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A NEW SPECIES OF *MAXILLARIA* (MAXILLARIINAE) FROM THE NORTHERN ANDES AND A NEW SYNONYM OF *MAXILLARIA FLORIBUNDA*

Gustavo Adolfo Pisso-Florez[1, 2, 7], Juan Sebastián Moreno[3, 4], Patricia A. Harding[5] & Luis E. Baquero[6]

[1]Parque Nacional Natural Puracé, Carrera 9 # 25 N-06, Cauca, Popayán, Colombia.
[2]Fundación Herencia Natural, Calle 32 EE # 80C-24, Antioquia, Medellín, Colombia.
[3]Departamento de Biología, Universidad del Valle, Calle 13 # 100-00, Cali, Colombia.
[4]Grupo de Investigación Schultes, Fundación Ecotonos, Valle del Cauca, Cali, Colombia.
[5]39127 Griggs Dr., Lebanon, Oregon 97355, U.S.A.
[6]Grupo de Investigación en Medio Ambiente y Salud BIOMAS, Facultad de Ingeniería y Ciencias Aplicadas, Universidad de Las Américas, vía a Nayón, Quito 170124 Ecuador.
[7]Author for correspondence: tapiflo@gmail.com

Abstract. *Maxillaria andina,* a new orchid species from high-Andean ecosystems of southwestern Colombia and northern Ecuador, is described. The new species is distinguished by having long and narrowly linear white sepals and petals with revolute margins, lip with mucronate epichile, and callus without hairs or trichomes. Distinguishing characters are provided to differentiate it from morphologically similar species, along with ecological and taxonomical notes. Additionally, *Maxillaria sibundoyensis* is synonymized with *Maxillaria floribunda*.

Resumen. *Maxillaria andina*, una nueva especie de orquídea de ecosistemas altoandinos del suroccidente de Colombia y norte de Ecuador, es descrita. La nueva especie se distingue por presentar sépalos y pétalos blancos, largos y estrechamente lineales, con los márgenes revolutos, el labelo con un epiquilo mucronado y el callo sin pelos ni tricomas. Presentamos caracteres distintivos que diferencian a la nueva especie de sus especies morfológicamente similares, así como notas ecológicas y taxonómicas. Adicionalmente, *Maxillaria sibundoyensis* es sinonimizada con *Maxillaria floribunda.*

Keywords/ Palabras clave: Colombia, ecosistemas altoandinos, Ecuador, flora neotropical, high-Andean ecosystems, Neotropical flora, taxonomía, taxonomy

Introduction. *Maxillaria* Ruiz & Pav. *sensu lato* is one of the most diverse orchid genera in the world, embracing about 651 species (Christenson *et al.* 2012, Engels & Smidt 2023, Lipińska *et al.* 2022, Schuiteman & Chase 2015, Whitten *et al.* 2007). Plants of *Maxillaria* grow as epiphytes, lithophytes, or terrestrials in cloudy, wet, or more rarely in seasonally dry forests, from the United States (Florida) and Mexico to northern Argentina, including the Antilles (Schuiteman & Chase 2015). In last decades, the circumscription of *Maxillaria* has been a subject of controversy (Barros 2002, Blanco *et al.* 2007, Dressler 1993, Ojeda *et al.* 2005, Szlachetko *et al.* 2006, Szlachetko & Miszek 2007, Whitten *et al*. 2007, Whitten & Blanco 2011); it was divided into 17 genera (Blanco *et al.* 2007), later expanded into 37 genera (Szlachetko *et al.* 2012), but has recently been lumped into a single genus, including other genera that no previous authors had synonymized with *Maxillaria sensu lato* (Schuiteman & Chase 2015). This new reclassification includes the genus *Chrysocycnis* Linden & Rchb.f., *Cryptocentrum* Benth., *Cyrtidiorchis* Rauschert, *Mormolyca* Fenzl, *Pityphyllum* Schltr., and *Trigonidium* Lindl. According to Schuiteman and Chase (2015), *Maxillaria* groups species with single-flowered

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inflorescences, sepals, and petals free or partially fused, with a free labellum articulated at the base of the stout column or rigidly fused to the column foot, and conduplicate leaves (Moreno *et al.* 2017, Schuiteman & Chase 2015, Zambrano-Romero & Solano-Gomez 2016).

The Andean countries of northern South America are the richest in *Maxillaria* species. Colombia and Ecuador together have more than 400 species recorded (Govaerts *et al.* 2021, Ortiz Valdivieso & Uribe Vélez 2007), with several new species discovered and described in the last years (Moreno *et al.* 2017, Szlachetko *et al.* 2017, Zambrano-Romero *et al.* 2020; Lipińska *et al.* 2022). Nonetheless, taxonomic studies for *Maxillaria* remain scarce in both countries, and new species can still be found (Zambrano-Romero & Solano-Gómez 2016). Recent explorations conducted in the last few years in the Andes of southwestern Colombia and northern Ecuador expanded our knowledge of orchid diversity, notably in the poorly studied Puracé National Natural Park (PNNP), where two new species of orchids have been described in recent years (Moreno *et al.* 2020). In the latest expeditions in Colombia and Ecuador, we found two populations of a morphologically distinctive species from the genus *Maxillaria*, which we propose here as a new species. Furthermore, we found a specimen of *Maxillaria* within PNNP that aligns with the characteristics of *Maxillaria sibundoyensis* Szlach., Kolan., Lipińska & Medina Tr. However, upon conducting an extensive review of the literature concerning related taxa and examining the type specimens of *Maxillaria floribunda* Lindl., we observed significant morphological similarities between these species. Consequently, we consider *M. sibundoyensis* as synonymous with *M. floribunda*, based on the compelling morphological evidence.

Materials and methods. The location visited by the first author was the southern area of PNNP, municipality of San Agustín, department of Huila, Colombia, between September and October 2022 and March 2023, when two specimens of the new species were collected. Additionally, one specimen of *Maxillaria sibundoyensis syn. nov.* was collected from a nearby locality (Colombia, Huila, Municipality of Isnos, Puracé National Natural Park, road Paletará-Isnos, 2.081 -76.355, WGS 84, 2742 m a.s.l. 12 October 2022). In October 2018, the senior author collected living plants of the new species in a site near the village of Huaca, in Sucumbios province, northwestern Ecuador. The photographic plates are based on the specimens collected in Colombia. The composite photographic plate was prepared in Adobe Photoshop CS6. The *Maxillaria* specimens were pressed and mounted as herbarium specimens to be deposited at the CAUP (Universidad del Cauca in Popayán, Colombia) and QCNE (Quito, Ecuador) herbaria. We used the software QGIS 3.22 (QGIS.org 2023) to prepare the distribution map for the new taxon, based on the available collections. To validate the identification of the collected plants as a species new to science, available literature for *Maxillaria* was reviewed (Bennett & Christenson 1998, 2001, Christenson *et al.* 2012, Lindley 1845, Schlechter 1921). Also, we examined eight specimens (type and isotypes) of *Maxillaria floribunda* available on JSTOR Global Plants (https://plants.jstor.org/) from different herbaria (Kew Herbaria (K): K000793155 (Type); K000799448-49, Natural History Museum (BM): BM000533577; Muséum National d'Histoire Naturelle (P): P00445883; Herbarium Russian Academy of Sciences - V. L. Komarov, Botanical Institute (LE): LE00006574; Conservatoire et Jardin botaniques de la Ville de Genève (G): G00355249; Lund University Botanical Museum (LD): LD1411678) and used selected references to compare the morphological descriptions of *M. sibundoyensis* with *M. floribunda*. Morphological and coloration terms were based on Beentje (2010).

Taxonomic treatment

Maxillaria andina Pisso-Florez, J.S.Moreno, P.A.Harding & Baquero, ***sp. nov.***

TYPE: Colombia. Huila: Municipio de San Agustín, Corregimiento de San Antonio, Parque Nacional Natural Puracé, Camino Nacional. 3204 m. 12 September 2022. *G.A. Pisso Florez GAP 290* (Holotype: CAUP 53405). (Fig. 1).

Diagnosis: *Maxillaria andina* is most similar to *M. floribunda* and *Maxillaria caveroi* D.E.Benn. & Christenson. It is distinguished from *M. floribunda* by having the entirely white sepals and petals (*vs*. yellow, white and brownish petals), the longer and narrower sepals (6.08–6.55 × 0.26–0.57 *vs*. 5.3 × 1.0 cm), the smaller lip (0.78 × 1.14 *vs*. 1.3 × 1.8 cm), with the mid-lobe

Figure 1. *Maxillaria andina* Pisso-Florez, J.S.Moreno, P.A.Harding & Baquero. **A**. Habit. **B**. Flower. **C**. Dissected perianth, not flattened. **D**. Ovary, column and lip, lateral view. **E**. Adaxial view of lip. **F**. Column, oblique, ventral, and lateral views. LCDP by G.A. Pisso-Florez and J.S. Moreno based on the holotype.

apex verrucose (*vs*. scabrous), and the base of the lip scabrous (*vs*. slightly verrucose or spiculate). The new species differs from *M. caveroi* by having narrower, linear sepals and petals (*vs*. lanceolate) and the absence of sparse trichomes on the lip.

Plant terrestrial, ascendent, evergreen, sympodial with pseudobulbs between the ascending rhizome segments, rhizome segments *ca*. 15 cm long. *Roots* white, 0.11 cm in diameter, profuse, flexuous, produced from the base of the rhizome. *Pseudobulbs* ovate-pyriform, grooved, compressed, 2.94–5.04 × 0.66–3.49 cm, partially or completely covered by leaf sheaths, unifoliate, base with 1–2 foliaceous rigid sheaths. *Leaves* distichous, 1–4 per rhizome segment, 7.24–15.9 × 2.06–2.92 cm, monomorphic, coriaceous, blade oblong-elliptic, apex acute, base conduplicated with a clear abscission line. *Phyllopodium* 1.23–1.80 × 0.36–0.55 cm, conduplicate and articulated with the leaf, coriaceous. *Inflorescences* 1–10 flowers produced from the basal leaf sheath's axils. *Peduncles* 11–16 cm long, with 3–5 alternate and distichous bracts; bracts acute, grooved, red-brown or green in the medial-upper part and green in the base, papyraceous, including the floral bract, the latter not surpassing one-third of the pedicel. *Ovary* pedicellate, 3.57 cm long including the pedicel, verrucose, and sulcate with six longitudinal grooves. *Flower* spidery, without detectable odor. Sepals and petals white, immaculate, lip white, lateral margins heavily colored deep red-purple, mid-lobe with white margin and central portion yellow, callus white with base yellow and red-purple dots, column white, the foot deep red-purple, becoming yellow with red-purple spots distally. *Sepals* narrowly linear with the base widest and concave, margins revolute, apex attenuate and circinate; dorsal sepal incurved towards the apex, 6.55 × 0.37 cm, 12-veined; lateral sepals falcate 6.08–6.54 × 0.26–0.57 cm, 11-veined. *Petals* narrowly linear, 4.42–4.74 × 0.16–0.32 cm, 7–8 veined, with the base widest and concave, margins revolute, apex attenuate and circinate. *Lip* three-lobed, elliptical, 1.14 × 0.78 cm; base scabrous, slightly truncate; callus oblong-elliptic, apex obtuse, smooth, extending from the base of the lip to the base of the mid-lobe, simple, verrucose at base; lateral lobes 0.54 × 0.23 cm entire, obtuse, elliptic; mid-lobe 0.44 × 0.68 cm, fleshy, broadly obovate, subtruncate, obtuse with a small mucron at the apex, thickened with a rugose surface, margins thinner, sub-crenate. *Column* stout, arching, with the apex broad. *Anther* apical, 0.3–0.4 cm long. *Stigma* ventral. *Pollinia* 2-paired, obovoid, 0.1 × 0.14 cm; viscidium inverted V-shaped, ivory-colored. *Fruits* saffron-colored, narrowly ellipsoid, 3.90 × 0.95 cm, dehiscent by 6 longitudinal slits.

Paratypes: **Colombia**. Huila: Municipio de San Agustín, Corregimiento de San Antonio, Parque Nacional Natural Puracé, Camino Nacional. 1.935, -76.586, WGS84. 3204 m. October 2022. *G.A. Pisso-Florez GAP 291* (CAUP 53406). **Ecuador**. Sucumbios: cerca de Huaca, 3100 m. October 2018. *L. Baquero LB-3143* (QCNE).

Etymology: Named in reference to the Andean region of Colombia and Ecuador in South America, where the new species was found. The Andean region is a key area for conserving the diversity of Maxillariinae species.

Distribution and ecology: *Maxillaria andina* is known from Camino Nacional (Fig. 2A), Paramo de Las Papas, PNNP, municipality of San Agustín, Department of Huila, southwestern Colombia (1.935, -76.586, WGS84), at 3204 m (Fig. 2B), with one individual observed at 3425 m in elevation (Fig 2C), and near Huaca, Sucumbíos province in northeastern Ecuador (0.610, -77.699, WGS84), at 3100 m in elevation (Fig. 3). At present, our observations suggest that the species has not yet been found in other localities, but it may be present in other high-Andean ecosystems in southwestern Colombia and northern Ecuador. The plant grows on the ground, surrounded by mosses (Fig. 2B). Colombian populations of this species are present in well-conserved high-Andean ecosystems inside the PNNP, with sympatric species such as *Blechnum loxense* (Kunth) Hieron. ex Salomon (Blechnaceae), *Bomarea linifolia* (Kunth) Baker (Alstroemeriaceae), *Calamagrostis* sp. (Poaceae), *Cortaderia* sp. (Poaceae), *Epidendrum fimbriatum* Kunth (Orchidaceae), *Epidendrum macrostachyum* Lindl. (Orchidaceae), *Macleania* sp. (Ericaceae), *Weinmannia* sp. (Cunoniaceae), all representative of the ecotone between sub-paramo and high-Andean forest. In Ecuador, a population of the *M. andina* was found growing in sub-paramo remnants of forest near the town of Huaca sympatrically with both species of *Epidendrum* mentioned above, but the native forest cover is rapidly disappearing due to strawberry

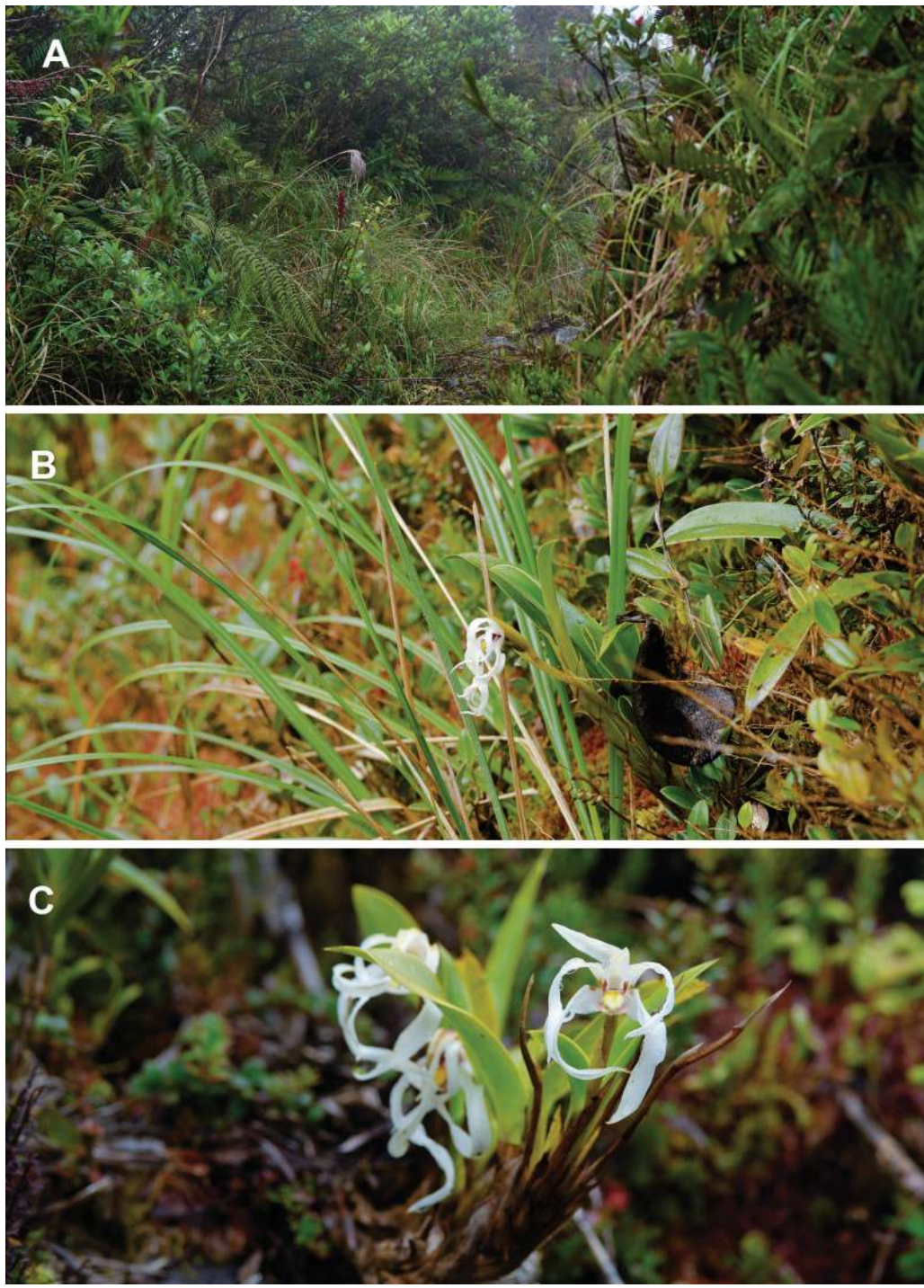

Figure 2. Habitat and habit of *Maxillaria andina* Pisso-Florez, J.S.Moreno, P.A.Harding & Baquero. **A**. The "Camino Nacional", a historical route traversing the southern portion of Puracé National Natural Park where the new species was found. Image of the plant *in-situ*. **B**. Lateral view (type specimen at 3204 m). **C**. Frontal view (individual observed at 3250 m). Photographs by G.A. Pisso-Florez

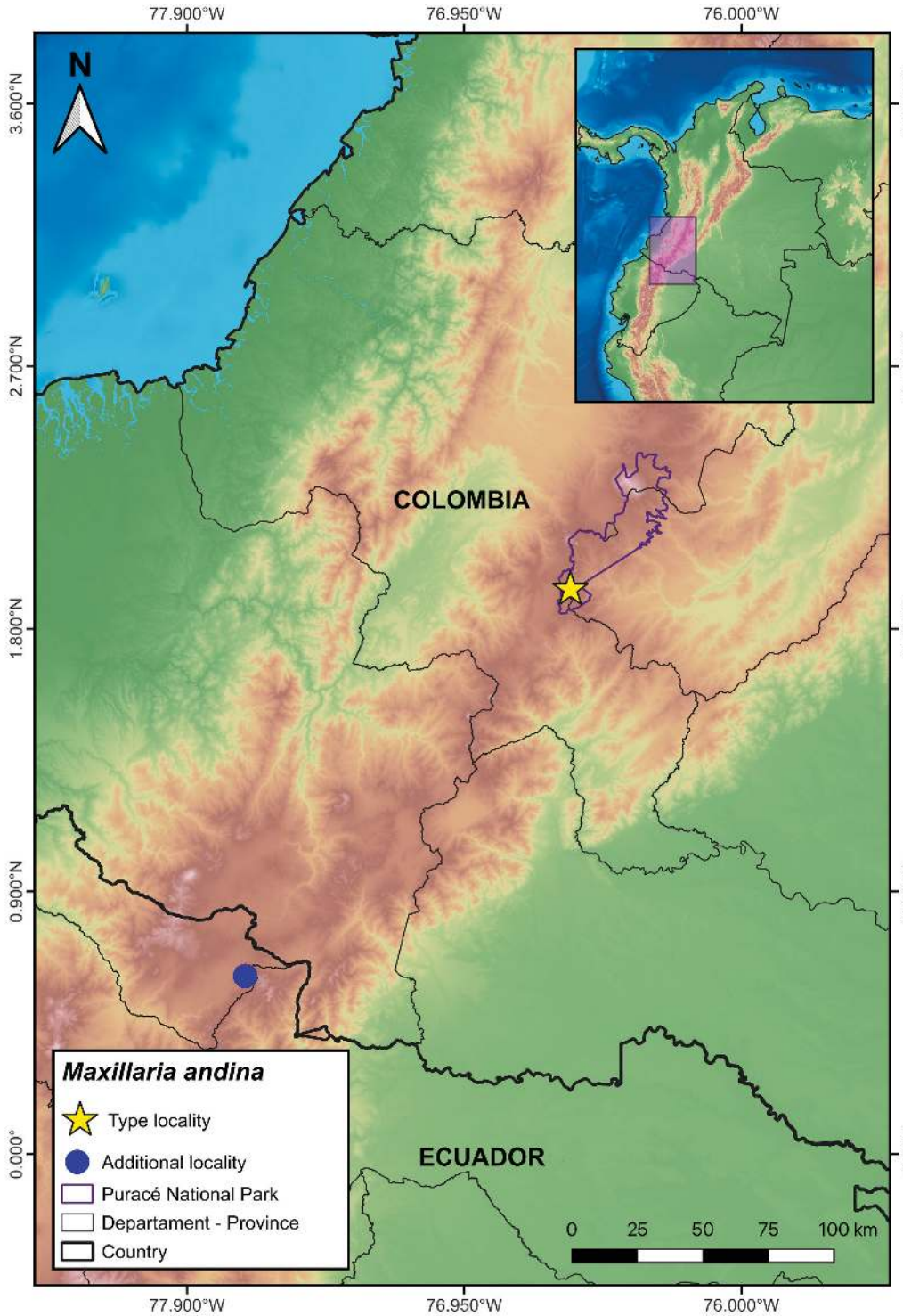

FIGURE 3. Geographical locations of *Maxillaria andina* Pisso-Florez, J.S.Moreno, P.A.Harding & Baquero in Colombia and Ecuador. Names in capital letters indicate countries.

cultivation and cow pastures and it does not occur in a protected area. On the other hand, we found populations of *M. floribunda* (Fig. 4) within PNNP growing sympatrically with *M. andina*, according to our field observations with unvouchered individuals. Given the little knowledge available for *Maxillaria andina*, we propose an IUCN categorization as data deficient (DD) because adequate information on population status and distribution to assess the conservation status of the species is unavailable.

Phenology: Flowering occurs from August to March (Figure 2B–C), with additional observations of immature fruits in March. The records from August and March are based on unvouchered observations.

Additional notes: The University of Florida Herbarium website provides compilation of early drafts for the project "Phylogenetics of Maxillariinae" and includes proposed *Maxillaria* species alliances (Atwood *et al.* 2015). Though not all of these alliances have been formally recognized, the authors do provide their thoughts on species that would fit into each alliance. They list a "Floribunda Alliance", including species such as *Maxillaria caveroi*, *M. dodsonii* (Carnevali) Molinari, *M.* × *dunstervillei* Carnevali & I.Ramirez, *M. floribunda*, *M. merana* Dodson, *M. platyloba* Schltr., *M. quelchii* Rolfe, and *M. yanganensis* Dodson.

This alliance shares the traits of having crawling, rambling growth habit, long rhizome segments between pseudobulbs, oblong leaves, long thin tepal segments, a lip mid-lobe that is thickened with a rugose or scaly surface and with thinner margins.

Maxillaria andina, having the characteristics of a rambling growth habit, long rhizome segments between pseudobulbs, oblong leaves, long, narrow tepal segments, and most notably a lip mid-lobe that is thickened with a rugose or scaly surface with thinner margins, fits into this "Floribunda Alliance". The species is distinguished from others by occurring at higher elevations than other members of the alliance, except *M. floribunda,* which has been recorded at 3500 m a.s.l. in La Paz-Bolivia (Herbario Nacional de Bolivia: *LPB 3843*), the color of the flower being white with deep purple on the margins of the lip and base of the column, and the central portion of the lip mid-lobe yellow. The base of the callus is scaly and irregular; some species in this alliance have trichomes on the callus and even on the surface of the lip, but none are described as having a callus that is rough at the base and smooth apically. A comparison of flower, ovary, column and lip of *M. andina* with those of the most similar species, *M. floribunda*, is shown in Figure 5.

A new synonym of *Maxillaria floribunda*. Szlachetko *et al.* (2017) described and illustrated six new *Maxillaria* species from the Department of Putumayo in southwestern Colombia. Among these species, *Maxillaria sibundoyensis* was described, and it was compared with *Maxillaria floribunda* in the diagnosis and discussion as the most similar species. They state that *M. sibundoyensis* can be distinguished by the wider, linear-ligulate to linear-lanceolate sepals and petals, compared to the lanceolate sepals and petals of *M. floribunda*. However, in the extended description of *M. floribunda* by Schweinfurth (1945), the sepals and petals are described as linear-lanceolate, which is the same shape as in the new species' description. Szlachetko *et al*. (2017) ignored that the species they described has the same shape and size of sepals and petals as *M. floribunda*.

Szlachetko *et al.* (2017) also described the lateral lobes of the lip in *M. sibundoyensis* as obliquely triangular-obovate with rounded apices, contrasting to *M. floribunda*, whose lateral lobes they describe as obliquely elliptic and acute. However, the lateral lobes in *M. floribunda* display a broad variation in shape. In this way, the original description by Lindley (1845) does not detail the shape of the lateral lobes specifically but describes the lip as oblong and three-lobed, with an oblong and concave callus and lobes obtuse, and a fleshy, elongated mid-lobe ("*…labello oblongo trilobo callo oblongo excavato in medio laciniis obtusis intermedia carnosa longiore…*") (Lindley 1845). In other published descriptions of *M. floribunda* (Bennett & Christenson 2001, Dodson & Bennett 1989, Dunsterville & Garay 1979), the lateral lobes are described as obliquely oblong (e.g., Fig. 6), which is practically the same description as the lateral lobes of *M. sibundoyensis*. Similarly, the mid-lobe in *M. sibundoyensis* is described as transversely elliptic to rhombic, with an oblong, thick callus that, at its basal part, is covered by erect, somewhat thick hairs. In contrast, the mid-lobe in *M. floribunda* was originally described as fleshy and longer (Lindley 1845), while Bennet and Christenson

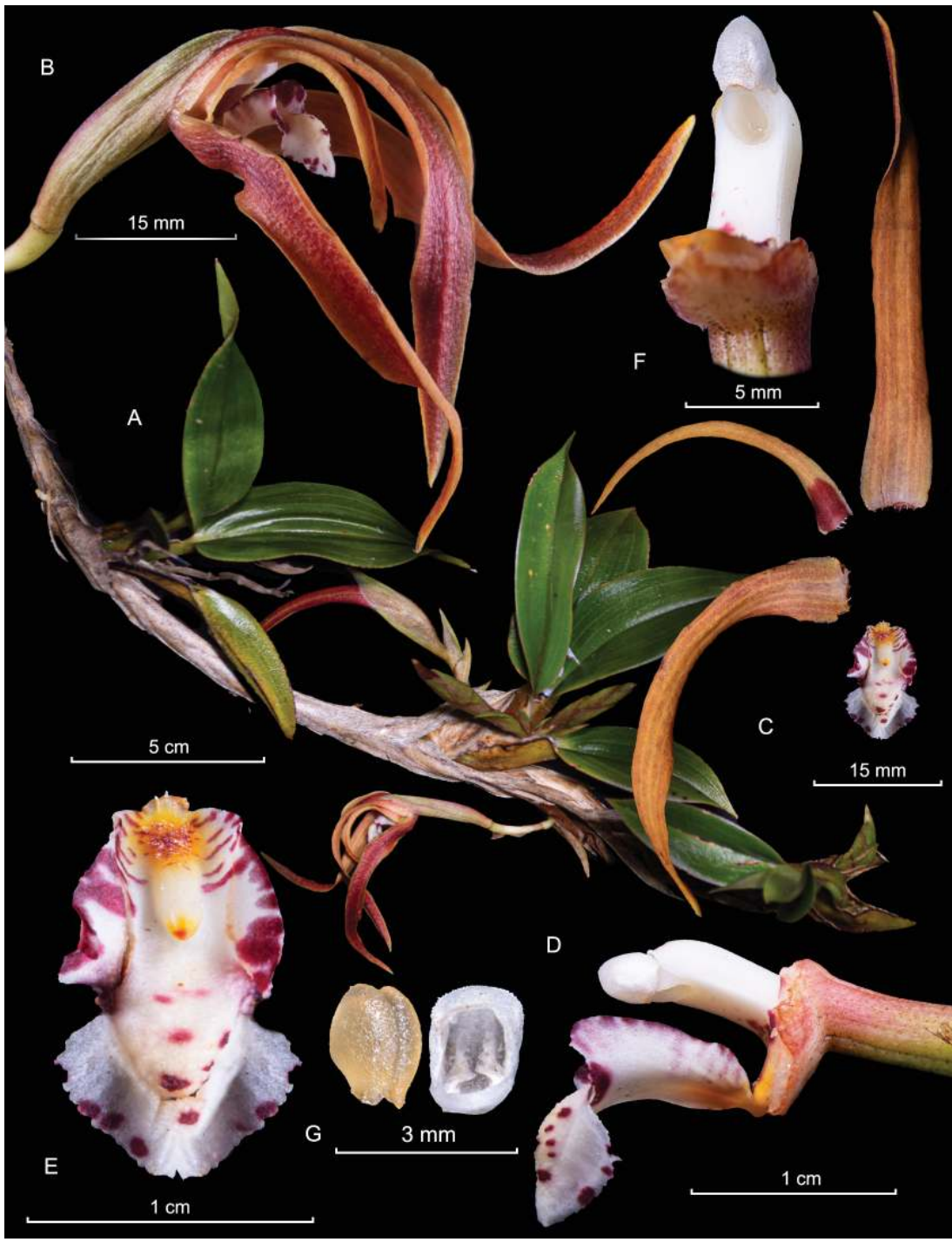

FIGURE 4. *Maxillaria floribunda* Lindl. **A**. Habit. **B**. Flower. **C**. Dissected perianth (one of the lateral sepals and one of the lateral petals omitted). **D**. Ovary, column and lip, lateral view. **E**. Adaxial view of lip. **F**. Column, oblique view. **G**. Anther cap and pollinia. LCDP by J.S. Moreno based on collected specimen by G.A. Pisso-Florez (*GAP 392*) in Puracé National Natural Park (CAUP!).

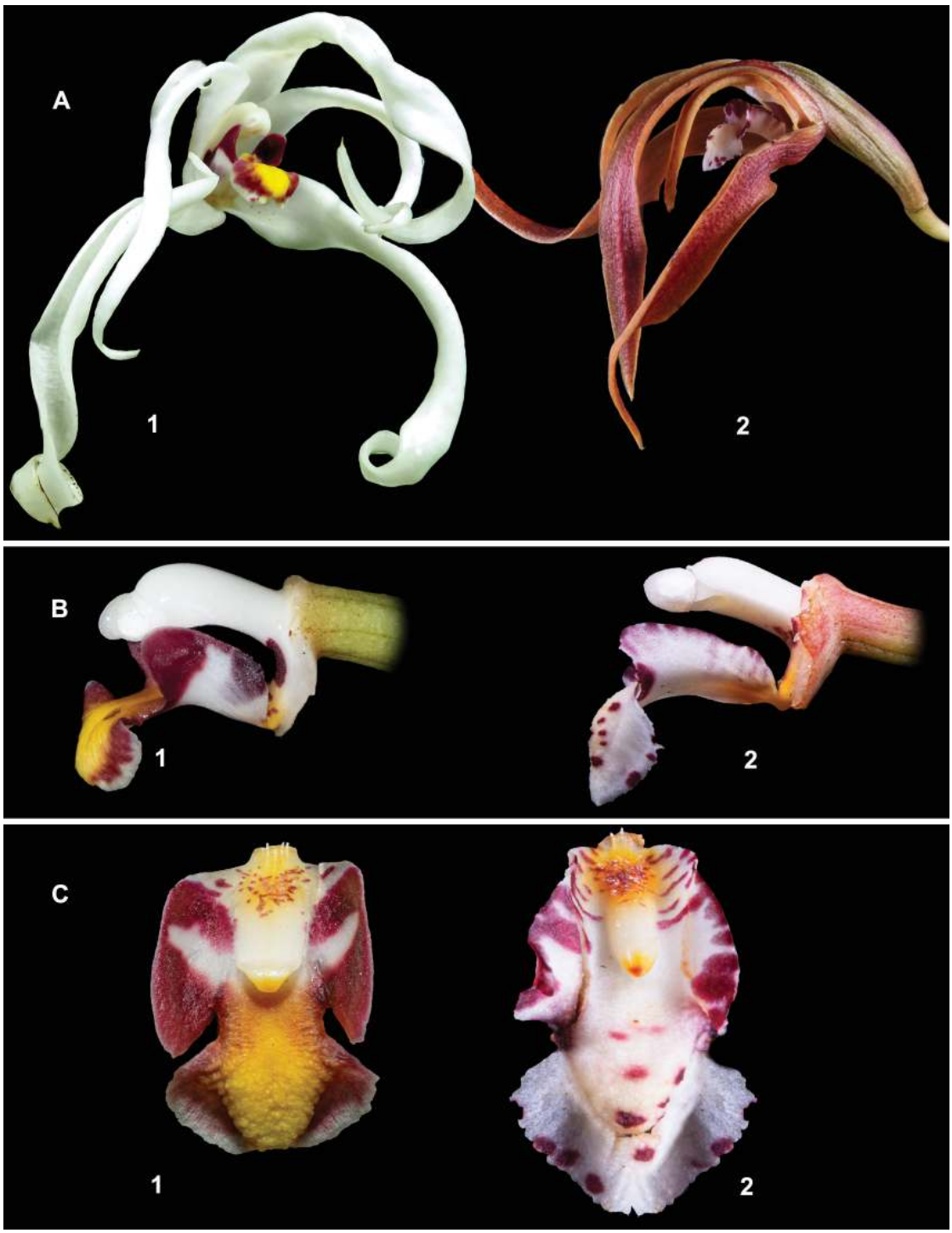

Figure 5. Comparison of *Maxillaria andina* (1) and *Maxillaria floribunda* (2). **A**. Flowers. **B**. Ovaries, columns, and lips. **C**. Lips (not flattened). Photographs by G.A. Pisso-Florez and J.S. Moreno based on the holotype of *M. andina* and collected specimen by G.A. Pisso-Florez (*GAP 392*) in Puracé National Natural Park (CAUP!).

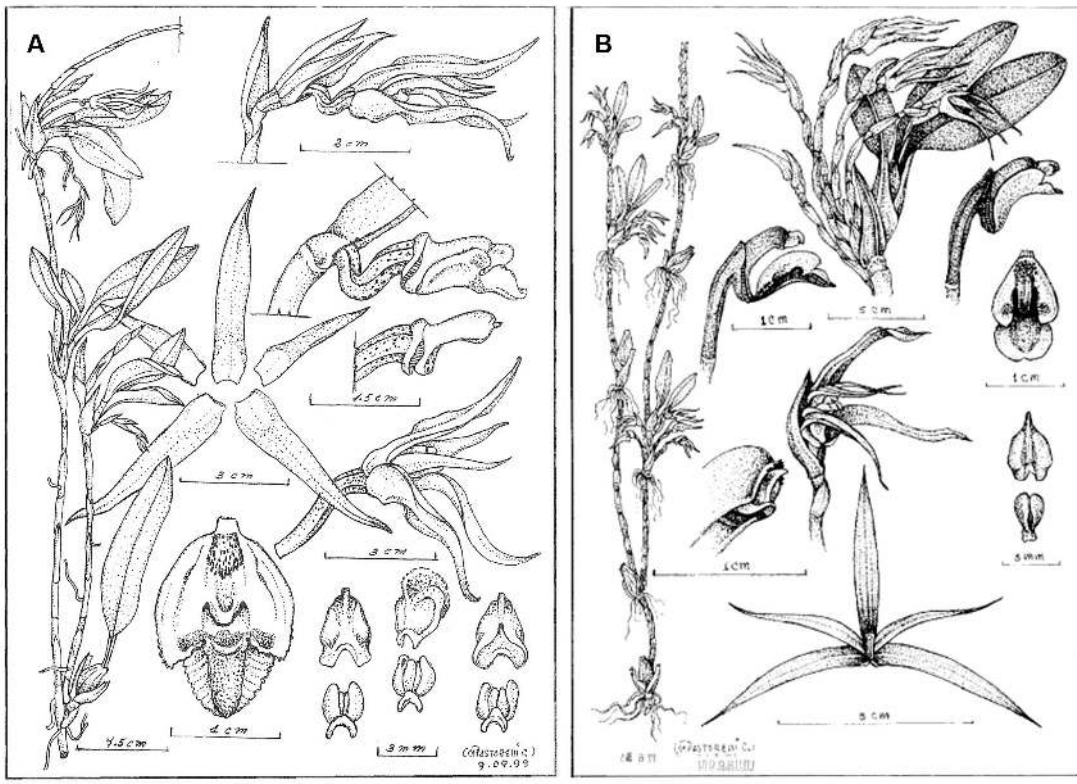

FIGURE 6. Drawings of *Maxillaria floribunda* Lindl. **A**. Drawing by M. Pastorelli A., Plate 693 in Icones Orchidacearum Peruviarum (Bennett & Christenson 2001). **B**. Drawing by M. Pastorelli, Plate 106 in Icones Plantarum Tropicarum, Series II (Dodson & Bennett 1989).

(2001) described it as transversely broadly ovate to suborbicular, with an oblong and scabrous callus in the basal part. Furthermore, the description of *M. floribunda* by Schweinfurth (1945) mentions a mid-lobe that is transversely broadly oblong or reniform and broadly ovate. These descriptions could represent a broad variation of the transversely elliptic to rhombic mid-lobe, including the shape of *M. sibundoyensis*. Finally, in the description of *Maxillaria floribunda* of Bennett and Christenson (2001), it is clearly shown that the lip is slightly verrucose or verruculose and spiculate at the base, which is what Szlachetko *et al*. (2017) describe as "thick hairs at the base," and not scabrous.

Maxillaria floribunda, a species distributed throughout the Andes from Venezuela to Bolivia, is, in fact, a variable species in the shape of the plant due to its prolific and terrestrial habit and varies in the coloration of the flowers in the sepals and petals, which can vary in color from white tinted with yellow to orange, red-brown tinted with orange along the margins, and in some specimens, red with the base of the sepals and petals white on the adaxial and abaxial surfaces (Fig. 7).

For the reasons mentioned above, we consider *Maxillaria sibundoyensis* as a synonym of *Maxillaria floribunda.*

Maxillaria floribunda Lindl. Plantas Hartwegianas imprimis Mexicanas 154. (1845). TYPE: Ecuador. Hartweg collected the specimens in this country extended to the Río Marañón and the capital of the Province, [Date unknown], *K. T. Hartweg 851* (holotype, (K), K000793155).

Maxillaria sibundoyensis Szlach., Kolan., Lipińska & R.Medina. Botany Letters 164 (2): 162–163 (2017), ***syn. nov.*** Type: Colombia. Putumayo: Mpio. San Francisco, collected in the place called La Torre, La Siberia pathway, [6 Jul 2009], *R. Medina 345* (holotype, HPUJ !).

Figure 7. Color and shape variation of *Maxillaria floribunda* Lindl. throughout the Andes. **A**. Photograph by Nelson Apolo in Yangana, Ecuador. **B**. Photograph by Alfredo F. Fuentes (*Fuentes 8703*, BOLV, HSB, LPB, MO) in Bolivia. **C**. Photograph by Thibaud Aronson in Peru. **D**. Photograph by Eric Hunt in Peru. **E**. Photograph by Brayan Coral Jaramillo from Putumayo, Colombia.

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