apex, rigid, conduplicate, gently curved, 4–10 × 2–6 mm; leaf sheaths smooth, striate, margins minutely denticulate, dorsal exposed edge 3.5–4.0 mm long. *Inflorescences* to 11.5 mm long; peduncle ca. 9 mm long; rachis 4–6 flowered, 2.5 mm long; floral bracts deltate, acute, margins minutely denticulate, 2.0–2.2 × 3.0 mm. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 5.7 mm long. *Dorsal sepal* broadly oblong-lanceolate, acute, low carinate, 3.20 × 1.50–1.55 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, low carinate, 3.5 × 1.5 mm. *Petals* oblong-elliptic, acute, midvein low carinate, 3.0 × 1.4 mm. *Labellum* oblong-elliptic from a shortly clawed base, obtuse, claw 0.95 mm long, blade ca. 2.5 × 1.5 mm, in total 3.4–3.5 × 1.8 mm; callus of 2 short, slightly divergent lamellae in the middle of the blade. *Column* shortly and broadly clawed, each side with a somewhat suborbicular wing, ca. 2 mm long, 1.65–1.70 mm wide.

Distribution: Bolivia.

Habitat: cloud forest, trees 8–10 m tall, dominant tree *Alchornea* spp., 2700 m.

Etymology: from the Old English *scofl,* spade, presumably derived from the Germanic *schaufel*, and *formis,* Latin for shape, in reference to the shape of the labellum.

This species is probably closely related to *Fernandezia minor* (Schltr.) M.W. Chase, sharing with it a similar habit, and similar details of the lip and column. *Fernandezia shoveliformis,* however, differs from *F. minor* in having a distinctly clawed lip with distinct basal corners.

Fernandezia shoveliformis var. ***inversa*** Ormerod, *var. nov.*
TYPE: BOLIVIA. Cochabamba: Prov. Chapare, along road to Villa Tunari, 2840 m, 13 & 16 June 1981, *C. Luer, J. Luer, E. Besse & R. Vasquez 5614* (Holotype: SEL). Fig. 54.

Differs from typical *Fernandezia shoveliformis* in the flowers having the blade of the labellum narrower (vs. broader) in the basal part, and the apex deltate and obtuse (vs. rounded).

Epiphytic *herb*. *Roots* terete, 0.4–0.8 mm thick. *Stems* simple, sublaxly to densely leafy, 6–14 cm long, to 0.25 cm wide across leaf sheaths, ca. 0.15 cm thick. *Leaves* oblong, acute, stiffly coriaceous, gently curved, 10–13 × 4–6 mm; leaf sheaths tubular, striate, not fully covering internodes. *Inflorescence* 11 mm long; peduncle ca. 6 mm long; rachis successively 6 flowered, 5 mm long; floral bracts deltate, acute, to 2.7 × 2.0 mm. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 7 mm long. *Dorsal sepal* oblong, subacute, 3.7 × 1.6 mm. *Lateral sepals* obliquely oblong-lanceolate to lanceolate, subacute, midvein shortly carinate near apex, 3.75 × 1.60 mm. *Labellum* shortly clawed, blade elliptic-subpandurate, obtuse, claw 0.3 mm long, blade 3.15 × 1.75 mm, in total ca. 3.45 × 1.75 mm; lower part of lip with a broadly thickened midline ending in 2 short lamellae. *Column* shortly and broadly clawed, each with a suborbicular wing, 2.65 mm long, 1.75–1.90 mm wide laterally.

Distribution: Bolivia.

Habitat: roadside cloud forest, 2840 m.

Etymology: from the Latin *inversus,* upside down, in reference to the inverted proportions of the labellum as compared with the typical variety.

This variety has larger leaves than typical *Fernandezia shoveliformis,* and also differs in the flowers having a lip of inverse proportions with less distinct corners at the base, and a more triangular (vs. broadly rounded) apex.

Fernandezia solomonii Ormerod, *sp. nov.*
TYPE: BOLIVIA. La Paz: Prov. Sud Yungas, 3.1 km E of Unduavi bridge, below on old road, 3000 m, 6 November 1982, *J.C. Solomon 8665* (Holotype: MO; Isotype: SEL). Fig. 55.

Related to *Fernandezia breviconnata* (Schltr.) M.W. Chase but the flowers with a shortly (vs. long) clawed, subpandurate (ovate-lanceolate) labellum, and more broadly (2.3 vs. 1.6 mm) winged column.

Epiphytic *herb*. *Roots* terete, 0.3–0.7 mm thick. *Stems* pendent, 7–8 branched (branches 3.5–25.5 cm long), sublaxly leafy, flexuous, to 37 cm long, ca. 0.1 cm thick. *Leaves* lanceolate to oblong-lanceolate, acute, thinly coriaceous, margins minutely denticulate toward apex, 13.0–16.0 × 5.0–5.5 mm; leaf sheaths semitubular, smooth, margins recurved, minutely denticulate. *Inflorescence* to 8.5 mm long; peduncle 6.0–6.5 mm long; rachis 1–2 flowered, 1–2 mm long; floral bracts ovate-lanceolate, acute, to 5.5 × 3.0 mm. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 5 mm long. *Dorsal sepal* oblong-ligulate, acute, low carinate, recurved, 5.5 × 1.5 mm. *Lateral sepals* obliquely lanceolate, acute, carinate, upcurved, 8.8 × 2.2 mm. *Petals* obliquely oblong-oblanceolate, acute, lower margin joined to sepals for 0.75 mm, 5.2 × 1.8 mm. *Labellum* shortly clawed, subpandurate, acute, claw 0.8 mm long, blade 5 × 2 mm, in total 6 × 2 mm; lower half with a low median thickening ending in 2 semi-elliptic to trapeziform lamellae. *Column* stoutly clawed, each side with an obliquely semicircular wing, 3.2 mm long, 2.3 mm wide laterally.

Distribution: Bolivia.

Eponymy: named after Jim Solomon, collector of the type, and curator at Missouri Botanic Gardens herbarium (MO).

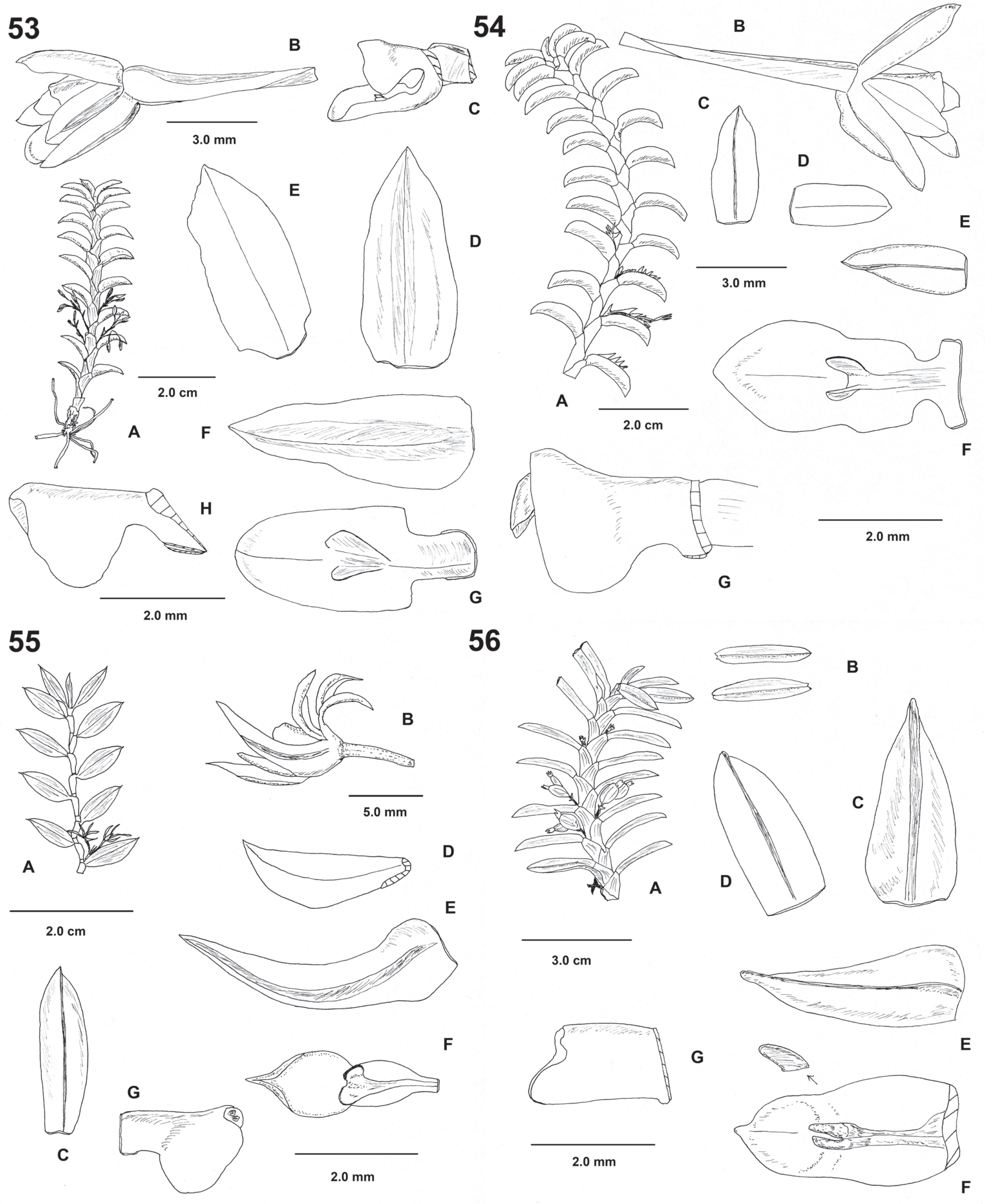

FIGURE 53–56. **53**, *Fernandezia shoveliformis* Ormerod var. *shoveliformis*. **A**, stem; **B**, flower; **C**, labellum and column; **D**, dorsal sepal; **E**, petal; **F**, lateral sepal; **G**, labellum; **H**, column. Drawn from holotype. **54**, *Fernandezia shoveliformis* Ormerod var. *inversa* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype. **55**, *Fernandezia solomonii* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype. **56**, *Fernandezia squarrosa* (Lindl.) M.W. Chase. **A**, stem (upper part); **B**, leaves; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. A–B, D, G from *Cuatrecasas 19188* (AMES); C, E–F from *Marulanda & Betancur 470* (MO).

This species appears to be closest to *Fernandezia breviconnata* from Peru, but differs in having a narrower dorsal sepal, a subpandurate (vs. ovate-lanceolate), shortly (vs. long) clawed lip, and a more broadly (2.3 vs. 1.6 mm) winged column.

Fernandezia squarrosa (Lindl.) M.W. Chase, Phytotaxa 20: 30. 2011.

Basionym: *Pachyphyllum squarrosum* Lindl., Ann. Mag. Nat. Hist. 15: 107. 1845. TYPE: COLOMBIA. Cauca: woods of Pitaya, 3200 m, 1843, *K.T. Hartweg 1409* (Holotype: K-L; Isotypes: K, LD, images seen). Fig. 56.

Usage synonym: *Pachyphyllum hartwegii auct. non* Rchb.f., L.O. Williams, Lilloa 3: 482. 1938 *p.p.*

Epiphytic *herb*. *Roots* terete, to 1.5 mm thick. *Stems* simple to branching (1–4 branches, 3–12 cm long), densely leafy, to 33 cm long, to 0.6 cm wide across leaf sheaths, to 0.25 cm thick. *Leaves* oblong to ligulate, acute, thinly fleshy, 15–18 × 5 mm; leaf sheaths broad deltate, smooth. *Flowers* white. *Dorsal sepal* ovate, subacute, thickly carinate medially, 3 × 1.4 mm. *Lateral sepals* obliquely lanceolate, acute, medially carinate, carinae obliquely truncate apically, 3.2 × 1.2 mm. *Petals* oblong-obcuneate, acute, midvein ridged, 2.2 × 1.1 mm. *Labellum* ovate-oblong, subpandurate, subacute, lower half 2 × 1.8 mm, upper half 1.2 × 1.4 mm, in total 3.2 × 1.8 mm; lower half divided by a ridge that terminates just above the middle in two conical calli. *Column* 1.9 mm long.

Distribution: Colombia.

Additional specimens examined: COLOMBIA. Antioquia: Municipio Santa Rosa de Osos, Corregimiento Aragon, Finca Venecia, near the road from Santa Rosa de Osos to Aragon, 2600 m, 7 June 1986, *F.J. Roldan, O. Marulanda & J. Betancur 470* (MO). Cauca: Cordillera Central, W slope, headwaters of the Rio Palo, Quebrada de Santo Domingo, Campamento de los quineros, 2700–2800 m, 13 December 1944, *J. Cuatrecasas 19188* (AMES, MO); Cordillera Central, "Canaan," Mt. Purace, 3100–3300 m, 11–13 June 1922, *F.W. Pennell & E.P. Killip 6603* (AMES, GH).

This species has some superficial similarities to *Fernandezia crystallina,* such as the forward produced lobes of the column wings, but the plants always have longer, ligulate leaves, and the flowers do not have denticulate margins to the petals and the upper half of the lip is straight (not recurved).

Its closest relative is another Colombian entity from the Department of Antioquia that Dr. Szlachetko intends to describe (four collections seen). This vegetatively similar entity differs in its smaller flowers (sepals ca. 2 mm long), broadly ovate-elliptic petals, and shorter (1.5 mm long) column.

Fernandezia steinbachii Ormerod, *sp. nov.*

TYPE: BOLIVIA. Santa Cruz: Comarapa, Cerro San Mateo, 2800 m, 24 October 1898, *J. Steinbach 8501* (Holotype: GH; Isotypes: AMES, BM, F, K, MO, NY). Fig. 57.

Similar to *Fernandezia barnettiae* Ormerod but a taller (stems to 19.5 vs. to 10.5 cm) plant, the flowers with a longer (5.0 vs. 1.5 mm) pedicellate ovary, and wider (1.2–1.5 vs. 0.8 mm) labellum that has divergent (not parallel) lamellae.

Epiphytic *herb*. *Roots* terete, elongate, 0.5–1.3 mm thick. *Stems* simple to branching, subdensely to laxly leafy, to 19.5 cm long, 0.10–0.25 cm thick. *Leaves* suborbicular to oblong, acute to subacuminate, margins minutely denticulate toward apex, coriaceous, 6.0–8.0 × 3.5–4.5 mm; leaf sheaths semitubular, margins recurved, entire to minutely denticulate, 5 mm long. *Inflorescence* 7 mm long; peduncle 3 mm long; rachis to 7 flowered, 4 mm long; floral bracts widely ovate, subacuminate, to 2.5 × 1.6 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 5 mm long. *Dorsal sepal* elliptic, acute, weakly carinate near apex, 2.1 × 1.0 mm. *Lateral sepals* obliquely oblong-lanceolate, acute, low carinate, 2.4 × 1.1 mm. *Petals* elliptic, obtuse, 2.1 × 1.0 mm. *Labellum* broadly elliptic from a shortly clawed base, subacute, 2.15 × 1.20–1.30 mm; lower half with a low median thickening that divides into 2 divergent lamellae. *Column* shortly clawed, each side dilated into a subquadrate-suborbicular wing, 1.4 mm long, 1.0–1.1 mm wide laterally.

Distribution: Bolivia.

Additional specimen examined: BOLIVIA. Santa Cruz: near Comarapa, 2600 m, April 1911, *T. Herzog 1946 p.p.* (L, upper lhp; S, image seen).

Eponymy: named after Jose Steinbach (1875–1930), originally from Germany. He made several collections of plants and insects from Bolivia, including the type of this species.

Among Bolivian taxa with flat, coriaceous (vs. conduplicate, fleshy) leaves and long lamellate keels on the lip, *Fernandezia steinbachii* may be recognized by its long pedicellate ovaries (5 mm), elliptic petals, and broadly winged column. Another feature that may help identify *F. steinbachii* is that it seems to produce many long roots. See also the comparative notes under *F. barnettiae*. The collection *T. Herzog 1946* is the type number of *Pachyphyllum herzogii* Schltr.; both L and S duplicates are mixtures that contain material of *F. steinbachii,* which can be distinguished by its flat, coriaceous (vs. conduplicate, ensiform) leaves.

Five other collections from the type region (Comarapa to Serrania Siberia) that probably belong here, but lack flowers or are in bud, are *A.L. Arbelaez et al. 872* (MO), *J. Balcazar & L. Fernandez 902* (NY), *C.G. Jordan & I.G. Vargas 377* (MO), *N. Ritter & J. Wood 2891* (F), and *M. Saldias & M. Fernandez 4556* (NY).

Fernandezia teranii Ormerod, *sp. nov.*

TYPE: BOLIVIA. Cochabamba: Prov. Tiquipaya, Alto 1 Totolima, exposed NE slope, 2400 m, 2 May 2008, *J. Teran, Cespede, A. Soux & D. Soux 2534* (Holotype: MO). Fig. 58.

Similar to *Fernandezia amboroensis* Ormerod var. *amboroensis* in habit and flower size, but the labellum has in the middle (vs. in lower half) 2 short, subquadrate to circular (vs. two elongate) lamellae.

Epiphytic (?) *herb*. *Roots* terete, 0.3–0.8 mm thick. *Stems* simple to much branched (branches 1.5–5.5 cm long), leafy, 8-16 cm long, 0.1 cm thick, 0.2 cm wide across leaf sheaths. *Leaves* oblong-lanceolate, acute, coriaceous, conduplicate (in dry material), minutely denticulate near apex, 4.0–8.0

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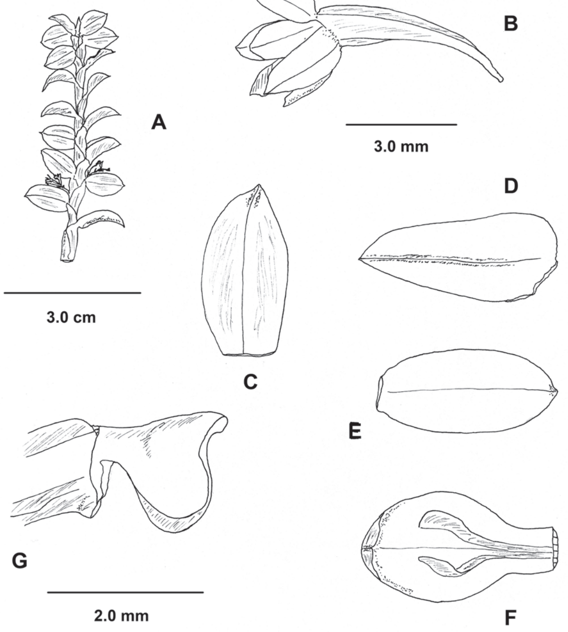

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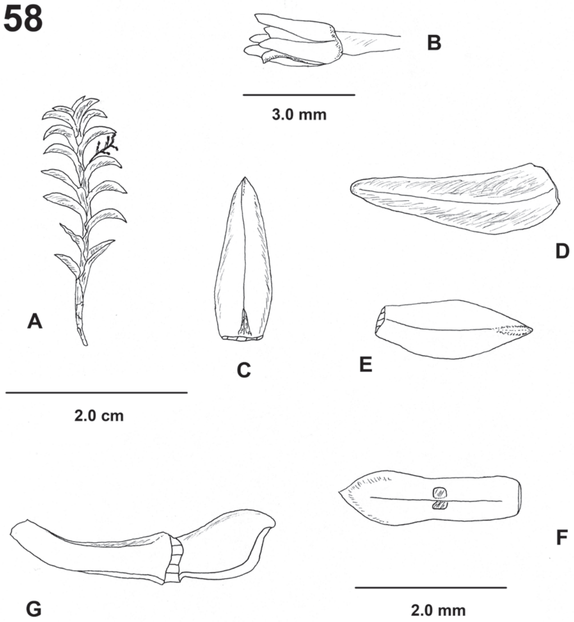

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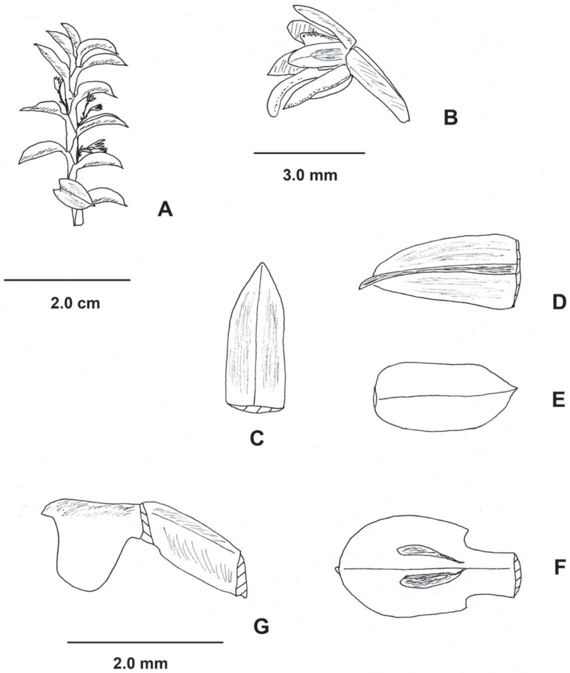

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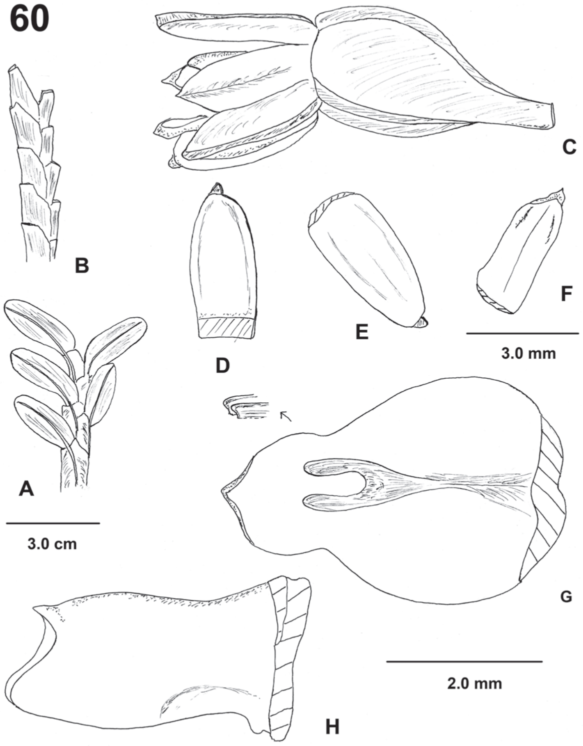


FIGURE 57–60. **57**, *Fernandezia steinbachii* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **58**, *Fernandezia teranii* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **59**, *Fernandezia tinquiana* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from holotype. **60**, *Fernandezia tintasensis* Ormerod. **A**, part of stem; **B**, part of stem minus leaves; **C**, flower; **D**, dorsal sepal; **E**, lateral sepal; **F**, petal; **G**, labellum; **H**, column. Drawn from holotype.

× 2.0–3.2 mm; leaf sheaths semitubular, smooth, striate, margins minutely denticulate. *Inflorescence* 8–21 mm long; peduncle 6–8 mm long (exposed part 4 mm long); rachis 6–10 flowered, 2–3 flowers open at once, 4–13 mm long; floral bracts widely ovate, acute, 1.5–2.0 mm long. *Flowers* white (anther cap purple-red in rehydrated flower of *Luer et al. 4881*). *Pedicellate ovary* weakly clavate, triquetrous, 1.8–2.7 mm long. *Dorsal sepal* lanceolate, acute, 1.9–2.0 × 0.7–0.8 mm. *Lateral sepals* obliquely lanceolate, obtuse, gently upcurved, thinly fleshy, 2.4–2.5 × 0.7–0.8 mm. *Petals* somewhat rhombic to narrowly oblong-elliptic, acute to subacute, 1.75–2.00 × 0.65–0.80 mm. *Labellum* ligulate-spatulate to broadly oblong-oblanceolate, acute to subacute, carinate below tip, 2.00 × 0.65–0.80 mm, lower half 0.60 mm wide; medially with 2 seemingly isolated subquadrate to semicircular lamellae. *Column* 1.0–1.1 mm long, 0.75 mm wide laterally.

Distribution: Bolivia.

Additional specimens examined: BOLIVIA. Cochabamba: Prov. Chapare, along road to Villa Tunari, 2400 m, 13 & 16 January 1981, *C. Luer, J. Luer, E. Besse & R. Vasquez 5656* (SEL); along road NE of Cochabamba, toward Villa Tunari, 2500 m, 4 February 1983, *C. Luer, J. Luer, E. Besse & R. Vasquez 8686* (SEL); along road to Villa Tunari, 2500 m, 22 January 1980, *C. Luer, J. Luer & R. Vasquez 4881* (SEL).

Habitat: humid montane forest dominated by Melastomataceae, Rubiaceae, and Asteraceae. Forest dominated by Ericaceae, pteridophytes, and abundant bryophytes. Soil not very deep, covered with decomposing organic matter (type), cloud forest (*Luer et al. 4881, 8686*), 2400–2500 m.

Eponymy: named after J. Teran, one of the collectors of the type specimen.

This species resembles *Fernandezia amboroensis* var. *amboroensis* in habit and flower size but differs in the flowers having somewhat rhombic (vs. weakly obovate-elliptic) petals, and ligulate-spatulate (vs. oblong-elliptic) lip with 2 remote lamellae in the middle. Another species with a similar lip is *F. cardenasii* (L.B. Smith & S.K. Harris) M.W. Chase, but in that taxon the lip is twice the length (ca. 4 mm long), and strongly cymbiform near the apex, thus giving it a canoe-like appearance. The measurements of *Luer et al. 4881* are not included in the description—it has rather shorter sepals but otherwise agrees in critical characters with the type. The deviant measurements are *dorsal sepal* 1.30 × 0.65 mm; *lateral sepals* 2.10 × 0.65 mm; *petals* 1.5 × 0.7 mm.

Fernandezia tinquiana Ormerod, *sp. nov.*

TYPE: BOLIVIA. Santa Cruz: Prov. Manuel M. Caballero, near Tinqui Laguna (8 km to the N of Comarapa), 2500–2600 m, 12–16 November 1995, *I.G. Vargas 4178 p.p.* (Holotype: NY, upper rhp). Fig. 59.

Related to *Fernandezia quadrangularis* Ormerod but with smaller flowers (sepals 1.80 vs. 2.50–2.95 mm), a broadly elliptic (vs. quadrangular) lip blade, and a more shortly stalked column.

Epiphytic (?) *herb*. *Roots* terete, profuse, 0.5–0.7 mm thick. *Stems* simple or occasionally 1–2 branched (branches 2.5–9.0 cm long), subdensely leafy, 3.0–25.5 cm long, to 0.15 cm wide across leaf sheaths, 0.05–0.07 cm thick. *Leaves* ovate, apiculate, fleshy, margins minutely denticulate toward apex, 6.0–6.5 × 4.0–5.0 mm; leaf sheaths semitubular, margins recurved, surface smooth. *Inflorescence* to 12 mm long; peduncle 5 mm long; rachis 6–9 flowered, to 7 mm long; floral bracts widely ovate, acute, to 2.5 × 2.0–2.2 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 2.3 mm long. *Dorsal sepal* oblong, subacute, 1.8 × 0.8 mm. *Lateral sepals* obliquely ovate-lanceolate, acute, midvein thickly carinate, 1.8 × 0.9 mm. *Petals* oblong-elliptic, acute, 1.75 × 0.80 mm. *Labellum* with a broadly elliptic blade from a short claw, obtuse, claw 0.5 mm long, blade 1.5 × 1.2 mm, in total 2.0 × 1.2 mm; callus of slightly divergent lamellae in the lower half of the blade. *Column* very shortly stalked, each side with a subquadrate-suborbicular wing, 1.15 mm long, 1 mm wide laterally.

Distribution: Bolivia.

Etymology: named after the type locality, Tinqui Laguna.

As noted above in the diagnosis, this taxon is related to *Fernandezia quadrangularis* but has smaller flowers and a broadly elliptic (not quadrangular) lip. The type sheet contains another element with narrower leaves, narrower leaf sheaths, and 3-flowered inflorescences.

Fernandezia tintasensis Ormerod, *sp. nov.*

TYPE: ECUADOR. Santiago-Zamora: slopes of Rio Tintas, SE of El Pan, 2895 m, 10 July 1943, *J.A. Steyermark 53505* (Holotype: AMES). Fig. 60.

Related to *Fernandezia putumayoensis* (Szlach., Kolan. & Mystk.) Molinari but leaves longer (26.0–27.0 vs 5.0–10.5 mm), flowers larger (sepals 3.50–3.80 vs. 2.30–2.65 mm), and column longer (2.8–3.0 vs. 1.9–2.0 mm).

Epiphytic (?) *herb*. *Roots* terete, to 1.6 mm thick. *Stem* simple, densely leafy, 35 cm long, to 1.2 cm wide across leaf sheaths, to 0.3 cm thick. *Leaves* oblong, obtuse, margin minutely denticulate toward apex, midvein low lamellate below, thinly coriaceous, 24–26 × 9-11 mm; leaf sheaths deltate, truncate. *Inflorescence* ca. 16 mm long; peduncle ca. 8 mm long, mostly hidden in leaf sheath; rachis pectinate, 7–8 mm long; floral bracts ovate, acute, 2.2 × 1.0 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, ca. 3.0–3.5 mm long; capsule triquetrous, 6.2 mm long, one side 3.2-3.3 mm wide. *Dorsal sepal* oblong, acute, midvein broadly carinate, 3.50–3.80 × 1.25–1.75 mm. *Lateral sepals* obliquely oblong, obtuse to subacute, 3.75–3.80 × 1.20–1.75 mm. *Petals* oblong, acute, 3.3–3.5 × 1.0–1.4 mm. *Labellum* ovate-subpandurate, acute, lower part 2.3–2.4 × 2.0–2.5 mm, upper part 1.6 × 1.3–1.5 mm, in total 3.8–4.0 × 2.0–2.5 mm; lower half of lip divided by a thick ridge that ends in 2 parallel, fleshy, oblongoid calli. *Column* rectangular in lateral view, each side at apex with a forward-pointing rounded wing, 2.8-3.0 mm long, 1.5-1.6 mm wide laterally.

Distribution: Ecuador.

Additional specimen examined: ECUADOR. Loja, Saraguro, 3300 m, cult. at Ecuagenera Gualaceo facility, 11 July 2002, *A. Hirtz 8419* (SEL).

Etymology: named after the Rio Tintas, near the type locality.

This species shares with the Colombian *Fernandezia putumayoensis* characters such as densely leafy stems and thinly coriaceous leaves set on broad triangular leaf sheaths. It differs in having longer leaves, larger flowers, and a longer column.

Fernandezia transversalis Ormerod, *sp. nov.*

TYPE: PERU. Amazonas: Prov. Bagua, Cordillera Colan, SE of La Peca, third camp, 2455 m, 6 October 1978, *P. Barbour 3770 p.p.* (Holotype: MO). Fig. 61.

A singular species characterized by the flowers having the labellum broadly clawed in the lower 2/3 while the upper 1/3 is transversely elliptic.

Epiphytic *herb*. *Roots* terete, 0.5–0.8 mm thick. *Stems* simple, laxly leafy, 10.5–25.0 cm long, 0.2–0.3 cm wide across leaf sheaths, 0.15 cm thick. *Leaves* narrowly oblong to elliptic, acute, coriaceous, 7.5–12.0 × 3.0–5.0 mm; leaf sheaths tubular, smooth, striate. *Inflorescence* hidden in leaf sheath and leaf base, ca. 5 mm long; peduncle ca. 3 mm long; rachis biflorous, ca. 2 mm long; floral bracts not seen. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, ca. 5 mm long. *Dorsal sepal* ovate-oblong, acute, carinate, 3.3 × 2.0–2.2 mm. *Lateral sepals* obliquely ovate-lanceolate, acute, carinate, 3.90 × 1.75–1.80 mm. *Petals* oblong-elliptic to elliptic, subacute, 3.65–3.80 × 2.1–2.2 mm. *Labellum* oblong-subpandurate in lower 2/3, upper 1/3 transversely elliptic, acute, lower 2/3 2.2–23 × 1.2–1.5 mm, upper 1/3 1.5–2.0 × 2.65–2.80 mm, in total 3.8–4.2 × 2.8 mm; lower 2/3 divided by a low ridge that becomes bilamellate in its upper part and ends in 2 triangular tips. *Column* somewhat elongate, with a low dorsal hump, 3.2 mm long, 1.7 mm wide laterally.

Distribution: Peru.

Additional specimens examined: PERU. Amazonas: Prov. Bagua, Cordillera Colan, SE of La Peca, third camp, 2455 m, 6 October 1978, *P. Barbour 3769* (MO); same area, 2440 m, 25 September 1978, *P. Barbour 3563* (MO).

Habitat: humid cloud forest (type; *Barbour 3769*), elfin bog (*Barbour 3563*), 2440–2455 m.

Etymology: from the Latin *transversus,* crosswise, going across, in reference to the transversely elliptic upper 1/3 of the labellum.

This unique species lacks close relatives in the genus *Fernandezia*. It is somewhat intermediate in habit between *F. subbiflora* Ruiz & Pav. and *F. crystallina,* but florally it resembles neither. The column is relatively long like in some species of *Fernandezia* related to *F. subbiflora,* but not broadly winged. The labellum shape is unique in the genus, with the narrower lower 2/3 suddenly expanded into a transversely elliptic “midlobe.”

Fernandezia unduaviae Ormerod, *sp. nov.*

TYPE: BOLIVIA. La Paz: Prov. Sud Yungas, 3.1 km E of Unduavi bridge, below on old road, 3000 m, 6 November 1982, *J.C. Solomon 8664* (Holotype: MO). Fig. 62.

Related to *Fernandezia gracillima* (C. Schweinf.) M.W. Chase but with a narrowly clawed lip bearing an oblong to elliptic blade (vs. shortly and broadly clawed lip with a suborbicular blade).

Epiphytic *herb*. *Roots* terete, 0.5–0.6 mm thick. *Stems* simple to 8 branched (branches 1.5–11.0 cm long), densely leafy, flexuous, 4–20 cm long, 0.03–0.10 cm thick. *Leaves* oblong, oblong-lanceolate, to elliptic, apiculate, thinly coriaceous, margins minutely denticulate near the apex, 5.0–8.0 × 1.5–4.0 mm; leaf sheaths semitubular, margins minutely denticulate. *Inflorescence* to 9 mm long; peduncle 3–5 mm long; rachis up to 5 flowered, to 4 mm long; floral bracts ovate-lanceolate, acute, 1.0–2.0 × 0.6–1.6 mm. *Flowers* white. *Pedicellate ovary* narrowly clavate, triquetrous, 1.5–2.7 mm long. *Dorsal sepal* oblong, subacute, low carinate, joined to petals for 0.5–0.8 mm basally, 1.70–2.30 × 0.65–0.90 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, low carinate, joined to each other and claw of lip for 1.2 mm, joined to petals for 0.5–0.8 mm, 1.9–2.8 × 0.8–0.9 mm. *Petals* oblong from a shortly clawed base, acute, midvein prominently carinate near apex, 1.7–2.0 × 0.7–0.8 mm. *Labellum* oblong to elliptic from a narrowly clawed base, acute, carinate below tip, claw ligulate, 0.80–1.15 mm long, blade 1.30–1.35 × 0.8-0.9 mm; callus of 2 semi-elliptic to obliquely deltate, obtuse lobes with low lamellate bases, the calli may or may not overlap the sides of the lip. *Column* each side medially dilated into a low suborbicular wing, 1.1–1.5 mm long, 0.7–0.9 mm wide laterally.

Distribution: Bolivia.

Additional specimens examined: BOLIVIA. La Paz: Prov. Nor Yungas, old road to La Paz, SW of Coroico, 2800 m, 4 February 1980, *C. Luer, J. Luer, R. Vasquez & R. Nara 5114* (SEL). Cochabamba: Prov. Chapare, near Siberia, between Comarapa and Cochabamba, 2500–2600 m, 18 January 1988, *C. Luer, J. Luer, E. Besse & R. Vasquez 8535* (SEL); NE of Cochabamba, toward Villa Tunari, 2500 m, 26–30 November 1978, *C. Luer, J. Luer, J. Kuhn & F. Fuchs 3554 p.p.* (SEL); toward Villa Tunari, 2500 m, 4 February 1983, *C. Luer, J. Luer, E. Besse & R. Vasquez 8685* (SEL).

Etymology: named after the Rio Unduavi, and its eponymous town and district, the type locality.

As noted above in the diagnosis, this species is close to the Peruvian *Fernandezia gracillima* but has a narrower lip claw with an oblong to elliptic (vs. suborbicular blade). Another close relative is the Peruvian *F. nunezii,* which has a more rectangular lip with distinctly right-angled corners (vs. rounded) at the base of the blade; furthermore, the calli seem a little more widely separated.

Fernandezia vaginata (Schltr.) M.W. Chase, Phytotaxa 20: 31. 2011.

Basionym: *Pachyphyllum vaginatum* Schltr., Rep. Sp. Nov. Regni Veg., Beih. 27: 182. 1924. TYPE: COLOMBIA. Cundinamarca: In the country around Bogota, 2500 m, 1921, *H. Hopf s.n.* (Holotype: B, destroyed). Neotype (here designated): COLOMBIA. Cundinamarca: Monserrate, above Bogota, 3200m, 26 March 1944, *M. Schneider 272* (Holoneotype: AMES; Isoneotype: COL, not seen). Fig. 63.

Homotypic synonym: *Orchidotypus vaginatus* (Schltr.) Senghas, in Schltr., Die Orchideen ed. 3, I/B (31): 1923. 1995.

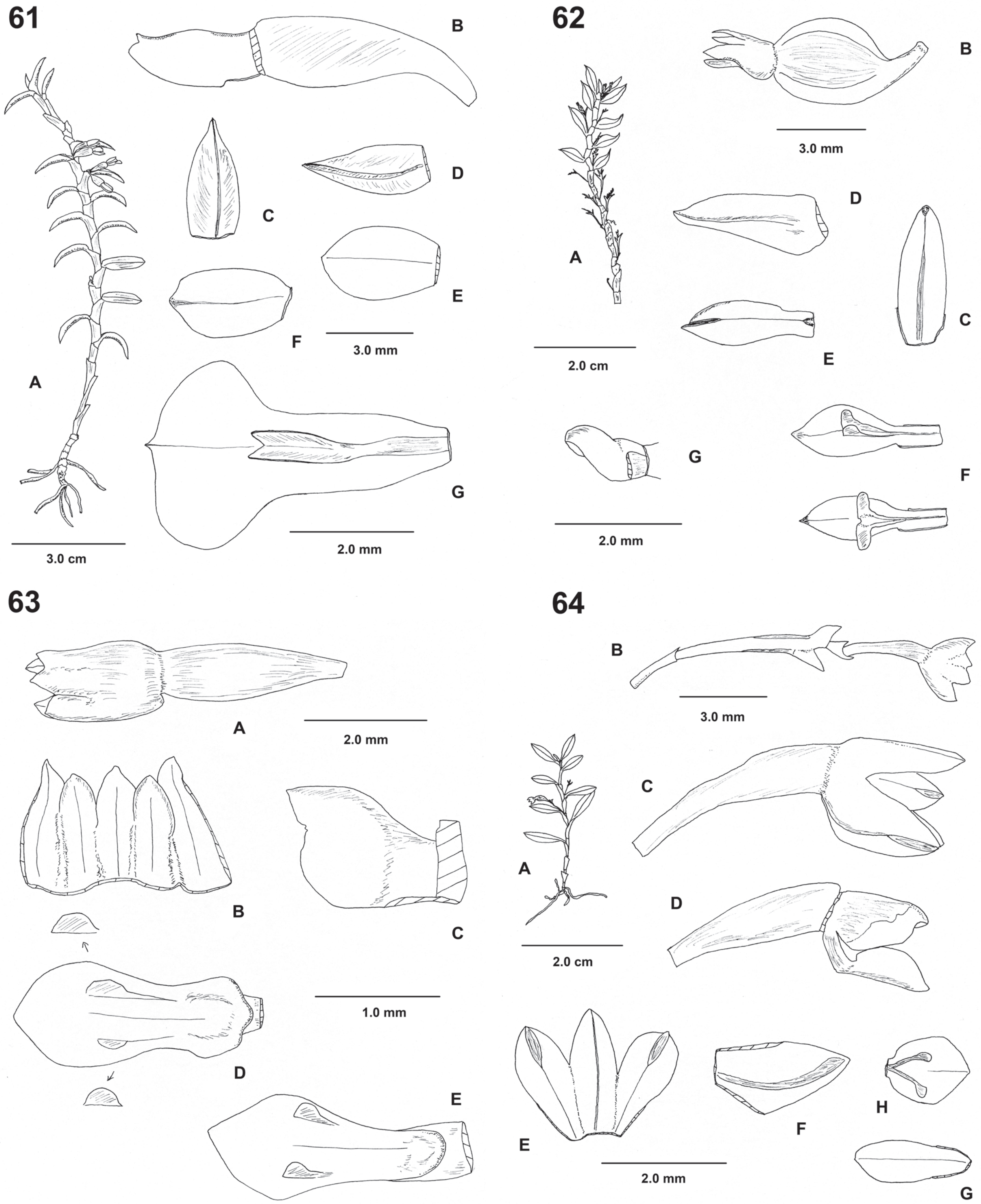


FIGURE 61–64. **61**, *Fernandezia transversalis* Ormerod. **A**, stem; **B**, column; **C**, dorsal sepal; **D**, lateral sepal; **E–F**, petals; **G**, labellum. Drawn from holotype. **62**, *Fernandezia unduaviae* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum (with calli unspread and spread); **G**, column. Drawn from holotype. **63**, *Fernandezia vaginata* (Schltr.) M.W. Chase. **A**, flower; **B**, tepals (lateral sepal, petal, dorsal sepal, petal, lateral sepal); **C**, column; **D–E**, labellums. A–D from neotype; E from *Garcia-Barriga & Jaramillo Mejia 19784* (AMES). **64**, *Fernandezia vanderwerffii* Ormerod. **A**, stem; **B**, inflorescence; **C**, flower; **D**, labellum and column; **E**, tepals (petal, dorsal sepal, petal); **F**, lateral sepal; **G**, petal (inside); **H**, labellum blade. Drawn from holotype.

Usage synonym: *Orchidotypus schultesii auct. non* (L.O. Williams) Senghas, Szlach., Kolan. & Mystk., Polish Bot. J. 59, 2: 170, f.6. 2014 *p.p.*

Epiphytic *herb*. *Roots* terete, 0.3–0.5 mm thick. *Stems* simple, secondly to distichously leafy, 1–5 cm long. *Leaves* ligulate-lanceolate, acute, margins minutely denticulate near the apex, 4.0–7.0 × 1.2–2.1 mm; leaf sheaths with a lobe each side at apex, margins minutely papillose-denticulate. *Inflorescence* 2.9 mm long; peduncle 2.7 mm long; rachis 1–2 flowered, 0.2 mm long; floral bracts deltate, acute, ca. 1 mm long. *Flowers* white, or light greenish with a white lip. *Pedicellate ovary* clavate, 2–3 mm long. *Dorsal sepal* oblong, subacute, united to petals and lateral sepals for ca. 0.8 mm, free part ca. 1 mm long, in total 1.75–1.80 × 0.70–0.80 mm. *Lateral sepals* obliquely oblong, acute, united to each other and petals for ca. 0.8 mm, 1.85–1.90 × 0.75–0.80 mm. *Petals* from an oblong part united to sepals, dilated into an ovate-elliptic lobe, acute to subacute, free part 0.70–0.90 × 0.70–0.75 mm, in total 1.70–1.75 × 0.70–0.75 mm. *Labellum* broadly clawed, obovate-oblong, subacute, thinly carinate below tip, claw 0.8 × 0.6 mm, upper part 0.80–0.95 × 0.70–0.80 mm, in total 1.65–1.75 × 0.80 mm; calli 2, remote, semicircular. *Column* shortly and broadly stalked, each side with a low broad wing, 0.95–1.00 mm long, 0.8 mm wide laterally.

Distribution: Colombia.

Additonal specimens examined: COLOMBIA. Santander del Norte: below Paramo de Jurisdicciones, 3150 m, 10 May 1984, *C. Luer, J. Luer, R. Escobar & E. Valencia 10237* (MO). Santander del Norte/Cesar: 20 km to the S of Abrego, Las Jurisdicciones (Cerro de Oroque), 3700–3960 m, 19/21 May 1969, *H. Garcia-Barriga & R. Jaramillo 19784* (AMES); same area, 3000–3900 m, 22–27 July 1974, *H. Garcia-Barriga & R. Jaramillo 20683* (GH).

This species is closely related to *Fernandezia schultesii* but generally it has slightly smaller (sepals 1.75–1.90 vs. 2.2–2.9 mm long) flowers with an elliptic (vs. triangular in upper half) dorsal sepal, and ovate (vs. ovate-lanceolate) petals. It is possible that the plant (*G.C.K. Dunsterville 1029*) from Venezuela illustrated as *Pachyphyllum schultesii* in Dunsterville and Garay (1979) actually represents *Fernandezia vaginata,* because it agrees in all the characters of the species cited above.

Fernandezia vanderwerffii Ormerod, *sp. nov.*

TYPE: PERU. Amazonas: Chachapoyas to Mendoza road, a little past Molinopampa, 2400 m, 15 March 1998, *H. van der Werff, B. Gray, R. Vasquez & R. Rojas 15056* (Holotype: MO). Fig. 64.

Similar to *Fernandezia tenuis* (Schltr.) M.W. Chase but with broader (1.5–3.0 vs. 1.0 mm) leaves, and the labellum with smaller lamellae that do not overlap the edges of the blade.

Epiphytic *herb*. *Roots* terete, slender, 0.2–0.6 mm thick. *Stems* simple to 5 branched (branches 3.2–5.0 cm long), densely leafy, weakly to moderately flexuous, 2.1–9.0 cm long, 0.01–0.10 cm thick. *Leaves* oblong-oblanceolate to oblanceolate, acute, thin, 6.0–9.0 × 1.5–3.0 mm; leaf sheaths semitubular, smooth, striate, 2.5–3.0 mm long. *Inflorescence* 5.01–8.00 mm long; peduncle narrowly winged toward apex, 5 mm long; rachis 1–5 flowered, 0.1–3.0 mm long; floral bracts ovate-deltate, acute, ca. 1 × 1 mm. *Flowers* white. *Pedicellate ovary* clavate, 3 mm long. *Dorsal sepal* oblong, cymbiform, subacute, midvein low carinate, joined to lateral sepals and petals for 0.5–1.0 mm, 1.80 × 0.75–0.80 mm. *Lateral sepals* obliquely rhombic, subacute, midvein carinate, united to claw of labellum, 1.9 × 1.0 mm. *Petals* oblong-oblanceolate, subacute, midvein thickly carinate in apical third, ca. 1.75 × 0.75 mm. *Labellum* clawed, pentagonal, subacute, claw ca. 0.7–0.8 mm long, blade 1.2 × 1.0 mm, in total ca. 2 × 1 mm; lower half of lip with 2 widely divergent lamellae, each raised apically ovate-elliptic lobule. *Column* each side with low wing, broadest in the lower half, 1.2 mm long, 0.9–1.0 wide laterally.

Distribution: Peru.

Habitat: scrub and degraded forest (type), 2400 m.

Eponymy: named after Henk van der Werff (1946–), one of the collectors of the type and well-known specialist in Lauraceae.

Fernandezia vanderwerffii appears to be related to *F. gracillima* and its two closest allies (*F. nunezii* and *F. unduaviae*), which however differ in having elliptic leaves tapered at each end. Another similar Peruvian species is *F. tenuis* (Schltr.) M.W. Chase, but it has much narrower leaves (1 mm wide) and the lip has much larger calli that far overlap the sides of the lip when spread out.

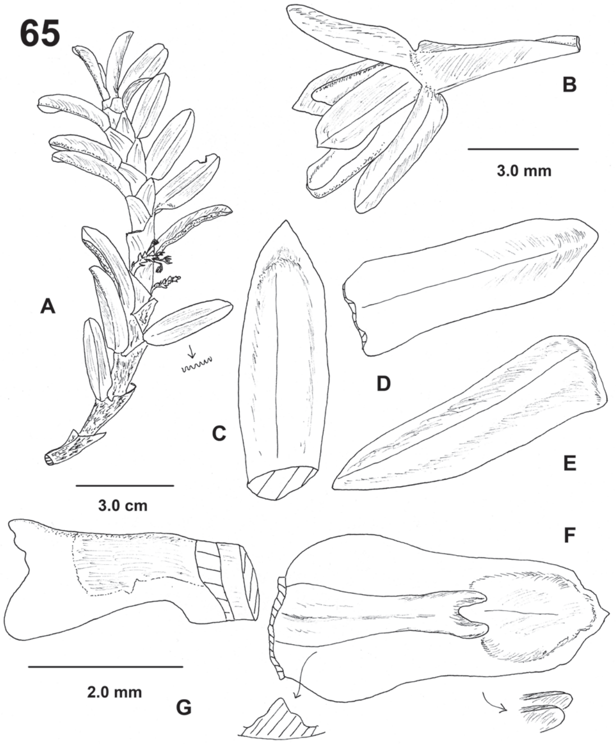
Fernandezia vargasii Ormerod, *sp. nov.*

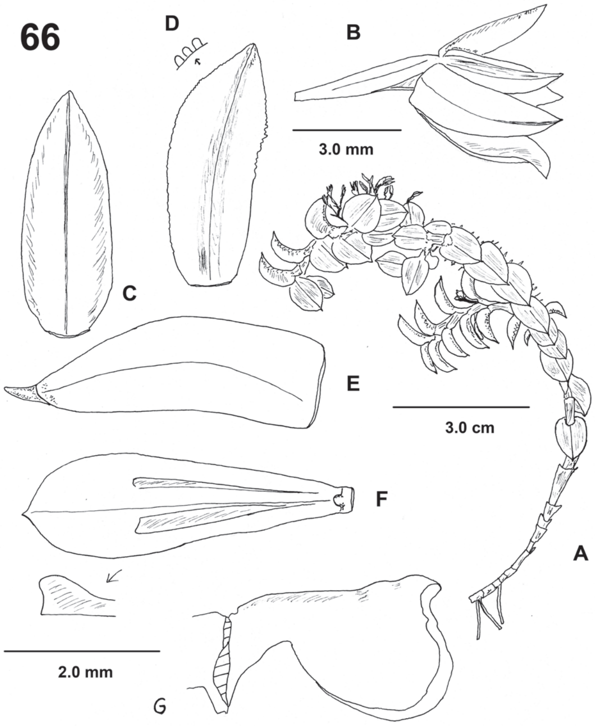
TYPE: PERU. Cusco: Prov. La Convencion, Tanamanche to Quellomayo, 3750 m, 25 July 1944, *C. Vargas C. 4445* (Holotype: AMES). Fig. 65.

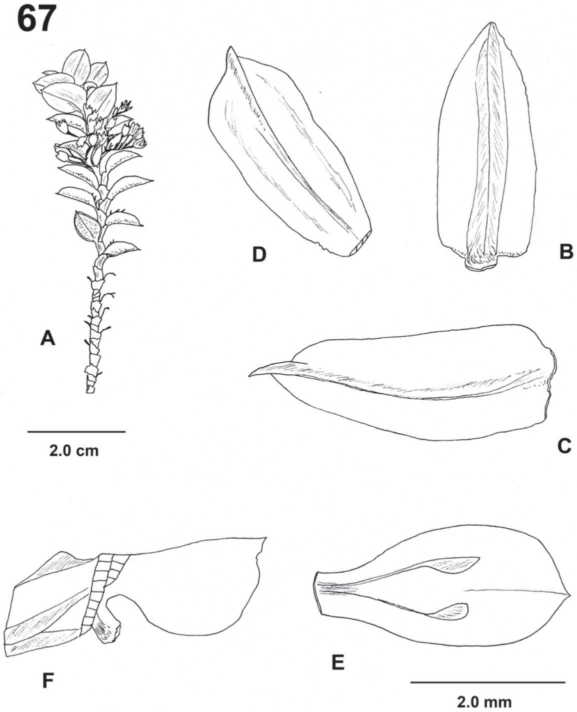
Usage synonym: *Pachyphyllum distichum auct. non* Kunth, C. Schweinf., Fieldiana, Bot. 30, 4: 975, 1961 *p.p.*

Related to *Fernandezia distichoides* M.W. Chase but the leaves oblong to oblong-elliptic (vs. narrowly oblong), not so fleshy, and flat (vs. V-shaped in section).

Epiphytic (?) *herb*. *Roots* terete, 0.8–2.0 mm thick. *Stems* stout, simple to branched (branches to 3.5 cm long), densely leafy, 17.0–21.5 cm long, up to 1 cm wide across leaf sheaths, 0.3–0.5 cm thick. *Leaves* oblong-elliptic to oblong, obtuse, coriaceous, margins minutely laxly denticulate, denser apically, 12.0–31.0 × 7.0–9.5 mm; leaf sheaths (exposed part) triangular, smooth, striate, margins minutely laxly denticulate, exposed dorsal edge to 8 mm long. *Inflorescence* to 19.5 mm long; peduncle 6.5–7.0 mm long; sheathing bract midway along peduncle, 3 mm long; rachis densely flowered, to 11 mm long; floral bracts suborbicular, acuminate, margins minutely denticulate, 3 × 4 mm. *Flower* color not known. *Pedicellate ovary* clavate, triquetrous, 4 mm long. *Dorsal sepal* oblong, acute, rigid, fleshy, 3.1 × 1.2 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, rigid, fleshy, 3.2 × 1.2 mm. *Petals* oblong, subacute, 2.9 × 1.1 mm. *Labellum* ovate-oblong, subacute, carinate below tip, lower part 2.2 × 2.0–2.1 mm, upper part shallowly concave, 1.75 × 1.50 mm, in total 3.95 × 2.0–2.1 mm; lower part divided by a thick ridge that ends in 2 oblong, parallel calli. *Column* clavate, at apex each side with a rounded, forward-pointing wing, 2.3 mm long, 1.5 mm wide laterally.







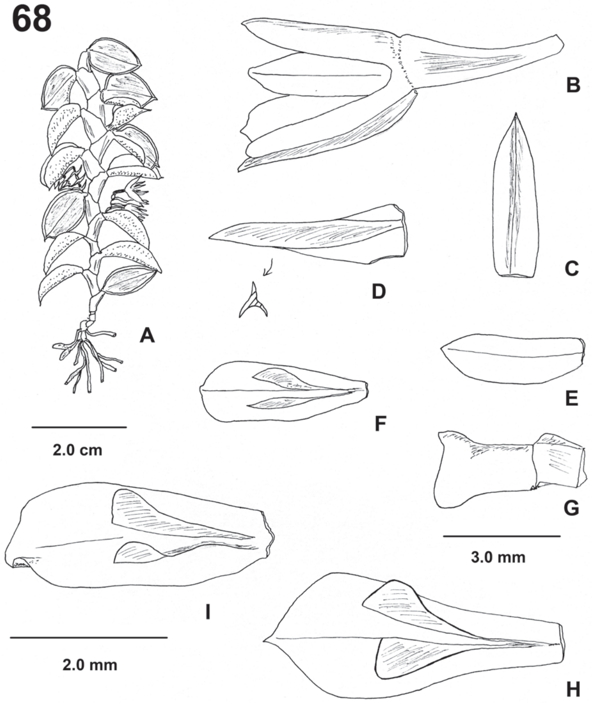


FIGURE 65–68. **65**, *Fernandezia vargasii* Ormerod. **A**, stem (upper part); **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype. **66**, *Fernandezia weberbaueri* Ormerod var. *weberbaueri*. **A**, stem; **B**, flower; **C**, dorsal sepal; **D**, petal; **E**, lateral sepal; **F**, labellum; **G**, column. Drawn from holotype. **67**, *Fernandezia weberbaueri* Ormerod var. *platychila* Ormerod. **A**, stem (upper part); **B**, dorsal sepal; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from holotype. **68**, *Fernandezia weberbaueri* Ormerod var. *tricrucensis* Ormerod. **A**, stem; **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column; **H–I**, labellums. A–G from holotype; H from *Cano 3997* (MO); I from *Huamantupa et al*. *6971* (MO).

Distribution: Peru.

Eponymy: named after C. Vargas Calderon (1903–2002), Peruvian botanist and collector of the type.

This species is a member of the florally conservative *Fernandezia distichoides* complex. It may be distinguished from *F. distichoides* by its flatter, less fleshy, oblong-elliptic to oblong leaves. In *F. distichoides* the leaves are fleshier with upcurved sides and narrowly oblong.

It should be noted that the plant illustrated as *Pachyphyllum distichum* Kunth (= *Fernandezia distichoides* M.W. Chase) by Bennett and Christenson (1998) is not related to that species but is rather an undescribed member of section *Lamellata* (i.e., related to *F. pectinata*). The depiction of a thick V-shaped callus on the lip is erroneous and is correctly interpreted as 2 lamellae arising from the thickened midline of the lip.

Fernandezia weberbaueri Ormerod, *sp. nov.*
TYPE: PERU. Cusco: Prov. Quispicanchi, Marcapata, 3000–3100 m, 17 February 1929, *A. Weberbauer 7813* (Holotype: F). Fig. 66.

Related to *Fernandezia ichneumonea* Ormerod but the leaves flat (vs. conduplicate) with a shorter (1 vs. 2 mm long) apiculus, the inflorescences generally with more (up to 5 vs. up to 3) flowers, the dorsal sepal acute (vs. subacuminate), and the column with broader (1.5–1.6 vs. 1.3 mm wide) wings.

Epiphytic *herb*. *Roots* terete, 0.5–0.7 mm thick. *Stems* simple to branched (branches 1–3 cm long), laxly to densely leafy, 6–16 cm long, ca. 1–2 mm thick. *Leaves* ovate-elliptic to ovate-suborbicular, acute or with an apiculus to 1 mm long, margins minutely denticulate near the apex, coriaceous, 5.5–8.0 × 4.5–7.5 mm; leaf sheaths tubular, margins minutely denticulate. *Inflorescence* to 7 mm long; peduncle 3-4 mm long; rachis up to 5 flowered, ca. 3–4 mm long; floral bracts ovate-lanceolate, acute, margins minutely denticulate, to 2.8 × 1.6 mm. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, 3.0–3.5 mm long. *Dorsal sepal* oblong to oblong-lanceolate, acute, 2.9–4.2 × 1.1–1.2 mm. *Lateral sepals* obliquely oblong, apiculate, midvein carinate, 3.75–4.00 × 1.20–1.60 mm. *Petals* obliquely oblong, acute, margins subentire to papillose-denticulate, midvein carinate near apex, 3.1–3.2 × 1.1 mm. *Labellum* oblanceolate, acute, 3.3–3.8 × 1.3–1.5 mm; lamellae 2, weakly divergent, running 2/3 length of lip. *Column* each side with an obliquely semicircular, rounded wing, 2.1 mm long, 1.5–1.6 mm wide.

Distribution: Peru.

Additional specimen examined: PERU. Cusco: Prov. Paucartambo, Pillahuata to Ajanaco, 3000 m, 1994, *D. Moscoso Z. 1019E* (MO).

Habitat: bushwood consisting of high shrubs and small trees, with many hard-leafed types (type), 3000–3100 m.

Eponymy: named after the collector of the type, Augusto Weberbauer (1871–1948), German naturalist and botanist, who devoted much of his life to furthering botanical studies in Peru.

As noted above I consider this plant closely related to *Fernandezia ichneumonea,* but it seems to be more slender in appearance with narrower leaf sheaths, shorter apiculi at the leaf tips, more floriferous inflorescences, flowers with an acute (vs. subacuminate) dorsal sepal, and broader column wings.

Fernandezia weberbaueri var. ***platychila*** Ormerod, *var. nov.*
TYPE: PERU. Cusco: Prov. La Concencion, Distrito Huayopata, Sector San Luis, 2995 m, 23 November 2006, *L. Valenzuela, J. Farfan & E. Suclli 8087* (Holotype: MO). Fig. 67.

Differing from typical *F. weberbaueri* in having a shorter and broader labellum.

Epiphytic *herb*. *Roots* terete, 0.4–1.0 mm thick. *Stems* simple, densely leafy, 6.0–19.3 cm long, 0.18–0.28 cm wide across leaf sheaths, 0.05–0.10 cm thick. *Leaves* ovate to ovate-elliptic, apiculate, coriaceous, 6.5–12.0 × 4.0–6.0 mm; leaf sheaths semitubular, smooth. *Inflorescence* to 9 mm long; peduncle to 6 mm long; rachis 3–6 flowered, 0.5-3.0 mm long; floral bracts deltate-lanceolate, acute, ca. 1 mm long. *Flowers* white. *Pedicellate ovary* clavate, trialate, 5 mm long. *Dorsal sepal* oblong, acute, midvein thickly carinate, 3.0 × 1.2 mm. *Lateral sepals* obliquely oblong, acute, carinate, 3.7 × 1.4–1.5 mm. *Petals* broadly oblong-oblanceolate, subacute, midvein carinate, 2.85 × 1.15 mm. *Labellum* shortly clawed, blade elliptic, subacute, 3.0 × 1.7 mm; claw divided medially by a low thickening that divides into 2 divergent lamellae that each end in a triangular lobe. *Column* shortly and broadly stalked, each side with a broadly semicircular wing, 1.7 mm long, 1.1–1.2 mm wide laterally.

Distribution: Peru.

Habitat: disturbed primary forest, 2995 m.

Etymology: from the Classical Greek *platys,* broad, and *cheilos,* lip, in reference to the broad labellum of this variety.

As noted above, this variety differs in its shorter and broader lip.

Fernandezia weberbaueri var. ***tricrucensis*** Ormerod, *var. nov.*
TYPE: PERU. Cusco: Prov. Paucartambo, Distrito Challabamba, Tres Cruces, 3450 m, 27 October 2007, *R. Vasquez, C. Davidson, S. Davidson, J. Farfan, E. Suclli & A. Pen 32884* (Holotype: MO). Fig. 68.

Differing from *Fernandezia weberbaueri* Ormerod var. *weberbaueri* in the flowers having a column with straight lower margins and the wings slightly apically produced and rounded.

Epiphytic *herb*. *Roots* terete, 0.4–1.0 mm thick. *Stems* simple to branching (branches 1.5 cm long), sublaxly to densely leafy, 6–15 cm long, 0.2–0.4 cm wide across leaf sheaths, 0.08 cm thick. *Leaves* oblong, ovate, to ovate-elliptic, shortly apiculate, margin minutely denticulate toward apex, drying pale greenish-blue with a white margin (type), 8.0–13.0 × 4.5–8.5 mm; leaf sheaths semi-rhombic in lateral view, truncate, margins recurved, entire to minutely denticulate, 5 mm long. *Inflorescence* to 9 mm long; peduncle 3.5–4.0 mm long; rachis 5–6 flowered, 5 mm long; floral bracts ovate-rhombic, acute, margins entire to minutely denticulate, to 2.8 × 2.4 mm. *Flowers* white. *Pedicellate ovary* clavate, triquetrous, ca. 4 mm long. *Dorsal sepal* ligulate to oblong-lanceolate, acute, midvein low carinate, 3.25–4.00 × 1.20–1.30 mm. *Lateral sepals* obliquely lanceolate, acute, high carinate, 4.00–4.65 × 1.10–1.75 mm. *Petals* narrowly oblong, acute, 3.00–3.75 × 0.95–1.20 mm. *Labellum* oblong-oblanceolate to oblong-cuneate, subacute, carinate below tip, 3.65–4.10 × 1.35–1.80 mm; midline thickened in lower 1/4 of lip before dividing into 2 weakly divergent lamellae. *Column* each side with a low, suborbicular, apical wing, 1.9–2.2 mm long, 1.0–1.6 mm wide laterally.

Distribution: Peru.

Additional specimens examined: PERU. Cusco: Prov. Paucartambo, Pillahuata, Tres Cruces, about 130 km from Cusco on the road toward Pilcopta, 2000 m, 4 April 1987, *P. Nunez 7805 p.p.* (NY); Acjanaco, Cerro Macho Cruz, 3440 m, 28 July 1990, *A. Cano E. 3997* (MO). Prov. La Convencion, Distrito Santa Teresa, Uchuyillaspay, 3885 m, 22 September 2005, *I. Huamantupa, N. Anaya, M. Callalli, J. Tito, L. Vargas & E. Paz 6971* (MO).

Habitat: roadside remnant forest (type), frequent in forest dominated by *Weinmannia* (*Cano 3997*), in mixed "Pajonal" (*Huamantupa et al. 6971*), 2000–3885 m.

Etymology: named after the type locality, Tres Cruces.

Fernandezia weberbaueri var. *tricrucensis* may be distinguished from typical *F. weberbaueri* by its flowers having a column with straight lower margins with slightly produced and rounded wings at the apex.

Fernandezia yahuarcochae Ormerod, *sp. nov.*
TYPE: PERU. Cajamarca: Prov. Chota, Laguna Yahuarcocha (above Incahuasi), 3600 m, 14 September 1985, *A. Sagastegui A., D. Skillman, J. Mostacero L. & L. Ramirez V. 12885* (Holotype: MO; Isotypes: F, HUT, not seen). Fig. 69.

Related to *Fernandezia hamiltonii* Ormerod but flowers with the upper half of the labellum wider (1.50–1.60 vs. 1.10–1.15 mm).

Lithophytic (?) *herb*. *Roots* terete, 0.75–1.00 mm thick. *Stems* simple, densely leafy, 6–18 cm long, 0.3–0.6 cm wide across leaf sheaths. *Leaves* ligulate, acute, thickly coriaceous, 8–10 mm long, 1.2–2.0 mm wide laterally; leaf sheaths deltate in lateral view, truncate, smooth. *Inflorescence* ca. 8 mm long; peduncle hidden in leaf sheath, ca. 4 mm long; rachis 4–5 flowered, ca. 4 mm long; floral bracts ovate-deltate, acute, 2.5 × 2.2 mm. *Flowers* whitish. *Pedicellate ovary* clavate, triquetrous, 2.5 mm long; capsule triquetrous, 5 mm long (incl. 1.2 mm long pedicel), one side 4 mm side. *Dorsal sepal* oblong-lanceolate, subacute, midvein low carinate, 2.8 × 1.2 mm. *Lateral sepals* obliquely oblong, subacute, midvein high carinate in upper half, 2.9 × 1.2 mm. *Petals* broadly oblong-oblanceolate, subacute, 2.20–2.30 × 1.15–1.20 mm. *Labellum* oblong-elliptic, shallowly subpandurate, carinate below tip, lower half 1.8 × 2.0 mm, upper half 1.2 × 1.5–1.6 mm, in total ca. 3 mm × 2 mm; lower half divided by a thick ridge ending in 2 conical-ellipsoid calli. *Column* cuneate in lateral view, 2 mm long, 1.2 mm wide laterally.

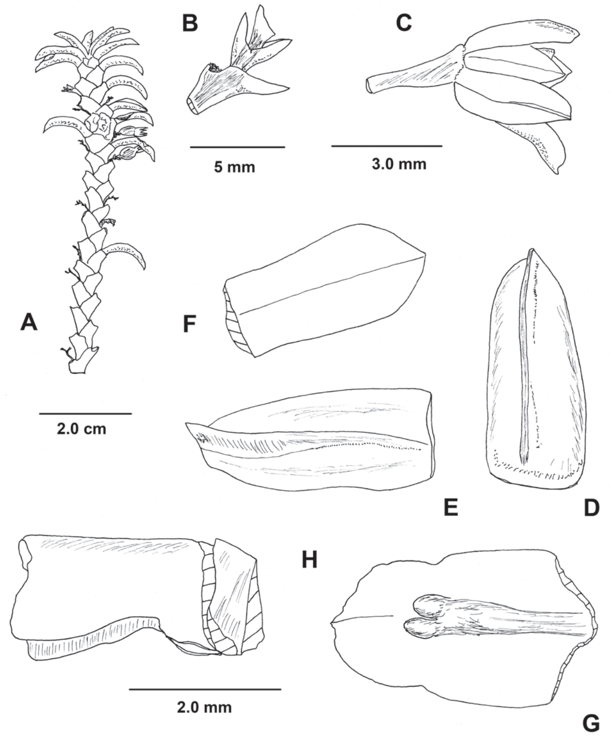


FIGURE 69. *Fernandezia yahuarcochae* Ormerod. **A**, stem (upper part); **B**, rachis; **C**, flower; **D**, dorsal sepal; **E**, lateral sepal; **F**, petal; **G**, labellum; **H**, column. Drawn from holotype.

Distribution: Peru.

Habitat: rocky "Jalca," 3600 m.

Etymology: named after the type locality, Lake Yahuarcocha.

This species appears to be related to *Fernandezia hamiltonii* but differs in having the leaves more drawn out toward the apex, and the upper half of the lip is wider (1.50–1.60 vs. 1.10–1.15 mm).

LITERATURE CITED

BENNETT, JR., D. E. AND E. A. CHRISTENSON. 1998. *Pachyphyllum distichum* Kunth. Icon. Orch. Peruv.: t. 547.

CHASE, M.W. AND W. M. WHITTEN. 2011. Further taxonomic transfers in Oncidiinae (Orchidaceae). Phytotaxa 20: 26–32.

CHRISTENSON, E. A. 2008. A Synopsis of *Pachyphyllum* (Orchidaceae). J. Bot. Res. Inst. Texas 2, 1: 285–289.

DUNSTERVILLE, G. C. K. AND L. A. GARAY. 1972. Venezuelan Orchids Illustrated 5. Andre Deutsch, London.

———. 1979. *Orchids of Venezuela. An Illustrated Field Guide. P–Z.* Botanical Museum, Harvard University, Cambridge, U.S.A.

KOLANOWSKA, M. AND D. L. SZLACHETKO. 2014. Notes on Pachyphyllinae (Vandoideae, Orchidaceae) with a description of a new genus. Plant Syst. Evol. 300, 5: 95–111.

KUNTH, C. S. 1816. *Nova Genera et Species Plantarum 1*. Librariae Graeco-Latini-Germanicae, Paris.

NEUBIG, K. M., W. M. WHITTEN, N. H. WILLIAMS, M. A. BLANCO, L. ENDARA, J. G. BURLEIGH, K. SILVERA, J. C. CUSHMAN, AND M. W. CHASE. 2012. Generic recircumscriptions of Oncidiinae (Orchidaceae: Cymbidieae) based on maximum likelihood analysis of combined DNA datasets. Bot. J. Linn. Soc. 168: 117–146.

ORMEROD, P. 2016. Neotropical Orchid Miscellanea. Harvard Pap. Bot. 21, 2: 231–245.

RUIZ, H. AND J. PAVON. 1794. *Flora Peruviana et Chilensis Prodromus*. Imprenta de Sancha, Madrid.

SCHLECHTER, R. 1929. Figuren-Atlas zu den Orchideenfloren der sudamerkanischen Kordillerenstaaten. Repert. Sp. Nov. Regni Veg., Beih. 57: Taf. 1–142.

———. 1930. Blutenanalysen neuer Orchideen. I. Suderamerikanische Orchideen. Repert. Sp. Nov. Regni Veg., Beih. 58: Taf. 1–60.

SCHWEINFURTH, C. 1970. First Supplement to the Orchids of Peru. Fieldiana, Bot. 33: 1–80.

SZLACHETKO, D. L., M. KOLANOWSKA, AND K. MYSTKOWSKA. 2014. A Synopsis of the Genus *Orchidotypus* (Orchidaceae, Vandoideae) in Colombia, with description of a new species. Polish Bot. J. 59(2): 165–172.

NOTES ON *ZEUXINE* LINDL. (ORCHIDACEAE: GOODYERINAE)

Paul Ormerod[1]

Abstract. Notes are supplied on various species of the Jewel Orchid genus *Zeuxine,* particularly those taxa found in western Malesia, nearby Thailand, and Cambodia. Narrower circumscriptions are proposed for *Z. gracilis* and *Z. parvifolia,* whereas *Z. flava* is expanded into a broader concept. *Zeuxine leucochila* is reinstated, and the identities of *Z. exilis* and *Z. rupestris* are clarified. *Zeuxine leucochila* var. *cambodiana* is raised to species status as *Z. cambodiana,* and three new species are proposed, namely, *Z. eryliae, Z. pseudogracilis,* and *Z. subquadrata*.

Keywords: *Zeuxine,* new species, synonymy, Malesia

Zeuxine Lindl. is a genus of 90–100 tender, delicate terrestrial herbs, growing among leaf litter on the floors of various types of forest. Only a few species (*Z. strateumatica* [L.] Schltr. and its allies) grow in open places like fields and lawns. The plants have rather small (sepals 3–8 mm long) flowers, usually with greenish sepals, white petals and lip. Because of the superficial similarity (stems with wilted leaves at anthesis, small pubescent flowers, and bilobed lip with rectangular lobules) of some of the taxa discussed here, there has been much confusion in the literature, with several misidentifications evident, thus leading to overly broad synonymies.

In the taxonomic treatment provided below, it is intimated that more attention needs to be paid to certain floral parts of *Zeuxine,* especially the glands in the labellum, the profile of the column, placement of the stigma lobes, and shape of the rostellum lobes. Unfortunately, these parts can be difficult to study in old or poor herbarium material and may shrink or deteriorate.

Zeuxine cambodiana (Gagnep.) Ormerod, *comb. et stat. nov.*
Basionym: *Zeuxine leucochila* Schltr. var. *cambodiana* Gagnep., in Lecomte, Fl. Gen. Indo-Chin. 6: 555. 1934. TYPE: CAMBODIA. Kep, 18 November 1904, *C. Geoffray 453* (Holotype: P; Isotype: P). Fig. 1.

Terrestrial *herb. Rhizome* terete, slender, short, to 16 mm long. *Roots* terete, pubescent, emerging from nodes. *Stems* erect, terete, 5–10 leaved, 47–75 × 2 mm; internodes to 24 mm long. *Leaves* obliquely oblong-lanceolate to ovate-elliptic, acute, 21–49 × 10–16 mm; petiole and sheath 9–16 mm long. *Inflorescence* pubescent, 87–173 mm long; peduncle 52–107 mm long; sheathing bracts two to three, lax to scattered, 12–18 mm long; rachis subdensely to densely many-flowered, 35–81 mm long; floral bracts ovate-lanceolate, acute, to 9 mm long. *Flowers* white rose, slightly fragrant. *Pedicel with ovary* fusiform, laxly pubescent, ca. 7.5 mm long. *Dorsal sepal* ovate-lanceolate, acute, concave, forming a galea with the petals, ca. 5.0 × 2.5 mm. *Lateral sepals* obliquely ovate-lanceolate, acute, ca. 4.8 × 2.0 mm. *Petals* oblong-oblanceolate, subacute, 2 veined, ca. 4.80 × 1.75 mm. *Labellum* ca. 4 mm long; hypochile saccate, ca. 2 mm long and wide, inside each side with a single, obliquely triangular gland with a short, decurved free tip; mesochile semitubular, ca. 1 mm long; epichile bilobed, ca. 1.0 × 4.5–5.0 mm, lobules cuneate, obtuse to truncate, ca. 2.25 × 1.50 mm. *Column* 2.0–2.1 mm long.

Distribution: Cambodia.

Gagnepain (1934) distinguished this taxon from the Thai *Zeuxine leucochila* by its broader leaves and inflorescence with more flowers. However, the isotype of *Z. leucochila* in Paris is a small specimen, thus these differences are somewhat artificial. *Zeuxine cambodiana* may be distinguished from *Z. leucochila* by the glands in the lip that are obliquely triangular with only a short, free apex (vs. subulate-lanceolate and mostly free), and the ligulate (vs. spathulate) arms of the rostellum.

Zeuxine clandestina Blume, Coll. Orch. Arch. Ind.: 70. 1858; Fl. Javae Ins. Adj. n.s. 1: 57. 1858. TYPE: INDONESIA. Java, Eastern part, *F.A.C. Waitz s.n.* (Holotype: L, not seen). Fig. 2.
Homotypic synonym: *Monochilus clandestinum* (Blume) Miquel, Fl. Ned. Ind. 3: 724. 1859.

Distribution: Indonesia (Java); Singapore; Malaysia (Peninsula).

Additional specimens examined: INDONESIA. Java: Batavia, Tjiletoeh, NE of Leuwiliang, W of Buitenzorg, 300 m, 14 August 1927, *R.C. Bakhuisen van den Brink Sr. 6852* (L). SINGAPORE. Bukit Timah Nature Reserve, Taban Valley, 4 March 2003, *R. Kiew, P. Leong, A. Samsuri & A.T. Gwee GW2* (SING); Holland Woods, 5 January 2011, *I. Hassan SING 2011-001* (SING); Holland Woods, 16 August 2011, *P. Leong & I. Hassan SING 2011-522* (SING); Holland Woods, 16 August 2011, *I. Hassan & P. Leong SING 2011-523* (SING).

Seidenfaden (1978) reported *Zeuxine clandestina* from Thailand, Peninsular Malaysia, and Singapore. However, the specimen from Peninsular Malaysia (*Haniff 2405*) is referrable to *Z. pseudogracilis,* and the one from Singapore to *Z. parvifolia*. The collection from Thailand I haven't seen, but it needs to be critically restudied. Nevertheless *Z. clandestina* likely occurs in Peninsular Malaysia since Holttum's 1957 drawing agrees well the characters of the

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I wish to thank herbarium and library staff at AMES, BM, and K for their help and hospitality during my visits. K, L, P, and SING also loaned material for this study. Paul Leong (SING) kindly sent images and drawings of Singaporean material of *Z. clandestina*.

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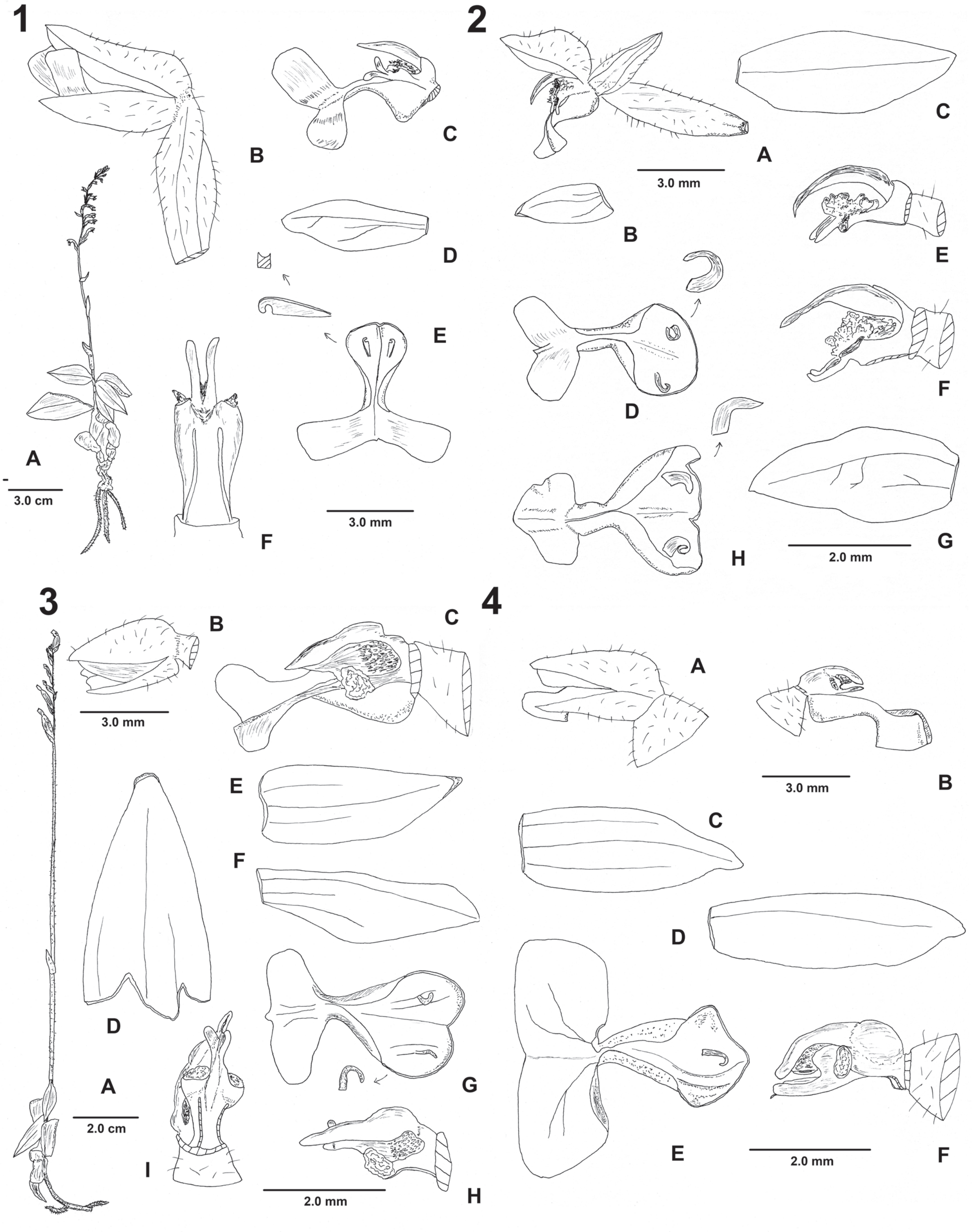

FIGURE 1–4. 1, *Zeuxine cambodiana* (Gagn.) Ormerod. **A**, plant; **B**, flower; **C**, flower minus tepals; **D**, petal; **E**, labellum; **F**, column, ventral. Drawn from holotype. 2, *Zeuxine clandestina* Blume. **A**, flower; **B**, lateral sepal; **C**, **G**, petals; **D**, **H**, labella; **E**, **F**, columns. A–E from *Bakhuisen van der Brink 6852* (L); F–H from *Hassan & Leong SING 2011-523* (SING). 3, *Zeuxine eryliae* Ormerod. **A**, plant; **B**, flower; **C**, flower minus tepals; **D**, dorsal sepal; **E**, lateral sepal; **F**, petal; **G**, labellum; **I**, **H**, column, lateral and ventral. Drawn from holotype. 4, *Zeuxine exilis* Ridl. **A**, flower; **B**, flower minus tepals; **C**, lateral sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from lectotype.

species. Unfortunately, I have not seen any collections from Malaysia, though it is apparently common in the lowlands.

The specimens collected after the year 2000 from Singapore represent a new record for that country. Yet specimens collected from 1898 to 1917 by Ridley all represent *Zeuxine parvifolia*. I am not sure if the latter has become extinct in Singapore, but it does seem that the recent collections of *Z. clandestina* in Singapore represent a relatively new colonization event.

Zeuxine clandestina may be characterized by the leaves being green (not wilted) at anthesis, the relatively small, bilobed labellum epichile (1.75 mm wide, lobules 0.8 mm long), the short column (1.6 mm long) with a very short basal part, an elongate anther, and seemingly elongate rostellum brachia (this is due to the much reduced clinandrium, which exposes the pollinia and therefore ensures self-pollination).

The Singapore specimen illustrated had an aberrantly shaped labellum epichile, but other flowers agree in lip shape with the Javanese specimens.

Zeuxine eryliae Ormerod, *sp. nov.* TYPE: THAILAND. Khao Rum, 455 m, February 1922, *E.G. Smith 578* (Holotype: K). Fig. 3.

Similar to *Zeuxine clandestina* Blume but differing in the labellum, which has a lateral flange on the mesochile, and subterete (vs. lanceolate) glands in the hypochile.

Terrestrial *herb*. *Rhizome* terete, creeping, fragment 16 mm long. *Roots* terete, pubescent, emerging from nodes. *Stem* erect, terete, 4–5 leaved, 35–40 × 1 mm. *Leaves* obliquely lanceolate, acute, wilted at anthesis, 25–30 × 8 mm; petiole and sheath 4–5 mm long. *Inflorescence* pubescent, 140 mm long; peduncle 110 mm long; sheathing bracts 1, ca. 8.5 mm long; rachis few (ca. 6), flowered, 30 mm long; floral bracts ovate-lanceolate, subacuminate, ca. 6 mm long. *Flowers* purplish, externally laxly pubescent. *Pedicel plus ovary* fusiform, laxly pubescent, 4–5 mm long. *Dorsal sepal* ovate-lanceolate, obtuse, concave, 3 veined, forming with the petals a galea, 3.4 × 1.9 mm. *Lateral sepals* obliquely ovate-elliptic, subacute, 3 veined, 3.0 × 1.2–1.3 mm. *Petals* obliquely oblong-rhombic, acute, 3 veined, 3.2 × 1.1 mm. *Labellum* 2.7 mm long; hypochile ovate, saccate, ca. 1.7 × 1.9 mm, on outside with a laminate flange, inside each side with a terete, falcate, obtuse gland; epichile obtriangular, ca. 1 × 2 mm, lobules obliquely oblong-elliptic, obtuse, 0.9 mm long, base 0.8 mm wide, 0.6 mm wide near apex. *Column* 1.95 mm long; rostellum brachia oblong-ligulate, obtuse, thin.

Distribution: Thailand.

Habitat: jungle, 455 m.

Eponymy: named after Eryl Glynne Smith (ca. 1890–1930), collector of the type.

This taxon superficially resembles other species that have the leaves wilted at anthesis. It may however be recognized by its small labellum that has an external flange on the hypochile, obtriangular epichile that is only 2 mm wide, and its column bearing narrow, obtuse, thin rostellum brachia. The column of *Zeuxine eryliae* appears to have a very short basal part due to the disintegration of the clinandrium, which thus exposes the pollinia, and probably leads to self-fertilization. A similar situation occurs in *Z. clandestina* as noted above. The latter species differs in having green leaves at anthesis, no flange on the labellum hypochile, and lanceolate (vs. subterete) glands in the lip.

Two different collections have been assigned the number *E. Smith 578*. The one described here is the small plant with wilted leaves. The other sheet represents an undescribed taxon; it is a taller, laxly leaved plant with unwilted leaves, and though florally similar, the column differs in having two oblong, ventral wings. A very similar plant to the second taxon was illustrated as *Hetaeria* sp. (*Kerr 899*) by Seidenfaden and Smitinand (1959).

Zeuxine exilis Ridl., J. Str.Br. Roy. As. Soc. 45: 236. 1906. TYPE: AUSTRALIA. Christmas Island, Murray Hill track, 18 October 1904, *H.N. Ridley s.n.* (Lectotype [designated by Wood, 1982: 143]: K; Isolectotypes: BM, SING, images seen). Fig. 4.

Flowers externally pubescent. *Dorsal sepal* ovate-lanceolate, obtuse, 3 veined, forming a galea with the petals, ca. 4.0 × 2.2 mm. *Lateral sepals* broadly oblong-lanceolate, obtuse, 3 veined, 3.40 × 1.25 mm. *Petals* oblong, obtuse, 1 veined, 3.7 × 1.0 mm. *Labellum* ca. 3.2 mm long; hypochile ca. 1.0 × 1.9 mm, inside each side with a retrorse, subulate gland; mesochile semitubular, externally papillose, ca. 1.2 mm long; epichile bilobed, transversely rectangular, ca. 1.2 × 3.1 mm, lobules subquadrate, 1.5–1.6 × 1.6 mm. *Column* 1.8 mm long, ca. 0.9 mm wide laterally.

Distribution: Australia (Christmas Island).

This species is closely related to *Zeuxine gracilis,* which occurs nearby on Java. It has been included in the synonymy of the latter (Barretto et al., 2011) but differs in having a fleshier labellum mesochile, and narrower profile of the column with the stigma lobes set slightly further back. *Zeuxine exilis* was for 105 years known only from the type, despite several attempts to relocate it. It was apparently rediscovered in 2009 (Green et al., 2010). I have not seen the modern collections but would like to point out the case in Singapore where *Z. clandestina* taxon has apparently superseded *Z. parvifolia,* and the colonization of Verlaten Island by *Z. pseudogracilis*. A short description of the floral parts with a figure is provided to augment further studies of this enigmatic species.

Zeuxine flava (Wall. ex Lindl.) Trimen, J. Ceyl. Br. Roy. As. Soc. 9: 90. 1885.

Basionym: *Monochilus flavum* Wall. ex Lindl., Gen. Sp. Orch. Pl.: 487. 1840. TYPE: NEPAL. Without locality, 1821, *N. Wallich Catal. No. 7380A* (Holotype: K-L; Isotypes: K, K-W). Fig. 5.

Homotypic synonym: *Haplochilus flavum* (Wall. ex Lindl.) D. Dietr., Syn. Pl. 5: 172. 1852.

Heterotypic synonyms: *Adenostylis benguetensis* Ames, Leafl. Philipp. Bot. 5: 1551. 1912 *syn. nov.* TYPE: PHILIPPINES. Luzon, Benguet Prov., Baguio, March 1907, *A.D.E. Elmer 8856* (Holotype: AMES).

Zeuxine benguetensis (Ames) Ames, Bot. Mus. Leafl. Harv. Univ. 5: 100. 1938.

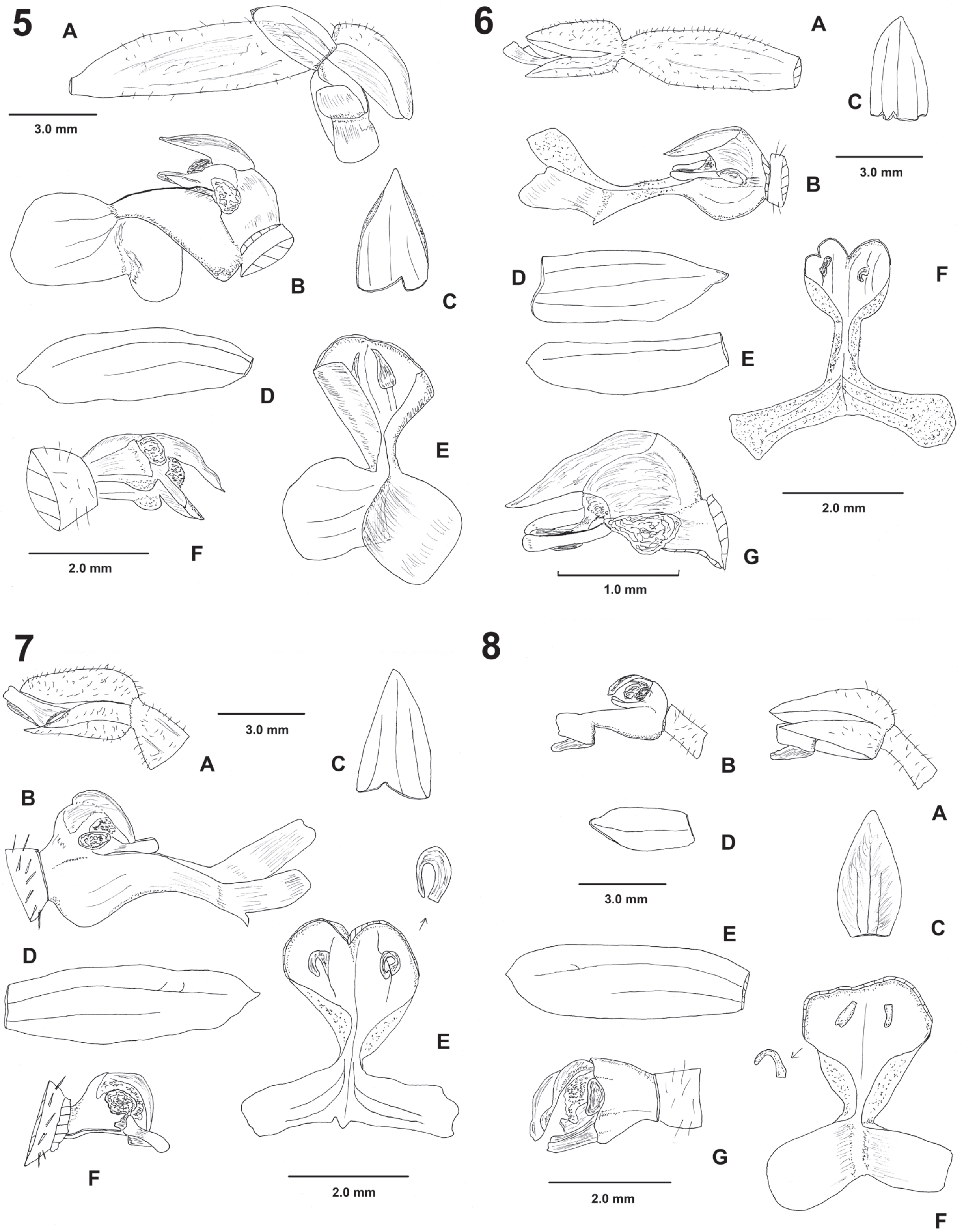

FIGURE 5–8. 5, *Zeuxine flava* (Wall. ex Lindl.) Benth. ex J.D. Hook. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from *Carr 3177* (AMES). 6, *Zeuxine parvifolia* (Ridl.) K. Schum. & Fedde. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from *Ridley s.n.* (K). 7, *Zeuxine parvifolia* (Ridl.) K. Schum. & Fedde. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, petal; **E**, labellum; **F**, column. Drawn from *Lamb AL 1208A/90* (K). 8, *Zeuxine gracilis* (Breda) Blume. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from *Docters van Leeuwen 2328* (L).

Zeuxine aurantiaca Schltr., Rep. Sp. Nov. Regni Veg. 19: 377. 1924. TYPE: CHINA. Yunnan, Shweli-Salween Divide, 2440 m, August 1913, *G. Forrest 11914* (Holotype: E).

Zeuxine tonkinensis Gagnep., Bull. Nat. Hist. Mus. Paris 2, s. 3, 7: 325. 1931 *syn. nov.* TYPE: VIETNAM. Tonkin, Mt. Bavi, 400 m, 27 March 1887, *B. Balansa 2002* (Holotype: P).

Zeuxine kantokeiensis Tatewaki & Masamune, Bot. Mag. (Tokyo) 46: 772. 1932 *syn. nov.* TYPE: TAIWAN. Taityusyu, 9 April 1932, *M. Tatewaki 18663* (Syntype: lost); Taityusyu, Baibara, 9 April 1932, *M. Tatewaki s.n.* (Syntype: lost).

Zeuxine sakagutii Tuyama, Bot. Mag. (Tokyo) 50: 26. 1936. TYPE: JAPAN. Ryukyu Islands, Ishigaki Island, 4 August 1922, *S. Sakaguti s.n.* (Holotype: TNS, not seen).

Zeuxine gracilis (Breda) Blume var. *sakagutii* (Tuyama) Hashimoto, Ann. Tsukuba Bot. Gard. 5: 28. 1986.

Zeuxine taiwaniana S.S. Ying, Quart. J. Chin. For. 20, 2: 57. 1987. TYPE: TAIWAN. Taitung, Chi-pen, 1 April 1987, *S.S. Ying s.n.* (Holotype: NTUF, not seen).

Zeuxine uraiensis S.S. Ying, Col. Illustr. Fl. Taiwan 3: 620. 1988. TYPE: TAIWAN. Taipei, Urai, 10 April 1988, *S.S. Ying s.n.* (Holotype: NTUF, not seen).

Zeuxine chenkangensis Ormerod, Taiwania 55, 1: 26. 2010. TYPE: CHINA. Yunnan, Chen-Kang Hsien, 1640 m, March 1936, *C.W. Wang 72192* (Holotype: AMES).

Usage synonyms: *Zeuxine affinis auct. non* (Lindl.) Benth. ex J.D. Hook., W.W. Smith, Not. Roy. Bot. Gard. Edinb. 13–14: 221. 1921; T.P. Lin, Nat. Orch. Taiwan 3: 280, fig., Pl. 158–159. 1988.

Zeuxine gracilis auct. non (Breda) Blume, Carr, Gard. Bull. Singap. 8, 2: 189. 1935; Barretto, Cribb & Gale, Wild Orch. Hong Kong: 158. 2011 p.p.

Zeuxine leucochila auct. non Schltr., Garay & Sweet, Orch. S. Ryukyu Isl.: 83. 1974 p.p.

Zeuxine parvifolia auct. non (Ridl.) K. Schum. & Fedde, Seidenf., Dan. Bot. Ark. 32, 2: 82–84. 1978 p.p.

Zeuxine tenuifolia auct. non Tuyama, F. Maekawa, Wild. Orch. Japan Col.: 251, Pl. 88. 1974.

Distribution: Nepal; India; Bhutan; China (Yunnan, Hong Kong); Myanmar; Thailand; Vietnam; Taiwan; Japan (Ryukyus); Philippines; Malaysia (Sabah).

Select specimens examined: THAILAND. Nan District, Hue Sala, 400 m, 10 March 1921, *A.F.G. Kerr 396* (AMES). CHINA. Hong Kong, *leg. S.C. Tse,* April 1976, cult. *G. Barretto 173* (K). MALAYSIA. Sabah: Mt. Kinabalu, Kadamaian River, Menetendok Gorge, 255 m, March 1933, *C.E. Carr 3177* (AMES, K, SING); Menetendok River, 305 m, 25 March 1933, *C.E. Carr SFN 26756* (SING).

I have for some time maintained the belief that *Zeuxine benguetensis* could be treated as a western sister species of *Z. flava,* being distinguished by its leaves that are green (vs. wilted) at anthesis, longer inflorescence peduncle, slightly smaller flowers, and T-shaped labellum (epichile lobules at right angles). However, none of these characters really stand up upon an examination of the broader material, and as such I agree with the widened species concept proposed by Lin et al. (2016).

The type material of *Adenostylis benguetensis* is rather poor, but it was possible to assess its characters from a flower preserved in glycerine at AMES. This showed it to have a number of floral features in common with *Zeuxine flava,* such as the retrorse glands in the lip, and two minutely papillose, small wings under the column. The same features are present in the Vietnamese *Z. tonkinensis*. The latter has narrower epichile lobules (1 mm wide), but even on the same plant (e.g., *Carr 3177*) the lobules can vary from 1.0 to 1.5 mm wide. Analysis of the description of *Z. kantokeiensis* leads me to place it in synonymy here too.

The main reason that influenced Garay and Sweet (1974) to place *Zeuxine benguetensis* and *Z. sakagutii* in the synonymy of *Z. leucochila* seems to have been the width of the labellum epichile (3 mm wide). This was further compounded when Seidenfaden (1978) found the earlier name *Hetaeria parvifolia* Ridl., to which he also added *Z. tonkinensis* in synonymy, both taxa with a 3-mm-wide epichile. Both *Z. leucochila* and *Z. parvifolia* differ from *Z. flava* in having white (not yellow) labellum lobules, erect (not retrorse) glands in the labellum hypochile, and glabrous (not papillose) column wings, or even lacking wings under the column.

Thus *Zeuxine flava* may be recognized by its leaves being either wilted or green at anthesis, the peduncles variable in length, the flowers with a bright yellow labellum epichile, that is Y- to T-shaped, 3–5 mm wide, the lobules 0.95–1.50 mm wide, retrorse glands in the hypochile, and two small papillose wings under the column.

The two specimens cited from Sabah represent a new record for Borneo (and Malaysia).

Zeuxine gracilis (Breda) Blume, Coll. Orch. Arch. Ind.: 69. 1858; Fl. Javae Ins. Adj. n.s. 1: 56. 1858.

Basionym: *Psychechilos gracile* Breda, Gen. Sp. Orch. Asclep.: t.9. 1829. TYPE: INDONESIA. Java, Bantam Prov., *J.C. van Hasselt s.n.* (Holotype: lost). Lectotype (Bhattacharjee et al., 2011: 153): t.9, in Breda, Gen. Sp. Orch. Asclep. 1829. Fig. 6.

Homotypic synonyms: *Monochilus gracilis* (Breda) Miquel, Fl. Ned. Ind. 3: 723. 1859.

Adenostylis gracilis (Breda) Ames, J. Str. Br. Roy. As. Soc. (Spec. No.): 141. 1921.

Heterotypic synonym: *Monochilus zollingeri* Rchb.f., Xenia Orch. 1: 215. 1856. TYPE: INDONESIA. Java, near Tjudruk to Tjigalin waterfall, 2 September 1842, *H. Zollinger 592* (Holotype: W-R 1199, image seen).

Distribution: Indonesia (Java).

Specimen examined: INDONESIA. Java, Preanger Pandang, October 1916, *W.M. Docters van Leeuwen 2328* (L).

Zeuxine gracilis has been recorded over a broad area from western India (Santapau and Kapadia, 1962) to Hong Kong, China (Barretto et al., 2011). However, it seems that none of the records outside Java can be substantiated and these are referrable to a number of different species.

Thus, some of the Indian records of *Zeuxine gracilis* were found to belong to *Z. blatteri* C.E.C. Fischer, an entity occurring in India and Sri Lanka (Ormerod, 2002). Plants recorded from Odisha State, India (e.g., Misra, 2004) seem to be another entity again, perhaps closer to *Z. pseudogracilis* judging from the single collection (*S. Misra SM 734B* [K]) that I have been able to examine.

A record of *Zeuxine gracilis* from Borneo by Carr (1935) I have found above to represent *Z. flava*. However the record of *Z. gracilis* from Hong Kong (Barretto et al., 2011) appears to represent what is called *Z. affinis* (Lindl.) Benth. ex J.D. Hook. by Taiwanese authors (e.g., Lin et al., 2016), judging from the illustration provided by the former authors.

Seidenfaden (1978) attempted to define the true *Zeuxine gracilis* on the basis of Indonesian material, but unfortunately the plant he illustrated from Verlaten Island (= Pulau Sertung) is referrable to *Z. pseudogracilis*.

Zeuxine gracilis can be recognized by its leaves being wilted at anthesis, the labellum epichile bent at right angles to the mesochile, the rectangular lobules 1.4 × 1.0 mm, inside each side of the hypochile a lanceolate-subulate forward-pointing gland, and the column (minus the rostellum brachia) distinctly obconical in shape (like the headlights of some 1930s cars), with each stigma lobe placed midway laterally.

Zeuxine leucochila Schltr., Rep. Sp. Nov. Regni Veg. 3: 46. 1907. TYPE: THAILAND. Petchabun, Menam, Phra-Tak-Thal (Phra Sak Valley), 11 December 1905, *C.C. Hosseus 715A* (Holotype: B, destroyed; Isotypes: K; BM, M, P, images seen). Fig. 7.

Homotypic synonym: *Zeuxine siamensis* Schltr. ex Hosseus, Beih. Bot. Centralbl. 28, Abt. 2: 380. 1911 *nom. nud.*

Flowers with greenish sepals, white petals, and white labellum, externally pubescent. *Pedicel with ovary* fusiform, pubescent, 4–6 mm long. Dorsal sepal ovate-elliptic, obtuse, concave, 3 veined, forming a galea with the petals, 4.2 × 2.7 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, 3 veined, 3.80 × 1.85 mm. *Petals* obliquely oblong-oblanceolate, acute to subacute, 2 veined, 4.0 × 1.3 mm. *Labellum* 3.5–3.8 mm long; hypochile ca. 1.5 × 2.6–2.7 mm, inside each side with a lanceolate to lanceolate-subulate gland; mesochile semitubular, ca. 1.2 mm long; epichile ca. 1.0 × 3.6–4.2 mm, lobules oblique to patent, oblong to elliptic-obovate, obtuse, 1.9–2.1 × 1.2–1.3 mm. *Column* 2.4–2.5 mm long; rostellum brachia spathulate; wings 2, ventral, very low, thin.

Distribution: Thailand.

Specimens examined: THAILAND. Ban Den, near Palunampo, 40 m, 9 December 1913, *A.F.G. Kerr 334* (K); Meh Ping Rapids, 900 m, 15 December 1908, *A.F.G. Kerr 212A* (K).

Garay and Sweet (1974) recorded this taxon from the Ryukyu Islands and included four other heterotypic names in synonymy. Seidenfaden (1978) then reduced *Zeuxine leucochila* to *Z. parvifolia,* and also added *Z. tonkinensis* to the synonymy. Later authors (e.g., Hashimoto, 1986; Lin et al., 2016) have disputed the extensive list of entities referred to *Z. parvifolia,* a view with which I agree. *Zeuxine leucochila* may be generally distinguished from *Z. parvifolia* by its larger flowers (sepals 3.8–4.2 vs. 2.8–3.3 mm long), longer column (2.4–2.5 vs. 1.5–1.7 mm long) with longer, more spathulate rostellum brachia.

In my opinion *Zeuxine leucochila* is much more closely related to *Z. affinis* (Lindl.) Benth. ex J.D. Hook., resembling a small form of the latter. *Zeuxine leucochila* differs from *Z. affinis* in having a smaller labellum epichile (3.6–4.5 vs. 7.0–8.0 mm wide), entire (not bifid) glands in the hypochile, and a shorter column (2.4–2.5 vs. 3.0–3.5 mm long) with more distinctly spathulate rostellum brachia.

Thus, *Zeuxine leucochila* may be characterized by its flowers with a white labellum, small flowers (sepals 3.8–4.2 mm long), the labellum Y- to T-shaped, the epichile lobules oblong to obliquely obovate-elliptic, each 1.9–2.1 × 1.2–1.3 mm, entire, lanceolate to subulate glands in the hypochile, and a 2.4–2.5 mm long column with distinctly spathulate rostellum brachia.

Zeuxine parvifolia (Ridl.) K. Schum. & Fedde, Just's Bot. Jahresb. 31, 1: 786. 1903.

Basionym: *Hetaeria parvifolia* Ridl., J. Roy. As. Soc. Str. Br. 39: 87. 1903. TYPE: MALAYSIA. Penang: Penang Island, Penang Hill, December 1895, *H.N. Ridley s.n.* (Lectotype [designated by Seidenf. 1978: 82–83, as "Type"]: K; Isolectotype: SING, image seen). Fig. 8–9.

Usage synonym: *Zeuxine clandestina auct. non* Blume, Seidenf., Dan. Bot. Ark. 32, 2: 87–88, fig. 54c. 1978 p.p.

Terrestrial *herb*. *Rhizome* terete, creeping, rooting at nodes. *Roots* terete, pubescent. *Stem* erect, terete, laxly 3–6 leaved, 49.0–90.0 × 0.5–2.2 mm; internodes 7.0–33.5 mm long. *Leaves* obliquely lanceolate, oblong-lanceolate to ovate-lanceolate, acute, green at anthesis, 8.0–43.0 × 4.2–11.5 mm; petiole and sheath 6.5–14.0 mm long. *Inflorescence* pubescent, 97–132 mm long; peduncle 59–100 mm long; sheathing bracts 1–3, 8–20 mm long; rachis sublaxly flowered, 32–38 mm long. *Flowers* externally pubescent. *Pedicel plus ovary* fusiform, pubescent, 5–6 mm long. *Dorsal sepal* ovate-elliptic, subacute, 3 veined, forming a galea with the petals, 3.0 × 1.6–1.8 mm. *Lateral sepals* obliquely ovate-lanceolate, acute, 2.8–3.0 × 1.0–1.3 mm. *Petals* oblong, acute, 1 veined, 2.9 × 0.9–1.2 mm. *Labellum* 2.5–2.7 mm long; hypochile saccate, 1.3–1.4 × 1.5–1.6 mm, inside each side with a subulate gland; mesochile semitubular, 0.5–0.8 mm long; epichile bilobed, 0.6–0.7 × 2.5–3.1 mm, lobules rectangular, 1.0–1.5 × 0.5–0.8 mm. *Column* 1.5 mm long; rostellum brachia narrowly clavate.

Distribution: Malaysia; Singapore.

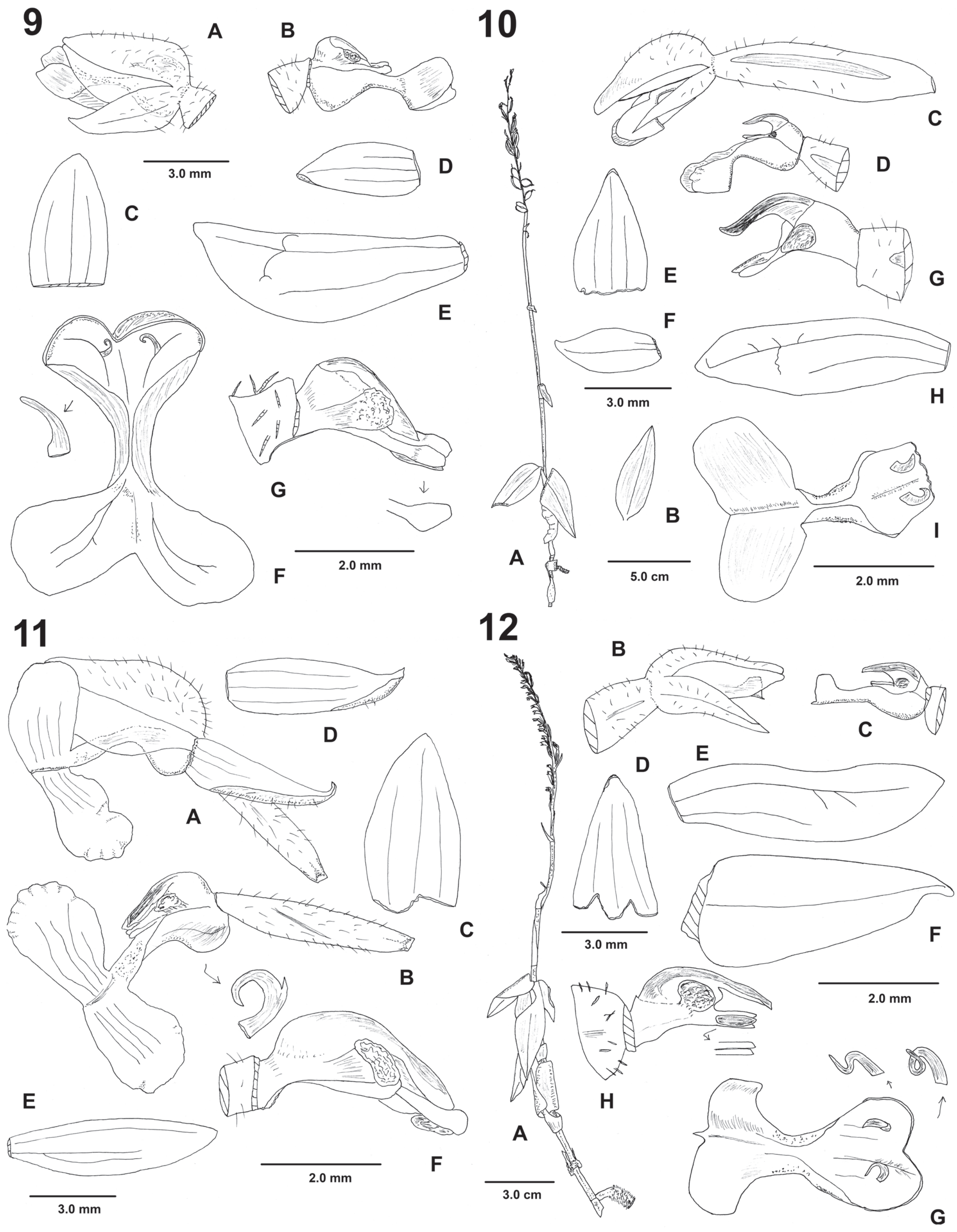

FIGURE 9–12. 9, *Zeuxine leucochila* Schltr. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, labellum; **G**, column. Drawn from isotype (K). 10, *Zeuxine pseudogracilis* Ormerod. **A**, plant; **B**, leaf; **C**, flower; **D**, flower minus tepals; **E**, dorsal sepal; **F**, lateral sepal; **G**, column; **H**, petal; **I**, labellum. Drawn from holotype. 11, *Zeuxine rupestris* Ridl. **A**, flower; **B**, flower minus tepals; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, column. Drawn from *Lobb 434* (AMES). 12, *Zeuxine subquadrata* Ormerod. **A**, plant; **B**, flower; **C**, flower minus tepals; **D**, dorsal sepal; **E**, petal; **F**, lateral sepal; **G**, labellum; **H**, column. Drawn from holotype.

Specimens examined: MALAYSIA. Penang: Penang Island, dry track from waterfall, 12 March 1915, *H.N. Ridley s.n.* (K); Garden Jungle, Monday 15 th [no year], *sine coll. (H.N. Ridley?) s.n.* (K); Richmond Road, March 1915, *H.N. Ridley s.n.* (K); Mt. Olivia, 245 m, 22 March 1923, *R.E. Holttum 10284* (K, SING); Highlands Hill, 215 m, 20 January 1918, *M. Nur 3033* (SING). Johore: Sungei Tukong Estate, 11 February 1931, *G.H. Spare 1018* (SING). Sabah: Interior Zone, Tambunan District, near Batu Bajau, 1500 m, 16 January 1990, *A. Lamb AL 1208A/90* (K). SINGAPORE. Garden Jungle, 5 May 1897, *H.N. Ridley 8785* (SING); Garden Jungle, 1898, *H.N. Ridley s.n.* (SING); Garden Jungle, 1904, *H.N. Ridley s.n.* (AMES); Garden Jungle, January 1917, *H.N. Ridley s.n.* (K); Bukit Timah, 1899, *H.N. Ridley s.n.* (SING).

The material available of this species is often in a poor state and difficult to study. I provide two figures, the first is from the type locality (Penang Island), collected by Ridley on the 12 th March 1915. The second is from the Sabah specimen, a new record for Borneo. The identity of the Bornean collection may be questioned when more material is available; it differs from the other specimens in having larger flowers (sepals 3.7–3.9 mm long) and the stigma lobes being located higher up (not in line with the rostellum brachia) on the clinandrium.

The collection *Nur 3033* from Penang Island is also a little different from the other material. The plant is somewhat larger (stems to 14 cm long), peduncle 11.7–15.1 cm long, the flowers slightly larger (sepals 3.2–3.4 mm long), the labellum slightly longer (3.2 mm), and the epichile lobules to 1.7 × 1.0 mm. Thus the above description is based on the non-deviating specimens.

Zeuxine parvifolia may recognized by its leaves often being green at anthesis, small flowers (sepals 2.8–3.0 mm long), oblong petals, short labellum (2.5–2.7 mm long), the epichile (2.0–)2.5–3.1 mm wide with rectangular lobules 1.0-1.5 × 0.5-0.8 mm, a short (1.5 mm long) column with narrowly clavate rostellum brachia, and stigma lobes that are in line with the rostellum brachia.

Zeuxine pseudogracilis Ormerod, *sp. nov.* TYPE: INDONESIA. Sumatra, Dolok Merangir, 245 m, 6 February 1932, *W.N. Bangham & C.M. Bangham 943* (Holotype: AMES). Fig. 10.

Usage synonyms: *Zeuxine gracilis auct. non* (Blume) Breda, Ames & C. Schweinf., Contr. Arn. Arb. 8: 22. 1934; Seidenf., Dan. Bot. Ark. 32, 2: 86-87, fig. 53. 1978 p.p.; Seidenf. & J.J. Wood, Orch. Pen. Malays. & Singap.: 89, fig. 34d-g. 1992 p.p.

Zeuxine clandestina auct. non Blume, Seidenf., Dan. Bot. Ark. 32, 2: 87-88, fig. 54a-b. 1978 p.p.; Seidenf. & J.J. Wood, Orch. Pen. Malays. & Singap.: 87, fig. 33n-o. 1992 p.p.

Related to *Zeuxine gracilis* (Breda) Blume but the column semi-obconical (vs. obconical) in profile, and the stigma lobes placed at base of rostellum brachia (vs. halfway laterally on column).

Terrestrial *herb*. *Rhizome* terete, creeping, 35.0–38.5 × 1.0–3.0 mm, rooting at nodes; internodes 7.50–21.5 mm long. *Roots* terete, pubescent. *Stems* erect, terete, 3–6 leaved, 95.0–100.0 × 1.5–3.5 mm; internodes 8.5–30.0 mm long. *Leaves* obliquely ovate-lanceolate to lanceolate, acute, 40–45 × 20 mm; petiole and sheath 10–17 mm long. *Inflorescence* pubescent, 185–240 mm long; peduncle 150–160 mm long; sheathing bracts 1–2, 7.5–23.5 mm long; rachis sublaxly to subdensely flowered, 35–80 mm long; floral bracts ovate-lanceolate, acute, to 10 mm long. *Flowers* white (presumably lip and petals are white), externally pubescent. *Pedicel with ovary* fusiform, pubescent, ca. 7.5 mm long. *Dorsal sepal* ovate, obtuse, concave, 3 veined, forming a galea with the petals, 4.4 × 2.4 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, 3.40 × 1.35–1.50 mm. *Petals* obliquely oblong, obtuse, 2 veined, 3.80 × 1.15 mm. *Labellum* 3.0–3.2 mm long; hypochile saccate, 1.3 × 1.5 mm, inside each side with a ligulate-lanceolate gland; mesochile semitubular, 0.7 mm long; epichile bilobed, 1.2 × 2.8 mm, lobules elliptic, obtuse to truncate, 1.4–1.6 × 1.3–1.4 mm. *Column* 1.7–1.8 mm long; rostellum brachia spathulate.

Distribution: Malaysia (Penang); Indonesia (Sumatra).

Specimen examined: MALAYSIA. Penang: Penang Island, Government Hill, 760 m, 22 January 1907, *M. Haniff 2405* (AMES, K, SING).

Etymology: from the Classical Greek prefix *pseudo-,* false, and the species name *gracilis,* in reference to the similarity with *Z. gracilis*.

This taxon has been mistaken for *Zeuxine gracilis* but may be distinguished from it by the shape of the column and placement of the stigma lobes. It is also closely related to *Z. exilis* but again differs from that in the profile of the column (gently curved dorsally in basal half vs. abruptly raised from the base), and the obliquely angled down (vs. horizontal) rostellum brachia.

Seidenfaden (1978) illustrated a specimen (as *Zeuxine gracilis*) of *Z. pseudogracilis* from Verlaten Island (now Pulau Sertung). This is a very interesting find because Verlaten Island is next to Krakatau (or Krakatoa) Island in the Sunda Strait between Java and Sumatra. The flora of Verlaten Island was obliterated by the famous eruption of Krakatau in 1883. Therefore, the occurrence of *Z. pseudogracilis* on Verlaten Island appears to be from a later colonization event. In my opinion it is highly likely *Z. pseudogracilis* will also be found on Java.

Zeuxine rupestris Ridl., J. Roy. As. Soc. Str. Br. 39: 86. 1903. TYPE: MALAYSIA. Penang: Penang Island, Government Hill, 610 m, February 1892, *H.N. Ridley & C. Curtis 2823* (Holotype: K; Isotype: SING). Fig. 11.

Usage synonym: *Zeuxine affinis auct. non* (Lindl.) Benth. ex J.D. Hook., Ridl., J. Linn. Soc., Bot. 32: 402. 1896; Seidenf., Dan. Bot. Ark. 32, 2: 88. 1978 p.p.

Distribution: Malaysia (Penang Island).

Specimens examined: MALAYSIA. Penang: Penang Island, Government Hill, 610 m, 1894, *M. Haniff s.n.* (K);

Government Hill, 610 m, November 1910, *M. Haniff s.n.* (SING). ORIGIN DUBIOUS ("Singapore," "Java"): *T. Lobb 434* (AMES, K-L, SING).

This characteristic species appears to be endemic to Penang Island. Hooker (1890) mentions the occurrence of *Zeuxine flava* on Java, I believe based on the above Lobb collection in Herbarium Lindley. Lobb often gave false localities for his collections, presumably to mislead his horticultural competitors. *Zeuxine rupestris* may be recognized by its few-flowered (up to 6 flowers) inflorescence, labellum with a relatively long (1.8 mm) mesochile, large epichile (6.0–7.9 mm wide) with patent lobules, and large column (3 mm long).

Zeuxine subquadrata Ormerod, *sp. nov.* TYPE: MALAYSIA. Sabah: Ranau District, East Mesilau River, between Mt. Kinabalu golf course site and Mesilau Cave, 1700–1900 m, 26 March 1984, *J.H. Beaman 9147* (Holotype: K). Fig. 12.

Related to *Zeuxine baliensis* J.J. Sm. but with larger (20.0–32.0 × 7.5–13.0 mm vs. 19.5 × 8.5–10.0 mm) leaves, rachis longer (vs. much shorter) than the peduncle, bearing more (ca. 23 vs. 3–4) flowers, with a smaller (2.1 vs. 2.6 mm wide) labellum epichile, and oblong (vs. dimidiately ovate-elliptic) petals.

Terrestrial *herb*. *Rhizome* not seen. *Roots* terete, pubescent, emerging from nodes. *Stem* erect, terete, sublaxly ca. 8-leaved, 95 mm long, to 2.5 mm thick; internodes 9–21 mm long. *Leaves* obliquely ovate-lanceolate, acute, wilting during anthesis, 20.0–32.0 × 7.5–13.0 mm; petiole and sheath to ca. 10 mm long. *Inflorescence* pubescent, 155 mm long; peduncle 65 mm long; sheathing bracts 2, remote, 16 mm long; rachis secundly ca. 23 flowered, 90 mm long; floral bracts lanceolate, acute, to 12 × 3 mm. *Flowers* externally pubescent, color not known. *Pedicel with ovary* fusiform, pubescent, to 6 mm long. *Dorsal sepal* ovate-lanceolate, obtuse, 3 veined, forming with the petals a galea, ca. 3.5 × 2.5 mm. *Lateral sepals* obliquely ovate-lanceolate, subacute, 3.8–4.0 × 1.5 mm. *Petals* oblong, acute to subacute, 2 veined, 4.0 × 1.1 mm. *Labellum* 3.2–3.5 mm long; hypochile saccate, 1.8 × 2.0 mm, inside each side with a linear-lanceolate gland; mesochile semitubular, 0.8 mm long; epichile bilobed, transversely rectangular, 0.9–1.0 × 2.1 mm, lobules subquadrate, ca. 0.9 × 0.7–0.8 mm. *Column* ca. 1.8 mm long; rostellum brachia ligulate, truncate.

Distribution: Malaysia (Sabah).

Habitat: oak-laurel forest on Trusmadi Formation and intrusives, 1700–1900 m.

Etymology: from the Classical Latin prefix *sub-,* below or almost, and *quadratus,* four-angled, in reference to the shape of the labellum lobules.

This species appears to be related to *Zeuxine baliensis* J.J. Sm. from Bali, Indonesia. It differs in having larger leaves, a more floriferous rachis longer than the peduncle, flowers with narrower petals, and smaller labellum epichile.

LITERATURE CITED

BARRETTO, G., P. CRIBB AND S. GALE. 2011. *The Wild Orchids of Hong Kong*. Natural History Publications, Borneo.

BHATTACHARJEE, A., H. J. CHOWDHERY, AND R. K. BHAKAT. 2011. Lectotypification in *Zeuxine* Lindl. (Orchidaceae). Taiwania 56, 2: 153–156.

CARR, C. E. 1935. Two collections of orchids from British North Borneo. Gard. Bull. Singap. 8, 2: 165–240.

GAGNEPAIN, F. 1934. Orchidaceae. Pages 142—647 in H. LECOMTE, ED., *Flore Generale de l'Indo-Chine*. Vol. 6.

GARAY, L. A. AND H. R. SWEET. 1974. *Orchids of Southern Ryukyu Islands*. Botanical Museum, Harvard University, Cambridge, Massachusetts.

GREEN, P. T., J. CLAUSSEN, AND D. J. O'DOWD. 2010. Lost for a century: Rediscovery of the Endemic Ridley's Jewel Orchid, *Zeuxine exilis* Ridl., on Christmas Island, Indian Ocean. Gard. Bull. Singap. 61, 2: 319–326.

HASHIMOTO, T. 1986. Taxonomic miscellanies of Orchidaceous plants (2). Ann. Tsukuba Bot. Gard. 5: 17–30.

HOLTTUM, E. 1957. *Orchids*. Vol. 1 of *Flora of Malaya*. 2d ed. Government Printing Office, Singapore.

HOOKER, J. D. 1890. *Orchideae*. In *The Flora of British India* 6: 1–195.

LIN, T.P., H.Y. LIU, C.F. HSIEH, AND K.H. WANG. 2016. Complete list of the native orchids of Taiwan and their type information. Taiwania 61(2): 78–126.

MISRA, S. 2004. *The Orchids of Orissa*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

ORMEROD, P. 2002. Taxonomic changes in Goodyerinae (Orchidaceae: Orchidoideae). Lindleyana 17(4): 189–238.

SANTAPAU, H. AND Z. KAPADIA. 1962. Critical notes on the Orchidaceae of Bombay State 8. J. Bomb. Nat. Hist. Soc. 59(1): 154–172.

SEIDENFADEN, G. 1978. Orchid genera in Thailand VI. *Neottioideae* Lindl. Dan. Bot. Ark. 32(2): 1–195.

SEIDENFADEN, G. AND T. SMITINAND. 1959. *The Orchids of Thailand. A Preliminary List*. Part 1. The Siam Society, Bangkok.

WOOD, J. J. 1982. The orchids of Christmas Island. Orchadian 7(6): 143–146.

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NOTES ON ASIATIC *TROPIDIA* (ORCHIDACEAE: TROPIDIEAE)

Paul Ormerod[1]

Erratum

In "Notes on Asiatic *Tropidia* (Orchidaceae: Tropidieae)," published in the previous number of *Harvard Papers in Botany* (Ormerod, 2018), Fig. 4 and 5 were transposed; thus Fig. 4 actually represents *Tropidia squamata* Blume, and Fig. 5 represents *Tropidia septemnervis* (Schauer) Rchb.f.

Literature Cited

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NEW NAMES IN INDIAN AND SRI LANKAN ORCHIDS

Paul Ormerod[1,2] and C. Sathish Kumar[3]

Abstract. A reinstatement, three new combinations, and one new species are proposed for orchids that occur in India and Sri Lanka. The name that is reinstated is *Dendrobium crispum,* with *D. peguanum* treated as a synonym; the new combinations are *Cylindrolobus lindleyi, Peristylus caranjensis,* and *Trichotosia thwaitesii;* and *Dendrobium turbinatum* is proposed as a new species.

Keywords: India, new names, *Cylindrolobus, Dendrobium, Peristylus, Trichotosia*

Literature and herbarium studies of various Indian and Sri Lankan orchids have revealed the need to update the nomenclature of some entities, especially in tribe Podochileae. The latter group has been subjected to an extensive molecular study (Ng et al., 2018), which we follow here. The other taxon that bears some discussion is *Habenaria caranjensis* Dalz.; it had already been treated as an imperfectly known species in the 19th century (Hooker, 1890). However, we believe it can be identified now that Indian orchids are better understood.

Cylindrolobus Blume, Fl. Javae Praef.: 6. 1828.
Type species: *Ceratium compressum* Blume.

A genus of subtribe Eriinae with about 80 species distributed from Sri Lanka and India, through Malesia to Papua New Guinea. A synopsis of the Malesian species was published by Ormerod (2014), from where 57 taxa were recorded.

Cylindrolobus lindleyi (Thwaites) Ormerod & C. Sathish Kumar, *comb. nov.*

Basionym: *Eria lindleyi* Thwaites, Enum. Pl. Zeyl.: 299. 1861. TYPE: SRI LANKA. Mt. Nuera Ellia, August, *J. Macrae s.n.* (Holotype: K-L; drawing K-L).

Homotypic synonyms: *Dendrobium bicolor* Lindl., Gen. Sp. Orch. Pl.: 90. 1830 *nom. illeg.* [non (Ruiz & Pav.) Pers. 1807].

Eria bicolor (Lindl.) Lindl., J. Proc. Linn. Soc., Bot. 3: 58. 1858 *nom. illeg.* (non Lindl. 1830).

Eria ephemera Rchb.f., Ann. Bot. Syst. 6, 2: 272. Oct.-Dec. 1861.

Pinalia lindleyi (Thwaites) Kuntze, Rev. Gen. Pl. 2: 679. 1891.

Cylindrolobus bicolor (Lindl.) Rauschert, Rep. Sp. Nov. Regni Veg. 94: 445. 1983. *nom. illeg.*

Distribution: India, Sri Lanka.

The name *Eria lindleyi* is the first valid available name for this taxon, which we here transfer to *Cylindrolobus* following Ng et al. (2018). The earlier *Dendrobium bicolor* Lindl. is a homonym of the Peruvian *D. bicolor* (Ruiz & Pav.) Pers., the latter now known as *Cyrtochilum bicolor* (Ruiz & Pav.) Ormerod.

Dendrobium Swartz, Nova Acta Regiae Soc. Sci. Upsal. ser. 2, 6: 82. 1799. *nom. cons.*
Type species: *Dendrobium moniliforme* (L.) Sw. *typ. cons.*

The sole genus of subtribe Dendrobiinae, with about 1600–1800 species distributed from Sri Lanka and India to Tahiti. The two taxa discussed below belong to section *Stachyobium* Lindl., a group of about 48 species distributed from Sri Lanka and India to Lombok in central Indonesia. The plants are mostly only a few centimetres tall, but *Dendrobium venustum* Teijsm. & Binn. may reach to about 50 cm tall. The pseudobulbs vary from ovoid to cylindric, bearing two to several usually deciduous leaves, with axillary to pseudoterminal inflorescences bearing few to many smallish to midsized (sepals 4–15 mm long) flowers that are colored white to green, often with some purple on the lip; the lip varies from entire to trilobed, usually with a keel between the sidelobes.

Dendrobium crispum Dalz., J. Bot. Kew Gard. Misc. 4: 111. 1852 (excl. descr.).

Basionym: *Dendrobium humile* R. Wight, Icon. Pl. Ind. Orient. 5, 1: 5, t. 1643. 1851 *nom. illeg.* [non (J.E. Sm.) J.E. Sm. 1808]. TYPE: INDIA. Tamil Nadu: Iyamally Hills, July and August, *R. Wight s.n.* (Holotype: K, image seen). Fig. 1.

Heterotypic synonyms: *Dendrobium pygmaeum* Lindl., Gen. Sp. Orch. Pl.: 85. 1830 *nom. illeg.* (non J.E. Sm. 1804). *syn. nov.* TYPE: MYANMAR. Prome, January 1827, *N. Wallich Catal. No. 1999* (Holotype: K-L, image seen).

Callista pygmaea Kuntze, Rev. Gen. Pl. 2: 654. 1891.

Dendrobium wallichii Hawkes & Heller, Lloydia 20, 2: 125. 1957.

Dendrobium peguanum Lindl., J. Proc. Linn. Soc., Bot. 3: 19. 1858 *syn. nov.* TYPE: MYANMAR. Pegu, Hlain Dirt, 5 January 1854, *J. McClelland*

The first author would like to thank the herbarium and library staff at the Harvard University Herbaria for their help and hospitality during his visits. We also wish to thank K. Gandhi (GH) for nomenclatural advice.

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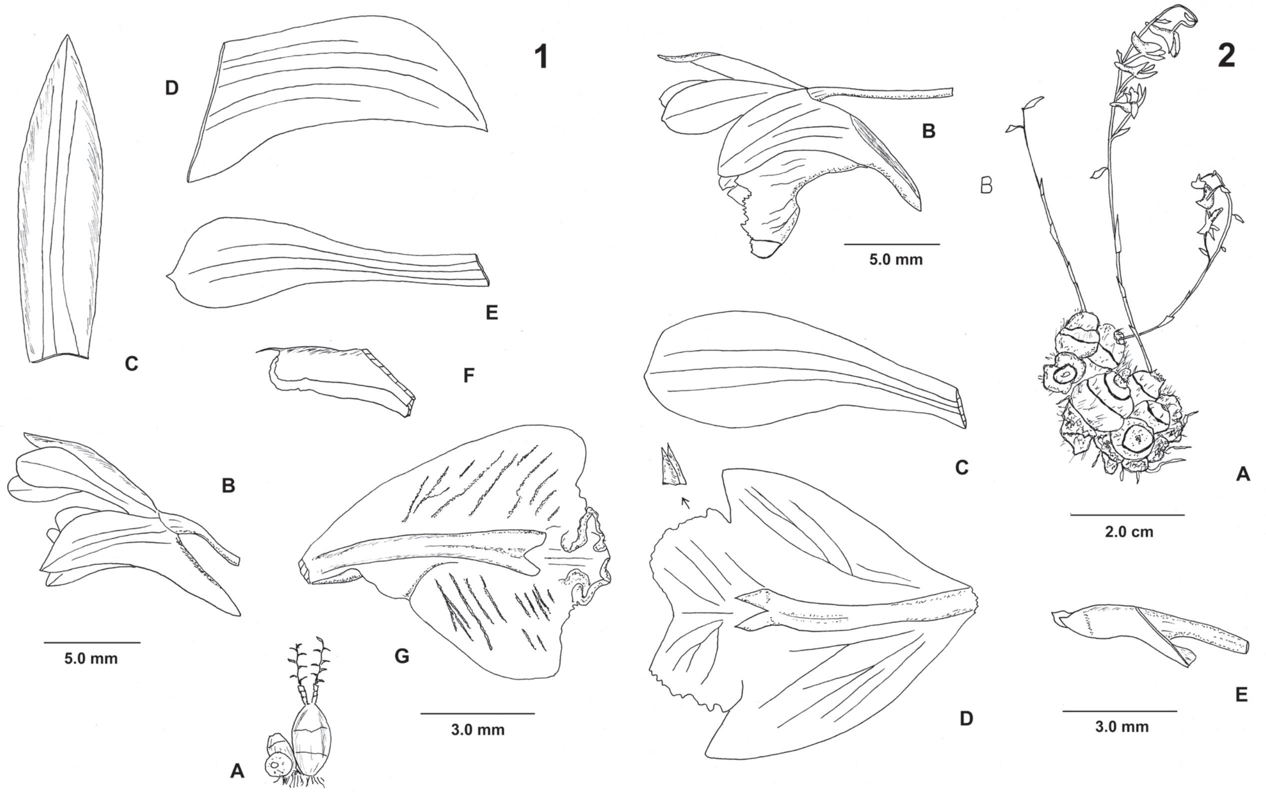

FIGURE 1–2. 1, *Dendrobium crispum* Dalz. **A**, plant (no scale); **B**, flower; **C**, dorsal sepal; **D**, lateral sepal; **E**, petal; **F**, column; **G**, labellum. Drawn from *Ritchie 1413* (GH). 2, *Dendrobium turbinatum* Ormerod & C. Sathish Kumar. **A**, plant; **B**, flower; **C**, petal; **D**, labellum (calli indicated with an arrow); **E**, column. Drawn from holotype.

s.n. (Syntype: K-L, image seen); "Borneo" [prob. Myanmar], *T. Lobb s.n.* (Syntype: K-L, not seen).

Dendrobium fesselianum M. Wolff, Orchidee (Hamburg) 41, 3: 97. 1990 *syn. nov.* TYPE: THAILAND. Without locality, *cult. H. Fessel 90002* [Holotype: D.O.G. (Deutsch Orchideen-Gesellschaft herbarium), not seen].

Distribution: India, Nepal, Bhutan, Myanmar, Thailand.

Specimen examined: INDIA. "S. India," *D. Ritchie 1413* (GH). Kerala: Paulghautcherry (= Palakkad), November 1849, *R. Wight s.n.* (K, image seen).

When describing *Dendrobium crispum,* Dalzell said it was the same as *D. humile* R. Wight. Thus *D. crispum* is a superfluous name for *D. humile,* but since the latter is a homonym, the name *D. crispum* becomes its valid substitute. Therefore, the type of *D. humile* is also the type of *D. crispum*. This is important to remember because the description accompanying *D. crispum* applies to another species, which we here describe as *D. turbinatum*.

Wight's figure of *Dendrobium humile* shows plants that flower either with or without leaves. Those depicted as having leaves during flowering appear to have slightly longer inflorescence peduncles, but this may be artistic licence as one of the leafless plants has a rather long peduncle.

Lindley (1858) declared *Dendrobium crispum* and *D. humile* to be conspecific with *D. microbulbon* A. Rich. He has been followed by all later authors. However, *D. crispum* differs from *D. microbulbon* in having much shorter inflorescence peduncles fully covered by sheaths, a narrowly conical, straight mentum, and a lip with a short, crispate-margined midlobe. The Herbarium Stocks specimen cited by Lindley (1858) as *D. microbulbon* belongs to *D. turbinatum*.

After further study we also find that *Dendrobium peguanum* and its synonyms must be reduced to *D. crispum*. There are some slight differences in the apex of the labellum callus of eastern populations (e.g., in Myanmar and Thailand) of *D. crispum*. In the eastern forms the callus is not so retuse apically but can be weakly tridentate or almost truncate.

Dendrobium crispum is characterized by having ellipsoid pseudobulbs forming a dense mat or patch, 1–2 apical linear-ligulate leaves, 1–2 apical inflorescences, a short peduncle (to 7 mm long) covered by sheaths, the rachis about 15 mm long with patent floral bracts, the flowers greenish yellow, tipped with pink, the lip pink with darker crimson lines, a narrowly conical, straight, acute mentum, an obtriangular labellum with veins inside the obtuse sidelobes forming low serrulate ridges, a short midlobe with crispate margins that when spread out is transversely oblong (1 x 3 mm), and a bidentate to almost truncate callus.

Dendrobium turbinatum Ormerod & C. Sathish Kumar, *sp. nov.*

TYPE: INDIA. "W. India," without locality, *sine coll., s.n.* (Holotype: GH 4663). Fig. 2.

Affinis D. crispum Dalz. *sed inflorescentiis longe pedunculatis (vs. brevipedunculatis), lobis lateralibus acutis (vs. obtusis), et dentae callus erectus (vs. prostratis) differt.*

Usage synonyms: *Dendrobium microbulbon auct. non* A. Rich., Lindl., Proc. J. Linn. Soc., Bot. 3: 19. 1858; J.D. Hook., Fl. Brit. Ind. 5: 716. 1890 *p.p.;* Gammie, J. Bomb. Nat. Hist. Soc. 16: 567. 1905; Fischer, in Gamble, Fl. Madras 3: 1412. 1928; Santapau & Kapadia, Orch. Bombay: 87, Pl. 19. 1966; Seidenf., in Matthew, Fl. Tamil Nadu Carnat. 3: 1588. 1983; Pande, Sant, Vishwasrao & Datar, Wild Orch. North. West. Ghats: 208–209. 2010.

Dendrobium crispum auct. non Dalz., Dalz., J. Bot. Kew Gard. Misc. 4: 111. 1852 (descr. only).

Epiphytic *herb*. *Pseudobulbs* caespitose, ovoid to turbinate, 2–3 noded, 2–3 leaved apically, usually leafless at flowering time, to 20 x 10 mm. *Leaves* linear-ligulate, acute, 20–140 × 3–13 mm. *Inflorescences* 1–3, apical, 15–100 mm long; peduncle 10–60 mm long; peduncular sheaths up to 3, 2–7 mm long; rachis straight to slightly flexuous, 2 to many flowered, 26–40 mm long; floral bracts oblong-lanceolate, subacute, to 4 × 2 mm. *Flowers* white, the lip marked with purple. *Pedicel with ovary* terete, dilated only at apex, 7.5–10.0 mm long. *Dorsal sepal* oblong, subacute, 3 veined, midvein externally low carinate, 7.20 × 2.75 mm. *Lateral sepals* obliquely oblong from a wide base, midvein low carinate, 6.5 mm long, 3 mm wide medially, forming with the column foot an infundibuliform, straight, subacute, 6.9–7.0 mm long mentum, front of mentum closed and spur-like for 3–4 mm. *Petals* obliquely oblanceolate, obtuse, 3 veined, 7.5 × 2.8 mm. *Labellum* trilobed, 7 mm long; hypochile obdeltate with triangular, truncate sidelobes, 5.0 × 6.5 mm; epichile transversely rectangular, broadly retuse, side margins irregular, 2.0 × 4.9 mm; callus a broad, thickened, sulcate medial ridge, terminating below apex of hypochile as two erect teeth. *Column* relatively slender, semiterete, apically with 2 ovate, apiculate brachia, 1.9–2.0 mm long.

Distribution: India.

Additional specimens examined: INDIA. Malabar, 1896, *T. Cooke s.n.* (K, drawing seen). Without locality, *N.A. Dalzell 34* (K, image seen); *N.A. Dalzell s.n.* (K, image seen); *J.S. Law s.n.* (K, image seen).

Etymology: from the Latin *turbinatus,* cone-shaped, in reference to the shape of the pseudobulbs.

As noted above this species was first described under the name *Dendrobium crispum,* but because of the laws of nomenclature that name must be applied to the homonym *D. humile* R. Wight. Therefore we have described it anew. Unfortunately Lindley (1858) united *D. crispum* and *D. humile* with *D. microbulbon,* a mistake that has been followed ever since.

Dendrobium turbinatum may be distinguished from *Dendrobium crispum* by its elongate (vs. abbreviated) inflorescence peduncle that is laxly three-sheathed, larger labellum midlobe (2.0 × 4.9 vs. 1.0 × 3.0 mm), and medial labellum callus that ends in two erect (vs. prostrate) horns.

Dendrobium microbulbon differs from *D. turbinatum* in being leafy (vs. leafless) at flowering time, flowers with a conical, obtuse, incurved (vs. infundibuliform, acute, almost straight) mentum, and a suborbicular (vs. transversely rectangular) labellum midlobe.

Peristylus Blume, Bijdr. Fl. Ned. Ind.: 404. 1825.

Type species: *Peristylus grandis* Blume.

A genus of about 100 species related to *Habenaria* Willd. In India and Sri Lanka there are respectively about 18 and 8 species, with four shared between the two nations. The genus is generally distinguished from *Habenaria* by technical details of the flowers, such as the stigmatophores being united (vs. free) to the sides of the labellum.

Peristylus caranjensis (Dalz.) Ormerod & C. Sathish Kumar, *comb. nov.*

Basionym: *Habenaria caranjensis* Dalz., J. Bot. Kew Gard. Misc. 2: 262. 1850 as *caraujensis*. TYPE: INDIA. "Insula Carauja," near Bombay, *N.A. Dalzell s.n.* (Holotype: lost, but see note). NEOTYPE (here designated): INDIA. Dronagheree, July 1848, *"J.E. Stocks" s.n.* (Holotype: K 000387524, image seen).

Heterotypic synonyms: *Habenaria stocksii* J.D. Hook., Fl. Brit. Ind. 6: 158. 1890 *syn. nov.* TYPE: INDIA. Mysore, *J.E. Stocks 173* (Lectotype, here designated: K 0000387526, image seen); Dronagheree (= Dronagiri), July 1848, *"J.E. Stocks" s.n.* (Syntype: K 000387524, image seen); Concan, *"23. Platanthera," J.S. Law s.n.* (Syntype: K 000974268; Isosyntype: P, images seen); Ram Ghaut, July, *D. Ritchie 1398* (Syntype: K 0000387525, image seen).

Peristylus stocksii (J.D. Hook.) Kraenzl., Orch. Gen. Sp.: 513. 1898.

Distribution: India.

Habenaria caranjensis has had a troubled and complicated history. It was described by N. A. Dalzell (1817–1878) from a plant he collected near Bombay during his time as a civil servant there. Dalzell sent his manuscripts from Bombay to William Hooker in England, who duly published them. It is possible that during this process a couple of misinterpretations arose. The first is the locality "Insula Carauja," which doesn't exist, it is rather the Caranja Peninsula. The incorrect spelling "Carauja" was corrected to Caranja (now Karanja) by Joseph Hooker (1890), who also emended the specific epithet. Hooker treated *Habenaria caranjensis* under the imperfectly known species at the end of the *Habenaria* taxa in the *Flora of British India*. The reason for this is that Dalzell said his taxon had cuneate, truncate labellum sidelobes, a rare feature in the genus, so far not found in any Indian member of the genus.

Analysis of the description of *Habenaria caranjensis* reveals an almost perfect match for the later *Habenaria stocksii,* except for the cuneate lip sidelobes. Nevertheless, *Habenaria caranjensis* is the only west Indian species with yellow flowers, a clavate spur, broad semi-ovate petals, and trilobed labellum. Therefore, we think Dalzell made a mistake in his description, which is understandable because the sidelobes can appear cuneate in live material (see photographs in Pande et al., 2010).

Another complicating factor has been the apparent lack of a type specimen of *Habenaria caranjensis*. We believe it is still extant, but like many other Dalzell types not recognized. The specimen chosen as neotype comes from Dronagheree (now Dronagiri), which is a fort on the Karanja Peninsula south of Bombay (now Mumbai), and which was collected in July 1848 and is probably Dalzell's type. The collector has noted the plant is yellow-flowered and is undescribed. A study of the handwriting on the original label is needed. A later hand in black ink and smaller writing has added J. E. Stocks as the collector, but we think incorrectly.

Among the syntypes of *Habenaria stocksii* is a collection by D. Ritchie from Ram Ghaut (= Ram Ghat). There are several places in India with this name, but the one Ritchie is referring to is an area south of Amboli and north of Tinari in Maharashta State.

Trichotosia Blume, Bijdr. Fl. Ned. Ind.: 342. 1825.
Type species: *Trichotosia ferox* Blume.

This genus of Eriinae contains about 80 species distributed from India and Sri Lanka to Vanuatu in the western Pacific. Most species are found in the Malesian part of the distribution, especially New Guinea where 24 species so far occur. The following taxon requires transfer to the genus, which is done here.

Trichotosia thwaitesii (Trimen) Ormerod & C. Sathish Kumar, *comb. nov.*

Basionym: *Eria thwaitesii* Trimen, J. Ceyl. Br. Roy. As. Soc. 9: 88. 1885. TYPE: SRI LANKA. Central Prov., Dolosbage, 915 m, December 1854, *G.C.K. Thwaites CP 2349* (Holotype: PDA, not seen; Isotypes: GOET, LE, P, 2 sheets, images seen).

Homotypic synonyms: *Eria velutina* Thwaites, Enum. Pl. Zeyl.: 299. 1861 *nom. illeg.* (non Lodd. ex Lindl. 1840). *Pinalia thwaitesii* (Trimen) Kuntze, Rev. Gen. Pl. 2: 679. 1891.

Distribution: Sri Lanka.

This species is clearly a member of the genus *Trichotosia* since its leaves and sheaths are covered with reddish-brown hairs. It is rather odd though that *Trichotosia* does not occur nearby in southern India.

LITERATURE CITED

HOOKER, J. D. 1890. Orchideae (pp. 1–198). *Flora of British India* 5 (Part 16). L. Reeve & Co., London.

LINDLEY, J. 1858. Contributions to the Orchidology of India. No. 2. J. Proc. Linn. Soc., Bot. 3: 1–63.

NG, Y. P., A. SCHUITEMAN, H. A. PEDERSEN, G. PETERSEN, S. WATTHANA, O. SEBERG, A. M. PRIDGEON, P. J. CRIBB, AND M. W. CHASE. 2018. Phylogenetics and systematics of *Eria* and related genera (Orchidaceae: Podochileae). Bot. J. Linn. Soc. 186: 179–201.

ORMEROD, P. 2014. A synopsis of *Eria* Lindl. section *Cylindrolobus* (Blume) Lindl. (Orchidaceae: Eriinae in Malesia. Harvard Pap. Bot. 19(1): 77–95.

PANDE, S., N. SANT, V. VISHWASRAO, AND M. DATAR. 2010. *Wild Orchids of Northern Western Ghats*. Ela Foundation, India.

ON THE IDENTITY OF *TRICHOCENTRUM ORTHOPLECTRON* (ORCHIDACEAE: ONCIDIINAE), WITH A NEW SPECIES FROM BOLIVIA

Franco Pupulin[1–4] and Adolfo Moreno[5]

Abstract. The species traditionally included under the synonymy of *Trichocentrum albococcineum* are re-evaluated, and *T. orthoplectron* is reinstated as a separate species. A new species of *Trichocentrum* from Bolivia, *T. moreniorum*, is described and illustrated, and its relationships with other species of the genus are discussed. A key to the species of the *Trichocentrum fuscum* group is presented.

Keywords: Bolivia, Orchidaceae, *Trichocentrum*

Even when species of *Cohniella* Rchb.f. and *Lophiaris* Raf. are included in a broad concept of *Trichocentrum* Poepp. & Endl. (Williams et al., 2001; Chase, 2009; Neubig et al., 2012), members of *Trichocentrum* sensu stricto are easily recognized by the presence of a labellar, nonfunctional spur and the basal margins of the lip fused to the sides of the column, which altogether lacks a *tabula infrastigmatica* (Pupulin, 1995; Cetzal-Ix et al., 2016). Species of *Trichocentrum* with a long spur, often largely exceeding the length of the lip, are exclusively South American in distribution (Pupulin, 1995). Among them, the six species informally assigned to the *Trichocentrum pulchrum* group, uniquely characterized by their triquetrous ovary, are strictly Andean (Pupulin, 1995, 1998). Species of the *Trichocentrum fuscum* group (10 taxa, including the new species described here) are distributed throughout tropical South America, with a majority of taxa recorded in the Guyanese and coastal Brazilian regions (Pupulin, 1995; Cetzal-Ix et al*.,* 2016). All the species of the latter group presents successive inflorescences and an ovary that is round in section (Pupulin, 1995).

Pupulin (1995), as well as Cetzal-Ix and collaborators (2016), treated *Trichocentrum albococcineum* Linden as a variable species with broad geographical distribution, ranging from northwestern Brazil, close to the Venezuelan border (where it should be also expected), to Peru and Bolivia. They included in its synonymy five heterotypic names, namely *T. amazonicum* Barb.Rodr. (from Brazil, Maranhao), *T. ionopthalmum* Rchb.f. (Amazon, without further data), *T. leeanum* Rchb.f. (dubiously from the western Cordillera of Equatorial America), *T. orthoplectron* Rchb.f. (origin unknown), and *T. porphyrium* Rchb.f. (origin unknown).

The synonymy of the well-known *Trichocentrum albopurpureum* Linden & Rchb.f. requires no discussion, as it was ostensibly based on the same material previously described by Linden in one of his catalogues on newly introduced plants (Linden, 1865; Reichenbach f., 1866) (Fig. 1), and it has to be treated as a homotypic name (Pupulin, 1995). On the other hand, it was João Barbosa Rodrigues (1882) himself who synonymized his *T. amazonicum* (Barbosa Rodrigues, 1877), after comparing it with the description and the illustration of *T. albopurpureum* published by Joseph Dalton Hooker (1868) in the *Botanical Magazine*.

In the protologue of *Trichocentrum ionopthalmum*, Reichenbach f. (1876) compared it with *T. albococcineum* (as *T. albopurpureum*), mainly distinguishing it by the presence of two basal keels on the lip (instead of four). However, the "three projecting angles" described by Reichenbach could easily be interpreted as shorter, lateral keels, so becoming practically indistinguishable from the four major keels and the two lateral, short teeth of the latter species. The flower analysis of *T. ionopthalmum* published by Pabst and Dungs (1977: 314, fig. 2098), supposedly from Brazilian Amazonas and Mato Grosso, shows an obcordate lip, cuneate at the base, which does not match either the protologue ("*labelli ungue semilibero lamina pandurata, apice emarginata*," Reichenbach f., 1876) or the drawing of the type. If not a form of the species similar to that described by Reichenbach f. as *T. porphyrio* (see discussion under), it could well be a still undescribed taxon from Brazil.

Trichocentrum leeanum was originally described from a plant flowered in the collection of William Lee of Downside, Leatherhead, Surrey (United Kingdom), where Reichenbach f. saw it in a living state. The origin of the specimen was dubiously indicated as the western Cordillera of Equatorial America ("*ex cordill. occid. Am. Aequat.*"). As the Andean mountain range splits into several branches only north of Ecuador, it is possible that type specimen was Colombian, and so it was treated by Dodson in his unpublished "Checklist of the Orchids of the Western Hemisphere" (C. H. Dodson, unpubl. manuscript). The occurrence of *T. albococcineum* in Colombia was confirmed by Ortiz (1995), who identified

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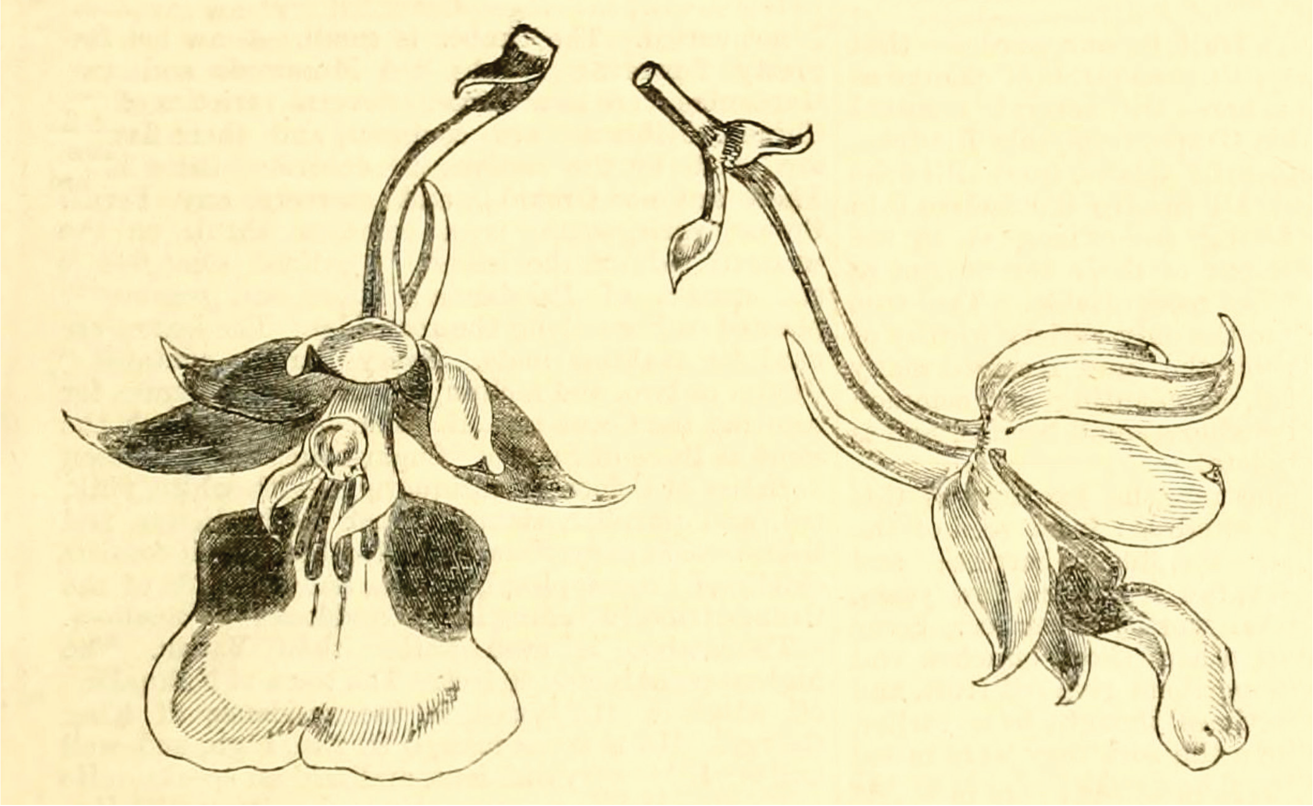

FIGURE 1. Illustration of the flowers of *Trichocentrum albopurpureum* (= *T. albococcineum*) from the plant that served as the type. *The Gardeners' Chronicle & Agricultural Gazette* 1866, page 219 (March 10, 1866).

it as *T. orthoplectron* (Bernal et al., 2016). Reichenbach f. mostly characterized *T. leeanum* by the solid purple lip with a bilobed white blotch at the base (Reichenbach f., 1886). The solid purple phase of *T. albococcineum* is apparently the most common in Peru (Schweinfurth, 1960; Zelenko and Bermúdez, 2009; American Orchid Society, 2018), where populations are usually found along the major rivers that drain the Amazonas. One of us (FP) examined living material from Peru (Fig. 2A) and found the flowers morphologically inseparable from those of populations from the Brazilian Amazonas. We also had the opportunity to study material from Bolivia, close to the border with Brazil (Santa Cruz: Noel Kempff National Park, *D. Ric & R. Vasquez s.n.*, not conserved) (Fig. 2B), and we can record the presence of the solid purple form also in this country.

Reichenbach f. described *Trichocentrum porphyrio* in 1884 from a plant without known origin and grown by Jean Linden, who had it illustrated for the *Illustration Horticole* (Reichenbach f., 1884) (Fig. 3). Even though the plant that served as the type has a distinctly obovate-subpandurate lip, the shape of the column and the purple coloration of the lip, blotched of whitish yellow at the base, are consistent with the solid purple phase of *T. albococcineum*. The flower analysis of *T. porphyrio* in Pabst and Dungs (1977: 315, fig. 2102) was probably traced from the original illustration, so the occurrence of a *Trichocentrum* species with these characters in the Brazilian Amazonas is questionable.

Upon a second examination, we thought that the concept of *Trichocentrum orthoplectron* deserves being treated as a separate species. Reichenbach f. described the species in 1883 on the basis of another plant without known origin that he received from William Lee, who apparently had acquired it from the nurseries of Frederick Sander at St. Albans, Hertfordshire, England. The most prominent collectors working in South America for Sander were Benedict Roezl (1823–1885), who explored all the Andes from Colombia to Peru, and his nephews Eduard Klaboch (fl.1870s) and Franz Klaboch (died 1879), who mainly collected in northern Andes (Cribb, 2010). Nevertheless, the firm of Sander came to employ over 20 collectors at the same time to search for new orchids in Asia and tropical America (Swinton, 1970), so that any attempt to guess the origin of the plant on the basis of Sander collectors' histories would be futile. Reichenbach f. compared *T. orthoplectron* with his *T. ionopthalmum* (= *T. albococcineum*), distinguishing it by cuneate petals (vs. hastate), the uncinate wings of the column, the "nearly obliterated" keels at the base of the lip, and the straight, not sigmoid spur shorter than the column. The drawing of the type kept in Vienna (W-R 42226) clearly shows the subquadrate lip and the "five [deep crimson-lake] stripes …in lieu of genuine keels" described in the protologue (Fig. 4–5). The light cinnamon-colored sepals and petals are covered with cinnamon spots at the apex (Fig. 5). A photograph of a flower very nearly approaching the possible concept of *T. orthoplectron* was published electronically by Jean Claude George at Orchidorama (George, 2006) (Fig. 6). Even though no information about the original locality was available, the depicted flower shows

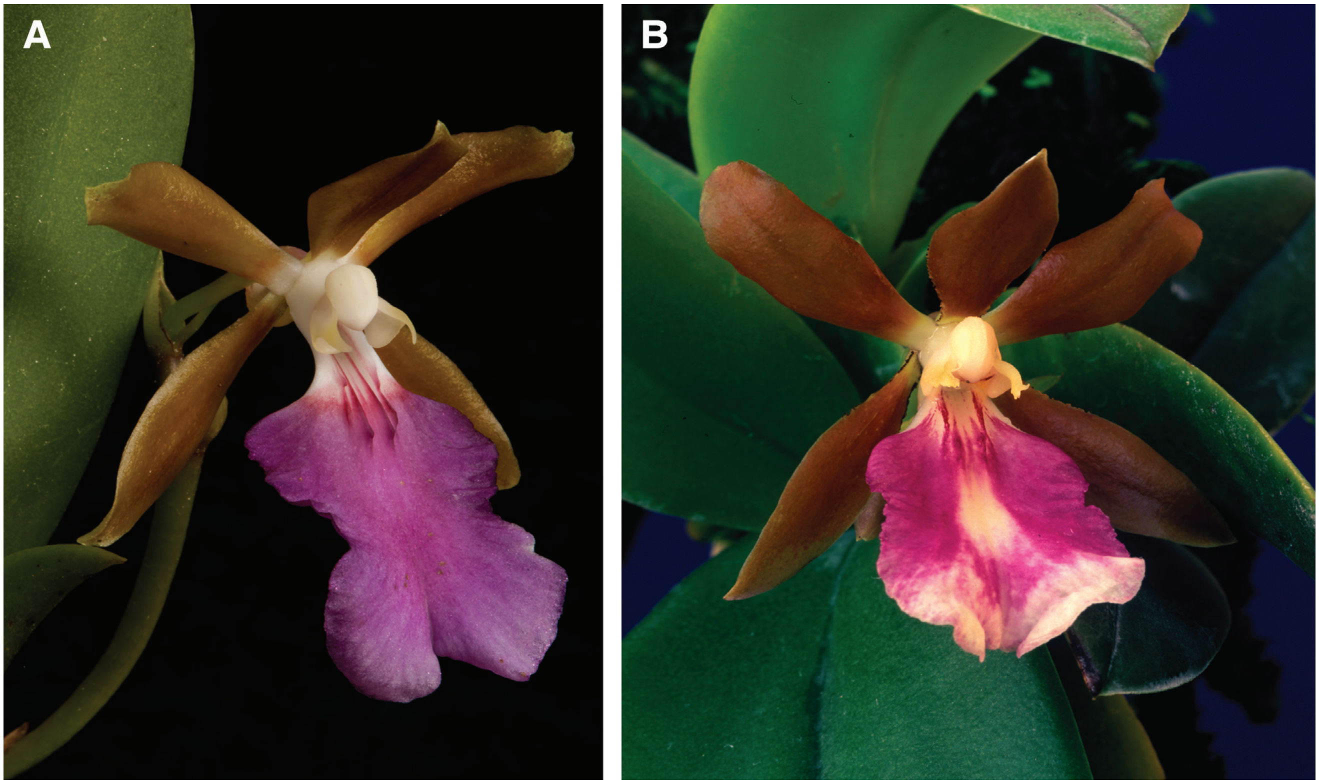

FIGURE 2. Flowers of *Trichocentrum albococcineum*. **A**, Peru: without specific locality, photographed in the orchid collection of Ecuagenera, Gualaceo, Ecuador, Oct. 2017; **B**, Bolivia: Parque Nacional Noel Kempff, border with Brazil, Jan. 1998, *D. Ric & R. Vásquez s.n*. Photographs by F. Pupulin.

the very low keels at the lip base, the uncinate wings, and the finely spotted sepals and petals matching Reichenbach f.'s description and drawing. Under the name of *T. orthoplectron*, Pabst and Dungs (1977: fig. 2101) presented the analysis of a flower that also corresponds quite closely to the concept of the species according to Reichenbach f. The Brazilian origin of the illustrated specimens was however dubious. The plant illustrated by John Nugent Fitch for Warner and Williams's *Orchid Album* (1887: pl. 272), under the name *T. orthoplectron,* represents instead a specimen of *T. albococcineum* with solid purple lip.

During the activities aimed at an inventory of the orchid flora of the surroundings of Amboró National Park and Integrated Management Natural Area in Santa Cruz, Bolivia, specimens of a unidentified species of *Trichocentrum* were collected, and studied upon flowering. The taxon is hereafter described as a species new to science:

Trichocentrum moreniorum Pupulin & Moreno-Pareja, *sp. nov.*
TYPE: Bolivia. Santa Cruz: Ichilo, Buena Vista, 17˚28'S, 63˚40'W, 400 m, epiphytic on *Albizia saman* (Fabaceae) tree, September 2013, flowered in cultivation in Santa Cruz de la Sierra, 22 February, 2017, *A. Moreno-Pareja s.n.* (Holotype: Herbario Germán Coímbra Sanz of the Jardín Botánico Municipal de Santa Cruz de la Sierra [HGCS, acronym not registered] [5600]). Fig. 7–8.

Species Trichocentro orthoplectro Rchb.f. *affinis sed sepalis petalisque non brunneo-punctatis, callo quinque lamellis erectis tenuibus altis e basi ad medium laminae labelli extensiis duobusque dentibus brevis lateralibus formato, alis columnae triangularis truncatis apicaliter paulo denticulatis plerumque recedit*.

An epiphytic, caespitose, suberect to pendent *herb* with short rhizome, forming clumps to 15–20 cm tall. *Roots* flexuous, thick, 2–3 mm diam., white with green tips, produced on the rhizome under the attachment of the pseudobulbs. Pseudobulbs obsolete, cylindrical-ellipsoid, ca. 6 × 4 mm, covered by 2–3 triangular, papyraceous sheaths to 7 mm long, monophyllous. *Leaves* fleshy, sessile, lanceolate, acute, abaxially minutely mucronate, curved, conduplicate at the base, 8.5–14.5 × 2.1–3.0 cm, green. *Inflorescence* lateral, a pendent, successive-flowered (up to at least 4 flowers) raceme shorter than the leaves, to 5 cm long; peduncle terete, to 3 cm long, with a papyraceous, brown, clasping, ovate bract ca. 5 mm long; rachis strongly flexuose. *Floral bracts* triangular-ovate, acute to acuminate, glumaceous, becoming dry-papyraceous when old, ca. 10 × 4 mm. Pedicellate *ovary* terete-subclavate, ca. 2.5 cm long, the ovary portion ca. 6–7 mm long. *Flowers* spreading; sepals and petals yellow, boldly blotched with light chestnut brown, the claw and the apex yellow; lip white, tinged with rose on the basal margins; ridges of the callus lined with purple, fading into a yellow blotch in front, up to the point where they merge to the blade; the column white, marked with 2 bright yellow blotches and a few purple strikes in the substigmatic area. *Dorsal sepal* elliptic, obtuse, apiculate, strongly conduplicate at apex, 10.0 × 4.5 mm. *Lateral sepals* obliquely oblanceolate,

FIGURE 3. Illustration of the type plant of *Trichocentrum porphyrio* (= *T. albococcineum*). L'Illustration Horticole 31: t. 508, 1884.

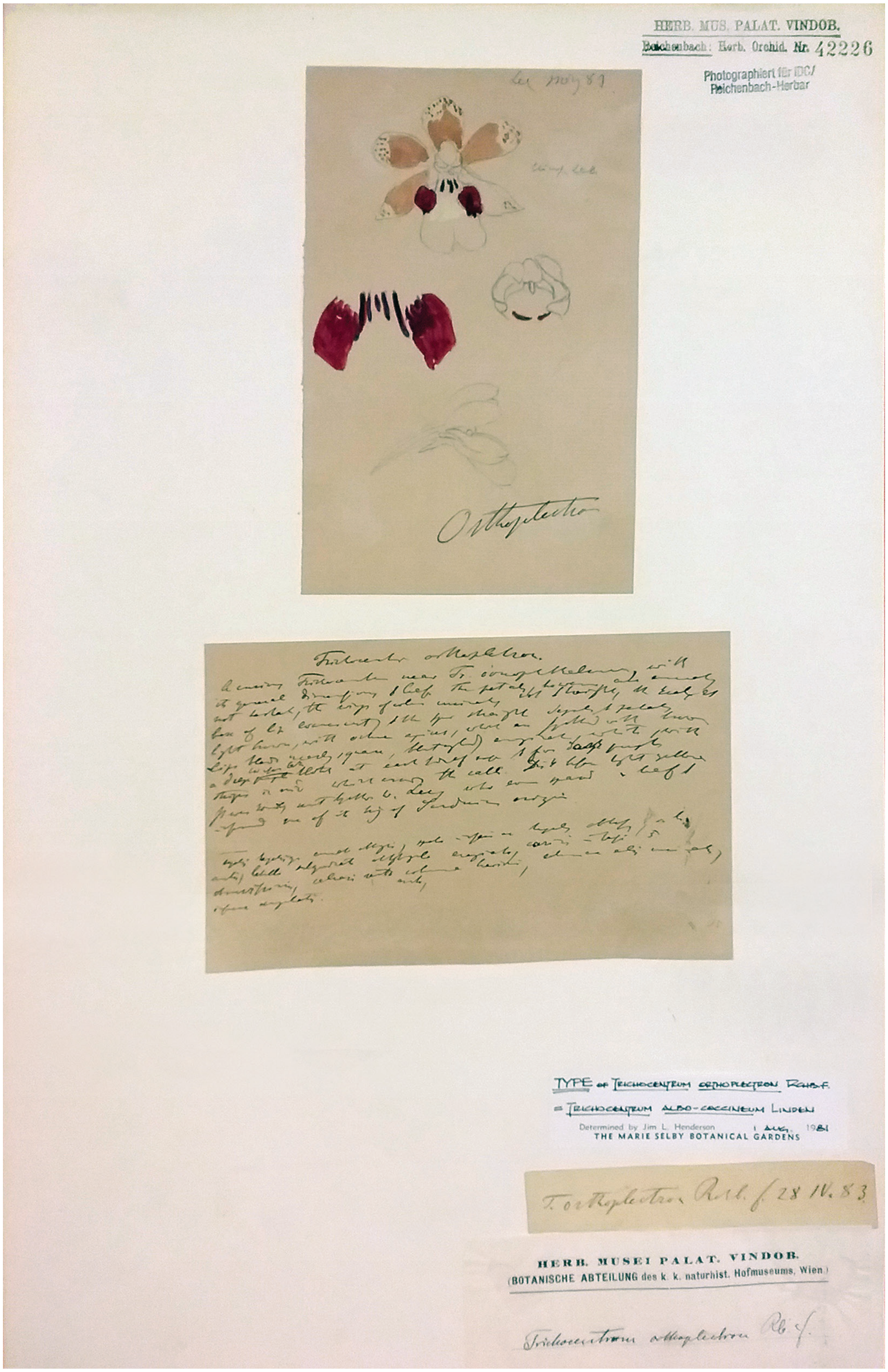

FIGURE 4. Holotype sheet of *Trichocentrum orthoplectron* (W-R 42226). Courtesy of the Naturhistorisches Museums, Wien.

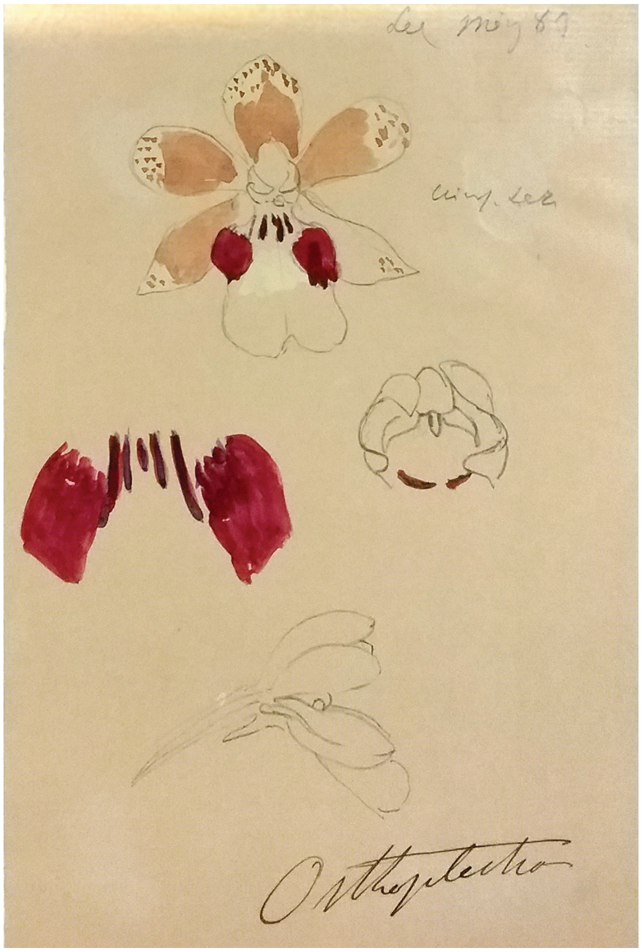

FIGURE 5. Detail of Reichenbach f. sketch of the type flower of *Trichocentrum orthoplectron* (W-R 42226). Courtesy of the Naturhistorisches Museums, Wien.

subacuminate, asymmetrical, 11 × 4 mm. *Petals* oblanceolate-elliptic, subobtuse to acute, strongly conduplicate at apex, 9.0 × 4.5 mm. *Lip* obovate-subcircular from a cuneate base, adnate to the base of the column, rounded and deeply notched at apex, the margins irregularly crenulate, waved, the apical portion deflexed, 14 × 12 mm excluding the spur, extended at the base into a conic, downcurved, internally papillose-hirsute spur, 8 mm long, 2 mm diam. at the base; callus on the disc composed by 2 lateral, acute, hirsutiuscule, elevated teeth running on the rear into the entrance of the spur, and 5 elevated, narrow, velutine keels, abruptly subtruncate before decurring into the lamina, the external ones longer, running to about the midpoint of the blade, radiating toward the apex, the central one shorter, straight. *Column* short, stout, hemiterete, ca. 7.5 mm long, rounded-truncate at the dilated apex, provided with two triangular, acute, incurved wings, the labellar margin subsigmoid, ca. 4 mm long. *Anther cap* elliptic, rounded-cucullate, finely hirsutiuscule, 2 celled, white; the anther incumbent, the stigma ventral, transversely broadly elliptic, large. *Pollinia* 2, ovate, complanate, ca.1.0 × 0.7 mm, on a triangular, subtruncate stipe, the apical margins of the stipe incurving after the removal, dorsiventrally superposing the pollinia; viscidium elliptic, large, brown. *Fruit* not seen.

Eponymy: dedicated to the brothers Luis René and Oscar Moreno Suárez, from Santa Cruz, Bolivia, for their contribution to the study and knowledge of Bolivian orchids.

Distribution: known only from Bolivia.

Habitat and ecology: collected in urban area, growing epiphytically over *Albizia saman* and also observed over *Enterolobium contortisiliquum* (Fabaceae) trees in Buena Vista and surroundings, north of Amboró National Park and Integrated Management Natural Area, a region of convergence of Amazonian, Chaco, and Andean biomas; altitude 400 m; mean temperature 24.3°C; annual average rainfall 2.563 mm.

Phenology: flowers from December to April.

Trichocentrum moreniorum is a close ally of *T. albococcineum* and *T. orthoplectron*, with which it shares the short spur and the triangular column wings. It differs from both by the apically truncate, erose column wings (vs. pointed, entire). It is more similar to *T. orthoplectron*, with which it shares the sessile lip with a subquadrate blade, and the base of the column wing provided with a gibbous, rounded protuberance, but from which it is distinguished by the prominent, high keels running from the base to the middle of the lip blade (vs. obscure keels, restricted to the base of the lip). It is distinct from *T. albococcineum* mainly by the sessile lip (vs. clawed), provided with a subquadrate lamina (vs. rectangular-obovate, pandurate). *Primo visu*, *T. moreniorum* is also very similar to *Trichocentrum fuscum* Lindl., but the short spur and the different column immediately distinguish the two taxa.

FIGURE 6. Flower of *Trichocentrum orthoplectron* (as *Trichocentrum albopurpureum*). Without collecting data. Photograph by J. C. George.

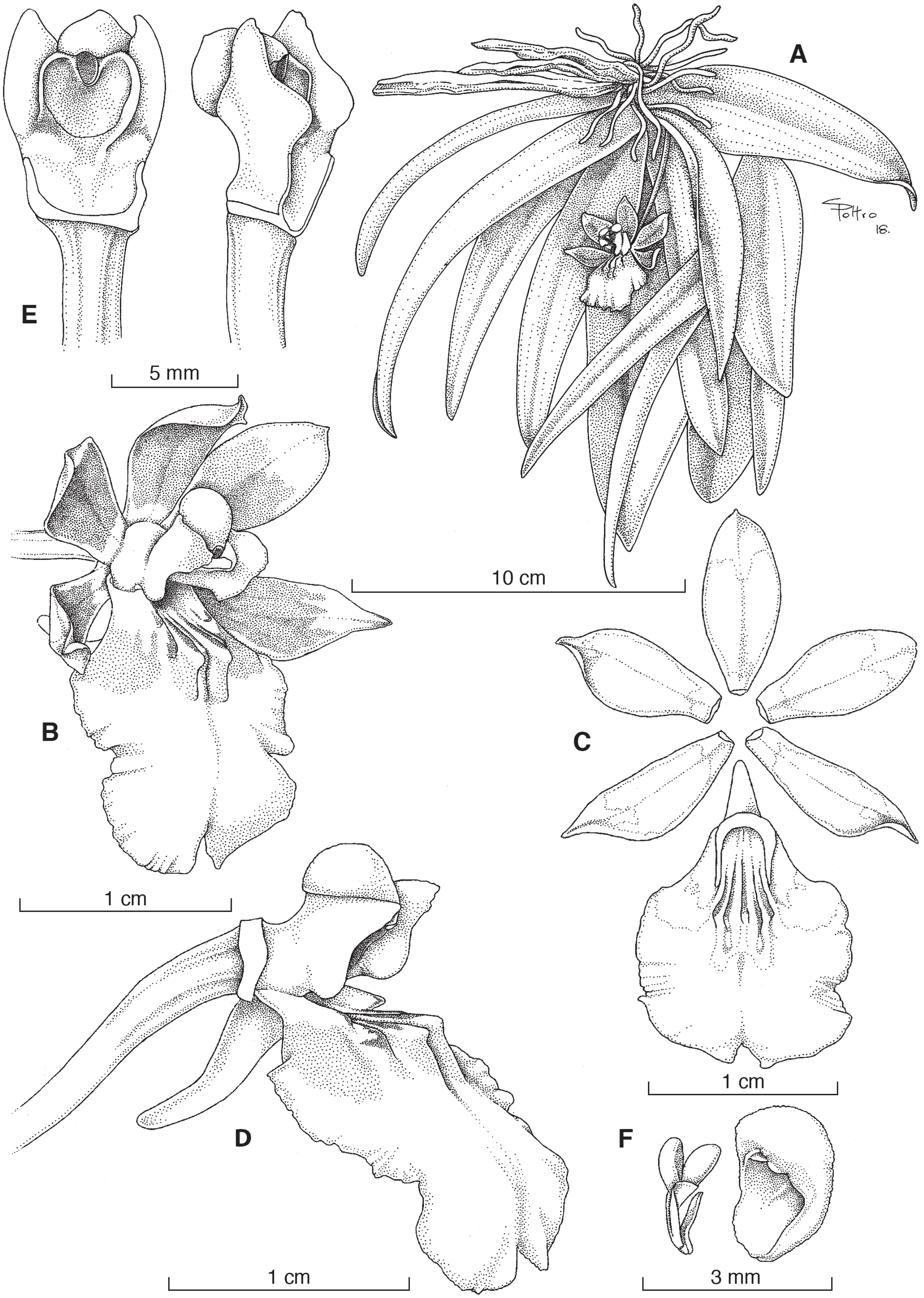

Figure 7. *Trichocentrum moreniorum*. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, three-quarters view; **E**, column, ventral and lateral views; **F**, pollinarium and anther cap. Illustration by F. Pupulin and S. Poltronieri.

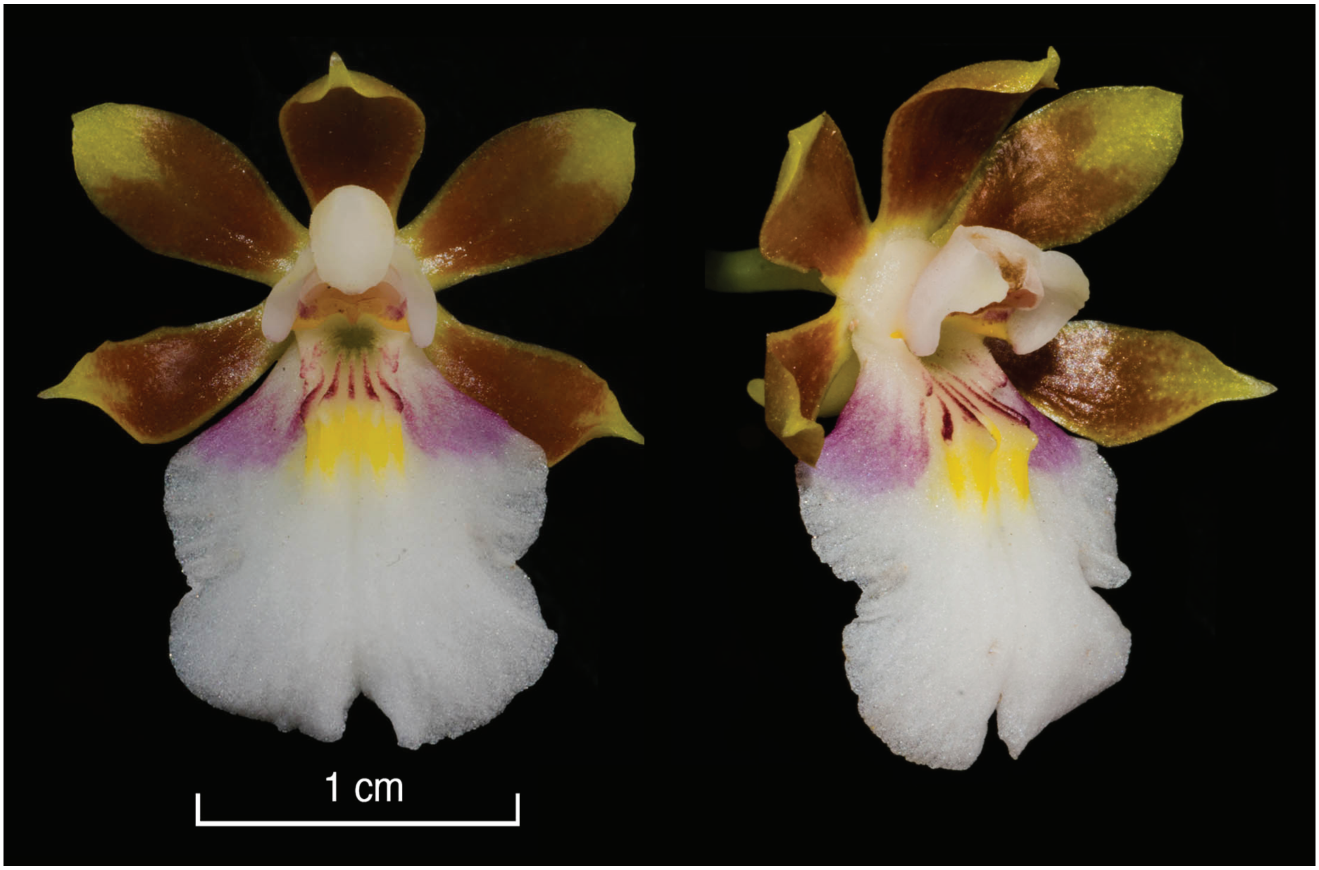

FIGURE 8. *Trichocentrum moreniorum*. Flowers from the holotype. Photographs by Cesar David Salazar.

Key to the Species of the *Trichocentrum fuscum* Group

1a. Spur shorter than the blade of the lip; wings of the column triangular, pointed 2
1b. Spur distinctly longer than the blade of the lip; wings of the column trapezoidal to dolabriform, rounded 4
2a. Lip clawed, the blade obovate-pandurate, gradually expanding from the cuneate claw; spur longer than the column . . . . . . ***T. albococcineum***
2b. Lip sessile, the blade quadrate, abruptly expanding from the base; spur shorter than the column 3
3a. Keels at the base of the lip high, running to the middle of the blade; column wings straight, apically truncate, erose . . . . ***T. moreniorum***
3b. Keels at the base of the lip low, obscure, restricted to the base of the blade; column wings uncinate, apically attenuate, entire . . . . ***T. orthoplectron***
4a. Disc of the lip with 2 keels . . . . ***T. popowianum***
4b. Disc of the lip with 4 or more keels 5
5a. Sepals and petals rose; the lip subquadrate . . . . ***T. tenuiflorum***
5b. Sepals and petals pale chestnut brown, mostly faded light cinnamon toward the apex; the lip white, variously striped and/or blotched with purple; the lip obovate oblong or pandurate 6
6a. Flowers campanulate, not completely spreading 7
6b. Flowers with the perianth spreading 8
7a. The apex of the spur up-curved, hooked . . . . ***T. recurvum***
7b. The spur sinuous, not apically hooked . . . . ***T. panduratum***
8a. Spur about twice as long as the labellum . . . . ***T. wagneri***
8b. Spur as long as the labellum or shorter 9
9a. Labellum obovate-oblong . . . . ***T. purpureum***
9b. Labellum pandurate . . . . ***T. fuscum***

Literature cited

American Orchid Society. 2018. *Trt. albococcineum* 'Peru' CHM/AOS. Retrieved at: http://www.aos.org/orchids/orchids-a-to-z/letter-t/trichocentrum.aspx, (consulted June 2018).

Barbosa Rodrigues, J. 1877. *Genera et species Orchidearum novarum quas collegit, descripsit et iconibus illustravit…1*. Imprimérie de C. et H. Fleiuss, Sebastianopolis.

——. 1882. *Genera et species Orchidearum novarum quas collegit, descripsit et iconibus illustravit… 2*. Imprimérie de C. et H. Fleiuss, Sebastianopolis.

Bernal, R., S. R. Gradstein, and M. Celis (eds.). 2016. *Catálogo de plantas y líquenes de Colombia. Volumen II. Magnoliaceae a Zygophyllaceae—Especies introducidas y cultivadas*. Universidad Nacional de Colombia, Bogotá.

Cetzal-Ix, G. Carnevali, and G. Romero-González. 2016. Synopsis of the *Trichocentrum* clade (Orchidaceae, Oncidiinae). Harvard Papers in Botany 21(2): 141–169.

Chase, M. W. 2009. Subtribe Oncidiinae. Pages 211–220 in A. M. Pridgeon, P. J. Cribb, M. W. Chase, and T. N. Rassmussen, eds., Genera Orchidacearum. Vol. 5. Epidendroideae. Part II. Oxford University Press, Oxford.

Cribb, P. 2010. The orchid collections and illustrations of Consul Friedrich C. Lehmann. Lankesteriana 10(2–3): 1–217.

George, J. C. 2006. *Trichocentrum albopurpureum* (=*albo-coccineum*). Retrieved: http://orchidorama.free.fr/04-juillet-d%E9cembre/Trichocentrum%20albo-coccineum04.JPG (consulted June 2018).

Hooker, J. D. 1868. *Trichocentrum albo-purpureum*. Botanical Magazine 94 (Ser. 3, 24): sub pl. 5688.

Linden, J. 1865. Introductions nouvelles de M. J. Linden, a Bruxelles. Belgique Horticole 15: 98–104.

Neubig, K. M., W. M. Whitten, N. H. Williams, M. A. Blanco, L. Endara, J. G. Burleigh, K. Silvera, J. C. Cushman, and M. W. Chase. 2012. Generic recircumscriptions of Oncidiinae (Orchidaceae: Cymbidieae) based on maximum likelihood analysis of combined DNA datasets. Botanical Journal of the Linnean Society 168: 117–146.

Ortiz, P. 1995. *Orquídeas de Colombia*. 2a ed. Corporación Capitalina de Orquideología, Bogotá.

Pabst, G. F. and F. Dungs. 1977. *Orchidaceae Brasilienses Band II*. Schmersow, Hildesheim, Germany.

Pupulin, F. 1995. A revision of the genus *Trichocentrum* (Orchidaceae: Oncidiinae). Lindleyana 10: 183–210.

———. 1998. New species of *Trichocentrum* (Orchidaceae) from the Andes with a realignment of the *Trichocentrum pulchrum* group. Novon 8: 283–287.

Reichenbach F., H. G. 1866. New plants. Gardeners' Chronicle 1866: 218–219.

———. 1876. New garden plants. Gardeners' Chronicle n.s. 6: 218–219.

———. 1884. *Trichocentrum porphyrio*. L'Illustration Horticole 31: 9, pl. 508.

———. 1886. *Orchideae describuntur*. Flora oder Botanische Zeitung 69: 547–562.

Schweinfurth, C. 1960. Orchids of Peru. Part 3. Fieldiana, Botany, 30(3).

Swinton, A. 1970. *Frederick Sander: The Orchid King*. Hodder and Stoughton, London, England.

Warner, R. and B. S. Williams. 1887. *The Orchid Album. Comprising Coloured Figures and Descriptions of New, Rare, and Beautiful Orchidaceous Plants*. Vol. 6. Victoria and Paradise Nurseries, London.

Williams, N. H., M. W. Chase, T. Fulcher, and W. M. Whitten. 2001. Molecular systematics of the Oncidiinae based on evidence from four DNA sequence regions: Expanded circumscriptions of *Cyrtochilum, Erycina, Otoglossum, Trichocentrum*, and a new genus (Orchidaceae). Lindleyana 16: 113–139.

Zelenko, H. and P. Bermúdez. 2009. *Orchids: Species of Peru*. ZAI Publications, Quito, Ecuador.

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ELEVEN NEW RECORDS OF MALVOIDEAE (MALVACEAE) SPECIES FROM PARAIBA STATE, BRAZIL

Sara Morais Pordeus,[1] Fernanda Maria Sobreira,[2] and José Iranildo Miranda de Melo[1,3]

Abstract. This work presents 11 new records for species of Malvoideae (Malvaceae) found in Paraíba state, northeastern Brazil: *Herissantia crispa*, *Malachra fasciata*, *Malvastrum coromandelianum*, *Pavonia malacophylla*, *Sida acuta*, *S. castanocarpa*, *S. glaziovii*, *S. glomerata*, *S. jussiaeana*, *S. urens*, and *Sidastrum micranthum*. Data on geographical distribution, habitats, flowering, and fructification and notes about morphological characters are presented for the species.

Keywords: diversity, flora, Malvales, northeastern Brazil

Malvaceae in their current circumscription are composed of nine subfamilies: Bombacoideae, Browlowioideae, Byttnerioideae, Dombeyoideae, Grewioideae, Helicterioideae, Malvoideae, Sterculioideae, and Tilioideae (Judd and Manchester, 1997; Le Péchon and Gigord, 2014) as recommended by APG I (1998), APG II (2003), APG III (2009), and APG IV (2016). Malvoideae is the largest group, comprising the genera treated as Malvaceae s.str. as well as some genera belonging to the subfamilies Sterculioideae and Bombacoideae (Grings, 2011).

Malvaceae subfam. Malvoideae includes 110 genera and 1,730 species with Pantropical distribution (Bayer and Kubitzki, 2003). It is estimated that 65% of its genera are concentrated in the Americas (Fryxell, 1997). *Pavonia* Cav. is the largest genus, with 250 species, of which 224 occur in the Americas, absent only from Chile (Esteves, 2001). However, considering Malvaceae as a whole, 73 genera and 785 species have been reported in Brazil, with 44 genera and 291 species found in the northeastern region, and 23 genera and 56 species recorded in Paraíba state (Flora do Brasil, 2020, in progress).

While conducting floristic-taxonomic studies focusing on Malvaceae in an area of Caatinga vegetation (Engenheiro Ávidos Ecological Park) and the subfamily Malvoideae in an Atlantic Forest/Caatinga transition area (Mesorregion Agreste), both located in Paraíba state, northeastern Brazil, 11 new records were found for Malvoideae. The results presented in this work expand to 67 and 45 the number of species for Malvaceae and for Malvoideae, respectively, in the state's flora (an increase of ca. 20% for the family and almost 32.5% for the subfamily).

Material and Methods

Collections were undertaken between May 2014 and February 2016 in Paraíba state, northeastern Brazil (Fig. 1). We collected fertile specimens (with flowers and/or fruits) of all of the Malvoideae species encountered during random walks in the areas (Fig. 2A–C), recording data on plant habitats, habits, the colors of the reproductive structures (androecium and gynoecium), and any other aspects that could be important for the identification of genera and species. The collection points were recorded using a GPS unit (Global Positioning System), registering latitude, longitude, and the altitude of each individual and population; digital photographs were made of the species and their respective environments. Reproductive structures (flowers and/or fruits) were preserved in 70% alcohol in the field.

Specimen were processed according to usual techniques and deposited in the Manuel de Arruda Câmara Herbarium (ACAM) of the State University of Paraíba (UEPB), Campina Grande, Paraíba state, Brazil.

The identifications were based on the classic and modern bibliography: Schumann (1891), Fuertes (1993), Fryxell (1997), Bovini (2001), Esteves (1998, 2001), Krapovickas (2003, 2007), and Rondón (2009). The geographic distribution was based on W^3 Tropicos and *Flora do Brasil 2020* (in progress), as well as the literature cited above for the family.

The herbaria JPB, EAN, UFPB, and RB also were consulted, where several of the new records were detected after specimens were correctly identified (acronyms follow Thiers, continuously updated).

Data on geographical distribution, habitats, flowering, and fructification, as well as notes about morphological characters, are presented for all species.

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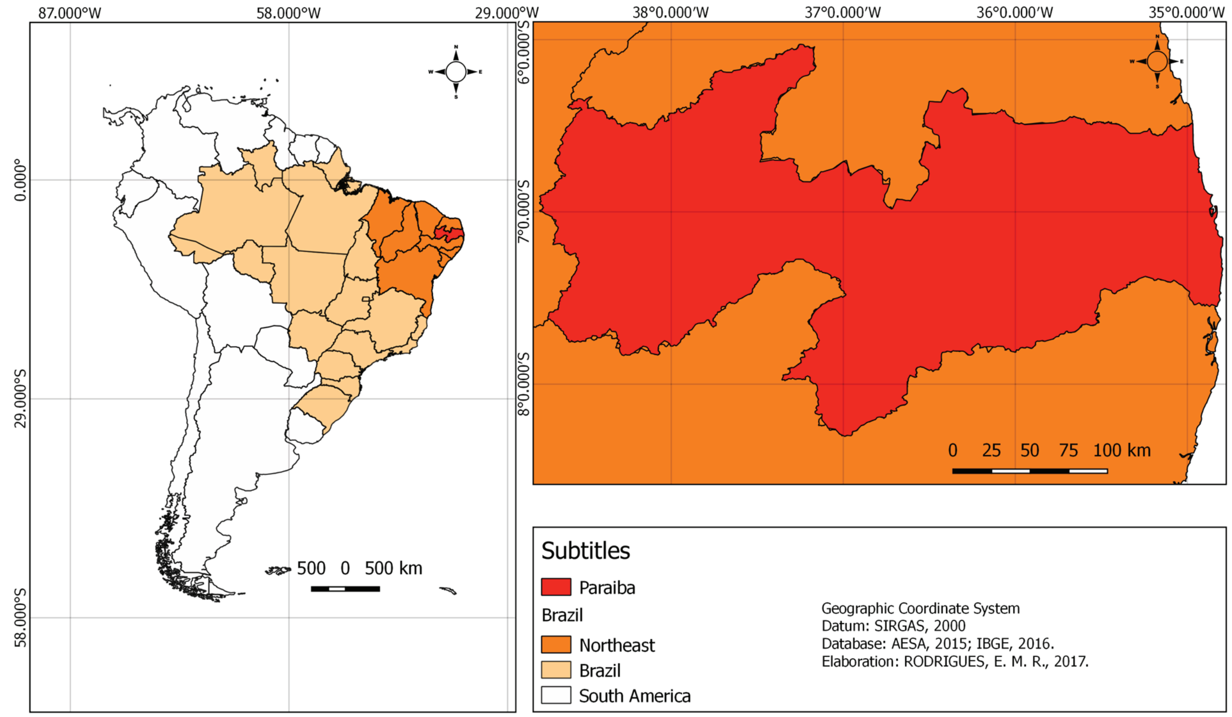

FIGURE 1. Study area, Paraíba state, northeastern Brazil.

RESULTS

1. Herissantia crispa (L.) Brizicky, J. Arnold Arbor. 49(2): 279. 1968.

Basionym: *Sida crispa* L., Sp. Pl. 2: 685. 1753. TYPE: INDONESIA (as "FILIPINAS"). Java, s.d., *C. L. von Blume s.n.* (not seen).

Distribution and habitat: this species shows pantropical distribution (Fryxell, 1997). In Brazil, it is distributed exclusively in the northeastern region (states of Alagoas, Bahia, Pernambuco, and Sergipe), growing in Caatinga and Cerrado vegetation, including disturbed areas (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in May, June, and August, and fruiting in June and August.

Additional specimens examined: BRAZIL. Paraíba state: Araruna, 29/31 August 2002, *M. F. Agra et al. 6237* (JPB); *Ibidem*, 02 August 2005, *M. F. Agra et al. 6517* (JPB); Campina Grande, 23 June 1995, *M. F. Agra et al. 3347* (JPB); Tacima, 18 May 2002, *M. F. Agra et al. 5868* (JPB).

The species is characterized especially by having inflated fruits and a corolla with white petals; morphologically similar to *Herissantia tiubae* (L.) Brizicky, from which it differs principally by having stellate trichomes on its branches and simple trichomes on its fruits (Amorim et al., 2009).

2. Malachra fasciata Jacq., Collectanea 2: 352. 1788[1789]. TYPE: VENEZUELA. Crescit in America ad Caraccas. In caldariis nostris annua planta sero floret, sub finem demum Octobres & Novembri, *N. J. Jacquin s.n.* (Holotype: W, photograph).

Distribution and habitat: this species is native to South America (Rondón, 2009). In Brazil, it is distributed in the northeastern (Bahia, Maranhão, and Pernambuco) and southeastern (Minas Gerais and Rio de Janeiro) regions, being encountered in the Amazon, Cerrado, and Atlantic Forest domains, including disturbed areas (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in May and September, and fruiting in May.

Additional specimens examined: BRAZIL. Paraíba state: Alagoinha, 08 September 1942, *L. P. Xavier s.n.* (JPB 860); Caldas Brandão, 16 May1986, *M. F. Agra 532* (JPB); Sossego, s.d., *G. S. Gonçalves 03* (EAN).

The species is characterized by having long, rigid trichomes that are slightly irritating and distributed throughout the branches, which readily distinguishes it from the other species of Malvoideae encountered in the study area.

3. Malvastrum coromandelianum (L.) Garcke, Bonplandia 5(18): 295. 1857.

Basionym: *Malva coromandeliana* L., Sp. Pl. 2: 687. 1753. TYPE: PERU, without locality designation, s.d., *A. Weberbauer 3196* (F [0BN009310], photograph).

Distribution and habitat: this species shows pantropical distribution, occurring principally in South America (Peru, Argentina, and Brazil) (Bovini, 2001). In Brazil, it is distributed in the north (Amazonas), northeast (Bahia, Ceará, and Pernambuco), central-west (Goiás), southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo),

FIGURE 2. Some of the explored areas and species of Malvoideae, Paraíba state, northeastern Brazil. **A**, Ecological Park Engenheiro Ávidos (PECEA), municipality of Cajazeiras; **B**, *Sida acuta*, inflorescences; **C**, Pedra da Boca State Park, municipality of Araruna; **D**, *Sida castanocarpa*, inflorescences; **E**, *Sida jussiaeana*, inflorescences; **F**, *Sidastrum micranthum*, inflorescence. Photographs A–B and D–F by F. C. P. da Costa; photograph C by F. K. da S. Monteiro.

and south (Paraná, Rio Grande do Sul, and Santa Catarina), associated with the Amazon, Caatinga, Cerrado, and Atlantic Forest domains, in disturbed areas, and seasonal semi-deciduous and ombrophilous forests (*Flora do Brasil 2020*, in progress).

Phenology: found flowering and fruiting in July.

Additional specimen examined: BRAZIL. Paraíba state: Areia, 31 July 2006, *M. F. Mata 603* (EAN).

This species can be recognized by having fewer bracteoles in the epicalyx than sepals, in general 4, with solitary flowers, occasionally congested, characteristics that easily identify it.

4. Pavonia malacophylla (Link & Otto) Garcke, Jahrb. Königl. Bot. Gart. Berlin 1: 221. 1881.

Basionym: *Sida malacophylla* Link & Otto, Icon. Pl. Select.: 67. 1828. TYPE: BRAZIL. Rondônia, 17 km N de Vilhena, camino a Juína, 20 July 1985, *A. Krapovickas, J. F. Valls, C. Simpson & G. Silva 40143* (Neotype: NY; Isoneotypes: C, CEN, CTES, F, G, K, UC; Neotype and Isoneotypes designated by Fryxell, 1988).

Distribution and habitat: this species shows Neotropical distribution, occurring in southern Mexico, Central America, Cuba, Peru, Bolivia, and Brazil (Bovini, 2001). In Brazil, it is distributed in the northern (Amapá, Amazonas, Pará, Rondônia, and Roraima), northeastern (Alagoas, Bahia, Ceará, Maranhão, Pernambuco, and Sergipe), central-western (Federal District and Mato Grosso), and southeastern (Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo) regions, associated with the Amazon, Caatinga, Cerrado, and Atlantic Forest domains (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in August and October, and fruiting in October.

Additional specimens examined: BRAZIL. Paraíba state: Areia, 24 August 1956, *J. C. Moraes s.n.* (EAN 1602*)*; Boa Vista, 18 October 2005, *M. F. Agra 6244* (JPB).

This species is characterized morphologically by having a schizocarp with 5 mericarps (4 equal and 1 atrophied).

5. Sida acuta Burman f., Fl. Indica: 147. 1768. TYPE: INDONESIA. Java, no locality cited, s.d., *N. L. Burman s.n.* (Lectotype: G, photograph, designated by B. Walkes, 1966). Fig. 2B.

Distribution and habitat: this species occurs in the Americas as well as in Asia and Africa (Krapovickas, 2003). In Brazil, it is distributed in the northern (Pará and Tocantins), northeastern (Bahia, Ceará, Maranhão, Pernambuco, Piauí, and Sergipe), central-western (Goiás), and southeastern (Minas Gerais) regions, in the Amazon, Caatinga, Cerrado, and Atlantic Forest domains, as well as in disturbed areas (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in May and July, and fruiting in July.

Additional specimens examined: BRAZIL. Paraíba state: Areia, 21 July 1994, *G. S. Baracho & A. J. Castro s.n.* (JPB [20340]); Guarabira, 21 May 2015, *S. Pordeus 56* (ACAM); Lagoa Seca, 29 July 2001, *C. E. Lourenço 228* (JPB).

Sida acuta is characterized, primarily, by having distichous branching and corollas clear-yellow or, when white, the center is deep yellow.

6. Sida castanocarpa Krapov., Bonplandia 16(3-4): 226. 2007. TYPE: BRAZIL. Tocantins, 40 Km NE of Wanderlandia, *A. Krapovickas, J.F.M. Valls & G.P. Silva 37845* (Holotype: CEN). Fig. 2D.

Distribution and habitat: this species occurs in the northeastern (Bahia, Ceará, Maranhão, Piauí, and Rio Grande do Norte) and central-western (Goiás) regions, associated with the Caatinga and Cerrado domains (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in April, July, October, and December, and fruiting in April.

Additional specimens examined: BRAZIL. Paraíba state: Boa Vista, 27/29 April 1994, *M. F. Agra et al. 2944* (JPB); Campina Grande, 23 October 2014, *S. Pordeus 40* (ACAM); Campina Grande, 16 July 2015, *S. Pordeus 61* (ACAM); Pocinhos, 11 December 1958, *J. C. Moraes s.n.* (EAN 2005); Ceará state: Fortaleza, 31 December 1975, *s.c.* (RB 234039); Minas Gerais state: Januário, 04 November 1978, *L. Krieger 16120* (RB); Rio Grande do Norte state: São João do Sabugi, 18 March 2011, *A. Roque 943* (RB); São Paulo state: São Paulo, 11 April 1949, *F. Hoehne s.n.* (RB 333140); Sergipe state: Nossa Senhora da Glória, 16 June 2014, *E. S. Almeida 404* (RB); Poço Redondo, 16 June 2014, (fl.), *A. S. Jesus 10* (RB).

This species can be recognized especially by its leaf blade shape, and densely pubescent branches with long trichomes, these being most dense near the apex; its flowers are short-pedicellate.

7. Sida glaziovii K. Schum., Fl. Bras. (Martius) 12(3): 322. 1891. TYPE: BRAZIL. Environs de Rio Janeiro [Rio de Janeiro] et D'Ouro Preto, 1883, *K. M. Glaziou 14510* (K [000528433], photograph).

Distribution and habitat: this species is distributed in Bolivia and Brazil (W^3 Tropicos, 2018) and, in Brazil, occurs in the northeastern (Bahia), central-western (Federal District and Mato Grosso do Sul), southeastern (Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo), and southern (Paraná) regions, associated with the Cerrado and Atlantic Forest domains, including anthropic areas (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in April and May, and fruiting in May.

Additional specimens examined: BRAZIL. Paraíba state: Bananeiras, 30 April 2015, *S. Pordeus 51* (ACAM); Guarabira, 21 May 2015, *S. Pordeus 55* (ACAM).

Sida glaziovii has a dense indument covering the entire plant; it is morphologically similar to *S. rhombifolia* L., although the latter has dense trichomes exclusively on the inner surface of its leaf blade.

8. Sida glomerata Cav., Diss. 1: 18. 1785. TYPE: Without recorded locality, without recorded date, *A. L. Jussieu s.n.* (P-JU [12249], photograph).

Distribution and habitat: occurs in Central and South America, having also been recorded in the United States (Fuertes, 1993). In Brazil, this species is distributed in the northern (Amazonas, Pará, and Tocantins), northeastern (Bahia, Ceará, Maranhão, Pernambuco, Piauí, and Rio Grande do Norte), central-western (Goiás, Mato Grosso do Sul, and Mato Grosso), and southeastern (Minas Gerais and Rio de Janeiro) regions, associated with the Amazon, Caatinga, Cerrado, Atlantic Forest, and Pantanal domains, including disturbed areas (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in February to June, and fruiting in February, April, May, and July.

Additional specimens examined: BRAZIL. Paraíba state: Araruna, 02 August 2005, *M. F. Agra et al. 6500* (JPB); Areia, 15 May 1953, *J. C. Moraes s.n.* (EAN 695); *Ibidem*, 28 July 1986, *G. V. Dornelas 250* (EAN); *Ibidem*, 17 February 2011, *L. L. Barreto 84* (EAN); Campina Grande, 23 June 1995, *M. F. Agra et al. 3330* (JPB); Ingá, 28 April 1994, *M. F. Agra et al. 2871* (JPB).

Sida glomerata can be characterized as having flowers united in glomerules, these generally being congested and axillary, and having fruits with 5 mericarps.

9. Sida jussiaeana DC., Prodr. 1: 463. 1824. TYPE: Pérou, *s.l.*, *s.d.*, *A. L. Jussieu 12267-A* (Holotype: P [00680410]). Fig. 2E.

Distribution and habitat: this species presents a Neotropical distribution, occurring mainly in Central and South America. It is registered in the northeastern (Bahia, Ceará, Maranhão, and Piauí), central-western (Goiás), and southeastern (Minas Gerais) regions, associated with the Caatinga and Cerrado domains (*Flora do Brasil 2020*, in progress). In the studied area was recorded in the shrub-tree stratum in an area of Caatinga vegetation, occurring at the base of the mountain range.

Phenology: found flowering and fruiting in May.

Additional specimens examined: BRAZIL. Paraíba state: Cajazeiras, Engenheiros Ávidos Ecological Park (PECEA), 454 m, 06°59'35S,7"S, 38°28'41,0"W, 23 May 2015, *F. M. Sobreira 52* (HUNEB); *Ibidem*, 454 m, 06°59'35,7"S, 38°28'41,0"W, 23 May 2015, *F. M. Sobreira 53* (ACAM).

This species can be recognized especially by prostrate habit, asymmetric leaf blade, accrescent calyx, and truncate sepals.

10. Sida urens L., Syst. Nat. (ed. 10) 2: 1145. 1759. TYPE: Jamaica, without locality noted, s.d., *P. Browne s.n.* (Holotype: LINN-866.20).

Distribution and habitat: this species is widely distributed in the tropical regions of the Americas and Africa and has been reported for Madagascar and temperate regions of the United States (Fuertes, 1993; W^{3}Tropicos, 2017). In Brazil, it occurs in the northern (Amazonas, Rondônia), northeastern (Alagoas, Bahia, and Pernambuco), central-western (Federal District, Goiás, and Mato Grosso do Sul), southeastern (Minas Gerais, Rio de Janeiro, and São Paulo), and southern (Paraná, Rio Grande do Sul, and Santa Catarina) regions, associated with the Amazonian, Cerrado, Atlantic Forest, Pampa, and Pantanal domains, including anthropic areas (*Flora do Brasil 2020,* in progress.).

Phenology: found flowering and fruiting in July.

Additional specimens examined: BRAZIL. Paraíba state: Areia, 31 July 2006, *M. F. Mata s.n.* (EAN [12112]).

According to Fuertes (1993), this species is characterized by having smooth mericarps and obtrulate sepals.

11. Sidastrum micranthum (A. St.-Hil.) Fryxell, Brittonia 30(4): 452. 1978.

Basionym: *Sida micrantha* A. St.-Hil. (1827: 190). TYPE: CUBA. Without locality noted 1860–1864, *C. Wright 2048* (Isotype: MO, photograph). Fig. 2F.

Distribution and habitat: this species occurs in South America, being encountered in Venezuela, Bolivia, and Brazil. In Brazil, it was encountered in the northeastern (Alagoas, Bahia, Ceará, Piauí, and Sergipe), central-western (Goiás), southeastern (Minas Gerais, Rio de Janeiro, and São Paulo), and southern (Paraná) regions, associated with the Caatinga, Cerrado, Atlantic Forest, and Pantanal domains, including anthropic areas (*Flora do Brasil 2020*, in progress).

Phenology: found flowering in April, June, and July, and fruiting in June.

Additional specimens examined: BRAZIL. Paraíba state: Alagoa Grande, 26 April 1959, *J. C. Moraes s.n.* (EAN 2052); Araruna, 27 June 2014, *S. Pordeus 20* (ACAM); Areia, 18 July 1986, *G. V. Dornelas 241* (EAN).

This species has diminutive flowers united in panicles of glomerules, thus differing from the other species of Malvoideae (Amorim et al., 2009). It differs from the other species of *Sidastrum* encountered in the study area by having a light-yellow to salmon corolla, and yellow staminate tube.

Literature Cited

Amorim, B., J. G. Saunders, A. L. Du Bocage-Neta, And M. Alves. 2009. Malvaceae. Pages 245–262 in M. Alves, M. F. Araújo, J. R. Maciel, and S. Martins, organizadores. *Flora de Mirandiba*. Associação Plantas do Nordeste, Recife.

APG I—Angiosperm Phylogeny Group. 1998. An ordinal classification for the families of flowering plants. Annals of the Missouri Botanical Garden 85: 531–553.

APG II—Angiosperm Phylogeny Group. 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Botanical Journal of the Linnean Society 141: 399–436.

APG III—Angiosperm Phylogeny Group. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. Botanical Journal of the Linnaean Society 161: 105–202.

APG IV—Angiosperm Phylogeny Group. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. Botanical Journal of the Linnean Society 181: 1–20.

Bayer, C. and K. Kubitzki. 2003. Malvaceae. Pages 225–311 in C. Bayer and K. Kubitzki, eds., *Flowering Plants. Dicotyledons: Malvales, Capparales and Nonbetalain Caryophyllales*. Vol. 5. Springer-Verlag, Berlin.

Bovini, M. G. 2001. Malvaceae *s.str.* na Reserva Rio das Pedras, Mangaratiba, Rio de Janeiro, Brasil. Rodriguésia 61: 289–301.

Esteves, G. L. 1998. O gênero *Pavonia* Cav. (Malvaceae) na região Nordeste do Brasil. Boletim do Instituto de Botânica 11: 161–235.

———. 2001. O gênero *Pavonia* Cav. (Malvaceae) na região Sudeste do Brasil. Boletim do Instituto de Botânica 15: 125–194.

Flora do Brasil 2020 (in progress). Malvaceae. In M. G. Bovini, G. Esteves, M. C. Duarte, C. Takeuchi, and J. Kuntz, orgs. Rio de Janeiro: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro. [online]. Available at floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB156 (accessed August 29, 2018).

Fryxell, P. A.1988. Flora of México. Malvaceae. Systematic Botany Monographs 25: 1–522.

———. 1997. The American genera of Malvaceae. Vol. 2. Brittonia 49: 204–269.

Fuertes, J. A. 1993. Revisión taxonómica del género *Sida* L. (Malvaceae) en Colombia. Ph.D. thesis, Facultad de Biología, Departamento de Biología Vegetal, Universidad de Salamanca, Salamanca.

Grings, M. 2011. O gênero *Pavoni*a Cav. (Malvaceae) no Rio Grande do Sul, Brasil. Dissertação, Universidade Federal do Rio Grande do Sul, Porto Alegre.

Judd, W. S. and S. R. Manchester. 1997. Circumscription of Malvaceae (Malvales) as determined by a preliminary cladistics analysis of morphological, anatomical, palynological, and chemical characters. Brittonia 49: 384–405.

Krapovickas, A. 2003. *Sida* sección *Distichifolia* (Monteiro) Krapov. Comb. Nov., Stat. Nov., (Malvaceae-Malveae). Bonplandia 12: 83–121.

Krapovickas, A. 2007. Las especies de *Sida* sect. *Malacroideae* (Malvaceae) del cono sur de Sudamérica. Bonplandia 16: 209–253.

Le Péchon, T. and Luc D. B. Gigord. 2014. On the relevance of molecular tools for taxonomic revision in Malvales, Malvaceae *s.l.*, and Dombeyoideae. Pages 337–363 in P. Besse, ed., *Molecular Plant Taxonomy: Methods and Protocols*. Vol. 1115 in *Methods in Molecular Biology*. Springer Science+Business Media, New York.

Rondón, J. B. 2009. La subfamilia Malvoideae (Malvaceae *s.l.*) en el occidente del estado Sucre, Venezuela. Revista UDO Agrícola 9, 3: 599–621.

Schumann, K. 1891. Malvaceae I. Flora Brasiliensis 12(3): 253–456, tab. 51–80.

Thiers, B. (continuously updated). *Index Herbariorum: a global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium [online]. Available at sweetgum.nybg.org/ih (accessed August 27, 2018).

W^{3}Tropicos. Saint Louis: Missouri Botanical Garden [online]. Available at www.tropicos.org (accessed August 27, 2018).

THE REESTABLISHMENT OF *BAKERANTHA*, AND A NEW GENUS IN HECHTIOIDEAE (BROMELIACEAE) IN MEGAMEXICO, *MESOAMERANTHA*

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Abstract. The most recent phylogenetic analyses using molecular and morphological data of Hechtioideae revealed the presence of three well-supported, morphologically distinct clades related to each other as follows: (*Hechtia tillandsioides* complex [*Hechtia guatemalensis* complex (*Hechtia s.s.*)]). (1) *H. tillandsioides* complex is recognized here at the generic level (under the reestablished name *Bakerantha*), characterized by its grass-like leaves, which are almost entire or minutely dentate, central inflorescences with pedicellate flowers, and papyraceous, pendent fruits; this clade includes four species confined to the Veracruzan, Sierra Madre Oriental, Balsas Basin, and Transmexican Volcanic Belt biotic provinces. (2) The *H. guatemalensis* complex, here proposed as the new genus *Mesoamerantha*, is characterized by the presence of central inflorescences and flowers with ¾ superior ovaries and is confined to the Pacific Lowlands, Veracruzan, Mosquito, and Chiapas Highlands provinces (in Belize, Guatemala, Honduras, El Salvador, and Nicaragua). The remaining sampled taxa are grouped into a clade (3) that consists of three well-supported lineages: the *Hechtia glomerata* complex distributed in the drainage of the Gulf of Mexico; a clade conformed by two species (*H. deceptrix* and *H. epigyna*) from the Sierra Madre Oriental that share an inferior ovary, and a poorly resolved internal clade (Core *Hechtia*) with the remaining species containing several well-supported, geographically restricted clades.

Resumen. El análisis filogenético más reciente utilizando datos moleculares y morfológicos en Hechtioideae, reveló la presencia de tres clados bien soportados, relacionados de la siguiente manera: (*Hechtia tillandsioides* complex [*Hechtia guatemalensis* complex (*Hechtia* s.s.)]). (1) Complejo *H. tillandsioides,* reconocido aquí a nivel genérico (con el nombre de *Bakerantha*); caracterizado por inflorescencias centrales, hojas parecidas a gramíneas, casi enteras o diminutamente dentadas, con flores pediceladas, frutos papiráceos y colgantes, que incluye cuatro especies confinadas a las provincias bióticas de Veracruz, Sierra Madre Oriental, Depresión del Rio Balsas, y Eje Volcánico Transmexicano. (2) El segundo clado incluye especies del complejo *H. guatemalensis*, aquí propuesto como el nuevo género *Mesoamerantha*, caracterizado por la presencia de inflorescencias centrales, flores con ovarios ¾ superiores, con sus especies confinados a las provincias biogeográficas Tierras Bajas del Pacífico, Veracruzana, Mosquito, y Tierras Altas de Chiapas (en Belice, Guatemala, Honduras, El Salvador, y Nicaragua). (3) El resto de las especies se agrupan en un clado el cual consiste de tres linajes bien apoyados: complejo *Hechtia glomerata* distribuido en la vertiente del Golfo de México; (4) un clado conformado por dos especies (*H. deceptrix* y *H. epigyna*) de la Sierra Madre Oriental que comparten ovario ínfero; y un clado no resuelto con el resto de las especies de *Hechtia* (Grupo nuclear) con algunos clados bien apoyados y geográficamente restringidos.

Keywords: Dioecy, endemism, *Hechtia*, Megamexico

Hechtioideae (Bromeliaceae), as proposed by Givnish et al. (2007), included a single genus, *Hechtia* Klotzsch, characterized by dioecy, capsular fruits, winged or almost naked seeds, spiny foliar margins, and the lack of stellate sclerenchyma. Ramírez-Morillo et al. (2018) included as additional characters the terrestrial or lithophytic habit, often growing over limestone, gypsum, or volcanic rocks, as well as fragrant flowers (with the exception of at least *H. rosea* E. Morren ex Baker, *H. iltisii* Burt-Utley & Utley, and *H. meziana* L.B. Sm.). Furthermore, pistillate flowers show a sessile stigma and staminodia, whereas staminate flowers bear stamens as well as pistillodes. An exception is *H. gayorum* Lenz, from Baja California Sur in Mexico, which is a polygamomonoecious species (pistillate, staminate, and hermaphrodite flowers on the same individual; Lenz, 1995). Hechtioideae is confined to a region called Megamexico III (sensu Rzedowski, 1991), a region that extends from the Chihuahuan and Sonoran deserts to northern Nicaragua, although most of the species (94%) are restricted to Mexico proper, reaching its highest richness in the biogeographic

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provinces of Sierra Madre del Sur, Veracruz, Chiapas Highlands, Pacific Lowlands, Balsas Basin, Transmexican Volcanic Belt, and Mexican Plateau (circumscribed as in Morrone, 2014).

The most recent phylogenetic analysis of the Hechtioideae (Ramírez-Morillo et al., 2018), which included 82.6% of the known taxa, was based on plastid (ycf1, the rpl32-trnL intergenic spacer) and nuclear (PRK) DNA regions, as well as morphological characters. Using parsimony and Bayesian inference (Fig. 1), this analysis supported the monophyly of Hechtioideae, as well as the identification of three well-supported internal clades, the first two being (1) the *Hechtia tillandsioides* complex, as the sister group to the rest of Hechtioideae and proposed here at the generic level (with the reestablished name *Bakerantha* L.B. Sm.) and (2) the *H. guatemalensis* complex, here proposed as the new genus *Mesoamerantha*. The remaining sampled taxa are grouped into a clade that consists of three well-supported lineages: (3) the *Hechtia glomerata* complex, distributed in the drainage of the Gulf of Mexico, (4) a clade of two species (*H. deceptrix* I. Ramírez & C.T. Hornung and *H. epigyna* Harms) that share an inferior ovary and are distributed north of the Isthmus of Tehuantepec in the Sierra Madre Oriental, and (5) a poorly resolved internal clade (*Hechtia* s.s.) with the remaining species containing several well supported, geographically restricted clades.

The *Hechtia tillandsioides* complex currently comprises four species—*H. caerulea* (Matuda) L.B. Sm., *H. lundelliorum* L.B. Sm., *H. purpusii* Brandegee, and *H. tillandsioides* (André) L.B. Smith—and is characterized by acaulescent to caulescent rosettes, these round and flat when young, with strict sympodial growth, with or without a well-defined, prostrate to suberect stem (*H. caerulea* and *H. purpusii*); older plants growing on cliffs feature long, narrow, pendent leaves rendering the plants a grass-like aspect when seen from afar (somewhat suggesting species of the genus *Pitcairnia* L'Hér). The leaves are succulent, channeled above, usually very narrow, long, and pending, with minutely serrate margins or even entire in some portions; adaxially, the leaves are green, glaucous, and shiny, whereas abaxially they are always white-lepidote; the apex acute, sometimes dry, often coiled. The flowers show conspicuously thin pedicels, as long as or half the length of the ovaries; the petals are spreading, coiled/reflexed, exposing the entire ovary (or pistillode), and stamens (or staminodes). The thin-textured petals vary in color from white (as in *H. purpusii* and *H. lundelliorum*) to pink (*H. tillandsioides*), or lilac to caerulescent (as in *H. caerulea*); the fruits are capsules, erect when immature, then the pedicel bends down and the fruit becomes pendulous upon maturity with carpels turning papyraceous and releasing minute seeds, 3–3.5 mm long and 0.56–0.67 mm wide, with two apical wings. Most species from this clade grow on rocky volcanic soils. They occur in low caducifolious forests at several elevations, in some places always on steep, often continuously seeping, wet walls (as *H. lundelliorum*). Members of this clade are distributed in the Transmexican Volcanic Belt, Sierra Madre Oriental, and Veracruzan provinces, always on the Mexican Gulf slope (Pech-Cárdenas, 2015; Romero-Soler, 2017). The monophyly of this clade is also well supported by molecular features, along with a fairly circumscribed biogeographical distribution. Because of its distinctness and ease of diagnosis, here we propose its recognition at the generic level in

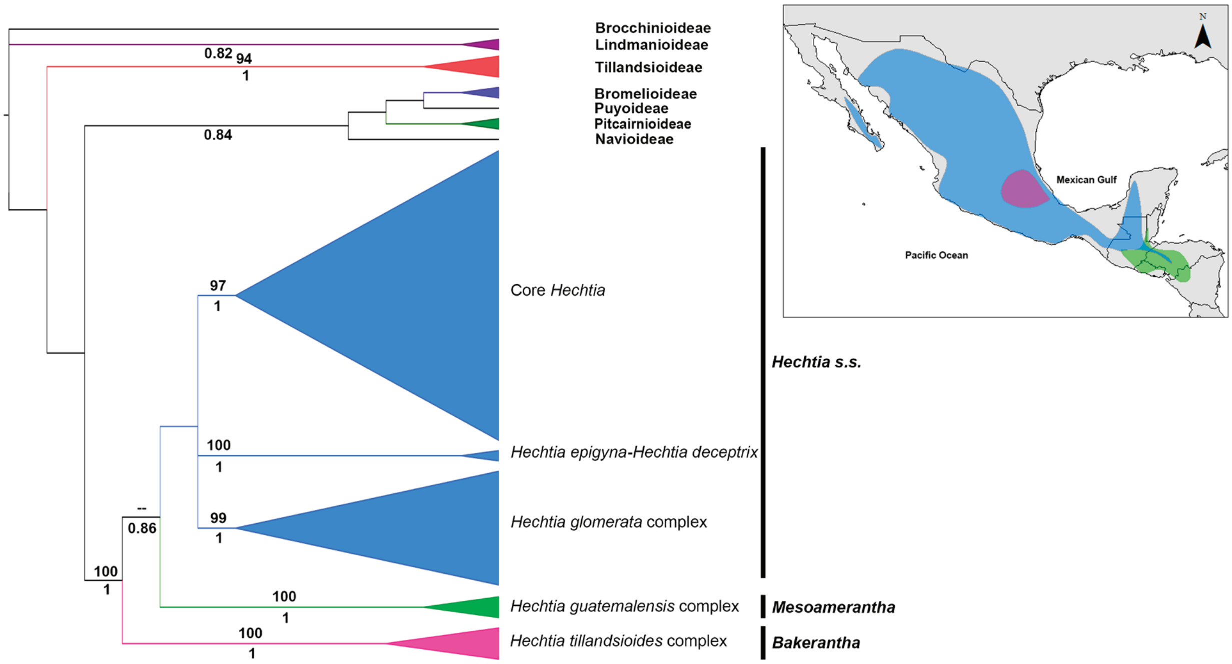

FIGURE 1. Consensus tree of 50% of the majority of the analysis of Bayesian Inference integrating total evidence from molecular characters (*matK-trnK*, *rpl32-trnL* + indels, fragments 4 and 6 of the gene *ycf1* and the nuclear region PRK) and morphological features. The values above the branches indicate the bootstrap support; the values under the branches indicate the posterior probabilities. Upper right: a map depicting the geographical distribution of the three genera in Hechtioideae (colors according to those in the cladogram).

Hechtioideae, reestablishing the name *Bakerantha* proposed by L. B. Smith (1934).

The second clade, the *Hechtia guatemalensis* complex, consists of three species distributed in the southern portion of Megamexico III. Its distribution spans the Veracruzan, Mosquito, Pacific Lowlands, and Chiapas Highlands provinces (in Belize, Guatemala, Honduras, El Salvador, and Nicaragua). They occur in caducifolious forests as well as pine-oak forests, as terrestrials or lithophytes. This species aggregation is characterized by rosettes with strict sympodial growth, serrate leaves, very short spines, which are non-uncinated but hard and rigid and homogenous in size and shape along the margin, otherwise, when long, they are soft and flexible; upon exposure to the sun, the foliar blades develop red pigments. Foliar surfaces are lustrous adaxially, white-lepidote abaxially. The flowers have green or red sepals, the corolla is spreading and the petals form a basal semi-cup; the star-like flowers have white petals and a ¾ inferior ovary; some species (*H. guatemalensis* Mez) have pendulous mature fruits. The inflorescences develop quickly but flowers open successively a few at a time, thus making the blooming period last for almost a month, more than any other species group in the subfamily, where the inflorescences usually bloom for just a week or so, also developing quickly but the flowers opening several at a time in quick succession. This clade is diagnosed by the following combination of characters: central inflorescences, flowers with ovary ¾ inferior, white (sometimes apically reddish) petals, and a distribution restricted to Central America, spanning the southern section of Megamexico III, from Belize through the dry areas south of the Motagua River close to the Guatemalan-Honduras border, then extending to northern Nicaragua, north of the lakes. This complex includes the following species: *H. malvernii* Gilmartin, *H. dichroantha* Donn. Sm., and *H. guatemalensis*. Because of its morphological distinctness and geographical circumscription, here we propose the new genus *Mesoamerantha* for this clade.

TAXONOMY

All phylogenetically informative evidence available to us (morphology and both plastid and nuclear DNA) strongly supports the *Hechtia tillandsioides* complex and the *H. guatemalensis* complex as nested within Hechtioideae but distinct and readily diagnosable. Nuclear evidence, when analyzed on its own, supports the hypothesis that these two clades are sister to each other, forming a highly supported clade, sister to the rest of Hechtioideae (henceforth *Hechtia* s.s.) (Ramírez-Morillo et al., 2018). However, when considering solely cpDNA evidence, the *H. guatemalensis* complex is sister group of a clade formed by *H. tillandsioides* complex and *Hechtia* s.s.

We propose that the morphological and ecological diversity of Hechtioideae is better accounted for by treating the subfamily as composed by three strongly supported, easily diagnosed genera. Simultaneously, the conservation of species of Hechtioideae is most easily managed if their taxonomy reflects, nomenclaturally, their diversity. This is particularly relevant as the species of *Mesoamerantha* occur in four different countries (Belize [Holst et al., 2017], Nicaragua, El Salvador, Honduras, and Guatemala), affording these countries a better grasp of the conservation needs for these taxa.

Here we include the required new nomenclature for the newly described (*Mesoamerantha*) and the reestablished (*Bakerantha*), as well as the pertinent synonymy.

Members of Hechtioideae are often difficult to identify without well-preserved, fairly complete, informative herbarium material. Identifications are also more reliable when rosette features are available, especially showing where inflorescences are borne; the morphology of both staminate and pistillate flowers, as well as that of fruits, is usually important for species-level determination. In many cases, accurate determination to species is extremely difficult without geographical information and field data, particularly with less than perfect material. The following artificial key was explicitly devised to help identify the three genera of Hechtioideae. It is important to understand that most of these clades are internally variable, and variation patterns often partially overlap: the key below is therefore polythetic and thus several characters often have to be evaluated simultaneously to arrive at a positive identification.

KEY TO MAJOR CLADES OF HECHTIOIDEAE

1a. Inflorescences lateral, originating from the lower internodes of a pseudomonopodial rosette 2

1b. Inflorescences terminal either on a fully grown rosette or from a rosette in development, which may or may not halt its growth after flowering, often both types present simultaneously . . . . 3 (*Hechtia, pro parte*)

2a. Peduncle, rachis, bracts, and sepals with dense lanuginose pubescence; ovary superior . . . . *Hechtia* (*H. glomerata* complex)

2b. Peduncle, rachis, bracts, and sepals glabrous or subglabrous; ovary ½ inferior . . . . *H. epigyna*–*H. deceptrix* Clade

3a. Rosettes round and flat to funnel-shaped; leaves spreading to erect, never pendent; foliar margins armed with pungent, usually uncinate spines; flowers sessile or pedicellate, pedicel rarely thin (<1 mm diam.), usually thick (>2 mm diam.), corolla rotate or tubular, petals patent; ovary superior or rarely half-inferior . . . . Core *Hechtia* (Fig. 2)

3b. Rosettes round and flat when young, usually becoming grass-like upon maturing, with leaves spreading to pendent, never erect; foliar margins armed but spines not pungent, or minutely serrate; inflorescences centrally borne on a fully grown rosette; flowers sessile to pedicellate, corolla with petals spreading, coiled/reflexed; ovary superior or ¾ inferior 4

4a. Flowers long-pedicellate, pedicel thin, with white, lilac, or pink petals, green or lilac sepals, ovary superior; fruits pendulous when mature, septicidal, carpels papyraceous, sepals and petals persistent on the fruit; seeds with white wings when dry; species native from the Veracruzan, Transmexican Volcanic Belt, Balsas Basin, and Sierra Madre Oriental provinces, endemic to Mexico . . . . . . *Bakerantha* (Fig. 3)

4b. Flowers sessile, with white petals, or white with red apical portions, green or red sepals, ovary ¾ inferior; fruits erect or sometimes pendulous when mature, loculicidal, carpels rigid; seed with brown wings when dry; species native from the Chiapas Highlands, Pacific Lowlands, Mosquito, and Veracruzan biogeographical provinces, in Belize, Guatemala, Honduras, El Salvador, and Nicaragua . . . . *Mesoamerantha* (Fig. 4)

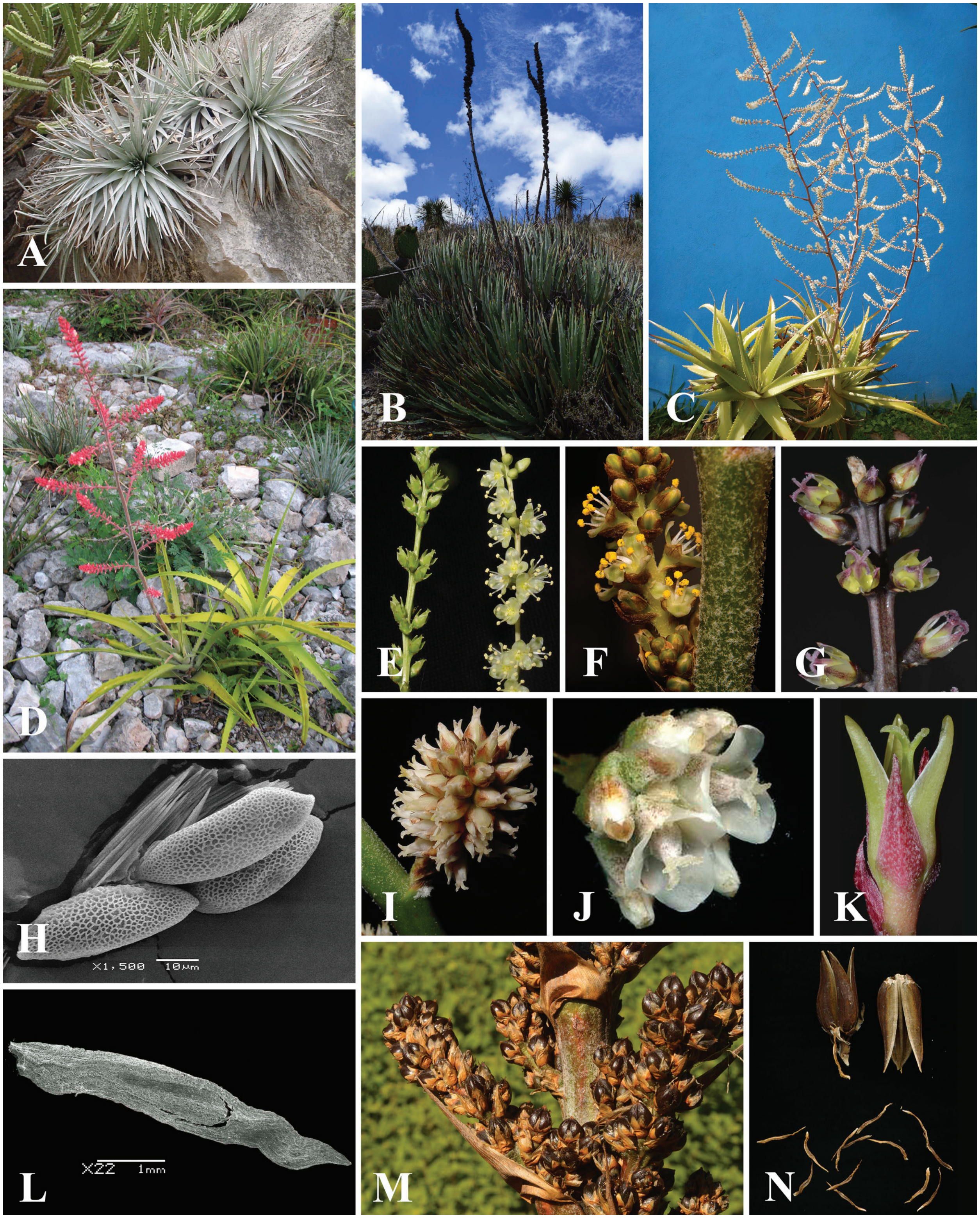

FIGURE 2. Some features of *Hechtia* s.s. **A**, *Hechtia zamudioi* Espejo, López-Ferr. & I. Ramírez showing its litophytic habit; **B**, *H. perotensis* I. Ramírez & Martinez-Correa in habitat; **C**, staminate plant of *H. fosteriana* L.B. Sm. under cultivation; **D**, *H. meziana* L.B. Sm. in bloom under cultivation; **E**, flowers of *H. aquamarina* I. Ramírez & C.F. Jiménez: pistillate (left) and staminate (right); **F**, staminate flowers of *H. confusa*; **G**, pistillate flowers of *H. huamelulaensis* I. Ramírez & Carnevali; **H**, pollen grain and raphides on *H. argentea* K. Koch; **I**, pistillate flowers of *H. nuusaviorum* Espejo & López-Ferr.; **J**, pistillate flowers of *H. glomerata* Zucc.; **K**, pistillate flower of *Hechtia iltisii* Burt-Utley & Utley; **L**, seed of *Hechtia stenopetala* Klotzsch; **M**, capsules of *Hechtia bracteata* Mez; **N**, open capsules and seeds of *Hechtia rosea* E. Morren ex Baker. Photograph and image credits: (A, C, D, E, I, J, K, M, N) I. Ramírez-Morillo, (B) C. Ramírez-Díaz, (F) G. Carnevali, (G) G. Romero-González, (H) E. Herrera and L. Can, (L) E. Gorocica and L. Can.

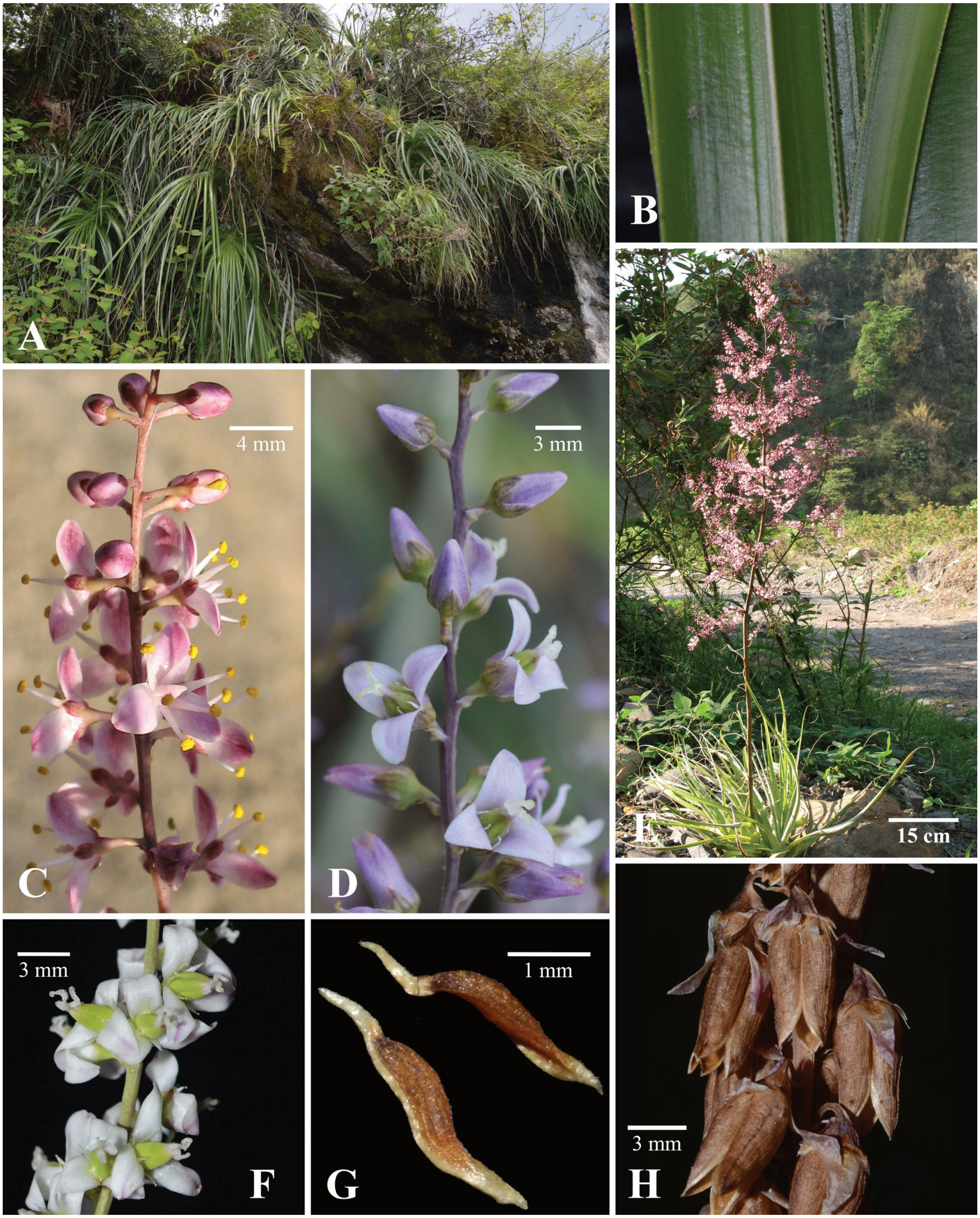

FIGURE 3. Main morphological features of the genus *Bakerantha* L.B. Sm. **A–B**, **F**. *Bakerantha lundelliorum* (L.B. Sm.) I. Ramírez & K. Romero. **A**, habit, note long and pending leaves; **B**, leaves with minute, sparsely distributed teeth on margins; **F**, pistillate flowers with white petals, note white staminodes around the ovary. **C**, **E**. *Bakerantha tillandsioides* (André) L. B. Sm. **C**, staminate flowers in anthesis; **E**, staminate plant in bloom. **D**, **G–H**. *Bakerantha caerulea* (Matuda) I. Ramírez & K. Romero. **D**, pistillate flowers; **G**, seeds; **H**, pendulous, dry fruits with persistent petals and sepals. Photograph credits: (A, B, D, F) K. Romero-Soler, (C, E) I. Ramírez-Morillo, (G, H) G. Salazar.

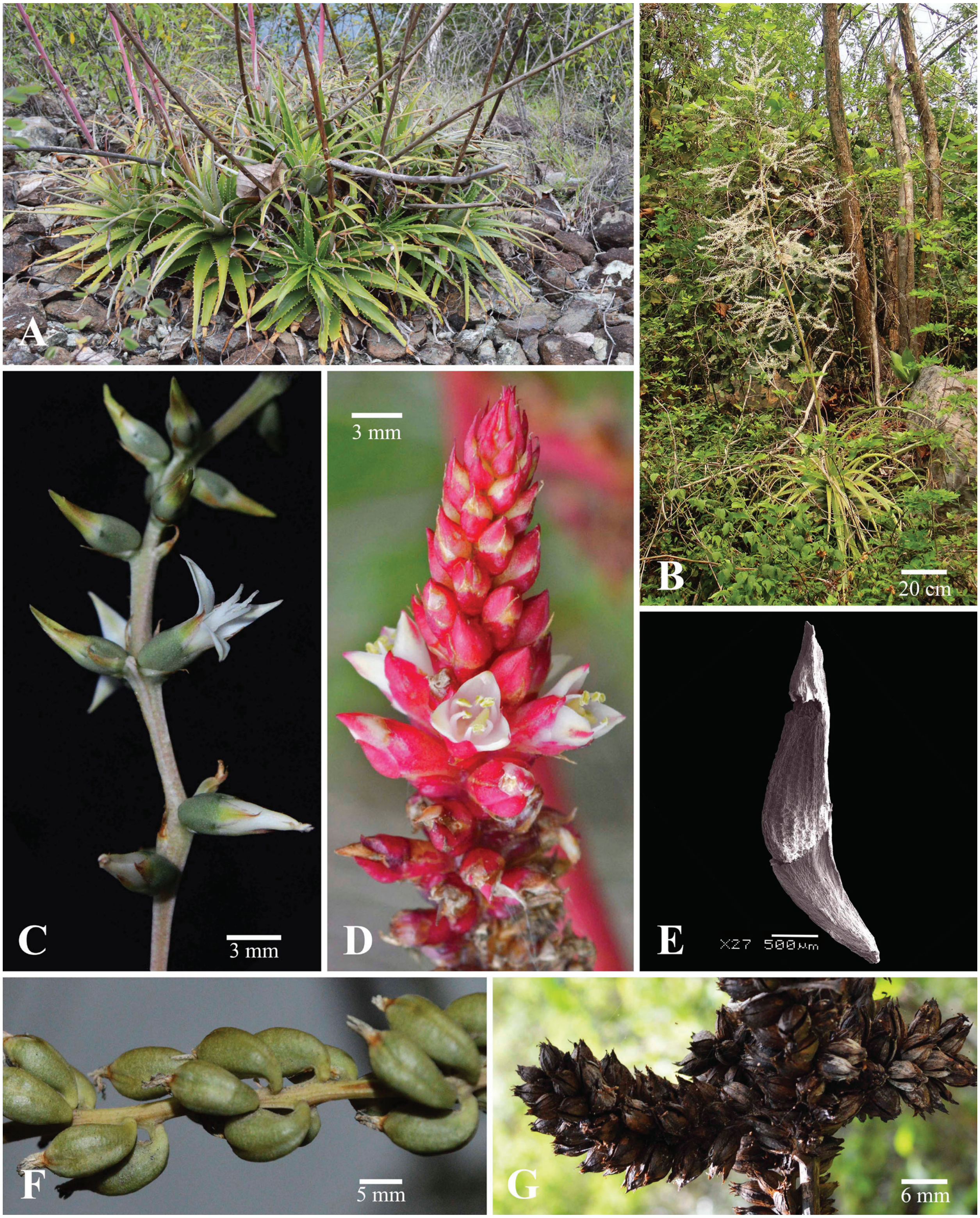

FIGURE 4. Main morphological features of the genus *Mesoamerantha* I. Ramírez & K. Romero, *gen. nov.* **A**, **D**, **G**. *Mesoamerantha dichroantha* (Donn. Sm.) I. Ramírez & K. Romero. **A**, habitat; **D**, staminate flowers **G**, fruits. **B**, **C**, **F**. *Mesoamerantha guatemalensis* (Mez) I. Ramírez & K. Romero. **B**, male plant in bloom; **C**, pistillate flowers; **F**, fruits. **E**. *Mesoamerantha malvernii* (Gilmartin) I. Ramírez & K. Romero. **E**, seeds. (A, C, D, F, G) K. Romero-Soler (B) I. Ramírez-Morillo, (E) E. Gorica and L. Can.

Bakerantha L.B. Sm., Contr. Gray. Herb. 104: 72 (1934).
Type species: *Bakerantha tillandsioides* (André) L.B. Sm.
Synonym: *Niveophyllum* Matuda, Cactáceas y Suculentas Mexicanas 10: 3–5, f. 2–4 (1965).
Type species: *Niveophyllum caeruleum* Matuda

Plants terrestrial or lithophytic herbs, acaulescent to caulescent, medium to large sized, forming rosettes but some becoming grass-like when adults. *Leaves* many per rosette; *foliar sheaths* square, ovate to transversely oblong, glabrous or white-lepidote abaxially; *foliar blades* narrowly triangular to linear-triangular, sometimes apically dry and curly, frequently pendulous, margins entire or minutely dentate, glabrous adaxially or scarcely lepidote, white and densely lepidote abaxially. *Inflorescences* central, paniculate, staminate (1)–3 divided, pistillate 1–3 divided, erect to pendulous, longer than leaves; scape and main axis glabrous; *flowers* polystichous, divaricate to diffuse, pedicellate, pedicels filiform; *sepals* petaloid, free; *petals* free, white, pink, cerulean, or lilac, membranaceous, multinerved, spreading, coiled/reflexed, exposing the entire ovary (or pistillode), and stamens (or staminodes) at anthesis; *staminodes* laminate; *ovary* superior, conical; *stamens* erect, filaments laminate; *anther* oblong, dorsifixed; *pistillode* conical, conspicuous; *stigma* sessile, lobes long and conspicuous; *fruits* dry capsules, septicidal, when immature erect, becoming pendulous when mature and seeds are free, carpels papyraceous, sepals and petals persistent on the fruit; *seeds* small and thin, fusiform, 3–3.5 mm long, 0.56–0.67 mm wide, bicaudate.

Distribution: Veracruzan, Transmexican Volcanic Belt, Balsas Basin, and Sierra Madre Oriental biogeographical provinces (sensu Morrone, 2014, and references therein) in Mexico (States of Hidalgo, Guerrero, México, Morelos, Puebla, Querétaro, San Luis Potosí, and Veracruz).

Nomenclatural history: in 1889, the French botanist Édouard François André, honoring the bromeliologist John G. Baker, proposed the genus *Bakeria* and described the first species referable to this genus (*B. tillandsioides*). André was apparently unaware that the generic name he coined was pre-occupied twice, once for a taxon in the Araliaceae (*Bakeria* Seemann, 1864), then again in the Rosaceae, when Michel Gandoger (1876) raised his own *Rosa* sect. *Bakeria* to the generic level. The great doyen of bromeliology, Lyman B. Smith, then proposed in 1934 the genus *Bakerantha* to accommodate *Bakeria tillandsioides* André (=*Bakerantha tillandsioides* (André) L.B. Smith). Later on, Smith (1951) placed *Bakerantha* in the synonymy of *Hechtia*. In 1965, a second species of this affinity was described as *Niveophyllum caeruleum* by Eizi Matuda, who referred his new taxon to Liliaceae. Smith realized this taxon was related to *H. tillandsioides* and transferred it to *Hechtia* in 1972 as *H. caerulea*. In the meantime, M. B. Foster had described *H. integerrima* in 1968, and Smith, realizing it was conspecific with Matuda's taxon, also placed it the synonymy of *H. caerulea* (Smith, 1972); Espejo et al. (2010) eventually referred the latter to the synonymy of *H. tillandsioides*. An analysis of the complex of taxa related to *H. tillandsioides* (Romero-Soler, 2017) required four species to account for the variability in geography and morphological space of the group. This analysis also strongly supported the notion that *H. tillandsioides* was more closely related to *H. lundelliorum* than to *H. caerulea*.

Bakerantha caerulea (Matuda) I. Ramírez & K. Romero, *comb. nov.*
Basionym: *Niveophyllum caeruleum* Matuda, Cactáceas y Suculentas Mexicanas 10: 3–5, f. 2–4 (1965).
TYPE: MEXICO. Mexico State: ravine, Santo Tomás de los Plátanos, S of Valle de Bravo, 1200 m, 15 March 1960, *E. Matuda 37440* ♀/♂ (Holotype: MEXU-273770, MEXU-273771).
Homotypic synonym: *Hechtia caerulea* (Matuda) L.B. Sm., Phytologia 24: 446, t. 5, f. 5 (1972).

Distribution: this species is known from a few localities in the Mexican states of Guerrero, Mexico, and Morelos, where it appears to be endemic. Localities are within the biogeographical region of the Balsas Basin, very close to the limits of the Transmexican Volcanic Belt. It grows on igneous rocks at elevations of 1100–1800 m in tropical dry forests. Espejo et al. (2010) proposed *Hechtia caerulea* as a synonym of *H. tillandsioides*, but our results (Ramírez-Morillo et al., 2018), based on cladistic analyses of DNA sequences (plastid and nuclear regions) and morphology and including all taxa in the complex, support the hypothesis that these entities are two different species.

Bakerantha lundelliorum (L.B. Sm.) I. Ramírez & K. Romero, *comb. nov.*
Basionym: *Hechtia lundelliorum* L.B. Sm., North American Flora 19: 97–98 (1938).
TYPE: MEXICO. San Luis Potosí, Tamazunchale, July 1937, C. *Lundell & A. Lundell 7265* ♀ (Holotype: MICH; Isotype: GH).
Heterotypic synonym: *Hechtia integerrima* M.B. Foster, Bromeliad Society Bulletin 18: 4, f. (1968). Type: Mexico: no exact locality, no date, *M. B. Foster 3072* ♀ (Holotype: US).

Distribution: populations of this species have been reported from the Mexican states of Hidalgo, Querétaro, and San Luis Potosí (where the type specimen comes from) or more properly from the Veracruzan and Sierra Madre Oriental biogeographical provinces, at elevations of 200–1250 m. There, mature rosettes grow on steep, continuously seeping rocky slopes, forming colonies of many individuals with pendent leaves, inflorescences, and infructescences.

Bakerantha purpusii (Brandegee) I. Ramírez & K. Romero, *comb. nov.*
Basionym: *Hechtia purpusii* Brandegee, University of California Publications in Botany 7: 325 (1920).
TYPE: MEXICO. Veracruz, Barranca de Tenampa, May 1919, C. A. *Purpus 8420* ♀ (Holotype: GH; Isotypes: NY, UC, US).
Heterotypic synonym: *Hechtia lindmanioides* L.B. Sm., Contributions from the Gray Herbarium of Harvard University 117: 14–15, t. 1, f. 24–26 (1937). TYPE:

MEXICO. Veracruz, stony slopes, Barranca de Consoquitla near El Fortin, *F. M. Liebmann 7951* ♀ (Holotype: F [photograph, GH]; Isotype: C, photograph available at JStor).

Distribution: this species is endemic to the Mexican state of Veracruz, where it is found in low caducifolious forests, on vertical walls of canyons in the Sierra Madre Oriental and Veracruzan biogeographical provinces, at 300–600 m of elevation.

Bakerantha tillandsioides (André) L. B. Sm., Contributions from the Gray Herbarium of Harvard University 104: 72 (1934). TYPE: [BRASIL] most likely MEXICO. Without precise locality, *ex Hort*. [Monsieur] A. de la Devansaye *sub E. André s.n*. (Holotype: K [K000307707]). Fig. 5–6.

Basionym: *Bakeria tillandsioides* André, Revue Horticole 61: 84, pl. (1889), *nom. illeg*. [Art. 52.1].

Homotypic synonym: *Hechtia tillandsioides* (André) L. B. Sm., Contributions from the United States National Herbarium 29(10): 431 (1951).

Distribution: populations of this species are known from the Sierra Madre Oriental biogeographical region, close to the limits of the Veracruzan Province, in the Mexican states of Hidalgo, Puebla, and Querétaro, at 750–850 m, on steep vertical walls along rivers in tropical dry forests.

Additional specimens examined: without country of origin, most likely MEXICO: K00030778 (Fig. 5); MEXICO. Puebla: Mun. Pahuatlán, El Río, a 3 Km al N de Pahuatlán, carr. a San Pablito, 20°18'N, 98°13'W [20°17'29.6"N, 98°08'49.1"W], 850 m, 04 Mayo 1989, *P. Tenorio 15730*♂ (MEXU); 20°17'33.5"N, 98°08'50"W, 767 m, 26 Abril 2007, *I. Ramírez, J.L. Tapia Muñoz y F. Chi May 1475a*♀, *1475*♂ (CICY); *I. Ramírez & G. Carnevali 1851*♂ (CICY).

Several features of this entity are relevant and are here discussed in detail as follows.

The first is the gender of the flowers in the holotype: in the protologue of the species, the androecium was described as "Étamines égalant les pétales, insérées suivant une ligne simple et régulière; anthères ovales, dorsifixies, versatiles" and the gynoecium as "*Ovaire semi-infère, dressé, trigone e triloculaire; ovules nombreux, superposés; style et stigmates très-courts, non tordus*." In order to determine whether the flowers were hermaphroditic or unisexual, the first author studied the holotype at K (K000307707; see Fig. 6) and concluded that the ovary did not have ovules. It is probable, but unlikely, that the supposedly hermaphroditic flower André examined (1889) had "ovules" in early stages of development; nonetheless, our examination of the ovary (pistillode) did not reveal ovules at all, and we conclude that the flowers are unisexual, staminate in this case, and support the transfer by Smith (1951) from *Bakerantha* to the dioecious genus *Hechtia*.

Another element we need to clarify is the place of origin of this species. When Édouard André (1889) described *Bakeria tillandsioides*, he was unsure as to the country of origin ("Brésil?"). Later, Mez (1896: 344) indicates at the very end of the description of *Bakeria* "(=*Bakeria*)… '*Patria dubia, verisimiliter Columbia*.'" Later on, Smith (1951) mentioned that stating "Colombia" as the place of origin "was another of those confusions so frequent in the description of novelties from horticultural material," concluding that the species was a native of Mexico. We have collected staminate plants in bloom in Puebla (Pahuatlán) and studied herbarium material from Querétaro (Moctezuma and Estórax rivers) that perfectly match the illustration, and we conclude that both populations represent the concept in the protologue of *Bakeria tillandsioides*, especially the illustration (Fig. 7), as well as the holotype, including drawings included thereon. Relevant herbarium material from Mexico here assigned to this species is cited above.

Mesoamerantha I. Ramírez & K. Romero, *gen. nov.*
Type species: *Hechtia guatemalensis* Mez

A genus of Hechtioideae closely related to *Hechtia* but diagnosable by means of the following character combination: central inflorescence, sessile flowers with a ¾ inferior ovary, and white, rarely apically red petals. It is also restricted to the extreme south of Megamexico.

Etymology and distribution: *Mesoamerantha* alludes to the fact that this new genus is restricted to the Mesoamerica region, particularly to Nicaragua, El Salvador, Honduras, Guatemala, and Belize, in pine-forest or low caducifolious forests.

Three species are recognized in this genus and are distributed in the biogeographical provinces of Chiapas Highlands, Pacific Lowlands, Mosquito, and Veracruzan (sensu Morrone, 2014).

Mesoamerantha guatemalensis (Mez) I. Ramírez & K. Romero, *comb. nov.*

Basionym: *Hechtia guatemalensis* Mez, Repertorium Specierum Novarum Regni Vegetabilis 3: 14. 1906.

TYPE: GUATEMALA. Guatemala: San Bernardo between Trapiche Grande and Las Canoras, April 1905, *H. F. Pittier 137*♂ (Holotype; US; Isotypes: B, GH).

Mesoamerantha guatemalensis is known from Belize to northern Nicaragua, commonly growing over rocky soils and road cuts. It usually forms dense colonies in open areas of tropical dry forests and xerophytic scrub. The populations of the species are distributed along the Chiapas Highlands, Pacific Lowlands, Mosquito, and Veracruzan biogeographical provinces (sensu Morrone, 2014), at elevations of 100–1600 m.

Mesoamerantha dichroantha (Donn. Sm.) I. Ramírez & K. Romero, *comb. nov.*

Basionym: *Hechtia dichroantha* Donn. Sm., Botanical Gazette 42(4): 299–300. 1906. TYPE: GUATEMALA. Baja Verapaz: slopes above Río Quililiha near Santa Rosa, May 1905, *O. F. Cook s.n.* ♂ (Holotype: US; Isotype: GH, US).

Mesoamerantha dichroantha is endemic in Guatemala, where it grows on rocky soils and cliffs, forming dense colonies in an area of pine-oak forests at 500–1600 m. Populations of *M. dichroantha* are apparently restricted to the central zone of the Chiapas Highlands biogeographical province (sensu Morrone, 2014).

FIGURE 5. Holotype of *Bakerantha tillandsioides* André. ex Hort. [Monsieur] A. de la Devansaye sub *E. André s.n.* (K000307707). Courtesy of Herbarium K. © by the Board of Trustees of the Royal Botanic Gardens, Kew. http://specimens.kew.org/herbarium/K000307707.

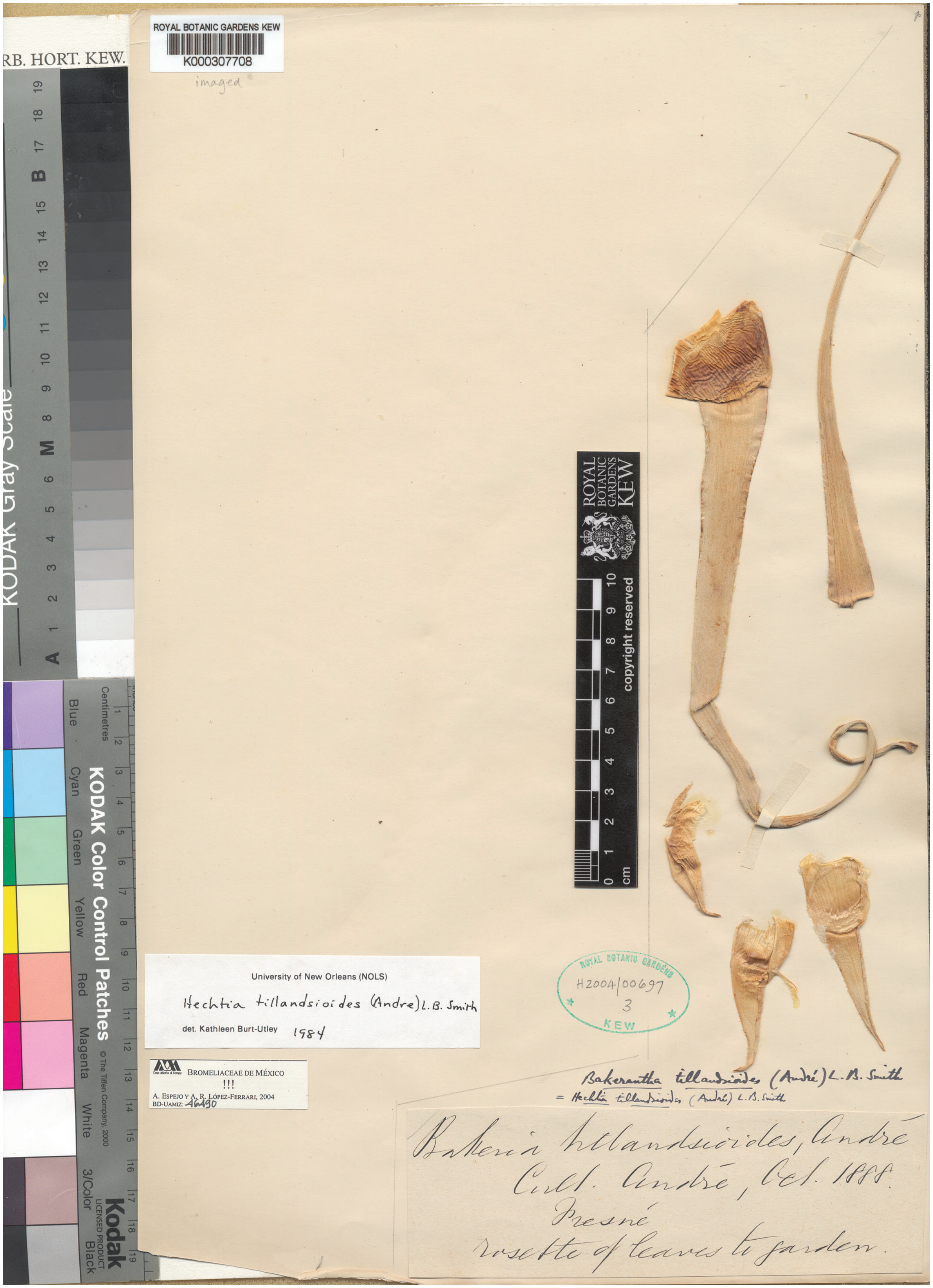

FIGURE 6. An additional specimen (K00030778) specifies "*Cult. André... 1888*," indicating that the plant was probably taken from a cultivated plant by André, which discards it as holotype. Courtesy of Herbarium K. © by the Board of Trustees of the Royal Botanic Gardens, Kew. http://specimens.kew.org/herbarium/K000307708.

FIGURE 7. *Bakerantha tillansioides* (André) L. B. Smith (sub *Bakeria*). Illustration in André (1889). Courtesy of the Botany Libraries, Harvard University Herbaria.

Mesoamerantha malvernii (Gilmartin) I. Ramírez & K. Romero, *comb. nov.*

Basionym: *Hechtia malvernii* Gilmartin, Ceiba 11(2): 9, f. 4. 1965.

TYPE: HONDURAS. El Paraiso: bank road cut near small ravine, km. 75 Tegucigalpa-Danli, 700 m, July 1964, *A. J. Gilmartin 966* ♀ (Holotype: US; Isotypes: EAP, US).

Mesoamerantha malvernii is endemic to Honduras where it inhabits pine-oak forests, more rarely tropical deciduous forests, in the eastern portion of the country, and in the southern portion of the Chiapas Highlands biogeographical province at 600–1800 m elevation.

LITERATURE CITED

André, E. F. 1889. *Bakeria tillandsioides*. Revue Horticole 61: 84–85.

Brandegee, T. S. 1920. Plantae Mexicanae Purpusianae X. University of California Publications in Botany 7: 325–331.

Espejo-Serna, A., A. R. López-Ferrari, and I. M. Ramírez-Morillo. 2010. Bromeliaceae. In: *Flora del Bajío y de Regiones Adyacentes*, Fascículo 165: 1–307. Instituto de Ecología A.C. Centro Regional del Bajío. Pátzcuaro, Michoacán, México.

Foster, M. B. 1968. A new *Hechtia* species. Bromeliad Society Bulletin 18: 4–6.

Gandoger, M. 1876. *Essai sur une nouvelle classification des roses de l'Europe, de l'Orient et sur du Bassin Méditerranéen*. Savy, CY Paris.

Gilmartin, A. J. 1965. Las Bromeliacias de Honduras. Ceiba 11(2): 1–81.

Givnish, T. J., K. C. Millam, P. E. Berry, and K. J. Sytsma. 2007. Phylogeny, adaptive radiation, and historical biogeography of Bromeliaceae inferred from ndhf sequence data. Aliso 23: 3–26. http://dx.doi.org/10.5642/aliso.20072301.04

Holst, B. K., D. Amaya, E. Baron, M. Paredes, and E. Kay. 2017. *Spiny Bromeliaceae of Belize*. Field Guide 969. The Field Museum, Chicago. http://fieldguides.fieldmuseum.org/guides/guide/969

Lenz, L. W. 1995. A new species of *Hechtia* (Bromeliaceae, Pitcairnioideae) from the Cape Region, Baja California Sur, Mexico. Aliso 14(1): 59–61.

Matuda, E. 1965. *Niveophyllum* Matuda, *gen. nov*. Cactáceas y Suculentas Mexicanas 10: 3–5.

Mez, C. 1896. Bromeliaceae. In C. de Candolle, ed., *Monographiae Phanerogamarum* 1. Masson & C^{iæ}, Paris.

Morrone, J. J. 2014. Biogeographical regionalization of the Neotropical region. Zootaxa 3782: 001–110. http://dx.doi.org/10.11646/zootaxa.3782.1.1

Pech-Cárdenas, F. D. 2015. Análisis de la distribución geográfica y del estado de conservación de *Hechtia* Klotzsch (Hechtioideae:Bromeliaceae) en Megaméxico 3. M.Sc. Thesis, Centro de Investigación Científica de Yucatán.

Ramírez-Morillo, I. M., G. Carnevali, J. P. Pinzón, K. Romero-Soler, N. Raigoza, C. Hornung-Leoni, R. Duno, J. L. Tapia-Muñoz, and I. Echevarría. 2018. Phylogenetic relationships of *Hechtia* (Hechtioideae; Bromeliaceae). Phytotaxa 376: 227–253. https://doi.org/10.11646/phytotaxa.376.6.1

Romero-Soler, K. J. 2017. Sistemática y filogenia de los complejos *Hechtia guatemalensis* Mez y *Hechtia tillandsioides* (André) L.B. Sm. (Hechtioideae: Bromeliaceae). M.Sc. Thesis, Centro de Investigación Científica de Yucatán.

Rzedowski, J. 1991. Diversidad y orígenes de la flora fanerogámica de México. Acta Botanica Mexicana 14: 3–21.

Seemann, B. C. 1864. Revision of the natural Order Hederaceae. Journal of Botany British and Foreign 2: 23–250.

Smith, L. B. 1934. Studies in Bromeliaceae—V. Contributions from the Gray Herbarium of Harvard University 104: 71–83. Available from: https://www.biodiversitylibrary.org/page/39576023#page/425/mode/1up (accessed May 1, 2018).

———. 1951. Studies in Bromeliaceae—XVI. Contributions from the United States National Herbarium 29: 429–520. Available from: http://biodiversitylibrary.org/item/13789 (accessed May 1, 2018)

———. 1972. Notes on Bromeliaceae—XXXIV. Phytologia 24: 419–453. Available from: https://www.biodiversitylibrary.org/page/13127337#page/375/mode/1up (accessed May 1, 2018).

PLANTS RELATED TO *MECONOPSIS PSILONOMMA* (PAPAVERACEAE) IN NORTHERN SICHUAN AND SOUTHEASTERN QINGHAI, CHINA

TOSHIO YOSHIDA[1,2] AND HANG SUN[3]

Abstract. Four new species of *Meconopsis—M. huanglongensis, M. inaperta, M. hispida,* and *M. trichogyna*—are described and illustrated, *M. barbiseta* is redescribed, and a new series of *Meconopsis,* series *Barbisetae,* is proposed.

Keywords: *Meconopsis,* series *Barbisetae,* Huanglong, Jiuzhi, Nianbao Yuze, Yanggong Shan

Following the rediscovery and revision of *Meconopsis psilonomma* Farrer (Yoshida and Sun, 2017), the taxonomy of species related to it in northern Sichuan and adjacent southeastern Qinghai are subject to review. Through collaborative studies of related plants in the field and in herbaria, four species are distinguished as new: *Meconopsis huanglongensis* T. Yoshida & H. Sun*, M. inaperta* T. Yoshida & H. Sun*, M. hispida* T. Yoshida & H. Sun, and *M. trichogyna* T. Yoshida & H. Sun. *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou*,* which was treated as a synonym of *M. psilonomma* in Grey-Wilson's (2014) monograph of the genus, is reestablished on the basis of new specimens and photographs and is recognized as a distinct species.

Meconopsis huanglongensis grows around the pass called Xueshanliang (雪山梁), located 8 km west of the famous sightseeing spot, Huanglong (黄龙) in Songpan Xian (松潘县), northern Sichuan. *Meconopsis inaperta* grows in Baiyu Xian (白玉县), Litang Xian (理塘县), and Yajiang Xian (雅江县) in northwestern Sichuan. *Meconopsis barbiseta* grows in Jiuzhi Xian (久治县) and Banma Xian (班玛县) in southeastern Qinghai. *Meconopsis hispida* grows on Yanggong Shan (羊拱山), a mountain range running along the boundary between Hongyuan Xian (红原县) and Heishui Xian (黑水县), northern Sichuan. *Meconopsis trichogyna* is in Dege Xian (德格县), northwestern Sichuan. The ovaries of *Meconopsis barbiseta, M. hispida,* and *M. trichogyna* have hairs with minute branches near their bases. These species are included in series *Barbisetae*, which is proposed here.

TAXONOMY

Meconopsis huanglongensis T. Yoshida & H. Sun, *sp. nov*. TYPE: CHINA. Sichuan: Xueshanliang, near Huanglong, Songpan Xian, 32°44'23"N, 103°44'02"E, 4000 m, 11 July 2016, *T. Yoshida* K107 (Holotype, KUN; Isotype, TI). Fig. 1–5, 28–29.

Meconopsis huanglongensis differs from the related *M. psilonomma* Farrer in the posture of the flowers, opening flat or dish-shaped in fine weather (usually cup-shaped in the latter), and stigma less than 5 mm long (to 8 mm long in the latter).

Herbs, monocarpic, 18–45 cm tall. *Taproot* napiform or broadly napiform, occasionally dauciform, 1–2.5 cm long, 0.6–1.6 cm across, contracted at junction with stem, distally with slender roots. Most parts of plant covered with bristles; bristles to 4 mm long. *Stem* (below uppermost leaf) simple, 0.3–5 cm long. *Leaves* crowded near base of stem, petiolate; *petiole* membranous, broadly linear, 1–6 cm long, 1.2–4 mm wide; *lamina* somewhat thick, oblong, oblanceolate or elliptic, or lowest small leaves ovate, 1.5–8 cm long, 0.5–1.9 cm wide, base attenuate, or occasionally cuneate, margin entire or occasionally wavy, apex obtuse or acute, both surfaces sparsely or moderately bristly or occasionally glabrous. *Inflorescence* scapose; scape 3—9 mm across when fresh, 2—7 mm across when dried, with dense retrorse or patent bristles. *Flowers* 1 per scape, laterally facing, opening flat or dish-shaped in fine weather, 5.5–11 cm across. *Calyx* 1.5–2.3 cm long, sparsely or moderately hairy with short bristles. *Petals* 6–10, deep purple or magenta purple, obovate, broadly obovate, rounded, rhombic or elliptic, 3–5.7 cm long, 1.5–5 cm wide, 3.2–3.7 times longer than stamens, base cuneate, margin entire or occasionally denticulate near apex, apex rounded or obtuse. *Stamens* numerous; *filaments* similar to or more deeply colored than petals, 7–13 mm long, lower 1/2 to 3/4 dilated, to 1.5 mm wide, boat-shaped, upper portion filiform, outermost filaments often scarcely dilated; dilated part of filaments overlapping and tightly surrounding ovary, filiform part of filaments more or less erect; *anthers* oblong, 1.2–1.8 mm long, *thecae* yellow or dull orange. *Ovary* ellipsoid, 4–7 mm long, densely or sparsely hairy with ascending bristles;

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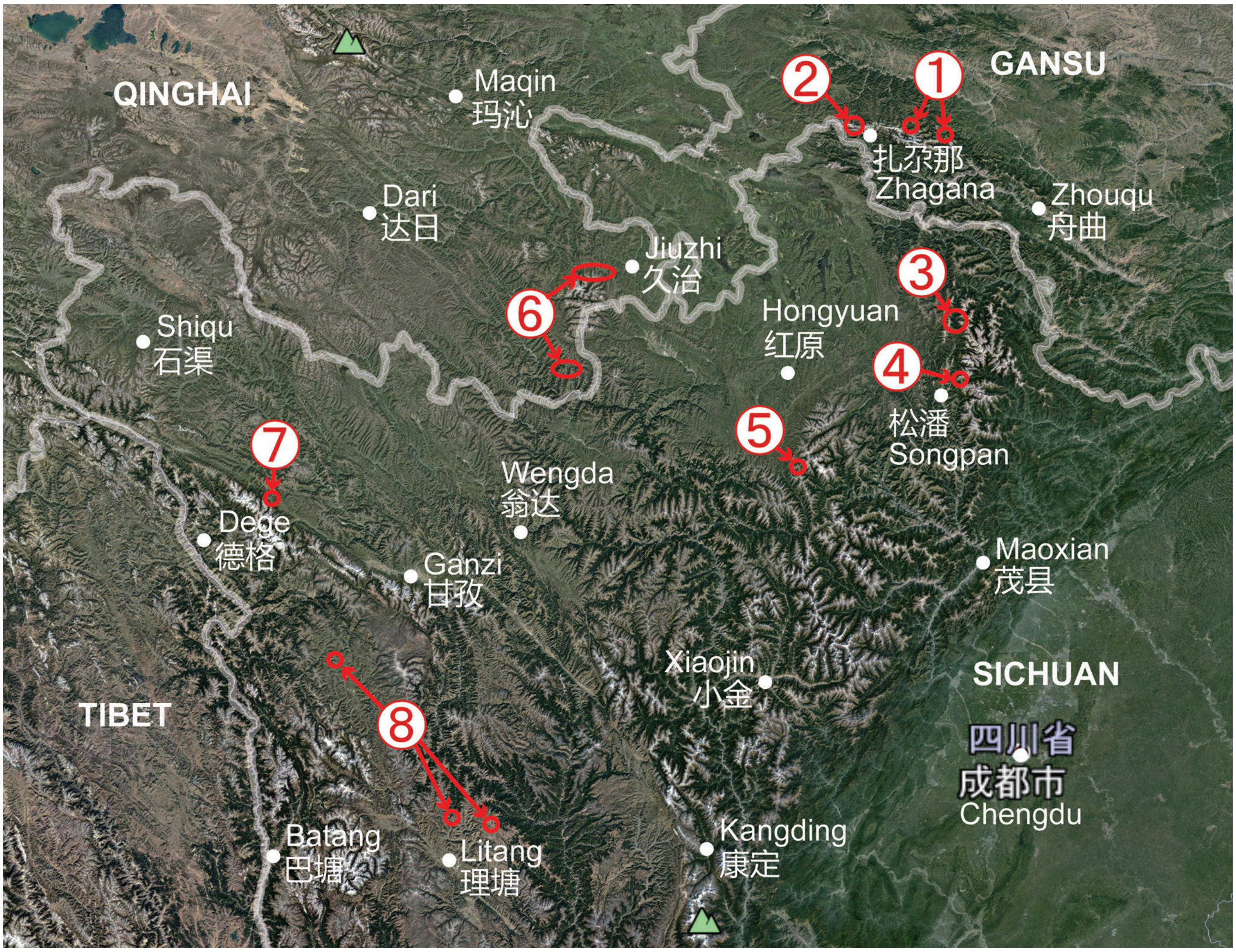

FIGURE 1. Distribution map of *Meconopsis psilonomma* Farrer and related plants, based on Google Earth. 1: *M. psilonomma* Farrer var. *psilonomma*; 2: *M. psilonomma* var. *zhaganaensis* T. Yoshida & H. Sun, *M. psilonomma* var. *calcicola* T. Yoshida & H. Sun; 3: *M. psilonomma* var. *sinomaculata* (Grey-Wilson) H. Ohba; 4: *M. huanglongensis* T. Yoshida & H. Sun; 5: *M. hispida* T. Yoshida & H. Sun; 6: *M. barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou; 7: *M. trichogyna* T. Yoshida & H. Sun; 8: *M. inaperta* T. Yoshida & H. Sun.

style 2–4 mm long in flower, to 7 mm long in fruit; *stigma* clavate, 2–5 mm long, 4- to 6-lobed; lobes linear-oblong. *Fruit* a capsule, ellipsoid or broadly ellipsoid, 10–16 mm long, 6–12 mm across, bristly or glabrous.

Distribution: CHINA. N Sichuan: Xueshanliang, near Huanglong, Songpan Xian, 3900–4100 m elevation.

Habitat and ecology: southwest-facing alpine slopes, sometimes among dwarf shrubs of *Potentilla* (*Dasiphora*) and others, occasionally with inflorescence protruding through canopy of shrubs; rooting in gravelly humus soil.

Additional specimens examined: CHINA. Sichuan: Xueshanliang, near Huanglong, Songpan Xian, 32°44'23"N, 103°44'02"E, 4000 m, 28 July 2014, *T. Yoshida* K98 (KUN, TI).

Meconopsis huanglongensis is rather uniform in comparison with *M. psilonomma*. *Meconopsis huanglongensis* is stouter and somewhat fleshier, with more widely opening showy flowers. The flowers have deeper and more brightly colored petals and have relatively shorter stamens gathered compactly around the pistil. *Meconopsis huanglongensis* grows in drier and sunnier habitats without a covering of mosses and in more exposed and bare soils than does *M. psilonomma*. Flies frequent the mass of stamens on fine days.

The anthers of *Meconopsis psilonomma* do not form a compact mass around the stigma because the outer filaments of *M. psilonomma* are gradually shorter and the upper filiform part of the filaments usually radiate outward. The longer stigma of *M. psilonomma* clearly protrudes from the loose mass of anthers at anthesis.

Meconopsis huanglongensis is also similar to *M. henrici* Bureau & Franch., but differs in having a solitary scape (2–12 scapes in the latter), in the often scarcely dilated outermost filaments (outer- and innermost filaments similarly dilated in the latter), in the ellipsoid or broadly ellipsoid capsules (obovoid or narrowly obovoid in the latter), and in the taproot usually napiform (elongate in the latter).

Meconopsis huanglongensis and *M. psilonomma* belong to series *Henricanae* C. Y. Wu & H. Chuang ex Grey-Wilson (2014).

FIGURE 2. *Meconopsis huanglongensis* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 11 July 2016.

FIGURE 3. *Meconopsis huanglongensis* T. Yoshida & H. Sun in foggy weather at type locality. Photograph by T. Yoshida, 11 July 2016.

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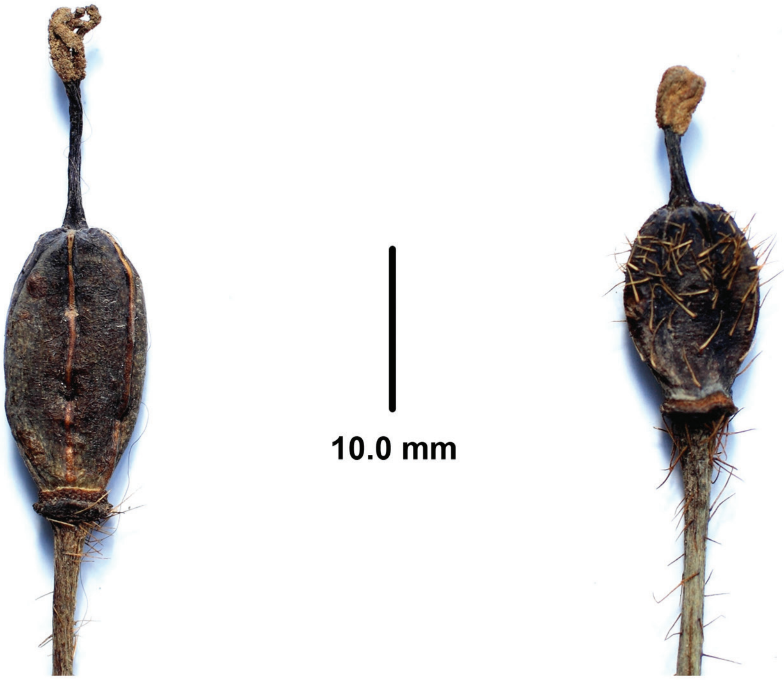

FIGURE 4–5. **4**, *Meconopsis huanglongensis* T. Yoshida & H. Sun. Flower without petals (left), flower without petals and outer stamens (right); collected at type locality on 11 July 2016. Photograph by T. Yoshida. **5**, *Meconopsis huanglongensis* T. Yoshida & H. Sun. Dried fruit collected at type locality on 28 July 2014. Photograph by T. Yoshida.

TABLE 1. Major features separating *Meconopsis huanglongensis* from *M. psilonomma*.

	M. huanglongensis	***M. psilonomma***
Shape of taproot	Napiform, broadly napiform, occasionally dauciform	Dauciform or narrowly napiform
Size of taproot	1–2.5 cm long, 0.6–1.6 cm across	1–4 cm long, 0.6–1.3 cm across
Length of bristles	To 4 mm long	To 3(–4) mm long
Thickness of fresh peduncle	3–9 mm across	2–7 mm across
Flower posture	Laterally facing	Half-nodding or laterally facing, occasionally upright in small plants
Flower shape in fine weather	Opening flat or dish-shaped	Usually cup-shaped, occasionally dish-shaped in small plants
Petal number	6–10	5–7(or 8)
Petal color	Deep purple or magenta purple	Pale purple, lavender purple, purple or deep purple; deeper colored toward base; with or without prominent dark purple blotch at base
Proportion of petals to stamens	Petals ca. 3.5 times longer than stamens	Petals ca. 3 times longer than stamens
Length of filaments	7–13 mm long; outer filaments nearly similar or slightly shorter than others	5–15 mm long; outer filaments gradually shorter
Dilated part of filaments	Lower 1/2 to 3/4 of filaments dilated to 1.5 mm wide, boat-shaped; outermost filaments often scarcely dilated	Inner filaments dilated to 1.5 mm wide toward base, outer filaments often scarcely dilated, or all filaments scarcely dilated
Filiform part of filaments	More or less erect	Erect or ascending, often radiating
Length of stigma	2–5 mm long	3–8 mm long
Habitat	Dry, without moss cover	Moist, partly moss covered

Meconopsis inaperta T. Yoshida & H. Sun, *sp. nov.* TYPE: CHINA. NW Sichuan: Baiyu Xian, western side of Ganbailu Yakou (甘白路丫口) near Acha (阿察), 31˚06'25"N, 99˚26'17"E, 4000 m, 16 July 2017, *T. Yoshida* K120 (Holotype, KUN; Isotype, TI). Fig. 1, 6–9.

Meconopsis inaperta resembles *M. psilonomma* Farrer but differs from the latter in the racemose inflorescence (solitary scape and solitary flower in the latter), taproot elongate (dauciform or napiform in the latter), capsule narrowly ellipsoid (ellipsoid in the latter), and flowers usually with 4 petals (with 5 or more petals in the latter). *Meconopsis inaperta* also resembles *M. lancifolia* (Franch.) Franch. ex Prain but differs from the latter in the cup-shaped flowers with half closed mouth (dish- or bowl-shaped in the latter) and petals 4 or occasionally 5 or 6 (4–9, often 5–6 in the latter).

Herbs, monocarpic, (20–)30–50 cm tall. *Taproot* elongate, to 15 cm long or more, 0.7–1.5 cm across, distally gradually narrowed and with slender roots. Most parts of plant densely or moderately bristly; bristles to 2–4(–5) mm long. *Stem* (below uppermost leaf) 0.7–2.7 cm long. *Leaves* crowded near base of plant, petiolate; *petiole* membranous, linear, 1.5–5 cm long, 1–2 mm wide; *lamina* linear-oblong or oblanceolate, 2.5–12 cm long, 0.5–1.5 cm wide, base attenuate, margin entire, apex acuminate or sometimes acute or obtuse, both surfaces bristly. *Inflorescence* racemose, with 2–8 flowers mostly on upper half of rachis, without bracts, some flowers occasionally in axils of basal leaves (bracts); basal pedicels sometimes elongating to 10 cm or more, rarely bracteolate, rarely with additional lateral flower; *peduncle* (rachis) to 9 mm across when fresh, 3.5–6 mm across when dried, usually hollow, covered with retrorse bristles; *pedicels* 0.5–5 cm long, to 10 cm long in fruit (in terminal flowers). *Flowers* cup-shaped, often half-closed at mouth, 3–5 cm across. *Calyx* 1.7–2.5 cm long, densely bristly. *Petals* purple, gradually more deeply colored near base, 4 or occasionally 5 (or 6), rounded, broadly obovate or obovate, (3–)3.5–5.5 cm long, 2–4.5 cm wide, base cuneate or subrounded, margin entire, occasionally irregularly denticulate near apex, occasionally cleft toward base, apex rounded or

FIGURE 6. *Meconopsis inaperta* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 16 July 2017.

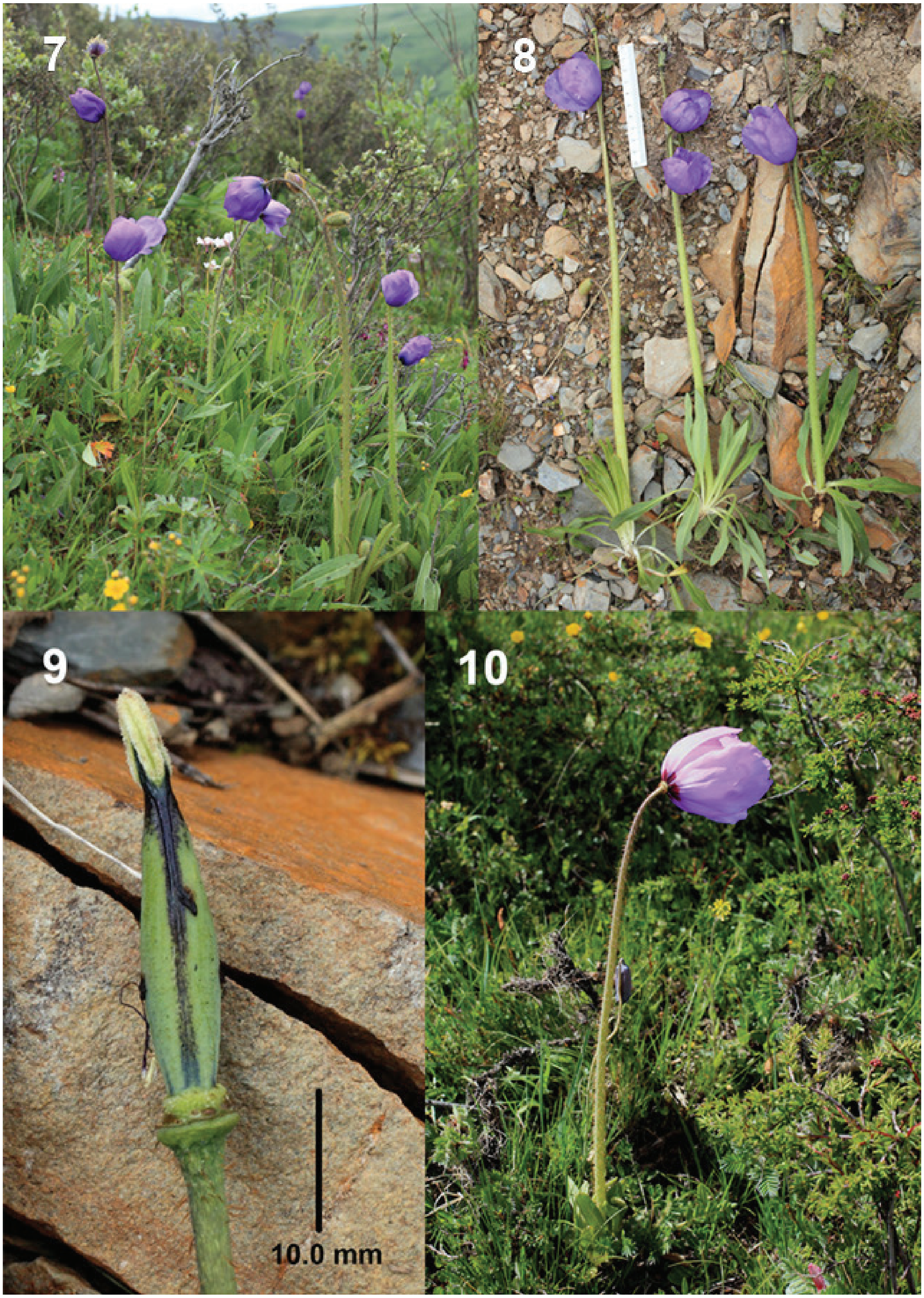

FIGURE 7–10. **7**, *Meconopsis inaperta* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 16 July 2017. **8**, *Meconopsis inaperta* T. Yoshida & H. Sun at type locality on 16 July 2017. Photograph by T. Yoshida. **9**, *Meconopsis inaperta* T. Yoshida & H. Sun. Young fruit at type locality on 16 July 2017. Photograph by T. Yoshida. **10**, *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou at Sangchi Shan. Photograph by T. Yoshida, 21 June 2016.

obtuse, *Stamens* numerous; *filaments* pale purple, sometimes darker toward base, filiform, 7–14 mm long; *anthers* oblong, (1–)1.5–2.2 mm long, *thecae* pale yellow. *Ovary* pale green, often tinged with dark purple toward apex, usually with 3–5 dark purple streaks, narrowly ovoid or ellipsoid, 9–13 mm long, glabrous or hairy with ascending bristles; *style* tinged dark purple, 0.5–1.5 mm long, to 3 mm long in fruit; *stigma* pale yellow, ovoid or oblong, 3–5 mm long, with 3–5 lobes. *Capsules* narrowly ellipsoid, 1.5–2 cm long, 5–7 mm across, glabrous or sparsely bristly.

Distribution: CHINA. Sichuan: Baiyu Xian, Litang Xian and Yajiang Xian, 3950–4200 m elevation.

Habitat and ecology: often on northwest-facing alpine slopes densely covered with various herbs and grasses and scattered shrubs of scale-bearing *Rhododendron* and *Salix*; rooting in humus soil intermixed with gravel.

Additional specimens examined: CHINA. Sichuan: Yajiang Xian, Kazi La Shan (卡子拉山), 30°01'05"N, 100°48'42"E, 4,150 m, 19 June 2017, *T. Yoshida* K112 (KUN).

The specimen *T. Yoshida* K112 is similar to *T. Yoshida* K120, but the plants are 15–20 cm tall, the 4–6 petals are 3–4 cm long and often cleft, and the anthers are 0.8–1.3 mm long. The immature plants have the terminal cup-shaped flowers barely open and the lateral flowers just in bud. Although the plants are smaller and appear somewhat different, they share the key features of *Meconopsis inaperta*.

Meconopsis inaperta is unique in the half-closed, cup-shaped flowers usually with 4 petals. We consider it to be intermediate between *M. psilonomma* in series *Henricanae* (C. Y. Wu & H. Chuang) Grey-Wilson section *Impeditae* Grey-Wilson and *M. lancifolia* of section *Forrestianae* (C. Y. Wu & H. Chuang) Grey-Wilson. More studies are needed to determine its higher-level classification.

Meconopsis barbiseta C. Y. Wu & H. Chuang ex L. H. Zhou, *Acta Phytotax. Sin.* 17 (4): 113–114 (1979). TYPE: CHINA. Qinghai: Jiuzhi Xian, eastern bank of Xiemu Cuo (斜木措), north side of Nianbao Shan (年保山), 4400 m, 1971, *Guoluo Team* (果洛队) 438 (HNWP). Fig. 1, 10–14, 33–38.

Herbs, monocarpic, 20–50 cm tall. *Taproot* napiform or narrowly napiform, 1–3 cm long, 0.7–1.4 cm across, contracted at junction with stem, distally with slender roots. *Stem* (below uppermost leaf) simple, 0.3–1.5 cm long. *Leaves* all basal; *petiole* membranous, broadly linear, 1–5 cm long, 1–4 mm wide; *lamina* oblong, oblanceolate or strap-shaped (lowermost small leaves elliptic), 1.5–8 cm long, 0.4–1.2 cm wide, base attenuate, margin entire, apex obtuse or acute, upper surface densely bristly, lower surface moderately or sparsely bristly. *Inflorescence* a solitary scape; *scape* 2.5–7 mm across when dried, densely covered with patent or retrorse bristles; bristles to 2–4.5 mm long. *Flower* solitary, half nodding or laterally facing, cup-shaped, 3–5 cm across. *Calyx* unknown. *Petals* 5–8, often 6, purple with dark reddish purple blotch at base, obovate or occasionally elliptic, 3.7–6.5 cm long, 1.5–4 cm wide, base cuneate, margin entire, occasionally irregularly denticulate near apex, apex rounded. *Stamens* numerous, radiating; *filaments* purple or dark reddish purple, paler toward apex, filiform, 7–13 mm long, slightly or scarcely dilated toward base; *anthers* oblong, 1–2.5 mm long, *thecae* pale yellow or occasionally whitish. *Ovary*

FIGURE 11. *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou at Sangchi Shan. Photograph by T. Yoshida, 10 July 2017.

FIGURE 12. *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou at Luanshitou Yakou on 10 July 2017. Photograph by T. Yoshida.

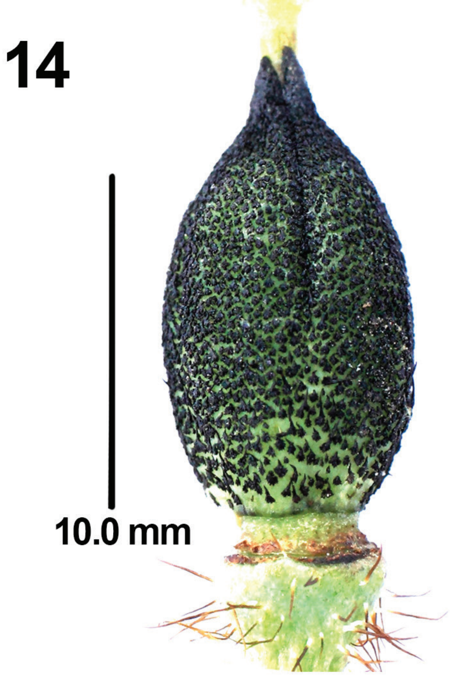

FIGURE 13–16. **13**, *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou at Sangchi Shan on 10 July 2017. Photograph by T. Yoshida. **14**, *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou. Ovary just after flowering at Sangchi Shan on 21 June 2016. Photograph by T. Yoshida. **15**, *Meconopsis hispida* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 20 June 2016. **16**, *Meconopsis hispida* T. Yoshida & H. Sun. Flower near type locality on 18 July 2017. Photograph by T. Yoshida.

ovoid, 6–12 mm long, with dense dark purple branched hairs in close contact with each other; hairs 0.3–0.8 (–1) mm long, usually erect along surface of ovary and incurved above branches, occasionally straight and ascending especially those near base of ovary, with several rounded ridges running longitudinally on surface and with hollow pits inside hairs, apex rather obtuse; branches to 0.25 mm long on lower half of hairs, retrorse, imbricate, surrounding axis of hairs, apex obtuse; *style* pale green or occasionally whitish, 1.5–4 mm long, ridged toward base, covered at least near base with hairs like those on ovary; *stigma* pale yellow, 3–5 mm long, 4–7–lobed, lobes linear-oblong, often free after flowering. *Capsules* ellipsoid, 1.5–2.3 cm long, 0.8–1.4 cm across, with dense branched hairs.

Distribution: CHINA. SE Qinghai: Jiuzhi and Banma Xian, 3650–4100 m elevation.

Habitat and ecology: on southwest-facing alpine slopes with dwarf shrubs of *Spiraea, Sibiraea, Caragana, Potentilla* (*Dasiphora*) and *Salix*; often rooting close to dwarf shrubs with scapes protruding through canopy of shrubs; rooting in gravelly humus.

Additional specimens examined: CHINA. Qinghai: Jiuzhi Xian, July 1974, *Guoluo Grassland Team* (果洛草原站) 289 (HNWP); Qinghai: Jiuzhi Xian, Sangchi Shan (桑赤山), 33°22'03"N, 101°19'18"E, 3,950 m, 21 June 2016, *T. Yoshida* K100 (KUN, TI); Qinghai: Jiuzhi Xian, Luanshitou Yakou (乱石头丫口), 33°25'23"N, 101°13'30"E, 4,000 m, 23 June 2016, *T. Yoshida* K101 (KUN, TI); Qinghai: Banma Xian, Makehe (玛可河) Forest Reserve, southern side of Nianbao Yuze, 32°47'53"N, 101°04'42"E, 3650 m, 25 June 2016, *T. Yoshida* K103 (KUN, TI).

The type specimen of *Meconopsis barbiseta, Guoluo Team* 438, was collected on the eastern bank of Xiemu Cuo (斜木措); also known as Ximeng Cuo (希門措) or Xian-nu Hu (仙女湖), north of Nianbao Shan (年保山); also known as Nianbao Yuze (年保玉则) or Guoluo Shan (果洛山), 4400 m, on 1 August 1971. The type locality is difficult to approach because of a wide debouchure of the lake that floods during the rainy season.

The specimens *T. Yoshida* K100 and K101 were collected on ridges north of Nianbao Yuze in an area similar to the type locality of *Meconopsis barbiseta,* but ca. 10 km east. These collections are similar to the type specimen in having branched hairs on the ovary. Observation of the branched hairs on the ovary is difficult because the entangled hairs are less than 1 mm long and the tips of each are usually incurved and inserted behind adjacent hairs. Drawings of the branched hairs accompanying the description of *M. barbiseta* by L. H. Zhou (1979) are inaccurate in shape and length.

The intricate hollow branched hairs of the ovary are considered to be advantageous in preventing freezing of the ovary by keeping an insulating layer of air on the surface and in offering a foothold for pollinators visiting the laterally facing or half-nodding flowers.

Meconopsis hispida T. Yoshida & H. Sun, *sp. nov*. TYPE: CHINA. N Sichuan: Hongyuan Xian, western side of Yanggong Shan (羊拱山), 32°13'22"N, 102°35'04"E, 3850 m, 20 June 2016, *T. Yoshida K99* (Holotype, KUN; Isotype: TI). Fig. 1, 15–19, 30–32.

Meconopsis hispida resembles *M. barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou in many features, especially in sharing the feature of hairs on the ovary with branches near their base. It differs from the latter in the branched hairs on the ovary to 2 mm long (to 0.8 mm long in the latter), usually with straightly elongate and sharply pointed tip (often incurved above the branches and rather obtuse at apex in the latter), with many minute ridges running longitudinally on the surface (with several rounded ridges running longitudinally on the surface in the latter); in the branches borne close to the base of hairs (borne in the lower half of hairs in the latter), often gradually upturned toward the apex (retrorse and not upturned in the latter); in the larger capsules, to 2.8 cm long (to 2.3 cm long in the latter); and in the longer stigma, to 9 mm long (to 5 mm long in the latter).

Herbs, monocarpic, 30–45 cm tall in flower, to 55 cm tall in fruit. *Taproot* napiform, 1–3 cm long, 8–13 mm across, contracted at transition to stem, distally with slender roots. *Stem* (below uppermost leaf) simple, 0.5–2.5 cm long. *Leaves* all basal; *petiole* membranous, broadly linear, 2–4 cm long, 1.5–3.5 mm wide; *lamina* oblanceolate or linear-oblong, 2–10 cm long, 5–12 mm wide, base attenuate, margin entire, apex obtuse or acute, both surfaces densely or moderately, rarely sparsely, bristly. *Inflorescence* scapose, with solitary scapes and solitary flowers; *scapes* 2–5 mm across in flower, to 8 mm across in fruit, densely bristly; bristles to 3(–4) mm long. *Flowers* laterally facing or half nodding, cup- or bowl-shaped, 4–7 cm across. *Calyx* unknown. *Petals* often 6, rarely 5 or 7, purple with dark reddish purple blotch at base, obovate or elliptic, 3.7–5 cm long, 1.7–3 cm wide, base cuneate, margin entire or irregularly denticulate and wavy near apex, apex rounded. *Stamens* numerous, radiating; *filaments* dark reddish purple, gradually whitish near apex, filiform, 6–12 mm long, slightly dilated toward base; *anthers* ellipsoid or oblong, 1–2 mm long, *thecae* pale yellow or whitish. *Ovary* ovoid or broadly ellipsoid, 6–10 mm long at anthesis, densely covered with hairs in close contact with each other; hairs dark purple, 0.3–2 mm long, branched at base, with many ridges running longitudinally on surface, with narrow and hollow pits inside hairs; main branches of hairs usually erect or ascending, straight, elongate, much longer than basal branches, rarely nearly equaling basal branches in length; basal branches to 0.3 mm long, radiating in various directions, often gradually upturned toward apex; main branches and basal branches with sharply pointed tips; *style* pale yellow, 1.5–4 mm long, often covered with dark purple branched hairs at base; *stigma* pale yellow, 4–9 mm long, 4- to 6-lobed; lobes linear-oblong. *Capsules* obovoid or ellipsoid, 1.7–2.8 cm long, 9–15 mm across, densely covered with branched hairs.

Distribution: CHINA. N Sichuan: Yanggong Shan, along boundary between Hongyuan and Heishui Xian, 3750–4000 m. Most plants in the population of *Meconopsis hispida* on Yanggong Shan are on the western side of the mountain range, but some are on the eastern side.

Habitat and ecology: among shrubs of *Spiraea, Salix,* and *Berberis* on mostly southwest-facing but occasionally southeast-facing slopes; rooting in moist, humus-rich gravelly soil.

Additional specimen examined: CHINA. N Sichuan: Hongyuan Xian, western side of Yanggong Shan (羊拱山), 32°13'39"N, 102°35'08"E, 3900 m, 18 July 2017, *T. Yoshida* K121 (KUN, TI).

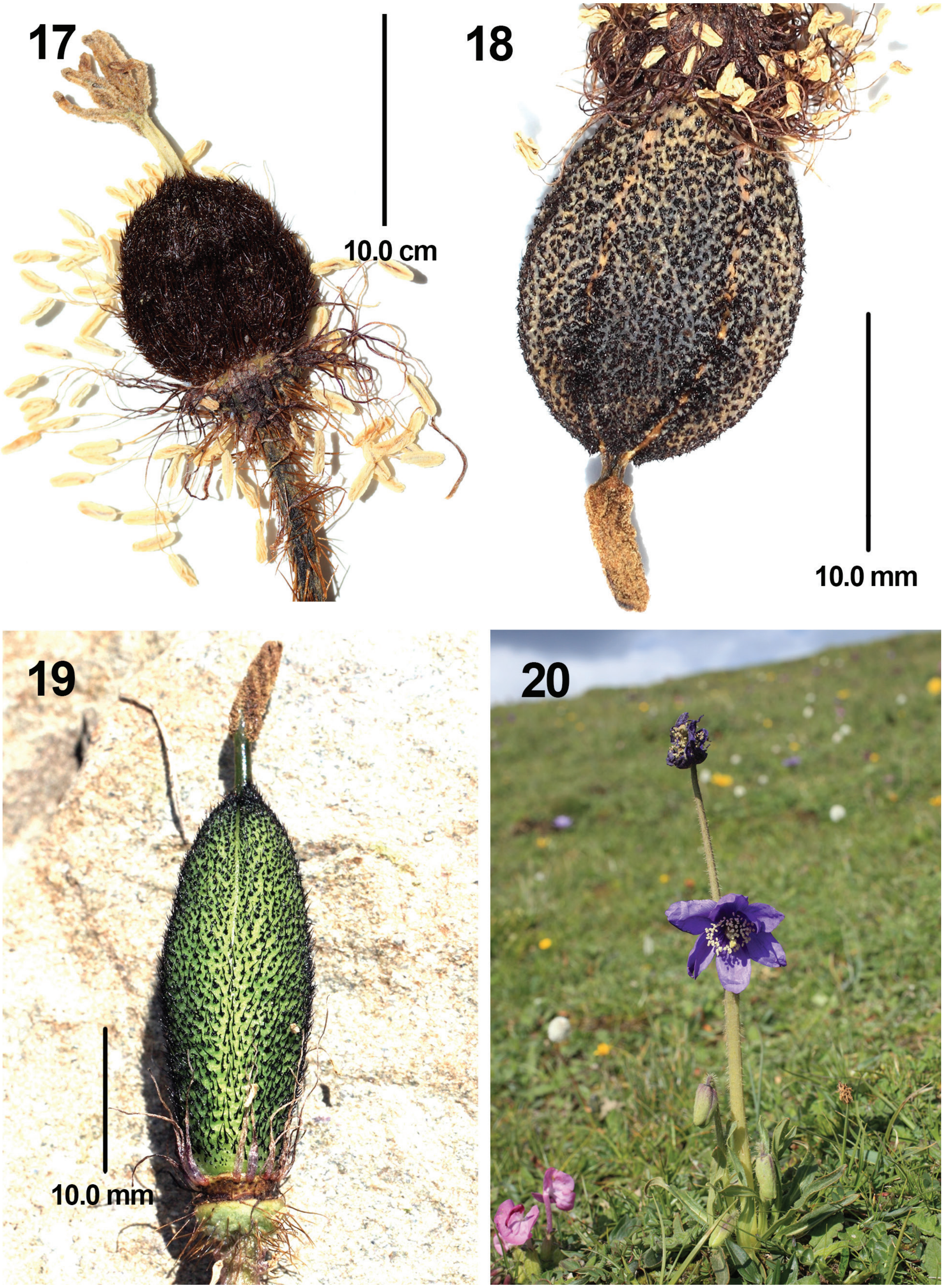

FIGURE 17–20. **17**, *Meconopsis hispida* T. Yoshida & H. Sun. Dried flower with petals removed, collected at type locality on 20 June 2016; ovary covered with dense bristles to 1.5 mm long. Photograph by T. Yoshida. **18**, *Meconopsis hispida* T. Yoshida & H. Sun. Dried flower just after flowering with petals removed, collected near type locality on 18 July 2017; developed ovary with dense bristles 0.3–0.7 mm long. Photograph by T. Yoshida. **19**, *Meconopsis hispida* T. Yoshida & H. Sun. Young fruit near type locality on 18 July 2017. Photograph by T. Yoshida. **20**, *Meconopsis trichogyna* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 14 July 2017.

Meconopsis barbiseta grows among dwarf shrubs on windy alpine slopes near the ridge. The flowering scapes often protrude slightly through the canopy of the shrubs. *Meconopsis hispida* grows among taller shrubs, occasionally in partial shade, on gentle slopes on the flank of mountains where the microclimate is milder.

We consider *Meconopsis hispida* to be intermediate between *M. barbiseta* and *M. psilonomma* Farrer var. *sinomaculata* (Grey-Wilson) H. Ohba in morphology and in distribution. The hairs on the ovary in *M. hispida* have ascending, straight, elongate tips similar to those of *M. psilonomma* var. *sinomaculata,* but have minute branches near their base similar to those of *M. barbiseta*. Yanggong Shan, where *M. hispida* occurs, is between Gonggaling, where *M. psilonomma* var. *sinomaculata* occurs, and Nianbao Yuze where *M. barbiseta* grows.

The specific epithet, *hispida*, derives from the branched hairs with sharply pointed tips on the ovary.

Meconopsis trichogyna T. Yoshida & H. Sun, *sp. nov.* TYPE: CHINA. NW Sichuan: Dege Xian, Haizi Shan (海子山), 32°03'13"N, 99°00'43"E, 4450 m, 14 July 2017, *T. Yoshida* K119 (Holotype, KUN; Isotype, TI). Fig. 1, 20–24, 39–42.

Meconopsis trichogyna resembles *M. barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou in the hairs on the ovary with retrorse branches near the base, but differs from the latter in the color of the hairs: whitish in *M. trichogyna*, dark purple in *M. barbiseta*. The hairs of *M. trichogyna* are in two layers; an under layer of short hairs in close contact with each other and bending sharply in various directions, and an upper layer of longer hairs erect along the surface of the ovary (the hairs on the ovary of *M. barbiseta* are in a single layer). The inflorescence of *M. trichogyna* is racemose with a few basal flowers, while *M. barbiseta* has a solitary scape with a solitary flower. The flowers of *M. trichogyna* are dish- or bowl-shaped (*M. barbiseta* has a cup-shaped flower). *Meconopsis trichogyna* also resembles *M. lancifolia* (Franch.) Franch. ex Prain in the inflorescence and flower shape, but differs in having branched hairs on the ovary; the hairs on the ovary of *M. lancifolia* are unbranched.

Herbs, monocarpic, 12–28 cm tall in flower. *Taproot* elongate or dauciform, to 6 cm long or more, 6–9 mm across, distally gradually narrowed and with slender roots. Most parts of plant bristly; bristles pale green except on ovary. *Stem* (below lowermost flower) contracted, less than 6 mm long. *Leaves* crowded, petiolate; *petiole* membranous, broadly linear, 1.5–2.5 cm long, 1.5–2.5 mm wide; *lamina* oblong or linear-oblong, 2–8 cm long, 3–10 mm wide, base attenuate, margin entire, apex obtuse, acute or acuminate, both surfaces densely or moderately bristly. *Inflorescence* racemose and with few basal flowers, 3–5 flowers total; *peduncle* to 4 mm across when dried; *pedicels* 3–25 cm long in flower; peduncle and pedicels with dense retrorse bristles; bristles to 2 mm long on small plants, to 4.5 mm long on large plants, those near flowers often tinged purple at apex. *Flowers* laterally facing, half-nodding or ascending, dish- or bowl-shaped, 4–7 cm across. *Calyx* 1–1.5 cm long, moderately or sparsely bristly. *Petals* 4–8, purple, obovate or elliptic, 2–3.8 cm long, 0.8–2 cm wide, base cuneate, margin entire or sometimes crenate and wavy near apex, apex obtuse or rounded, occasionally cleft toward base. *Receptacle* to 1.5 mm tall. *Stamens* numerous, radiating; *filaments* similar to petals in color, filiform, 6–9 mm long, gradually thickened toward base; *anthers* ellipsoid, ca. 1 mm long, *thecae* pale yellow. *Ovary* pale yellowish green, ovoid, 5–7 mm long, with dense whitish hairs; hairs with rounded ridges running longitudinally on surface, with hollow pits inside, with retrorse branches at base; hairs in two layers; hairs of under layer 0.2–0.5 mm long, densely covering whole surface of ovary, in close contact with each other, often bending sharply in various directions above basal branches; hairs of upper layer 1–2.5 mm long, rather soft, gradually thickened or dilated toward base, erect along surface of ovary and covering lower layer of hairs except near apex of ovary. *Style* pale yellowish green, 1–2.5 mm long. *Stigma* 1.5–3 mm long, 1.5–2.5 mm across, with 3–6 lobes. *Fruit* unknown.

Distribution: CHINA. NW Sichuan: Dege Xian, 4400–4550 m in elevation.

Habitat and ecology: northwest-, west-, and southwest-facing gentle slopes in grasslands, occasionally among dwarf shrubs of *Caragana* and *Rhododendron*.

Meconopsis trichogyna is endemic to the limited region around the type locality. Because of its small population, we consider it to be one of the most endangered species of *Meconopsis*.

Like the hairs on the ovary of *Meconopsis barbiseta,* those of *M. trichogyna* are also considered to prevent the ovary from freezing or chilling by retaining air on the surface of the ovary and provide a foothold for visiting pollinators.

The intricate branched hairs covering the ovary of *Meconopsis barbiseta, M. hispida,* and *M. trichogyna* are unique in *Meconopsis* and the basis for establishing the new series *Barbisetae* for these species.

Meconopsis series ***Barbisetae*** T. Yoshida & H. Sun, *series nov*. Type species: *Meconopsis barbiseta* C. Y. Wu & H. Chuang ex L. H. Zhou.

Series *Barbisetae* differs from other series of *Meconopsis* in the intricately entangled, hollow, branched hairs covering the ovary. The series is related to series *Henricanae* C. Y. Wu & H. Chuang and to *M. lancifolia* (Franch,) Franch. ex Prain in section *Forrestinae* C. Y. Wu & H. Chuang. More studies are needed to resolve the higher classification of the series.

KEY TO SPECIES OF SERIES *BARBISETAE*

1a. Inflorescence racemose and with few basal flowers; flowers opening widely; hairs on ovary with root-like branches at base and several rounded ridges on surface . . . . *M. trichogyna*

1b. Inflorescence a solitary scape and a solitary flower; flower cup-shaped. 2

2a. Hairs on ovary with branches at base, with many longitudinal ridges on surface and with straight, ascending, sharply pointed tips; branches of hairs often gradually upturned toward apex . . . . *M. hispida*

2b. Hairs on ovary with branches in lower half, with several rounded longitudinal ridges on surface, usually incurved above branches, apex rather obtuse; branches of hairs retrorse and imbricate, not upturned toward apex . . . . *M. barbiseta*

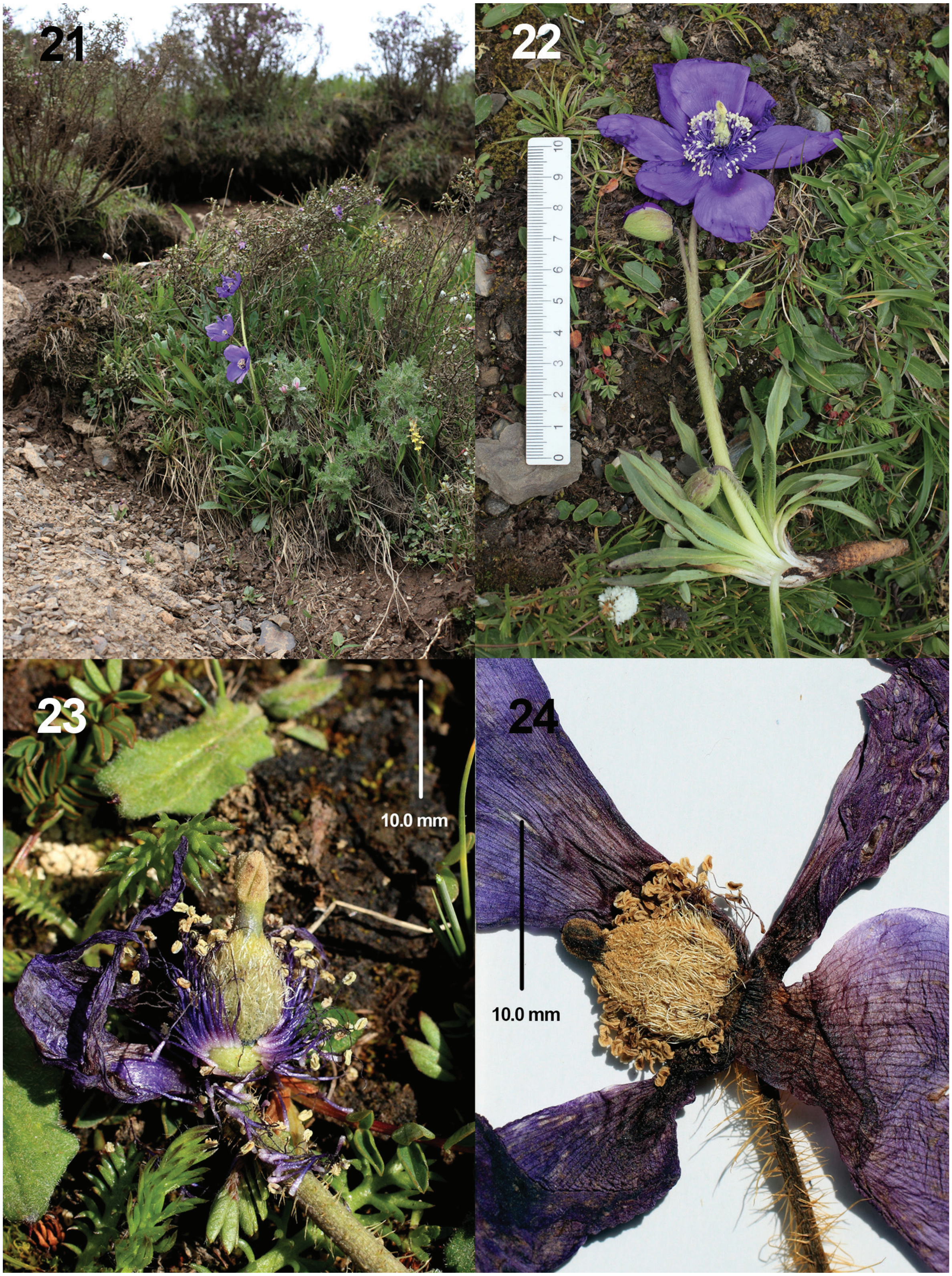

FIGURE 21–24. **21**, *Meconopsis trichogyna* T. Yoshida & H. Sun at type locality. Photograph by T. Yoshida, 14 July 2017. **22**, *Meconopsis trichogyna* T. Yoshida & H. Sun at type locality on 14 July 2017. Photograph by T. Yoshida. **23**, *Meconopsis trichogyna* T. Yoshida & H. Sun. Upper part of plant at end of flowering at type locality on 14 July 2017. Foreground stamens removed to show whitish hairs densely covering ovary, raised receptacle, and thickened base of filaments. Photograph by T. Yoshida. **24**, *Meconopsis trichogyna* T. Yoshida & H. Sun. Upper part of dried specimen collected at type locality on 14 July 2017. Foreground stamens removed to show ovary covered with two layers of hairs: hairs of lower layer to 0.5 mm long and densely covering whole ovary in close contact with each other; erect hairs of outer layer to 2.5 mm long, covering 2/3 of ovary from base. Photograph by T. Yoshida.

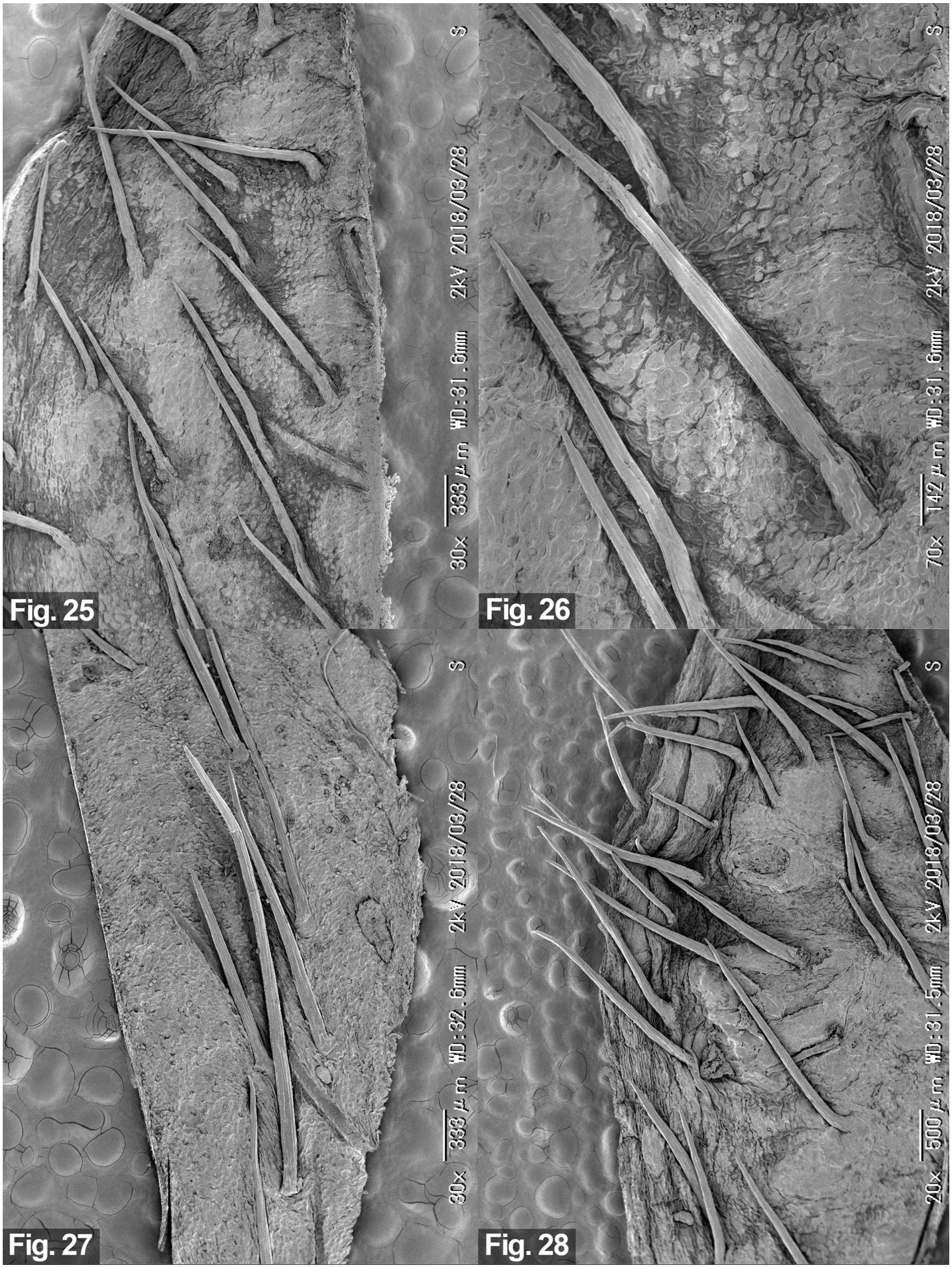

FIGURE 25–28. Scanning electron microscope images of the hairs on the dried ovary and capsules. **25–26**, *Meconopsis psilonomma* var. *psilonomma* (*T. Yoshida* K109). Ascending bristles on capsule; bristles with hard, sharply pointed apex and numerous fine longitudinal ridges on surface. **27**, *Meconopsis psilonomma* var. *sinomaculata* (*T. Yoshida* K116). Erect bristles on ovary at the end of flowering; bristles with sharply pointed hard apex and with numerous fine longitudinal ridges on surface. Lumpy surface of adhesive tape for attaching sample is visible around segment of ovary. **28**, *Meconopsis huanglongensis* (*T. Yoshida* K98). Ascending bristles on capsule; bristles with sharply pointed hard apex and numerous fine longitudinal ridges on surface.

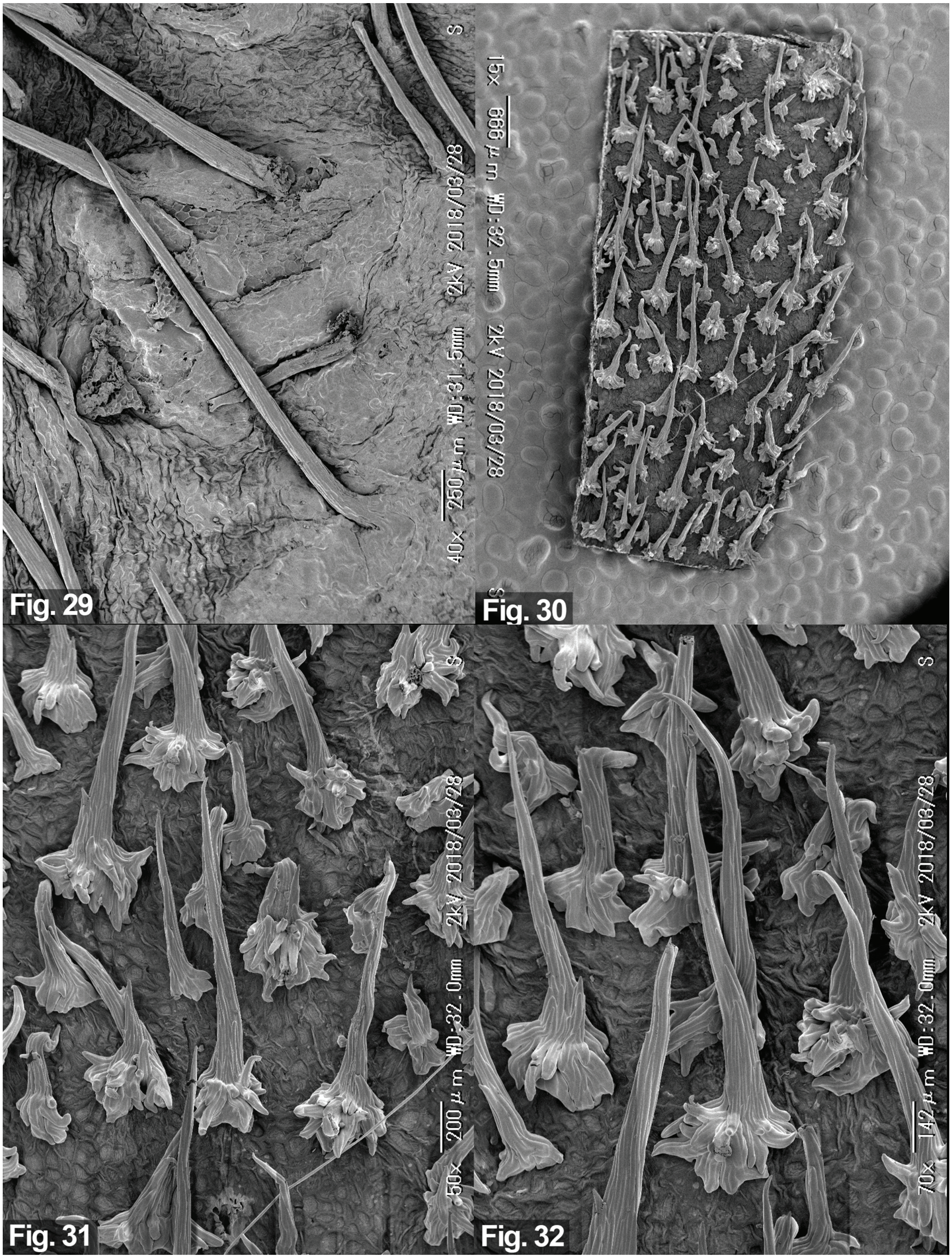

FIGURE 29–32. Scanning electron microscope images of the hairs on the dried capsule. **29**, *Meconopsis huanglongensis* (*T. Yoshida* K98). Ascending bristles on capsule; bristles with sharply pointed hard apex and numerous fine longitudinal ridges on surface. **30**, *Meconopsis hispida* (*T. Yoshida* K121). Ascending bristles on young capsule; segment of capsule on adhesive tape. **31**–**32**, *Meconopsis hispida* (*T. Yoshida* K121). Ascending bristles with sharply pointed apex and many rounded longitudinal ridges on surface and minute branches at base; branches often gradually upturned toward apex; hollow hairs are seen in cross section of branch of hair at upper right corner of Fig. 31.

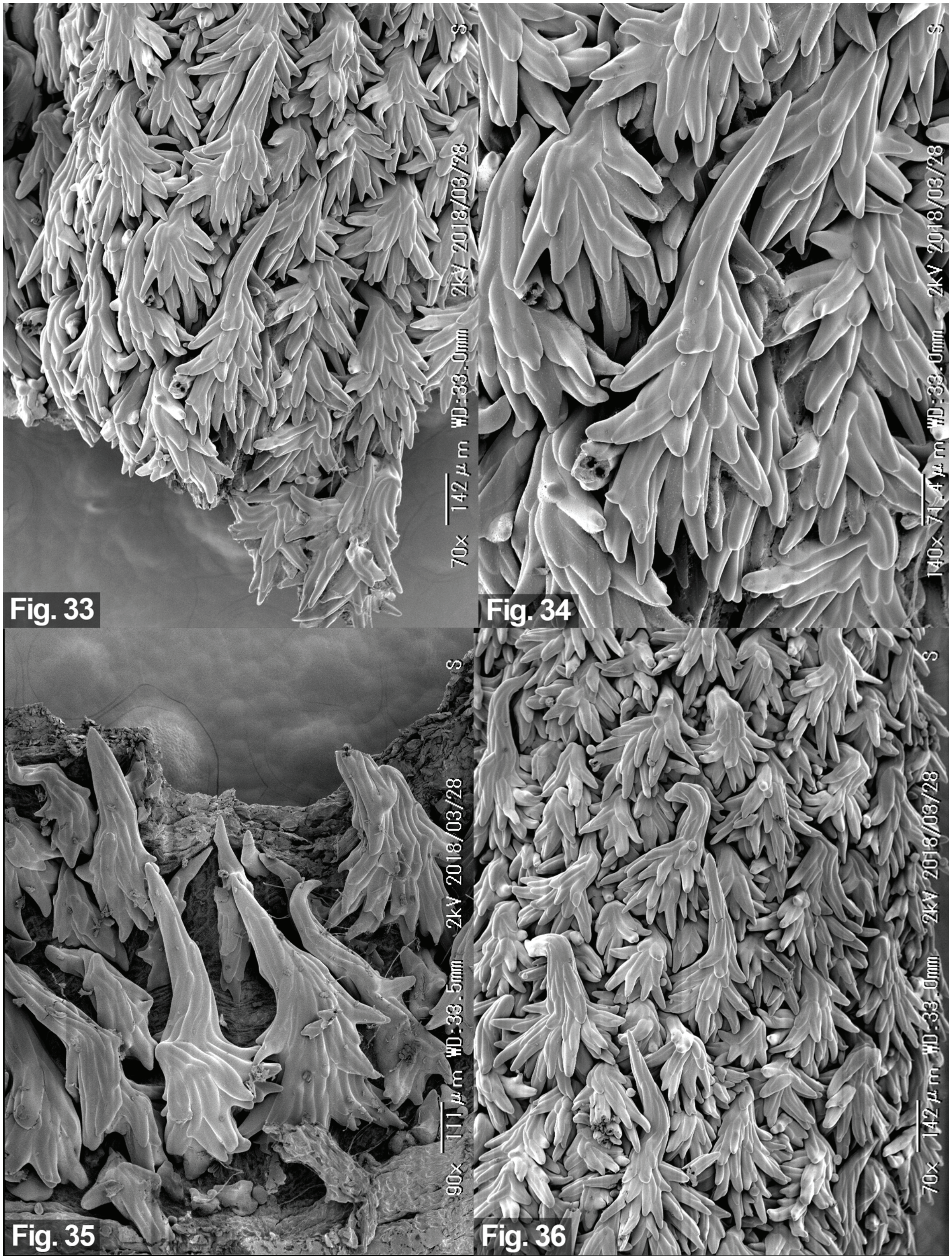

FIGURE 33–36. Scanning electron microscope images of the hairs on the dried ovary of *Meconopsis barbiseta* (*T. Yoshida* K100). Erect or ascending hairs on ovary; hairs often with obtuse apex, several rounded longitudinal ridges on surface and retrorse, imbricate branches on lower half of hairs; most erect hairs incurved above retrorse branches have tip inserted among bases of adjacent hairs. **33**, basal part of ovary with erect or ascending hairs; surfaces of broken branches of hairs in lower left of image show hairs gathered in clusters of several hollow hairs. **34**, ascending hairs near base of ovary; surfaces of broken branches of hairs are in lower left of image. **35**, ascending hairs near base of ovary. **36**, middle part of ovary.

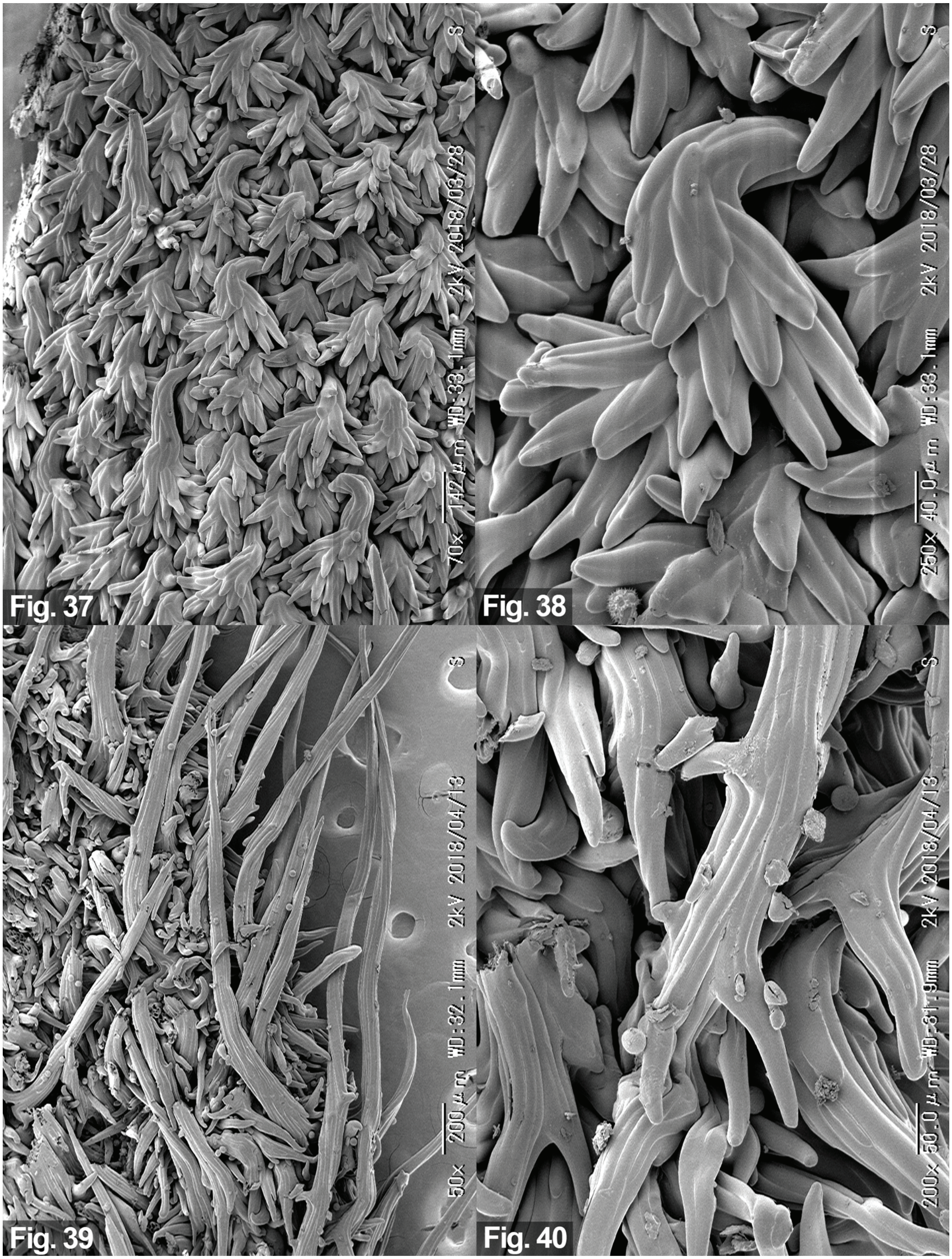

FIGURE 37–40. Scanning electron microscope images of the hairs on the dried ovary. **37**, *Meconopsis barbiseta* (*T. Yoshida* K100). Upper part of ovary. **38**, *Meconopsis barbiseta* (*T. Yoshida* K100). Incurved hair near apex of ovary. **39**, *Meconopsis trichogyna* (*T. Yoshida* K119), basal part of ovary with erect long hairs and crowded short hairs; long hairs have many rounded longitudinal ridges on surface and sharply pointed tips; long hairs near the left margin of image are broken. **40**, *Meconopsis trichogyna* (*T. Yoshida* K119), basal part of long hairs with root-like retrorse branches, with rounded pollen adhering to hairs.

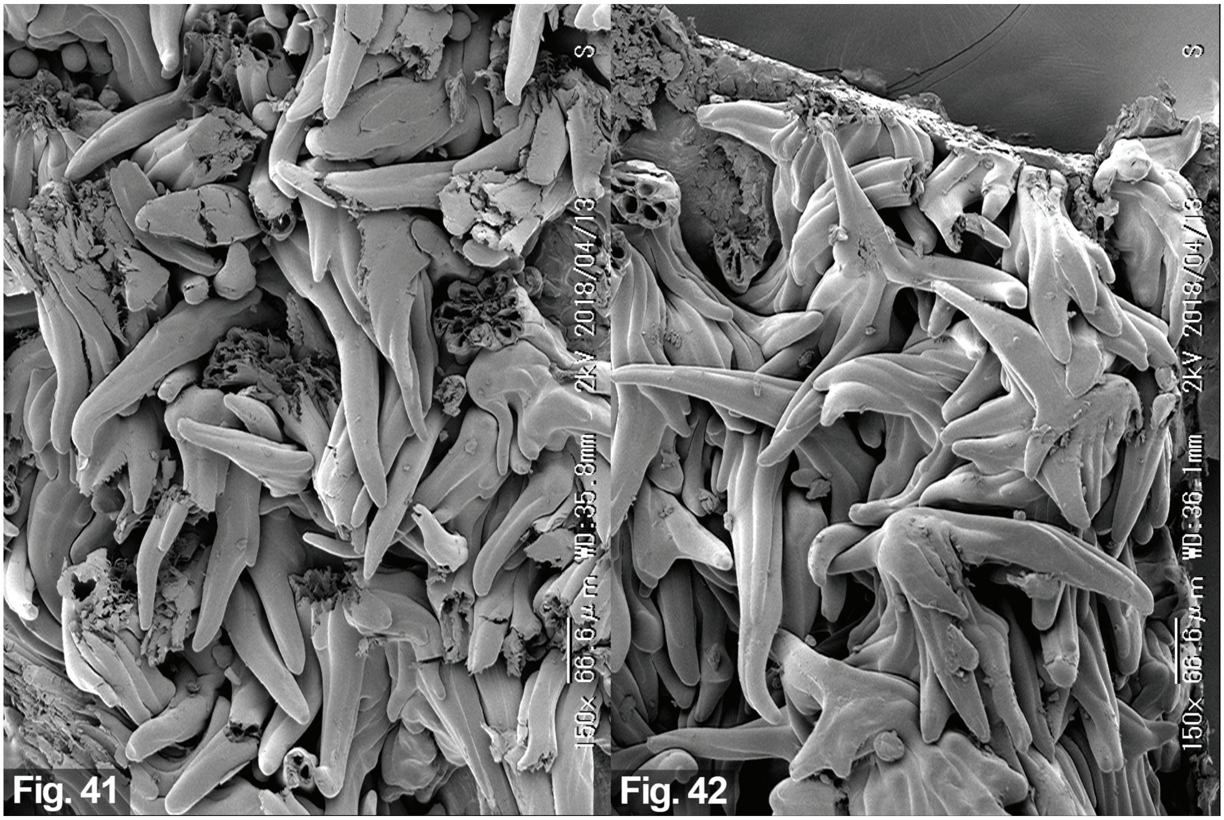

FIGURE 41–42. Scanning electron microscope images of the hairs on the dried ovary of *Meconopsis trichogyna* (*T. Yoshida* K119). **41**, basal part of ovary with long hairs broken off above base; surfaces of broken hairs imply that slender, long, hollow hairs are cohesive. **42**, upper part of ovary with crowded short hairs; short hairs often bend sharply in various directions above basal retrorse branches, few or several rounded ridges run longitudinally on surface of main and basal branches.

LITERATURE CITED

GREY-WILSON, C. 2014. *The Genus Meconopsis—Blue Poppies and Their Relatives*. Kew Publishing, Royal Botanic Gardens, Kew, Richmond.

YOSHIDA, T. AND H. SUN. 2017. *Meconopsis lepida* and *M. psilonomma (Papaveraceae)* rediscovered and revised. Harvard Papers in Botany 22 (2): 157–192.

ZHANG, M. L. (张明理) AND C. GREY-WILSON. 2008. *Meconopsis*. In *Flora of China* 7: 262–278. Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.

ZHOU, L. H. (周立华). 1979. New taxa of Meconopsis from Qinghai-Tibet Plateau. Acta Phytotaxonomica Sinica (植物分类学报) 17(4): 112–114.

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KNOXIA HOOKERI (RUBIACEAE): A NEW SPECIES FROM INDIA

P. Lakshminarasimhan[1]

Abstract. A new species, *Knoxia hookeri* (Rubiaceae), is proposed here, and a discussion about the invalidity of the three previously published names is presented. A dichotomous key is provided to distinguish the two *Knoxia* species: *K. hookeri* from *K. sumatrensis*. The synonymy of both species is presented with comments on typification.

Keywords: *Knoxia*, *K. hookeriana*, *K. sumatrensis*, Peninsular India, Sri Lanka, Rubiaceae

Knoxia L. (Rubiaceae) is a small genus consisting of ca. nine species confined to the Old World, with about seven species occurring in the Indo-Malayan area and two species in Africa (Mabberley, 2017). In India, *Knoxia* is represented by two species, one subspecies, and four varieties (Bhattacharjee and Deb, 1985).

Bhattacharjee and Deb (1985) proposed "Knoxia sumatrensis var. hookeriana" as a "*stat. et nom. nov*." for what were previously known as "K. mollis sensu Hook. f., Fl. Brit. India 3 (1880) 129, *non* R. Br. ex Wight & Arn., Prodr. Fl. Ind. Orient. (1834) 439," "K. corymbosa sensu Thwaites, Enum. Pl. Zeyl. (1864) 151 *non* Willd., Sp. Pl. (1798) 587," and "K. teres *auct. non* (Roxb.) DC.: Hook., f. F.B.I. 3 (1880) 129." The two cited specific references ("K. mollis sensu Hook. f., Fl. Brit. India 3 [1880] 129" and "K. corymbosa sensu Thwaites, Enum. Pl. Zeyl. [1864] 151") did not have Latin descriptions or diagnoses.

The varietal taxon proposed by Bhattacharjee and Deb (1985) differs from *Knoxia sumatrensis* (Retz.) DC. var. *sumatrensis* in having shorter and ovate-elliptical, shortly petiolate to subsessile leaves with length/width (l/w) ratio 1.5–2.5:1, congested corymbose inflorescence and more or less globose, subterete and smaller, dark and blackish-brown fruits with mericarps usually remaining unsplit and falling off from the pedicel carrying the columella inside. Since Bhattacharjee and Deb (1985) believed that their varietal name "Knoxia sumatrensis var. hookeriana" was a replacement name at a new rank, they did not provide a Latin diagnosis or description and did not cite a type. These authors, however, did not realize that they inadvertently proposed the name of a new varietal taxon previously known under a misapplied name, that a Latin diagnosis or description and a type citation were needed for a valid publication, and that their intended varietal name was not validly published (Art. 41.7 Note 3, Ex. 23; Turland et al., 2018).

Unaware of the invalidity of "Knoxia sumatrensis var. hookeriana," Prasad and Lakshminarasimhan (in Mudaliar & Prasad, 2001) proposed "Knoxia mollis var. hookeriana" as a "new combination"; later, Subba Rao and Kumari (2003) perpetuated the error in proposing "Knoxia hookeriana" as a *comb. & stat. nov*. Neither of these two combinations was accompanied by a Latin description and type citation. Since the cited basionym "K. sumatrensis var. hookeriana" was not validly published, the two new combinations proposed in 2001 and 2003 were also not validly published.

The current study of the *Knoxia sumatrensis* complex supports the recognition of variety *hookeriana* as a distinct taxon at the rank of species. Accordingly, *K. hookeri* is proposed here as a new species: a description is provided in English, and a holotype is cited. A dichotomous key is provided to distinguish two *Knoxia* species: *K. hookeri* from *K. sumatrensis*. It is noted here that Almeida (2001) did not mention the new taxon at any rank.

Knoxia hookeri Lakshmin., *sp. nov.*
TYPE: INDIA. Tamil Nadu, Pulney mountains, July 1836, *R. Wight 1506* (Holotype: K [K000031543], image)]. Fig. 1.

Erect or straggling *herbs* up to 90 cm high, variable; *stems and branches* obscurely 4-angled, pubescent villous or tomentose. *Leaves* ovate-lanceolate, up to 12.5 × 4 cm, rounded at base, entire at margins, mostly acute at apex, pubescent to villous on both sides, ciliate, brown when dry, with often rufous hairs; petioles up to 1.2 cm long, pubescent; stipules with bristles. *Cymes* with short spreading branches, terminal, forming umbels; *peduncles* up to 2.7 cm long, villous. *Flowers* crowded, ca. 3 mm long, bluish, foetid; *pedicels* up to 3 mm long, villous; *bracts* up to 2 mm long, deltoid, long acuminate, hairy. *Calyx* up to 2 mm long; *tube* hirsute outside; lobes 4, deltoid, up to 1 mm long, acute, pubescent on both sides, ciliate. *Corolla* white, up to 3 mm long; tube up to 1.5 mm long; lobes deltoid, as long as corolla tube, obtuse. *Stamens* 4; filaments up to 1.5 mm long; anthers up to 1.5 mm long. *Ovary* up to 1 mm long; 2-celled; style filiform, up to 1 mm long; stigma bilobed. *Fruits* crowded, smooth, terete, ellipsoid, ca. 2 mm long, glabrous, black when dry, crowned with rounded calyx teeth; *mericarps* connate and adnate to columella.

Distribution: India [Tamil Nadu, Kerala, Karnataka, Maharashtra, Andhra Pradesh], Sri Lanka, Indonesia.

Key to *Knoxia hookeri* and *K. sumatrensis*

1a. Leaves ovate-lanceolate; corolla hirsute without; fruit ovoid to ovoid-ellipsoid, subterete . . . . *K. hookeri*
1b. Leaves lanceolate to linear-lanceolate; corolla glabrous without; fruit oblong-ellipsoid, quadrangular . . . .*K. sumatrensis*

I thank the Director, Botanical Survey of India, for facilities, and Dr. Kanchi N. Gandhi (GH) for suggesting the description of the species proposed and illustrated here, for critically reviewing the text, and for his valuable comments. Anthony R. Brach (A, GH) provided helpful comments. I acknowledge the assistance of the Board of Trustees of the Royal Botanic Gardens, Kew, for supplying and permitting me to use the scanned image for publication.

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see Bhattacharjee & Deb. J. Econ. Tax. Bot. 6 (1985) p 92
det. (Rijksherbarium, Leiden) , 1992

Taxonomic revision of *Knoxia*
S.C.Das & C.C.Wilcock
K. sumatrensis (Retz.) DC. var. *hookeriana* B & D
Determinavit Sujit Chandra Das March, 2000

Two points to note :

1. Which is the TYPE? there are two (Pulney and Shevagherry) collections on the same sheet!
2. The Pulney specimen on which the label is stuck is Knoxia mollis R.Br. ex ~~Wight~~ & Arnott, not K. sumatrensis (Retz.) DC.

K. M. Matthew
K M Matthew
29 September 1989

FLORA BRIT. IND. Vol. III, p. 129
Named by Sir J.D.HOOKER.

Shevagerry hills
August 1836

Peninsula Indiae Orientalis.
No. 1506
Knoxia mollis W. & A.
Herb. Wight.
Distributed at the Royal Gardens, Kew. 1866-7.

FIGURE 1. Holotype of *Knoxia hookeri* Lakshmin. (K). © by the Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with permission.

Knoxia hookeri Lakshmin.

Synonyms: “Knoxia hookeriana” Subba Rao & Kumari in P.S.N. Rao (Ed.), Fl. Visakhapatnam Distr. (Andhra Pradesh) 1: 404. 2003, *nom. inval*.

“Knoxia sumatrensis (Retz.) DC. var. hookeriana” R. Bhattacharjee & Deb, J. Econ. Taxon. Bot. 6(1): 92. 1985, *nom. inval*.

“Knoxia mollis R.Br. var. hookeriana” V.P. Prasad & Lakshmin. in N.P. Singh & al., Fl. Maharashtra State, Dicot. 2: 142. 2001, *nom. inval*.

Knoxia sumatrensis (Retz.) DC., Prodr. 4: 569. 1830.

Basionym: *Spermacoce sumatrensis* Retz., Observ. Bot. 4: 23. 1786. TYPE: INDONESIA. “In Sumatra lectam dedit Cel. Wennerberg,” *s.d*., *H.P. Wennerberg s.n*. (Lectotype [likely designated by Bhattacharjee and Deb, 1985: 89]: (LUND).

Although one may interpret Retzius’s citation of Wennerberg’s single collection from Sumatra as an indication of type (cf., Arts. 40.1, 40.3), it is emphasized here that the preceding two articles pertain to names published during 1953–1989, that Retzius did not cite or indicate a holotype, and that it is impossible to be certain that he used only a single specimen for his description. Therefore, what has been commonly cited as holotype (*H.P. Wennerberg s.n*.: LUND) is construed here as the lectotype (see Shenzhen Code; Turland et al., 1918: xvi).

Synonyms: *Cuncea trifida* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 135. 1825. TYPE: NEPAL [“Hab. in Nepalia. Hamilton”]. Lectotype (likely designated by Bhattacharjee and Deb, 1985: 89): s.d., *F. Buchanan–Hamilton s.n*. (CAL 0000025266; isolectotype CAL 0000025267).

David Don did not cite a holotype or the herbarium housing the type collection; he also did not mention or indicate the number of specimens he used for the description. Therefore, a lectotype designation is required and was likely designated by Bhattacharjee and Deb (1985: 89).

Synonyms: *Knoxia corymbosa* Willd., Sp. Pl. 1: 582. 1798. TYPE: INDIA. [“Habitat prope Velore in India orientali. (v.s.)”]. Tamil Nadu, Vellore 1797, *J.G. Klein 139* (W [BW02677010] image; Curators Herbarium B, 2017).

Willdenow’s citation “Habitat prope Velore in India orientali. (v.s.)” pertains to a single specimen at B-W, and it is construed here as the holotype. Willdenow cited “*Knoxia stricta* Gaert. Sem. 1. p. 122. t. 25. f. 8 [1788]?” as a synonym. Since the preceding synonym was cited with an expression of doubt, it does not cause superfluity and illegitimacy (see Art. 52, Note 1).

Knoxia mollis R.Br. in N. Wallich, Numer. List n. 820. 1829. TYPE: INDIA, ANDHRA PRADESH [“A native of moist places amongst the Circar mountains. Flowers during the rainy season”]. Lectotype (designated here): “Spermacoce sumatrensis Linn.,” watercolour drawing on paper. Roxburgh number “536” (CAL; Isolectotype: K). Fig. 2.

The protologue of n. 820 (*Knoxia mollis*) is ascribed to Brown and includes a reference to a description (“Spermacoce sumatrensis” sensu Roxb., Fl. Ind. 1: 372. 1820, non Retz. 1786). Since the name *K. mollis* was validly published solely by reference to a previously and effectively published description of Roxburgh, and since Brown did not definitely designate the Wallich Cat. no. 820 as the type, the species name should be typified by an element selected from the entire context of the validating description (Art. 7.8).

Roxburgh (1820: 372), in his treatment of *Spermacoce sumatrensis* Retz., did not cite any collection, but cited the locality and phenology as “[a] native of moist places amongst the Circar mountains. Flowers during the rainy season.” A dried specimen collected by Roxburgh from the Circar Mountains has not been located. Alternatively, I looked for any uncited original material used by Roxburgh. According to notes by Clarke (1874), Roxburgh “left at the Calcutta Botanic Garden a set of life-sized coloured drawings, with botanical dissections, of plants 2,542 in number, among which nearly all the Indian species described in his *Flora Indica* are depicted. By these (of which a duplicate set is preserved in the India House, Westminster) the species in the *Flora Indica* may be verified.” Among the Roxburgh’s icons housed at CAL and also at K (Royal Botanic Gardens, 2006), the Roxburgh number 536 pertains to “Spermacoce sumatrensis sensu Roxb.” and agrees with the protologue. Hence, following the Art. 9.12 of the International Code of Nomenclature for Algae, Fungi and Plants (Turland et al. 2018), I have chosen the illustration as the lectotype of *Knoxia mollis*.

In the above regard, Roxburgh’s watercolor illustration, housed at CAL, is chosen here as the lectotype, and Kew’s icon becomes the isolectotype.

Knoxia stricta Gaertn., Fruct. Semi. Pl. 1: 122, t. 25, fig. 8. 1788. TYPE: SRI LANKA [without precise locality] [“Ex herbario Banksiano. Habitat in Ceylona, undemissa a Koenigio” s.d.]. *J. Koenig* s.n. (TUB? *n.v*).

Gaertner’s types are at TUB (vide TL-2, 1: 902; Stafleu and Cowan, 1976); he mentioned that he saw specimen(s) from Banks Herbarium (BM-Banks). It is uncertain whether Gaertner’s description was based on a single or two+ specimens. Whatever specimen(s) Gaertner used are likely to be found at TUB; its duplicate(s) may be found elsewhere, for example, BM.

Spermacoce corymbosa Roth in Roemer & Schultes, Syst. Veg., ed. 15 bis. 3: 278. 1818 (non L., 1762) [*Spermacoce corymbosa* Roth, Nov. Gen. Sp. 98. 1821, isonym]; *Knoxia heyneana* DC., Prodr. 4: 570. 1830. TYPE: INDIA [without precise locality] [“*In India. orientali. Benj. Heyne*” s.d.]. *B. Heyne s.n*. (B or B-WILLD; *n.v*.).

Roth’s types are at B and B-WILLD (vide TL-2, 4: 916; Stafleu and Cowan, 1983). It is uncertain whether Roth’s description was based on a single or two+ specimens. Bhattacharjee and Deb (1985: 90) treated *Knoxia heyneana* as a new species and cited a type. It is emphasized here that de Candolle (1830) proposed *K. heyneana* as a replacement name for *Spermacoce corymbosa* Roth (non L. 1762).

Spermacoce exserta Roxb., Fl. Ind. (Carey & Wallich ed.) 1: 374. 1820. TYPE: INDIA. Andhra Pradesh [“A native of the Circars, where it blossoms in October and November”]. A lectotype designation is needed. Unfortunately, no original material exists at the CAL.

FIGURE 2. Lectotype of *Spermacoce sumatrensis* L. (Roxburgh No. 536—CAL). © by the Director, Botanical Survey of India, Kolkata.

FIGURE 3. Lectotype of *Spermacoce teres* Roxb. (Roxburgh No. 1335—CAL). © by the Director, Botanical Survey of India, Kolkata.

For his *Spermacoce exserta*, Roxburgh did not cite any collection but cited the locality and phenology.

Spermacoce teres Roxb., Fl. Ind. (Carey & Wallich ed.) 1: 373. 1820. *Knoxia teres* (Roxb.) R.Br. in N. Wallich, Numer. List n. 819. 1829 [*Knoxia teres* (Roxb.) DC., Prodr. 4: 569. 1830, isonym] TYPE: INDIA. Coorg District, Karnataka ["Knoxia umbellata, Banks. Herb." "Found by Dr. Buchanan in the woods of Koorg, from whence he sent the seed to the Botanic Garden, where the plants thrive well, and blossom during the rainy season"]. Lectotype (designated here): Watercolor drawing on paper, Roxburgh number "1335" (CAL; Isolectotype: K). Fig. 3.

From Roxburgh's citation ("Found by Dr. Buchanan in the woods of Koorg, from whence he sent the seed to the Botanic Garden, where the plants thrive well, and blossom during the rainy season"), it is evident that his description was based on plants grown at the Calcutta Botanical Garden and that his collection should be chosen as the lectotype. In this regard, it is noted here that Wallich (1829: no. 819g) also referred to "*Spermacoce teres* Hb. Roxb." However, no original material collected by Roxburgh from the Calcutta Botanical Garden has been located at the CAL. Therefore, his watercolor illustration housed at CAL is chosen here as the lectotype, and the Kew icon becomes the isolectotype (see the type remarks sub *Knoxia mollis*).

LITERATURE CITED

ALMEIDA, M. R. 2001. Rubiaceae in Flora of Maharashtra. 3(A): 1–61. Published by Mr. Thomas Paul Almeida for Blatter Herbarium, Mumbai.

BHATTACHARJEE, R. AND D. B. DEB. 1985. A revision of *Knoxia* (Rubiaceae). J. Econ. Taxon. Bot. 6(1): 73–96.

DE CANDOLLE, A. P. 1830. *Prodromus Systematis Naturalis Regni Vegetabilis* .... Vol. 4. Parisiis, Sumptibus Sociorum Treuttel et Wurtz, rue de Lille, no. 17. Venitque in eorumdem bibliopoliis Argentorati et Londini.

CLARKE, C. B. 1874. Preface to the reprint, 1874. Pages i–vi in W. ROXBURGH, Flora Indica; or descriptions of Indian Plants. Thacker, Spink and Co., Calcutta.

CURATORS HERBARIUM B. 2017. Digital specimen images at the Herbarium Berolinense. [Dataset]. Version: 08 July 2018. Botanic Garden and Botanical Museum Berlin, Berlin. http://ww2.bgbm.org/herbarium/specimen.cfm?SpecimenPK=106571&idThumb=317166&SpecimenSequenz=1&loan=0].

MABBERLEY, D. J. 2017. *Mabberley's Plant-Book: A Portable Dictionary of Plants, Their Classification and Uses*. 4th ed. Cambridge University Press, Cambridge, U.K.

MUDALIAR, S. K. AND V. P. PRASAD. 2001. Rubiaceae. Pages 116–174 in N. P. SINGH, P. LAKSHMINARASIMHAN, S. KARTHIKEYAN, AND P. V. PRASANNA, EDS., *Combretaceae to Ceratophyllaceae*. Vol. 2 of *Flora of Maharashtra State Dicotyledones*. Botanical Survey of India, Calcutta.

ROXBURGH, W. 1820. *Flora indica* I. WILLIAM CAREY, ED. Printed at the Mission Press, Serampore, India.

ROYAL BOTANIC GARDENS, KEW. 2006. Roxburgh's *Flora Indica*. Published on the Internet; http://www.kew.org/floraIndica/ (accessed July 9, 2018).

STAFLEU, F. A. AND R. S. COWAN. 1976. *Taxonomic Literature: A Selective Guide to Botanical Publications and Collections With Dates, Commentaries and Types*. Vol. 1: A–G. 2d ed. Bohn, Scheltema & Holkema, Utrecht.

———. 1983. *Taxonomic Literature: A Selective Guide to Botanical Publications and Collections With Dates, Commentaries and Types*. Vol. 4: P–Sak. 2d ed. Bohn, Scheltema & Holkema, Utrecht/Antwerpen dr. W. Junk b.v., The Hague/Boston.

SUBBA RAO, G. V. AND G. R. KUMARI. 2003. Rubiaceae. Pages 378–427 in P. S. N. RAO, ED., *Flora of Visakhapatnam District Andhra Pradesh*. Vol. 1. Botanical Survey of India, Kolkata.

TURLAND, N. J., J. H. WIERSEMA, F. R. BARRIE, W. GREUTER, D. L. HAWKSWORTH, P. S. HERENDEEN, S. KNAPP, W.-H. KUSBER, D.-Z. LI, K. MARHOLD, T. W. MAY, J. MCNEILL, A. M. MONRO, J. PRADO, M. J. PRICE, AND G. F. SMITH. 2018. *International Code of Nomenclature for Algae, Fungi and Plants (Shenzhen Code)*. Regnum Veg. Vol. 159. Koeltz Scientific Books, Königstein.

WALLICH, N. 1828–1849. A Numerical List of dried specimens of plants in the East India Company's Museum. Collected under the superintendence of Dr. Wallich of the Company's botanic garden at Calcutta. London.

CHARLES DARWIN ON CATASETINAE (CYMBIDIEAE, ORCHIDACEAE)

Gustavo A. Romero-González[1]

Abstract. The background and accomplishments of Darwin's work on Catasetinae are analyzed, and issues that he and others did not resolve are discussed in detail. The segments on Catasetinae published by Darwin in the *Annals and Magazine of Natural History* in September 1869 and in the second edition of his orchid pollination opus (as Catasetidæ) published in 1877, as well as his paper "On the three remarkable sexual forms of *Cataseum tridentatum*," all including the text, plates, and notes, are presented in three appendixes.

Keywords: Catasetinae, Catasetidæ, Darwin, Orchidaceae, pollination

> If I have seen further it is by standing on the shoulders of giants.
> (Isaac Newton in a letter to Robert Hooke, dated 15 February 1676)
>
> In investigating the obscure subject of generation, additional light is perhaps more likely to be derived from a further minute and patient examination of the structure and action of the sexual organs in Asclepiadeæ and Orchideæ, than from that of any other department either of the vegetable or animal kingdom. (Brown, 1833)
>
> I know of no individual of this family [Orchidaceae] which has flowers so splendid and so curious.
> (Hooker, 1824, referring to what he had described as *Catasetum tridentatum*)
>
> The most singular Orchideous plant which has yet been seen in a cultivated state…
> (John Lindley, 1824, referring to what he had described as *Catasetum claveringii* [2])
>
> But what is impossible in nature? (John Lindley, 1843b, referring to sexual forms of *Cycnoches* Lindl.)
>
> Who would have been bold enough to surmise that the propagation of a species should have depended on so complex, so apparently artificial, and yet so admirable an arrangement?
> (Darwin, 1862a, referring to flowers of *Cataseum tridentatum* Hook.[2])
>
> Under-sampling—in only one time slice and in one locality—can give a critically false impression of what's out there—the extent of diversity, the full quantitative and qualitative range in morphological features, and life stories and processes. (Pridgeon, 2003)

Charles Darwin's two articles and the two editions of his book on the pollination of Orchidaceae were fundamental contributions to our understanding of this perhaps most diverse of plant families. Prior to his publications (Darwin, 1862a,b, 1869, 1877a), orchids were mostly treated "morphologically," with little offered on other biological aspects of the family. There had been many publications about their pollination, some accurate (most influential to Darwin appear to be Sprengel, 1793, and Brown, 1833), some not so accurate and speculative. It was Darwin, ultimately, who carefully compiled the scattered literature and established a wide network of collaborators in England and throughout the world, especially from the Neotropics (Table 1). Most important of all, he introduced new methods—namely, careful and detailed experimentation with live plants and flowers, and in the case of subtribe Catasetinae, with flowers preserved in spirits, an effort that would have no parallel in Orchidaceae until the 1960s, when there was a resurgence of studies on orchid pollination biology (Dodson, 1962a,b; Dodson and Frymire, 1961; Dodson and Hills, 1966; Van der Pijl and Dodson, 1966; Vogel, 1963, 1966, 1990; Dressler, 1968).[3] Unlike most of his contemporaries, Darwin examined the structure of orchid flowers in terms of homologies (e.g., when describing the male flowers of *Cataseum tridentatum* as "[a] deep chamber, which from its homological relations must be called the stigmatic chamber"; 1877a: 152), a critical approach needed to properly interpret the flowers of this group.

Darwin's orchid publications, particularly the last edition of his book (Darwin, 1877a), have been praised lately (Beatty, 2006; Singer, 2009; Bellon, 2009; Cameron, 2011;

I am grateful to the Botany Libraries at the Harvard University Herbaria, the library of the Arnold Arboretum, and the Luesther T. Mertz Library of the New York Botanical Garden for allowing access to their resources. I also thank G. Carnevali (CICY), G. Gerlach (Botanical Garden Munich, Germany), and I. Ramírez (CICY) for their useful comments on earlier versions of this text. Most important of all, I acknowledge the help of the Biodiversity Heritage Library; the International Plant Name Index (IPNI); Taxonomic Literature II (TL-2), a site maintained by the Smithsonian Institution; and Tropicos, a site maintained by the Missouri Botanical Garden, tools without which I could not have completed this contribution.

[1] Orchid Herbarium of Oakes Ames, Harvard University Herbaria, 22 Divinity Avenue, Cambridge, Massachusetts 02138, U.S.A.; romero@oeb.harvard.edu

[2] These two species are currently considered synonyms of the earlier *Catasetum macrocarpum* Rich. ex Kunth.

[3] Also noteworthy are Oakes Ames's publication on the pollination of orchids through pseudocopulation (1937) and the rarely cited one on the pollination of *Coryanthes* (1941).

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TABLE 1. Botanists and naturalists who interacted with Darwin in his studies of Catasetinae (in alphabetical order).[1]

IN ALPHABETICAL ORDER
Hermann Crüger (1818–1864): from 1857 until his death served as a government botanist and director of the botanical garden in Port-of-Spain, Trinidad; exchanged correspondence with Darwin
William J. Hooker (1775–1865): worked closely with Lindley in early work on Catasetinae
Joseph D. Hooker (1817–1911): son of William J., Darwin's closest friend, and a supplier of orchid flowers
John Lindley (1799–1865): an early expert on Catasetinae, who identified some of the orchids that Darwin examined
Johann F. T. Müller (a.k.a. Fritz Müller and Müller-Desterro) (1821–1897): corresponded with Darwin; Müllerian mimicry is named after him
Robert A. Rolfe (1855–1921): a gardener at the Royal Botanic Gardens, Kew, and later in his life the leading expert on Orchidaceae
Sigismund Rucker (ca. 1809–1875): a private and successful orchid grower who supplied Darwin with flowers of Catasetinae
Robert H. Schomburgk (1804–1865): an explorer, naturalist, collector of plant and animal museum samples in northern South America; studied *Catasetum* in the field and sent *Catasetum* samples in spirit to the Linnean Society of London that were examined by Darwin and the bases for one of his publications (Darwin, 1862a)
James Veitch, Jr. (1792–1863): an orchid grower, member of the famous Veitch dynasty, who supplied Darwin with flowers of Catasetinae

[1] For most entries, see Cribb (2010) for more details.

Endersby, 2016), and a partial analysis of the contents of the 1877 edition was also published recently (Edens-Meier and Bernhardt, 2014). Notwithstanding, his treatment of Catasetinae (as "Catasetidæ") has not been the focus of any recent publications, other than having been used to point out Darwin's favorite orchids, "Catasetidæ" (Romero, 1990; Pérez-Escobar, 2016; Pérez-Escobar et al., 2016, 2017). As further testimony to his special interest in Catasetinae, a male flower of *Cycnoches ventricosum* Bateman illustrated the cover of the first edition of his orchid pollination book (Darwin 1862b; Fig. 1).

The purpose of this essay is primarily to reprint Darwin's texts on Catasetinae (see Appendixes I–III), to present notes on his accomplishments, and to clarify issues that he and others did not resolve. There exists a trove of additional information on Darwin's work on Catasetinae in his compiled correspondence, which falls outside the scope of this essay.[4]

Catasetinae is one of 11 currently recognized subtribes of tribe Cymbidieae (Cribb, 2009; Li et al. 2016), in subfamily Epidendroideae of Orchidaceae. It currently includes eight genera (Table 2). However, Darwin's Catasetinae included

TABLE 2. Approximate current number of species of "core" Catasetinae, number known by 1860, and number examined by Darwin (1877a), by genera.[1]

	CURRENT SPECIES	SPECIES KNOWN IN 1860	SPECIES THAT DARWIN EXAMINED
Catasetum Rich. (1822)	130	51	6
Clowesia Lindl. (1843)[2]	7	2	0
Cycnoches Lindl. (1832)	34	10	1
Dressleria Dodson (1975)[2]	13	0	0
Mormodes Lindl. (1836)	80	20	2

[1] An approximation of the number of species currently known was taken for *Catasetum* from Romero-González (2009; number reported most likely under-represents the numbered of published species); for *Cycnoches* from Pérez-Escobar (2016) and Gerlach and Pérez-Escobar (2014); for *Clowesia* from Tamayo Cen (2018); for *Dressleria* from Hills (2012) and Hills and Weber (2012); and for *Mormodes* from Salazar et al. (2016).

[2] Many species of *Clowesia* and *Dressleria* remained in the synonymy of *Catasetum* until Dodson (1975) revived *Clowesia* and proposed *Dressleria*. Notwithstanding, Darwin does not appear to have examined flowers of these two genera.

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[4] See https://www.darwinproject.ac.uk

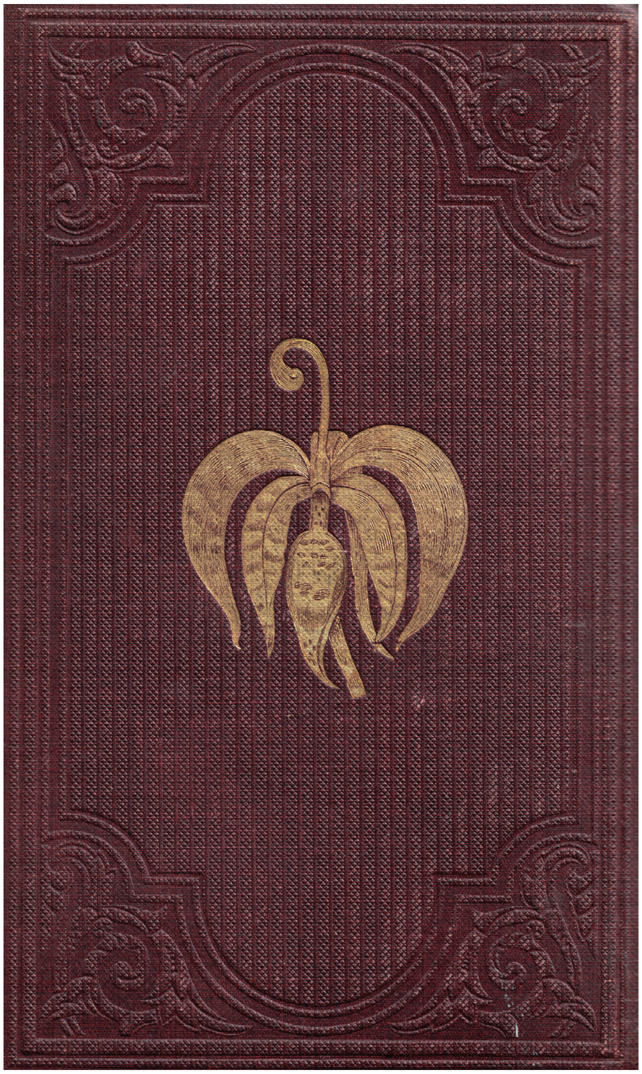

FIGURE 1. Book cover of Darwin's first edition (Darwin, 1862b), showing a male flower of *Cycnoches loddigesii* Bateman (positioned upside down). From a copy in the author's personal library.

only *Catasetum* Rich. ex H.B.K., *Cycnoches* Lindl., and *Mormodes* Lindl., genera currently included in "core" Catasetinae (e.g., Salazar et al., 2016). Core Catasetinae includes two additional genera, *Clowesia* Lindl. and *Dressleria* Dodson; the flowers of these group are charactized by the motility—that is, the active movement—of their pollinaria upon discharge (see Table 3 for terminology).[5]

Darwin faced a daunting challenge when trying to decipher flower function of Catasetinae. Unlike other orchid flowers he had examined before, both in the field and from cultivated plants, those of *Catasetum*, *Cycnoches*, and *Mormodes* had no parallel in Orchidaceae: the flowers borne by plants of these three genera are relatively large, exhibit unusual morphology (Fig. 3–4), have extremely mobile pollinarium discharge mechanisms, and, as Darwin later determined, could be male (pollen bearing) or female (ovule bearing), with intermediate, nonfuncional ones in between (shown for the first time in Lindley, 1837; see Fig. 5) and, most extreme of all in Orchidaceae, exhibiting in some cases dramatic sexual dimorphism (Romero and Nelson, 1986; Fig. 6). Judging from some of the quotes cited in the beginning of this essay, other authors shared his fascination with Catasetinae.

Perhaps less critical, the names of the species, particularly in *Catasetum*, had not been well established. *Catasetum* Rich. ex Kunth had been proposed by K. (Carolus) S. Kunth in 1822 (Kunth, 1822: 330), on the basis of notes of Louis C. M. Richard (1754–1821); two species, *C. maculatum* Kunth and *C. macrocarpum* Rich. ex Kunth, were described in the same publication without illustrations (Kunth, 1822: 331). Later it was revealed that the descriptions of both *C. maculatum* and *C. macrocarpum* were largely based on rather crude sketches ("*Descriptio ex schedis Humboldtianis*" and "*Descriptio excerta ex schedis Richardianis*," respectively; Humboldt et al. 1825: 157–158).

In the meantime, William J. Hooker published *Catasetum tridentatum* in 1824 (Fig. 7), adding,

> ... it was impossible to read the character given by M. Richard, of *Catasetum*, in the 1st volume of *Synopsis Plant. Æquinoct. Orbis novi* of HUMBOLDT and KUNTH, without being satisfied that it must belong to that genus. The species there given is the *Catastum maculatum* of New Grenada... a second individual, afterwards noticed, is the *C. macrocarpum* of Richard's MSS. with blossoms of a deep purple color, and fruit four or five inches long. No figures exist of either of these (Hooker, 1824).

Hooker's species was published in March 1824, but the plates illustrating *Catasetum maculatum* Kunth and *C. macrocarpum* Rich ex Kunth did not appear until 24 December 1824 and 21 February 1825, respectively (in volume 7, plates 630 and 631 of *Nova Genera et Species Plantarum*; see Fig. 8 herein for plate 631).

Despite doubts expressed by Lindley (1824), comments about the validity of *Catasetum tridentatum* and his own *C. claveringii* (e.g., that they may actually be synonyms of *C. macrocarpum*), and further comments by Crüger (1864), the name *C. tridentatum*, instead of *C. macrocarpum*, was used in the orchid literature until Rolfe (1890) formally reestablished the latter.

A large number of exotic orchids were cultivated in England in the 1830s, including several representatives of Catasetinae. These plants were examined, studied, described, and reported in the literature, at least morphologically, by William J. Hooker (1785–1865) and John Lindley (1799–1865) (for these two authors, see Literature Cited).

Besides the already described and known *Catasetum*, Lindley proposed two additional genera in the same

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[5] The active movement of the pollinarium in these five genera differs tremendously, and varies from a rapid and total detachment from the column in *Catasetum* subgenus *Catasetum* to a simple flipping of the viscidium in *Clowesia*. The pollinarium itself moves hygroscopically in some genera, such as *Cycnoches* and *Mormodes*: in these two genera, the pollinarium curls tightly upon discharge, later straightening up as it becomes dry (Fig. 2). In *Mormodes*, plants can bear flowers whose columns move after the pollinaria are discharged (see fig. 1E in Salazar et al., 2016).

FIGURE 2. *Cycnoches* pollinarium movement by hygroscopy. The complete movement from curled to erect depends on ambient relative humidity; in this case, at about 60%, it took approximately 6 minutes. Based on *Tamayo Cen 127* (CICY). Photographs by the author.

TABLE 3. A glossary of floral terms in Catasetinae with equivalency in Darwin's writings (1862a, 1862b, 1877).[1]

Antenna (antennae)	A filamentous process of the rostellum, two per flower, that triggers the discharge of the pollinarium in *Catasetum* subgenus *Catasetum*
Anther	The part of the flower that produces pollen; in Orchidaceae, the "envolture" of the pollinarium
Anther filament	A thin strap of tissue, most likely of derived from the anther, that joins the latter to the clinandrium; it is discernable in *Clowesia* and *Cycnoches*, and projects beyond the apex of the column, as a tubular process, in *Mormodes* (see Romero, 1990: Figure 3); it is entirely fused to the clinandrium in *Catasetum*
Caudicle (caudicles)	A slender, elastic extension of each pollinium that connects them to the stipe
Clinandrium	The bed of the anther, prolonging into a beak-like process in flowers of some species of *Catasetum* subgenus *Catasetum* and, in *Mormodes*, beyond the apex of the column
Column (Gynostemium)	A compound organ made up of the style and the filament of one or more anthers in Orchidaceae
Curtain	A non-viscid extension of the viscidium, highly developed in *Cycnoches* and *Dressleria*, which in flowers of both genera covers the stigmatic cavity
Labellum	A modified petal, facing the column, which usually serves as a landing platform in Orchidaceae
Ovarium	See ovary
Ovary	Part of the gynoecium that holds the ovules. The "Ovarium" in Darwin's writings
Pollen masses	In Darwin's writings: see pollinia
Pollinarium	A compound organ composed, in Catasetinae, of a viscidium, a stipe, and two pollinia. "Pollinium" or "pollinia" in Darwin's writings
Pollinium (pollinia)	In Darwin's writings: see pollinarium
Pollinium (pollinia)	In the current orchid literature, a compact mass of aggregated pollen grain. Pollen-mass in Darwin's writing
Rostellum	A portion of the stigma over which, in Catasetinae, the stipe is stretched taut, storing energy to discharge the pollinarium partially or completely
Sepals and petals	Homologous to sepals and petals of other plants, mostly all colored in Orchidaceae
Stigma	The sticky, receptive part of the pistil, where the pollen grains contain within each pollinium germinate. In Catasetinae, the stigma is "hidden" inside a cavity, the latter sometimes reduced to a fissure or cleft. "Stigmatic cavity" or "Stigmatic cleft" in Darwin's writings
Stipe	A strap of tissue of columnar tissue that connect the viscidium and the pollinia. "Pedicel of pollinium" or "elastic pedicel" in Darwin's writings
Viscidium	A sticky disc that serves to attach the pollinarium to the pollinator. The "disk" in Darwin's writings.

[1] Most entries modified from Dressler (1990: 306–316).

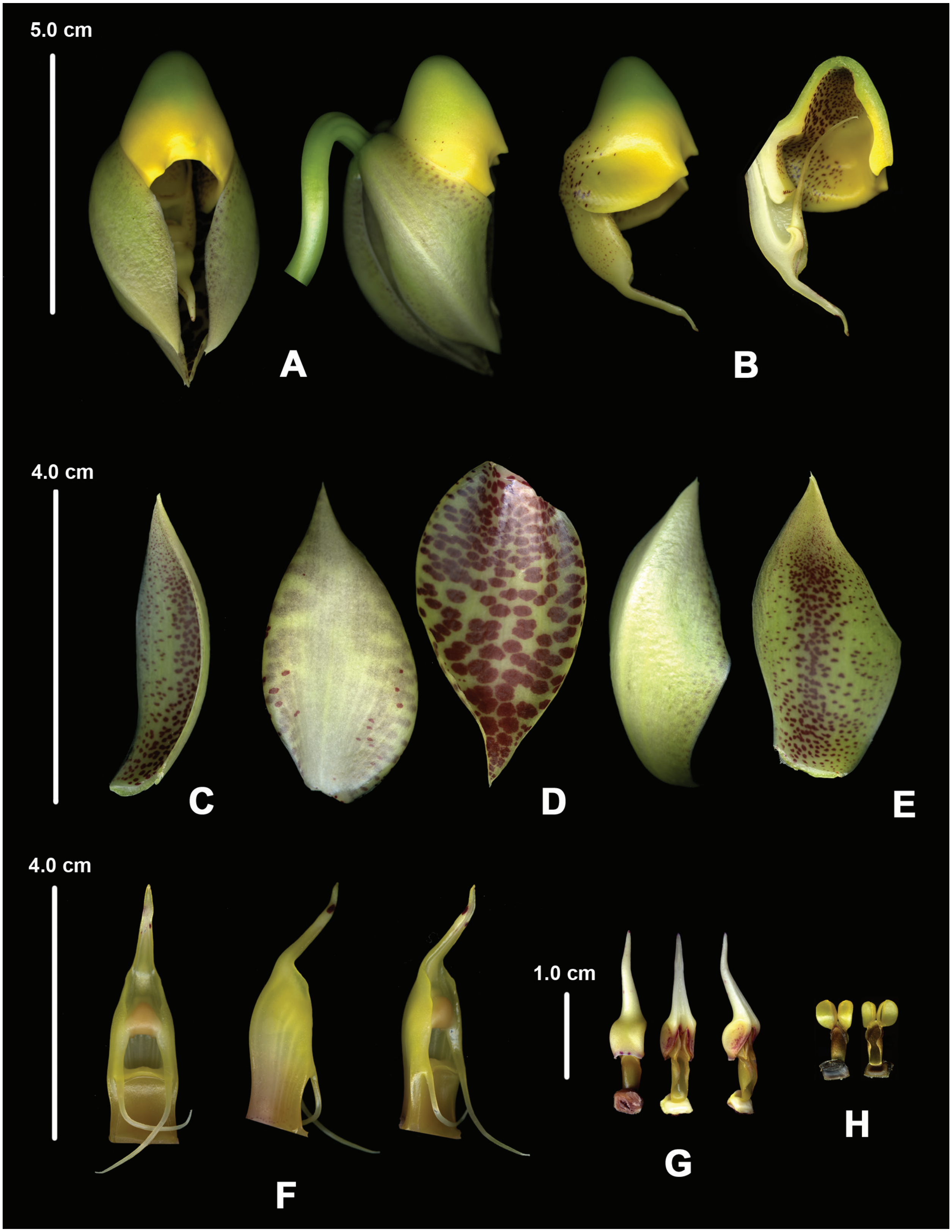

FIGURE 3. *Catasetum macrocarpum* Rich. ex Kunth. **A**, front and side view of flower; **B**, side view of flower after the removal of sepals and petals (from left to right: entire and cross-section views of the labellum); **C**, dorsal sepal; **D**, petal; **E**, lateral sepals; **F**, views of the column; **G**, views of the pollinarium and anther (from left to right: abaxial, adaxial, and side views); **H**, views of the pollinarium (from left to right: abaxial and adaxial views). Based on plant cultivated by *D. Fulop sub G. A. Romero-González s.n.* (AMES). Photographs by the author.

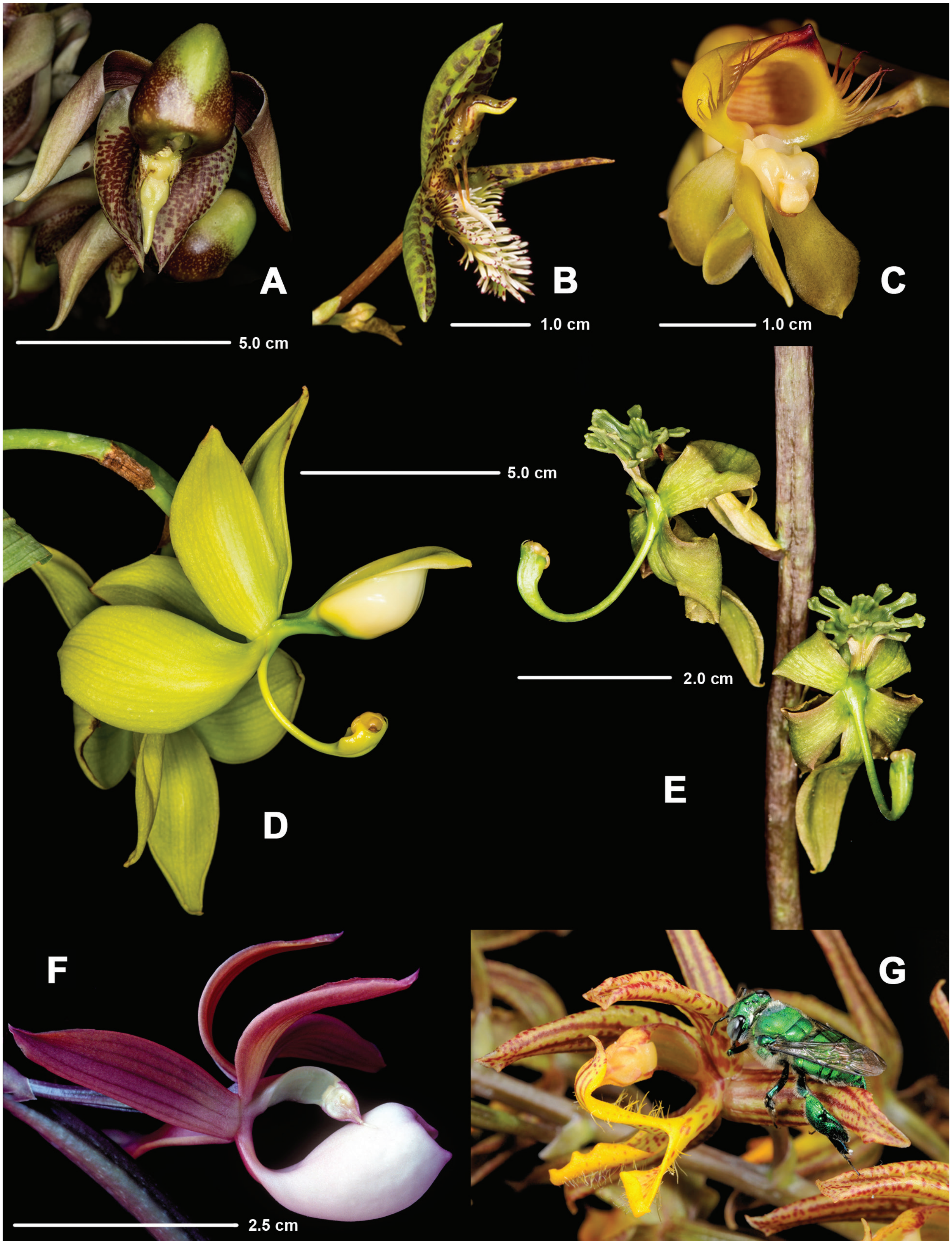

FIGURE 4. **A**, *Catasetum maculatum* Kunth (male flower); **B**, *Catasetum barbatum* (Lindl.) Lindl. (male flower); **C**, *Catasetum roseo-album* (Hook.) Lindl. (male flower); **D**, *Cycnoches ventricosum* Bateman (male flower); **E**, *Cycnoches egertonianum* Bateman (male flowers); **F**, *Mormodes vernixoidea* ssp. *autanensis* Salazar & G. A. Romero (female flower); **G**, *Mormodes lineata* Lindl. with *Euglossa viridissima* Friese (male flower). A based on *Guánchez 5384* (JBL); B *ex Hort*. Familia Aragua; C on *Romero et al*. *3592*; D on *Tamayo Cen 127* (CICY); E on *Guánchez et al*. *5366* (JBL); F on *Romero & Guánchez 1434* (VEN); G on *Carnevali 7416* (CICY).

FIGURE 5. Lindley's plate with male, female, and intermediate flowers of *Catasetum cristatum* Lindl. The hooded, green flowers in the apex of the inflorescence represent female flowers, as does flower 1 (the latter, drawn upside down, has a longer than normal clinandrum); the "cristate" ones at the bottom are male flowers, as is flower 4; flowers 2–3 are intermediate, nonfunctional flowers. From Lindley (1837). Courtesy of the Orchid Library of Oakes Ames.

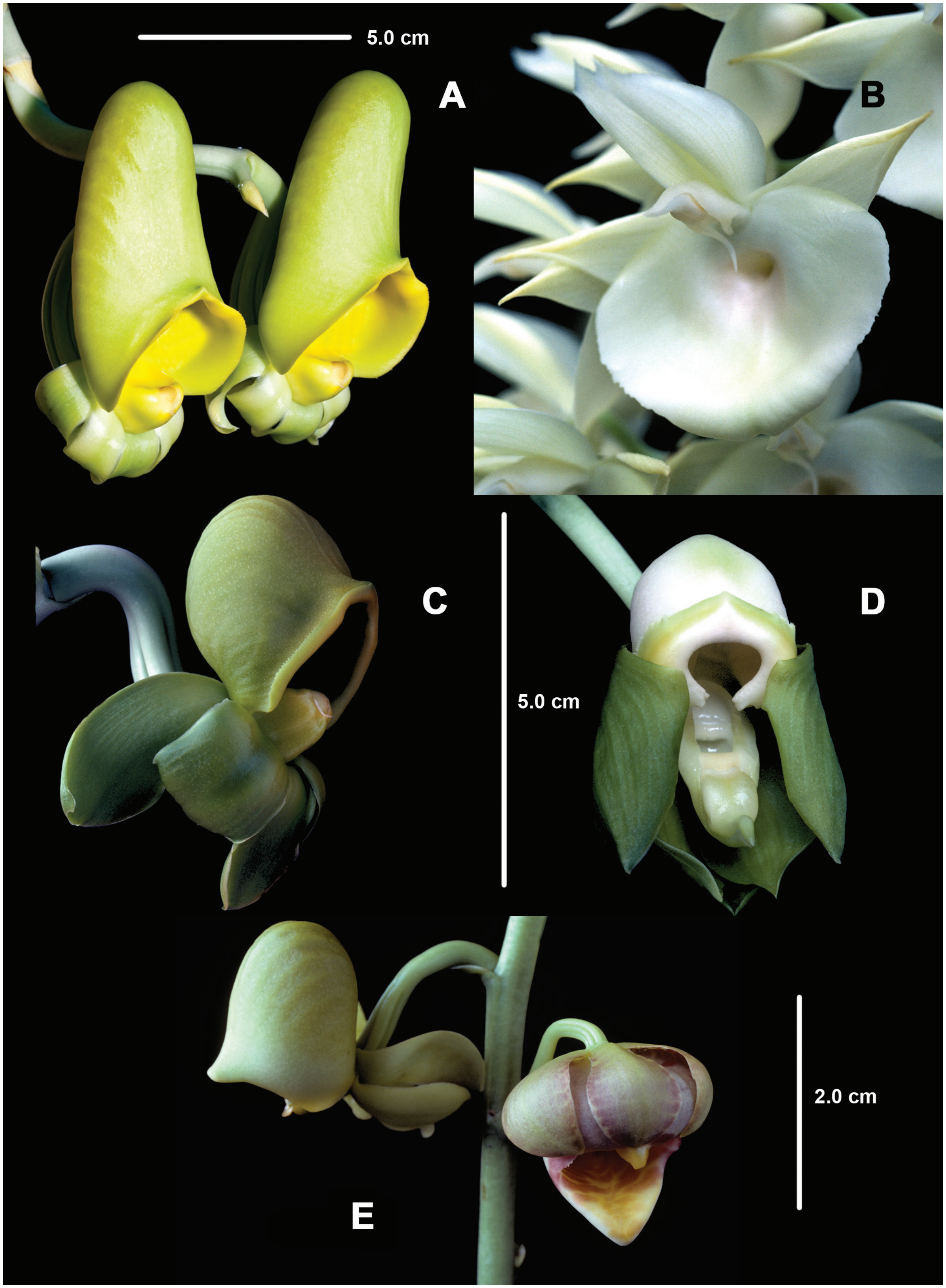

FIGURE 6. *Catasetum* sexual dimorphism. **A–B**, *Catasetum pileatum* Rchb.f. female and male flower, respectively; **C–D**, *Catasetum collare* Cogn. female and male flowers, respectively; **E**, *Catasetum bergoldianum* Foldats (from left to right: female and male flowers). A based on *Romero & Gómez 3632*; B on *ex Hort*. R. de Tomacini; C on *ex Hort*. R. de Tomacini; D on *Romero 1155*; E on *Romero 1119*. Photographs by the author.

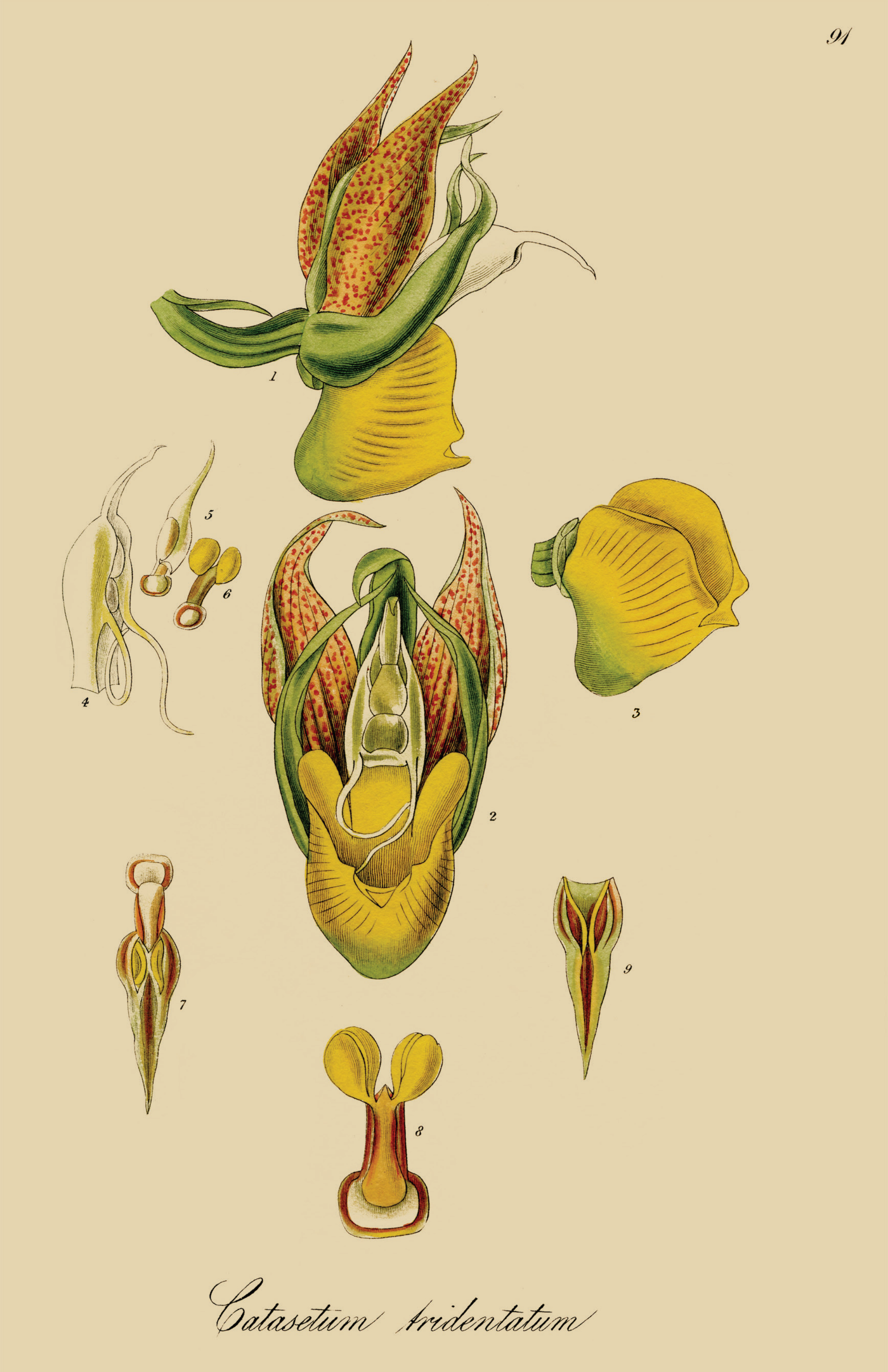

FIGURE 7. *Catasetum macrocarpum* Rich. ex Kunth (as *C. tridentatum* Hook.). From Hooker (1824: tab. 91). Quoting the text that originally accompanied the plate: 1, "Side view of flower"; 2, "Front view of same"; 3, "Side view of the lip"; 4, "Side view of column with the anther"; 5, [anther] removed"; 6, "Pollen mass" [pollinarium]; 7, "Inner view of the Anther-case, containing the pollen-mass"; 8, "Pollen-mass" [pollinarium]; 9, "Anther case, inside view." Courtesy of the Orchid Library of Oakes Ames.

FIGURE 8. *Catasetum macrocarpum* Rich. ex Kunth. from Humboldt, Bonpland, and Kunth (1825: tab. 631). Courtesy of the Orchid Library of Oakes Ames.

publication (Lindley, 1832): *Myanthus* (based on *Myanthus cernuus*) and *Monachanthus* (based on *Monachanthus viridis*). Later, these genera were determined to be male flowers of *C. cernuum* and female flowers of *C. macrocarpum,* respectively. He never illustrated *Myanthus cernuus*, and the first species that appeared in the iconography was his *Myanthus barbatus* (Lindley, 1835b; Fig. 9); he did illustrate *Monachanthus viridis* (Lindley, 1835a; Fig. 10). A total of 12 new species, varieties, and combinations would be proposed in *Myanthus*, and 10 in *Monachanthus*.

Hooker (1836) was the first author to doubt Lindley's genera:

> The present plant [*Myanthus barbatus*] … is referred [by John Lindley] to *Myanthus*, without any allusion to its exceedingly close affinity with his *Catasetum cristatum*, a similarity so great, that I was at first disposed to consider our plant with a white lip the same species, differing chiefly in being furnished with a spur or tooth-like process at the base of the lip. The two plants are indeed, I doubt not, specifically distinct; but they cannot be separated generically, and perhaps Professor Lindley will agree with me in thinking, that *Myanthus* should only form a section of *Catasetum* (Hooker, 1836).

Lindley (1837), after examining the then-existing evidence, including the already cited inflorescence having a mixture of male, female, and intermediate flowers of *Catasetum cristatum* (Lindley, 1837; Fig. 5), concluded that "the necessary consequence ... is, that the supposed genera *Myanthus* and *Monachanthus* must be restored to *Catasetum*"; adding, "which of the species have their masks on, and which shew their real faces, I certainly will not at present presume to guess" (see Gerlach, 2013, for an account of Lindley's "nightmare").

Robert H. Schomburgk (1804–1865), with the additional advantage of knowing plants in the field, had also concluded that "the genera *Monachanthus*, *Myanthus*, and *Catasetum* form but one genus" (Schomburgk, 1837).

Thus, the fact that all three genera (i.e., *Catasetum*, *Monachanthus*, and *Myanthus*) were not "sportings" (see Lindley, 1837) or "monsters" (see J. Paxton's note in Lindley, 1837), but referrable to one single genus, had already been firmly established by the time Darwin expressed interest in this group of orchids.

Furthermore, Schomburgk (1837) pointed out that

> We have traces of sexual difference in Orchideous flowers. I have seen hundreds of *Catasetum tridentatum* on savannahs adjacent to the Capoeya (Arabisce coast of Essequibo), without ever finding one specimen with seeds, while those bulbs, which, according to Dr. Lindley's description, belonged to *Monachanthus viridis*, astonished me by the gigantic seed-vessels.

William J. Hooker, John Lindley, and Robert H. Schomburgk had paved the way for Darwin, and Schomburgk (1837), in particular, had alluded to the fact that "sexual difference" was involved. However, these authors had examined few species; the limited information available to them brings to our attention Pridgeon's quote in the beginning of this contribution (Pridgeon, 2003).

Darwin went on to paintakingly demostrate that the species of *Catasetum* known thus far bore male flowers, that those of *Monachanthus* were female flowers of *Catasetum*, and, erroneously, that flowers of *Myanthus* were hermaphroditic flowers of *Catasetum*: "*Myanthus barbatus* may be considered as the hermaphrodite form of the same species, of which the *Catasetum* is the male, and the *Monachanthus* the female" (Darwin, 1877a: 156). To conduct his work on Catasetinae Darwin relied on fresh flowers from Joseph D. Hooker, of the Royal Botanic Gardens, Kew, James Veitch "of Chelsea," and Mr. Sigmund Rucker "of West Hill, Wandsworth"; some of the species and flowers he examined were identified by John Lindley, the leading orchid expert at that time. Perhaps most important of all for his work, Darwin also examined an inflorescence in spirits that R. H. Schomburgk had sent to the Linnean Society of London that bore male and female flowers of *Catasetum barbatum* (Lindl.) Lindl. (illustrated in Schomburgk, 1837; Fig. 11–12); the former previously had been interpreted as being flowers of *Myanthus*, the latter as flowers of *Monachanthus* (Schomburgk, 1837; Darwin, 1862a).

It is lamentable that neither Darwin nor any of the other botanists who had worked earlier on *Catasetum* apparently ever studied the descriptions of *Catasetum macrocarpum* Rich. ex Kuth in *Synopsis Plantarum* ("*flores fusco-purpurei, labellum non ciliatum, fructus 4–5-pollicares*" [Kunth, 1822: 331]), the more detailed one in *Genera Plantarum* (1824: 158), or particularly the plate in *Genera Plantarum* (Humboldt et al., 1825: tab. 631), which shows both an inflorescence with two male flowers (one in bud) and another, borne on a second pseudobulb, with a fruit with a persistant perianth (see Fig. 13). They would have realized that plants of the genera *Catasetum* and *Cycnoches* can bear male and female flowers in the same or in different flowering seasons (Dodson, 1962b; Gregg, 1975, 1982; Romero, 1992).

Rolfe (1890, 1895) partially solved the puzzle: he correctly ascertained that flowers of *Myanthus* were actually male flowers of another group of *Catasetum*, currently referred to subgenus *Catasetum* section *Isoceras*, by far the most diverse group in the genus, and definitively not hermaphroditic flowers.

A similar conundrum involved *Cycnoches* Lindl. in the 1840s and 1850s, this time not involving different genera, because plants of the species then known bore generally similar flowers that could easily be referred to that genus; in this case, male and female flowers of different species were referred to the same species and male and female flowers of the same species to different ones. The first "monster" appeared on plate 40 of John Bateman's *The Orchidaceæ of Mexico and Guatemala*, published in 1843 (Fig. 14). It presented, originating from the same pseudobulb, one pendent inflorescence bearing many flowers and flower buds of the new species described in the plate, *Cycnoches*

FIGURE 9. *Myanthus barbatus* Lindl. Darwin (1862a,b, 1877a) incorrectly treated the flowers of this species as the hermaphroditic form of *Catasetum* from Lindley (1835b). Courtesy of the Orchid Library of Oakes Ames.

FIGURE 10. *Monachanthus viridis* Lindl. from Lindley (1835a). Darwin (1862a,b, 1877a) correctly treated the flowers of this species as the female form of *Catasetum*, and eventually it became clear that it was the female flower of *C. macrocarpum* Rich. ex Kunth. Courtesy of the Orchid Herbarium of Oakes Ames.

FIGURE 11. *Catasetum barbatum* Lindl. in Schomburgk (1837). The plate shows two inflorescences. The first is an erect one, borne at the base of the pseudobulb, showing a mixture of female flowers (the hooded ones, supposedly *Monachanthus viridis*) and male ones (the "barbate" ones, supposedly *Myanthus barbatus*); some of the female flowers show abnormally long clinandria. The second inflorescence, somewhat arcuate, bears all "barbate," male flowers. Courtesy of the Botany Libraries, Harvard University Herbaria.

FIGURE 12. *Catasetum barbatum* Lindl. in Schomburgk (1837). Again, the "hooded" flowers are female, the "barbate" ones are male. Detail redrawn by Blanche Ames and reproduced in Ames (1945). From the original drawing at the Botany Library, Harvard University Herbaria.

FIGURE 13. *Cycnoches* "monster" showing two inflorescences originating from the same pseudobulb, each bearing male flowers of two different species: in the upper left, two flowers of *Cycnoches ventricosum* Bateman; in the center, a multiflowered inforescence with flowers of *Cycnoches egertonianum* Bateman. The line drawing shows a male flower of *C. egertonianum* with sepals and petals removed, drawn upside down. From Bateman (1843: tab. 40). Courtesy of the Missouri Botanical Garden and the Biodiversity Heritage Library.

FIGURE 14. *Cycnoches ventricosum* Bateman. The inflorescence shows six male flowers; to the right, borne in an old pseudobulb and inflorescence, there is a dehisced fruit. From Bateman (1838: tab. 5). Courtesy of the Missouri Botanical Garden and the Biodiversity Heritage Library.

egertonianum Bateman, and another erect one bearing two flowers of *C. ventricosum* Bateman, a different species that had been described earlier in the same work (Bateman, 1838: tab. 5; Fig. 14 herein). Although Lindley (1843a, 1843b) had stated, in reference to this plate, "But what is impossible in nature?" we now know it is impossible that flowers of these two species could be born from the same plant.

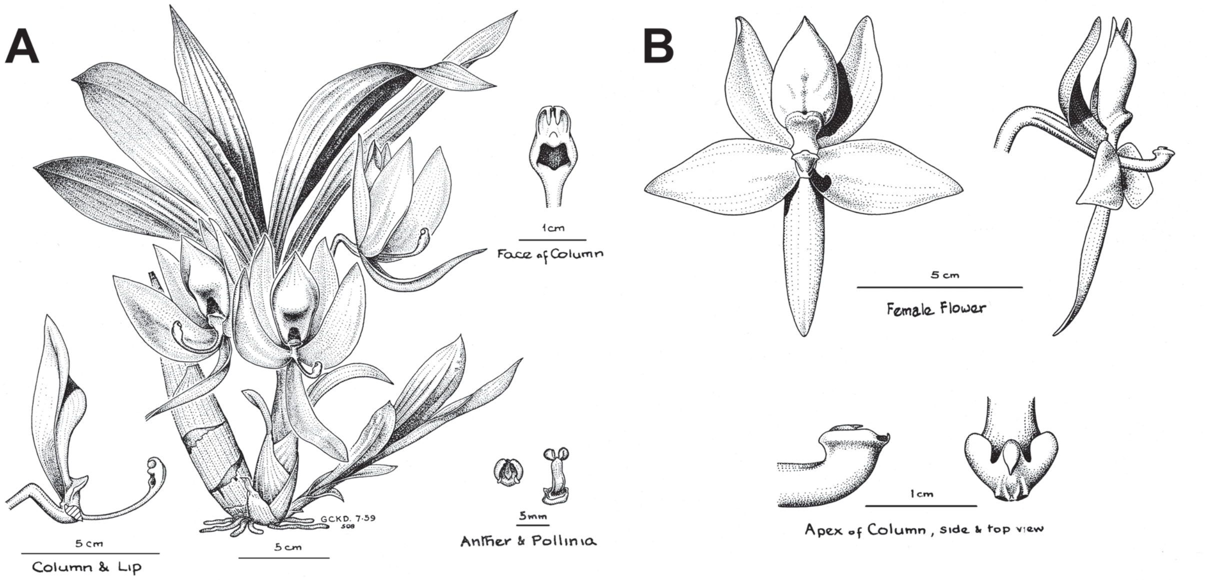

FIGURE 15. *Cycnoches chlorochilon*. Klotzsch. **A**, plant bearing an inflorescence with three male flowers; **B**, female flower. Based on *G. C. K. Dunsterville 508*. From two photostats at AMES.

The following is part of the text that accompanies Bateman's plate 40:

> Among Mr. Skinner's earliest Guatemala collections, attention was particularly directed to the specimens of a plant which to the habit of a *Cycnoches* joined the long pendulous stems of a *Gongora*, and for the possession of which, in a living state, no small anxiety was entertained. Some plants were speedily transmitted by Mr. Skinner, but these, on flowering, proved to be merely the old *C. ventricosum*. A mistake was of course suspected, and Mr. Skinner being again applied to, sent over a fresh supply of plants, for the authenticity of which he vouched; but these were scarcely settled in the stove, when flowers of *C. ventricosum* were again produced. Mr. Skinner being importuned for the third time, and being then on the point of returning to this country, determined to take one of the plants under his special protection during the voyage, which, flowering on the passage, seemed to preclude the possibility of further confusion or disappointment. The specimens produced at sea were exhibited, and the plant itself placed in the stove at Knypersley, where it commenced growing with the utmost vigour. The season of flowering soon arrived, but brought with it a recurrence of the former scene of astonishment and vexation, for the blossoms, instead of those of the coveted novelty, were not distinguishable from the old *C. ventricosum*. These were still hanging to the stem when the inexplicable plant sent forth a spike of a totally different character, and which was, in fact, precisely similar to the specimens gathered in Guatemala, and to those produced on the voyage.
>
> It is, at present, impossible to attempt any explanation of so strange a phenomenon, especially on the supposition that the two forms of flower are analogous to the male and female blossoms of other tribes, for *C. ventricosum* alone not unfrequently perfects seeds. (Bateman, 1843: tab. 40).

The confusion arose because Bateman and others mistook, despite a considerable difference in size and form,[6] the male flower of *Cycnoches ventricosum* for the female flower of *C. egertonianum*, first pointed out by Rolfe (1902: 298, 1909). The statement "*C. ventricosum* alone not unfrequently perfects seeds" (Bateman, 1843: tab. 40) resulted perhaps from the observation of a fruit borne by the same plant of *C. ventricosum* that bore male flowers (see Fig. 14).

John Lindley further confused the issue when he described, as *Cycnoches cucullata*, a female flower of what he previously had described as *C. loddigesii* (Lindley, 1837, sub tab. 1951*).

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[6] The female flower of *Cycnoches egertonianum* is much smaller than the male flower of *C. ventricosum*; see Fig. 15 for differences between male and female flowers of *Cycnoches*, chiefly the shorter and thicker column of the latter, as well as the morphology of the clinandrium.

Later, Lindley (1843a) mistakenly referred male flowers and female flowers belonging to the same species to two different species, again confusing the female flowers of *Cycnoches egertonianum* with *C. ventricosum* (Fig. 16; also reproduced in Lindley, 1843b).[7]

He described an inflorescence of *Cycnoches egertonianum* as follows:

> On the spike, No. 1 is more *Egertonianum* than *ventricosum*; the next is almost wholly *ventricosum*; that which succeeds, No. 3, is more *ventricosum* than *Egertonianum*; and 4 and 5, the last on the spike, are wholly *Egertonianum*.

Lindley, in the same publication, added his much quoted statement (i.e., Darwin, 1862a; Rolfe, 1902: 298, 1909), "What with such cases as this ... all ideas of species and stability of structure in the vegetable kingdom, are shaken to their foundation."

By 1846 Lindley came up with another solution—plants of *Cycnoches* were "sporting":

> But what is *C. Egertonianum* itself? In our volume for 1843, at p. 77 of the miscellaneous matter [Lindley, 1843a,b], we have extracted from Mr. Bateman's magnificent work his account of how the long-spiked small-purple-flowered *C. Egertonianum* is only the short-spiked large-green-flowered *C. ventricosum*; how the same plant at one time bears one sort of flowers, and at another time another sort; and we have shewn how the same plant, nay the same spike, is sometimes both the one, the other, and neither. *Cycnoches Egertonianum* is then a "sports," as gardeners say, of *C. ventricosum*.
>
> But what again is *C. ventricosum*? Who knows that it is not another "sport" of *C. Loddigesii*, which has indeed been caught in the very act of shewing a false face, something wonderfully suspicious, all things considered, and justifying the idea that it is itself a mere Janus, whose face is green and short on one side, and spotted and long on the other.
>
> Then, if such apparently honest species as *C. Egertonianum*, *ventricosum*, and *Loddigesii* are but counterfeits, what warrant have we for regarding the other so-called species as not being further examples of plants masquerading with false faces? For ourselves we cannot answer the question; nor should we be astonished at finding some day a *Cycnoches* no longer a *Cycnoches*, but something else; perhaps a *Catasetum*. If one could accept the doctrine of the author of the "Vestiges," it might be said that in this place we have found plants actually undergoing the changes which he assumes to be in progress throughout nature, and that they are thus subject to the most startling conditions only because their new forms *have not yet acquired stability*. (Lindley, 1846)

FIGURE 16. *Cycnoches egertonianum* Bateman from Lindley (1843a). The text accompanying this figure reads, "on the spike, No. 1 is more *Egertonianum* than *ventricosum*; the next is almost wholly *ventricosum*; that which succeeds, No. 3, is more *ventricosum* than *Egertonianum*; and 4 and 5, the last on the spike, are wholly *Egertonianum*." All the flowers represent *C. egertonianum*: 2 represent the typical female flower and 4–5 male flowers; 1 and 3 are intermediate in color (see footnote 7 below) but apparently fully functional male flowers.

Lindley maintained the same view in 1852, when he described *Cycnoches aureum*, and, as in 1846, presented a list of all the then-known species of the genus under the title "so-called species of *Cycnoches*"; under *C. egertonianum* he added "*Sports to ventricosum*" and under *C. ventricosum* "*Sports to Egertonianum*" (Lindley, 1846, 1852, his italics). Lindley, a keen observer, did add, under *Cycnoches loddigesii*, "*Sports by producing smaller broad-lipped flowers without scent, and with a very short club-shaped column*" (again, his italics in Lindley, 1846, 1852), describing the flowers of *C. cucullata* and a typical female flower (Fig. 15B), but not realizing that the difference between the two "species" involved sexual dimorphism.

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[7] Rolfe (1902: 298) cited, for the line drawing reproduced in Lindley (1843a, 1843b), "two purple flowers of *C. egertonianum*, one green flower, which Lindley called 'nearly *C. ventricosum*' ... and two flowers in a transition state so far as the shape and color of the sepals and petals are concerned." However, the published plate does not show any color, and Rolfe perhaps had access to the original, colored plate, which is likely among the collection of plates in the Orchid Herbarium, Royal Botanic Gardens, Kew.

Darwin did not have much to add to the different "forms" or "sports" of *Cycnoches*. On page 224 of the second edition he stated (also partially in Darwin, 1862a: 269):

> Therefore it appears that this *Cycnoches* [*C. ventricosum*] must be an hermaphrodite; and Mr. Bateman, in his work on the Orchideæ, says that the present species produces seeds without being, as I understand, artificially fertilised; but how this is possible is unintelligible to me.… According to Lindley *C. ventricosum* produces on the same scape flowers with a simple labellum, others with a much segmented and differently coloured labellum (viz., the so-called *C. egertonianum*), and others in an intermediate condition. From the analogous differences in the flowers of *Catasetum*, we are tempted to believe that we here have male, female, and hermaphrodite forms of the same species of *Cycnoches*.

Then, on a footnote on the same page:

> Mr. Bateman also says that *C. egertonianum* has been known to produce in Guatemala and once in England scapes of a purple-flowered and widely different species of *Cycnoches*; but that it generally produces in England scapes of the common yellow *C. ventricosum*.

The mystery surrounding *Cycnoches* would remain unsolved until Rolfe (1902: 298, 1909) correctly interpreted the male and female flowers of the different species of *Cycnoches*, thus solving the riddle.

After Rolfe, one major issue remained unsolved: do plants of *Catasetum* and *Cycnoches* ever bear hermaphroditic flowers?

"Hermaphroditic flowers" in *Catasetum* and *Cycnoches* have long been reported in the orchid literature (Ames, 1945; Hoehne, 1953; Soukup, 1976; Gregg, 1975, 1982; Bicalho and Barros, 1988; Van der Cingel, 2001: 90; Cribb, 2003; Pridgeon, 2003; Arditti, 2008: 291; Domínguez, 2007; Oliveira et al., 2013), although there is incontravertible evidence that such flowers, intermediate in morphology between male and female flowers, are actually nonfuncional (Romero, 1992; Gerlach, 2007).

Another avenue of research originated from Darwin's work and his correspondence with two particular collaborators, Hermann Crüger (1818–1864), then stationed in Trinidad, and Johann Friedrich Theodor Müller (a.k.a. Fritz Müller, 1821–1897), who lived in Santa Catarina, Brazil. Crüger sent bees that visited *Catasetum* to Darwin: "Dr. Crüger sent me specimens of the humble-bees which he caught gnawing the labellum, and these consist of *Euglossa nov. spec.*, *cajennensis* and *piliventris*" (Darwin, 1877a: 206; see Nemésio and Rasmussen, 2011, for comments on Darwin's correspondence with Crüger and Müller, and on work on euglossine bees prior to Darwin's). Crüger (1864) was the first naturalist to report the pollination of certain orchids by euglossine bees, although he misinterpreted what atracted the bees to the flowers:

> ... that the insects are attracted at first by the smell of the flower I take from the fact that the same insect visits *Coryanthes macrantha*, *Stanhopea grandiflora*, and *Gloxinia maculata* [Gesneriaceae], all three of which have the same perfume. But the smell probably only gives notice to the insects; the substance they really come for, in the case of these Orchids, is the interior lining of the labellum, which they gnaw off with great industry, and for which there is a continual contest.

Crüger did not realize that "the substance they really come for, in the case of these Orchids, [in] the interior lining of the labellum" were actual fragrances, secreted by osmophores, which male euglossine bees actively collect (see Roubik and Knudsen, 2017, for a recent review of this pollination syndrome).

Crüger (1864) and Müller's (1868, 1869) work was no doubt the beginning of research on orchid fragrances and pollination by euglossine bees, research that languished until the 1960s (see references in the beginning of this contribution).

Darwin's editions of his orchid pollination books went on to be reprinted multiple times in the 1800s (see notes in Literature Cited under Darwin, 1877a), as well as in the 20th century, and translated into mutiple languages (Darwin, 1870 [French translation of the first edition], 1877b [German translation of the first edition], 1883 [Italian translation of the second edition], 2007 [Spanish translation of the second edition]). His books were no doubt bestsellers!

The texts that Darwin wrote on Catasetinae are presented in three appendices (which include Darwin, 1862a,b, 1869, and 1877a). The texts were transcribed verbatim with the following exceptions. Darwin (1877a) and his editor wrote binomials in italics, but generic names in roman, which are here all transcribed in italics; the names of journals were written in roman and between single quotes, which are here transcribed in italics without quotes. The transcribed texts include the published illustrations. The footnotes have been renumbered, where notes were added to the original text. The numbering and order of the figures in Appendixes I and III follows that of the original text.

A fourth appendix lists the specimens cited in the illustrations presented herein.

LITERATURE CITED

AMES, O. 1937. Pollination of orchids through pseudocopulation. Botanical Museum Leaflets 5(1): 1–32.

———. 1941. Pollination in *Coryanthes*. American Orchid Society Bulletin 10: 146–150.

———. 1945. The strange case of of *Catasetum barbatum*. American Orchid Society Bulletin 13: 289–294.

ARDITTI, J. 2008. *Micropropagation of Orchids*. 2nd ed. Vol. 1. Blackwell, Malden, Mass.

BATEMAN, J. 1837–1843. *The Orchidaceæ of Mexico and Guatemala*. J. Ridway and Sons, London.

BEATTY, J. 2006. Chance variation: Darwin on orchids. Philosophy of Science 73(5): 629–641.

Bellon, R. 2009. Charles Darwin solves the "riddle of the flower"; or, why don't historians of biology know about the birds and the bees. History of Science 47(4): 373–406.

Bernhardt, P. and R. Edens-Meier. 2014. Darwin's orchids (1862, 1877): Origins, development, and impact. Pages 3–19 in R. Edens-Meier and P. Bernhardt, eds., *Darwin's Orchids*. University of Chicago Press, Chicago.

Bicalho, H. D. and F. de Barros. 1988. On the taxonomy of *Catasetum* subsection *Isoceras*. Lindleyana 3: 87–92.

Brown, R. 1833. On the organs and mode of fecundation in Orchideæ and Asclepiadeæ. Transactions of the Linnean Society of London 16: 685–745, t. 34–36.

Cameron, K. M. 2011. A look at "The Orchid Book" in celebration of Charles Darwin's 200th birthday. Lankesteriana 11(3): 223–231.

Cribb, P. 2003. Morphology [of Orchidaceae]. Pages 13–23 in A. M. Pridgeon, P. J. Cribb, M. W. Chase, and F. N. Rasmussen, eds., *Genera Orchidacearum*. Vol. 1. Oxford University Press, New York.

———. 2009. Distribution [of tribe Cymbidieae]. Page 3 in A. M. Pridgeon, P. J. Cribb, M. W. Chase, and F. N. Rasmussen, eds., *Genera Orchidacearum*. Vol. 5. Oxford University Press, Oxford, U.K.

———. 2010. Orchid collections and illustrations of Consul Friederich C. Lehmann. Lankesteriana 10(2–3): 1–215 ("Biographies" on pages 183–206).

Crüger, H. 1864. A few notes on the fecundation of orchids and their morphology. Journal of the Proceedings of the Linnean Society of London 8: 127–135, pl. 9.

Darwin, C. 1862a. On the three remarkable sexual forms of *Cataseum tridentatum*, an orchid in the possession of the Linnean Society ["Read April 3, 1862"]. Journal of the Proceedings of the Linnean Society 6: 151–157.

———. 1862b. *On the Various Contrivances by which British and Foreign Orchids are Fertilised by Insects and on the Good Effects of Intercrossing [with illustrations]*. John Murray, London.

———. 1869. Notes on the fertilization of orchids. Annals and Magazine of Natural History, ser. 4, no. 21: 141–159.

———. 1870. *De la Fécondation des Orchidées par les Insectes*. C. Reinwald et C^{ie}, Paris.

———. 1877a. *The Various Contrivances by which Orchids are Fertilised by Insects [with illustrations]*. 2nd ed., revised. John Murray, London [reprinted, with the same pagination, by John Murray in 1882, 1885, 1890, 1898, and 1899 (as "Sixth impression, second edition"), and by D. Appleton and Company, New York, in 1877, 1884, 1886, 1892, 1895, and 1898; John Murray published a "Popular edition, *being the seventh impression of the second edition*" in 1904].

———. 1877b. *Die verschiedenen Einrichtungen durch welche Orchideen von Insecten befruchtet werden*. E. Schweizerbart, Stuttgart.

———. 1883. *I diversi apparecchi col mezzo dei quali le orchidee vengono fecondate dagli insetti*. Unione Tipografico, Torino.

———. 2007. *La Fecundación de las Orquídeas* [traducción de Carmen Pastor, introducción de Martí Domínguez]. Editorial Laetoli, Pamplona, Spain.

Dodson, C. H. 1962a. The importance of pollination in the evolution of the orchids of tropical America. American Orchid Society Bulletin 31: 525–534, 641–649, 731–735.

———. 1962b. Pollination and variation in the subtribe Catasetinae. Annals of the Missouri Botanical Garden 49: 35–56.

———. 1975. *Dressleria* and *Clowesia*: A new genus and an old one revived in the Catasetinae (Orchidaceae). Selbyana 1(2): 130–137.

——— and G. P. Frymire. 1961. Natural pollination of orchids. Missouri Botanical Garden Bulletin 49: 133–139.

——— and H. G. Hills. 1966. Gas chromatography of orchid fragances. American Orchid Society Bulletin 35: 720–725.

Domínguez, M. 2007. Introducción. Pages 7–25 in C. Darwin, *La Fecundación de las Orquídeas* [translated by C. Pastor Gradolí]. Editorial Laetoli, Pamplona, Spain.

Dressler, R. L. 1968. Observations on orchids and euglossine bees in Panama and Costa Rica. Revista de Biologia tropical 15: 143–183.

———. 1990. *The Orchids*. Harvard University Press, Cambridge, Mass.

Edens-Meier, R. and P. Bernhardt, eds., 2014. *Darwin's Orchids*. University of Chicago Press, Chicago.

Endersby, J. 2016. Deceived by orchids: sex, science, fiction and Darwin. BJHS 49, 2, 205—229.

Gerlach, G. 2007. The true sexual life of *Catasetum* and *Cycnoches*. Caesiana 28: 57–62.

———. 2013. La pesadilla de Lindley—la biología sexual de *Catasetum* y *Cycnoches*. Lankesteriana 13(1–2): 39–46.

——— and O. A. Pérez-Escobar. 2014. Looking for missing swans. Orchids 84: 434–437.

Gregg, K. B. 1975. The effect of light intensity on sex expression in species of *Cycnoches* and *Catasetum* (Orchidaceae). Selbyana 1(2): 101–113.

———. 1982. Sunlight-enhanced ethylene evolution by developing inflorescences of Catasetum and Cycnoches and its relation to female flower production. Botanical Gazette 143(34): 466–475.

Hills, H. G. 2012. Taxonomic revision of *Dressleria* (Orchidaceae, Catasetinae). Phytoneuron 48: 1–28.

——— and M. H. Weber. 2012. *Dressleria morenoi* (Orchidaceae, Catasetinae): A new species from Colombia. Phytoneuron 103: 1–5.

Hoehne, F. C. 1953. Contribuição para o conhecimiento do género *Catasetum* Rich. e especialmente o hermaphroditismo e trimorphismo das suas flores. Boletim da Agricultura (São Paulo) 33: 133–196.

Hooker, W. J. [March] 1824. *Catasetum tridentatum*. Exotic Flora 2: tab. 90–91.

———. 1836. *Myanthus barbatus* var. *labello albo*. Curtis's Botanical Magazine 63: tab. 3514.

Humboldt, A. von, A. Bonpland, and C. S. Kunth. 1824–1825. *Nova Genera et Species Plantarum*. Vol. 7. Gide Filium, Paris.

Kunth, C. S. 1822. *Synopsis Plantarum*. Vol. 1. F. G. Levrault, Paris.

Li, M.-H., G.-Q. Zhang, Z.-J. Liu, and S.-R. Lan. 2016. Subtribal relationships in Cymbidieae (Epidendroideae, Orchidaceae) reveal a new subtribe, Dipodiinae, based on plastid and nuclear coding DNA. Phytotaxa 246(1): 37–48.

Lindley, J. 1824. *Catasetum claveringii* [as "Claveringi"]. Botanical Register 10: tab. 840.

———. 1832. *Myanthus* and *Monachanthus*. Edwards's Botanical Register 18: sub tab. 1538.

———. 1835a. *Monachanthus viridis*. Edwards's Botanical Register 21: tab. 1752.

———. 1835b. *Myanthus barbatus*. Edwards's Botanical Register 21: tab. 1778.

———. 1837. *Monachanthi et Myanthi cristati*. Edwards's Botanical Register 23: tab. 1947^{A} [text *sub* 1951*].[8]

———. 1843a. *Cycnoches ventricosum* and *Cycnoches Egertonianum*. Edwards's Botanical Register 29: misc. 75–77.

———. 1843b. The vagaries of flowers. The Gardeners' Chronicle no. 44: 775–776.

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[8] This particular plate in *Edwards's Botanical Register* (vol. 23) has a confusing numeration due no doubt to a printing error. Plate 1947 shows *Laelia anceps* Lindl. var. *barkeriana* Lindl.; it is accompanied by the numerically matching and correct text. However, the text for plate "1947^{A}," cited above, was published as "1951*," the asterisk used surely to distinguish it from plate 1951, which shows *Trichocentrum fuscum* Lindl., which, again, is accompanied by the numerically matching and right text. Therefore, authors wishing to cite the plate of "*Monachanthi et Myanthi cristati proles biformis*" (see Fig. 5 herein) have to cite the number "1947^{A}," whereas those wishing to cite the text, as when citing what appears to be the protologue of *Cycnoches cucullata* Lindl., have to cite number "1951*," and not "1951," as currently cited in IPNI and Tropicos.

———. 1846. Cycnoches *egertonianum* var. *viride*. Edwards's Botanical Register 32: tab. 46.

———. 1852. The Golden Swan-Orchid. Paxton's Flower Garden 3: 5–6, tab. 75.

Müller, F. 1868. Ueber Befruchtungserscheinungen bei Orchideen. Botanische Zeitung 26: 629–631.

———. 1869. Ueber Befruchtungserscheinungen (*Eschscholtzia*, *Faramea*, *Epidendrum*, *Scorzonera*). Botanische Zeitung 27: 115: 224–226.

Nemésio, A. and C. Rasmussen. 2011. Nomenclatural issues in the orchid bees (Hymenoptera: Apidae: Euglossina) and an updated catalogue. Zootaxa 3006: 1–42.

Oliveira de, V. M., F. de Barros, and E. R. Forni-Martins. 2013. Chromosome numbers and karyotypes of *Catasetum* species (Orchidaceae). Plant Biosystems 148(3): 499–507.

Pérez-Escobar, O. A. 2016. Molecular phylogenetics, evolution of sexual systems and historical biogeography of Darwin's favourite orchids (Catasetinae) and swan orchids (*Cycnoches* Lindl.). Doctoral diss., Ludwig-Maximilians-Universität München. Munich, Germany.

———, G. Chomicki, F. L. Condamine, J. M. de Vos, A. C. Martins, E. C. Smidt, B. Klitgård, G. Gerlach, and J. Heinrichs. 2017. Multiple geographical origins of environmental sex determination enhanced the diversification of Darwin's favourite orchids. Nature Scientific Reports 7(12878): 1–11.

———, M. Gottschling, W. M. Whitten, G. Salazar, and G. Gerlach. 2016. Sex and the Catasetinae (Darwin's favourite orchids). Molecular Phylogenetics and Evolution 97: 1–10.

Pridgeon, A. M. 2003. Modern species concepts and practical considerations for conservation of Orchidaceae. Pages 43–53 in K. W. Dixon, S. P. Kell, R. L. Barrettt, and P. J. Cribb, eds., *Orchid Conservation*. Natural History Publications (Borneo), Kota Kinabalu, Sabah.

Rolfe, R. A. 1890. On the sexual forms of *Catasetum*, with special reference to the researches of Darwin and others. Journal of the Linnean Society of London, Botany 27: 206–225, tab. VIII.

———. 1894, 1900–1902. [The] History of orchid cultivation. Orchid Review 2 [1894], no. 14: 44–48; no. 15: 75–78; no. 17: 133–136; 8 [1900], no. 95: 331–335; 9 [1901], no. 99: 69–72; no. 101: 132–136; no. 102: 164–168; no. 104: 228–232; no. 107: 330–336; 10 [1902], no. 112: 108–112; no. 118: 298–305.

———. 1895. Notes on the genus *Catasetum*. Orchid Review 3(29): 138–143.

———. 1909. A revision of the genus *Cycnoches*. Bulletin of Miscellaneous Information (Kew) no. 6: 268–277.

Romero, G. A. 1990. Phylogenetic relationships in subtribe Catasetinae (Orchidaceae, Cymbidiieae). Lindleyana 5(3): 160–181.

———. 1992. Non-functional flowers in *Catasetum* orchids (Catasetinae, Orchidaceae). Botanical Journal of the Linnean Society 109: 305–313.

——— and C. A. Nelson. 1986. Sexual dimorphism in *Catasetum* orchids: Forcible pollen emplacement and male flower competition. Science 232(4757): 1538–1540.

Romero-González, G. A. 2009. Distribution [of *Catasetum*]. Page 14 in A. M. Pridgeon, P. J. Cribb, M. W. Chase, and F. N. Rasmussen, eds., *Genera Orchidaceaeum*. Vol. 5. Oxford University Press, New York.

Roubik, D. W. and J. T. Knudsen. 2017. An embellishment that became a mutualism: Inquiries on male bee tibial bouquets and fragrance-producing orchids in Panama and oceanic islands (Apidae: Apinae, Euglossini; Orchidaceae: Epidendroideae). Flora 232: 117–127.

Salazar, G. A., L. I. Cabrera, G. Gerlach, E. Hágsater, and M. W. Chase. 2016. Phylogenetic relationships in *Mormodes* (Orchidaceae, Cymbidieae, Catasetinae) inferred from nuclear and plastid DNA sequences and morphology. Phytotaxa 263(1): 18–30.

Schomburgk, R. H. 1837. On the identity of three supposed genera of Orchideous epiphytes. Transactions of the Linnean Society of London 17(4): 551–552.

Singer, R. B. 2009. Morfología floral y polinización de orquídeas: El segundo libro de Charles Darwin. Acta Biologica Colombiana 14S: 337–350.

Soukup, V. G. 1976. *Catasetum barbatum* Lindl.: Male, female, and hermaphroditic flowers. American Orchid Society Bulletin 45(7): 603–605.

Sprengel, C. K. 1793. *Das entdeckte Geheimnis der Natur im Bau und in der Befruchtung der Blumen*. Friedrich Vieweg, Berlin.

Tamayo Cen, I. 2018. Filogenia, sistemática y biogeografia de *Clowesia* Lindl. (Orchidaceae: Catasetinae). M.S. thesis, Centro de Investigación Científica de Yucatán, Mérida, Yucatán, México.

Van der Cingel, N. A. 2001. *An Atlas of Orchid Pollination*. A. A. Balkema, Rotterdam.

Van der Pijl, L. and C. H. Dodson. 1966. *Orchid Flowers—Their Pollination and Evolution*. University of Miami Press, Coral Gables, Florida.

Vogel, S. 1963. *Duftdrüsen im Dienste der Bestäubung: über Bau und Funktion der Osmophoren*. Akademie der Wissenschaften und der Literatur, Mainz.

———. 1966. Parfümsammelnde Bienen als Bestäuber von Orchidaceen und *Gloxinia*. Oesterreichische Botanische Zeitschrift 113: 302–361.

———. 1990. *The Role of Scent Glands in Pollination: On the Structure and Function of Osmophores*. Smithsonian Institution Libraries and National Science Foundation, Washington, D.C. [Translation; original published in 1963.]

Appendix I

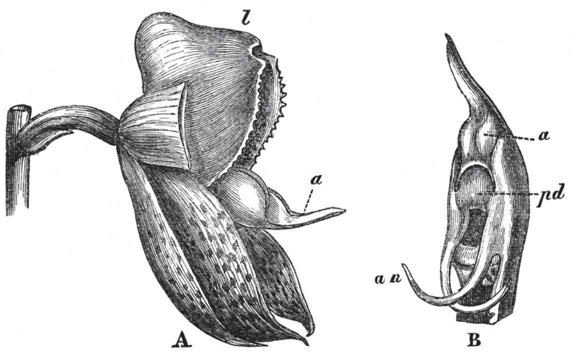
(Transcribed from Darwin, 1862a)

The President and Officers of the Linnean Society having kindly permitted me to examine the remarkable specimen, preserved in spirits in their collection, of an Orchid bearing flowers of two supposed genera, and known sometimes to bear the flowers of a third genus, I have thought that the Society might like to hear a short account and explanation of this singular case. The following details will hereafter appear in a small work on the "Fertilization of Orchids by Insect-agency," which I am preparing for early publication.[1]

Botanists were astonished when Sir E. Schomburgk[2] stated that he had seen three distinct forms, believed to constitute three distinct genera, namely *Catasetum tridentatum*, *Monachanthus viridis*, and *Myanthus barbatus*, all growing on the same plant.[3] Lindley[4] remarked that "such cases shake to the foundation all our ideas of the stability of genera and species." Sir R. Schomburgk affirms that he has seen hundreds of plants of *C. tridentatum* in Essequibo without ever finding one specimen with seeds,[5] but that he was surprised at the gigantic seed-vessels of the *Monachanthus*; and he correctly remarks that here we have traces of sexual difference in Orchideous flowers.

The general appearance of the flower of *Catasetum tridentatum*, in its natural position, is given in the diagram, p. 152 (fig. 1); but the two lower sepals have been cut off. The column is figured separately in an upright position, showing the two curious prolongations of the rostellum, or, as I shall call them, the antennae.

Fig. 1.



Catasetum tridentatum.

a. anther. *an*. antennae.

pd. pedicel of pollinium. *l*. labellum.

A. Side view of flower in its natural position with the properly lower sepals cut off.

B. Front view of column, placed upright.

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A deep chamber, which from its homological relations must be called the stigmatic chamber, lies between the bases of the antennae; and the anther, with its concealed pollen-masses, is seated above. My object is not here to describe in detail the structure of the flower and its curious mechanism. But it must be observed that the ovarium is much shorter, thinner, less deeply furrowed, more solid in the centre, and the bract at its base smaller, than in the two succeeding sexual forms presently to be described. The ovarium is bent so that the bucket-like labellum stands upper-most, instead of forming the lower lip as in most Orchids.

From what I had myself observed previously to reading Sir B. Schomburgk's paper, I was led to examine carefully the female organs of this species, and, I may add, of *C. callosum* and *C. saccatum*. In no case was the stigmatic surface viscid, as it is in all other Orchids (excepting *Cypripedium*), and as is indispensable for securing the pollen-masses on the rupture of the caudicles. I carefully looked to this point in both young and old flowers of *C. tridentatum*. When the surface of the stigmatic chamber and of the stigmatic canal of the above-named three species is scraped off, after having been kept in spirits of wine, it is found to be composed of utriculi (with nuclei of the proper shape), but not nearly so numerous as with ordinary Orchids. The utriculi cohere more together, and are more transparent. I examined for comparison the utriculi of many kinds of Orchids, which had been kept in

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spirits, and in all found they were much less transparent. Again, in all three species of *Catasetum* the ovule-bearing cords are short, and the ovules present a considerably different appearance, in being thinner, more transparent, and

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[1] Here Darwin was announcing the first edition of his book on orchid pollination (Darwin, 1862b) (note of the transcriber).

[2] "*Transactions of the Linnean Society*," vol. xvii. p. 522. Another account, by Dr. Lindley, has appeared in the "[*Edwards's*] *Botanical Register*," vol. xxiii. fol. 1951, of a distinct species of *Myanthus* and *Monachanthus* appearing on the same scape: he alludes also to other cases. Some of the flowers were in an intermediate condition, which is not surprising, seeing that in dioecious plants we sometimes have a partial resumption of the characters of both sexes. Mr. Rogers, of River Hill, informs me that he imported from Demerara a *Myanthus*, but that when it flowered a second time it was metamorphosed into a *Catasetum*. Dr. Carpenter (Comparative Physiology, fourth edition, p. 633) alludes to an analogous case which occurred at Bristol.

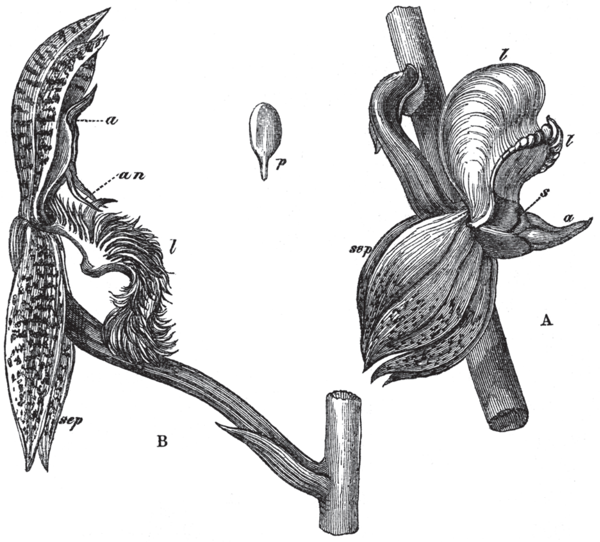
[3] Schomburgk (1837) never stated "that he had seen three forms, believed to constitute three distinct genera, namely, *Catasetum tridentatum*, *Monachanthus viridis*, and *Myanthus barbatus*, all growing on the same plant." He reported "a remarkable Orchideous plant, from appearance a *Monachanthus*, which on one side of the bulb produced a scape with six flowers of *Monachanthus viridis*, and two of *Myanthus barbatus*, while a second scape of the same bulb had twenty-five blossoms of the *Myanthus barbatus*" (note of the transcriber).

[4] *The Vegetable Kingdom*, 1853, p. 178.

[5] Brongniart states (*Bull, de la Soc. Bot. de France*, 1855, tom. ii. p. 20) that M. Neumann, a skilful fertilizer of Orchids, could never succeed in fertilizing *Catasetum*.

less pulpy than in the numerous other Orchids examined for comparison. They were, however, in not so completely an atrophied condition as in the genus *Acropera*. Although they correspond so closely in general appearance and position with true ovules, perhaps I have no strict right so to designate them, as I was unable in any case to make out the opening of the testa and the included nucleus; nor were the ovules ever inverted. From these several facts—namely, the shortness, thinness, and smoothness of the ovarium, the shortness of the ovule-bearing cords, the state of the ovules themselves, the stigmatic surface not being viscid, the empty condition of the utriculi —and from Sir R. Schomburgk never having seen *C. tridentatum* producing seed in its native home, we may confidently look at this species of *Catasetum*, as well as the other two species, as male plants.

Fig. 2.



Myanthus barbatus. *Monachanthus viridis*.

a. anther. *p*. pollen-mass, rudimentary.
an. antennae. *s*. stigmatic cleft.
I. labellum. *sep*. two lower sepals.

A. Side view of *Monachanthus viridis* in its natural position. (The shading in both drawings has been added from M. Reiss's drawing in the "Linnean Transactions.")

B. Side view of *Myanthus barbatus* in its natural position.

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With respect to *Monachanthus viridis* and *Myanthus barbatus*, these two forms are seen, in the specimen sent home by Sir R. Schomburgk, and preserved in spirits in the Society's collection, to be borne on the same spike. They are represented in the diagrams, page 153. The flower of the *Monachanthus*, like that of the *Catasetum*, grows lower side uppermost. The labellum is not nearly so deep, especially on the sides, and its edges are crenated. The other petals and sepals are all reflexed, and are not so much spotted as in the *Catasetum*. The bract at the base of the ovarium is much larger. The whole column, especially the filament at its summit and the spike-like anther, is much shorter; and the front of the rostellum is much less protuberant. The antennae or horn-like prolongations of the rostellum are entirely absent. The pollen-masses are rudimentary: I could find no trace of a viscid disk or of a pedicel; if they exist, they must be quite rudimentary, for there is hardly any space for the imbedment of the disk. The absence of the antenna; in this Orchid, which has no pollen-masses to eject, is an interesting fact, as it accords with the view to which I have been led by an examination of three living species of *Catasetum*, namely, that the function of the antenna is to convey the stimulus of a touch to the medial part of the rostellum, causing the membrane round the disk to rupture, and consequently the liberation and ejection of the pollen-masses. Instead of a large stigmatic chamber, there is a narrow transverse cleft close beneath the small anther. I was able to insert one of the pollen-masses of the male *Catasetum* into this cleft, which, from having been kept in spirits, was lined with coagulated beads of viscid matter and with utriculi. The utriculi, differently from those in *Catasetum*, were charged (after having been kept in spirits) with brown matter. The ovarium is much longer, thicker near the base, and more plainly furrowed than in *Catasetum*; the ovule-bearing cords are also much longer, and the ovules more opake and pulpy, as in all common Orchids. I believe that I saw the opening at the partially inverted end of the testa with a large nucleus projecting; but as the specimens had been kept many years in spirits, and were somewhat altered, I dare not speak positively. From these several facts it is almost certain that *Monachanthus* is a female plant; and Sir R. Schomburgk saw it seeding abundantly. Altogether this flower differs in a most remarkable manner from that of the male *Catasetum tridentatum*, and it is no wonder that they were formerly ranked as distinct genera.

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The pollen-masses offer so curious and good an illustration of a structure in a rudimentary condition, that they are worth description; but first I must briefly describe the perfect pollen-masses of the male *Catasetum*. These consist of a large sheet of cemented or waxy pollen-grains, folded over so as to form a sac with, an open slit along the lower surface; into this slit cellular tissue enters whilst the pollen is in the course of development in the bud. Within the lower and produced end of each pollen-mass a layer of highly elastic tissue, forming the caudicle, is attached, the other end being attached to the strap-shaped pedicel of the pollinium. The exterior grains of pollen are more angular, have thicker walls, and are yellower than the interior grains. In the early bud the two pollen-masses are enveloped in two conjoined membranous sacs, which are soon penetrated by the two produced ends of the pollen-masses, and by their caudicles; and then the ends of the caudicles adhere to the pedicel. Before the flower expands, the membranous sacs including the pollen-masses open, and leave them resting naked on the back of the rostellum.

In *Monachanthus* the two membranous sacs containing the rudimentary pollen-masses never open; they easily separate from each other and from the anther. The tissue of which they are formed is thick and pulpy. Like most rudimentary parts, they vary greatly in size and in form. The included, and therefore useless, pollen-masses are not one-tenth of the bulk of the pollen-masses of the male: they are flask-shaped, with the lower and produced end greatly exaggerated, and almost penetrating through the exterior or membranous sac. The flask is closed, and there is no fissure along the lower surface. The exterior pollen-grains are square and have thicker walls than the interior grains, just as in the proper male pollen; and what is very curious, each cell has its nucleus. Now R. Brown[6] states that, in the early stages of the formation of the pollen-grains in ordinary Orchids, a minute areola or nucleus is often visible; so that the rudimentary pollen-grains of the *Monachanthus* apparently have retained (as is so general with rudiments in the animal kingdom) an embryonic character. Lastly, at the base, within the flask of pollen, there is a little sheet of brown elastic tissue—that is, a vestige of a caudicle—which runs far up the produced end of the flask, but does not (at least in some of the specimens) come to the surface, and could not have been attached to any part of the rostellum. These rudimentary caudicles are, therefore, utterly useless.

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We thus see that every single detail of structure of the male pollen-masses, with some parts exaggerated and some parts slightly modified, is represented by these mere rudiments in the female plant. Such cases are familiar to every observer, but can never be examined without renewed interest.

We now come to the third form, *Myanthus barbatus*, often borne on the same plant with the two preceding forms. Its flower, in external appearance, but not in essential structure, is the most different of all. It generally stands in a reversed position, compared with *Catasetum* and *Monachanthus*—that is, with the labellum downwards. The labellum is fringed, in an extraordinary manner, with long papillæ; it has a quite insignificant medial cavity, at the hinder margin of which a curious curved and flattened horn projects. The other petals and sepals are spotted and elongated, with the two lower sepals alone reflexed. The antennæ are not so long as in the male *C. tridentatum*, and they project symmetrically on each side of the horn-like projection at the base of the labellum, with their tips (which are not roughened with papillæ as in the male flower) almost entering the medial cavity. The stigmatic chamber is of nearly intermediate size between that of the male and female forms; it is lined with utriculi, charged with brown matter. The straight and well-furrowed ovarium is nearly twice as long as in *Monachanthus*, but is not so thick where it joins the flower; the ovules are not so numerous as in the female form, but are opake and pulpy after having been kept in spirits, and resemble them in all respects. I believe, but dare not speak positively as in the case of the *Monachanthus*, that I saw the nucleus projecting from the testa. The pollinia are about a quarter of the size of those of the male *Catasetum*, but have a perfectly well developed disk and pedicel. The pollen-masses were lost in the specimens examined by me; but fortunately M. Reiss has given, in the "*Linnean Transactions*," a drawing of them, showing that they are of due proportional size, and have the proper folded or cleft structure; so that there can hardly be a doubt that they are functionally perfect. As we thus see that both the male and female organs are apparently perfect, *Myanthus barbatus* may be considered as the hermaphrodite form of the same species, of which the *Catasetum* is the male, and the *Monachanthus* the female.

It is not a little singular that the hermaphrodite *Myanthus* should resemble in its whole structure much more closely the male forms of two distinct species (namely *C. saccatum* and, more especially, *C. callosum*) than either its own male or female forms.

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Finally, the genus *Catasetum* is interesting in an unusual degree in several respects. The separation of the sexes is unknown in other Orchids, excepting probably in the allied genus *Cycnoches* and in one other member of the Vandeæ, namely, *Acropera*.[7] In *Catasetum* we have three sexual forms,[8] generally borne on separate plants, but sometimes mingled together; and these three forms are wonderfully different from each other—much more different than, for instance, a peacock is from a peahen. But the appearance of these three forms on the same plant now ceases to be an anomaly, and can no longer be viewed as an unparalleled instance of variability.

Still more interesting is this genus in its mechanism for fertilization. We see a flower patiently waiting, with its antennæ stretched forth in a well-adapted position, ready to give notice whenever an insect puts its head into the cavity of the labellum. The female *Monachanthus*, not having pollinia to eject, is destitute of antennae. In the male and hermaphrodite forms, namely *Catasetum* and *Myanthus*, the pollinia lie doubled up like a spring, ready to be instantaneously shot forth when the antennæ are touched. The disk end is always projected foremost, and is coated with viscid matter, which quickly sets hard and firmly affixes the hinged pedicel to the insect's body. The insect flies from flower to flower, till at last it visits a female or hermaphrodite plant; it then inserts one of the balls of pollen into the stigmatic cavity. When the insect flies away, the elastic caudicle, made weak enough to yield to the viscidity of the stigmatic surface, breaks, and leaves behind the pollen-mass; then the pollen-tubes slowly protrude, penetrate the stigmatic canal, and the act of fertilization is completed. Who would have been bold enough to surmise that the propagation of a species should have depended on so complex, so apparently artificial, and yet so admirable an arrangement?

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[6] *Transactions of the Linnean Society*, vol. xvi. p. 711.

[7] A name given to a group of orchids currently treated as *Gongora* section *Acropera*, the plants of which bear hermaphroditic, protrandic flowers, that is, functioning as pollen donors first, then as pollen acceptors (note of the transcriber).

[8] This assertion by Darwin is incorrect: plants of *Catasetum* can bear male flowers (what up to that point had been known as *Catasetum*) and female flowers (what had been described as *Monacanthus*), but not hermaphroditic flowers (what was then known as *Myanthus*, which Darwin regarded as hermaphroditic flowers). We now know, as stated by Rolfe (1890, 1895), that species of *Myanthus* represent certain species of *Catasetum* subgenus *Catasetum* section *Isoceras* (note of the transcriber).

Appendix II

(Transcribed from Darwin, 1869: 154–155)

Fertilization of *Catasetum*.—It has been highly satisfactory to me that my observations and predictive conclusions in regard to *Catasetum* have been fully confirmed by the late Dr. Crüger, the Director of the Botanic Gardens of Trinidad, in letters to me and in his paper in the *Journal of the Linnean Society* (vol. viii. Bot. 1864, p. 127). He sent me specimens of the bees, belonging to three species of *Euglossa*, which he saw gnawing the inside of the labellum. The pollinia, when ejected, become attached to, and lie flat on, the backs of the bees, on the hairy surface of the thorax. Dr. Crüger has also proved that I was correct in asserting that the sexes of *Catasetum* are separate, for he fertilized female flowers with pollen from the male plants; and Fritz Müller effected the same thing with *Catasetum mentosum* in South Brazil. Nevertheless, from two accounts which I have received, it appears that *Catasetum tridentatum*, though a male plant, occasionally produces seed-capsules;[1] but every botanist knows that this occasionally occurs with the males of other diœcious plants. Fritz Müller has given (*Botanische Zeitung*, Sept. 1868, p. 630) a most interesting account, agreeing with mine, of the state of the minute pollinia in the female plant: the anther never opens, and the pollen-masses are not attached to the viscid disks, so that they cannot be removed by an natural means. The pollen-grains, as so generally occurs with rudimentary organs, are extremely variable in size and shape. Nevertheless the grains of the rudimentary pollen-masses belonging to the female plant, when applied (which can never naturally occur) to the stigmatic surface, emitted their pollen-tubes![2] This appears to me a very curious instance of the slow and gradual manner in which structures are modified; for the female pollen-masses, included within an anther which never opens, are seen still partially to retain their former powers and function.

Mormodes luxatum (p. 265).[3]—I have now examined another species of *Mormodes*, the rare *M. luxatum*, and I find that the chief points of structure, and the action of the different parts, including the sensitiveness of the filament, are the same as in *M. ignea*. The cup of the labellum, however, is much larger, and is not pressed down firmly on the filament on the summit of the column. This cup probably serves to attract insects, and, as in *Catasetum*, is gnawed by them. The flowers are asymmetrical to an extraordinary degree, the right-hand and left-hand sides differing much in shape.

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Cycnoches ventricosum (p. 265).—The plant described in my work as a second species of *Mormodes* proves to be *Cycnoches ventricosum*. I first received from Mr.Veitch some flower-buds, from which the section (fig. XXX) was taken; but subsequently he sent me some perfect flowers. The yellowish-green petals and sepals are reflexed; the thick labellum is singularly shaped, with its upper surface convex, like a shallow basin turned upside down. The thin column is of extraordinary length, and arches like the neck of a swan over the labellum; so that the whole flower presents a very singular appearance. In the section of the flower, given in my work, we see the elastic pedicel of the pollinium bowed, as in *Catasetum* or *Mormodes*; but at the period of growth represented in the figure the pedicel was still united to the rostellum, the future line of separation being shown by a layer of hyaline tissue indistinct towards the upper end of the disk. The disk is of gigantic size, and its lower end is produced into a great fringed curtain, which hangs in front of the stigmatic chamber. The viscid matter of the disk sets hard very quickly, and changes colour. The disk adheres to any object with surprising strength. The anther is very different in shape from that of *Catasetum* or *Mormodes*, and apparently would retain the pollen-masses with greater force. A part of the filament of the anther,[4] lying between two little leaf-like appendages, is sensitive; and when this part is touched, the pollinium is swung upwards, as in *Mormodes*, and with sufficient force, if no object stands in the way, to throw it to the distance of an inch. An insect of large size alights probably on the labellum, for the sake of gnawing the convex surface, or perhaps on the extremity of the arched and depending column, and then, by touching the sensitive point, causes the ejection of the pollen-masses, which are affixed to its body and thus transported to another flower or plant.

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[1] This interpretation of Darwin's is partially incorrect simply because it is not the plant or even the inflorescence that is male or female, it is the flowers. Plants of *Catasetum* and *Cycnoches* and some species of *Mormodes* can bear male flowers one year and female the next, or even during the same flowering season, and inflorescences can have a mixture of male, female, and rarely intermediate, nonfunctional flowers. However, it is true that a plant of "*Catasetum tridentatum* … occasionally [bears female flowers and] produces seed-capsules" (note of the transcriber).

[2] Darwin was correct here: female and also intermediate flowers may bear fertile pollen, but the morphology of the flowers and the lack of a functional pollinarium (primarily the absence of a viscidium) keep them from placing it on a pollinator (note of the transcriber).

[3] Darwin cited pages and figures from the first edition of his book (Darwin, 1862b; note of the transcriber).

[4] The function(s) of the filament of the anther, present in all other genera of core Catasetinae (see Romero, 1990, fig. 3; in *Catasetum* it is fused to the clinandrium; see Table 3 above) is not entirely clear. It could trigger the discharge of the pollinarium in *Cycnoches*, but it is not accessible to the pollinator; it may be stimulated via a slight rotation of the anther (which the pollinator does move while collecting fragrances from the labellum; Romero-González et al., in prep.) (note of the transcriber).

Appendix III

(Transcribed from Darwin, 1877a)

CHAPTER VII.

VANDEÆ... CATASETIDÆ

Catasetidæ, the most remarkable of all Orchids—The mechanism by which the pollinia of *Catasetum* are ejected to a distance and are transported by insects—Sensitiveness of the horns of the rostellum—Extraordinary difference in the male, female, and hermaphrodite forms of *Catasetum tridentatum*—*Mormodes ignea*, curious structure of the flowers; ejection of the pollinia—*Mormodes luxata*—*Cycnoches ventricosum*, manner of fertilisation.

I have reserved for separate description one sub-family of the Vandeae, namely, the Catasetidæ, which must, I think, be considered as the most remarkable of all Orchids.

I will begin with *Catasetum*. A brief inspection of the flower shows that here, as with most other Orchids, some mechanical aid is requisite to remove the pollen-masses from their cells, and to carry them to the stigmatic surface. We shall, moreover, presently see that *Catasetum* is exclusively a male form; so that the pollen-masses must be transported to the female plant, in order that seed should be produced. The pollinium is furnished with a viscid disc of huge size; but this, instead of being placed in a position likely to touch and adhere to an insect visiting the flower, is turned inwards and lies close to the upper and back surface of a chamber, which must be called the stigmatic chamber, though functionless as a stigma. There is nothing in this chamber to attract insects; and even if they did enter it, the viscid surface of the disc could not possibly come into contact with them.

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How then does Nature act? She has endowed these plants with, what must be called for want of a better term, sensitiveness, and with the remarkable power of forcibly ejecting their pollinia even to a considerable distance. Hence, when certain definite points of the flower are touched by an insect, the pollinia are shot forth like an arrow, not barbed however, but having a blunt and excessively adhesive point. The insect, disturbed by so sharp a blow, or after having eaten its fill, flies sooner or later away to a female plant, and, whilst standing in the same position as before, the pollen-bearing end of the arrow is inserted into the stigmatic cavity, and a mass of pollen is left on its viscid surface. Thus, and thus alone, can the five species of *Catasetum* which I have examined be fertilised.

In many Orchideæ, as in *Listera*, *Spiranthes*, and *Orchis*, the surface of the rostellum is so far sensitive, that, when touched or when exposed to the vapour of chloroform, it ruptures in certain defined lines. So it is in the tribe of the Catasetidæ, but with this remarkable difference, that in *Catasetum* the rostellum is prolonged into two curved tapering horns, or, as I shall call them, antennæ, which stand over the labellum where insects alight. If these are touched even very lightly, they convey some stimulus to the membrane which surrounds and connects the disc of the pollinium with the adjoining surface, causing it instantly to rupture; and as soon as this happens the disc is suddenly set free. We have also seen in several Vandeæ that the pedicels of the pollinia are fastened flat down in a state of tension, and are highly elastic, so that, when freed, they immediately spring up, apparently for the sake of detaching the pollen-masses from the anther-cells. In the genus *Catasetum*, on the

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other hand, the pedicels are fastened down in a curved position; and when freed by the rupture of the attached edges of the disc, they straighten themselves with such force, that not only do they drag the balls of pollen together with the anther-cells from their places of attachment, but the whole pollinium is jerked forward, over and beyond the tips of the so-called antennæ, to the distance sometimes of two or three feet. Thus, as throughout nature, pre-existing structures and capa- cities are utilised for new purposes.

Catasetum saccatum[1]—I will first describe the male forms, belonging to five species, which are included under the generic name of *Catasetum*. The general appearance of the present species is represented in the following woodcut, fig. 28. A side view of the flower, with all the petals and sepals excepting the labellum cut off, is shown by B; and A gives a front view of the column. The upper sepal and two upper petals surround and protect the column; the two lower sepals project out at right angles. The flower stands more or less inclined to either side, but with the labellum downwards, as represented in the drawing. The dull coppery and orange-spotted tints,—the yawning cavity in the great fringed labellum,—the one antenna projecting with the other hanging down—give to these flowers a strange, lurid, and almost reptilian appearance.

In front of the column, in the middle, the deep stigmatic chamber (fig. 28, A, *s*), may be seen; but this is best shown in the section (fig. 29, C, *s*), in which all

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the parts are a little separated from each other, in order that the mechanism may be intelligible. In the middle of the roof of the stigmatic chamber, far back (*d*, in A, fig. 28), the upturned anterior edge of the viscid disc can just be seen. The upper membranous surface of the disc, before it is ruptured, is continuous with the fringed bases of the two antennæ between which it lies. The rostellum projects over the disc and stigmatic chamber (see section C, fig. 29), and is prolonged on each side so as to form the two antennæ;

[1] I am much indebted to Mr. James Veitch of Chelsea for the first specimen which I saw of this Orchid; subsequently, Mr. S. Rucker, so well known for his magnificent collection of Orchids, generously sent me two fine spikes, and has aided me in the kindest manner with other specimens.

the middle part is covered by the ribbon-like pedicel (*ped.*) of the pollinium. The lower end of the pedicel is attached to the disc, and the upper end to the two pollen-masses (*p*) within the anther-cell. The pedicel in its natural position is held much bowed round the protuberant rostellum; when freed it forcibly straightens itself, and at the same time its lateral edges curl inwards. At an early period of growth, it is continuous with the rostellum, but subsequently becomes separated from it by the solution of a layer of cells.

The pollinium when set free and after it has straightened itself, is represented at D, fig. 29. Its under surface, which lies in contact with the rostellum, is shown at E, with the lateral edges of the pedicel now curled inwards. In this latter view, the clefts in the under sides of the two pollen-masses are shown. Within these clefts, near their bases, a layer of strong extensible tissue is attached, forming the caudicles, by which the pollen-masses are united to the pedicel. The lower end of the pedicel is joined to the disc by a flexible hinge, which occurs in no other genus, so that the pedicel can play backwards and forwards, as far as the upturned end (fig. D) of the disc permits. The disc is large and thick; it consists of a strong upper membrane, to which the pedicel is united, with an inferior cushion of great thickness, of pulpy, flocculent, and viscid matter. The posterior margin is much the most viscid part, and this necessarily first strikes any object when the pollinium is ejected. The viscid matter soon sets hard. The whole surface of the disc is kept damp before ejection, by resting close against the roof of the stigmatic chamber; but in the section (fig. C) it is represented, like the other parts, a little separated from the roof.

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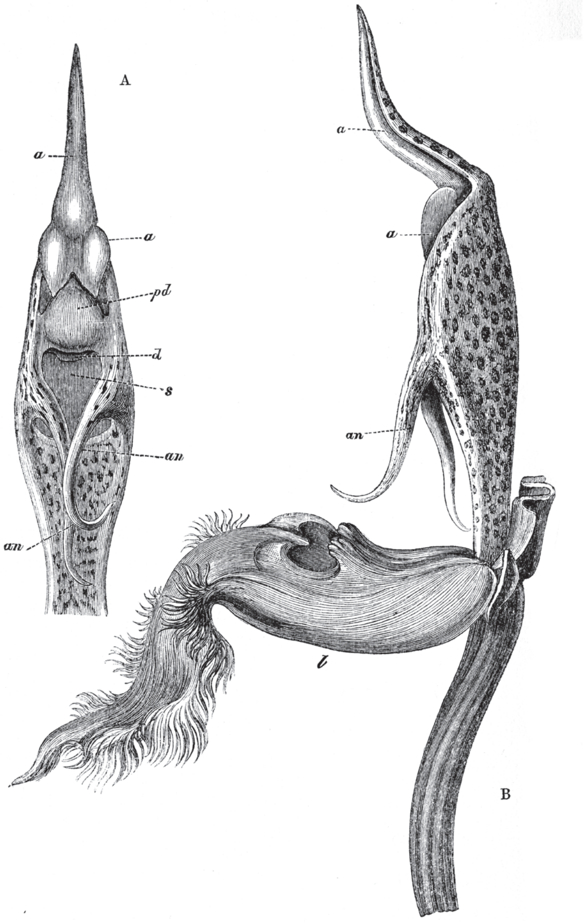

FIGURE 28. *Catasetum saccatum* Lindl.

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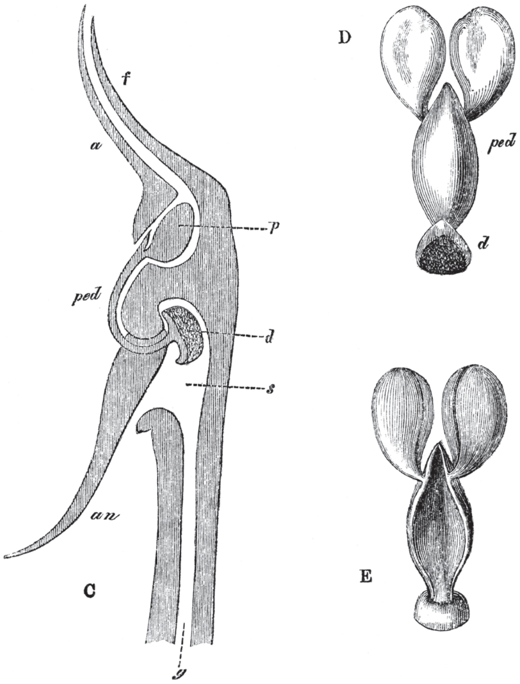

FIGURE 29. *Catasetum saccatum* Lindl.

a. anther. *an*. antenna; of the rostellum. *d*. disc of pollinium. *f*. filament of anther. *g*. germen or ovarium. *l*. labellum. *p*. pollen-masses. *pd*. or *ped*. pedicel of pollinium. *s*. stigmatic chamber. A. Front view of column. B. Side view of flower, with all the sepals and petals removed except the labellum. C. Diagrammatic section through the column, with all the parts a little separated. D. Pollinium, upper surface. E. Pollinium, lower surface, which before removal lies in close contact with the rostellum.

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The connective membrane of the anther (*a* in all the figures) is produced into a spike, which adheres loosely to the pointed end of the column; this pointed end (*f*, fig. C) is homologically the filament of the anther.

The anther has this peculiar shape apparently for the sake of leverage, so that it may be easily torn off by a pull at its lower end, when the pollinium is jerked out by the elasticity of the pedicel.

The labellum stands at right angles to the column, or hangs a little downwards; its lateral and basal lobes are turned under the middle portion, so that an insect can stand only in front of the column. In the middle of the labellum there is a deep cavity, bordered by crests. This cavity does not secrete nectar, but its walls are thick and fleshy, with a slightly sweet nutritious taste; and it will presently be shown that they are gnawed by insects. The extremity of the left-hand antenna stands immediately over the cavity, and would infallibly be touched by an insect visiting this part of the labellum for any purpose.

The antennæ are the most singular organs of the flower, and occur in no other genus. They form rigid, curved horns, tapering to a point. They consist of a narrow ribbon of membrane, with the edges curled inwards so as to touch; each horn therefore is tubular,

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with a slit down one side, like an adder's fang. They are composed of numerous, much elongated, generally hexagonal cells, pointed at both ends; and these cells (like those in most of the other tissues of the flower) have nuclei with nucleoli. The antennæ are prolongations of the sides of the anterior face of the rostellum. As the viscid disc is continuous with a little fringe of membrane on each side, and as this fringe is continuous with the bases of the antennæ, these latter organs are put into direct connection with the disc. The pedicel of the pollinium passes, as already stated, between the bases of the two antennas. The antennæ are not free for their whole length; but their exterior edges are firmly united to and blend for a considerable space with the margins of the stigmatic chamber.

In all the flowers which I examined, taken from three plants, the two antennæ which are alike in structure occupied the same relative position. The extreme part of the left-hand antenna bends upwards (see B, fig. 28, in which the position is shown plainer than in A), and at the same time a little inwards, so that its tip is medial and guards the entrance into the cavity of the labellum. The right-hand antenna hangs down, with its tip turned a little outwards; and as we shall immediately see, is almost paralysed, so as to be functionless.

Now for the action of the parts. When the left-hand antenna of this species (or either of the antennæ in three of the following species) is touched, the edges of the upper membrane of the disc, which are continuously united with the surrounding surface, instantly rupture, and the disc is set free. The highly elastic pedicel then instantly flirts the heavy disc out of the stigmatic chamber with such force, that the whole pollinium is ejected, bringing away with it the two

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balls of pollen, and tearing the loosely attached spike-like anther from the top of the column. The pollinium is always ejected with its viscid disc foremost. I imitated the action with a minute strip of whalebone, slightly weighted at one end to represent the disc; this was then bent half round a cylindrical object, the upper end being at the same time gently held by the smooth head of a pin, to represent the retarding action of the anther, the lower end was then suddenly set free, and the whalebone was pitched forward, like the pollinium of the *Catasetum*, with the weighted end foremost.

That the disc is first jerked out of the stigmatic chamber, I ascertained by pressing the middle of the pedicel; and when I touched the antenna the disc instantly sprung forth, but, owing to the pressure on the pedicel, the pollinium was not dragged out of the anther-cell. Besides the spring from the straightening of the pedicel, elasticity in a transverse direction comes into play: if a quill be split lengthways, and the half be forced longitudinally on a too thick pencil, immediately the pressure is removed the quill jumps off; and an analogous action takes place with the pedicel of the pollinium, owing to the sudden inward curling of its edges, when set free. These combined forces suffice to eject the pollinium with considerable force to the distance of two or three feet. Several persons have told me that, when touching the flowers of this genus in their hothouses, the pollinia have struck their faces. I touched the antennæ of *C. callosum* whilst holding the flower at about a yard's distance from a window, and the pollinium hit the pane of glass, and stuck by its adhesive disc, to the smooth vertical surface.

The following observations on the nature of the

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excitement which causes the disc to separate from the surrounding parts, include some made on the following species. Several flowers were sent me by post and by the railroad, and must have been much jarred, but they had not exploded. I let two flowers fall from a height of two or three inches on the table, but the pollinia were not ejected. I cut off with a crash with a pair of scissors the thick labellum and ovarium close beneath the flower; but this violence produced no effect. Nor did deep pricks in various parts of the column, even within the stigmatic chamber. A blow, sufficiently hard to knock off the anther, causes the ejection of the pollinium, as occurred to me once by accident. Twice I pressed rather hard on the pedicel, and consequently on the underlying rostellum, without any effect. Whilst pressing on the pedicel, I gently removed the anther, and then the pollen-bearing end of the pollinium sprang up from its elasticity, and this movement caused the disc to separate. M. Meniere,[2] however, states that the anther-case sometimes detaches itself, or can be gently detached, without the disc separating; and that then the upper end of the pedicel, bearing the pollen-masses, swings downwards in front of the stigmatic chamber.

After trials made on fifteen flowers of three species, I find that no moderate degree of violence on any part of the flower, except on the antennæ, produces any effect. But when the left-hand antenna of *C. saccatum*, or either antenna of the three following species, is touched, the pollinium is instantly ejected. The extreme tip and the whole length of the antennæ are sensitive. In one specimen of *C. tridentatum* a touch from a bristle sufficed; in five specimens of

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[2] *Bull. de la Soc. Bot. de France*, tom. i. 1854, p. 367.

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C. saccatum a gentle touch from a fine needle was necessary; but in four other specimens a slight blow was requisite. In *C. tridentatum* a stream of air and of cold water from a small pipe did not suffice; nor in any case did a touch from a human hair; so that the antennæ are less sensitive than the rostellum of *Listera*. Such extreme sensitiveness would indeed have been useless to the plant, for, as is now known, the flowers are visited by powerful insects.

That the disc does not separate owing to the simple mechanical movement of the antennæ is certain; for they adhere firmly for a considerable space to the sides of the stigmatic chamber, and are thus immovably fixed near their bases. If a vibration is conveyed along them, it must be of some special nature, for ordinary jars of manifold greater strength do not excite the act of rupture. The flowers in some cases, when they first arrived, were not sensitive, but after the cut-off spikes had stood for a day or two in water they became sensitive. Whether this was owing to fuller maturity or to the absorption of water, I know not. Two flowers of *C. callosum*, which were completely torpid, were immersed in tepid water for an hour; and then the antennæ became highly sensitive; this indicates either that the cellular tissue of the antennæ must be turgid in order to receive and convey the effects of a touch, or, as is more probable, heat increases their sensitiveness. Two other flowers placed in hot water, but not so hot as to scald my fingers, spontaneously ejected their pollinia. A plant of *C. tridentatum* had been kept for some days in a rather cool house, and the antennæ were consequently in a torpid condition; a flower was cut off and placed in water at a temperature of 100˚F. (37.7˚C), and no effect was immediately produced; but when it was

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looked at after an interval of 1 h 30 m the pollinium was found ejected. Another flower was placed in water at 90˚F. (32.2˚C), and after 25 m the pollinium was found ejected: two other flowers left for 20 m in water at 87˚F. (30.5˚C.) did not explode, though they were afterwards proved to be sensitive to a slight touch. Lastly, four flowers were placed in water at 83˚F. (28.3˚C.); two of these did not eject their pollinia in 45 m, and were then found to be sensitive; whereas the other two, when looked at after 1 hour 15 m, had spontaneously ejected their pollinia. These cases show that immersion in water raised to a temperature only a little higher than that to which the plant had been exposed, causes the membrane by which the discs are attached to rupture. A thin stream of almost boiling water was allowed to fall through a fine pipe on the antennæ of some flowers on the above plant; these were softened and killed, but the pollinia were not ejected. Nor did sulphuric acid, dropped on the tips of the antennæ, cause any action; though their upper parts which had not been injured by the acid were afterwards found to be sensitive to a touch. In these two latter cases, I presume that the shock was so sudden and violent that the tissue was instantly killed. Considering the above several facts, we may infer that it must be some molecular change which is conveyed along the antennæ, causing the membrane round the discs to rupture. In *C. tridentatum* the antennæ were one inch and a tenth in length, and a gentle touch from a bristle on the extreme tip was conveyed, as far as I could perceive, instantaneously throughout this length. I measured several cells in the tissue composing the antennæ of this species, and on a rough average it appeared that the stimulus must travel through no less than from seventy to eighty cells.

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We may, at least, safely conclude that the antennæ, which are characteristic of the genus *Catasetum*, are specially adapted to receive and convey the effects of a touch to the disc of the pollinium. This causes the membrane to rupture, and the pollinium is then ejected by the elasticity of its pedicel. If we required further proof, nature affords it in the case of the so-called genus *Monachanthus*, which, as we shall presently see, is the female of *Catasetum tridentatum*, and it does not possess pollinia which can be ejected, and the antennæ are here entirely absent.

I have stated that in *C. saccatum* the right-hand antenna invariably hangs down, with the tip turned slightly outwards, and that it is almost paralysed. I ground my belief on five trials, in which I violently hit, bent, and pricked this antenna, and this produced no effect; but when immediately afterwards the left-hand antenna was touched with much less force, the pollinium was shot forth. In a sixth case a forcible blow on the right-hand antenna did cause the act of ejection, so that it is not completely paralysed. As this antenna does not guard the labellum, which in all Orchids is the part attractive, that is to insects, its sensitiveness would be useless.

From the large size of the flower, more especially of the viscid disc, and from its wonderful power of adhesion, I formerly inferred that the flowers were visited by large insects, and this is now known to be the case. The viscid matter sticks so firmly after it, has set hard, and the pedicel is so strong (though very thin and only one-twentieth of an inch in breadth at the hinge), that to my surprise a pollinium attached to an object supported for a few seconds a weight of 1262 grains, or nearly three ounces; and it supported for a considerable time a slightly less weight. When

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the pollinium is shot forth, the large spike-like anther is generally carried with it. If the disc strikes a flat surface like a table, the momentum from the weight of the anther often carries the pollen-bearing end beyond the disc, and the pollinium is thus affixed in a wrong direction for the fertilisation of another flower, supposing it to have been attached to an insect's body. The flight of the pollinium is often rather crooked.[3] But it must not be forgotten that

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[3] M. Baillon (*Bull. de la Soc. Bot. de France*, tom. i. 1854, p. 285) states that *Catasetum luridum* ejects its pollinia always in a straight line, and in such a direction that it sticks fast to the bottom of the concavity of the labellum; and he imagines that in this position it fertilises the flower in a manner not clearly explained. In a subsequent paper in the same volume (p. 367) M. Ménière justly disputes M. Baillon's conclusion. He remarks that the anther-case is easily detached, and sometimes naturally detaches itself; the pollinia then swing downwards by the elasticity of the pedicel, the viscid disc still remaining attached to the roof of the stigmatic chamber. M. Ménière hints that, by the subsequent and progressive retraction of the pedicel, the pollen masses might be carried into the stigmatic chamber. This is not possible in the three species which I have examined, and would be useless. But M. Ménière himself then goes on to show how important insects are for the fertilisation of Orchids; and apparently infers that their agency comes into play with *Catasetum*, and that this plant does not fertilise itself. Both M. Baillon and M. Ménière correctly describe the curved position in which the elastic pedicel lies before it is set free. Neither of these botanists seems to be aware that the species of *Catasetum* (at least the five which I have examined) are exclusively male plants.

under nature the ejection is caused by the antennæ being touched by a large insect standing on the labellum, which will thus have its head and thorax placed near to the anther. A rounded object thus held is always accurately struck in the middle, and when removed with the pollinium adhering to it, the weight of the anther depresses the hinge of the pollinium; and in this position the anther-case readily drops off, leaving the balls of pollen free, in a proper position for fertilising the female flower. The utility

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of so forcible an ejection no doubt is to drive the soft and viscid cushion of the disc against the hairy thorax of the large hymenopterous insects which frequent the flowers. When once attached to an insect, assuredly no force which the insect could exert would remove the disc and pedicel; but the caudicles are ruptured without much difficulty, and thus the balls of pollen might readily be left on the adhesive stigma of the female flower.

Catasetum callosum.—The flowers of this species[4] are smaller than those of the last, but resemble them in most respects. The edge of the labellum is covered with papillae; the cavity in the middle is small, and behind it there is an elongated anvil-like projection,—facts which I mention from the resemblance in some of these points between the labellum of this species and that of *Myanthus barbatus*, the hermaphrodite form of *Catasetum tridentatum*, presently to be described. When either antenna is touched, the pollinium is ejected with much force. The yellow-coloured pedicel is much bowed, and is joined by a hinge to the extremely viscid disc. The two antennæ stand symmetrically on each side of the anvil-like projection, with their tips lying within the small cavity of the labellum. The walls of this cavity have a pleasant nutritious taste. The antennæ are remarkable, from their whole surface being roughened with papillae. The plant is a male, and the female form is at present unknown.

Catasetum tabulare.—This species belongs to the same type as *C. saccatum*, but differs greatly from it in appearance. The central portion of the labellum consists of a narrow, elongated, table-like projection, of

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an almost white colour and formed of a thick mass of succulent tissue, having a sweetish taste. Towards the base of the labellum there is a large cavity, which externally resembles the nectary of an ordinary flower, but apparently never contains nectar. The pointed extremity of the left-hand antenna lies within this cavity, and would infallibly be touched by an insect gnawing the bilobed and basal end of the medial projection of the labellum. The right-hand antenna is turned inwards, with the extreme part bent at right angles and pressed against the column; therefore I do not doubt that it is paralysed as in *C. saccatum*; but the flowers examined by me had lost almost all their sensitiveness.

Catasetum planiceps (*?*).—This species does not differ much from the following one, so I will describe it briefly. The green and spotted labellum stands on the upper side of the flower; it is jar-shaped, with a small orifice. The two elongated and roughened antennæ lie coiled up some little way apart and parallel to one another, within the labellum. They are both sensitive to a touch.

Catasetum tridentatum.—The general appearance of this species, which is very different from that of *C. saccatum*, *callosum* and *tabulare*, is represented in fig. 30, with a sepal on each side cut off.

The flower stands with the labellum uppermost, that is, in a reversed position compared with most Orchids. The labellum is helmet-shaped, its distal portion being reduced to three small points. It cannot hold nectar from its position; but the walls are thick, and have, as in the other species, a pleasant nutritious taste. The stigmatic chamber, though functionless as a stigma, is of large size. The summit of the column, and the spike-like anther, are not so much elongated as in

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C. saccatum. In other respects there is no important difference. The antennæ are of greater length; their tips for about one-twentieth of their length are roughened by cells produced into papillæ.

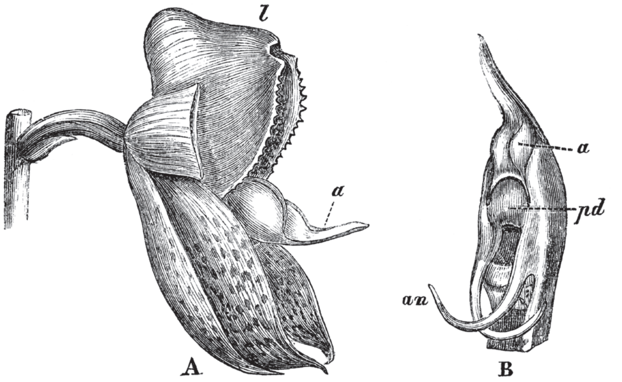

FIGURE 30. *Catasetum tridentatum*. *a*. anther. *pd*. pedicel of pollinium. *an*. antennæ. *l*. labellum. A. Side view of flower in its natural position, with two of the sepals cut off. B. Front view of column, in position reverse of fig. A.

The pedicel of the pollinium is articulated as before by a hinge to the disc; it can move freely only in one direction owing to one end of the disc being upturned, and this restricted power of movement apparently comes into play when the pollinium is carried by an insect to the female flower. The disc is, as in the other species, of large size, and the end which when ejected first strikes any object, is much more viscid than the rest of the surface. This latter surface is drenched with a milky fluid, which, when exposed to the air, rapidly turns brown, and sets into a cheesy consistence. The upper surface of the disc consists of strong mem-

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brane formed of polygonal cells, resting on and adhering to a thick cushion, formed of irregular rounded balls of brown matter, separated from each other and embedded in a transparent, structureless, highly elastic substance. This cushion towards the posterior end of the disc graduates

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[4] A fine spike of flowers of this species was kindly sent me by Mr. Rucker, and was named for me by Dr. Lindley.

into viscid matter, which when consolidated is brown, translucent, and homogeneous. Altogether the disc of *Catasetum* presents a much more complex structure than in the other Vandeæ.

I need not further describe the present species, except as to the position of the antennæ. They occupied exactly the same position in all the many flowers which were examined. Both lie curled within the helmet-like labellum; the left-hand one stands higher up, with its inwardly bowed extremity in the middle; the right-hand antenna lies lower down and crosses the whole base of the labellum, with the tip just projecting beyond the left margin of the base of the column. Both are sensitive, but apparently the one which is coiled within the middle of the labellum is the more sensitive of the two. From the position of the petals and sepals, an insect visiting the flower would almost certainly alight on the crest of the labellum; and it could hardly gnaw any part of the great cavity without touching one of the two antennæ, for the left-hand one guards the upper part, and the right-hand one the lower part. When either of these is touched the pollinium is ejected and the disc will strike the head or thorax of the insect.

The position of the antennæ in this *Catasetum* may be compared with that of a man with his left arm raised and bent so that his hand stands in front of his chest, and with his right arm crossing his body lower down so that the fingers project just beyond his left side. In *Catasetum callosum* both arms are held lower down

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and are extended symmetrically. In *C. saccatum* the left arm is bowed and held in front, as in *C. tridentatum*, but rather lower down; whilst the right arm hangs downwards paralysed, with the hand turned a little outwards. In every case notice will be given in an admirable manner, when an insect visits the labellum, and the time has arrived for the ejection of the pollinium, so that it may be transported to the female plant.

Catasetum tridentatum is interesting under another point of view. Botanists were astonished when Sir R. Schomburgk[5,6] stated that he had seen three forms, believed to constitute three distinct genera, namely, *Catasetum tridentatum*, *Monachanthus viridis*, and *Myanthus barbatus*, all growing on the same plant. Lindley remarked[7] that "such cases shake to the foundation all our ideas of the stability of genera and species." Sir R. Schomburgk affirms that he has seen hundreds of plants of *C. tridentatum* in Essequibo without ever finding one specimen with seeds;[8] whereas

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he was surprised at the gigantic seed-vessels of the *Monachanthus*; and he correctly remarks that "here we have traces of sexual difference in Orchideous flowers." Dr. Crüger also informs me that in Trinidad he never saw capsules naturally produced by the flowers of this *Catasetum*;[9] nor when they were fertilised by him with their own pollen, as was done repeatedly. On the other hand, when he fertilised the flowers of the *Monachanthus viridis* with pollen from the *Catasetum*, the operation never failed. The *Monachanthus* also commonly produces fruit in a state of nature.

From what I had myself observed, I was led to examine carefully the female organs of *C. tridentatum*, *callosum*, and *saccatum*. In no case was the stigmatic surface viscid, as it is in all other Orchids (except as we shall hereafter see in *Cypripedium*), and as is indispensable for securing the pollen-masses by the rupture of the caudicles. I carefully looked to this point both in young and old flowers of *C. tridentatum*. When the surface of the stigmatic chamber and of the stigmatic canal of the above-named three species is scraped off, after having been kept in spirits, it is found to be composed of utriculi (including nuclei of the proper shape), but not nearly so numerous as with ordinary Orchids. The utriculi cohere more together

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and are more transparent; I examined for comparison those of many kinds of Orchids which had been kept in spirits, and in all found them much less transparent. In *C. tridentatum*, the ovarium is shorter, much less deeply furrowed, narrower at the base, and internally more solid than in *Monachanthus*. Again, in all three species of *Catasetum* the ovule-bearing cords are short; and the ovules present a considerably different appearance, in being thinner, more transparent, and less pulpy than in the numerous other Orchids examined for the sake of comparison. Perhaps these bodies hardly ought to be called ovules, although they correspond closely in general appearance and position with true ovules, for I was unable in any case to make out the opening of the testa and the included nucleus; nor were the ovules ever inverted.

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[5] *Transactions of the Linnean Soc*. vol. xvii. p. 522. Another account by Dr. Lindley appeared in the [*Edwards's*] *Botanical Register*, fol. 1951, of a distinct species of *Myanthus* and *Monachanthus* appearing on the same scape: he alludes also to other cases. Some of the flowers in these cases were in an intermediate condition, which is not surprising, seeing that in diœcious plants we sometimes have a partial resumption of the characters of both sexes. Mr. Rodgers of River-hill informs me that he imported from Demerara a *Myanthus*, and that when it flowered a second time it was metamorphosed into a *Catasetum*. Dr. Carpenter (*Comparative Physiology*, 4th edit. p. 633) alluded to an analogous case which occurred at Bristol. Lastly Dean Herbert informed me many years ago that *Catasetum luridum* flowered and kept true for nine years in the Botanic Garden at York; it then threw up a scape of a *Myanthus*, which as we shall presently see is an hermaphrodite, intermediate in form between the male and female. Duchartre has given a full historical account of the appearance of these forms on the same plant, in *Bull. de la Soc. Bot. de France*, vol. ix. 1862, p. 113.

[6] See note 3 of Appendix 1 (note of the transcriber).

[7] *The Vegetable Kingdom*, 1853, p. 178.

[8] Brongniart states (*Bull. de la Soc. Bot. de France*, tom. ii. 1855, p. 20) that M. Neumann, a skilful fertiliser of Orchids, could never succeed in fertilising *Catasetum*.

[9] Dr. Hance writes to me that he has in his collection a plant of *Catasetum tridentatum* from the West Indies bearing a fine capsule; but it does not appear to have been ascertained that this particular flower was that of *Catasetum*, and there is no great improbability in a single flower of *Monachanthus* being produced by a plant of *Catasetum*, as well as a whole scape, which we know has often occurred. J. G. Beer says (quoted by Irmisch, *Beiträge zu Biologie der Orchideen*, 1853, p. 22) that during three years he tried in vain to fertilise *Catasetum*, but on one occasion, by placing only the viscid disc of a pollinium within the stigma, a ripe fruit was produced; but it may be asked, Did the seeds contain embryos?

From these several facts, namely,—the shortness, smoothness, and narrowness of the ovarium, the shortness of the ovule-bearing cords, the state of the ovules themselves, the stigmatic surface not being viscid, the transparent condition of the utriculi,—and from neither Sir R. Schomburgk nor Dr. Crüger having ever seen *C. tridentatum* producing seed in its native home, or when artificially fertilised, we may confidently look at this species, as well as the other species of *Catasetum*, as male plants.

With respect to *Monachanthus viridis*, and *Myanthus barbatus*, the President of the Linnean Society has kindly permitted me to examine the spike bearing these two so-called genera, preserved in spirits, which was sent home by Sir R. Schomburgk. The flower of the *Monachanthus* (A, fig. 31) resembles pretty closely in external appearance that of *Catasetum tridentatum* (fig. 30). The labellum, which holds the same relative position to the other parts, is not nearly so deep

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especially on the sides, and its edge is crenated. The other petals and sepals are all reflexed, and are not so much spotted as in the *Catasetum*. The bract at the base of the ovarium is much larger. The whole column, especially the filament and the spike-like anther, are much shorter; and the rostellum is much less protuberant. The antennæ are entirely absent, and the pollen-masses are rudimentary. These are interesting

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facts, from corroborating the view taken of the function of the antennæ; for as there are no pollinia to eject, an organ adapted to convey the stimulus from the touch of an insect to the rostellum would be useless. I could find no trace of a viscid disc or pedicel, and no doubt they had been lost; for Dr. Crüger says[10] that "the anther of the female flower drops off immediately after the opening of the same, i.e. before the flower has reached perfection as regards colour, size, and smell. The disc does not cohere, or very slightly, to the pollen-masses, but drops off about the same time, with the anther;" leaving behind them the rudimentary pollen-masses.

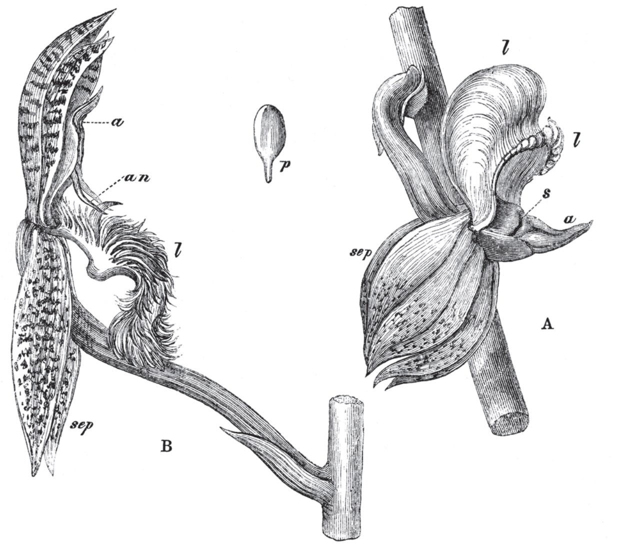

FIGURE 31. *Myanthus barbatus*.

a. anther. *an*. antennæ. *l*. labellum. *p*. pollen-mass, rudimentary. *s*. stigmatic cleft. *sep*. two lower sepals. A. *Monachanthus viridis*. A. Side view of *Monachanthus viridis* in its natural position. (The shading in both drawings has been added from Mr. Reiss' drawing in the Linnean Transactions.) B. Side view of *Myanthus barbatus* in its natural position.

Instead of a large stigmatic chamber, there is a narrow transverse cleft close beneath the small anther. I was able to insert one of the pollen-masses of the male *Catasetum* into this cleft, which from having been kept in spirits was lined with coagulated beads of viscid matter, and with utriculi. The utriculi, differently from those in *Catasetum*, were charged (after having been kept in spirits) with brown matter. The ovarium is longer, thicker near the base, and more plainly furrowed than in *Catasetum*; the ovule-bearing cords are also much longer, and the ovules more opaque and pulpy, as in all common Orchids. I believe that I saw the opening at the partially inverted end of the testa, with a large projecting nucleus; but as the specimens had been kept many years in spirits and were somewhat altered, I dare not speak positively. From these facts alone it is almost certain that *Monachanthus* is a female plant; and as already stated, Sir E. Schomburgk and Dr. Crüger have both seen it seeding abundantly. Altogether the flower differs in a most

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remarkable manner from that of the male *Catasetum tridentatum*, and it is no wonder that the two plants were formerly ranked as distinct genera.

The pollen-masses offer so curious and good an illustration of a structure in a rudimentary condition, that they are worth description; but I must first recur to the perfect pollen-masses of the male *Catasetum*. These may be seen at D and E, fig. 29, attached to the pedicel: they consist of a large sheet of cemented or waxy pollen-grains, folded over so as to form a sack, with an open slit along the lower surface, within which at the lower and produced end, a layer of highly elastic tissue, forming the caudicle, is attached; the other end being attached to the pedicel of the rostellum. The exterior grains of pollen are more angular, have thicker walls, and are yellower than the interior grains. In the early bud the two pollen-masses are enveloped in two conjoined membranous sacks, which are soon penetrated by the two produced ends of the pollen-masses and by their caudicles; and afterwards the extremities of the caudicles adhere to

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[10] *Journ. Linn. Soc. Bot.* vol viii. 1864, p. 127.

the pedicel. Before the flower expands the membranous sacks including the two pollen-masses open; and the pollen-masses are left resting naked on the back of the rostellum.

In *Monachanthus*, on the other hand, the two membranous sacks containing the rudimentary pollen-masses never open; but they easily separate from each other and from the anther. The tissue of which they are formed is thick and pulpy. Like most rudimentary parts, the pollen-masses vary much in size and form; they are only about one-tenth of the bulk of those of the male; they are flask-shaped (*p*, fig. 31), with the lower end greatly produced so as almost to penetrate the exterior or membranous sack. There is

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no fissure along their lower surfaces for the protrusion of the caudicles. The exterior pollen-grains are square and have thicker walls than the interior grains, just as in the proper male pollen; and, what is very curious, each cell has its nucleus. Now, B. Brown states[11] that in the early stages of the formation of the pollen-grains of ordinary Orchids (as with other plants) a minute nucleus is often visible; so that the rudimentary pollen-grains of *Monachanthus* apparently have retained—as is so general with rudiments in the animal kingdom—an embryonic character. Lastly, at the base, within each flask-shaped pollen-mass, there is a little mass of brown elastic tissue,—that is, a vestige of a caudicle,—which runs far up the pointed end of the flask, but does not (at least in some of the specimens) come to the surface, and could never be attached to any part of the pedicel. These rudimentary and enclosed caudicles are, therefore, utterly useless. Notwithstanding the small size and almost aborted condition of the female pollen-masses, when they were placed by Dr. Crüger within the stigma of a female plant they emitted "here and there a rudimentary tube." The petals then faded and the ovarium enlarged, but after a week it turned yellow and finally dropped off without bringing any seeds to perfection. This appears to me a very curious instance of the slow and gradual manner in which structures are modified; for the female pollen-masses, which can never be naturally removed or applied to the stigma, still partially retain their former powers and function.

Thus every detail of structure which characterises the male pollen-masses is represented in the female plant in a useless condition. Such cases are familiar to

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every naturalist, but can never be observed without renewed interest. At a period not far distant, naturalists will hear with surprise, perhaps with derision, that grave and learned men formerly maintained that such useless organs were not remnants retained by inheritance, but were specially created and arranged in their proper places like dishes on a table (this is the simile of a distinguished botanist) by an Omnipotent hand "to complete the scheme of nature."

The third form, *Myanthus barbatus* (fig. 31, B), is sometimes borne on the same plant together with the two preceding forms. The flowers differ greatly in external appearance, but not in essential structure, from those of both the other forms. They generally stand in a reversed position, compared with those of *Catasetum tridentatum* and of *Monachanthus viridis*, that is, with the labellum downwards. The labellum is fringed in an extraordinary manner with long papillae; it has a quite insignificant medial cavity, at the hinder margin of which a curious curved and flattened horn projects, which represents the anvil-like projection on the labellum of the male *C. callosum*. The other petals and sepals are spotted and elongated, with the two lower sepals alone reflexed. The antennæ are not so long as in the male *C. tridentatum*; they project symmetrically on each side of the horn-like process at the base of the labellum, with their tips, which are not roughened with papillae, almost entering the medial cavity. The stigmatic chamber is of nearly intermediate size between that of the male and female forms; it is lined with utriculi charged with brown matter. The straight and well-furrowed ovarium is nearly twice as long as that of the female *Monachanthus*, but not so thick where it joins the flower; the ovules are opaque and pulpy after having been kept

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in spirits, and resemble those of the female in all respects, but are not so numerous. I believe that I saw the nucleus projecting from the testa, but dare not, as in the case of the *Monachanthus*, speak positively. The pollinia are about a quarter of the size of those of the male *Catasetum*, but have a perfectly well developed disc and pedicel. The pollen-masses were lost in the specimens examined by me; but Mr. Reiss has given, in the *Linnean Transactions*, a drawing of them, showing that they are of due proportional size and have the proper folded or cleft structure, within which the caudicles are attached. Thus as both the male and female organs are in appearance perfect, *Myanthus barbatus* may be considered as an hermaphrodite form of the same species, of which the *Catasetum* is the male and *Monachanthus* the female. Nevertheless, the intermediate forms, which are common in Trinidad, and which resemble more or less closely the above described *Myanthus*, have never been seen by Dr. Crüger to produce seed-capsules.

It is a highly remarkable fact, that this sterile hermaphrodite form resembles in its whole appearance and structure the males of two other species, namely, *C. saccatum* and more especially *C. callosum*, much more closely than it does either the male or female form of the same species. As all orchids, with the exception of a few in the present small subfamily, as well as all the members of several allied groups of plants, are hermaphrodites, there can be no doubt that the common progenitor of the Orchideæ was an hermaphrodite. We may therefore attribute the hermaphrodite condition and the general appearance of *Myanthus* to reversion to a former state; and if so, the ancestors of all the species of *Catasetum* must

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[11] *Transactions of the Linnean Soc*. vol. xvi. p. 711.

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have resembled the males of *C. saccatum* and *callosum*, for as we have just seen, it is to these two plants that Myanthus presents so many striking resemblances.[12]

Lastly I may be permitted to add that Dr. Crüger, after having carefully observed these three forms in Trinidad, fully admits the truth of my conclusion that *Catasetum tridentatum* is the male and *Monachanthus viridis* the female of the same species. He further confirms my prediction that insects are attracted to the flowers for the sake of gnawing the labellum, and that they carry the pollen-masses from the male to the female plant. He says "the male flower emits a peculiar smell about twenty-four hours after opening, and the antennæ assume their greatest irritability at the same time. A large humble-bee, noisy and quarrelsome, is now attracted to the flowers by the smell, and a great number of them may be seen every morning for a few hours disputing with each other for a place in the interior of the labellum, for the purpose of gnawing off the cellular tissue on the side opposite to the column, so that they turn their backs to the latter. As soon as they touch the upper antenna of the male flower, the pollen-mass, with its disc and gland, is fixed on their back, and they are often seen flying about with this peculiar-looking ornament on them. I have never seen it attached except to the very middle of the

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thorax. When the bee walks about, the pollen-mass lies flat on the back and wings; but when the insect enters a female flower, always with the labellum turned upwards, the pollinium, which is hinged to the gland by elastic tissue, falls back by its own weight and rests on the anterior face of the column. When the insect returns backwards from the flower, the pollinia are caught by the upper margin of the stigmatic cavity, which projects a little beyond the face of the column; and if the gland be then detached from the back of the insect, or the tissues which connect the pollinia with the caudicle, or this with the gland, break, fecundation takes place." Dr. Crüger sent me specimens of the humble-bees which he caught gnawing the labellum, and these consist of *Euglossa nov. spec*., *cajennensis* and *piliventris*.[13]

Catasetum mentosum and a *Monachanthus*, according to Fritz Müller,[14] grow in the same district of South Brazil; and he easily succeeded in fertilising the latter with pollen from the former. The pollen-masses could be inserted only partially into the narrow stigmatic cleft; but when this was done, a process of deglutition, as described under *Cirrhæa*, commenced and was slowly completed. On the other hand, Fritz Müller entirely failed in his attempts to fertilise the flowers of this *Catasetum* with its own pollen or with that from another plant. The pollinia of the female *Monachanthus* are very small; the pollen-grains are variable both in size and shape; the anther never opens, and the pollen-masses are not attached to the caudicle. Nevertheless, when these rudimentary pollen-masses, which can never naturally be removed from their cells, were placed on the slightly viscid

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stigma of the male *Catasetum*, they emitted their tubes.

The genus *Catasetum* is interesting to an unusual degree in several respects. The separation of the sexes is unknown amongst other Orchids, except perhaps in the allied genus C*ycnoches*. In C*atasetum* we have three sexual forms, generally borne on separate plants, but sometimes mingled together on the same plant; and these three forms are wonderfully different from one another, much more different than, for instance, a peacock is from a peahen. But the appearance of these three forms now ceases to be an anomaly, and can no longer be viewed as an unparalleled instance of variability.

This genus is still more interesting in its manner of fertilisation. We see a flower patiently waiting with its antennæ stretched forth in a well-adapted position, ready to give notice whenever an insect puts its head into the cavity of the labellum. The female *Monachanthus*, not having true pollinia to eject, is destitute of antennæ. In the male and hermaphrodite forms, namely *Catasetum tridentatum* and *Myanthus barbatus*, the pollinia lie doubled up, like a spring, ready to be instantly shot forth when the antennæ are touched. The disc end is always projected foremost, and is coated with viscid matter which quickly sets hard and affixes the hinged pedicel firmly to the insect's body. The insect flies from flower to flower, till at last it visits a female plant: it then inserts one of the pollen-masses into the stigmatic cavity. As soon as the insect flies away the elastic caudicle, made weak enough to yield to the viscidity of the stigmatic surface, breaks, and leaves behind a pollen-mass; then the pollen-tubes slowly protrude, penetrate the stigmatic canal, and the act of fertilisation is completed. Who would have

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been bold enough to have surmised that the propagation of a species depended on so complex, so apparently artificial, and yet so admirable an arrangement?

I have examined three other genera placed by Lindley in the small sub-family of Catasetidæ, namely, *Mormodes*, *Cycnoches* and *Cyrtopodium*. The latter plant was purchased by me under this name, and bore a flower-stem about four feet in height with yellowish bracts spotted with red; but the flowers presented none of the remarkable peculiarities of the three other genera, with the exception that the anther was hinged to a point projecting from the summit of the column, as in *Catasetum*.

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[12] The male of the Indian antelope (*A. bezoartica*) after castration produces horns of a widely different shape from those of the perfect male; and larger and thicker than those occasionally produced by the female. We see something of the same kind in the horns of the common ox. I have remarked in my *Descent of Man* (2nd edit. p. 506), that such cases may probably be attributed to reversion to a former state of the species; for we have good reason to believe that any cause which disturbs the constitution leads to reversion. *Myanthus*, though having the organs of both sexes apparently perfect, is sterile; it has therefore had its sexual constitution disturbed, and this seems to have caused it to revert in character to a former state.

[13] Check comments in Nemésio and Rasmussen (2011) about euglossine bees cited by Darwin (note of the transcriber).

[14] *Bot. Zeitung*, 1868, p. 630.

Mormodes ignea.—To show how difficult it sometimes is to understand the manner in which an Orchid is fertilised, I may mention that I carefully examined twelve flowers,[15] trying various experiments and recording the results, before I could at all make out the meaning and action of the several parts. It was plain that the pollinia were ejected, as in *Catasetum*, but how each part of the flower played its proper part I could not even conjecture. I had given up the case as hopeless, until summing up my observations, the explanation presently to be given, and subsequently proved by repeated experiments to be correct, suddenly occurred to me.

The flower presents an extraordinary appearance, and its mechanism is even more curious than its appearance (fig. 32). The base of the column is bent backwards, at right angles to the ovarium or footstalk,

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and then resumes an upright position to near its summit, where it is again bent. It is, also, twisted in a unique manner, so that its front surface, including the anther, rostellum, and the upper part of the stigma faces one side of the flower; this being either to the

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right or left, according to the position of the flower on the spike. The twisted stigmatic surface extends down to the base of the column and is hollowed out into a deep cavity at its upper end. The large viscid disc of the pollinium is lodged in this cavity close beneath the rostellum; and the rostellum is seen in the drawing (*pd.*) covered by the bowed pedicel.

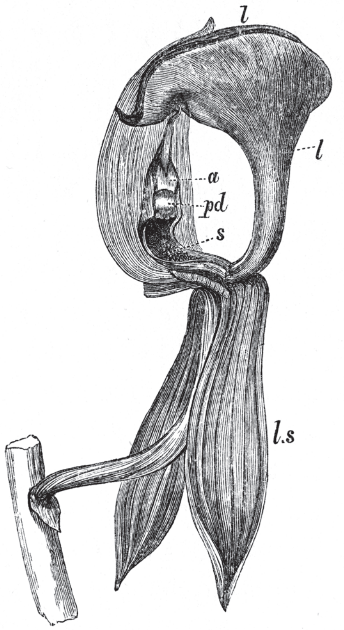

FIGURE 32. *Mormodes ignea.*

Lateral view of flower, with the upper sepal and the near upper petal cut off.

N.B. The labellum in the drawing is a little lifted up, to show the depression on its under surface, which ought to be pressed close down on the bent summit of the column. *a*. anther. *pd*. pedicel of pollinium. *s*. stigma. *l*. labellum *l*. *s*. lateral sepal.

The anther-case (*a* in the figure) is elongated and triangular, closely resembling that of *Catasetum*; but it does not extend up to the apex of the column. The apex consists of a thin flattened filament, which from the analogy of *Catasetum* I suppose to be the produced filament of the stamen; but it may be a prolongation of some other element of the column. In the bud-state it is straight, but before the flower expands, it becomes much bent by the pressure of the labellum. A group of spiral vessels runs up the column as far as the summit of the anther-case; they are then reflexed and run some way down the anther-case. The point of reflexion forms a short thin hinge by which the top of the anther-case is articulated to the column beneath its bent summit. The hinge, although smaller than a pin's head in size, is of paramount importance; for it is sensitive and conveys the stimulus from a touch to the disc of the pollinium, causing it to separate from its place of attachment. The hinge also serves to guide the pollinium during its ejection. As it has to convey the necessary stimulus to the disc, one may suspect that a portion of the rostellum, which lies in close contact with the filament of the anther, runs up to this point; but I could not here detect any difference in structure on comparing these parts with those of *Catasetum*. The cellular tissue round the hinge is gorged with fluid, and a large drop exudes when the anther is torn from the column during the ejection

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of the pollinium. This gorged condition may perhaps facilitate the rupture of the hinge.

The pollinium does not differ much from that of *Catasetum* (see fig. 29, D, p. 183); and it lies in like manner curved round the rostellum, which is less protuberant than in that genus. The upper and broad end of the pedicel, however, extends beneath the pollen-masses within the anther; and these are attached by rather weak caudicles to a medial crest on its upper surface.

The viscid surface of the large disc lies in contact with the roof of the stigmatic cavity, so that it cannot be touched by an insect visiting the flower. The anterior end of the disc is furnished with a small dependent curtain (dimly shown in fig. 32); and this, before the act of ejection, is continuously joined on each side to the upper margins of the stigmatic cavity. The pedicel is united to the posterior end of the disc; but when the disc is freed, the lowermost part of the pedicel becomes doubly bent, so that it then appears as if attached by a hinge to the centre of the disc.

The labellum is a highly remarkable structure: it is narrowed at its base into a nearly cylindrical foot-stalk, and its sides are so much reflexed as almost to meet at the

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[15] I must express my cordial thanks to Mr. Rucker, of West Hill, Wandsworth, for having lent me a plant of this *Mormodes* with two fine spikes, bearing an abundance of flowers, and for having allowed me to keep the plant for a considerable time.

back, forming a folded crest on the summit of the flower. After rising up perpendicularly it arches over the apex of the column, against which it is firmly pressed down. The labellum at this point is hollowed out (even in the bud) into a slight cavity, which receives the bent summit of the column. This slight depression manifestly represents the large cavity, with thick fleshy walls, which insects gnaw, on the anterior surface of the labellum in the several species of *Catasetum*. Here by a singular change of function, the cavity serves to keep the labellum in its proper position on the summit of the column, but is, perhaps,

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likewise attractive to insects. In the drawing (fig. 32) the labellum has been forcibly raised a little up, so as to show the depression and the bent filament. In its natural position it may almost be compared to a huge cocked-hat, supported by a footstalk and placed on the head of the column.

The twisting of the column, which I have seen in no other Orchid, causes all the important organs of fructification in the flowers on the left side of the spike to face to the left, and in all those on the right side to face to the right. So that two flowers taken from opposite sides of the same spike and held in the same relative position are seen to be twisted in opposite directions. One single flower, which was crowded by the others, was barely twisted, so that its column faced the labellum. The labellum is also slightly twisted: for instance, in the flower figured, which faced to the left, the midrib of the labellum was first twisted to the right-hand, and then to the left, but in a less degree, and being bent over it pressed on the posterior surface of the crooked summit of the column. The twisting of all the parts of the flower commences in the bud.

The position thus acquired by the several organs is of the highest importance; for if the column and labellum had not been twisted laterally, the pollinia, when shot forth, would have struck the overarching labellum and have then rebounded, as actually occurred with the single abnormal flower having a nearly straight column. If the organs had not been twisted in opposite directions on the opposite sides of the same crowded spike, so as always to face to the outside, there would not have been a clear space for the ejection of the pollinia and their adhesion to insects.

When the flower is mature the three sepals hang

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down, but the two upper petals remain nearly upright. The bases of the sepals, and especially of the two upper petals, are thick and swollen and have a yellowish tint; when quite mature, they are so gorged with fluid, that, if punctured by a fine glass tube, the fluid rises by capillary attraction to some height in it. These swollen bases, as well as the footstalk of the labellum, have a decidedly sweet and pleasant taste; and I can hardly doubt that they are attractive to insects, for no free nectar is secreted.

I will now endeavour to show how all the parts of the flower are co-ordinated and act together. The pedicel of the pollinium is bowed round the rostellum, as in *Catasetum*; in this latter genus, when freed, it merely straightens itself with force, in *Mormodes* something more takes place. If the reader will look forward to fig. 34 (p. 223), he will see a section of the flower-bud of the allied genus of *Cycnoches*, which differs only in the shape of the anther and in the viscid disc having a much deeper dependent curtain. Now let him suppose the pedicel of the pollinium to be so elastic that, when freed, it not only straightens itself, but suddenly bends back on itself with a reversed curvature, so as to form an irregular hoop. The curved surface which was before in contact with the protuberant rostellum now forms the outside of the hoop. The exterior surface of the curtain, which depends beneath the disc, is not viscid; and it now lies on the anther-case, with the viscid surface of the disc on the outside. This is exactly what takes place with *Mormodes*. But the pollinium assumes with such force its reversed curvature (aided, apparently, by a transverse curling outwards of the margins of the pedicel), that it not only forms itself into a hoop, but suddenly springs away from the protuberant

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lace of the rostellum. As the two pollen-masses adhere, at first, rather firmly to the anther-case, the latter is torn off by the rebound; and as the thin hinge at the summit of the anther-case does not yield so easily as the basal margin, the pollinium together with the anther-case is instantly swung upwards like a pendulum. But in the course of the upward swing the hinge yields, and the whole body is projected perpendicularly up in the air, an inch or two above and close in front of the terminal part of the labellum. If no object is in the way, as the pollinium falls down, it generally alights and sticks, though not firmly, on the folded crest of the labellum, directly over the column. I witnessed repeatedly all that has been here described.

The curtain of the disc, which, after the pollinium has formed itself into a hoop, lies on the anther-case, is of considerable service in preventing the viscid edge of the disc from adhering to the anther, and thus permanently retaining the pollinium in the form of a hoop. This would have been fatal, as we shall presently see, to a subsequent movement of the pollinium which is necessary for the fertilisation of the flower. In some of my experiments, when the free action of the parts was checked, this did occur, and the pollinium, together with the anther-case, remained permanently glued together in the shape of an irregular hoop.

I have already stated that the minute hinge by which the anther-case is articulated to the column, a little way beneath its bent filamentary apex, is sensitive to a touch. I tried four times and found that I could touch with some force any other part; but when I gently touched this point with the finest needle, instantly the membrane which unites the disc

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to the edges of the stigmatic cavity where it is lodged, ruptured, and the pollinium was shot upwards and fell on the crest of the labellum as just described.

Now let us suppose an insect to alight on the folded crest of the labellum, and no other convenient landing-place is afforded, and then to lean over the front of the column so as to gnaw or suck the bases of the petals swollen with sweet fluid. The weight and movements of the insect would disturb the labellum and the bent underlying summit of the column; and the latter, pressing on the hinge in the angle, would cause the ejection of the pollinium, which would infallibly strike the head of the insect and adhere to it. I tried by placing my gloved finger on the summit of the labellum, with the tip just projecting beyond its margin, and then gently moving my finger it was really beautiful to see how instantly the pollinium was projected upwards, and how accurately the viscid surface of the disc struck my finger and firmly adhered to it. Nevertheless, I doubt whether the weight and movements of an insect would suffice to thus act indirectly on the sensitive point; but look at the drawing and see how probable it is that an insect leaning over would place its front legs over the edge of the labellum on the summit of the anther-case, and thus touch the sensitive point. The pollinium would then be ejected, and the viscid disc would certainly strike and adhere to the insect's head.

Before proceeding, it may be worth while to mention some of the early trials which I made. I pricked deeply the column in different parts, including the stigma, and cut off the petals, and even the labellum, without causing the ejection of the pollinium; this, however, once happened when I cut rather roughly through the thick footstalk of the labellum, the

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filamentary summit of the column no doubt having been thus disturbed. When I gently prised up the anther-case at its base or on one side, the pollinium was ejected, but then the sensitive hinge would necessarily have been bent. When the flower has long remained expanded and is nearly ready for spontaneous ejection, a slight jar on any part of the flower causes the action. Pressure on the thin pedicel of the pollinium, and therefore on the underlying protuberant rostellum, is followed by the ejection of the pollen-masses; but this is not surprising, as the stimulus from a touch on the sensitive hinge has to be conveyed through this part of the rostellum to the disc. In *Catasetum* slight pressure on this point does not cause the act of ejection; but in this genus the protuberant part of the rostellum does not lie in the course along which the stimulus has to be conveyed from the antennæ to the disc. A drop of chloroform, of spirits of wine, or of boiling water placed on this part of the rostellum produced no effect; nor, to my surprise, did exposure of the whole flower to vapour of chloroform.

Seeing that this part of the rostellum was sensitive to pressure, and that the flower was widely open on one side, and being pre-occupied with the case of *Catasetum*, I at first felt convinced that insects entered the lower part of the flower and touched the rostellum. Accordingly I pressed the rostellum with variously-shaped objects, but the viscid disc never once adhered in a proper manner to the object. If I used a thick needle, the pollinium, when ejected, formed a hoop round it with the viscid surface outside; if I used a broad flat object, the pollinium struggled against it and sometimes coiled itself up spirally, but the disc either did not adhere at all, or very imperfectly. At the close of the twelfth trial I was in despair. The

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strange position of the labellum, perched on the summit of the column, ought to have shown me that here was the place for experiment. I ought to have rejected the notion that the labellum was thus placed for no good purpose. This plain guide was overlooked, and for a long time I completely failed to understand the structure of the flower.

We have seen that when the pollinium is ejected and swings upwards, it adheres by the viscid surface of the disc to any object projecting beyond the edge of the labellum directly over the column. When thus attached, it forms an irregular hoop, with the torn-off anther-case still covering the pollen-masses which are close to the disc, but protected from adhering to it by the dependent curtain. Whilst in this position the projecting and bowed part of the pedicel would effectually prevent the pollen-masses from being placed on the stigma, even supposing the anther-case to have fallen off. Now let us suppose the pollinium to be attached to an insect's head, and observe what takes place. The pedicel, when first separated from the rostellum, is damp; as it dries, it slowly straightens itself, and when perfectly straight the anther-case readily drops off. The pollen-masses are now naked, and they are attached to the end of the pedicel by easily ruptured caudicles, at the right distance and in a proper position for their insertion into the adhesive stigma, as soon as the insect visits another flower. Thus every detail of structure is now perfectly adapted for the act of fertilisation.

When the anther-case drops off, it has performed its triple function; namely, its hinge as an organ of sense, its weak attachment to the column as a guide causing the pollinium at first to swing perpendicularly upwards, and its lower margin, together with the curtain of the

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disc, as a protection to the pollen-masses from being permanently glued to the viscid disc.

From observations made on fifteen flowers, it was ascertained that the straightening of the pedicel does not occur until from twelve to fifteen minutes have elapsed. The first movement causing the act of ejection is due to elasticity, and the second slow movement to the drying of the outer and convex surface; but this latter movement differs from that observed in the pollinia of so many Vandeæ and Ophreæ, for, when the pollinium of this *Mormodes* was placed in water, it did not recover the hoop-like form which it had at first acquired by elasticity.

The flowers are hermaphrodites. The pollinia are perfectly developed. The elongated stigmatic surface is extremely viscid and abounds with innumerable utriculi, the contents of which shrink and become coagulated after immersion for less than an hour in spirits of wine.

When placed in spirits for a day, the utriculi were so acted on that they disappeared, and this I have not noticed in any other Orchid. The ovules, after exposure to spirits for a day or two, presented the usual semi-opaque, pulpy appearance common to all hermaphrodite and female Orchids. From the unusual length of the stigmatic surface I expected that, if the pollinia were not ejected from the excitement of a touch, the anther-case would have detached itself, and the pollen-masses would have swung downwards and fertilised the stigma of the same flower. Accordingly, I left four flowers untouched; after they had remained expanded from eight to ten days, the elasticity of the pedicel conquered the force of attachment and the pollinia were spontaneously ejected, but they did not fall on the stigma and were consequently wasted.

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Although *Mormodes ignea* is an hermaphrodite, yet it must be as truly dioecious in function as *Catasetum*; for as it takes from twelve to fifteen minutes before the pedicel of an ejected pollinium straightens itself and the anther-case drops off, it is almost certain that within this time an insect with a pollinium attached to its head would have left one plant and flown to another.

Mormodes luxata.—This rare and fine species is fertilised in the same manner as *Mormodes ignea*, but differs in several important points of structure. The right and left sides of the same flower differ from one another even in a greater degree than in the last species. One of the petals and one of the sepals project at right angles to the column, while the corresponding ones stand upright and surround it. The upturned and twisted labellum is furnished with two large lateral lobes: of these one embraces the column, while the other stands partly open on the side where the one petal and sepal lie flat. Insects can thus easily enter the flower on this latter side. All the flowers on the left side of the spike are open on their left sides, while those on the right side are open on this side. The twisted column with all the important accessory parts, together with the rectangularly bent apex, closely resemble the corresponding parts in *M. ignea*. But the under side of the labellum does not rest on and press against the rectangularly bent apex of the column. This stands free in the middle of a cup formed by the extremity of the labellum.

I did not obtain many flowers fit for examination, as three had ejected their pollinia owing to the shocks received during their journey. I pricked deeply the labellum, column and stigma of some of the flowers without any effect; but when I lightly touched with a

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needle, not the anther-hinge as in the last species, but the apex of the column of one flower, the pollinium was instantly ejected. The bases of the petals and sepals are not swollen and succulent like those of *M. ignea*; and I have little doubt that insects gnaw the labellum, which is thick and fleshy, with the same peculiar taste as in *Catasetum*. If an insect were to gnaw the terminal cup, it could hardly fail to touch the apex of the column, and then the pollinium would swing upwards and adhere to some part of the insect's body. The pedicels of the pollinia straighten themselves and the anther-cases are cast off, in about fifteen minutes after the act of ejection. We may therefore confidently believe that this species is fertilised in the same peculiar manner as *Mormodes ignea*.

Cycnoches ventricosum.—Mr. Veitch was so kind as to send me on two occasions several flowers and flower-buds of this extraordinary plant. A sketch of a flower in its natural position, with one sepal cut off, is shown at fig. 33 (p. 222), and a longitudinal section through a young bud at fig. 34 (p. 223). The labellum is thick and fleshy, with the usual taste of this organ in the Catasetidæ; it resembles in shape a shallow basin turned upside down. The two other petals and the three sepals are reflexed. The column is almost cylindrical, thin, flexible, elastic and of extraordinary length. It curves round so as to bring the stigma and anther opposite to and beneath the convex surface of the labellum. The apex of the column is not nearly so much produced as in Mormodes and *Catasetum*. The pollinia closely resemble those of *Mormodes*; but the disc is larger, and its curtain, which is fringed, is so large that it covers the whole entrance into the stigmatic chamber. The structure of these parts is best seen in the section,

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fig. 34; in which the pedicel of the pollinium has not as yet become separate from the rostellum, but the future line of separation is shown by a line (dotted in the figure) of hyaline tissue. The filament of the anther (*f*, fig. 34) has not as yet grown to its full length. When fully developed it bears two little leaf-like appendages which lie on the anther. Lastly, on the sides of the stigma there are two slight protuberances (fig. 33), which apparently represent the antennæ of *Catasetum*, but have not the same function.

Neither the labellum nor the protuberances on the sides of the stigma are at all sensitive; but when on three occasions I momentarily touched the filament, between the little leaf-like appendages, the pollinium was ejected in the same manner and through the same mechanism as in *Mormodes*; but it was thrown only to the distance of about an inch. If the filament had been touched by an object which had not been quickly removed, or if by an insect, the viscid disc would certainly have adhered to it. Mr. Veitch informs me that he has often touched the end of the column, and the pollinium has adhered to his finger. When the pollinium is ejected, the pedicel forms a hoop, with the exterior surface of the curtain of the disc resting on and covering the anther. In about fifteen minutes the pedicel straightens itself, and the anther-case drops off; and now the pollinium is in a right position for fertilising another flower. As soon as the viscid matter on the under surface of the disc is exposed to the air it quickly changes colour and sets hard. It then adheres with surprising force to any object. From these various facts and from the analogy of the other Catasetidæ, we may conclude that insects visit the flowers for the sake of gnawing the labellum:

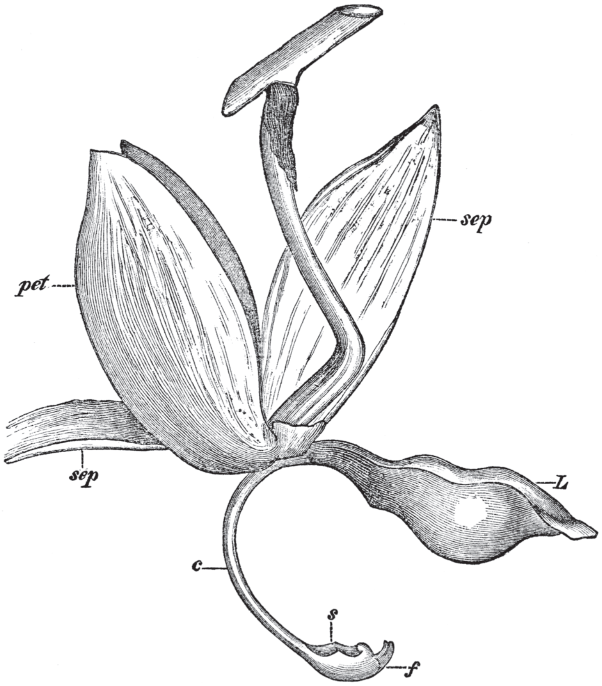

FIGURE 33. *Cycnoches ventricosum.*

Flower viewed in its natural dependent position.

c. column, after the ejection of the pollinium together with the anther. *f*. filament of anther. *s*. stigmatic cavity. *L*. labellum. *pet*. the two lateral petals. *sep*. sepals.

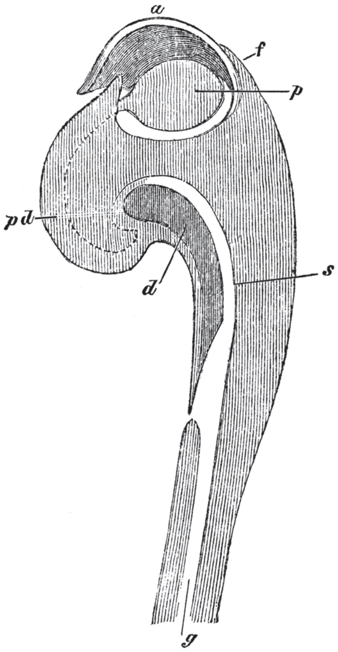

FIGURE 34. Diagrammatic Section of a Flower-bud, the column placed upright.

a. anther. *f*. filament of anther. *p*. pollen-mass. *pd*. pedicel of pollinium, barely separated as yet from the rostellum. *d*. disc of pollinium with the dependent curtain. *s*. stigmatic chamber. *g*. stigmatic canal leading to the ovarium.

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but it cannot be predicted whether they alight on the surface which is uppermost in the drawing (fig. 33) and then crawl over the margin so as to gnaw the convex surface, and in doing so touch with their abdomens

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the extremity of the column, or whether they first alight on this part of the column; but in either case they would cause the ejection of the pollinia, which would adhere to some part of their bodies. The specimens which I examined were certainly male plants, for the pollinia were well developed. The stigmatic cavity was lined with a thick layer of pulpy matter which was not adhesive. But as the flowers cannot possibly be fertilised until the pollinia have been ejected, together with the great curtain which covers the whole stigmatic surface, it may be that

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this surface becomes at a later period adhesive so as to secure the pollen-masses. The ovules when kept for some time in alcohol were filled with brownish pulpy matter, as is always the case with perfect ovules.

Therefore it appears that this *Cycnoches* must be an hermaphrodite; and Mr. Bateman, in his work on the Orchideæ, says that the present species produces seeds without being, as I understand, artificially fertilised; but how this is possible is unintelligible to me. On the other hand, Beer says[16] that the stigma of *Cycnoches* is dry, and that the plant never sets seeds. According to Lindley *C. ventricosum* produces on the same scape flowers with a simple labellum, others with a much segmented and differently coloured labellum (viz., the so-called *C. egertonianum*), and others in an intermediate condition. From the analogous differences in the flowers of *Catasetum*, we are tempted to believe that we here have male, female, and hermaphrodite forms of the same species of *Cycnoches*.[17, 18]

[16] Quoted by Irmisch, *Beiträge zur Biologie der Orchideen*, 1853, p. 22.

[17] Lindley's *Vegetable Kingdom*, 1853, p. 177. He has also published in the [Edwards's] Botanical Register, fol. 1951 [1837], a case of two forms appearing on the same scape of another species of *Cycnoches*. Mr. Bateman also says that *C. egertonianum* has been known to produce in Guatemala and once in England scapes of a purple-flowered and widely different species of *Cycnoches*; but that it generally produces in England scapes of the common yellow *C. ventricosum*.

[18] Here Darwin surely misquoted Lindley. He was most likely referring to Lindley (1843a,b), and not to figure "fol. 1951," which was actually tab. 1947^{A} (see Lindley, 1837, referring to *Catasetum*, not *Cycnoches*) (note of the transcriber).

I have now finished my description of the Catasetidæ as well as of many other Vandeæ. The study of these wonderful and often beautiful productions, with all their many adaptations, with parts capable of movement, and other parts endowed with something so like, though no doubt different from, sensibility, has been to me most interesting. The flowers of Orchids, in their strange and endless diversity of chape, may be compared

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with the great vertebrate class of Fish, or still more appropriately with tropical Homopterous insects, which appear to us as if they had been modelled in the wildest caprice, but this no doubt is due to our ignorance of their requirements and conditions of life.

Appendix IV

Specimens Cited

Catasetum barbatum (Lindl.) Lindl. (male flower). VENEZUELA. Amazonas: Municipio Maroa, Maroa, 2 August 2013, *ex Hort*. Familia Aragua (no voucher prepared).

Catasetum bergoldianum Foldats (male and female flowers). VENEZUELA. Amazonas: Municipio Atures, Río Sipapo, 5 June 1983, *G. A. Romero 1199* (AMES).

Catasetum collare Cogn. (female flower). VENEZUELA. Municipio Atures, río Orinoco, 27 June 1983 *ex Hort*. R. de Tomacini (no voucher prepared).

Catasetum collare Cogn. (male flower). VENEZUELA. Municipio Atures, El Burro, 26 November 1983, *G. A. Romero 1155* (AMES).

Catasetum maculatum Kunth. COSTA RICA. Cartago: Turrialba, campus of CATIE, DATE, *F. Guánchez* (JBL).

Catasetum pileatum Rchb.f. (female flower). VENEZUELA. Amazonas: Municipio Maroa, "Caño" San Miguel, 3 September 2007, *G. A. Romero & C. Gómez 3632* (VEN).

Catasetum pileatum Rchb.f. (male flower). VENEZUELA. Amazonas: Municipio Atures, Río Orinoco, 5 September 1983, *ex Hort*. R. de Tomacini (no voucher prepared).

Catasetum roseo-album (Hook.) Lindl. VENEZUELA. Amazonas: Municipio Maroa, Cerro Mesaque, 23 July 2006, *G. A. Romero, G. Gerlach & C. Gómez & G. Gerlach 3592* (VEN).

Cycnoches egertonianum Bateman. COSTA RICA: Cartago: Santa Cruz, 1200 m, 20 September 2018, *F. Guánchez, F. Cuza, G. Alvarado y G. A. Romero 5366* (JBL).

Cycnoches ventricosum Bateman. MEXICO. Chiapas: vicinity of Ocosingo, May 2017, *I. Tamayo Cen 127* (CICY).

Mormodes lineata Bateman ex Lindl. MEXICO: Oaxaca: Municipio San Miguel Chimalapa: Carretera El Jícaro-Rodulfo-Benito Juárez, 1038 m, 15 enero 2009, *G. Carnevali 7416* (CICY).

Mormodes vernixioidea Pabst ssp. *autanensis* Salazar & G. A. Romero: VENEZUELA. Amazonas: Río Autana, 28 November 1987, *G. A. Romero & F. Guánchez 1434* (VEN). Based on the holotype.

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Arnold Arboretum

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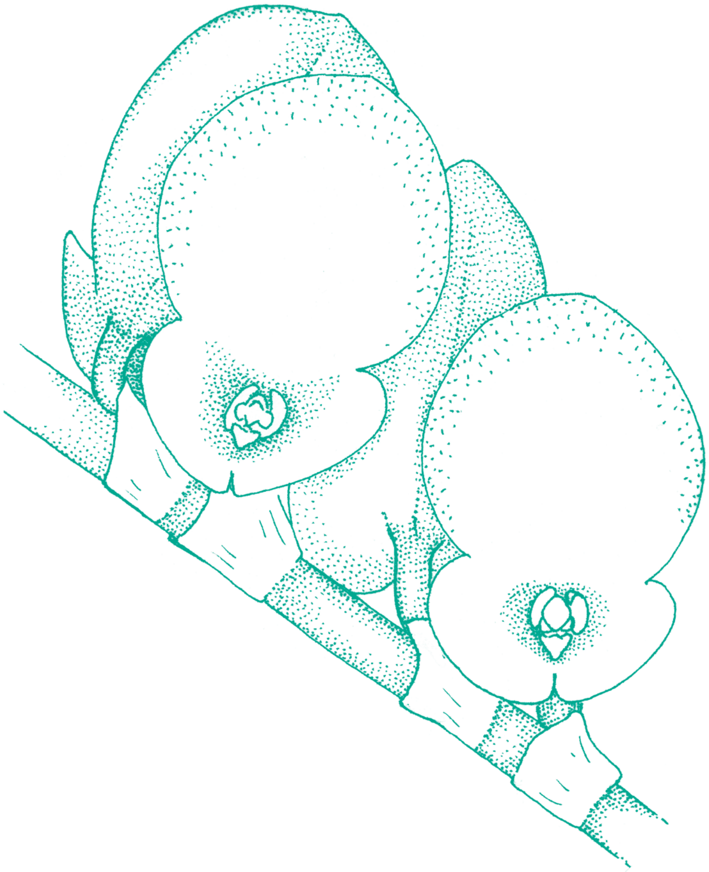

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