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Cover: *Neea gustaviaefolia* Aymard (See page 406, Fig. 1).
Drawn by M. Morales Sánchez based on the holotype (COL).

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WITH GREAT BIODIVERSITY COMES GREAT RESPONSIBILITY: THE UNDERESTIMATED DIVERSITY OF *EPIDENDRUM* (ORCHIDACEAE)

ADAM P. KARREMANS[1,2,3]

Abstract. *Epidendrum* (Orchidaceae) has been suggested to be a promising model system for evolutionary and ecological studies in the Neotropical region. Given its species diversity, the broad biogeographical and ecological range, and the variation in morphology, chromosome numbers and ecological interactions, the genus presents a rich source for intriguing and yet unanswered questions. *Epidendrum* is also a prime candidate to study speciation and this makes establishing precise species boundaries and diversity estimates in the genus extremely important. Through the recognition and discovery of hundreds of undescribed taxa, the number of formally described *Epidendrum* species has grown from 1000 to 1800 in the last two decades, while projections suggest the genus may have up to ca. 2400 species. This notorious underestimation of species diversity has serious consequences in many macroecological studies, including speciation, biogeographical patterns, diversification processes, and conservation priorities. Such a large number of unrecognized species in the genus has multiple unforeseen negative consequences and closing the gap between the described and projected diversity needs to become a priority. The isthmus of Costa Rica and Panama, one of the most biodiverse regions in the world, is also a center of diversity of *Epidendrum*. One out of every six species in the genus is present in the region and half of them are endemic. In the current paper, 20 new species are described from the isthmus and new records and exclusions are presented for both countries. Many of the newly recognized species had previously been included within broader circumscriptions of other taxa or had simply been misidentified. They represent a good example of how taxonomy can cause a sudden shift from a scenario where a few broadly distributed and unthreatened species become multiple potentially threatened species for which the population size, distribution and conservation status need to be urgently established. *Epidendrum* is the most specious orchid genus in Costa Rica and Panama, as well as most other Latin American countries, but species are poorly represented in herbaria and literature, and indetermination or incorrect determination of specimens is widespread. This results in a severe underestimation of *Epidendrum* species both in terms of species richness and their conservation priority levels.

Keywords: conservation, Costa Rica, Neotropics, new species, Panama, taxonomy, speciation

Epidendrum L. (Orchidaceae: Laeliinae) is a highly diverse and ubiquitous orchid genus endemic to the Neotropics. Species of *Epidendrum* may be found growing from North Carolina in the United States to Argentina, through Central America and the Antilles, and from sea level to about 4000 m elevation, covering virtually every type of habitat in the tropical and subtropical new world. They are recognized by the usually thick stems, with distichous leaves, apical inflorescences and flowers with the lip frequently fused to the column (Hágsater et al., 2003). The highest diversity is found in the mid to high elevation mountains of the Andes, especially Colombia, Ecuador, and Peru, but also in neighboring countries (Hágsater and Soto-Arenas, 2005; Hágsater et al., 2016). The isthmus of Costa Rica and Panama in Central America is a relatively small geographical area which nonetheless contains more than 10% of all known orchid species (Bogarín et al., 2013), giving it one of the highest species densities worldwide (Karremans and Bogarín, 2013). The isthmus has been shown to have a crucial role as biotic source for Neotropical Orchidaceae biodiversity (Pérez-Escobar et al., 2017), and with hundreds of species and tenths of dozens of endemics (Bogarín et al., 2016), it is another *Epidendrum* hotspot.

The painstaking effort to illustrate and describe the diversity of *Epidendrum* has been the focus of the AMO herbarium in Mexico for the last three decades or so, monographing hundreds of species, old and new, within the series *Icones Orchidacearum*: The genus *Epidendrum* (Hágsater and Salazar, 1993; Hágsater et al., 1999; Hágsater and Sánchez-Saldaña, 2001, 2004, 2006, 2007, 2008, 2009, 2010, 2013, 2015, 2016; Hágsater and Santiago, 2018a, 2018b, 2019, 2020a, 2020b, 2021). In 1993, upon publishing the first fascicle of *Icones Orchidacearum*: The genus *Epidendrum*, Hágsater noted that "little is known

First and foremost, I would like to thank the three people to whom taxa are dedicated in this manuscript. My wife Miriam and my mother Rossana, who have always supported my work and curiosity. I hope this minor gesture of gratitude and recognition can bring them some comfort in what has been a challenging year. My friend Rudolf, who's untimely passing came as a shock and has left an immense void. Thank you for your help and encouragement. I would also like to thank Eric Hágsater and Julián Duarte Salinas who have been instrumental in facilitating the study of *Epidendrum* and accessing the materials kept at AMO. Lizbeth Oses is thanked for her kind help in accessing and processing the materials at JBL. Mike Grayum kindly assisted in retrieving and scanning specimens at MO. Gustavo Romero and Irina Ferreras provided access and feedback on materials at AMES. Armando Estrada kindly received me at CR. Isler Chinchilla and Miriam Contreras enthusiastically accompanied me to the field on several occasions to gather much of the living materials on which this manuscript is based. Gustavo Romero and William Cetzal Ix are thanked for their feedback and sharing the information on *Epidendrum* diversity presented in Table 2. Gerson Villalobos, Gustavo Rojas, Giovanni Meza and the Horticulture staff at JBL are thanked for cultivating and caring for the living collection. Grettel Salguero, Melissa Díaz Morales, Gustavo Rojas Alvarado, Karen Gil, Youri Witmer and Eberhard Kaes kindly helped to photographically document *Epidendrum* species. Melania Fernández, Noelia Belfort, Jorge Warner and other colleagues at JBL have also supported this study in other ways through the years and are thanked. Sara Díaz Poltronieri kindly prepared the excellent ink illustration reproduced here. Special thanks to Diego Bogarín and Franco Pupulin for stimulating my work on *Epidendrum* through the years and for sharing their vast knowledge and materials on orchids of Costa Rican and Panama. We are thankful for the scientific services of Costa Rican Ministry of Environment and Energy (MINAE) and its National System of Conservation Areas (SINAC) for issuing the Scientific Passports under which the species treated in this study were collected.

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about the ecology of most *Epidendrum* species," and shortly after, the author estimated the diversity of *Epidendrum* at around 2000 species (Hágsater et al., 1999), which meant a whopping increase of 100% on the ca. 1000 species of *Epidendrum* described at that time. After carefully inspecting hundreds of herbarium specimens from diverse countries he cautioned "what seemed to be variable species have turned out to be groups of well-defined species." Not surprisingly, since then more or less 800 species and nothospecies of *Epidendrum* have been formally published, bringing the total number of accepted taxa in the genus to 1800, significantly closing the gap between formally recognized and estimated diversity. However, the authors have since also increased their projection to 2400 species (Hágsater et al., 2016), which would make *Epidendrum* the largest genus in Orchidaceae and one of the top three among vascular plants. It also means we are still far from grasping the full diversity of this genus (Table 1).

Why has the diversity of *Epidendrum* been so underestimated until recently? One critical issue pointed out by Hágsater and colleagues is "how poorly the diversity of species is represented in herbaria," coupled to the fact that "it is not until a number of species in a group have been cultivated together, illustrated and studied, that the specific differences become apparent," and they concluded "what seemed to be variable species have turned out to be groups of well-defined species." The key reasons *Epidendrum* diversity has been traditionally misjudged can be summarized in collection neglect or lack of representative specimens in herbaria and collections, and an overestimation of the natural variation of taxa. Contrary to what was believed before, there is a significant amount of local species radiation and endemism. The consequences of heavily underestimating the diversity of a genus like *Epidendrum* may be severe when it comes to conservation. Given the high degree of endemism in the genus it is quite likely that the populations of certain unrecognized taxa with very narrow distributions are highly threatened, and that such conservation priorities are being overlooked or overshadowed as a result of the misconception that *Epidendrum* species are common and widespread. Even though the outcome of a few recent studies has been the reduction of species diversity in the genus (Pessoa et al., 2020), the vast majority of works result in a continuous increase in the numbers of *Epidendrum* species recognized (e.g., Zambrano Romero et al., 2021).

TABLE 1. *Epidendrum* species, endemics and IUCN assessed.

REGION	SPECIES (ENDEMICS)/SPECIES PROJECTED	SPECIES IUCN ASSESSED (PERCENT)
Costa Rica (2002)	162* (29.6%*)	–
Costa Rica (2021)	247 (36.2%**)	5 (2%)
Panama	207 (23.1%**)	4 (1.9%)
Isthmus	310 (ca. 50%**)	6 (2%)
New World (1999)	1000 / 2000***	–
New World (2021)	1800 / 2400***	24 (1.3%)

* According to Pupulin (2002).
** Based on Bogarín et al. (2016).
*** Estimated by Hágsater et al. (1999) and Hágsater et al. (2016) respectively.

In Costa Rica and Panama, species of *Epidendrum* are mainly distributed in the wet, montane and cloud forest, between 1000 and 2500 m elevation (Hágsater et al., 2003). Nevertheless, *Epidendrum* species can be found virtually anywhere in both countries and the genus is by far the most species rich of both their orchid floras (Bogarín et al., 2016). Dozens of species have been added in recent years as new species and new country records are discovered in little explored areas and within species complexes (Hágsater and Sánchez-Saldaña, 2004, 2006, 2008, 2009, 2013; Bogarín et al., 2008; Karremans and Hágsater, 2010; Pupulin and Karremans, 2010; Karremans et al., 2012; Fernández et al., 2014; Díaz-Morales and Karremans, 2016). The unpublished updated catalogue of Costa Rican Orchidaceae (Pupulin, Bogarín and Karremans, in prep.) lists 223 *Epidendrum*. Here, 20 new species are described from the country, five species are newly recorded, and one is excluded. Therefore, Costa Rica currently holds 247 species of *Epidendrum*, a 52 % increase from the 162 species registered by Pupulin (2002) in the previous catalogue, twenty years ago. This substantial increase of 85 species—which roughly corresponds to the whole orchid diversity of countries such as the UK and The Netherlands—is a clear indication that the country is a center of diversity for *Epidendrum*, and Orchidaceae in general. The catalogue of orchids of Panama is much more recent (Bogarín et al., 2014), and just one *Epidendrum* novelty from the country has been described since (Hágsater and Sánchez-Saldaña, 2016). Two new species and a new record are added here, but two previously registered taxa are also excluded from the country, with a total of 207 species recognized (Table 1).

By carefully studying the species of the *Epidendrum anoglossoides* Ames & C.Schweinf., *E. rugosum* Ames and *E. sanchoi* Ames complexes in Costa Rica and Panama it has become apparent not only that there is much more diversity in this group than previously thought, but also that despite being locally abundant, each species clearly has a relatively narrow distribution, with many taxa growing only on a particular mountain range at a specific elevation. As soon as this habitat changes so does the species of *Epidendrum*. Both *E. rugosum* (Hágsater and Sánchez-Saldaña, 2007) and *E. sanchoi* (Hágsater and Sánchez-Saldaña, 2008) were circumscribed much more broadly than in the current paper, here several additional species are recognized in these complexes. It is certain that additional novelties will indeed be found in the future and it is best at this time not to speculate on the identity of all the specimens included in the records under those names without reinspecting them. The fact is, I have only seen plants of both species growing near the city of Cartago where they were originally discovered by Charles Lankester and can only speculate about what their true distribution may be.

The full list of taxonomic changes proposed herein is the following: *Epidendrum anoglossoides*, *E. bilobatum* Ames, *E. microcardium* Schltr., *E. rugosum* and *E. sanchoi* are recircumscribed. The former Panamanian endemics *Epidendrum bugabense* Hágsater, *E. cymbiglossum* Hágsater, *E. gymnochlamys* Hágsater & E.Santiago and *E. longibracteatum* Hágsater, as well as *E. vexillium* Hágsater, previously known to occur in Panama and Colombia, are recorded from Costa Rica for the first time. The former Costa Rican endemic *E. jorge-warneri* Karremans & Hágsater is reported for Panama. The reinterpretation of specimens of *Epidendrum unicallosum* Hágsater & E.Santiago from Costa Rica result in its reinstatement as a Panamanian endemic. *Epidendrum anoglossoides* and *E. rugosum* are excluded from Panama. The following novelties from Costa Rica and Panama are proposed: *Epidendrum aeolicum* Karremans, *E. bicentenarium* Karremans & Gil-Amaya, *E. capitalinum* Karremans, *E. chespiritorum* Karremans, *E. colibri* Karremans, *E. conservatorum* Karremans, *E. globuliferum* Karremans, *E. iricolor* Karremans, *E. mantabirostris* Karremans, *E. miriamae* Karremans, *E. nativitatis* Karremans, *E. rossanae* Karremans, *E. rudolfii* Karremans, *E. saltatrix* Karremans, *E. santaelenae* Karremans, *E. sidereum* Karremans, *E. sinac* Karremans, *E. spiculiferum* Karremans & Bogarín, *E. usurpator* Karremans, and *E. utyumii* Karremans.

MATERIALS AND METHODS

The examination of living plants, both in the field and cultivation, is a strong component in this study, allowing for a more refined assessment of morphological and geographical variation. This is especially needed in the *E. anoglossoides*, *E. rugosum* and *E. sanchoi* species complexes where many distinct entities have been included under broadly circumscribed species concepts because of their overall similarity. Species in these groups may be locally abundant, which helps when assessing their natural variation, but they are typically restricted in distribution with different species found on different mountain chains and at different altitudinal ranges.

The plant collection and documentation mostly followed the methods described by Pupulin et al. (2021). Living plants intended for this study were collected between 2005 and 2021 and cultivated at Lankester Botanical Garden (JBL, its acronym in Spanish), University of Costa Rica. Whenever possible, type localities and other critical localities were visited for plant collecting and subsequent study. At JBL plants were individually labelled and cultivated, field data was recorded and stored in the general databases. Photographs were mostly taken with Nikon cameras (D5200, D7100, D810) mounted on Manfrotto tripods, fitted with macro lenses (Micro Nikkor 105mm AF f/2.8, Sigma DG Macro HSM 105mm f/2.8). Images were optimized through post-processing with Adobe® Photoshop CS5 and CS6, and comparative plates of flowers and/or relevant floral details were also prepared using the same software. One or more vouchers for each specimen were conserved in the liquid collection of JBL.

Standard conditions of each organ, such as green leaves, glabrous perianth parts or regular and straight margins, are not mentioned expressly in any description. Descriptions are based on the type specimen unless specified otherwise. The dissected perianth is always shown in a resupinate position in the LCDP even when the flowers are are naturally non-resupinate, their natural orientation is always shown in the flower detail. The measurement of the lip always includes the basal section fused to the column.

The possibility of physical inspection of herbarium specimens for the current study has been reduced due to the travel and visitation restrictions imposed worldwide during 2020 and 2021, as a consequence of the pandemic caused by COVID19. Specimens cited here have been assessed physically or through digital photographs by the author. Specimens listed by other authors under the taxa here discussed have been expressly excluded when direct inspection and/or determination was not possible. This is necessary because herbarium materials of closely related taxa are difficult to distinguish and erroneous determinations are the rule rather than the exception.

TAXONOMIC TREATMENT

The lack of a formal subgeneric classification of the mammoth genus *Epidendrum* makes it challenging to treat the many species alliances which are found in the genus. Hágsater and colleagues have proposed groups and subgroups of species which are extremely useful in treating discrete taxa. Unfortunately, being informal they lack a clear phylogenetic placement, circumscription, and hierarchy. The proposal of a formal subgeneric classification of *Epidendrum* is a pressing necessity but is beyond the scope of the current paper. For the time being, reluctantly, the informal groupings are used to be able to place and treat the species according to their closest relatives.

Neowilliamsia Group

Hágsater and Sánchez-Saldaña (2007) informally characterize species belonging to the "Neowilliamsia Group" by the ancipitose stems and rachis, the rachis with conduplicate, acute bracts, distichous, usually non-resupinate flowers, the lip often digitate and the 2–4 pollinia with 2 hard, laminar, caudicles.

Epidendrum cymbiglossum Hágsater, Icon. Orchid. 2: pl. 126. 1993. TYPE: PANAMA. Chiriquí: Distr. Bugaba, Santa Clara, 8°50'N, 82°44'W, to Cerro Pando, *H. van der Werff 7186 and J. Herrera* (Holotype, SEL [not seen]; Isotypes, MO, SEL [not seen]).

Epiphytic, erect *herb*, somewhat scandent, up to 10 cm tall, excluding the inflorescence. Roots 1 mm in diameter, fleshy. *Stems* erect to arched, laterally compressed, born from an internode above the base of previous stem, covered by a papyraceous bract. *Leaves* up to 2–3, distributed only on the apex of the stem; leaf sheath 1–2 cm long, flattened, carinate; blade 4.5–7.0 × 1.7–2.0 cm, coriaceous, elliptic, unequally bilobed. *Inflorescence* up to 15 cm long, elongate, slightly sinuous, apical on mature stem, rachis flexuous, ancipitose. *Floral bracts* 1.0–1.5 cm long, ancipitose, carinate, shortly apiculate. *Flowers* up to 10, opening in succession, greenish-yellow throughout. *Ovary* 15–17 mm long, cylindrical, inflated towards the apex. *Sepals* free, spreading, recurved; dorsal sepal 13 × 5 mm, narrowly ovate-triangular, obtuse; lateral sepals 17.8 –18.2 × 7.0–7.5 mm deflexed, narrowly ovate-triangular, falcate, acute. *Petals* 13.0–13.3 × 4.0 mm, free, spreading, recurved, lanceolate, acute. *Lip* 18 × 9 mm, fused to the column only at the very base, entire, concave, trapezoid-elliptic, obtuse, unornamented. *Column* 13 mm long, broad laterally, ventrally narrowed, straight, apically rounded. *Anther* obovoid, 4-celled. *Pollinia* 4, obovoid, laterally compressed, caudicles hard. *Capsule* not seen. *Description based only on *Karremans 7575*.

Etymology: From Greek *kymbes*, boat-shaped vessel, and *glossa*, tongue, in reference to the concave, boat-shaped lip of this species.

Habitat and distribution: Only known from ca. 2100 m on the Pacific watershed of the southern Talamanca mountain range in Costa Rica and neighboring western Panama (Fig. 1).

Phenology: Collected in bloom in January and April.

Additional specimens examined: COSTA RICA. Puntarenas: Buenos Aires, Buenos Aires, camino a Cerros Utyum, 9°18'04.93"N, 83°12'51.59"W, 2157 m, bosque pluvial montano bajo, epífitas en bosque secundario,

FIGURE 1. View of the Talamanca mountain range in southern Costa Rica and western Panama, as seen from a collection site of *E. cymbiglossum* Hágsater, on the route to Cerros Utyum. By A.P. Karremans.

16 January 2017, *A.P. Karremans, D. Bogarín, M. Cedeño, I. Chinchilla, M. Díaz, E. Kaes, P. Lehmann and O. Zúñiga 7575* (JBL-J0652; Fig. 2). Buenos Aires, Buenos Aires, cerca de la división continental, cerro arbolado, entre cerro Durika y cerro Utyum, 9°19'15"N, 83°14'49"W, 2070 m, epífitas en bosque secundario. Transtalamanca, ruta de los conquistadores día 1, 24 April 2017, *A.P. Karremans, M. Cedeño, I. Chinchilla, E. Kaes, G.A. Rojas-Alvarado, O. Zuñiga 7726* (JBL-E1288).

Epidendrum cymbiglossum is closely related to the common *E. anoglossum* Schltr. but easily distinguished by the compact plants, with few apical leaves, a successive inflorescence bearing much larger flowers and a broad, elliptic-trapezoid lip. Previously known only from the type collected in Chiriquí, it is here recorded from Costa Rica based on material from high elevations on the Pacific watershed of the southern Talamanca mountain range.

Epidendrum wercklei Schltr., Repert. Spec. Nov. Regni Veg. Beih. 3: 48. 1906.
TYPE: COSTA RICA. [San José:] Bei [Alto de] La Palma, ca. 1500 m, October 1902, C. *Wercklé 16419* [Holotype, B, destroyed; drawings, based on Schlechter's analysis of type, published by Mansfeld (1931: pl. 59, fig. 234)]. Neotype, selected by Pupulin (2010), Costa Rica. [San José]: San Isidro de Coronado, 'Las Nubes,' 10 November 1932, *A.M. Brenes s.n.* [153 Serie de varios colectores] (CR).

Epiphytic, scandent *herb*, up to 1 m tall. Roots 1 mm in diameter, originating from the basal internodes of each stem, scarce, thin. *Stems* simple, produced from the lower internodes of the previous stems, cane-like, terete towards the base, laterally compressed above, thin, erect, straight, covered by rugose sheaths. *Leaves* up to 7, distributed on the apical half of the stem, the lower ones deciduous; leaf sheath up to 5 cm long, tubular, laterally compressed, ancipitose, minutely striated, transitioning from green to papery to brown with age; blades 6.5–7.8 × 1.3–1.6 cm, elliptic-lanceolate, acute, minutely apiculate. *Inflorescence* up to 20 cm long, apical, suberect to pendent, paniculate, many-flowered, flowering only once; peduncle laterally compressed, ancipitose, straight; rachis fractiflex, ancipitose. *Floral bracts* 2 mm long, notoriously shorter than the ovary. *Flowers* +65, opening almost simultaneously, creamish-white with dark-purple stripes and spots on the lip and occasionally on the sepals and petals, lip calli and column apex with bright yellow markings. *Ovary* 6.5–7.0 mm long, terete, thin. *Sepals* free, spreading widely, thick, obovate, obtuse, with a minute apiculum, margins microscopically glandular-irregular; dorsal sepal 3.9 × 2.2 mm; lateral sepals 4.5–4.7 × 2.5 mm. *Petals* 3.9–4.0 × 2.1–2.2 mm, free, partly spreading, somewhat concave above the middle, spathulate, broadly rounded, with a very small apiculate, apical margins minutely irregular. *Lip* 5.0 × 4.5 mm, fused to the column, free blade 3 mm long, conspicuously fringed-flabellate, fleshy, somewhat concave, the blade in shape broadly ovate to triangular, obtuse, ecallose, with 3 fleshy, thin keels, the lateral keels running from the blade base to the base of the midlobe, the central one longer, provided with 4-5 digitiform lobes on each side of the lanceolate midlobe. *Column* 3 mm, short, terete, straight with respect to the ovary, with a dentate clinandrium hood, and forming a narrow, conical, glandular, basal cuniculus with the lip. *Anther* sub-spherical, 2-celled, with a pair of long tails. *Pollinia* 2, obovoid, laterally compressed, caudicles laminar, notoriously larger than the pollen masses. Fragrance an intense sweet, coconut smell. *Description based only on *Karremans 8860*.

Etymology: The name honors Karl (Carlos) Wercklé (18 July 1860–24 November 1924), who extensively botanized in central Costa Rica from 1897 onwards.

Habitat and distribution: This species is a relatively common epiphyte at high elevations between 1500–1800 m north-east of San José in the Central Valley. Most specimens have been collected in the same general area around Zurquí and La Palma in the Braulio Carrillo National Park.

Phenology: It was recorded blooming between August and November.

Additional specimens examined: COSTA RICA. San José: Moravia, San Jerónimo, antes de llegar a túnel del Zurquí, sobre la Carretera que atraviesa el Parque Nacional Braulio Carrillo, 10°3'3"N, 84°0'20"W, 1610 m, 29 June 2021, prepared 21 October 2021, *A.P. Karremans and I. Chinchilla 8860* (JBL-spirit, Fig. 3). Moravia, San Jerónimo, 4–6 km norte del pueblo sobre camino conocido como "calle la torre," área de potreros para ganadería, árboles remanentes y pequeños fragmentos de bosque riparios, 10°1'7.9"N, 83°58'45.2"W, 1539 m, 4 Noviember 2008, *A. Cascante and E. Volio 2040* (CR-257611). Vásquez de Coronado: Braulio Carrillo National Park, Zurquí Station, around Alto La Palma, 10°3'00"N, 83°59'20"W, 1600 m, *S. Ingram and K. Ferrell 542* (CR; GH). La Palma de San José, 26 August 1940, *J. León 56* (CR-26639). Zurquí, September 1935, *J. Valerio 1183* (CR-25343). Zurquí, 1800 m, 28 October 1969, *L.D. Gómez 2422* (CR-57674). Cordillera Central en ciénega asbesta enmedio de selva de neblina entre La Palma y Cascajal, ca. 1500–1550 m, 7 October 1982, *E. Hágsater 6927* (CR; AMO; pl. 1000 in Hágsater and Sánchez-Saldaña 2007).

Epidendrum bicentenarium Karremans & Gil-Amaya, *sp. nov.*
TYPE: COSTA RICA. Heredia: Heredia, Vara Blanca, Calle la Legua, epífitas en bosque a orilla del camino, bosque pluvial montano bajo, 10°11'37.00"N, 84°7'41.12"W, 1745 m, 13 October 2021, *G. Rojas-Alvarado, I. Chinchilla and A.P. Karremans 577* (Holotype, JBL-spirit; Fig. 4).

Similar to *E. wercklei* but distinguished by the much larger flowers (more than double in area), the sepals 6.5–7.0 × 3.6–3.9 mm (vs. 3.9–4.7 × 2.2–2.5 mm), the petals 6.5–6.6 × 3.6–3.7 mm (vs. 3.9–4.0 × 2.1–2.2 mm) and lip 7.5–7.7 × 6.2–6.3 mm (vs. 5.0 × 4.5 mm), the greenish-white petals and sepals with dark-purple spots (vs. whitish-cream, sometimes with few purple spots), the lip with 7-8 digitiform lobes on each side of the midlobe (vs. 4-5 digitiform lobes on each side of the midlobe), the clinandrium erose and erect (vs. dentate and descending), the pollinarium with caudicles sub-equal to the pollinia (vs. caudicles notoriously larger) and the subtle disagreeable fragrance (vs. sweet, intense, coconut smell).

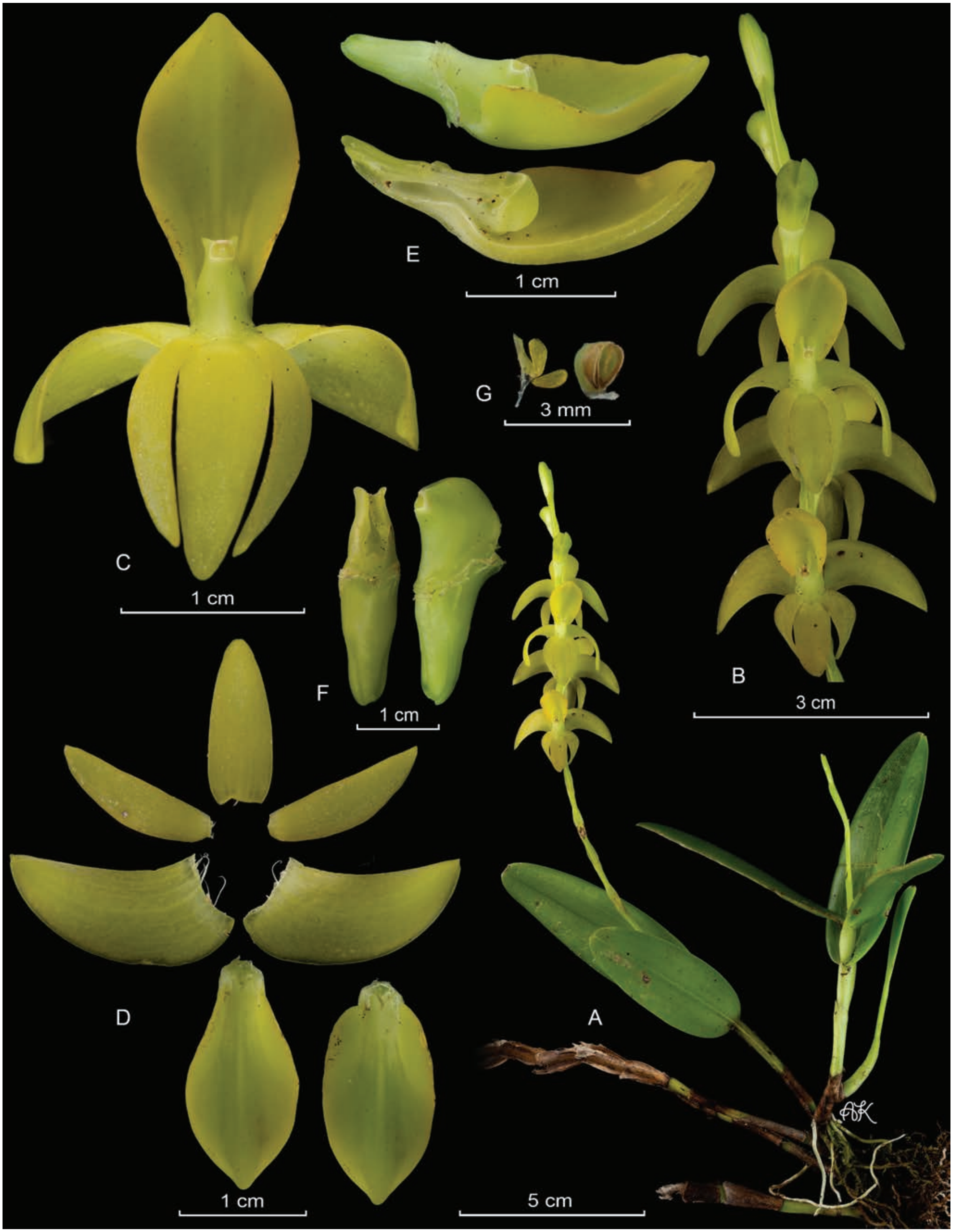

FIGURE 2. LCDP of *Epidendrum cymbiglossum* Hágsater. **A**, Habit; **B**, Inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view, and transversal section; **F**, Column, ventral and lateral views; **G**, Anther cap and pollinarium. By APK based on *Karremans 7575* (JBL-spirit).

FIGURE 3. LCDP of *Epidendrum wercklei* Schltr. **A**, Habit; **B**, Inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal section; **F**, Column, ventral and lateral views; **G**, Anther cap and pollinarium. By APK and K. Gil Amaya based on *Karremans 8860* (JBL-spirit).

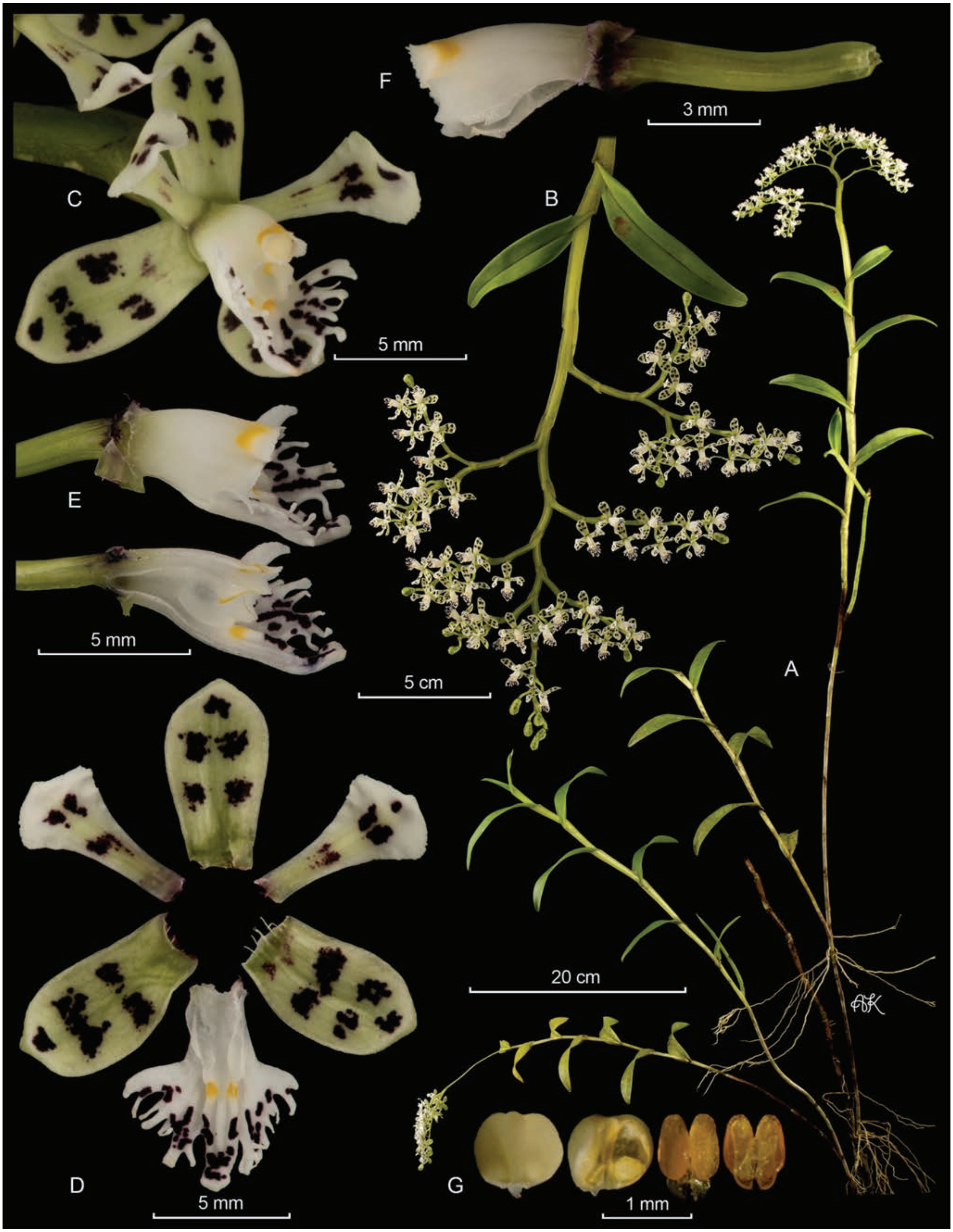

FIGURE 4. LCDP of *Epidendrum bicentenarium* Karremans & Gil-Amaya. **A**, Habit; **B**, Inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal section; **F**, Column lateral views; **G**, Anther cap and pollinarium views. By APK and K. Gil Amaya based on *Rojas-Alvarado 577* (JBL-spirit).

Epiphytic, scandent *herb*, up to 1 m tall. Roots 1 mm in diameter, originating from the basal internodes of each stem, scarce, thin. *Stems* simple, produced from the lower internodes of the previous stems, cane-like, terete towards the base, laterally compressed above, thin, erect, straight, covered by rugose sheaths. *Leaves* up to 9, distributed on the apical half of the stem, the lower ones deciduous; leaf sheath up to 6.5 cm long, tubular, laterally compressed, ancipitose, minutely striated, transitioning from green to papery to brown with age; blades 4.5–8.2 × 1.2–1.6 cm, elliptic-lanceolate, acute, minutely apiculate. *Inflorescence* up to 20 cm long, apical, suberect to pendent, paniculate, many-flowered, flowering only once; peduncle laterally compressed, ancipitose, straight; rachis fractiflex, ancipitose. *Floral bracts* 1.9–2.2 mm long, notoriously shorter than the ovary. *Flowers* +70, opening almost simultaneously, greenish-white with large, dark-purple spots on the sepals, petals, lip calli and column apex with bright yellow markings. *Ovary* 7.2 mm long, terete, thin. *Sepals* free, spreading widely, thick, obovate, obtuse, with a minute apiculum, margins microscopically glandular-irregular; dorsal sepal 6.8–7.0 × 3.6–3.8 mm; lateral sepals 6.5–6.7 × 3.8–3.9 mm. *Petals* 6.5–6.6 × 3.6–3.7 mm, free, partly spreading, somewhat concave above the middle, spathulate, broadly rounded, with a very small apiculate, apical margins minutely erose. *Lip* 7.5–7.7 × 6.2–6.3 mm, fused to the column, free blade 4.8 mm long, conspicuously fringed-flabellate, fleshy, somewhat concave, the blade in shape broadly ovate to triangular, obtuse, ecallose, with 3 fleshy, thin keels, the lateral keels running from the blade base to the base of the midlobe, the central one shorter, provided with 7-8 digitiform lobes on each side of the ligulate midlobe. *Column* 5.0–5.2 mm, short, terete, straight with respect to the ovary, with an erose clinandrium hood, and forming a conical, notoriously glandular, basal cuniculus with the lip. *Anther* sub-spherical, 2-celled. *Pollinia* 2, obovoid, laterally compressed, caudicles laminar. Fragrance a subtle disagreeable odor during the day.

Etymology: This striking new species honors the 200 anniversary of Costa Rican independence, officially celebrated on the 15th of September 2021.

Habitat and distribution: Currently known only from the Caribbean watershed of the Central and Tilarán mountain ranges in Costa Rica, where it grows as an epiphyte at high elevations between 1550 and 1745 m in elevation.

Phenology: It was recorded blooming from October to January.

Additional specimens examined: COSTA RICA. Puntarenas: Reserva Biológica Monteverde Road to divide, disturbed weedy forest edge and second growth, roadside, 10˚18'N, 84˚47'W, 1550 m, 5 January 1990, *W. Haber and W. Zuchowski 9738* (CR-164552).

Epidendrum bicentenarium is a large and attractive species closely related to and previously confused with *E. wercklei*, which is common in the Central Valley north-east of San José. However, the flowers of the new species are more than double in size, heavily spotted with purple, have a more prominent, erose and erect clinandrium, a larger cuniculus, the lip being more prominently fringed-flabellate, the caudicles sub-equal to the pollinia, and lack the characteristic coconut smell.

Oerstedella Group-Aberrans Subgroup.

The "Oerstedella Group" incorporates the members of the former genus *Oerstedella*, which can be recognized by the sympodial habit, verrucose stems, and the rostellum that is transverse to the column instead of parallel. Species informally placed in the "Aberrans subgroup" are recognized by the small, membranaceous flowers, with a prominent clinandrium-hood, and translucent, flattened, unequal pollinia, with the inner pair much smaller than the outer pair (Hágsater and Sánchez-Saldaña, 2006). To those features I would add that the inflorescence is typically sub-secund, the ovary crested-alate, the sepals thickened, with a prominent external elevated crest especially near the apex, and the anther is sub-rectangular and papery thin.

Epidendrum iricolor Karremans, *sp. nov.*

TYPE: COSTA RICA. Limón: Talamanca, Bratsi, Parque Internacional La Amistad, Valle del Silencio, alrededores de refugio, bosque pluvial montano, 2,462 m, 9˚06'41.81"N, 82˚57'42.44"W, 18 September 2014, *A.P. Karremans, M. Díaz, M. Fernández, C. Godínez, J. Godínez, L. Oses, J. Ramírez and D. Villalobos 6335* (Holotype, JBL [E1119]; Isotype, JBL [D6453]; Fig. 5).

Similar to *Epidendrum unicallosum* Hágsater & E.Santiago, but distinguished by the plants with shorter stems (10.3–11.7 vs. 22–42 cm tall), with fewer leaves (3–4 vs. +12), concentrated on the apical third of the stem (distributed along at least half of the stem), the sepals broader (3.5 mm vs. 2.8 mm), the shorter and broader (8.2 × 2.3 mm vs. 8.7 × 1.9 mm), obtuse (vs. acute) petals, and the significantly narrower lip (4.0–4.5 mm vs. 7.1 mm), that is almost completely covered by the clinandrium, the triangular (vs. elliptic) lateral lobes, and a sinuous column (vs. straight).

Epiphytic, sympodial, climbing *herb*, up to 20 cm tall including the inflorescence. *Roots* 2–3 mm in diameter, thin, fleshy. *Stems* 10.3–11.7 × 0.3–0.4 cm, erect, cane-like, terete, one or more produced from a middle internode of the previous stem, forming chains of multiple growths. *Leaves* 3–4, restricted to apical half of stem; leaf sheath 0.9–2.1 cm long, tubular, verrucose; blade 1.7–2.5 × 0.6–0.9 cm, articulate, lanceolate, acute, with margins entire. *Inflorescence* 2.0–2.5 cm long, apical, from mature growth, racemose, erect, lax. *Floral bracts* 2.0–2.5 mm long, up to 7 times shorter than the ovary, acute, incurved, green. *Flowers* 5–9, successive, 4–5 open at once, resupinate, sepals and petals whitish-pink to greenish-salmon, column pink, with a white apex. *Ovary* 1.5–1.7 cm long, cylindrical, thin, elongate, inflated ventrally behind the perianth, crested. *Sepals* free, spreading, 5-veined, apically thickened into a dorsal crest; dorsal sepal 8.1 × 3.5 mm, elliptic to narrowly oblanceolate, obtuse; lateral sepals 10.2 × 3.5 mm, elliptic, acute. *Petals* 8.2 × 2.3 mm, free, spreading, 3-veined, glabrous, margin entire, oblanceolate, obtuse. *Lip* 6.0–6.5 × 4.0–4.5 mm, fused to the column, trilobed, margin entire, white, callus single; lateral lobes triangular-narrowly ovate, acute, oblique, divaricate; midlobe ligulate, acute, with a pair of incipient apical triangular lobes. *Column* 6.5–7.0 mm long including the clinandrium-hood, straight, white to purple on the base; clinandrium-hood almost half the length of the column, margin crenate, white with purple

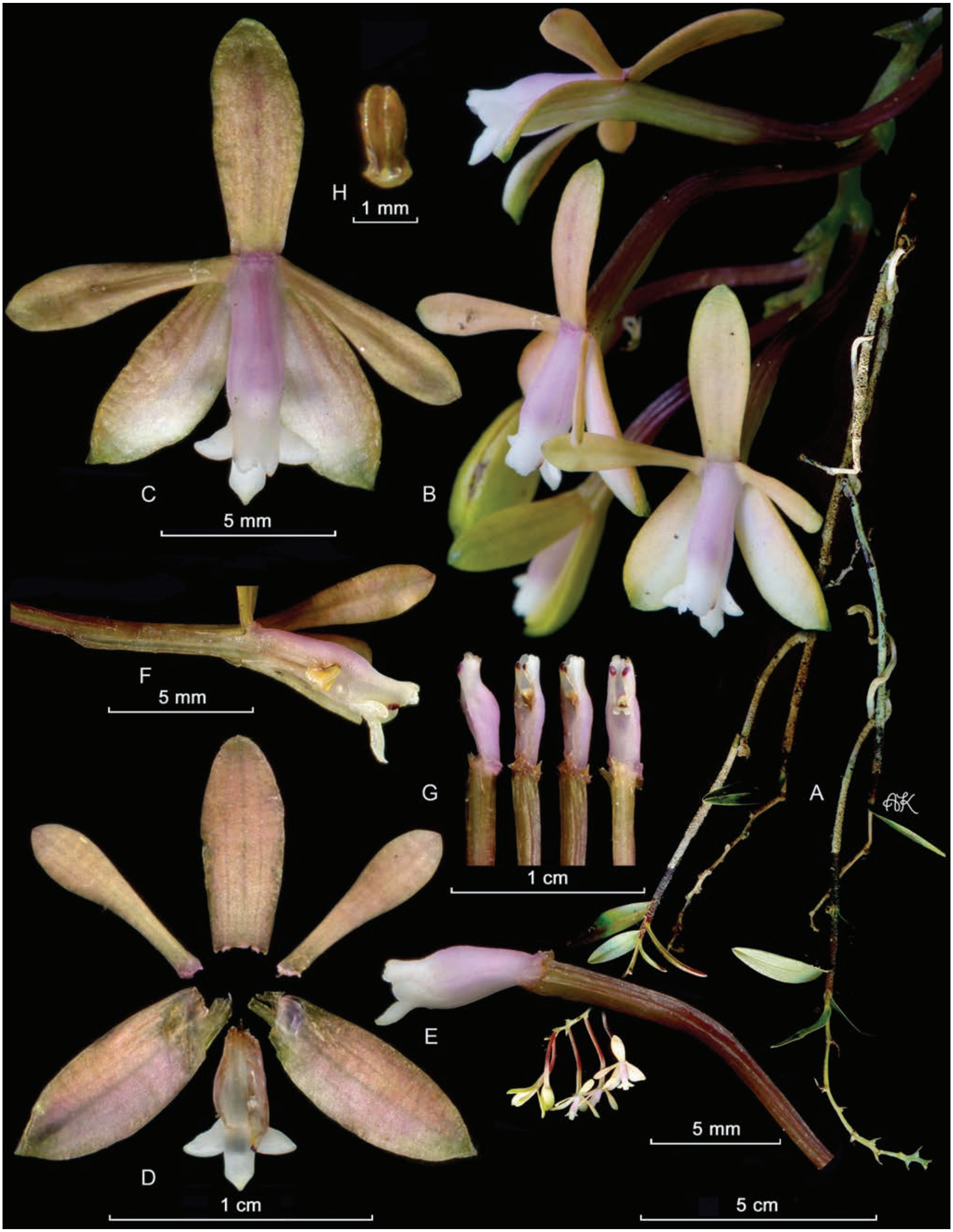

FIGURE 5. LCDP of *Epidendrum iricolor* Karremans. **A**, Habit; **B**, Inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view; **F**, Lip and column in transversal section; **G**, Column, ventral and lateral views. **H**, Pollinarium. By M. Díaz-Morales and APK based on *Karremans 6335* (JBL-spirit).

to red dots on outer crenations; rostellum perpendicular to the axis of the column. *Anther* ovoid, 4-celled. *Pollinia* 4, ovoid, laterally compressed, inner pair half the size of the outer pair. *Capsule* not seen.

Etymology: From the Latin *iris*, rainbow, in reference to the many colors of the flowers of this species which includes white, green, salmon, and pink, and changes notoriously with the age.

Habitat and distribution: Known from Valle del Silencio protected area in La Amistad National Park. It grows as an epiphyte in montane rainforest at above 2400 m elevation.

Phenology: Collected in bloom in September and November.

Additional specimens examined: COSTA RICA. Limón: Talamanca, Parque Internacional La Amistad (PILA), sector Altamira, Valle del Silencio, sendero a El Jardín, epífitas en bosque primario, bosque pluvial montano, 2550 m, 18 September 2014, *Fernández et al. 925* (JBL-spirit). Limón: Talamanca, Bratsi, Parque Internacional La Amistad, Valle del Silencio, orillas del Río Terbi cerca del andarivel, bosque pluvial montano, recolectada por D. Jiménez, 2462 m, 9°06'41.81"N, 82°57'42.44"W, 6 May 2013, *Bogarín 10133* (JBL-spirit). Limón: Talamanca, Parque Nacional La Amistad, Tararia, Valle del Silencio, 2 km antes del albergue, 2400–2500 m, 9°06'10"N, 82°58'25"W, 18 November 2004, *Soto and González 291* (CR-INB).

Díaz-Morales and Karremans (2016) mistakenly placed the specimens of *Epidendrum iricolor* under the name *E. unicallosum*, a species originally described from Panama. At the time the authors believed there was a single species with a three-lobed lip with a prominent clinandrium-hood that is longer than the body of the column and a thickened midlobe of the lip bearing triangular appendages near the apex, but in fact there are a few different species with these features. Two of them are described here on the basis of Costa Rican material, returning *E. unicallosum* to its status as a Panamanian endemic for now.

Epidendrum miriamae Karremans, *sp. nov*.
TYPE: COSTA RICA. Cartago: El Guarco, San Isidro, Madreselva, Tres de Junio, Carretera Interamericana Sur, 9°40'31"N, 83°53'33"W, 2530 m, bosque pluvial montano, en bosque secundario de Robles a orillas de la carretera, 19 June 2021, *A.P. Karremans and M. Contreras Fernández 8770* (Holotype: JBL-spirit; Fig. 6).

Similar to *Epidendrum unicallosum* Hágsater & E.Santiago, but distinguished by the longer plants with shorter stems (16–22 vs. 22–42 cm tall), with fewer leaves (3–7 vs. +12), the inflorescence with more flowers (up to 18 vs. 6), white with a basal orange blotch (vs. pink), the shorter petals (7.1–7.2 vs. 8.7 mm), the longer and narrower lip (6.3–6.4 × 5.3 mm vs. 5.1 × 7.1 mm), the bilobed callus (vs. unlobed), the lateral lobes oblanceolate and truncate (vs. elliptic and subacute), and a column bent (vs. straight).

Epiphytic, sympodial, pendent *herb*, up to 1 m long. Roots 2 mm in diameter, fleshy. *Stems* 16–22 × 0.2–0.3 cm, more or less horizontal, becoming pendent, cane-like, terete, one or more produced from a subapical internode of the previous stem, forming elongate chains of multiple growths. *Leaves* 3–7, restricted to the apical half of the stem or new stems; leaf sheath 0.9–2.1 cm long, tubular, verrucose, reddish when young, becoming papery with age; blade 1.3–3.0 × 0.3–0.6 cm, articulate, elliptic, acute. *Inflorescence* 5.5–6.0 cm long, apical, from mature new growths, racemose, arching, congested, sub-secund. *Floral bracts* 2.5–4.0 mm long, many times shorter than the ovary, acute, green marked with purple, dropping downwards from the ovary. *Flowers* up to 18 opening in succession, most eventually open simultaneously, resupinate, white, turning cream with age, bearing an orange blotch at the base of the lip and column sides. *Ovary* 1.8–1.9 cm long, cylindrical, thin, elongate, alate-crested. *Sepals* free, spreading, recurved, 5-veined, very thick, dorsally with elevated veins and a conspicuous green apical crest; dorsal sepal 8.0 × 2.2 mm, elliptic, acute; lateral sepals 8.9–9.1 × 3.0–3.2 mm, elliptic, acute. *Petals* 7.1–7.2 × 2.1–2.2 mm, free, spreading, 3-veined, oblanceolate, obtuse. *Lip* 6.3–6.4 × 5.3 mm, fused to the column, trilobed, white, with an orange blotch at the base, callus single, bilobed; lateral lobes obliquely oblanceolate to oblong, truncate, divaricate, 2.1–2.3 × 1.1–1.3; midlobe thickened, trilobate, with a ligulate base and three more or less triangular, opposing apical lobes. *Column* 5.0–6.0 mm long including the clinandrium-hood, with a 45 degree bend with respect to the ovary, white with an orange blotch near the base of the lip; clinandrium-hood more than half the length of the column, the margin crenate, sigmoid. Anther sub-rectangular, very thin, 4-celled, margins irregular. Pollinia 4, ovoid, laterally compressed, inner pair significantly smaller than the outer pair, so-called bird-wing type. Capsule not seen.

Etymology: The name honors my wife Miriam Contreras Fernández with whom I first found this beautiful white-flowered *Epidendrum*.

Habitat and distribution: Known only from the oak forests around Tres de Junio where it was found growing at 2530 m in elevation.

Phenology: Found blooming in June.

Polychlamys Group-Polychlamys Subgroup.

Hágsater and Sánchez-Saldaña (2006) informally recognize species of the "Polychlamys subgroup" by the successive lateral growths produced from the middle of the previous growth, few leaves aggregate towards the apex of the stems, the distichous, apical inflorescence with prominent, conduplicate, acute, glumaceous floral bracts.

Epidendrum bugabense Hágsater, Icon. Orchid. 2: t. 115. 1993. TYPE: PANAMA. Chiriquí: Distrito Bugaba, Cerro Punta, 8°52'N, 82°33'W, 2200 m, along ridge watershed to Bocas del Toro, 25 January 1985, *H. van der Werff and J. Herrera 6427* (Holotype, AMO; Isotype, MO [not seen]).

Etymology: The epithet refers to the Bugaba district in Chiriquí, Panama where the type specimen was collected.

Habitat and distribution: Known only from a few collections found between 2200–2560 m in elevation close to the continental divide on the Talamanca mountain range in southern Costa Rica and eastern Panama.

Phenology: Collected in bloom in January and September.

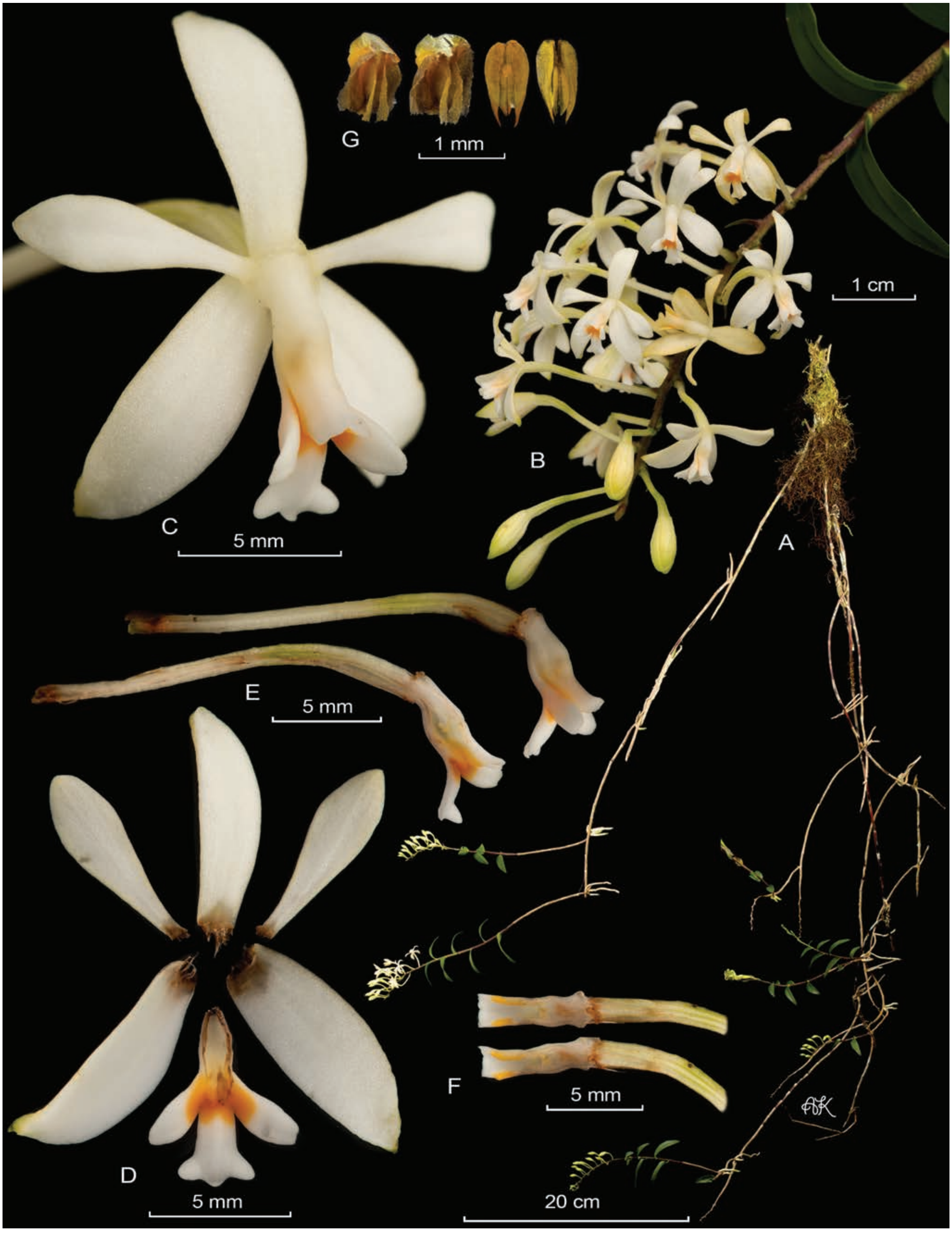

FIGURE 6. LCDP of *Epidendrum miriamae* Karremans. **A**, Habit; **B**, Inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal section; **F**, Column, ventral and lateral views; **G**, Anther cap and pollinarium. By APK based on *Karremans 8770* (JBL-spirit).

Additional specimens examined: COSTA RICA. Limón: Talamanca, Bratsi, Parque Internacional La Amistad, Valle del Silencio, sendero desde el Jardín (turbera) hacia los Cerros Tararias, sobre la parte alta del cerro mediano conocido como "Ventanas," 9°08'53.03"N, 82°57'25.91"W, 2560 m, bosque pluvial montano, 19 September 2014, *A.P. Karremans, M. Díaz, M. Fernández, C. Godínez, J. Godínez, L. Oses, J. Ramírez and D. Villalobos 6370* (JBL-6436). PANAMA. Reserva de la Biosfera La Amistad trail from Las Nubes Ranger Station, *G. Yong Gee s.n.* (AMO-digital voucher; Fig. 7).

This former Panamanian endemic is here recorded for Costa Rica on the basis of a specimen at JBL. Unfortunately, the specimen is in bad shape and there are no photographs of living material available. It is nonetheless the rare *E. bugabense*, for which an illustration and description can be found in Hágsater and Salazar (1993).

Epidendrum gymnochlamys Hágsater & E.Santiago, Icon. Orchid. 8: t. 839. 2006. TYPE: PANAMA. Chiriquí: above Boquete, on trail to Pate Macho on continental divide, 1850–2100 m, 13 March 1988, *G. McPherson 12323* (Holotype, MO).

Epiphytic, sympodial, erect *herb*, with successive lateral growth, where each new stem originates from an intermediate internode of the previous stem. *Roots* 1.0–1.5 mm thick scarce, distributed along the basal internodes of the stems, thin white. *Stems* 6–14 cm tall, simple, cane-like, terete at base, thin, short, erect, base arcuate; basal half covered by tubular sheaths, slightly inflated towards the apex, scarious, ancipitose, fibrous with time. *Leaves* 4–10, green to dark green, distichous, gladiate, alternate, articulate, basal leaf somewhat smaller; sheaths tubular; blade 12–40 × 3–14 mm, narrowly elliptic, acute, coriaceous, margin entire. *Inflorescence* 30 × 1 mm, apical, arching, flowering only once, distichous, lax-flowered; peduncle 20 × 3 mm, slightly compressed, very short, lacking bracts; rachis straight, hidden by floral bracts. *Floral bracts* 9.0–16.0 × 2.5 mm, much longer than the ovary covering nearly half the flower, progressively shorter, ovate, acute, conduplicate. *Flowers* successive, resupinate, pale green. *Ovary* 3 mm long, short, terete, thin, straight, not inflated, smooth. *Sepals* 8.0–8.5 × 2.5–2.8 mm, free, partly spreading, glabrous, narrowly triangular, 3-veined. *Petals* 7.5–8.0 × 2.8 mm, free partly spreading, elliptic, oblique, acute, 1-veined, the vein branching near the middle, margin spreading, entire. *Lip* 8.0 × 4.5 mm, united to the column, sides involute and embracing the apex of column covering it entirely in natural position, entire, ovate-oblong, base cordate, margin entire; bicallose the calli thin, laminar, low; disc with one smooth, keel that vanishes before the apex of the lip. *Column* 1.8 mm long, arcuate, short, thick. *Clinandrium-hood* short, margin entire. Nectary without penetrating the ovary, not inflated, smooth. *Description based only on *Karremans 7610*.

FIGURE 7. Photograph of *Epidendrum bugabense* Hágsater in situ at the Reserva de la Biosfera in Panama. By Gary Yong.

Etymology: From the Greek *gymnós*, naked, unclad, stripped, and *kládos*, military cloak, mantle, in reference to the lack of bracts on the peduncle of the inflorescence which are generally characteristic of the Polychlamys Group of species, and facilitate its recognition.

Habitat and distribution: Known only from a few collections made close to the continental divide at elevations between 1850–2748 m on the Talamanca mountain range in southern Costa Rica and eastern Panama (Fig. 8).

Phenology: Collected in bloom in January and March.

Additional specimens examined: COSTA RICA. Puntarenas: Buenos Aires, Buenos Aires, camino a Cerros Utyum, 9°19'22.54"N, 83°11'30.71"W, 2748 m, bosque pluvial montano, epífita en bosque secundario, 19 January 2017, *A.P. Karremans, D. Bogarín, M. Cedeño, I. Chinchilla, M. Díaz, E. Kaes, P. Lehmann and O. Zúñiga 7610* (JBL-J0323; JBL-A0035; Fig. 9).

Pseudepidendrum Group-Paniculatum subgroup.

The "Pseudepidendrum group" features species with caespitose plants, cane-like stems, acute to acuminate leaves, the inflorescence is usually apical, the petals filiform and the lip usually 3-lobed, bearing 3 parallel fleshy keels, the apical lobe often bifurcate, and the pollinarium is of the "bird-wing" type. Those belonging to the "Paniculatum subgroup" have green flowers, the lip white, the disc sometimes marked with purple (Hágsater and Sánchez-Saldaña, 2008). I would add that many species have minutely verrucose inflorescences and sepal exteriors, and the bracts of the inflorescence are notoriously variable in length. Interestingly, the so-called bird-wing type pollinaria are similar to those of the unrelated "Aberrans subgroup." However, they differ in that the pollinia are apically rounded in the "Paniculatum subgroup" rather than apically acuminate.

Epidendrum longibracteatum Hágsater, Icon. Orchid. 3: t. 347. 1999. TYPE: PANAMA: Chiriquí: Cerro Horqueta, detrás de Boquete, al Edel Volcán Barú, ca. 2000 m, col. 15 March 1981, pressed 7 June 1981, *Hágsater et al. 6526* (Holotype, AMO [not seen]; Isotypes, PMA [not seen], SEL [not seen]; Clonotypes: 22 February 1983 F [not seen], QCNE [not seen], S, WIS [not seen], 11 April 1989 AMES, COL [not seen], CR [not seen], ENCB [not seen], G [not seen], INB [not seen], K, MEXU [not seen], MO [not seen], NY [not seen], P, SCZ [not seen], US [not seen], USM [not seen]).

FIGURE 8. The continental divide, where *E. gymnochlamys* Hágsater & E.Santiago was found growing, separates the Caribbean and Pacific watersheds of the Talamanca mountain range. By APK.

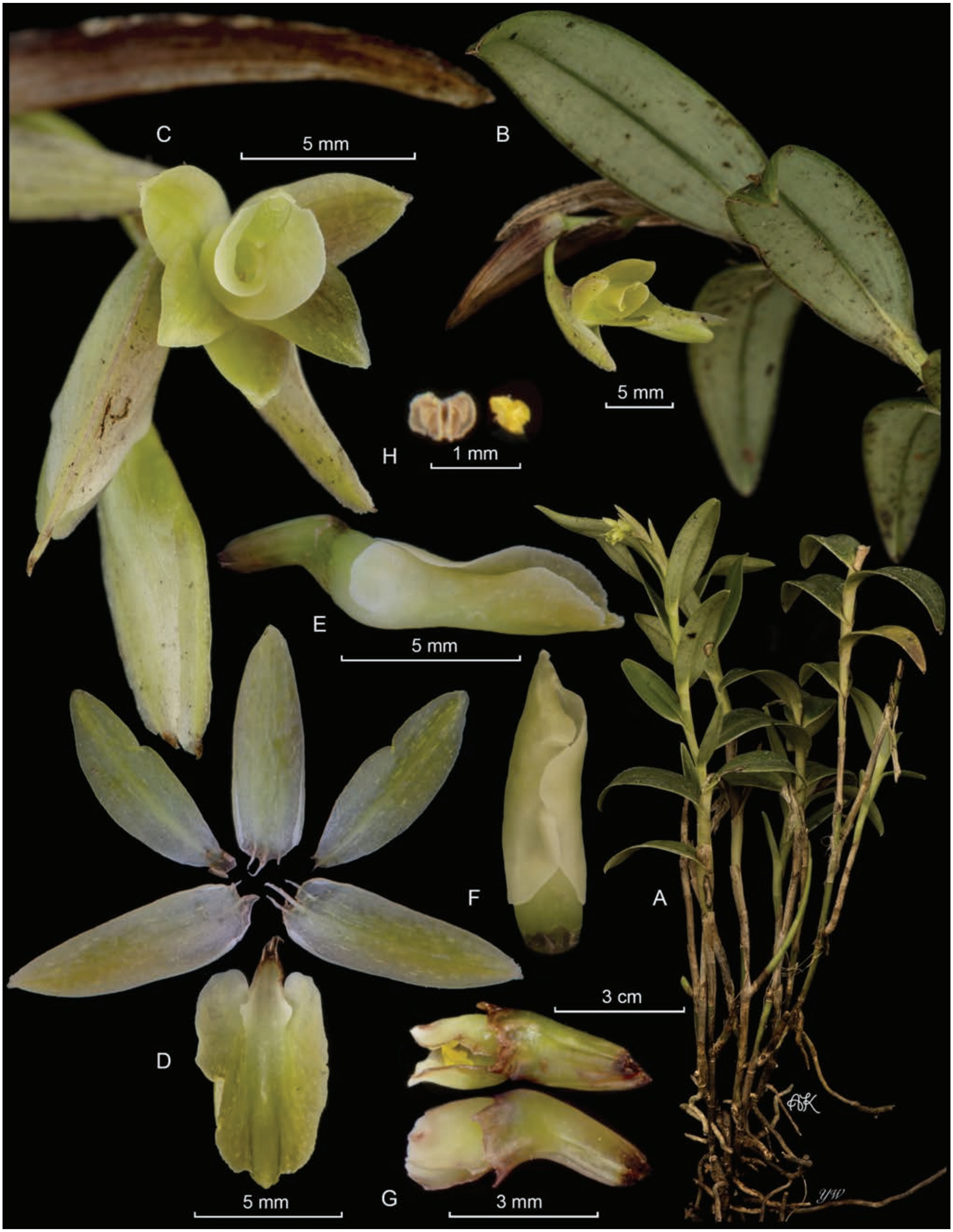

FIGURE 9. LCDP of *Epidendrum gymnochlamys* Hágsater & E.Santiago. **A**, Habit; **B**, Detail of the stem and inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view; **F**, Lip and column seen from above; **G**, Column, ventral and lateral views; **H**, Anther cap and pollinarium. By Youri Witmer and APK based on *Karremans 7610* (JBL-spirit).

Epiphytic, caespitose *herb*, up to 50 cm tall. *Roots* basal, fleshy. *Stems* simple, cane-like, terete, straight. Leaves 8–18 × 1.5–3.5 cm, distributed on the apical half of the plant; sheath tubular, 2–4 cm long; blade lanceolate, acuminate, main nerves clearly visible. *Inflorescence* 20 cm long, apical, paniculate, arched, from the mature stem, flowering once. Floral bracts 1–10 mm long, variable, long at the base of the inflorescence and progressively becoming shorter towards the apex. *Flowers* +100, opening in succession, many open at the same time, resupinate, sepals and petals green, lip immaculate white, column apical half white, basal half green. *Ovary* 1 cm long, not inflated, cylindric, tomentose, bent. *Sepals* 7.2–7.9 × 2.0–2.5 mm, free, spreading, reflexed, oblanceolate, acute, thick, papillose-tomentose abaxially, lateral sepals oblique. *Petals* 6.1–6.3 × 0.4 mm, spreading, reflexed, filiform, apically broadening, rounded, membranaceous. *Lip* three lobed, 8.6 × 7.8 mm; unicallose, disc with three central carinae; lateral lobes 2.5–2.8 × 2.5–2.8 mm, subquadrate, oblique; midlobe 3.8 × 0.9 mm, bilobed, divaricate, lobes linear-ligulate, rounded. *Column* 5.7–5.8 mm long, straight, thin, broadening apically. Anther ovoid, 4-celled. *Pollinia* 4, "bird-wing" type, laterally compressed. *Capsule* not seen. *Description based only on *Pupulin 5844*.

Etymology: In reference to the very long floral bracts sometimes observed in this species.

Habitat and distribution: *Epidendrum longibracteatum* seems to be endemic to the mountains between Coto Brus in southern-eastern Costa Rica and Chiriquí in western Panama, where it grows at elevations between 1500 and 2000 m.

Phenology: Flowering from May to August.

Additional specimens examined: COSTA RICA. Puntarenas: Coto Brus, Las Alturas de Cotón, Zona Protectora Las Tablas, Las Alturas Biological Station, southern slopes of Cerro Chai, 8°56'59"N, 82°50'01"W, 1500 m, lower montane wet forest, primary vegetation, 26 October 2005, prepared May 2008, *Pupulin 5844, D. Bogarín, R.L. Dressler, R. Gómez, A.P. Karremans, A. Rambelli and S. Rambelli* (JBL-D1768, JBL-D6129, Fig. 10). Primary forest above coffee fincas along Río Coto Brus, near Coton, 23 km north of La Unión (on Panama border), 9 August 1974, *T.B. Croat 26633* (MO).

Epidendrum longibracteatum was originally described from Cerro Horqueta, east of Volcán Barú in Chiriquí, Panama. The type locality is not far from the border with Costa Rica, and the species has since been collected in the neighboring Coto Brus, Puntarenas.

The species features large plants with prolific inflorescences bearing +100, tiny, immaculate green and white flowers. The Costa Rican plant illustrated and described has relatively short floral bracts and the flowers are larger and somewhat different in shape than those of the type, but at this time I believe they are conspecific. Hágsater et al. (1999) noted the extremely long floral bracts and used them as a diagnostic feature. However, the floral bracts are extremely variable in length in several species belonging to this group, and even within a single specimen they can vary from much shorter to much longer than the ovary (see duplicates of the type).

Epidendrum rossanae Karremans, *sp. nov.*
TYPE: COSTA RICA. Cartago: Turrialba, Santa Teresita, Guayabo, Monumento Nacional Guayabo, alrededores de los senderos principales, 9°58'23.31"N, 83°41'28.73"W, 1128 m, bosque muy húmedo, epífitas, 20 June 2015, *A.P. Karremans, M. Cedeño, I. Chinchilla, M. Díaz, L. Oses, G. Salguero, D. Sánchez y Curso de Orquideología UCR 6662* (Holotype, JBL-spirit [J0158]; Fig. 11).

Similar to *Epidendrum piliferum* Rchb.f. but the plants shorter (up to 90 vs. 200 cm tall), the inflorescence with more, elongated branches (vs. suborbicular), the sepals smaller (8.0–12.5 × 2.0–3.8 vs. 12.5–17.0 × 3.5–5.0 mm), much more conspicuously papillose-tomentose externally, reflexed about 45 degrees (vs. reflexed 90 degrees), the petals shorter (7.0–12.0 vs. 12.5–15.0 mm), the lip narrower (7.0–7.8 vs. 12 mm), with the basal and apical lobes overlapping when extended (vs. apical lobes well separated from basal lobes), and the purple dots on the lip forming three lines (vs. five lines).

Epiphytic, caespitose *herb*, up to 60–90 cm tall. *Roots* basal, fleshy. *Stems* simple, cane-like, terete, straight. Leaves 8.0–13.5 × 2.0–3.5 cm, distributed on the two apical third of the stems; sheath tubular, 2.5–3.5 cm long, when young green, marked with purple and becoming papery white; blade lanceolate, shortly acuminate, main nerves clearly visible. *Inflorescence* up to 30 cm long, apical, paniculate, with up to 8 branches, dense, arched, from the mature stem, flowering once, rachis furfuraceous. *Floral bracts* 3–22 mm, variable, very long at the base of the inflorescence and progressively becoming shorter towards the apex. *Flowers* +200, simultaneous, resupinate, sepals and petals green, lip white with a row of purple spots on each carina of the disc, and with purple sports in a ring around the disc, column apical half white, basal half green. *Ovary* 1.6 cm long, not inflated, cylindric, tomentose, bent. *Sepals* 8.0–12.5 × 2.0–3.8 mm, free, spreading, reflexed about 45 degrees, oblanceolate, acute, fleshy, apical margins thickened, forming a robust apiculum, papillose-tomentose abaxially,. *Petals* 7.0–12.0 × 1.0 mm, spreading, reflexed, typically coiling basally, making a full circle behind the lateral sepals and emerging frontally towards the lip, filiform, apically broadening, rounded, membranaceous. *Lip* 8–10 × 7.0–7.8 mm, three lobed, basal and apical lobes overlapping when extended; unicallose, disc with three central carinae; lateral lobes 2.5–3.0 × 3.0 mm, subquadrate, oblique, margins erose; midlobe bilobed, lobes 4.0 × 1.0 mm, divaricate, linear-ligulate, acute. *Column* 6.5–7.0 mm long, straight, thin, broadening apically. *Anther* white, ovoid, 4-celled. *Pollinia* 4, "bird-wing" type, laterally compressed, inner pair smaller. *Capsule* not seen.

Etymology: The name honors my mother Rossana Lok, on who's property, on the slopes of the Turrialba volcano (Fig. 12), I first became acquainted with this species.

Habitat and distribution: A common species in the Central Valley of Costa Rica, especially the mountains around Cartago where it grows at elevations between 1100 and 2000 m.

Phenology: Flowering has been registered from February to June.

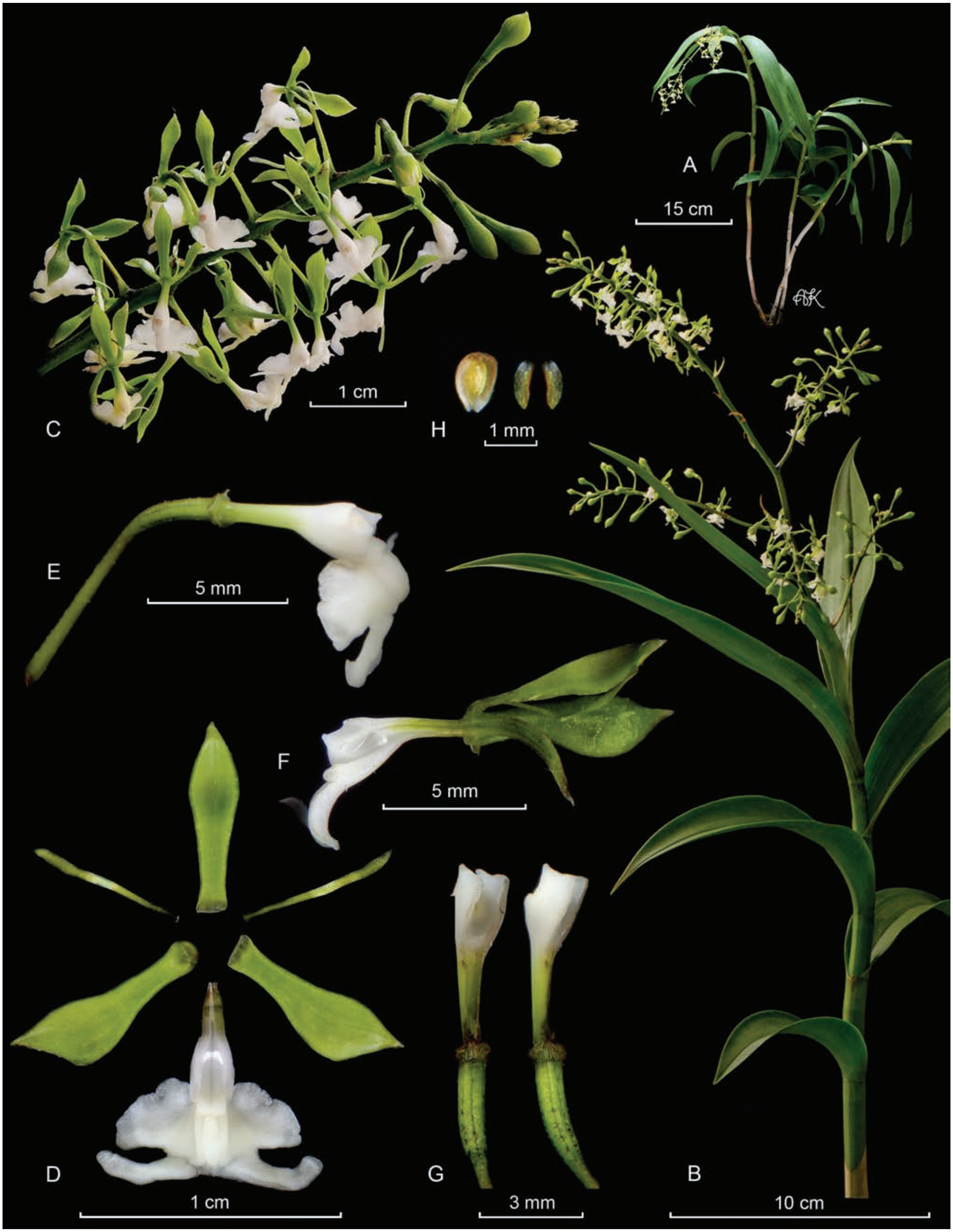

FIGURE 10. LCDP of *Epidendrum longibracteatum* Hágsater. **A**, Habit; **B**, Detail of the stem and inflorescence; **C**, Inflorescence; **D**, Dissected perianth; **E**, Lip and column lateral view; **F**, Lip and column transversal section; **G**, Column, ventral and lateral views; **H**, Anther cap and pollinarium. By APK based on *Pupulin 5844* (JBL-spirit).

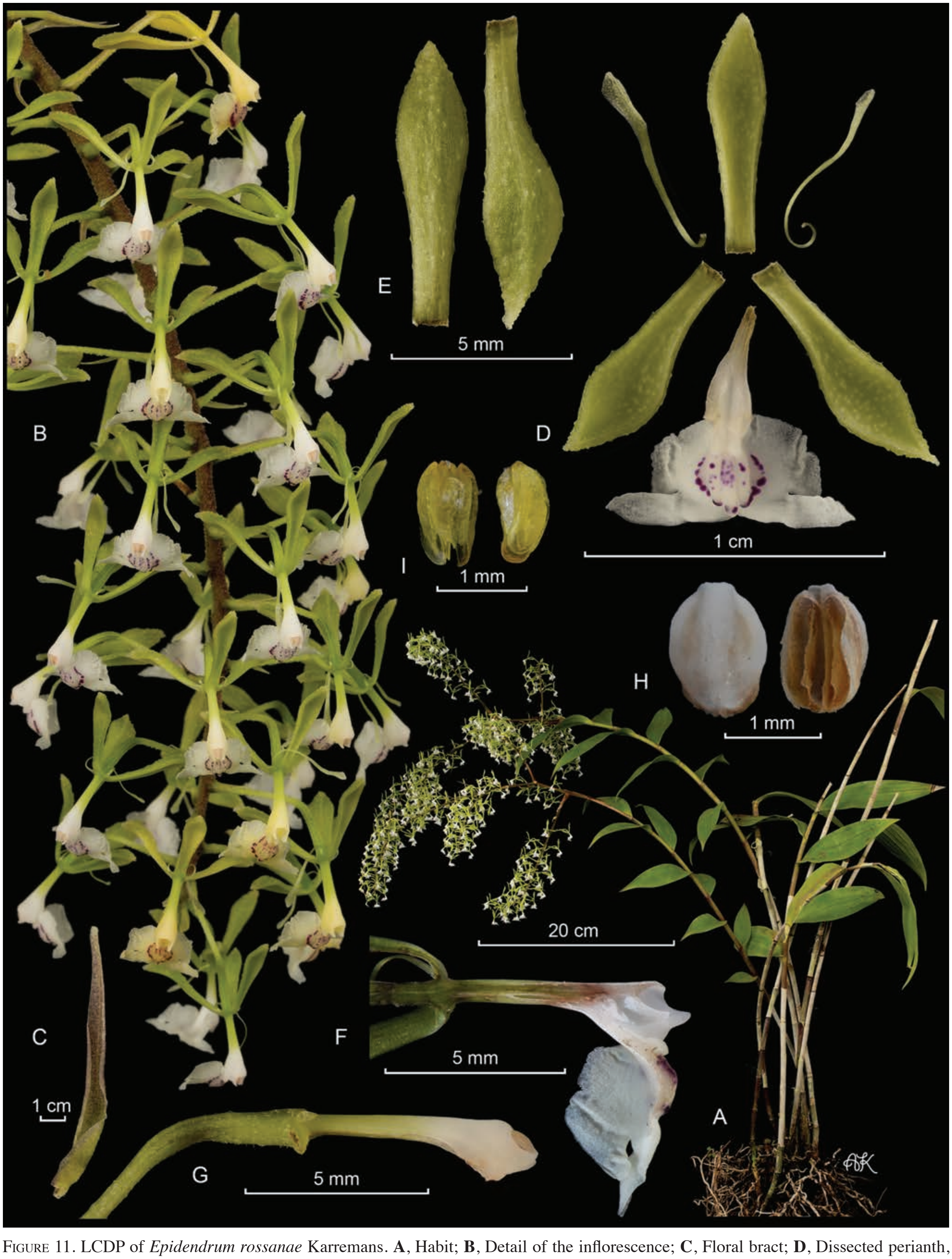

FIGURE 11. LCDP of *Epidendrum rossanae* Karremans. **A**, Habit; **B**, Detail of the inflorescence; **C**, Floral bract; **D**, Dissected perianth, **E**, Dorsal and lateral sepal external view; **F**, Lip and column transversal section; **G**, Column lateral view; **H**, Anther cap views; **I**, Pollinarium views. By APK based on *Karremans 6662* (JBL-spirit).

FIGURE 12. Agricultural pastures and remnants of forest property of the Guayabo Lodge along the Aquiares river in Santa Cruz, Turrialba, Costa Rica, where *E. rossanae* Karremans grows. By APK.

Additional specimens examined: COSTA RICA. Cartago: Turrialba, Santa Cruz. En límite con el cantón de Alvarado, sobre la carretera a San José, al lado del río Turrialba, en potreros a orillas del río. 9˚57'16"N, 83˚46'12"W, 1500–2000 m, 5 August 2006, *A.P. Karremans and D. Karremans 1391* (JBL-D0787). [Cartago] Las Cóncavas, 27 February 1924, *C.H. Lankester 768* (AMES). Dulce Nombre, 27 February 1924, *P.C. Standley 35951* (AMES). Cerro de La Carpintera, February 1924, *P.C. Standley 34281* (AMES).

Epidendrum rossanae has long been confused with *E. piliferum*, which indeed has similar flowers in color and general shape. However, it can be distinguished by the shorter plants, the inflorescence with more and longer branches, the significantly smaller flowers, the sepals much more conspicuously papillose-tomentose externally, reflexed only about 45 degrees, the petals neatly twisting backwards around the lateral sepals before extending forward, the lip with the basal and apical lobes overlapping when extended, and the purple dots on the lip forming three lines. They are also geographically well separated, with *E. rossanae* being found in the Central Valley in Costa Rica and *E. piliferum* growing only on the Pacific slope of the Talamanca mountain range in southern Costa Rica and neighboring western Panama. The new species is also similar to *E. horichii* Hágsater, but it can be distinguished by the dense inflorescence with up to +200 (vs. inflorescence lax, 20–60 flowers), the lip with many purple spots (vs. a solid pink blotch), the reflexed sepals (vs. non-reflexed), and the narrower petals (1.0 vs. 0.6 mm) and lip (7.0–7.8 vs. 10 mm). *Epidendrum horichii* is typically found on the mountains above Heredia, Costa Rica.

The species belonging to the *Epidendrum piliferum* alliance are notoriously variable in features that are typically more conserved in other *Epidendrum* species. No two lips are the same in shape and size, even within a single individual, and certainly among different individuals. The floral bracts in *E. horichii*, *E. longibracteatum* and *E. rossanae* vary notoriously in length, some individuals bear bracts that well exceed the ovary and can measure up to 2–3 cm at the base of the inflorescence, to bracts that are significantly shorter than the ovary, measuring 1–3 mm at the apex of the inflorescence. Besides the differences is size, other less traditionally used features such as the inflorescence shape, flower density, tepal disposition and coloration patterns may be much more informative to distinguish between species.

Ramosum Group-Platystigma Subgroup

The "Platystigma subgroup" features *Vanda*-like plants when young before branching occurs, with strap-like leaves (Hágsater and Sánchez-Saldaña, 2008). Species of this group present a notorious plant habit dimorphism, young plants feature a single long, erect, thick, leafy stem, which with time completely transforms into a Christmas-tree-like habit with many side branches that are very long at the base and become shorter towards the apex. The long leaves of the main stem fall off, while smaller leaves appear as it branches. Other distinctive features include the short inflorescence, the long floral bracts that cover and involve the ovary, the membranaceous perianth which makes the flowers harder to dissect, and the thick, concave lip. The anther cap is very unique, dorsally it forms an elevated disk-like structure with a pair of small flap-like lobes.

Epidendrum nativitatis Karremans, *sp. nov.*
TYPE: COSTA RICA. Alajuela: Upala, Bijagua. En la calle nueva desde el Celeste Mountain Lodge al Parque Volcán Tenorio, orillas del bosque y potrero al lado del camino, 10°43'8.46"N, 85°0'2.07"W, 729 m, collected 14 December 2016, prepared 23 December 2020, *A.P. Karremans, M. Cedeño, I. Chinchilla, M. Díaz and G. Rojas-Alvarado 7490* (Holotype, JBL-spirit [J1087]; clonotypus 5 February 2019, JBL-spirit [B2016]; Fig. 13, 33a).

Similar to *E. villegastigma* but distinguished by the longer leaves on the main stem (up to 12.5 vs. 6 cm long), the inflorescence bearing 5 flowers (vs. 3), the straight column (vs. slightly arched), the larger (10.0–12.5 × 4.0–4.5 vs. 5.5–7.5 × 2.5–3.5 mm) oblong, acute sepals (vs. elliptic, obtuse), the larger (9.5–10 × 3.0–3.5 mm vs. 5.5–6.5 × 2.0–2.5 mm), sub-quadrate to oblong, acute (vs. elliptic, obtuse) petals, the longer (10 vs. 4–5 mm) lip and the longer column (4.0–4.3 mm vs. 2.5–3.0 mm).

Epiphytic, pseudo-monopodial, branching, erect *herb*, up to 40 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching, cane-like, terete, covered by rugose sheaths; main stem long, with short to medium branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex of the branches with age; leaf sheath up to 3.3 cm long, tubular, rugose, reddish-brown when young, becoming papery with age; leaf blade up to 12.5 × 1.6 cm on the main stems, typically much smaller on the branches 3.5–6.5 × 0.9–1.6 cm on the branches, narrowly-ovate to oblong, unequally bilobed. *Inflorescence* 2.5 cm long, short, sessile, from the branches, racemose, erect to suberect, flexuous. *Floral bracts* up to 1.8 cm long, longer than the ovary, acute. *Flowers* 5, greenish-bronze tepals and a white lip, with a pinkish haze at the base of the petals and lip, and apex of the sepals, especially abaxially, column white apically, green at the base and pinkish ventrally. *Ovary* 8 mm long, cylindrical, elongate. *Sepals* free, spreading, reflexed, oblong, acute, with a dorsal keel, elevated at the apex to form a short mucro; dorsal sepal 10 × 4 mm, apically reflexed; lateral sepals 11.5–12.5 × 4.2–4.5 mm, apically reflexed, divergent. *Petals* 9.5–10 × 3.0–3.5 mm, free, spreading, reflexed, sub-quadrate to oblong, notoriously oblique, acute. *Lip* 10 × 9 mm, fused to the column, in natural position reflexed, margins recurved, extended blade cordiform to broadly ovate, obtuse, shortly apiculate, margins sinuous, with a tridentate callus near the base, and a slightly elevated keel in the middle. *Column* 4.0–4.3 mm long, short, stout, terete, straight with respect to ovary. *Anther* white, sub-orbicular externally, cellular-glandular, internally very thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: From the Latin, *nativitas*, Christmas. The plant flowered on the 23rd of December 2020 and, with my wife's kind consent, I took a few hours Christmas eve to prepare the complete photographic documentation of this undescribed species.

Habitat and distribution: Known only from the type plant collected in Bijagua, on the road to the Parque Nacional Volcán Tenorio in the Guanacaste Cordillera in northern Costa Rica, growing at an elevation of 729 m.

Phenology: Recorded to bloom from December to February.

Ramosum Group-Rugosum Subgroup.

Although not formally circumscribed, Hágsater and collaborators have grouped several closely allied Central American species under the "Rugosum subgroup" on the basis of the branched plant habit, the few-flowered distichous inflorescence from short secondary stems, rugose leaf-sheathes and the floral bracts shorter than the ovary in many species. To those features I might add that the flowers are typically glabrous, concolorous white, green, yellow, or purple, the sepals apically carinate, the petals narrowly lanceolate or linear, the anther cap frequently white with purple markings. They are generally found growing at mid to high elevations, large plants become bushy and, although many are restricted in distribution, they tend to be locally abundant. The Rugosum subgroup is especially species rich in Costa Rica and Panama, and despite the recognition of several new taxa recently its diversity continues to be highly underestimated. 14 additional novelties are proposed here.

Three alliances are recognized here. The *Epidendrum rugosum* Ames alliance featuring plants with multiple main stems with short branches, pink-purple plants and flowers, and a broad-flattened column. The *Epidendrum sanchoi* Ames alliance which features bushy plants with one or few central main stems with many long branches, green, yellow, or white flowers and the lip notoriously thickened on the apical margin. The *Epidendrum anoglossoides* Ames & C.Schweinf. alliance that includes bushy, irregular plants, ancipitose stems, bent inflorescences that are either ancipitose or filiform, with greenish-yellowish flowers.

Epidendrum rugosum Ames, Schedul. Orchid. 6: 74. 1923. TYPE: COSTA RICA: Without locality, received at the Royal Gardens, Kew, in 1923, *Charles H. Lankester s.n.* (Holotype, AMES [26978], Fig. 14; Isotype: K, Fig. 15).

Lithophytic, erect *herb*, up to 18 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, partially covered by rugose sheaths. *Leaves* up to 10, distributed along the stem, deciduous, concentrating close to the apex with age; leaf sheath 6–9 mm long, tubular, rugose, reddish when young, becoming papery

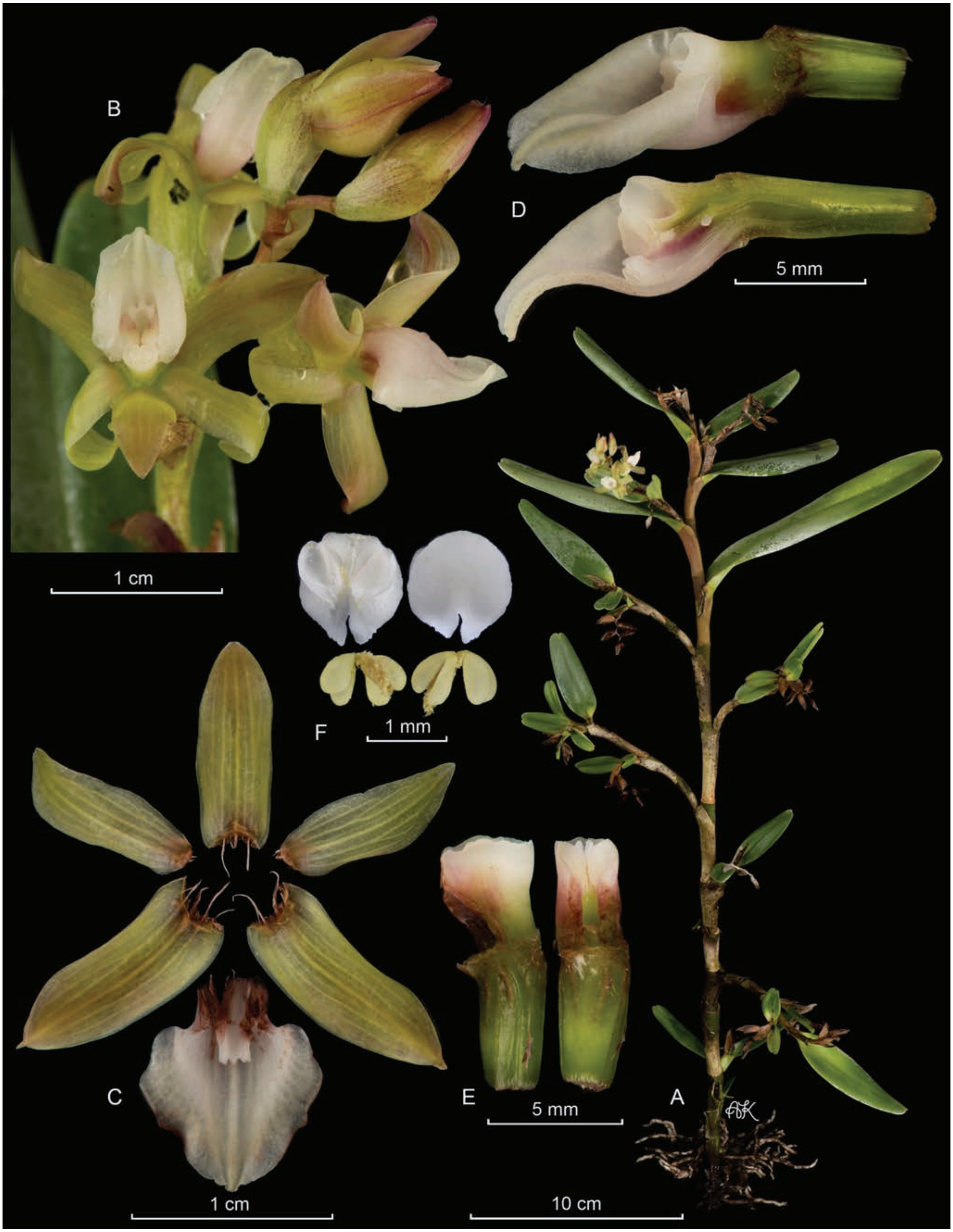

FIGURE 13. LCDP of *Epidendrum nativitatis* Karremans. **A**, Habit; **B**, Detail of the inflorescence and flower; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Column ventral and lateral views; **F**, Anther cap and pollinarium views. By APK based on *Karremans 7490* (JBL-spirit).

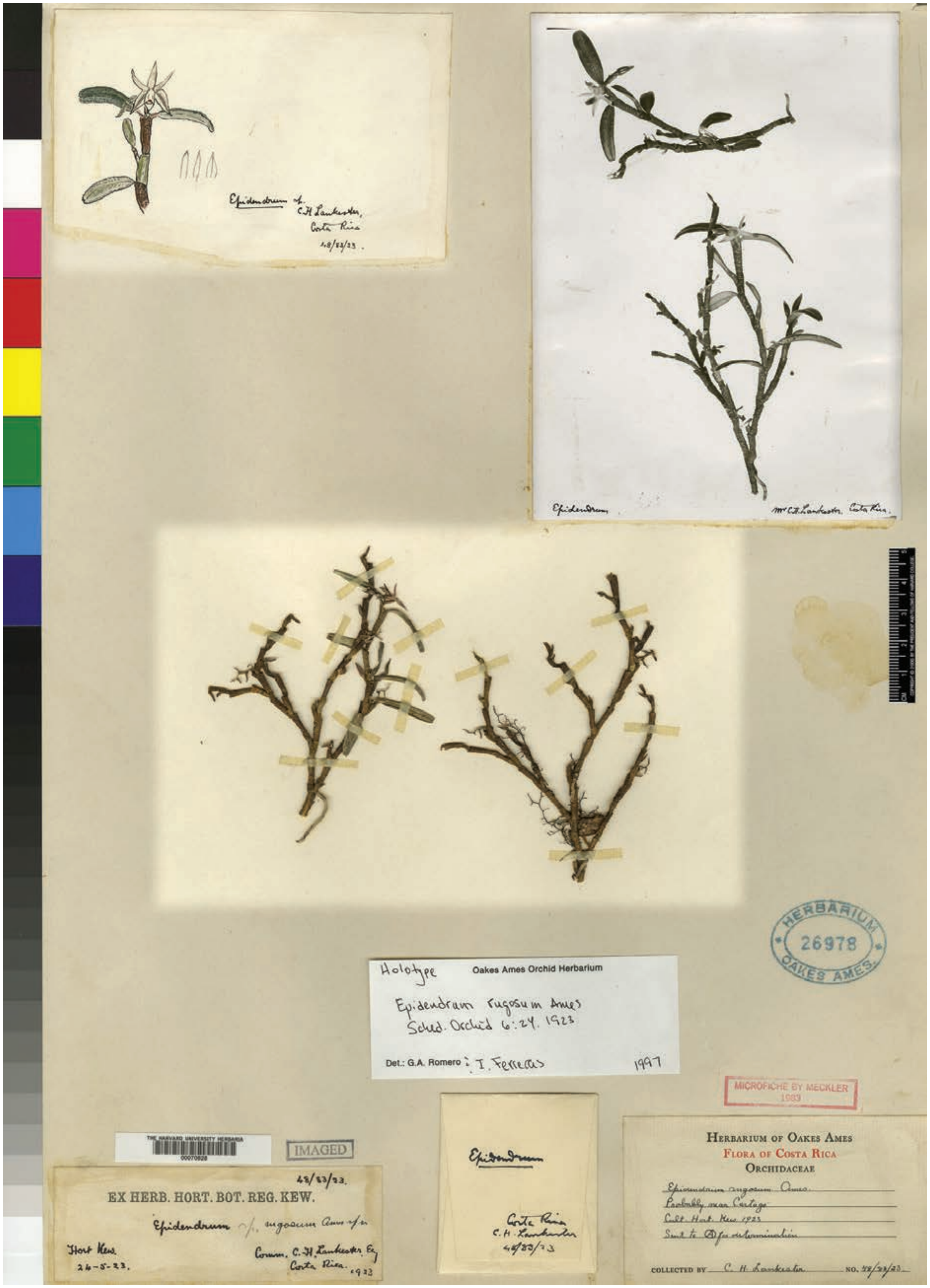

FIGURE 14. Holotype specimen of *Epidendrum rugosum* Ames collected by Charles H. Lankester (AMES 26978) © copyright of Harvard University, Cambridge.

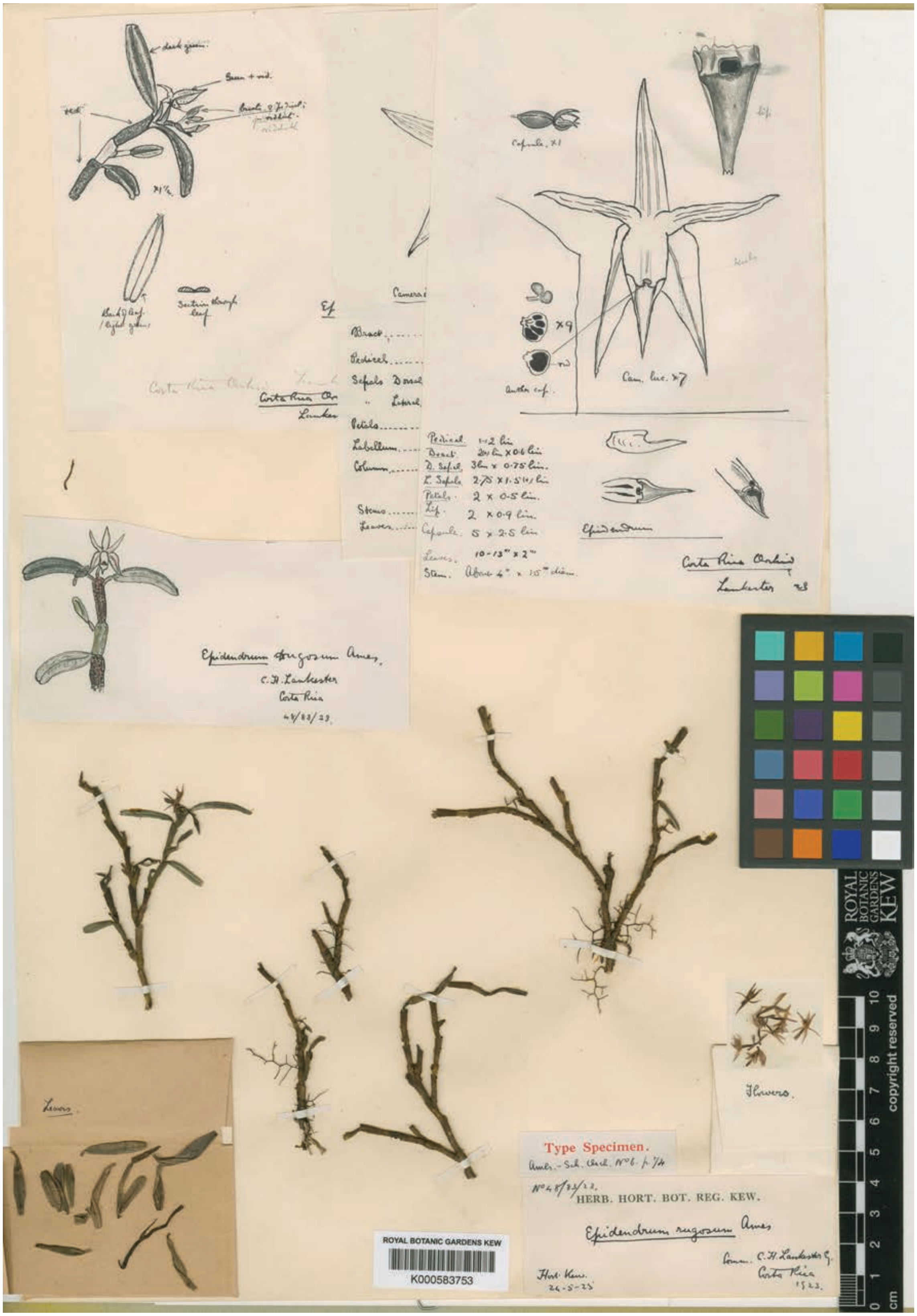

FIGURE 15. Isotype specimen of *Epidendrum rugosum* Ames collected by Charles H. Lankester (available at http://specimens.kew.org/herbarium/K000583753) © copyright of the Board of Trustees of the Royal Botanic Gardens, Kew.

with age; blade 1.3–1.8 × 0.3–0.5 cm, thick coriaceous, oblong, unequally bilobed. *Inflorescence* short, 5 mm long, from the branches, racemose, distichous, sub-secund, erect, congested. *Floral bracts* 2 mm long, much shorter than the ovary, acute. *Flowers* 1–3, with only one open at a time, a dull yellowish-pink color, anther dark purple. *Ovary* 6 mm long, cylindrical, trialate, thin, elongate. *Sepals* free, spreading, free, ovate-elliptic, acute with an apical dorsal keel; dorsal sepal 6.0 × 2.0 mm; lateral sepals 5.2–5.8 × 2.1–2.2 mm. *Petals* 5.1–5.2 × 1.0 mm, free, spreading, lanceolate, acute. *Lip* 4.2 × 2.0 mm, fused to the column, short, fleshy, triangular, base truncate, corners rounded, apex acute, margins thickened and slightly elevated, with a tall transversal callus below the stigma, and a low central keel on the free portion. *Column* 3 mm long, thick, broad, with a strong bend of at least 45 degrees with respect to the ovary. *Anther* sub-trapezoid, very thin, 4-celled, margins irregular, elevated dorsally, flanking a dark-purple central depression. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose, viscidium translucent. *Capsule* not seen. *Description based only on *Karremans 8800*.

Etymology: From the Latin *rugosus*, rugose, in reference to the leaf sheaths.

Habitat and distribution: All specimens that correspond well with this taxon were collected in the same general area around Casa Mata, Estrella (Fig. 16) and Santa Clara in El Guarco, on the mountains overlooking the city of Cartago, Costa Rica. It grows as an epiphyte or lithophyte at elevations around 1676–1950 m.

Phenology: Registered to flower in April, June, July, and September.

Additional specimens examined: COSTA RICA. Cartago: El Guarco, San Isidro, Estrella, sobre la Carretera Interamericana Sur, 9°45'53"N, 83°58'57"W, 1890 m, creciendo como litófitas sobre el talud de la carretera, 25 June 2021, *A.P. Karremans and I. Chinchilla 8800* (JBL-spirit, Fig. 17). Cartago, [El Guarco], Santa Clara, July 1923, *C.H. Lankester 496* (AMES). Cartago, El Guarco, 1900 m, 26 September 1996, *García-Cruz 940* (AMO). Cartago, Casa Mata, 1 km sur, 1950 m, 13 March 1981, prepared 30 April 1981, *E. Hágsater and C. Horich 6340* (AMO). [Cartago: Guarco] San Cristobal Road, 9°47'N, 84°01'W, 5500 ft, 14 June 1928, *H.E. Stork 2552* (MO; AMO-photo).

The identity of *Epidendrum rugosum* has remained unclear since its description. Hágsater and Sánchez-Saldaña (2007) characterized the species as having large stems up to

FIGURE 16. Photograph of *Epidendrum rugosum* Ames in situ growing as a roadside lithophyte among mosses and other orchids, near Estrella, El Guarco, Cartago. By APK.

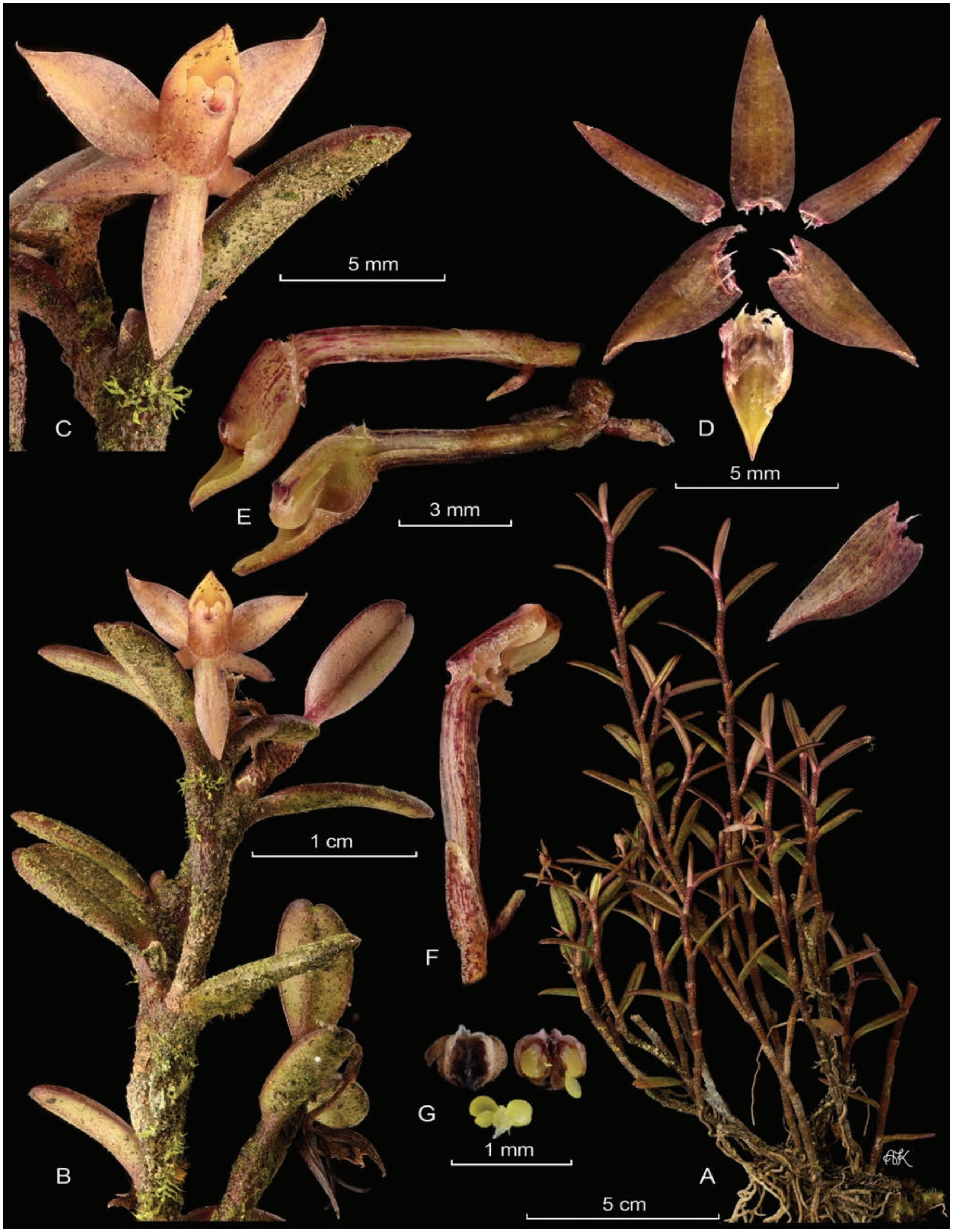

FIGURE 17. LCDP of *Epidendrum rugosum* Ames. **A**, Habit; **B**, Detail of the stem and inflorescence. **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal section; **F**, Column lateral view; **G**, Anther cap and pollinarium views. By APK based on *Karremans 8807* (JBL-spirit).

50 cm tall, completely covered in rugose sheaths, bearing 4–6 simultaneous, whitish, greenish-white to green flowers. However, the type material and accompanying illustrations clearly feature a small plant of up to 10 cm tall, with reddish leaf sheaths that do not fully cover the stem, a few-flowered inflorescence with up to three flowers a single open flower, the flower is described as whitish, but the accompanying illustration shows hyaline yellowish-cream-pink sepals and petals, with a dark red anther, the column is broad, flattened, and the broad lip, with a very short, triangular, free apical portion. Unfortunately, certain type elements are discordant and it is likely they are mixed collections. The flowers in the envelope on the Kew specimen have very narrow, lanceolate segments and the lip has a relatively large free portion. They do not match the flowers of the specimens on the photograph accompanying the type at AMES, which have broader segments and a very small free portion of the lip as illustrated in the color drawing on both type sheets. Plants from the mountains in the vicinity of Cartago, Costa Rica, where Lankester profusely collected, correspond quite closely to the type illustration and photographed specimens on the holotype of *E. rugosum* (Hágsater and Sánchez-Saldaña, 2007, pl. 981; Fig. 9). This is unlikely to be the same species as the flowers in the envelope at Kew, which bears the longer narrower segments that were described by Ames. However, assigning the name to this entity, together with a good illustration and emended description, will hopefully give us more confidence in applying this troublesome name in the future.

Epidendrum rugosum as here circumscribed can be recognized by the reddish, relatively small plants, up to 18 cm tall, the stems are very much branched, covered in dark-red foliar sheaths, bearing thick leaves with a red margin, the inflorescence arises from the branches, it is erect, very short, bearing up to three flowers, the flowers are open one at a time, they have a hyaline-cream color with yellowish-pink tones, the tepals are free and spreading, the sepals are 5.2–6.0 × 2.0–2.2 mm, the petals 5.1–5.2 × 1.0 mm, and the lip is triangular, with a short free portion and a transversal callus one third the length from the base.

Specimens labeled *E. rugosum* in herbaria, including many of those listed under this species in Hágsater and Sánchez (2007), belong to several other species. Some have been listed here under other taxa but I am unable to determine many of them with confidence without examining the floral parts in detail. The Panamanian record of *E. rugosum* cited by Bogarín et al. (2014), *S.A. Mori and J.A. Kallunki 5948* (MO), is *Epidendrum curvisepalum* Hágsater & Dressler. I have not seen material from that country that is attributable to *E. rugosum* as here circumscribed and the species should be therefore excluded.

Epidendrum atrorugosum Hágsater, Icon. Orchid. 3: t. 309. 1999. TYPE: COSTA RICA. San José: Pan Am. highway between km. 18 and 20 from El Empalme to Villa Mills, 2700 m, 8 August 1960, *M. Cruz 179* (Holotype, F, larger specimen on the right [not seen]; Isotype, AMES).

Epiphytic, caespitose erect *herb*, up to 30 cm tall. Roots 1 mm in diameter, fleshy. *Stems* green, branching conspicuously, cane-like, terete, partially covered by rugose sheaths. *Leaves* green. +10 distributed along the stem, deciduous, concentrating close to the apex with age; leaf sheath 7–15 mm long, tubular, rugose, green with red warts when young, becoming papery with age; blade 2.3–4.0 × 0.4–0.9 cm, thick coriaceous, oblong, unequally bilobed. *Inflorescence* 12–15 mm long, short, from the branches, racemose, distichous, sub-secund, erect, congested, notoriously sinuous, rachis twisting 90 degrees after each floral bract. *Floral bracts* 5 mm long, shorter than the ovary, acute. *Flowers* at least four, developing in very slow succession, with one or two open at a time, notoriously facing downwards in natural position, greenish diversely suffused with purple. *Ovary* 4.5 cm long, cylindrical, trialate, thin, elongate. *Sepals* free, spreading, very narrowly-ovate to lanceolate, shortly acuminate, with an apical dorsal keel; dorsal sepal 10.7 × 2.5 mm; lateral sepals 10.6–10.8 × 2.8–2.9 mm. *Petals* 9.2–9.3 × 1.4–1.6 mm, free, spreading, lanceolate, acute. *Lip* 7.8 × 2.7 mm, fused to the column, fleshy, triangular, base truncate, corners rounded, apex acute, margins thickened and slightly elevated, with a low transversal callus below the stigma, and a low central keel on the free portion. *Column* 3.5 mm long, thick, broad, with a strong bend of at least +45 degrees with respect to the ovary. *Anther* sub-trapezoid, very thin, 4-celled, margins irregular, elevated dorsally, flanking a dark-purple central depression. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen. *Description based only on *Karremans 8807*.

Etymology: From the Latin *atrans*, darkening, and *ruga*, wrinkle, in reference to the dark purple flowers and the close relationship with *E. rugosum*.

Habitat and distribution: Known from high elevations between 1900–3100 m growing in oak forests on the Talamanca mountain range in Costa Rica, down to ca. 1 km from the border with Panama where this species will surely be found as well.

Phenology: Registered to flowering from January to September.

Additional specimens examined: COSTA RICA. Cartago: El Guarco, San Isidro, Madreselva, Tres de Junio, Carretera Interamericana Sur, km 67, entrada a la finca El Jaular, 9°40'13"N, 83°51'56"W, 2610 m, bosque pluvial montano, en bosque secundario de Robles a orillas de la carretera, 25 June 2021, *A.P. Karremans and I. Chinchilla 8807* (JBL-spirit, Fig. 18). [El Guarco, San Isidro, Madreselva], Ciénega, Tres de Junio, 2700 m, 25 July 1960, *Cruz 11* (CR-41506; AMO-photo). La Cangreja, above and south of El Tejar, 1900 m, 20 May 1956, *L.O. Williams 20148* (INB-CR; AMO-photo). Cordillera de Talamanca, Ojo de Agua, 2900–3100 m, *J. Cuatrecasas and J. León 26545* (US; AMO-photo). El Guarco, San Isidro, Paso Macho (Macho Gaff), Parque Nacional Tapantí-Macizo de La Muerte, ca. 900 m después del puesto de guardaparques del sector La Esperanza, camino a las torres de transmisión eléctrica de Río Macho, 9°41'13.90"N, 83°52'9.65"W, 2748 m, epífitas en bosque pluvial montano, 30 September 2021, *D. Bogarín and E. Kaes 13484* (JBL-spirit). Copey, cloud forest area, Cordillera de Talamanca, 1900 m, 17 April 1949, *L.O. Williams 16370* (SEL-009757; SEL-009756; US-2024807; AMO-photos). Carretera panamericana km 66, trocha nueva

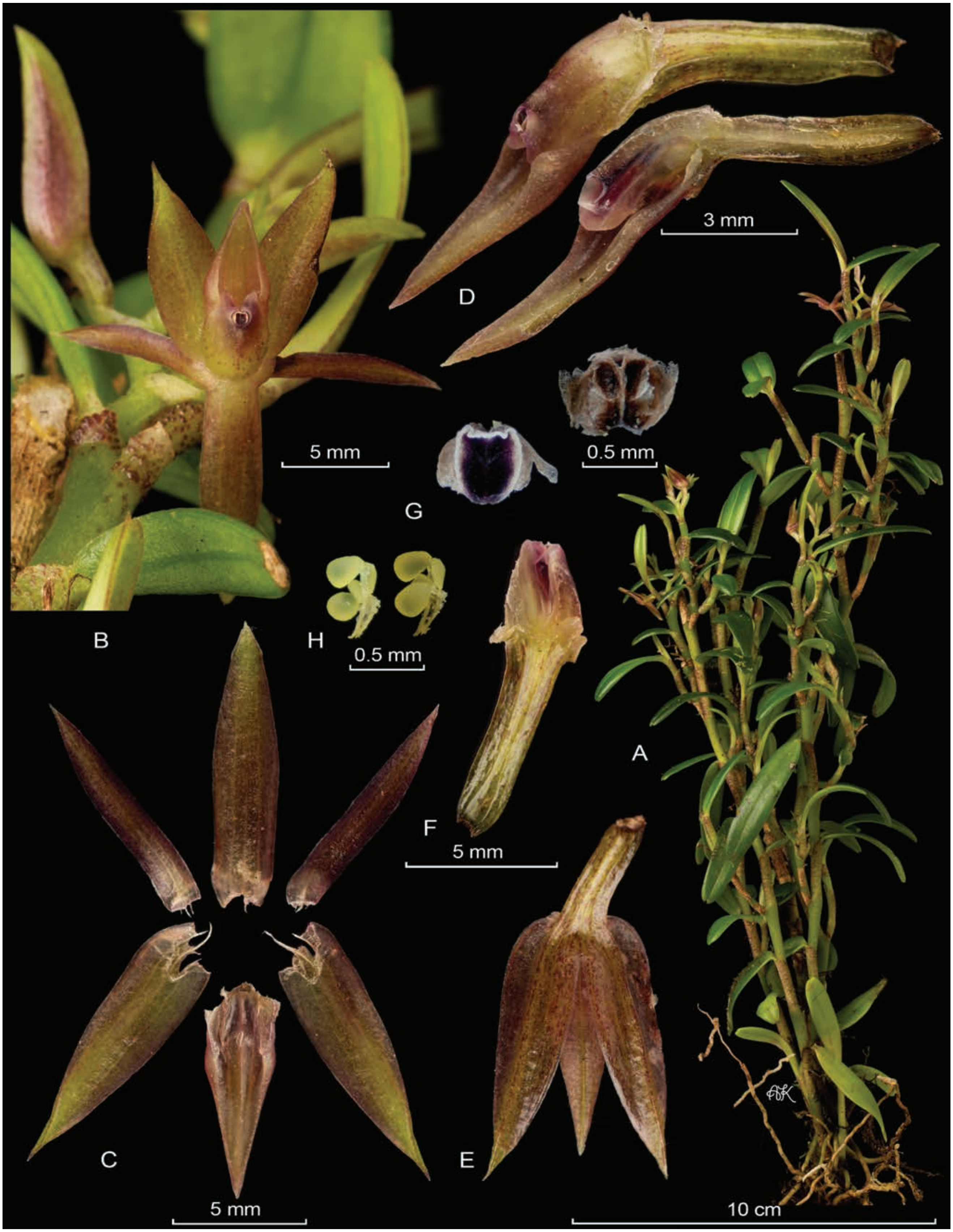

FIGURE 18. LCDP of *Epidendrum atrorugosum* Hágsater. **A**, Habit; **B**, Detail of the stem, inflorescence and flower seen from below; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Lateral sepals and lip seen from behind; **F**, Column ventral view; **G**, Anther cap views; H, Pollinarium views. By APK based on *Karremans 8807* (JBL-spirit).

al noreste, 18 August 1984, *R.L. Dressler 9* (USJ; AMO-photo). San Cristobal Road, 9°47'N, 84°01'W, 8000 ft, 27 May 1928, *H.E. Stork 2176* (MO; AMO-photo). San José: Cordillera de Talamanca, "The bog," elfin cloud forest area north of Cerro de la Muerte, 2600 m, 1 February 1963, *L.O. Williams et al. 24162* (AMES; CR-57625; F; AMO-photo). San José: Tres de Junio, Carretera Interamericana, 2600 m, 30 October 1979, *C. Todzia 795* (CR-72458; CR-84738; AMO-photo). San José: Dota, Copey, Salsipuedes, camino a Dos Amigos, Carretera Interamericana, km 70–71, en la entrada del Mirador de Quetzales, 9°39'05"N, 83°50'46"W, 2600–2800 m, 20 January 2008, *A.P. Karremans 2252* (JBL-D1541). Limón: Cordillera de Talamanca, Atlantic slope, Valle del Silencio, along the Río Terbi, 0.5–1.5 airline km W of the Costa Rican-Panamanian border; 9°08'N, 82°57'W, 2300–2400 m, 9 September 1984, *G. Davidse, G. Herrera and M.H. Grayum 28737* (MO; AMO-photo). N flank of Cerro Casma, along Ujarrás-San José Cabécar trail, Cordillera de Talamanca, 9°20'30"N, 83°13'30"W, 2250–2270 m, 17 March 1993, *M.H. Grayum 10334* (MO-4964304; MO-5620511; AMO-photo).

When originally described, *E. atrorugosum* was distinguished from the closely related *E. rugosum* by the larger purple flowers and the deflexed column forming a nearly 90 degree angle with the ovary (Hágsater et al., 1999). Relatively few specimens were known at the time, but a reexamination of the materials under *E. rugosum* in herbaria turned up many additional specimens. This species is easily recognized by the large, pendent, purple, or purple stained flowers that open in succession on a sinuous inflorescence.

Epidendrum manta-birostris Karremans, *sp. nov.*
TYPE: COSTA RICA. Limón: Talamanca, Telire, cerca de la cumbre de Cerros Utyum, 9°19'39.04"N, 83°10'44.12"W, 3047 m, bosque pluvial montano, epífita en páramo dominado por *Blechnum* y *Diplostephium floribundum*, 19 January 2017, *A.P. Karremans, D. Bogarín, M. Cedeño, I. Chinchilla, M. Díaz-Morales, E. Kaes, P. Lehmann and O. Zúñiga 7638* (Holotype, JBL-spirit; Fig. 19).

Similar to *Epidendrum atrorugosum* but distinguished by the scandent, purple plant (vs. caespitose, green), the shorter leaves (1.7–2.2 vs. 2.3–4.0 cm), the straight (vs. sinuous), shorter inflorescence (5 vs. 12–15 mm long), the bent ovary with a straight column (vs. ovary straight, column bent), the shorter sepals (7.5–7.6 vs. 10.6–10.8 mm), petals (6.6–6.9 vs. 9.2–9.3 mm) and lip (5.7 vs. 7.8 mm), the sepals ovate-elliptic, acute (vs. very narrowly-ovate to lanceolate, shortly acuminate).

Lithophytic, semi-erect, scandent, *herb*, up to 28 cm tall. Roots 1 mm in diameter, fleshy. *Stems* purplish, branching conspicuously, cane-like, terete, partially covered by rugose sheaths; branches generally short. *Leaves* up to 10, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath 7–13 mm long, tubular, rugose, reddish-purple when young, becoming papery with age; blade 1.7–2.2 × 0.4–0.7 cm, thick coriaceous, oblong, unequally bilobed. *Inflorescence* 5 mm long, short, from the branches, racemose, distichous, sub-secund, erect, congested. *Floral bracts* 3 mm long, much shorter than the ovary, acute. *Flowers* 2–3, wine-colored throughout. *Ovary* 6 mm long, triquetrous, elongate, strongly arched almost 90 degrees with respect to the base. *Sepals* free, spreading, ovate-elliptic, acute with an apical dorsal keel; dorsal sepal 7.5 × 2.0 mm; lateral sepals 7.5–7.6 × 2.5 mm. *Petals* 6.6–6.9 × 1.5 mm, free, spreading, lanceolate, acute. *Lip* 5.7 × 2.5 mm, fused to the column, short, fleshy, triangular, base truncate, corners rounded, apex acute, margins thickened and slightly elevated, with a very low transversal callus below the stigma, and a low central keel on the free portion. *Column* 3 mm long, thick, broad, ovoid, virtually straight. *Anther* sub-trapezoid, very thin, 4-celled, margins irregular, elevated dorsally, flanking a dark-purple central depression. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose, viscidium translucent. *Capsule* not seen.

Etymology: Derived from the scientific name of the giant oceanic manta ray *Manta birostris* (= *Mobula birostris*), of which I am reminded by the unusual column shape.

Habitat and distribution: Only known from the type specimen collected above 3000 m on the paramo at the summit of Cerros Utyum (Fig. 20), on the Cordillera de Talamanca in southern Costa Rica.

Phenology: Found blooming in January.

When first documented the type specimen of this taxon was believed to be *E. atrorugosum* on account of the overall similarity of the dark purple flowers. However, *E. manta-birostris* can be distinguished by the scandent, purple plant, the shorter branches and leaves, the shorter, straight inflorescence, the ovary strongly arched and the column straight, the smaller flowers with shorter sepals, petals and lip, and the sepals ovate-elliptic, acute. The type specimen of *Epidendrum manta-birostris* was found growing in very particular ecological conditions at 3047 m in the paramo on the summit of Cerros Utyum (Fig. 20). Even though there is one record of *E. atrorugosum* allegedly growing at around 3000 m, it is more typically found in the oak forests just below the summit of mountain peaks on the Talamanca Cordillera.

Epidendrum sanchoi Ames, Schedul. Orchid. 4: 48. 1923.
TYPE: COSTA RICA. Near Cartago, 6000 feet, *C.H. Lankester and A. Sancho 384* (Holotype, AMES [23158]; illustration of type, AMES [26877]).

Epiphytic, pseudo-monopodial, branching, *herb*, up to 65 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, covered by rugose sheaths; the main stem tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 2.8 cm long, tubular, rugose, brownish when young, becoming papery with age; leaf blade 3.0–3.8 × 0.4–0.6 cm on the main stems, 0.8–1.4 × 0.2–0.4 cm on the branches, coriaceous, oblong, unequally bilobed. *Inflorescence* short, 1 cm long, from the branches, racemose, distichous, sub-secund, erect, congested, with two sharp angles on the side facing the ovary. *Floral bracts* 2.5–3.0 mm long, shorter than the ovary, acute. *Flowers* 2–4, typically 3 or 4, pale green throughout. *Ovary* 3.5–4.0 mm

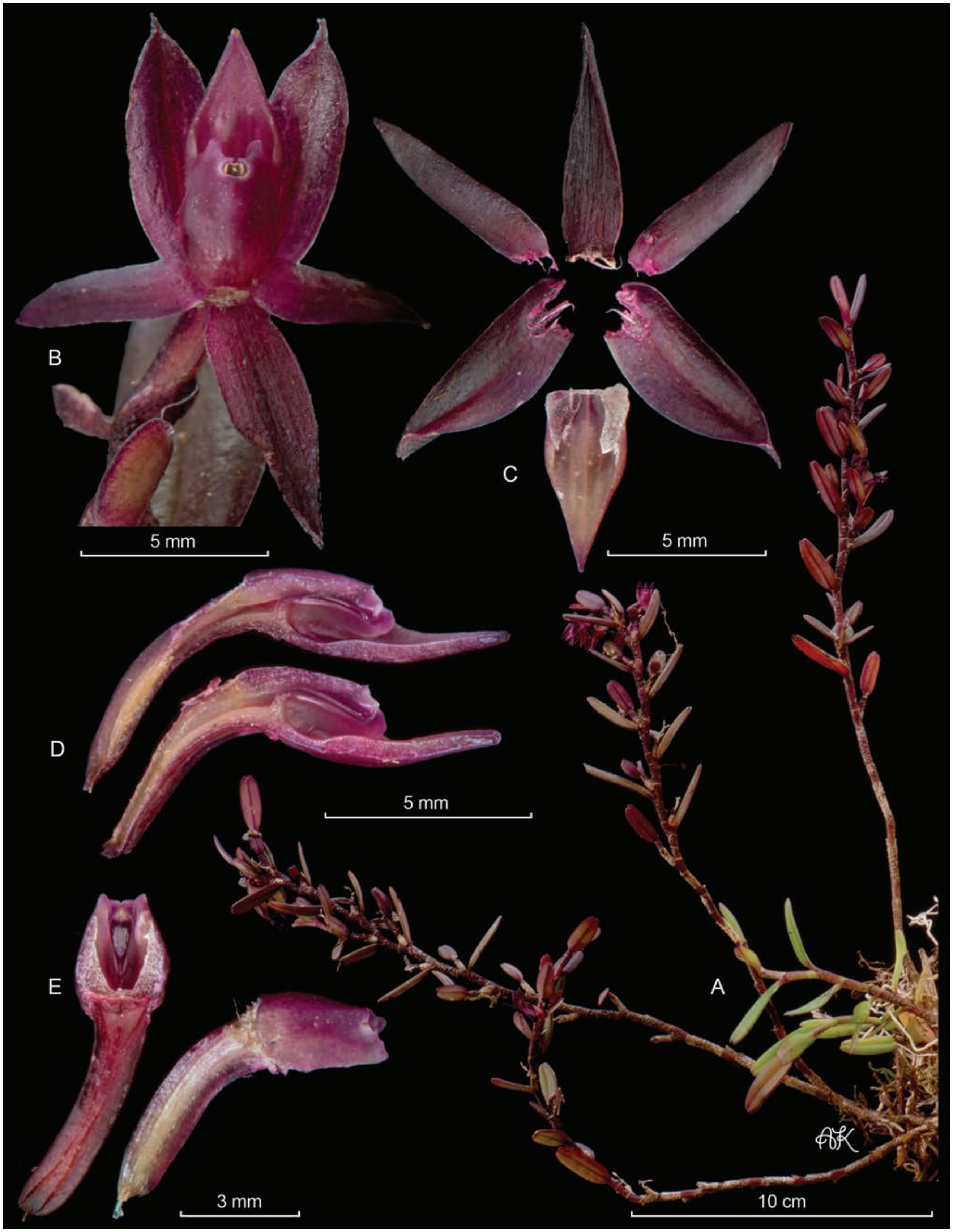

FIGURE 19. LCDP of *Epidendrum manta-birostris* Karremans. **A**, Habit; **B**, Flower; **C**, Dissected perianth; **D**, Lip and column transversal section; **E**, Column, ventral and lateral views. By APK based on *Karremans 7638* (JBL-spirit).

FIGURE 20. Type locality of *E. manta-birostris* Karremans in the paramo close to the summit of Cerros Utyum in Costa Rica. By APK.

long cylindrical, elongate. *Sepals* free, spreading widely, ovate-elliptic, acute with an apical dorsal keel; dorsal sepal 4.8 × 1.6 mm; lateral sepals 5.0 × 1.9–2.0 mm, slightly bent outwards. *Petals* 4.2–4.3 × 0.5 mm, free, spreading, linear-ligulate, acute. *Lip* 4.4 × 2.2 mm, fused to the column, short, fleshy, triangular, base truncate, corners rounded, apex acute, thick, margins thickened and slightly elevated, ecallose but with a pair of longitudinal depressions flanking the mid-vein, with give the appearance of an elevated keel. *Column* 2.3–2.6 mm long, terete, with a very subtle bend with respect to the ovary, conspicuously embraced by the lip. *Anther* sub-trapezoid externally, cellular-glandular, internally very thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen. *Description based only on *Karremans 8795*.

Etymology: In honor of Alfredo Sancho (1876–1929), a close friend and companion of Charles Lankester on his field trips.

Habitat and distribution: The specimens that correspond well with this taxon were collected on the mountains just above the city of Cartago, Costa Rica at an elevation of about 1700 m.

Phenology: It was recorded blooming in June and July.

Additional specimens examined: COSTA RICA. Cartago: El Guarco, San Isidro, entre Cangreja y Muñeco, 9°47'44"N, 83°56'21"W, 1700 m, creciendo en árboles de potrero, 25 June 2021, *A.P. Karremans and I. Chinchilla 8795* (JBL-spirit, Fig. 21, 33b).

Like *Epidendrum rugsoum*, *E sanchoi* was described by Ames in 1923 on the basis of plants collected by Lankester in Costa Rica. This name too has been and continues to be applied to several morphologically and ecologically dissimilar individuals that share the plants with a relatively large, much branched, bushy habit, bearing dozens of small white to green flowers, linear petals, and a thick, triangular lip. After careful inspection of living specimens from different localities it has become evident that there are in fact several species with these general features, some of which are proposed as new here. Therefore, it is essential to establish a new circumscription of *E. sanchoi*, by providing a new description and color plate, and expressly excluding the specimens cited by Hágsater and Sánchez-Saldaña (2008). The specimen illustrated and described here most closely resembles the original protologue, type and type illustration and was found growing at a similar elevation likewise on the mountains near the city of Cartago.

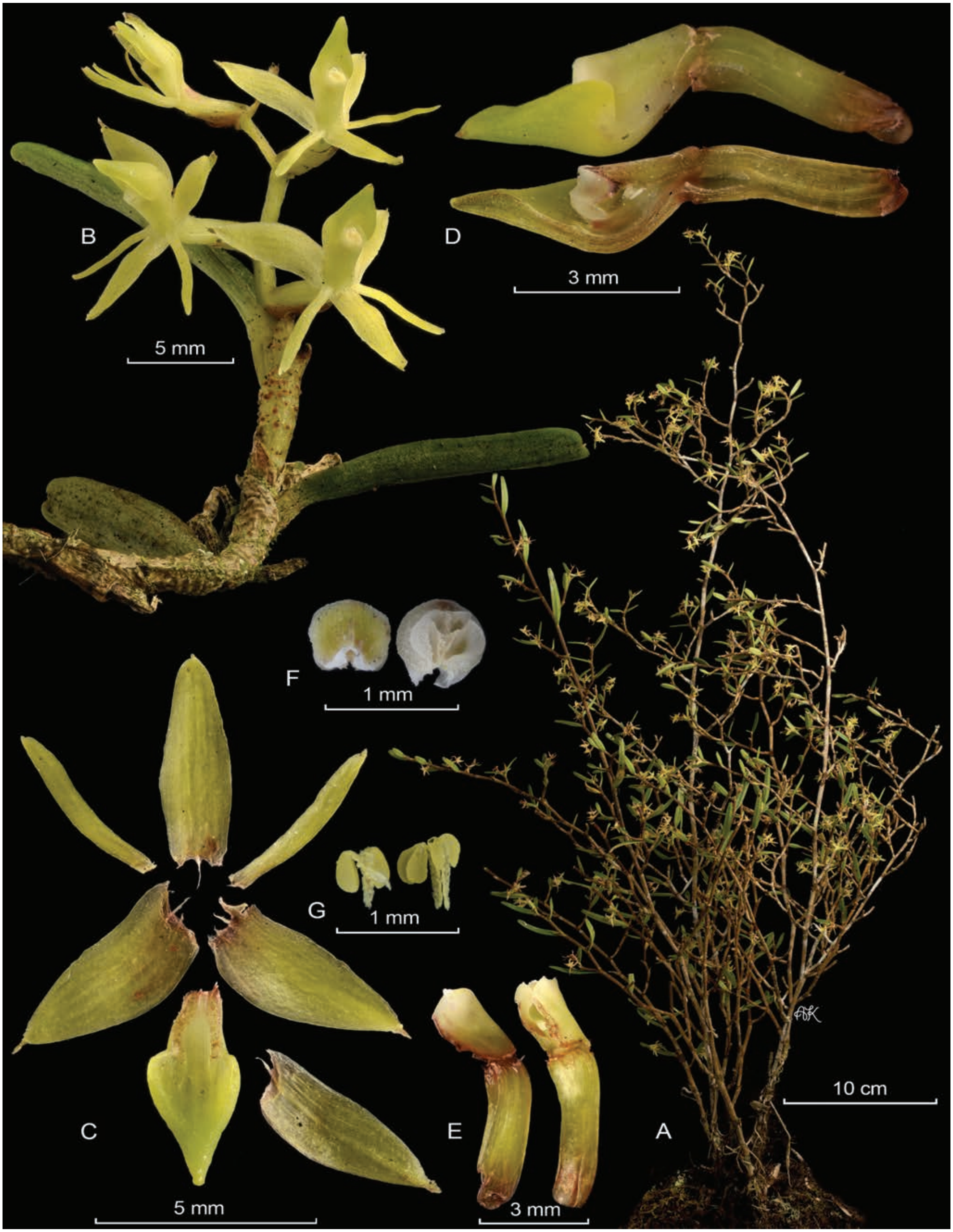

FIGURE 21. LCDP of *Epidendrum sanchoi* Ames. **A**, Habit; **B**, Detail of the stem, inflorescence and flower; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Column ventral and lateral views; **F**, Anther cap views; **G**, Pollinarium views. By APK based on *Karremans 8795* (JBL-spirit).

Epidendrum aeolicum Karremans, *sp. nov.*

TYPE: COSTA RICA. Cartago: El Guarco, San Isidro, Casa Mata, sobre la carretera interamericana, 9°46'52"N, 83°59'41"W, 1960 m, en árboles de potrero a la par de las eólicas, 9 January 2021, prepared 13 January 2021, *A.P. Karremans and M. Contreras Fernández 8640* (Holotype, JBL-spirit [K0108]; Fig. 22).

Similar to *E. sanchoi* but distinguished by the inflorescence typically bearing 2 flowers (vs. typically 3 or 4), the sepals narrowly lanceolate (vs. ovate-elliptic), the longer perianth segments, sepals 5.8–6.1 mm long (vs. 4.8–5.0), petals 5.5 mm long (vs. 4.2–4.3), lip 5.0 mm long (vs. 4.4), the lip lacking the longitudinal depressions flanking the midvein (vs. present, making the lip appear to have an elevated keel), column with a conspicuous 90 degree bend with respect to the ovary (vs. very slight bend), and anther cap purplish (vs. green).

Epiphytic, bushy, pseudo-monopodial, branching, *herb*, up to 60 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, somewhat flexuous, covered by rugose sheaths; the main stem tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 3 cm long, tubular, rugose, brownish, becoming papery with age; blades 8.0 × 0.8 cm on the main stems, 1.8–2.1 × 0.2–0.5 cm on the branches, thick coriaceous, oblong-ligulate, unequally bilobed. *Inflorescence* produced from the branches, racemose, distichous, sub-secund, erect, congested, 1 cm long, with two sharp angles on the side facing the ovary, verruculose. *Floral bracts* 2.0–2.5 mm long, shorter than the ovary, acute. *Flowers* 1–3, typically 2, light green throughout, anther purplish. *Ovary* 4 mm long, cylindrical, elongate, bent. *Sepals* free, spreading to revolute, narrowly lanceolate, non-carinate, except for a prominent, thickened dorsal apiculum; dorsal sepal 6.0–6.1 × 1.5 mm, perpendicular to the column; lateral sepals 5.8–6.1 × 1.8–1.9 mm, notoriously bent outwards above the middle. *Petals* 5.5 × 0.4–0.5 mm, free, spreading, held out backwards, linear, acute. *Lip* 5.0 × 2.5 mm, fused to the column, free portion 3.5 mm, short, fleshy, triangular, base truncate, corners rounded, ecallose, apex thickened, acute, margins thickened and slightly elevated. *Column* 2.5 mm long, short, terete, with a strong bend of about 90 degrees with respect to the ovary. *Anther* sub-ovoid, thin, 4-celled, cellular-glandular, provided with a pair of triangular, thin appendages. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose, viscidium translucent. *Capsule* not seen.

Etymology: Derived from *Aeolus*, keeper of the winds in Greek mythology, in reference to the windy habitat of this species.

Habitat and distribution: The species is only known from around Casa Mata, on very windy slopes at 1960 m in elevation (Fig. 23).

Phenology: It was recorded blooming in January.

Additional specimens examined: COSTA RICA. Cartago: El Guarco, San Isidro, Casa Mata, sobre la carretera interamericana, 9°46'52"N, 83°59'41"W, 1960 m, en árboles de potrero a la par de las eólicas, 9 January 2021, *A.P. Karremans and M. Contreras Fernández 8601* (JBL-spirit, F. 33c).

Of all the species here described *E. aeolicum* is the most superficially similar to *E. sanchoi*. However, when the floral details are carefully examined, they are easily distinguished. The inflorescences of *E. aeolicum* typically bear only 2 flowers, the flower segments are longer and much more lanceolate-acuminate, and the lip lacks the longitudinal depressions flanking the midvein. The most distinctive features are the conspicuous 90 degrees bend of the column with respect to the ovary and purplish anther cap.

Epidendrum utyumii Karremans, *sp. nov.*

TYPE: COSTA RICA. Limón: Talamanca, Telire, cerca de la cumbre de Cerros Utyum, 9°19'39.04"N, 83°10'44.12"W, 3047 m, bosque pluvial montano, epífita en páramo dominado por *Blechnum* y *Diplostephium floribundum*, 19 January 2017, *A.P. Karremans, D. Bogarín, M. Cedeño, I. Chinchilla, M. Díaz, E. Kaes, P. Lehmann and O. Zúñiga 7640* (Holotype, JBL-spirit; Fig. 24).

Similar to *E. sanchoi* but distinguished by the compact, purplish plant (vs. plant bushy, tall, green), with white flowers with a purple column apex (vs. flowers green throughout), dorsal sepal oblong (vs. ovate-elliptic), the larger lateral sepals (5.3–5.5 × 2.3–2.4 vs. 5.0 × 1.9–2.0 mm) and wider petals (0.9–1.0 vs. 0.5 mm), that are narrowly oblong (vs. linear-ligulate) and the lip lacking the longitudinal depressions flanking the midvein (vs. present, making the lip appear to have an elevated keel) and anther cap purplish (vs. green).

Epiphytic, branching, *herb*, up to 38 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, covered by rugose sheaths; main stems tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 2 cm long, tubular, rugose, reddish-purple when young, becoming papery with age; blade up to 1.5 × 0.5 cm, thick coriaceous, oblong to narrowly ovate, unequally bilobed, greenish-purple. *Inflorescence* 7.5 mm long, short, from the branches, racemose, distichous, sub-secund, erect, congested. *Flowers* 2–3, white throughout, except the column apex which is stained with purple and the center of the anther cap which is solid dark purple. *Ovary* 3.3 mm long, cylindrical, elongate, straight. *Sepals* free, spreading, apex recurved, acute with an apical dorsal keel; dorsal sepal 5.1 × 1.5 mm oblong, obtuse; lateral sepals 5.3–5.5 × 2.3–2.4 mm, ovate, acute. *Petals* 4.4–4.6 × 0.9–1.0 mm, free, spreading, held out backwards, narrowly oblong, acute. *Lip* 4.4 × 2.0 mm, fused to the column, short, fleshy, triangular, base truncate, corners rounded, apex acute, margins thickened and slightly elevated, without a callus. *Column* 1.6 mm long, thick, terete, straight with respect to the ovary. *Anther* sub-trapezoid, very thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: Named after the area of Cerros Utyum in the Cordillera de Talamanca, the type locality of this species. The name comes from the native Bribri language and it is derived from *Ùyöm: ù*, home, and *yöm*, which is a word for oronym.

Habitat and distribution: The species is only known from the on the continental divide between 2600 and 2800 m

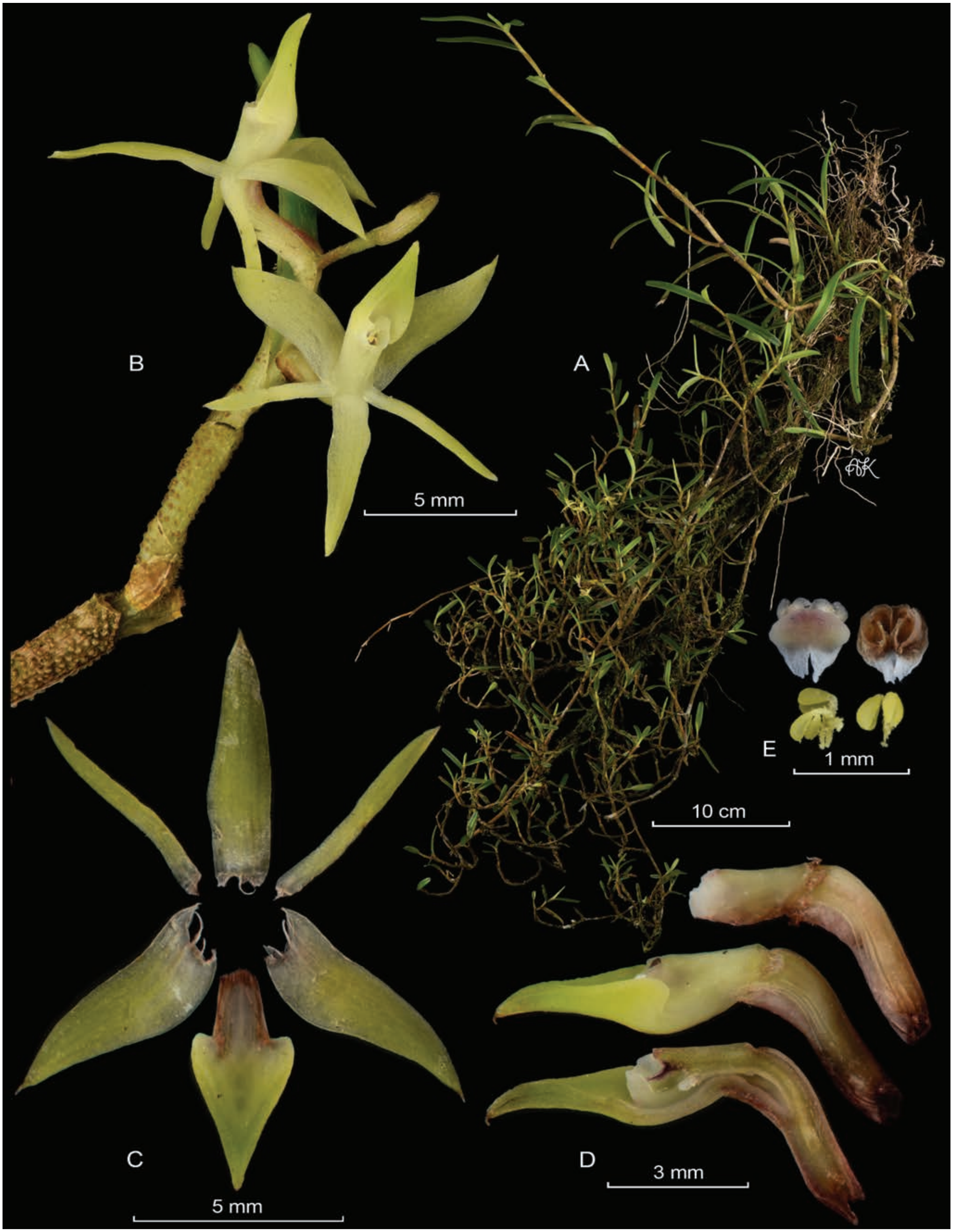

FIGURE 22. LCDP of *Epidendrum aeolicum* Karremans. **A**, Habit; **B**, Detail of the stem, inflorescence and flower; **C**, Dissected perianth; **D**, Lip and column lateral views and transversal section; **E**, Anther cap and pollinarium views. By APK based on *Karremans 8640* (JBL-spirit).

FIGURE 23. Type locality of *E. aeolicum* Karremans, pastures surrounding the wind turbines above the city of Cartago in Costa Rica. By APK.

along the Carretera Interamericana around the Salsipuedes area and paramo at the summit of Cerros Durika and Utyum, on the Cordillera de Talamanca in southern Costa Rica (Fig. 25).

Phenology: It was recorded blooming between September and January.

Additional specimens examined: COSTA RICA. San José: Dota, Copey, Salsipuedes, camino a Dos Amigos, Carretera Interamericana, km 70–71, en la entrada del Mirador de Quetzales, 9°38'46.5"N, 83°50'49.8"W, 2767 m, 20 January 2008, *A.P. Karremans 2267* (JBL-2267). San José: Dota, Copey, Salsipuedes, Dos Amigos, ca. 19 km del Empalme hacia San Isidro del General, Carretera Interamericana, km 69–70, entrada al Mirador de Quetzales, 9°38'46.5"N, 83°50'49.8"W, 2767 m, bosque pluvial montano, "*hoc plantae invenimus in sylvis palustribus alpinibus in loco typico Brachionidii cruzae,*" 30 January 2011, *A.P. Karremans, M. Contreras Fernández and D. Bogarín 3492* (JBL-D4629). San José: Dota, Copey, Salsipuedes, Dos Amigos, ca. 19 km del Empalme hacia San Isidro del General, Carretera Interamericana, km 69-70, entrada al Mirador de Quetzales, 9°38'50"N, 83°50'48"W, 2750 m, bosque pluvial montano, collected 19 June 2021, prepared 26 October 2021, *A.P. Karremans and M. Contreras Fernández 8778* (JBL-spirit). *Idem*, *A.P. Karremans and M. Contreras Fernández 8784* (JBL-spirit). Cordillera de Talamanca, Salsipuedes, 2700 m, prepared 20 November 1982, *Horich sub. Hágsater 6929* (CR; illustration). Copey, Salsipuedes, Dos Amigos, ca. 20 km del Empalme hacia San Isidro del General, Carretera Interamericana, calle al Cerro Vueltas, 9°38'27"N, 83°50'49"W, 2810 m, bosque pluvial montano, 26 September 2021, *A.P. Karremans and M. Contreras Fernández 8872* (JBL-spirit). Copey, Salsipuedes, Dos Amigos, ca. 19 km del Empalme hacia San Isidro del General, Carretera Interamericana, km 69-70, entrada al Mirador de Quetzales, 9°38'54"N, 83°50'45"W, 2765 m, bosque pluvial montano, 26 September 2021, *A.P. Karremans and M. Contreras Fernández 8873* (JBL-spirit). Cordillera de Talamanca, about 19 km S of El Empalme at 8750 ft. elevation, 6 March 1981, *F. Almeda and K. Nakai 4769* (CR-232430). Limón: Talamanca, Telire, cerca de la división continental entre Cerro Arbolado y Cerro Durika, 9°19'15"N, 83°13'26"W, ca. 2600 m, *E. Kaes s.n.* (JBL-photo, Fig. 33d).

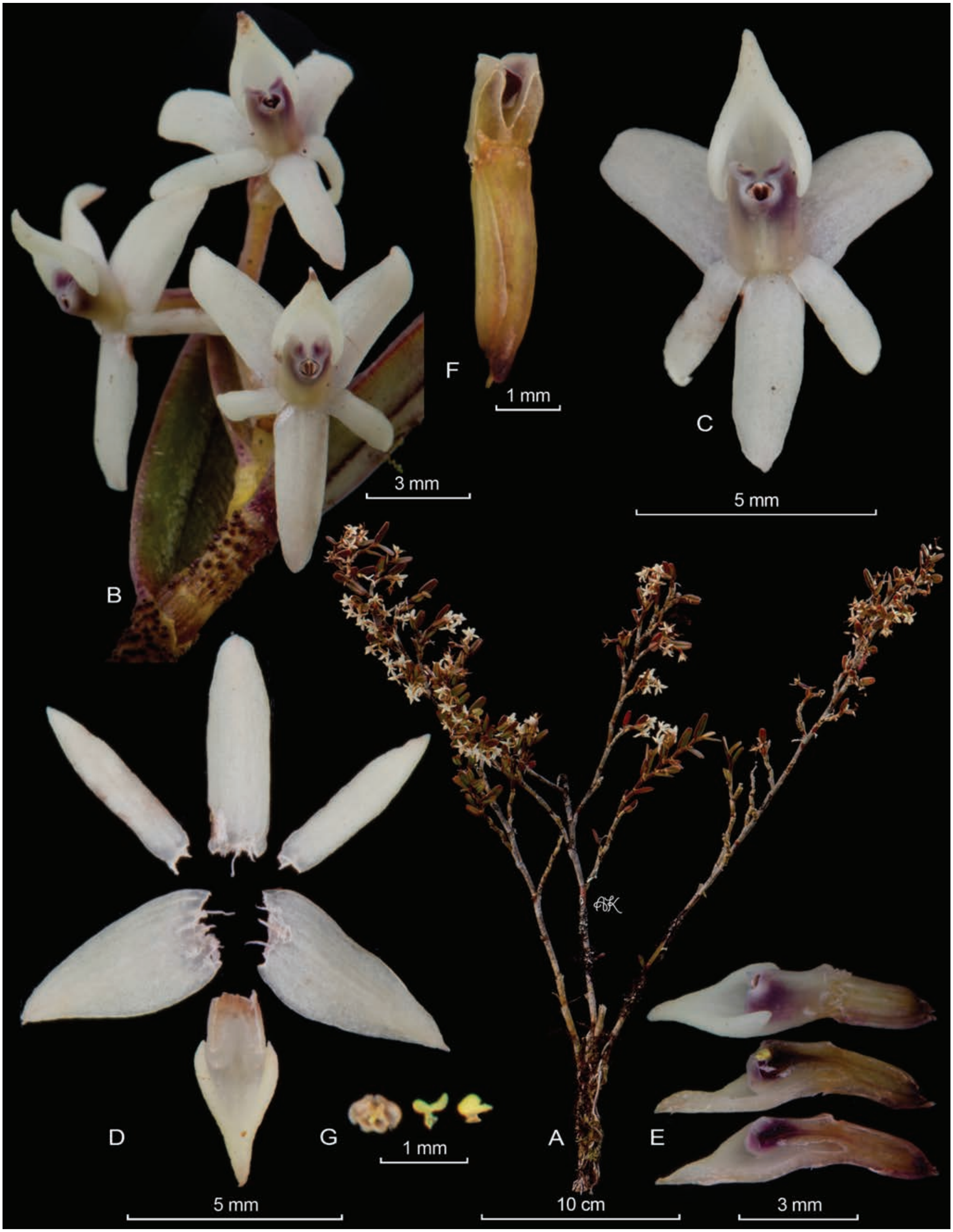

FIGURE 24. LCDP of *Epidendrum utyumii* Karremans. **A**, Habit; **B**, Detail of the stem, inflorescence and flower; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal sections; **F**, Column ventral views; **G**, Anther cap and pollinarium views. By APK based on *Karremans 7640* (JBL-spirit).

FIGURE 25. View of the Talamanca mountain range in southern Costa Rica and western Panama as seen from the type locality of *E. utyumii* Karremans, close to the summit of Cerros Utyum. By APK.

Epidendrum sidereum Karremans, *sp. nov.*
TYPE: COSTA RICA. San José: Perez Zeledón, Villa Mills, en bosque de roble al lado de la calle cerca de la Reserva Forestal Río Macho sector Villa Mills, 9°33'9"N, 83°41'49"W, 2820 m, 19 June 2021, *A.P. Karremans and M. Contreras Fernández 8772* (Holotype, JBL-spirit; Fig. 26).

Similar to *E. sanchoi* in the pseudo-monopodial, large, bushy habit, but distinguished by the white flowers with purple sepal apices, the much bigger leaves, on the main stems 7.5 × 0.9 cm (vs. 3.0–3.8 × 0.4–0.6 cm) on the branches 3.0 × 0.5 cm (vs. 0.8–1.4 × 0.2–0.4 cm) and longer inflorescence 1.5–2.0 cm (vs. 1 cm), the flowers are longer and narrower, sepals 6.0–6.5 × 1.0–1.5 mm (vs. 4.8–5.0 × 1.6–2.0 mm) and the lip is 6.0 × 1.5 mm (vs. 4.4 × 2.2 mm), the sepals are narrowly lanceolate (vs. ovate-elliptic), and the lip is ecallose (vs. callus-like longitudinal depressions flanking the midvein) and acuminate (vs. triangular).

Epiphytic, bushy, pseudo-monopodial, branching, *herb*, up to 65 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, somewhat flexuous, covered by rugose sheaths; main stem tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 2.5 cm long, tubular, rugose, brownish, becoming papery with age; blades 7.5 × 0.9 cm on the main stems, 3.0 × 0.5 cm on the branches, thick coriaceous, oblong-ligulate, unequally bilobed. *Inflorescence* 1.5–2.0 cm long, produced from the branches, racemose, distichous, sub-secund, erect, congested, with two sharp angles on the side facing the ovary, verrucose. *Floral bracts* 4–5 mm long, shorter than the ovary, acute, verruculose. *Flowers* 3–5, typically 4, white with a green column, lightly suffused with purple within the column apex and on the apex of the keels on the sepals. *Ovary* 6 mm long, cylindrical, elongate, verruculose. *Sepals* free, spreading only partially, narrowly lanceolate, non-carinate, but with a prominent, thickened apiculum; dorsal sepal 6.0—6.5 × 1.0 mm, bent over the column; lateral sepals 6.5 × 1.5 mm, with a slight inward bend near the apex. *Petals* 5.5 × 0.7—0.8 mm, free, spreading, held out straight, perpendicular to the column, linear to narrowly-lanceolate, slightly, but consistently undulate, acute. *Lip* 6.0 × 1.5 mm, fused to the column, free portion 4 mm long, short, fleshy, triangular, base truncate, corners rounded, ecallose, apex thickened, acuminate, margins thickened and

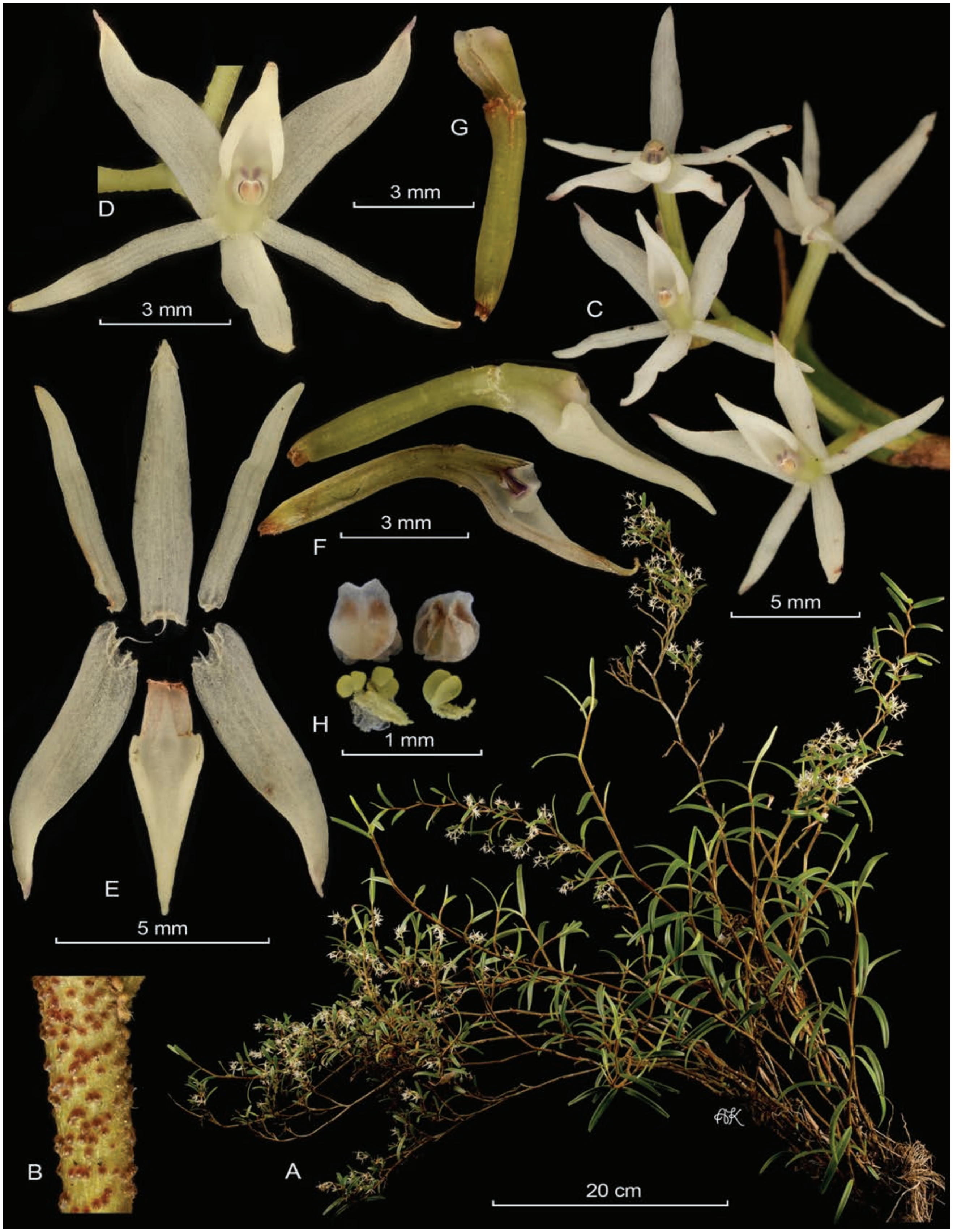

FIGURE 26. LCDP of *Epidendrum sidereum* Karremans. **A**, Habit; **B**, Detail of the rugose leaf sheaths; **C**, Inflorescence; **D**, Flower; **E**, Dissected perianth; **F**, Lip and column lateral view and transversal section; **G**, Column lateral view; **H**, Anther cap and pollinarium views. By APK based on *Karremans 8772* (JBL-spirit).

slightly elevated. *Column* 2 mm, short, terete, with a slight bend with respect to the ovary. *Anther* sub-ovoid, thin, 4-celled, cellular-glandular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose, viscidium translucent. *Capsule* 10 × 2 mm ellipsoid.

Etymology: The name comes from the Latin *sidereum*, starry, in reference to the appearance of a large, fully flowered plant with its dozens of delicate white flowers.

Habitat and distribution: The species is only known from the high elevation oak forests between 2600 and 2800 m along the Carretera Interamericana around Villa Mills (Fig. 27) and between Cerro Arbolado and Durika, in the Talamanca mountain range.

Phenology: It was recorded blooming in January, February, June and July.

Additional specimens examined: COSTA RICA. Limón: Talamanca, Telire, cerca de la división continental entre Cerro Arbolado y Cerro Durika, 9°19'15"N, 83°13'26"W, ca. 2600 m, *E. Kaes s.n.* (JBL-photo, Fig. 33e).

Epidendrum sidereum forms large bushy plants that become completely covered in small, white, star-shaped flowers. It is related to and has been confused with *E. sanchoi*. However, it can be distinguished from by the flowers that are almost pure white with the exception of the purple coloration within the anther and stigma region in the column and the apices of the sepals, by the larger leaves, the flowers with longer and narrower segments and the ecallose lip. It also grows at higher elevations on the Talamanca mountain range. In the flower color it is similar to *E. utyumii* which is also a high elevation species from the same mountain range. However, that species has compact, purplish plants, and the flowers have shorter and wider sepals, petals and lip, the lateral sepals are ovate, rather than narrowly lanceolate and the petals are narrowly oblong rather than linear to narrowly-lanceolate.

Epidendrum saltatrix Karremans, *sp. nov.*
TYPE: COSTA RICA. San José: Dota, Copey, Salsipuedes, Dos Amigos, ca. 18 km del Empalme hacia San Isidro del General, 1 km antes de la entrada al Mirador de Quetzales, Carretera Interamericana, 9°39'10"N, 83°50'53"W, 2728 m, bosque pluvial montano, 19 June 2021, *A.P. Karremans and M. Contreras Fernández 8785* (Holotype, JBL-spirit; Fig. 28, 33f).

Similar to *E. sanchoi* but distinguished by the larger branch leaves, 2.3 × 0.5 cm (vs. 0.8–1.4 × 0.2–0.4 cm), the

FIGURE 27. Habitat at the type locality of *E. sidereum* Karremans, close to Reserva Forestal Río Macho in Villa Mills. By APK.

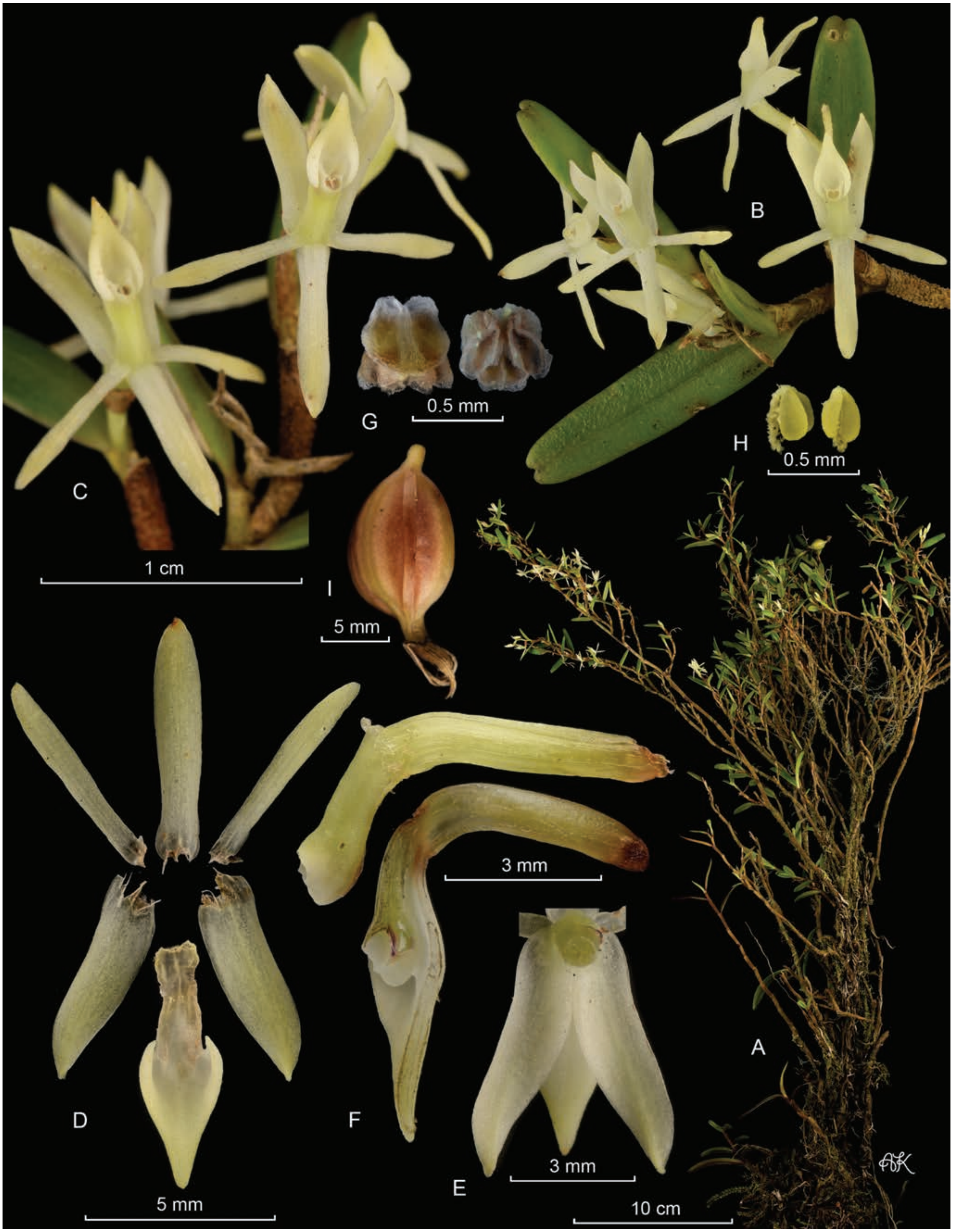

FIGURE 28. LCDP of *Epidendrum saltatrix* Karremans. **A**, Habit; **B**, Detail of the stem, inflorescence and flowers; **C**, Flowers; **D**, Dissected perianth; **E**, Lateral sepals fused at the base viewed from behind; **F**, Lip and column lateral view and transversal section; **G**, Anther cap views; **H**, Pollinarium views; **I**, Capsule. By APK based on *Karremans 8785* (JBL-spirit).

inflorescence that typically bears 2 cream-colored flowers (vs. typically 3 or 4, pale green), the longer floral bracts, 4.0 mm long (vs. 2.5–3.0 mm) and ovary, 5.0 mm long (vs. 3.5–4.0 mm), the lateral sepals which are fused at the base and flank the lip (vs. sepals free, spreading), the longer sepals (7.0 vs. 4.8–5.0 mm) and petals (6.0 vs. 4.2 mm), and the column with a notorious 90 degree bend with respect to the ovary (vs. column bend very subtle).

Epiphytic, bushy, branching, *herb*, up to 50 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, covered by rugose sheaths; the main stem tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 2 cm long, tubular, rugose, reddish-brown when young, becoming papery with age; leaf blade 2.3 × 0.5 cm on the branches, coriaceous, oblong, unequally bilobed. *Inflorescence* 5–7 mm long, short, from the branches, racemose, distichous, sub-secund, erect, congested, with two sharp angles on the side facing the ovary, verrucose. *Floral bracts* 4.0 mm long, shorter than the ovary, acute, verrucose. *Flowers* 1–3, typically 2, greenish-cream colored throughout. *Ovary* 5.0 mm long, cylindrical, elongate, bent apically. *Sepals* spreading widely, with a small apical dorsal keel; dorsal sepal 7.0 × 1.5 mm, oblong, acute; lateral sepals 7.0 × 2.0 mm, falcate, broadly lanceolate, acute, fused for 2 mm at the base and therefore flanking the lip. *Petals* 6 × 0.9–1.0 mm, free, spreading, linear to narrowly oblanceolate, acute, somewhat held backwards. *Lip* 4.4 × 2.2 mm, fused to the column, short, fleshy, triangular, base truncate, corners rounded, apex acute, thick, margins thickened and slightly elevated, ecallose. *Column* 2.5 mm long, terete, with a 90 degrees downward bend with respect to the ovary, and slightly bent upwards near the apex. *Anther* sub-trapezoid cellular-glandular, very thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed. *Capsule* 15 × 8 mm ellipsoid, three-winged, brownish-green.

Etymology: From the Latin *saltatrix*, "a woman dancer," in allusion to the graceful flower.

Habitat and distribution: Only known from the type specimen collected at 2728 m in elevation in Dos Amigos on the Carretera Interamericana.

Phenology: It was recorded blooming in June and July.

Epidendrum saltatrix is related to *E. sanchoi*, *E. utyumii*, and *E. sidereum*, but is immediately distinguished by the sharp, 90 degree bend of the column with respect to the ovary and by the lateral sepals that flank the lip in natural position due to a 2 mm basal fusion. All other species in the group have free and spreading lateral sepals except for *E. suturatum* Hágsater & Dressler. However, that species is endemic to central Panama and has shorter plants, with inflorescences bearing 4 to 5 flowers that are brownish-green with the column apex purple, the dorsal sepal is lanceolate, a thick and much longer column, and shorter lip.

Epidendrum colibri Karremans, *sp. nov.*
TYPE: COSTA RICA. Puntarenas: Buenos Aires, Buenos Aires, camino a Cerros Utyum, 9°18'04.93"N, 83°12'51.59"W, 2157 m, bosque pluvial montano bajo, epífitas en bosque secundario, collected 16 January 2017, prepared 31 March 2017, *A.P. Karremans, D. Bogarín, M. Cedeño, I. Chinchilla, M. Díaz, E. Kaes, P. Lehmann and O. Zúñiga 7574* (Holotype, JBL-spirit [E1253]; Fig. 29, 33g).

Similar to *E. sanchoi* but distinguished by scandent (vs. bushy) plant, with a longer inflorescence (2 vs. 1 cm long), with conspicuous (vs. inconspicuous) floral bracts and typically 5 flowers (vs. 3 or 4), that have purple stripes radiating on the external surface of the lip (vs. pale green throughout), the floral bracts are larger (4.5–5.0 vs. 2.5–3.0 mm long), covering the ovary (vs. not covering the ovary) the longer sepals (5.7–5.9 vs. 4.5–5.0 mm) that are narrowly ovate to lanceolate (vs. ovate-elliptic), the longer and broader petals (4.9–5.0 × 0.9–1.0 vs. 4.2–4.3 × 0.5 mm) and ecallose lip (vs. lip with callus-like longitudinal depressions flanking the midvein).

Epiphytic, pseudo-monopodial, scandent, branching, *herb*, up to 60 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching, cane-like, terete, somewhat flexuous, covered by rugose sheaths; the main stems tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 3.5 cm long, tubular, rugose, greenish-brown, becoming papery with age; blades 5.5 × 0.5 cm on the main stems, 1.2–1.7 × 0.2–0.4 cm on the branches, thick coriaceous, oblong-ligulate, unequally bilobed. *Inflorescence* 2 cm long, produced from the branches, racemose, distichous, sub-secund, erect to suberect, congested, rachis sinuous, with two sharp angles on the side facing the ovary, verruculose. *Floral bracts* 4.5–5.0 mm long, large, as long as the ovary, acute, notoriously dominating the inflorescence before anthesis. *Flowers* 4–5, greenish-cream throughout, lip externally with pale purple, radiating stripes, anther pale purple. *Ovary* cylindrical, elongate, 4.3 mm long, slightly bent. *Sepals* free, spreading widely, reflexed, narrowly ovate to lanceolate, with a thickened dorsal apiculum; dorsal sepal 5.7 × 1.6 mm; lateral sepals 5.7–5.9 × 2.2–2.3 mm, notoriously divergent. *Petals* 4.9–5.0 × 0.9–1.0 mm, free, spreading-reflexed, held out backwards, linear-ligulate, acute. *Lip* 4.5 × 2.7 mm, fused to the column, fleshy, triangular, base truncate, corners rounded, ecallose, apex thickened, acute, margins thickened and elevated, apex notoriously conically thickened, resulting in a deeply concave base. *Column* 2.3 mm long, short, terete, stout, apically truncate, slightly bent downwards with respect to the ovary. *Anther* sub-spherical dorsally, ventrally thin, with irregular margins, 4-celled. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: From the Spanish *colibrí*, hummingbird, in reference to the disposition of the flowers.

Habitat and distribution: The species is only known from high elevations between 2157 and 2550 m in the southern part of the Cordillera de Talamanca.

Phenology: It was recorded blooming in March and September.

Additional specimens examined: COSTA RICA. Puntarenas: Buenos Aires, P.N. La Amistad, cuenca Térraba-Sierpe, puesto Tres Colinas, 9°09'42"N, 83°04'01"W, 2550 m, 15 September 1996, *Billen Gamboa R. and A. Picado 569* (CR-INB; AMO-photo).

Epidendrum colibri is florally similar to *E. sanchoi* but immediately distinguished by the scandent plant, with a

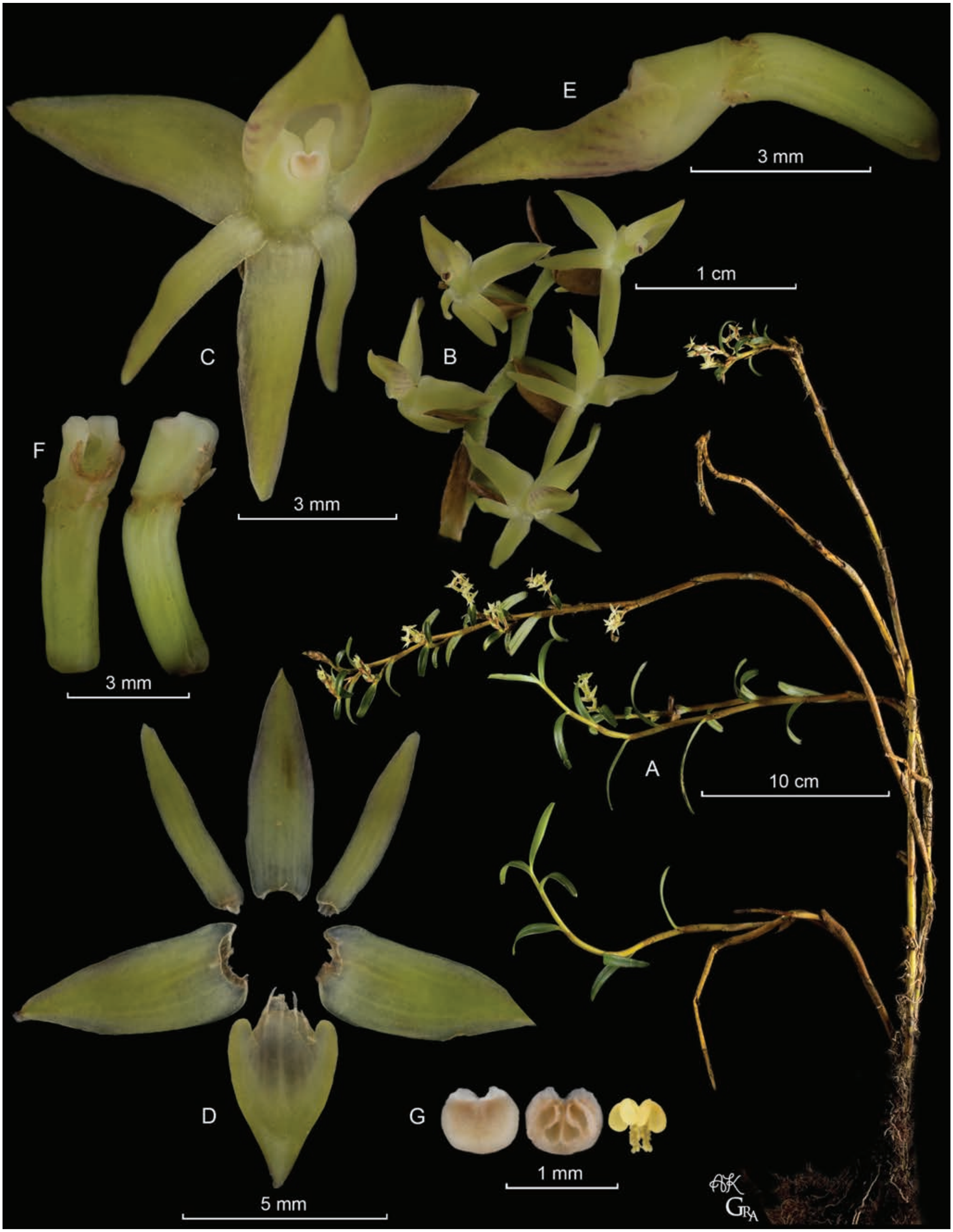

FIGURE 29. LCDP of *Epidendrum colibri* Karremans. **A**, Habit; **B**, Detail of the inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view; **F**, Column lateral and ventral views; **G**, Anther cap and pollinarium views. By G. Rojas-Alvarado and APK based on *Karremans 7574* (JBL-spirit).

longer inflorescence typically bearing 5 flowers, conspicuous floral bracts that cover the ovary and by the lip with radiating purple stripes externally. It is also similar to *E. microcardium* but can be easily distinguished by the bird-like disposition of the flowers with the sepals and petals spreading-reflexed and held backwards, the larger flowers, with an externally striped lip and the notoriously thickened conical apex.

Epidendrum microcardium Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 39. 1923. TYPE: COSTA RICA. Tablazo, 1921, *C. Wercklé 111* [Holotype, B, destroyed; lectotype, AMES [39893], selected by Pupulin (2010)].

Epiphytic, bushy, branching, *herb*, up to 55 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, covered by rugose sheaths; main stem tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 2.6 cm long, tubular, rugose, brownish when young, becoming papery with age; leaf blade up to 5.0 × 0.8 cm on the main stems, 1.7–3.6 × 0.4–0.6 cm on the branches, coriaceous, oblong, unequally bilobed. *Inflorescence* up to 2.5 cm long, sub-erect, from the branches, racemose, distichous, sub-secund, erect, congested, with two sharp angles on the side facing the ovary. *Floral bracts* 4.0–4.5 mm long, as long as or slightly exceeding the ovary, acute. *Flowers* 5–10, tiny, pale green throughout. *Ovary* 4 mm long, cylindrical, elongate, bent at the apex. *Sepals* free, not spreading, more or less sub-parallel the column and lip, oblong-elliptic, acute with an apical dorsal keel; dorsal sepal 4.4 × 1.3 mm; lateral sepals 4.1–4.2 × 1.6 mm. *Petals* 3.7–3.8 × 0.5 mm, free, not spreading, rather sub-parallel to the column, linear-ligulate, acute. *Lip* 3.8–3.9 × 2.3 mm, fused to the column, short, fleshy, triangular, base truncate-subcordate, corners rounded, apex acute, thick, with the margins elevated and thickened, slightly elevated at the base, not quite forming a callus. *Column* 2.3–2.4 mm long, terete, with a very subtle bend with respect to the ovary, embraced by the lip. *Anther* sub-trapezoid, thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen. *Description based only on *Karremans 8420*.

Etymology: From the Greek *μικρός*, small, and *καρδιά*, heart, probably referring to the small heart-shaped lip.

Habitat and distribution: Currently know from el Tablazo and Cerro Chompipe (Fig. 30), in Central Costa Rica. It was found growing at around 2200 m in elevation.

FIGURE 30. View of the forest around Cerro Chompipe in Heredia, where *E. microcardium* Schltr. grows. By APK

Phenology: Flowering was registered in August and December.

Additional specimens examined: COSTA RICA. Heredia: Heredia-San Rafael, San Rafael-Vara Blanca, Cerro Chompipe, orillas del camino a la antena cerca de la cumbre, 10˚5'4"N, 84˚4'22"W, 2220 m, bosque pluvial premontano, 12 December 2020, *A.P. Karremans and M. Contreras Fernández 8420* (JBL-spirit, Fig. 31, 33h). San José: Cordillera de Talamanca, Reserva Privada Cerros de Escazú, Finca El Cedral, 9˚51'30"N, 84˚08'40"W, 2200 m, 8 August 1996, *A. Cascante, H. Gómez, M. Valerio et al. 1106* (CR-107093; AMO-photo).

Epidendrum microcardium was described as having a decurved, 5–10-flowered inflorescence, with bracts that exceed the ovary, oblong, acute sepals, ca. 4 mm long, linear-ligulate petals similar in length and an ovate-cordate lip. Those distinctive features can also be observed on the lectotype specimen. They correspond well with the specimen illustrated (*Karremans 8420*), and not with the concept of *Epidendrum microcardium* sensu Hágsater and Sánchez-Saldaña (2008), which is here described as *Epidendrum globuliferum* Karremans.

The plant habit and flower shape resemble those of the *E. sanchoi* alliance, but the elongate, decurved inflorescence, bearing 5–10 flowers with non-spreading segments, and large bracts that exceed the ovary, set *E. microcardium* aside immediately.

Epidendrum globuliferum Karremans, *sp. nov.*

TYPE: COSTA RICA. Alajuela: San Carlos, Quesada, Volcán Platanar, 10˚17'43"N, 84˚22'18"W, 1890 m, 17 April 2021, *A.P. Karremans, I. Chinchilla, K. Gil, G. Rojas-Alvarado and A. Serna 8665* (Holotype, JBL-spirit, Fig. 32, 33i).

Synonym: *Epidendrum sanchoi* Ames var. *exasperatum* Ames & C.Schweinf., Sched. Orchid. 10: 1930. TYPE: COSTA RICA. Heredia: Cerro de las Lajas, North of San Isidro, 2000–2400 m, March 7, 1926. *P.C. Standley and J. Valerio 51488* (Holotype: AMES [33597]; US [139768]).

Similar to *Epidendrum sanchoi* but easily distinguished by the globose flower with reflexed tepals, the sepals are broader (2.2–2.6 vs. 1.6–2.0 mm wide) and obtuse (vs. acute), the petals are broader (1.0 vs. 0.5 mm wide), narrowly oblanceolate and obtuse (vs. linear-ligulate, acute), and the lip is sub-globose to broadly ovate, base somewhat cordate (vs. triangular, base truncate), and has a prominent hoof-like callus (vs. with a pair of longitudinal depressions flanking the mid-vein).

Epiphytic, pseudo-monopodial, branching, erect to pendent *herb*, up to 50 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, covered by rugose sheaths; the main stem long, with short to medium branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex of the branches with age; leaf sheath up to 2.0 cm long, tubular, rugose, green when young, becoming brownish and papery with age; leaf blade up to 4.2 × 0.5 cm on the main stems, typically much smaller on the branches 2.1–2.6 × 0.3–0.5 cm on the branches, coriaceous, oblong, unequally bilobed. *Inflorescence* 1.0–1.5 cm long, short, sessile, from the branches, racemose, distichous, sub-secund, erect to suberect, lax, with two sharp angles on the side facing the ovary, slightly sinuous. *Floral bracts* 2–3 mm long, shorter than the ovary, acute. *Flowers* 4–6, typically 5, pale green throughout, globose, with the tepals reflexed and somewhat revolute. *Ovary* 4–5 mm long, cylindrical, elongate. *Sepals* free, spreading widely, becoming reflexed, broadly elliptic, obtuse, with a short apiculum; dorsal sepal 4.6–4.7 × 2.2 mm; lateral sepals 4.8–5.0 × 2.4–2.6 mm, bent outwards, divergent. *Petals* 4.6–4.7 × 1.0 mm, free, spreading, reflexed, curved towards the dorsal sepal, narrowly oblanceolate, obtuse. *Lip* 4 × 2 mm, fused to the column, short, fleshy, sub-globose to broadly ovate, base somewhat cordate, corners rounded, apex acute, thick, margins significantly thickened and elevated, with a hoof-like elevated callus at the base of the blade. *Column* 3.0–3.1 mm long, terete, slightly bent downwards with respect to the ovary, conspicuously embraced by the lip. *Anther* sub-spherical externally, cellular-glandular, internally very thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: From the Latin *globuliferus*, bearing small spherical clusters, in reference to the appearance of the multiple inflorescences with several tiny, globose flowers.

Habitat and distribution: All specimens that correspond well with this taxon were collected in the same general area on the slopes of the Barva, Poás and Platanar volcanos on the Cordillera Volcánica Central, in Costa Rica. The species grows in high elevation, humid forests at around 2000 m.

Phenology: Flowering from January to May in the field.

Additional specimens examined: COSTA RICA. Heredia: Cerro de las Lajas, North of San Isidro, 2000–2400 m, 7 March 1926. *P.C. Standley and J. Valerio 51535* (AMES). Cerros de Zurquí, northeast of San Isidro, 3 March 1926, *P. C. Standley and J. Valerio 50685* (AMES). Idem, *P. C. Standley and J. Valerio 50722* (AMES). Cerro de las Caricias, north of San Isidro, 11 March 1926, *P. C. Standley and J. Valerio 52326* (AMES). Idem, *P. C. Standley and J. Valerio 52394* (AMES; US; AMO-photo). San Rafael, Concepción, Residencial El Castillo, Calle Lobo, falda oeste del Cerro Turú, 10˚3'52.2"N, 84˚03'43.2"W, 1840 m, bosque muy húmedo montano bajo, epífitas en potreros arbolados, 19 March 2009, *D. Bogarín 6438, R.L. Dressler, R. Gómez, F. Pupulin and R. Trejos* (JBL-D2814; JBL-D6157). San Rafael, Reserva Biológica "El Chompipe" adjacent to Parque Nac. Braulio Carrillo along forest/pasture edge on SE ridge of Río Segundo, 10˚05'00"N, 84˚05'00"W, 1950–2000 m, 9 January 1991, *S. Ingram and K. Ferrell 842* (CR-148225; AMO-photo). Alajuela: Viento Fresco, 13 February 1926, *P. C. Standley and R. Torres Rojas 47726* (AMES; US; AMO-photo). Laguna de Alfaro Ruiz, April 1923, *O. Jiménez and C. H. Lankester 2009* (AMES). Alfaro Ruiz, Palmira, 2200 m, 2 March 1938, *A. Smith H375* (SEL [9762]; AMO-photo). Alfaro Ruiz, Palmira, 2200 m, 9 May 1938, *A. Smith H530* (SEL [9762]; AMO-photo).

This species was originally described as a variety of *Epidendrum sanchoi* Ames, and later treated as a synonym of *E. microcardium* Schltr. (Hágsater and Sánchez-Saldaña, 2008). However, *E. globuliferum* is quite distinct

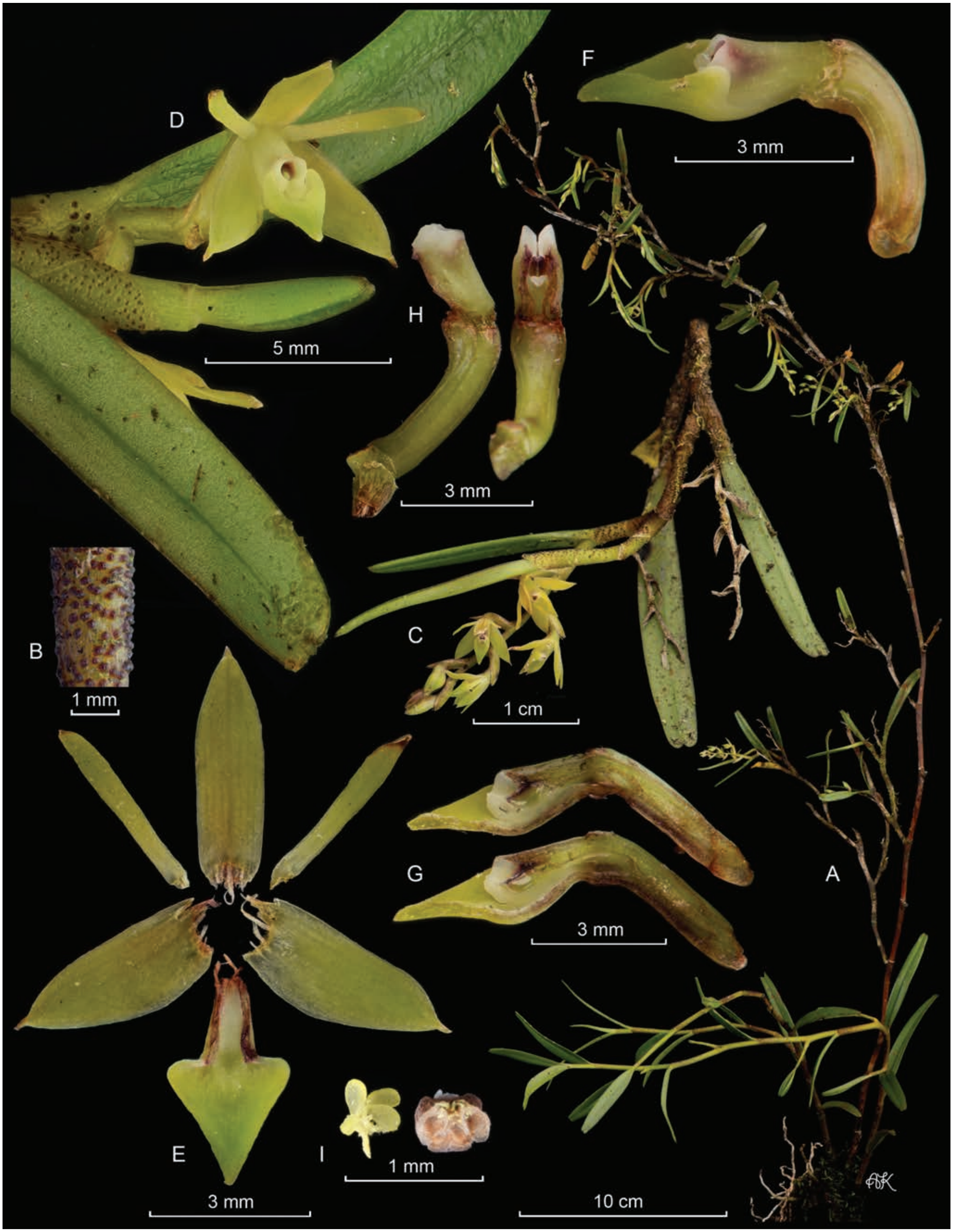

FIGURE 31. LCDP of *Epidendrum microcardium* Schltr. **A**, Habit; **B**, Detail of the rugose leaf sheaths; **C**, Detail of the stem and inflorescence; **D**, Flower; **E**, Dissected perianth; **F**, Lip and column lateral view and transversal section; **G**, Lip and column transversal section; **H**, Column lateral and ventral views; **I**, Anther cap and pollinarium. By APK based on *Karremans 8420* (JBL-spirit).

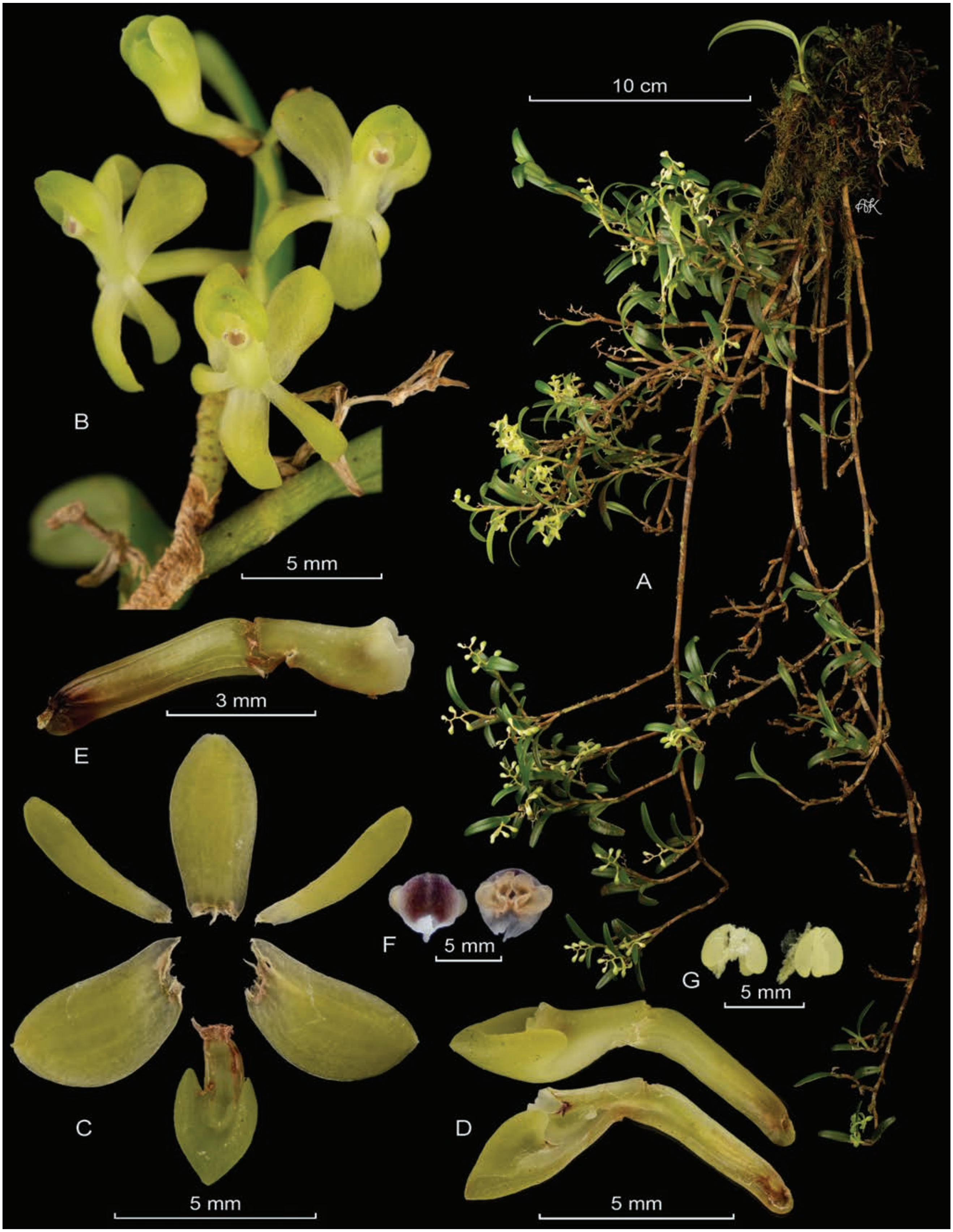

FIGURE 32. LCDP of *Epidendrum globuliferum* Karremans. **A**, Habit; **B**, Detail of the inflorescence; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Column lateral view; **F**, Anther cap views; **G**, Pollinarium views. By APK based on *Karremans 8665* (JBL-spirit).

FIGURE 33. Inflorescence comparison of *Epidendrum* species. **A**, *E. nativitatis* (*AK7490*); **B**, *E. sanchoi* (AK8795); **C**, *E. aeolicum* (AK8601); **D**, *E. utyumii* (*EKs.n.*). **E**, *E. sidereum* (*EKs.n.*); **F**, *E. saltatrix* (AK8785); **G**, *E. colibri* (AK7574); **H**, *E. microcardium* (AK8420); **I**, *E. globuliferum* (*AK8665*). Photographs by APK (A–C, F–I) and E. Kaes (D—E).

from *E. sanchoi* and *E. microcardium*, both illustrated here. *Epidendrum microcardium* is described as having a decurved, 5–10-flowered inflorescence, with bracts that exceed the ovary, acute sepals, linear petals, whereas *E. globuliferum* features a 4–6-flowered inflorescence, bracts significantly shorter than the ovary, sepals broad and obtuse, and petals narrowly oblanceolate. These and other distinguishing features are easily observable on the lectotype specimen of *E. microcardium* (AMES-39893).

Epidendrum globuliferum is closely related *E. sanchoi* and its allies, but easily can be distinguished by the globose flower with reflexed tepals, the sepals are broad and obtuse, the petals are narrowly oblanceolate, wider above the middle and obtuse, and the lip is sub-globose to broadly ovate, with the base somewhat cordate and the blade margin notoriously thickened and provided with a prominent horse-shoe like callus. The new taxon should replace the concept of *Epidendrum microcardium* sensu Hágsater and Sánchez-Saldaña (2008). Nevertheless, not all the specimens cited therein refer to the newly proposed taxon, some are of different taxa, including the actual *E. microcardium*. Those that could be reliably assigned to *E. globuliferum* are cited here, they have all been collected in relatively nearby locations in the mountains of the provinces of Heredia and Alajuela, at around 2000 m in elevation. No collections have been made on the Cordillera de Talamanca, where most of its close relatives occur.

Epidendrum conservatorum Karremans, *sp. nov.*
TYPE: COSTA RICA. Heredia: Heredia, Vara Blanca, Calle la Legua, epífitas en bosque a orilla del camino, bosque pluvial montano bajo, 10˚15'21"N, 84˚8'44"W, 1170 m, 13 October 2021, *A.P. Karremans, I. Chinchilla and G. Rojas-Alvarado 8950* (Holotype, JBL-spirit; Fig. 34).

Similar to *E. monophlebium* Hágsater but distinguished by the inflorescence with a straight rachis (vs. flexuous) bearing 2–3 flowers (vs. 4–6), that open in slow succession (vs. simultaneous), the longer floral bracts (5.5–6.5 vs. 2–4 mm), the longer ovary (5 vs. 2–4 mm), larger flowers, the sepals 6.6–7.9 × 1.9–2.6 mm (vs. 4.0–5.0 × 1.2–1.5 mm), the petals 6.0–6.9 mm long (vs. 4.5–5.0) and longer blade of the lip (4.5 vs. 2.7–3.0 mm), the petals are 3-nerved (vs. 1-nerved) and the lip is narrowly triangular and acute (vs. triangular and acuminate), with a notoriously thickened, elevated apex (vs. fleshy, not elevated).

Epiphytic, pseudo-monopodial, branching, *herb*, up to 35 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, somewhat flexuous, covered by rugose sheaths; producing many short and long branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 1.3 cm long, tubular, rugose, reddish-brown, becoming papery with age; blades of a branched plant 2.4–4.3 × 0.4–0.5 mm, thick coriaceous, narrowly ovate to oblong, unequally bilobed. *Inflorescence* 1.4–1.9 cm long, produced from the branches, racemose, distichous, sub-secund, sub-erect, congested, successive, rachis straight. *Floral bracts* 5.5–6.5 mm long, longer than the ovary, acute, verruculose. *Flowers* 2–3, typically 3, opening in slow succession with the first flower opening long before all buds are developed, light green throughout, occasionally with a light copper hue on the sepals, especially on the apiculum, naturally facing more or less downwards. *Ovary* 5 mm long, terete, elongate, broadening apically. *Sepals* free, spreading widely, lanceolate, with a prominent, thickened apiculum; dorsal sepal 6.6–7.7 × 1.9–2.0 mm; lateral sepals 6.8–7.9 × 2.3–2.6 mm, margins somewhat recurved. *Petals* 6.0–6.9 × 0.6 mm, free, spreading, with a strong backwards bend, narrowly linear-lanceolate, slightly, straight, acute, 3-nerved. *Lip* 5.5–6.3 × 2.2–2.4 mm, fused to the column, free blade 4.5 mm long, short, fleshy, narrowly triangular, base truncate, corners rounded, with a three-lobed callus just above the base of the blade, apex notoriously thickened, acute, margins thickened and slightly elevated. *Column* 2.8–3.1 mm, short, terete, straight with respect to the ovary. *Anther* sub-ovoid, thin, 4-celled, cellular-glandular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose.

Etymology: The epithet *conservatorum* collectively honors those people who have contributed to the conservation of biodiversity at every level. A thank you for their effort and dedication. They are aware that once any element of biodiversity is lost, it is lost forever.

Habitat and distribution: The species is only known from the humid Caribbean watershed of the Central Cordillera in the provinces of Alajuela and Heredia in Costa Rica, where it grows at mid elevations between 950 and 1170 m on the northern slopes of the Barva and Poás volcanos (Fig. 35).

Phenology: It was recorded blooming in October and November.

Additional specimens examined: COSTA RICA. Alajuela: Río Cuarto, ruta 708, hacia Pueblo Nuevo, epífitas en potrero arbolado a orillas del camino, bosque pluvial premontano, 10˚16'24.42"N, 84˚14'58.85"W, 1000 m, 13 October 2021, *A.P. Karremans, I. Chinchilla and G. Rojas-Alvarado 8955* (JBL-spirit). Heredia: Forest between Río Peje and upper Guácimo, Atlantic slope of Volcán Barva, 10˚17'N, 84˚05'W, 950–1150 m, 11 November 1986, *M.H. Grayum, G. Herrera and M. Santana 7791* (CR).

Epidendrum conservatorum seems to be relatively frequent, yet restricted in distribution to the northern-caribbean slopes of the Barva and Poás volcanos on the Central Cordillera in Costa Rica. The plant typically has a pseudo-monopodial habit with taller main stems that gradually branch, the few flowers open in slow succession and typically face downwards. It belongs to the *E. sanchoi* alliance, where the notorious three-dentate callus on the base of the lip blade places it close to the Costa Rican endemic *E. monophlebium* and the Panamanian endemic *E. hornitense* Hágsater & L.Sánchez. From the first, *E. conservatorum* can be distinguished by the inflorescence with a straight rachis, bearing 2–3 flowers, that open in slow succession, the longer floral bracts and ovary, the larger flowers, the petals that are 3-nerved and the lip that is narrowly triangular and acute, with a notoriously thickened, elevated apex. From the latter it can be distinguished by few-flowered inflorescence that is slowly successive (vs. up to 6 flowers, simultaneous), the larger flowers, with all perianth segments being notoriously longer and wider, the sepals (6.6–7.9 × 1.9–2.6 vs.

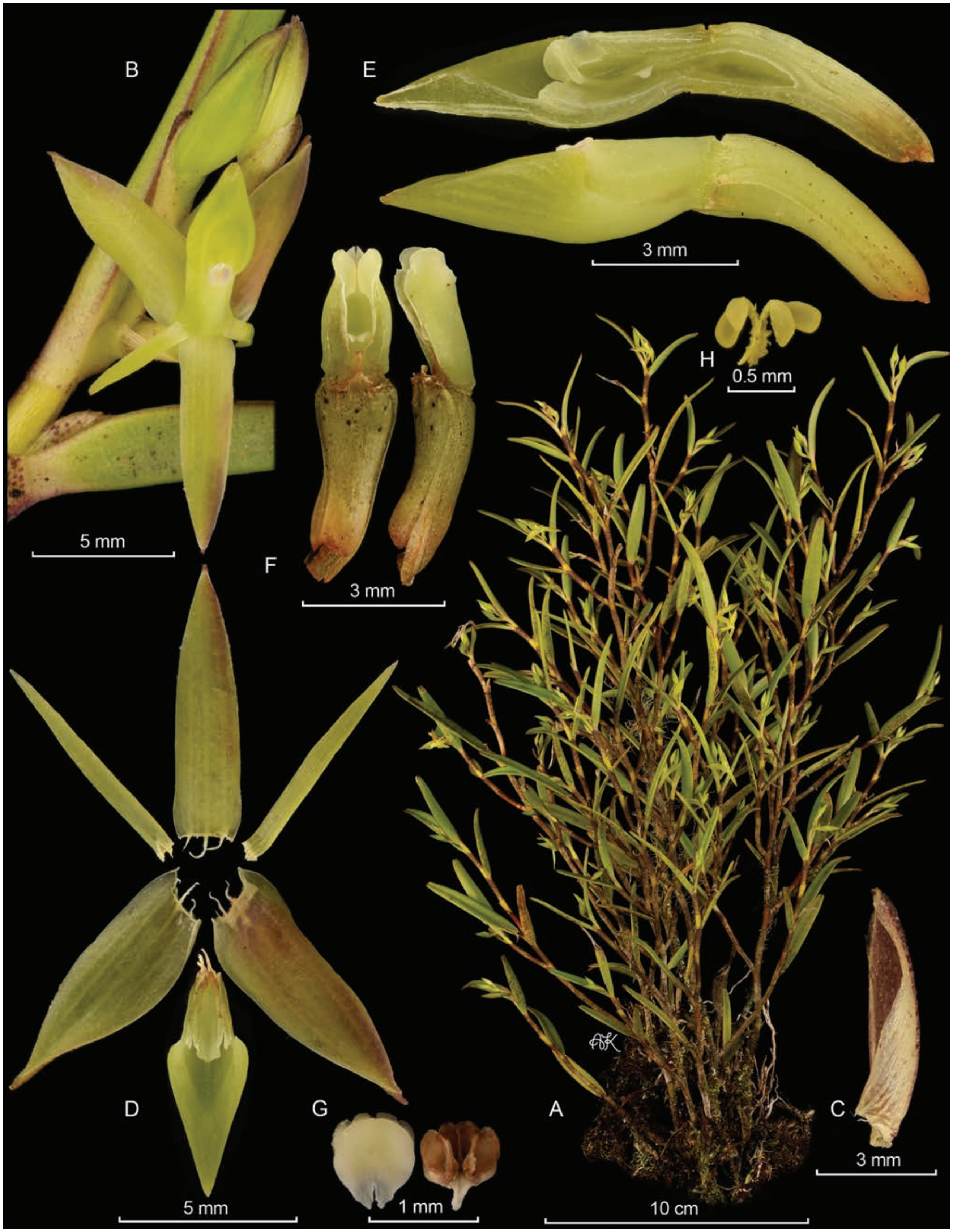

FIGURE 34. Illustration of *Epidendrum conservatorum* Karremans. **A**, Habit; **B**, Inflorescence; **C**, Floral bract; **D**, Dissected perianth; **E**, Lip and column lateral view; **F**, Column lateral and ventral views; **G**, Anther cap views; **H**, Pollinarium views. By APK based on *Karremans 8950* (JBL-spirit).

FIGURE 35. *Epidendrum conservatorum* Karremans growing epiphytically in situ near Río Cuarto in Alajuela, Costa Rica. By APK.

4.2–4.5 × 0.9–1.1 mm), the petals (6.0–6.9 × 0.6 vs. 4.0–4.2 mm × 0.05–0.1 mm) and the lip blade (4.5 × 2.2–2.4 vs. 3.0–3.2 mm × 1.1–1.3 mm), the longer column (2.8–3.1 mm vs. 1.2–1.4 mm).

Epidendrum santaelenae Karremans, *sp. nov.*
TYPE: COSTA RICA. Costa Rica. Guanacaste: Abangares, Sierra, Selvatura, hacia la Reserva Bosque Nuboso Santa Elena, 10°20'15"N, 84°48'38"W, 1600 m, bosque nuboso de Monteverde, collected 18 April 2021, prepared 18 October 2021, *A.P. Karremans, I. Chinchilla, K. Gil, G. Rojas-Alvarado and A. Serna 8710* (Holotype, JBL-spirit; Fig. 36).

Similar to *E. monophlebium* but distinguished by the inflorescence with a straight rachis (vs. flexuous), the longer ovary (4.7 vs. 2–4 mm), larger flowers, the sepals 5.6–6.1 × 1.7–2.1 mm (vs. 4.0–5.0 × 1.2–1.5 mm), the petals 5.0–5.1 mm wide (vs. 0.5) and longer blade of the lip (4.0 vs. 2.7–3.0 mm), the petals are 3-nerved (vs. 1-nerved), narrowly elliptic and obtuse (vs. linear and acute), and the lip is acute with a rounded apex (vs. acuminate), with a notoriously thickened, elevated apex (vs. fleshy, not elevated).

Epiphytic, bushy, pseudo-monopodial, branching, *herb*, up to 30 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, somewhat flexuous, covered by rugose sheaths; main stem tall, with short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 1.1 cm long, tubular, rugose, reddish-brown, becoming papery with age; leaf blade 2.0–2.3 × 0.5 cm on the main stems, 1.0–1.5 × 0.3–0.4 cm on the branches, coriaceous, oblong, unequally bilobed. *Inflorescence* up to 1.8 cm long, produced from the branches, racemose, distichous, sub-secund, erect, congested, more or less simultaneous, rachis straight, with two sharp angles on the side facing the ovary, verrucose. *Floral bracts* 1.0–1.5 mm long, much shorter than the ovary, acute. *Flowers* 3–5, opening more or less simultaneously, light green throughout. *Ovary* 4.7 mm long, terete, elongate, straight. *Sepals* free, spreading widely, elliptic, with a prominent, thickened apiculum; dorsal sepal 5.6–5.7 × 1.7 mm; lateral sepals 5.9–6.1 × 2.0–2.1 mm. *Petals* 5.0–5.1 × 0.9–1.0 mm, free, spreading, narrowly elliptic, obtuse, apiculate, 3-nerved. *Lip* 5.2 × 2.6 mm, fused to the column, free blade 4.0 mm long, short, fleshy, triangular, base truncate, corners rounded, with a three-lobed callus on the first third of the blade, apical portion notoriously thickened, acute, rounded apex, margins thickened and slightly elevated. *Column* 2.2–2.3 mm, short, terete, bent with a 45 degree angle with respect to the ovary. *Anther* disk-like, 4-celled, cellular-glandular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose.

Etymology: The name honors Santa Elena, the head town of the newly established Monteverde canton. Monteverde is a well-known tourist destination in Costa Rica thanks to its lush cloud forest and the immense national and international efforts to conserve its most unique biodiversity. The new species was collected on the road to one of its crown jewels, the Reserva Bosque Nuboso Santa Elena.

Habitat and distribution: This species is only known from the Monteverde Cloud Forest on the Guanacaste mountain range in northern Costa Rica where it grows at around 1500–1600 m in elevation.

Phenology: It was recorded blooming between mid October and mid November (coincidentally specimens were prepared on the same date in 1963, 1978 and 2021).

Additional specimens examined: COSTA RICA. Puntarenas: Monteverde, 1400–1700 m, 18 October 1978, *C. Todzia 485* (CR-72301). Monteverde, en propiedad de Mr. W. James, alt. 1500 m, 18 October 1963, *A. Jiménez M. 1254* (CR-57539). Upper San Gerardo, 2 km NE Santa Elena on border of Monteverde Reserve, 10°21'N, 84°48'W, 1550 m, 20 November 1988, *W. Haber and W. Zuchowski 8814* (CR-158644).

Epidendrum santaelenae is currently known only from the Monteverde area. The habit and greenish flowers with a fleshy, more or less triangular lip are similar to those of several other species in the *E. sanchoi* alliance. However, the notorious three-dentate callus near the base of the lip blade places it close to *E. monophlebium* from which it can be distinguished by the inflorescence with a straight rachis, the longer ovary and larger flowers, the petals that are narrowly elliptic, obtuse and 3-nerved, and the lip that is acute with a rounded apex, with a notoriously thickened, elevated apex.

Epidendrum spiculiferum Karremans & Bogarín, *sp. nov.*
TYPE: COSTA RICA. Puntarenas: Coto Brus, Sabalito, Zona Protectora Las Tablas, 15 km al noreste de Lucha, Sitio Tablas, Finca Sandí-Hartmann "El Chompipe," camino a El Surá, 8°57'0.63"N, 82°44'59.72"W, 2017 m, bosque pluvial montano bajo, 10 December 2013, *A.P. Karremans, D. Bogarín, M. Fernández and L. Sandoval 6079* (Holotype, JBL-spirit [D6337]; Isotype, JBL-spirit [D6610]; Fig. 37, 38a).

Reminiscent of *E. lancilabium* Schltr. in the compact plants with thick, semi-terete leaves and relatively large flowers borne on a short, few-flowered inflorescence. However, it may be distinguished by the green flowers (vs. purplish-brown), the longer and narrower sepals (9.0–9.9 × 2.5–2.7 vs. 8.0–9.0 × 2.8–3.2 mm) that are acuminate (vs. acute) and apically decurved (vs. straight), the longer (8.4 vs. 4.5–7.2), bent (straight) lip and the slender, terete column (vs. short and thick) that is notoriously bent (vs. straight).

Epiphytic, bushy, branching, *herb*, up to 15–20 cm tall. *Roots* 1 mm in diameter, fleshy. *Stems* branching, cane-like, terete, somewhat flexuous, covered by rugose sheaths; the main stem tall, with short branches. *Leaves* many, sticking out more or less erect, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 1.5 cm long, tubular, rugose, brownish-purple; blades thick coriaceous, linear-spiculate, subterete 1.5–4.0 × 0.2 cm. *Inflorescence* produced from the branches, racemose, distichous, sub-secund, very short, congested. *Floral bracts* shorter than the ovary, acute, verruculose. *Flowers* solitary, light green throughout, sepal apices purplish-green. *Ovary* cylindrical, bent. *Sepals* free, spreading, somewhat decurved apically, narrowly-elliptic to lanceolate, acuminate, margins apically thickened, forming a prominent, sharp apiculum; dorsal sepal 9.0 × 2.5 mm; lateral sepals 9.8–9.9 × 2.7 mm. *Petals* 7.4–7.6 × 0.2 mm, free, spreading, somewhat decurved apically, narrowly elliptic, acute. *Lip* 8.4 × 2.8–2.9

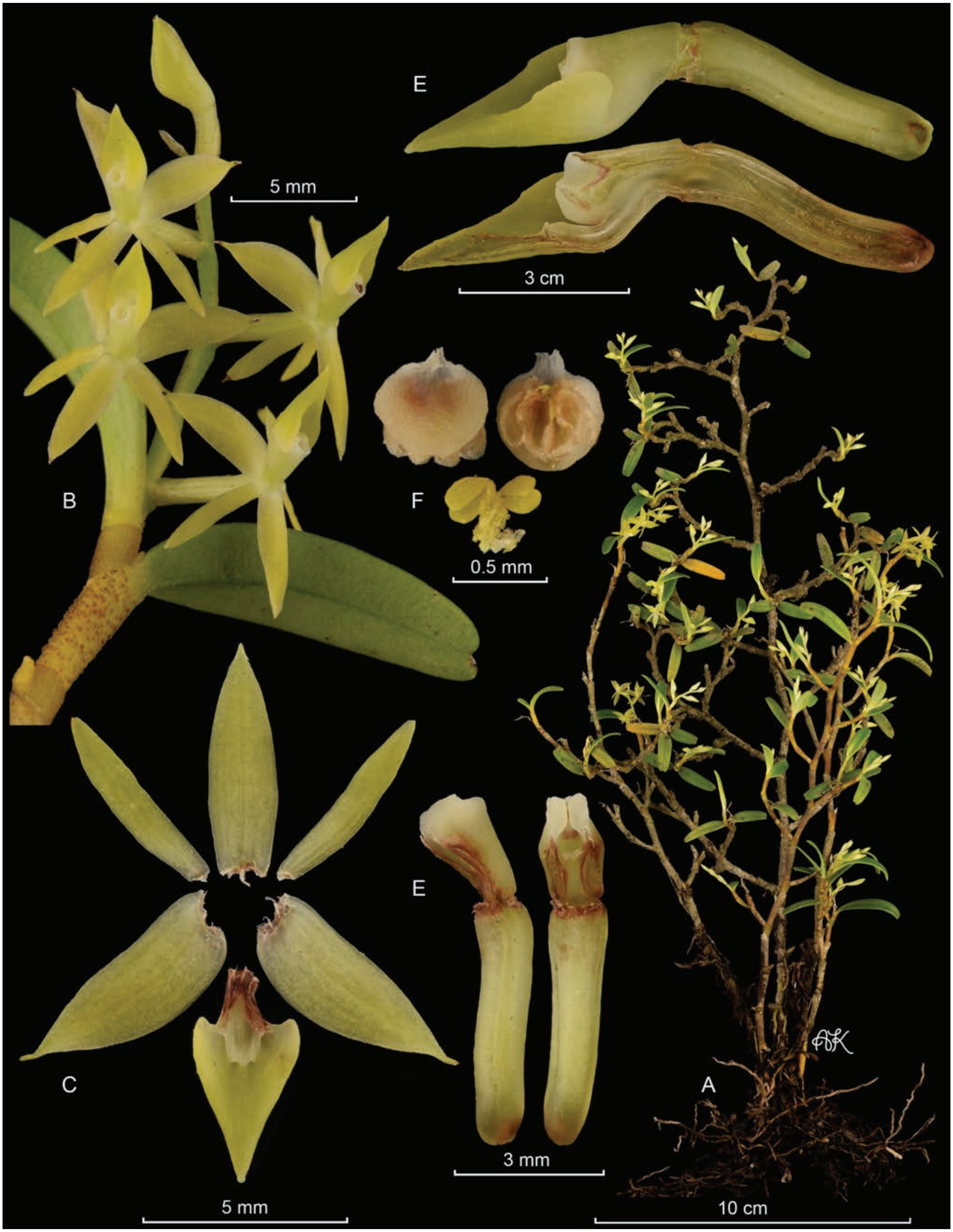

FIGURE 36. Illustration of *Epidendrum santaelenae* Karremans. **A**, Habit; **B**, Inflorescence; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Column lateral and ventral views; **F**, Anther cap and pollinarium views. By APK based on *Karremans 8710* (JBL-spirit).

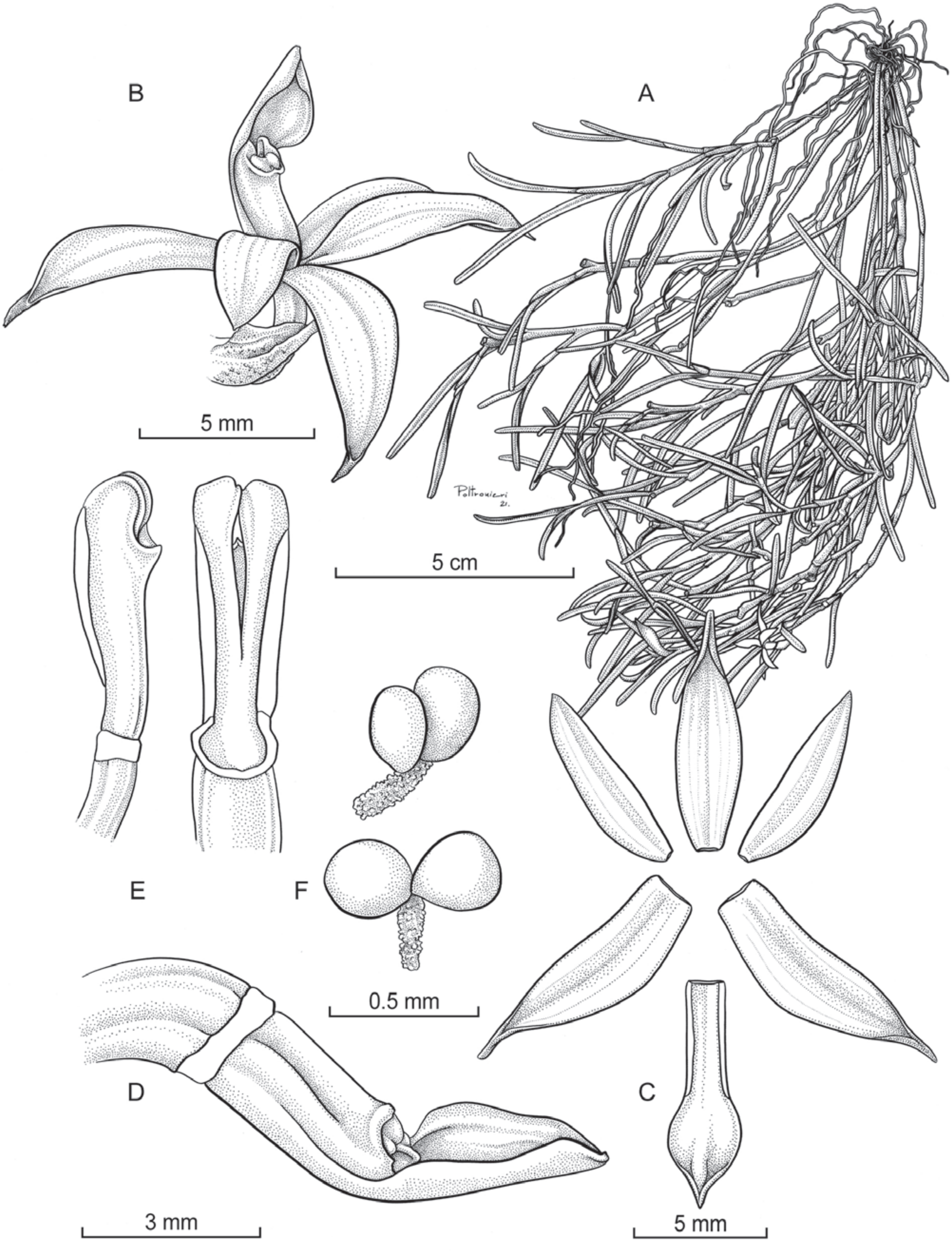

Figure 37. Illustration of *Epidendrum spiculiferum* Karremans & Bogarín. **A**, Habit; **B**, Flower; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Column lateral and ventral views; **F**, Pollinarium views. By D. Bogarín and S. Díaz Poltronieri based on *Karremans 6079* (JBL-spirit).

FIGURE 38. Photographs of *Epidendrum spiculiferum* Karremans & Bogarín. **A**, *Karremans 6079* (JBL-spirit); **B**, *Karremans 8050* (JBL-spirit). By D. Bogarín (A) and APK (B).

mm, fused to the column, bent, fleshy, lanceolate-spathulate, ecallose, apex thickened, shortly acuminate, margins thickened and slightly elevated. *Column* 4 mm long, terete, bent above 45 degrees with respect to the ovary at the base, and bent again in the opposite direction apically. *Anther* not seen. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: From the Latin *spiculifer*, spicule bearing, in reference to the long pointy leaves and acuminate perianth parts.

Habitat and distribution: The species is only known from the Southern Talamanca range in Costa Rica where it has been found only on two occasions growing at elevations ca. 1900–2000 m.

Phenology: It was recorded blooming in February and April.

Additional specimens examined: COSTA RICA. Limón: Talamanca, Bratsi, antes de llegar a la fila Bugu, 9˚24'38"N, 83˚12'02"W, 1883 m. Transtalamanca, ruta de los conquistadores, día 4, 27 April 2017, *A.P. Karremans, M. Cedeño, I. Chinchilla, E. Kaes, G.A. Rojas-Alvarado, O. Zuñiga 8050* (JBL-E1311; Fig. 38b).

Epidendrum capitalinum Karremans, *sp. nov.*

TYPE: COSTA RICA. San José: Moravia-Vásquez de Coronado, San Jerónimo-Jesús, sobre la antigua calle Carrillo entre San Jerónimo y el Alto La Palma. Parte más alta, antes de bajar al Bajo de La Hondura, 10˚2'49"N, 83˚59'15"W, 1530 m, 29 June 2021, *A.P. Karremans and I. Chinchilla 8837* (Holotype, JBL-spirit; Fig. 39).

The tiny erect habit with many short branches and rugose sheaths is suggestive of members of the *E. rugosum* subgroup, but the inflorescence and flowers are rather reminiscent of the *E. ramosum* subgroup. The flowers are superficially similar to *E. pseudoramosum* Schltr. but easily distinguished by the much smaller habit and flowers, the plant up to 20 cm tall (vs. up to 55 cm), the inflorescence up to 1.5 cm long (vs. up to 3 cm), the floral bracts 3–4 mm long (vs. 9.5–13.5 mm), the sepals 3.0–3.1 × 1.3–1.5 mm (vs. 5.0–5.6 × 1.5–2.6 mm), the petals 2.6–2.7 × 0.4–0.5 mm (vs. 5.0–5.7 × 1.0–1.2 mm) and the lip blade 1.8 × 1.9 mm (vs. 3.5–4.0 × 3.0–4.2 mm), the sepals are lanceolate and acute (vs. oblong-elliptic and obtuse), and the column is shorter (1.4 vs. 2–3 mm).

Epiphytic, bushy, pseudo-monopodial, branching, *herb*,

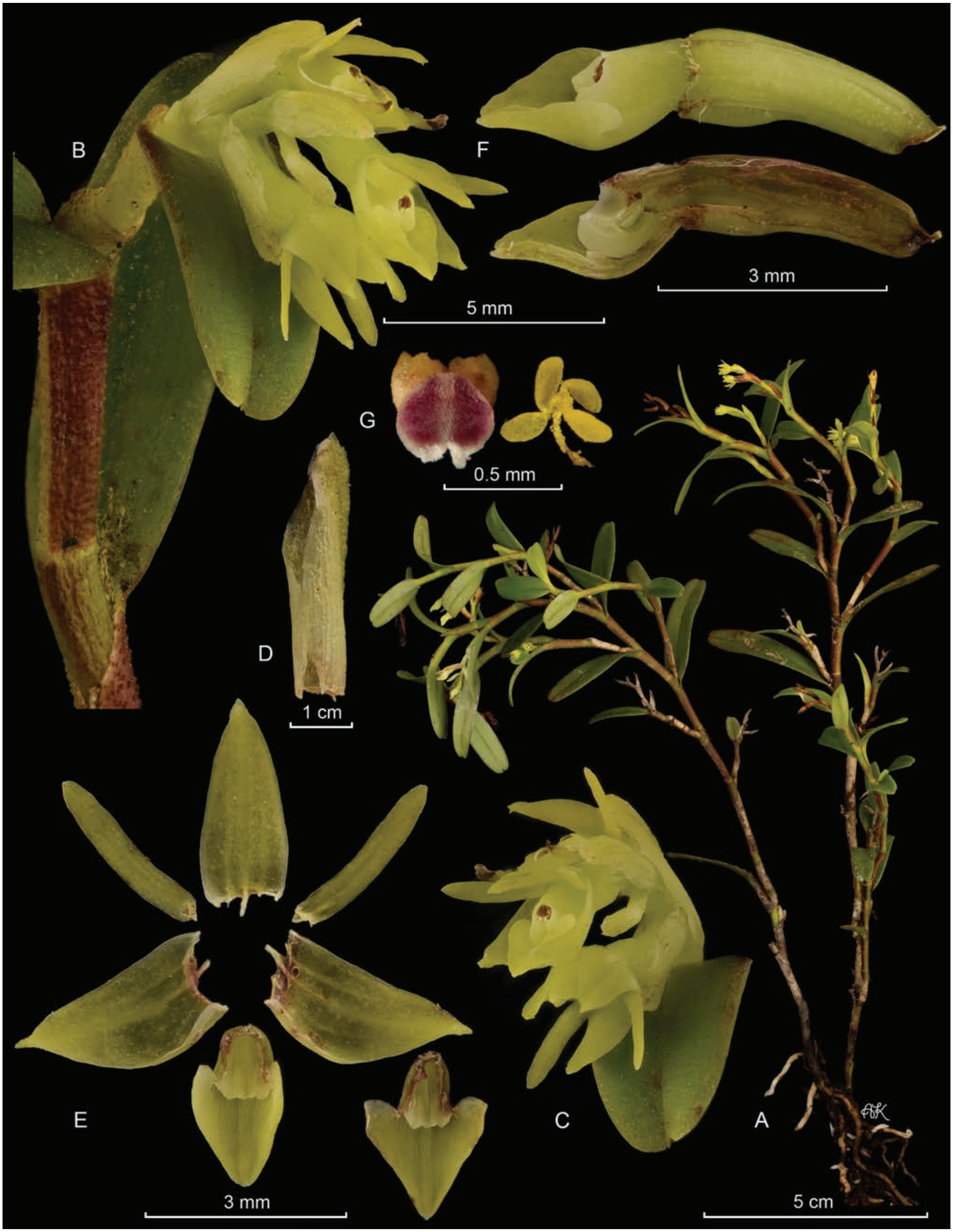

FIGURE 39. Illustration of *Epidendrum capitalinum* Karremans. **A**, Habit; **B**, Stem and inflorescence; **C**, Inflorescence detail; **D**, Floral bract; **E**, Dissected perianth; **F**, Lip and column lateral view and transversal section; **G**, Anther cap and pollinarium views. By APK based on *Karremans 8837* (JBL-spirit).

up to 20 cm tall. Roots 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, somewhat flexuous, covered by rugose sheaths; main stem tall, with many short branches. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath up to 9 mm long, tubular, rugose, reddish-green, becoming papery with age; leaf blade 2.2–2.9 × 0.4–0.6 cm on the main stems, smaller on the branches, coriaceous, oblong, unequally bilobed. *Inflorescence* up to 1.5 cm long, produced from the branches, racemose, distichous, sub-secund, erect to sub-erect, congested, more or less simultaneous, rachis straight. *Floral bracts* 3–4 mm long, similar in length ovary, acute. *Flowers* 1–3, opening more or less simultaneously, light green throughout. *Ovary* 3 mm long, terete, elongate, straight, somewhat inflated towards the apex. *Sepals* free, spreading only very partially, lanceolate, with a thickened, verruculose apiculum, 3-nerved; dorsal sepal 3.0 × 1.3 mm; lateral sepals 3.0–3.1 × 1.4–1.5 mm. *Petals* 2.6–2.7 × 0.4–0.5 mm, free, spreading, linear-ligulate, acute, 1-nerved. *Lip* 2.4–2.5 × 1.9 mm, fused to the column, free blade 1.8 mm long, short, fleshy, triangular-cordate, base truncate, corners rounded, with a three-lobed callus at the base and an elevated keel to the apex of the blade, acute, rounded apex, with a short apiculum. *Column* 1.4 mm, short, terete, straight with respect to the ovary. *Anther* ovoid, 4-celled, cellular-glandular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose.

Etymology: The name alludes to the capital of Costa Rica, the city of San José. The type locality of this species is in the outskirts of the city and the fact that botanical novelties may still be found only 16 km distance from the very center of the capital city is one of those features that make the country unique in the world. Its narrow distribution in the expanding metropolitan area raises immediate conservation concerns.

Habitat and distribution: This tiny species is currently known only from the Alto La Palma north-east of the city of San José in the Central Valley of Costa Rica, where it grows epiphytically at elevations between 1400–1530 m.

Phenology: It was recorded blooming between August and October.

Additional specimens examined: COSTA RICA. San José: Moravia-Vásquez de Coronado, San Jerónimo-Jesús, sobre la antigua calle Carrillo entre San Jerónimo y el Alto La Palma. Parte más alta, antes de bajar al Bajo de La Hondura, 10°2'49"N, 83°59'15"W, 1530 m, collected 29 June 2021, prepared 26 October 2021, *A.P. Karremans and I. Chinchilla 8838* (JBL-spirit). Idem, prepared 18 November 2021, *A.P. Karremans and I. Chinchilla 8831* (JBL-spirit). La Palma de San José, 1400–1500 m, 12 August 1979, *C. Todzia 683* (CR-72282).

Epidendrum chespiritorum Karremans, *sp. nov.*
TYPE: COSTA RICA. Cartago: El Guarco, San Isidro, Madreselva, Tres de Junio, Carretera Interamericana Sur, km 67, entrada a la finca El Jaular, 9°40'13"N, 83°51'56"W, 2610 m, bosque pluvial montano, en bosque secundario de Robles a orillas de la carretera, 25 June 2021, *A.P. Karremans and I. Chinchilla 8810* (Holotype, JBL-spirit; Fig. 40).

Similar to *E. anoglossoides* but distinguished by the flattened, ancipitose stems (vs. cylindric), the notoriously arching-nutant, pendent inflorescence (vs. inflorescence erect to suberect, more or less straight), bearing few flowers 2–5 (vs. flowers several, up to 9), the floral bracts longer (7.0–8.5 vs. 5–7 mm), the longer sepals (9.8–10.0 vs. 8.0–9.5 mm) and petals (8.6–8.8 vs. 7.7–8.2 mm), and the longer and narrower lip (6.7–7.5 × 3.5–4.0 mm vs. 6 × 6 mm).

Epiphytic or terrestrial branching *herb*, up to 45 cm tall, scandent, producing roots well above the base, becoming entangled with the surrounding vegetation. *Roots* 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete at the base, becoming notoriously flattened-ancipitose towards the apex, covered by rugose, ancipitose sheaths. *Leaves* many, distributed along the stem; leaf sheath 1.5–2.5 cm long, flattened, ancipitose, rugose, green when young, becoming brownish with age; blade 24–37 × 6–10 mm, thick coriaceous, oblong, unequally bilobed. *Inflorescence* up to 6 cm long, arching-nutant, becoming pendent, from the branches, racemose, distichous, sub-secund, congested, compressed, ancipitose, rachis triquetrous-ancipitose, edges sharp. *Floral bracts* 7.0–8.5 mm long, completely covering and slightly exceeding the ovary, acute, decurrent on the rachis. *Flowers* +5, greenish-yellow throughout. *Ovary* 6.5–7.5 × 3.0 mm, cylindrical, inflated, straight. *Sepals* free, spreading, acute with an apical dorsal keel; dorsal sepal 9.8–10.0 × 2.3–2.5 mm, sub-parallel to the column, oblong to sub-lanceolate; lateral sepals 9.9–10.0 × 2.8–3.3 mm, recurved, twisted, lanceolate to narrowly ovate. *Petals* 8.6–8.8 × 0.9–1.0 mm, free, spreading, recurved, linear-narrowly lanceolate, margin undulate, acute. *Lip* 6.7–7.5 × 3.5–4.0 mm, fused to the column, fleshy, hard, triangular-cordate, base with corners rounded, apex acuminate, margins thickened and elevated, embracing the apex of column without covering it, with a tridentate callus below the stigma, and a low central keel on the free portion. *Column* 3.0 mm long, thick, straight, with a slight bend with respect to the ovary. *Anther* dorsally showing an elevated sub-trapezoid structure, with a pair of flap-like tails, ventrally reniform, thin, 4-celled, margins irregular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: *Los Chespiritos* are local food serving establishments that have become an obligatory stop for anyone doing fieldwork on the Cerro de la Muerte. I first became acquainted with this species while visiting *Los Chespiritos 1* as a college student. Their name derives from Chespirito, a Mexican sketch comedy show created by and starring comedian and actor Roberto Gómez Bolaños, whose nickname gave the show its title.

Habitat and distribution: Only known from high elevations above 2400 m growing in oak forests on the Talamanca mountain ranging south of Cartago in Costa Rica to Bocas del Toro province in Panama.

Phenology: It has been recorded blooming in January to July.

Additional specimens examined: COSTA RICA. San José: Perez Zeledón. Macizo de La Muerte. Sobre la carretera Panamericana, Ojo de Agua, frente a restaurante Los Chespiritos 1, a la derecha de la entrada del Parque

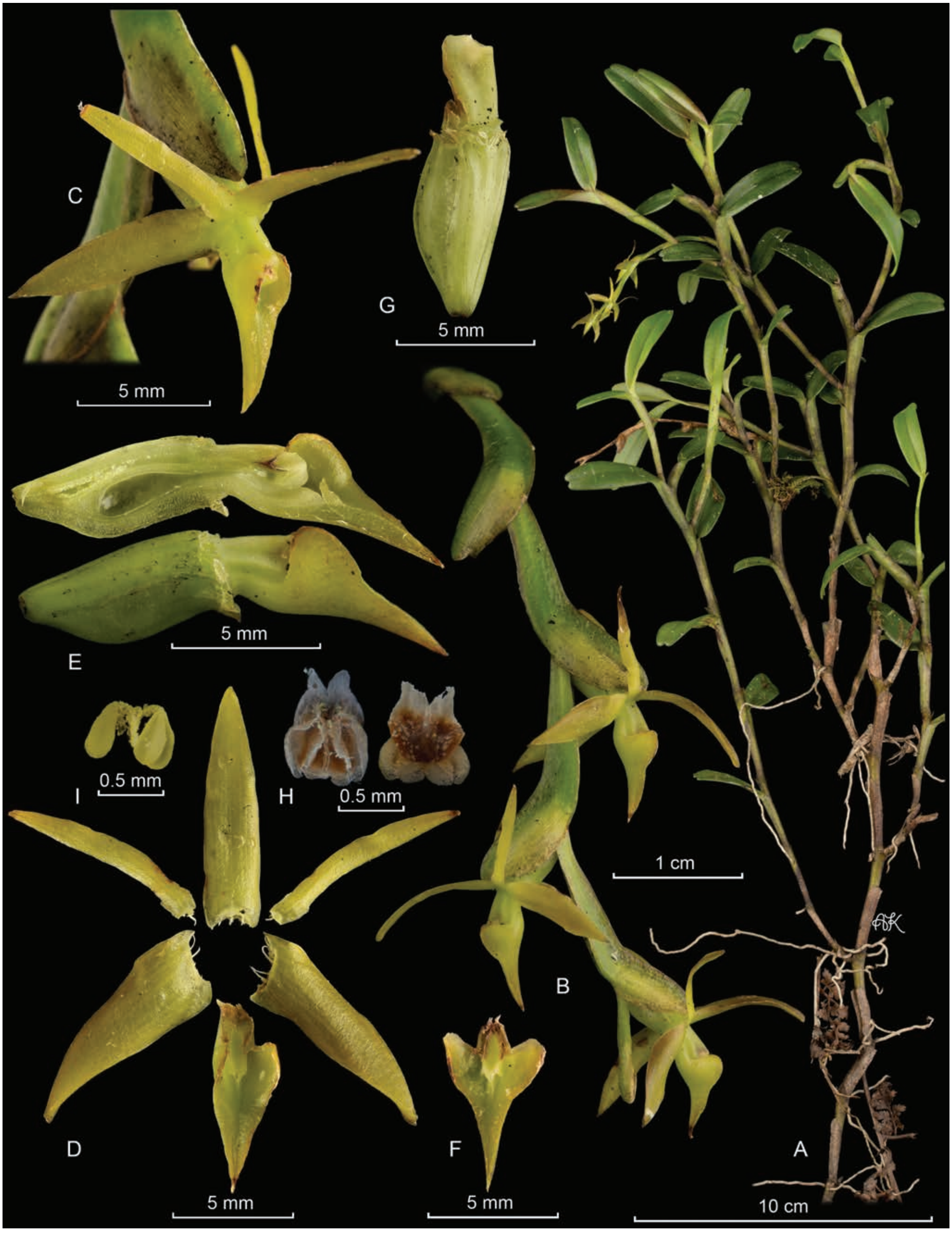

FIGURE 40. LCDP of *Epidendrum chespiritorum* Karremans. **A**, Habit; **B**, Detail of the inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal section; **F**, Lip flattened; **G**, Column lateral view; **H**, Anther cap views; **I**, Pollinarium. By APK based on *Karremans 8810* (JBL-spirit).

Nacional Los Quetzales, 24 May 2007, *A.P. Karremans and Fruticultura SA-UCR 1769* (JBL-D1340; JBL-D1254). San José: Pérez Zeledón, Cerro de la Muerte, sobre sendero hacia antenas del ICE, 9°40'52.10"N, 83°51'20.11"W, 2715 m, bosque montano de robledales, 26 May 2016, *A.P. Karremans, J. Alomía, N. Davin and M. Díaz 7207* (JBL-E1258). [San José: Pérez Zeledón]: Cordillera de Talamanca near Villa Mills, 9°33'N, 83°41'W, 2700 m, 15 January 1990, *Merz and Bittner 660* (CR; AMO-photo). Estación Cuericí, camino a la Auxiliadora, 2 km E de Villa Mills, 9°33'15"N, 83°41'25"W, 2800 m, 8 July 1996, *Billen Gamboa 459* (INB-CR; AMO-photo). Pan American Highway up Talamanca Range, km 57, 2400 m, 2 August 1967, *R. Lent 1167* (CR-58051). Carretera panamericana (Cerro de la Muerte), km 65, 26 September 1984, *R.L. Dressler 36* (AMO; USJ). Cartago: El Cañon Guarco, 2400–2500 m, 13 March 1981, prep. 30 April 1981, *Hágsater and Horich 6461* (CR; AMO-2307; AMO-2308; color photos AMO; pl. 907 in Hágsater and Sánchez-Saldaña 2007). Idem, prep. 30 April 1981 (AMO-3045). South of Cartago, along Inter-American Highway, Cordillera de Talamanca, km. 69, *A. Meerow, L. Besse and K. Tan 1173* (SEL-053592; AMO-photo). Cerro de la Muerte, "El Jardin," 2800 m, 20 May 1956, *L.O. Williams 20204* (SEL-009573). Limón: Talamanca. P.N. Cordillera de Talamanca, flanco NE y cumbre Cerro Biricuacua entre Ujarrás y San José Cabécar, 9°23'55"N, 83°10'10"W, 2600 m, 6 April 1993, *G. Herrera and W. Gamboa 6233* (AMO-17215; AMO-17216; MO-51550111). PANAMA. Bocas del Toro: headwaters of Río Colubre (Colubre camp.), 2400–2550 m, 3 March 1984, *L.D. Gómez, I. Chacón, G. Davidse and D. Herrera 22373* (CR-103758; AMO-photo).

Epidendrum chespiritorum has been readily confused with *E. anoglossoides* (Hágsater and Sánchez-Saldaña 2007). Even though florally similar, *E. anoglossoides* in the sense of the type has terete stems and an erect to suberect inflorescence, whereas the stems of *E. chespiritorum* are conspicuously flattened and ancipitose and the inflorescence is notoriously arching-nutant, typically pendent. The floral segments are also longer, and the lip is narrower. *Epidendrum chespiritorum* grows on very high elevations above 2400 m on the Talamanca mountain range southwards into Panama, while *E. anoglossoides* is only known from lower elevations between 1600 and 2400 m on the mountains north of the Central Valley, in the provinces of Alajuela and Heredia in central Costa Rica.

Two Panamanian records for *E. anoglossoides* are cited in literature (Hágsater and Sánchez-Saldaña, 2007; Bogarín et al., 2014). Neither correspond to *E. anoglossoides* in the sense of the type, and the species is therefore here excluded from Panama. *L.D. Gómez et al. 22373* is here included among the paratypes of *E. chespiritorum* Karremans, while *G. McPherson 9418* (MO-3432762) is the first Panamanian record of *E. jorge-warneri* Karremans & Hágsater.

Epidendrum sinac Karremans, *sp. nov.*

TYPE: COSTA RICA. Heredia: San José de la Montaña, Parque Nacional Braulio Carrillo, sector Volcán Barva, crater principal Laguna Barva, 10°8'00.5"N, 84°6'22.6"W, 2846 m, 12 October 2021, *A.P. Karremans, I. Chinchilla, G. Rojas-Alvarado and Y. Mena 8900* (Holotype, JBL-spirit; Fig. 41).

Similar in habit to *E. anoglossoides* but distinguished immediately by the inflorescence bearing only 3–4 flowers (vs. up to 9), the glaucous, non-spreading floral parts (vs. pale green, spreading), the elliptic (vs. triangular-lanceolate) sepals that are much broader (dorsal sepal 3.8–3.9 vs. 2 mm, lateral sepals 4.7–4.9 vs. 3 mm), the narrowly elliptic to oblanceolate petals (vs. narrowly linear) and the larger (blade 7.0 × 7.3 mm vs. 6.0 × 6.0 mm), broadly ovate, obtuse lip (vs. 3-lobed, acuminate) with irregular margins (vs. straight), and the presence of a notorious, erect, tooth-like midlobe on the column (vs. absent).

Epiphytic, branching, *herb*, up to 100 cm tall, scandent, producing roots well above the base, becoming entangled with the surrounding vegetation. *Roots* 1 mm in diameter, fleshy. *Stems* branching conspicuously, cane-like, terete, becoming somewhat flattened towards the apex, covered by leaf sheaths. *Leaves* many, distributed along the stem; leaf sheath up to 3.2 cm long, flattened towards the apex, becoming ancipitose, rugose, green when young, turning brownish with age and disintegrating; blade 31–62 × 7–14 mm, coriaceous, oblong, unequally bilobed. *Inflorescence* up to 3 cm long, arching-nutant, from the branches, racemose, distichous, sub-secund, congested, compressed, ancipitose, rachis triquetrous-ancipitose, edges sharp. *Floral bracts* 7 mm long, completely covering and exceeding the ovary, acute, decurrent on the rachis. *Flowers* 3–4, opening in succession, light green throughout, with a glaucous hue. *Ovary* 6.5 mm long, terete, with a slight bend. *Sepals* free, spreading only partially, elliptic, obtuse, margin microscopically glandular, with a short apiculum; dorsal sepal 9.6–9.7 × 3.8–3.9 mm; lateral sepals 9.3–9.5 × 4.7–4.9 mm. *Petals* 9.0–9.2 × 2.2–2.6 mm, free, spreading only partially, narrowly elliptic to oblanceolate, margin glandular-irregular, apically truncate, with an inconspicuous apiculum to one side. *Lip* 9.0 × 7.3 mm, fused to the column, free blade 7 mm long, fleshy, broadly ovate, with a three-lobed callus from the base to the middle of the blade, and a fleshy central keel, margins irregular, apex notoriously thickened, obtuse, in natural position lateral lobes fully erect, stiff, completely enclosing the column. *Column* 4 mm, short, terete, slightly bent with respect to the ovary, with a tooth-like, central lobe. *Anther* sub-ovoid, with a pair of conspicuous flap-like tails, thin, 4-celled, cellular-glandular. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose.

Etymology: The name honors the Sistema Nacional de Áreas de Conservación (SINAC), an agency of the Costa Rican Ministry of Environment (MINAE) in charge of managing the protected areas in the country. Its mission is the conservation and sustainable use of biodiversity and natural resources, and I would like to take the opportunity to recognize the great efforts of its staff in protecting the country's biodiversity. The new species was discovered while exploring the area around the crater of Barva volcano within the Braulio Carrillo National Park, which is administered by SINAC. Our team of researchers was kindly allowed access and accompanied by the local rangers.

Habitat and distribution: The species is only known from the high elevation oak forests between 2600 and 2846 m around the main crater of the Barva volcano in the Braulio Carrillo National Park (Fig. 42).

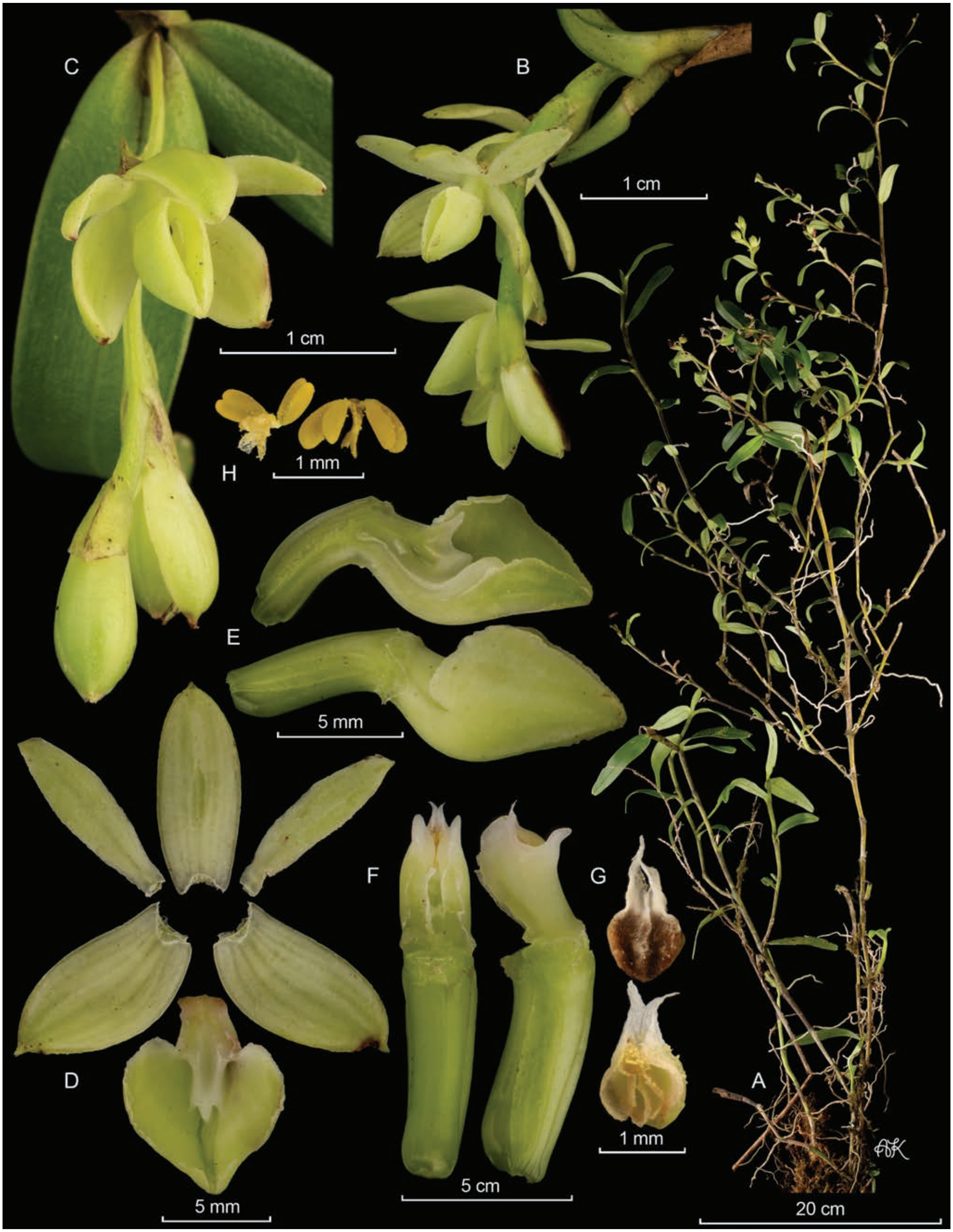

FIGURE 41. Illustration of *Epidendrum sinac* Karremans. **A**, Habit; **B**, Stem and inflorescence; **C**, Inflorescence detail; **D**, Dissected perianth; **E**, Lip and column lateral view and transversal section; **F**, Column lateral view; **G**, Anther cap views; **H**, Pollinarium views. By APK based on *Karremans 8900* (JBL-spirit).

FIGURE 42. Habitat at the type locality of *E. sinac* Karremans in the Braulio Carrillo National Park in Costa Rica, showing the Laguna Barva in the main crater of the Barva Volcano. By APK.

Phenology: It was recorded blooming in October.

Additional specimens examined: COSTA RICA. Heredia: San José de la Montaña, Parque Nacional Braulio Carrillo, sector Volcán Barva, sendero hacia el crater principal Laguna Barva, 10˚8'8"N, 84˚6'38"W, 2790 m, 12 October 2021, *A.P. Karremans, I. Chinchilla, G. Rojas-Alvarado and Y. Mena 8899* (JBL-spirit). Heredia: Parque Nacional Braulio Carrillo, sendero Cerro Guararí, 10˚7'35"N, 84˚7'00"W, 2600 m, 9 October 1989, *G. Rivera 128a* (CR).

The general habit and inflorescence of *E. sinac* is reminiscent of *E. anoglossoides* and *E. chespiritorum*, however it is florally quite distinct. The flowers, especially the very broad, thick lip with rigid, erect, irregular margins and the column with a notorious, tooth-like midlobe are similar to *E. nutantirhachis* Ames & C.Schweinf. instead.

Epidendrum jorge-warneri Karremans & Hágsater, Lankesteriana 13: 260. 2014. TYPE: COSTA RICA. Puntarenas: Buenos Aires, Buenos Aires, Olán, cumbre del Cerro Tinuk, 9˚17'29.1"N, 83˚10'11.2"W, 2417 m, bosque pluvial premontano, epífitas en bosque de páramo, 25 July 2012, *A.P. Karremans, D. Bogarín, D. Jiménez and V.H. Zúñiga 5545* (Holotype, CR; Isotype, JBL-spirit; Fig. 43).

Epiphytic, sympodial, caespitose, erect *herb*, up to 20 cm tall. *Roots* from the base up to above half the length of the stems, fleshy, filiform. *Stem* 15–20 cm tall, branching conspicuously, cane-like, laterally flattened, erect. *Leaves* up to 5, distributed along the stem, mostly close to the apex as the basal ones fall off with time; leaf sheath tubular, rugose, 1.5 cm long; blade 2.8–3.6 × 0.8–1.3 cm, elliptic to narrowly-ovate, obtuse bilobed, articulate. *Spathaceous bracts* lacking. *Inflorescence* apical, mostly from lateral branches, racemose, distichous, sub-secund, flowering only once; peduncle up to 2 cm long; rachis curved, laterally flattened. *Floral bracts* equal to longer than the ovary, acute, flattened, 1 cm long. *Flowers* 2–4, simultaneous, resupinate, brownish-yellow; fragrance sweet during the day. *Ovary* 8.0–8.5 mm, laterally compressed, prominently inflated throughout. *Sepals* free, spreading, the dorsal prominently bent inwards, narrowly-ovate to elliptic, acute, 9-veined, margin entire; the dorsal sepal 15 × 3.5 mm; the lateral sepals 15 × 4.0–4.5 mm, oblique. *Petals* 13.0–13.5 × 1.5–2.0 mm, spreading, strongly bent backwards, ligulate to narrowly-elliptic, obtuse, 3-veined, margin entire. *Lip* 12.5 × 5.5–6.0 mm, united to the column, ovate- lanceolate,

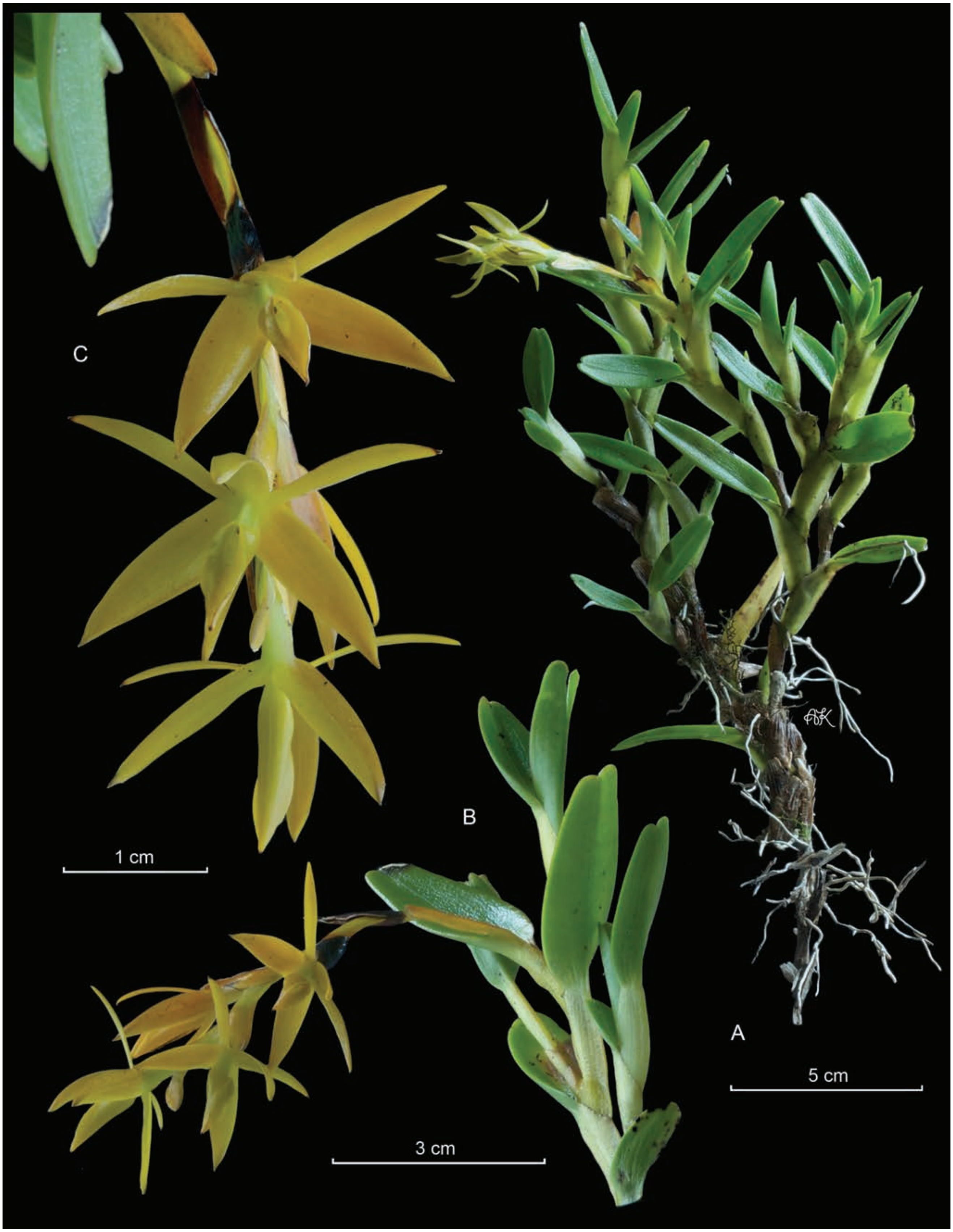

FIGURE 43. LCDP of *Epidendrum jorge-warneri* Karremans & Hágsater. **A**, Habit; **B**, Detail of the stem and inflorescence; **C**, Detail of the inflorescence and flower. By APK based on *Karremans 5545* (JBL-spirit).

slightly 3-lobed, margin wavy, embracing the column, completely covering it; callus Y-shaped, prolonged into a central rib extending to the apex of the lip; lateral lobes hemi-rhomboid; midlobe triangular, acute, apiculate. *Column* 3.5 mm long, straight, with two apical somewhat rounded wings. *Clinandrium-hood* short. *Anther cap* narrowly ovate with a prominent central rib, 4-celled. *Pollinia* 4, obovoid, laterally compressed, caudicles granulose. *Rostellum* apical, slit. Nectary penetrating the ovary up to near the base. *Capsule* not seen.

Etymology: The name honors Jorge Warner, former Director of the Lankester Botanical Garden of the University of Costa Rica, who has played a key role in developing the garden into the research center it is today.

Habitat and distribution: Known only from the summit of Cerro Tinuk in Costa Rica and Cerro Punta in Panama, where it grows epiphytically and lithophytic at around 2400 m in elevation.

Phenology: It has been recorded blooming in June and July.

Additional specimens examined: PANAMA. Chiriquí: Vicinity of Cerro Punta, above Guadalupe, ca. 8˚50'N, 82˚35'W, 2300–2450 m, forested slopes above STRI cabin, 7 June 1986, *G. McPherson 9418* (MO-3432762).

Epidendrum jorge-warneri can be recognized by the laterally compressed stems, the laterally compressed rachis and ovary, the 2–4, large, brownish-yellow flowers and the lip which embraces the column completely. *Epidendrum chespiritorum* is the most similar species, but has +5, greenish-yellow flowers, that are much smaller, sepals and petals 8.6–9.8 mm long, and lip 6.7 mm long. *Epidendrum anoglossoides* has much larger plants with the stems terete.

Epidendrum rudolfii Karremans, *sp. nov.*
TYPE: COSTA RICA. San José: Dota, Copey, Salsipuedes, Dos Amigos, ca. 19 km del Empalme hacia San Isidro del General, Carretera Interamericana, km 69–70, entrada al Mirador de Quetzales, 9˚38'50"N, 83˚50'48"W, 2750 m, bosque pluvial montano, 19 June 2021, *A.P. Karremans and M. Contreras Fernández 8782* (Holotype, JBL-spirit; Fig. 44).

Similar to *Epidendrum elcimeyae* Hágsater & García-Cruz, but distinguished by the coppery-yellow (vs. greenish) flowers that are much larger, the sepals 12.5–13.5 × 3.0–4.0 mm (vs. 6.5–7.0 × 2.0–2.7 mm), the petals 11.0 × 1.2–1.5 mm (vs. 6.0 × 0.9 mm), the lip 10 × 4.5 mm (vs 4 × 3 mm), the ovary conspicuously bent apically (vs. straight), the lip is elliptic (vs. triangular-cordate), and the column very prominent, 5.0–5.5 mm long (2 mm long).

Epiphytic, pseudo-monopodial, branching, *herb*, up to 50 cm long. *Roots* 1 mm in diameter, fleshy. *Stems* branching, flexuous, ancipitose, covered by rugose sheaths. *Leaves* many, distributed along the stem, deciduous, concentrating towards the apex with age; leaf sheath 10–12 mm long, tubular, rugose, greenish when young, becoming papery with age; blade 15–23 × 3–5 mm, thick coriaceous, oblong to narrowly ovate, unequally bilobed. *Inflorescence* up to 5 cm long, peduncle and rachis thin-filiform, arching-nutant, becoming pendent, from the branches, racemose, distichous, sub-secund, rachis flexuous-filiform, each internode very thin at the base of each bract and becoming broad and verrucose apically, below each floral bract. *Floral bracts* 4 mm long, much shorter than the ovary, acute. *Flowers* 2–3, coppery-yellow throughout. *Ovary* 9–10 mm long, cylindric, elongate, bent 90 degrees apically. *Sepals* free, spreading, ovate-elliptic, acute with an apical dorsal keel; dorsal sepal 12.5–13.0 × 3.0 mm; lateral sepals 13.0–13.5 × 3.8–4.0 mm. *Petals* 11.0 × 1.2–1.5 mm, free, spreading, linear-ligulate, acute. *Lip* 10 × 4.5 mm, fused to the column, elliptic, acute, margins slightly elevated apically, with 3–5-lobed callus at the base, 3 low carinae in front of it, and one thickened central lamella at the apex. *Column* 5.0–5.5 mm long, thick, broad, straight with respect to the ovary. *Anther* sub-trapezoid, very thin, 4-celled, margins irregular, elevated dorsally. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose. *Capsule* not seen.

Etymology: The name honors Rudolf Jenny (26 July 1953–10 August 2021), well-known orchid taxonomist and historian, and a dear friend. Always enthusiastic about going to the field and discovering orchids, his planned trip to visit us at Lankester Botanical Garden in Costa Rica was postponed due to COVID-19 restrictions.

Habitat and distribution: Known only from the Cordillera de Talamanca in Costa Rica and Panama, growing at elevations between 2600–2850 m.

Phenology: It was recorded blooming in March and June.

Additional specimens examined: COSTA RICA. Cerro de la Muerte, 30 May 1987, *O.E. Achí 1* (USJ-37870). PANAMA. Bocas del Toro: Cordillera de Talamanca, 2–5 airline km NW of the peak of Cerro Echandi on the Costa Rican-Panamanian international border; 9˚03–04'N, 82˚50–51'W, 2600–2850 m, mixed *Quercus-Podocarpus* forest with *Chusquea* understory on steep slopes with quebradas, March 1984, *G. Davidse, L.D. Gómez, G. Herrera, R. Chacón and A. Chacón 25145* (MO-011485; AMO-photo).

Spathiger Group-Coriifolium Subgroup

Hágsater and collaborators have placed the "Coriifolium subgroup" within the "Spathiger group," but it is not clear to me how species belonging to each of these groups are related and I find the association difficult to explain morphologically. In the "Coriifolium subgroup" the authors have included species with a sympodial growth habit, a distichous, secund inflorescence with large, conduplicate bracts, fleshy greenish flowers with narrow petals and reniform lip (Hágsater and Sánchez-Saldaña 2007, 2009). Other features include the extremely broad, leaf sheaths, the very large, ancipitose and acuminate floral bracts, the petals apically rounded, and the blade of the reniform lip is typically wider than long and apically emarginate.

Epidendrum usurpator Karremans, *sp. nov.*
TYPE: COSTA RICA. Alajuela: San Ramón, Piedades Sur, San Miguel (La Palma). Camino a San Bosco. A orillas y dentro de un pequeño bosque secundario. 10˚07'18.8"N, 84˚31'13.1"W, 1062 m. 21 December 2010. *A.P. Karremans, J.A.J. Karremans and M. Contreras Fernández 3237* (Holotype, JBL-spirit, Fig. 45).

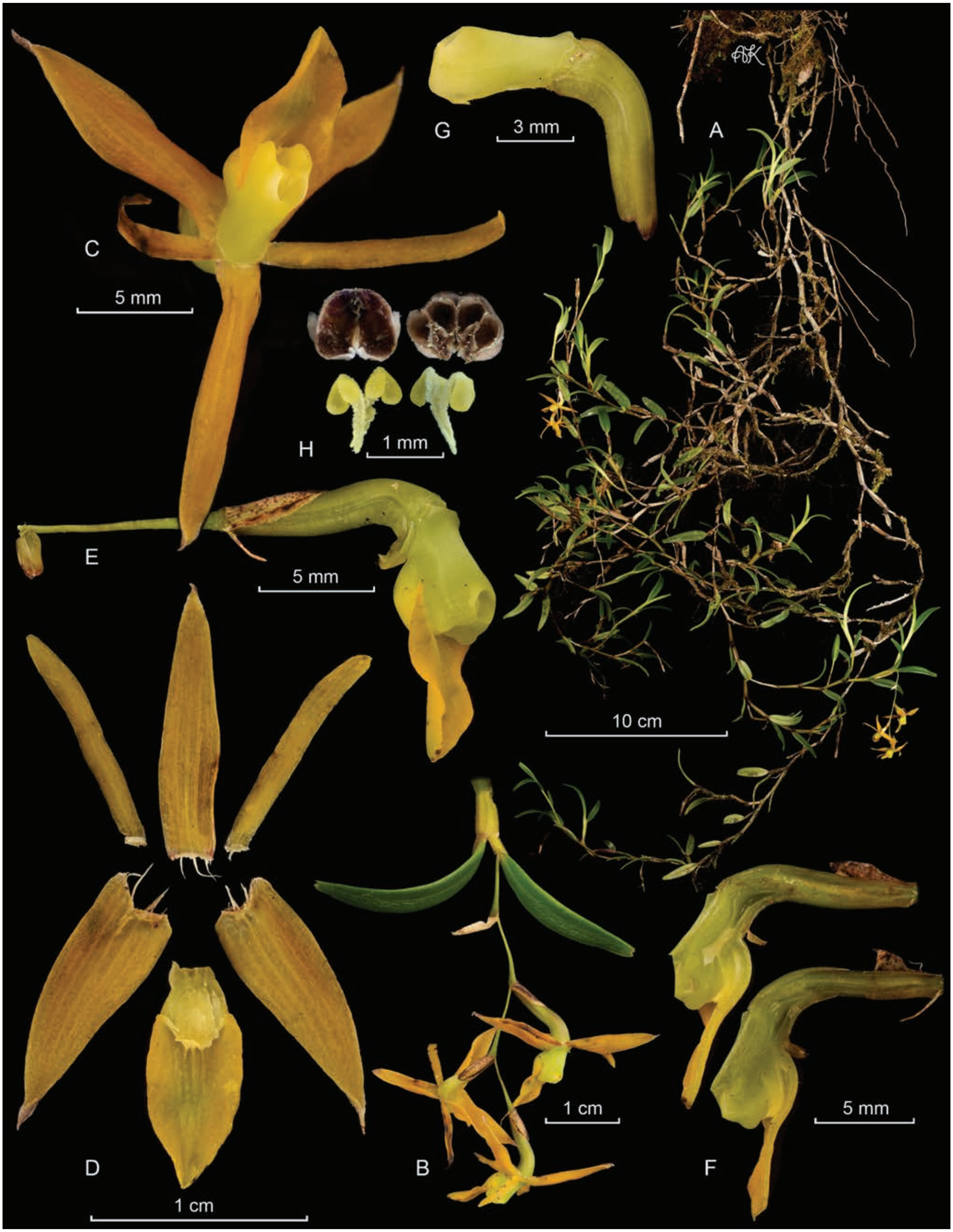

FIGURE 44. LCDP of *Epidendrum rudolfii* Karremans. **A**, Habit; **B**, Detail of the inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Lip and column lateral view; **F**, Lip and column transversal section; **G**, Column lateral view; **H**, Anther cap and pollinarium views. By APK based on *Karremans 8782* (JBL-spirit).

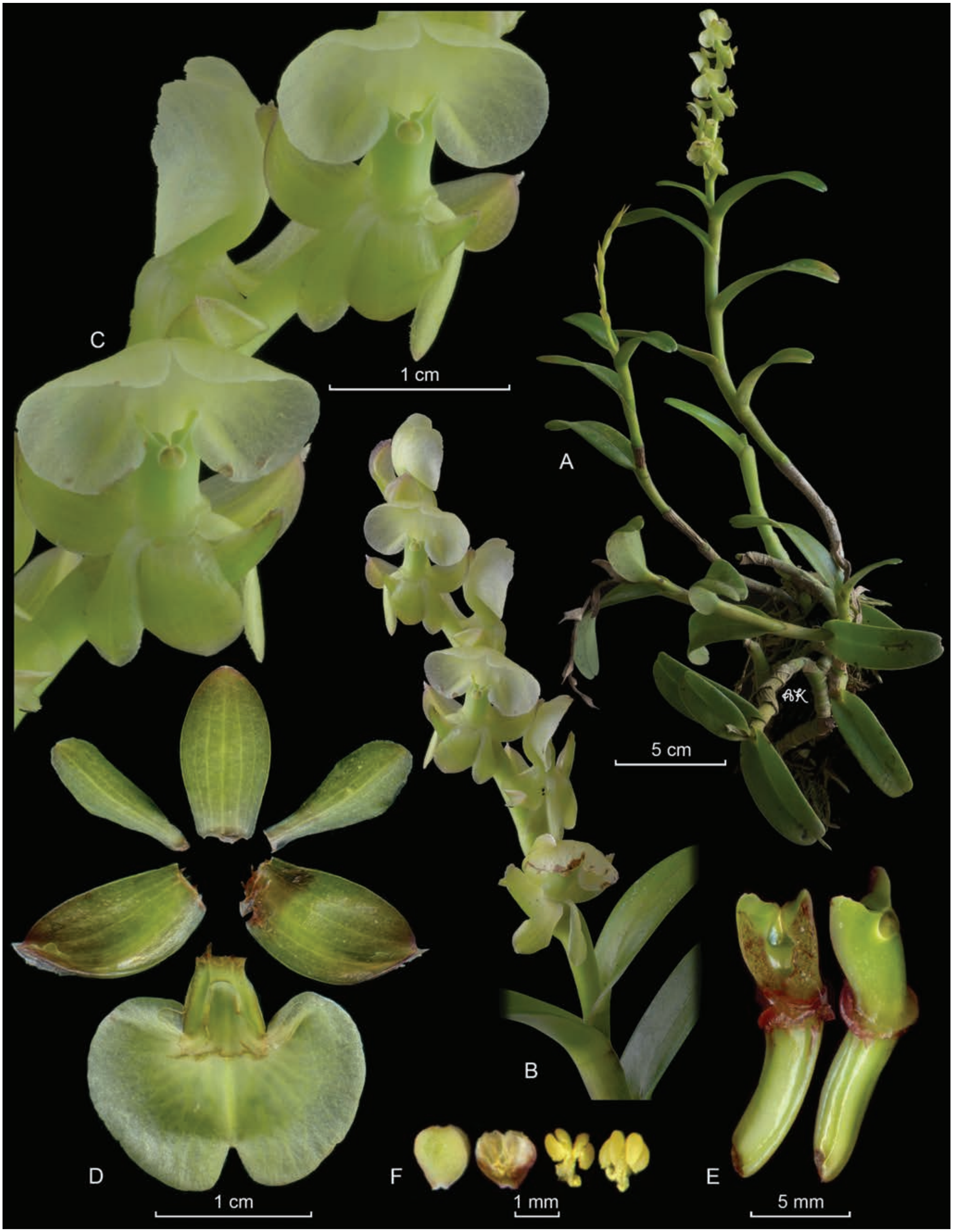

Figure 45. LCDP of *Epidendrum usurpator* Karremans. **A**, Habit; **B**, Detail of the inflorescence; **C**, Flower; **D**, Dissected perianth; **E**, Column lateral and ventral views; **F**, Anther cap and pollinarium views. By APK based on *Karremans 3237* (JBL-spirit).

Similar to *Epidendrum bilobatum* Ames, but the plants smaller, stems up to 20 cm long (vs. up to 30 cm long), leaves shorter, 4.0–6.0 cm (vs. leaves 11.0–12.5 cm), the flowers have a whitish lip (vs. apple green), the smaller dorsal sepal (11 × 3–4 mm vs. 14 × 6 mm), and the lip longer that wide, 18 × 15 mm (vs. lip slightly wider than long, 13.0–15.0 × 15.3 mm).

Epiphytic, sympodial, sub-caespitose, shortly repent *herb*, up to 32 cm tall including the inflorescence. Roots 1–2 mm in diameter, basal, produced along the short rhizomes, fleshy. *Stems* up to 20 cm tall, erect, simple, cane-like, terete at the base, separated along the rhizome which is 2.5–2.8 cm long, covered with tubular non-foliar sheaths at the base. *Leaves* 4–6, distributed on the upper half of the stem; *sheaths* 2.2–3.1 cm long, tubular, striated, scarious, green, turning papery brown with age; *blade* 4.0–6.0 × 0.9–2.0 cm, oblong-elliptic, flat, coriaceous, the apex bilobed. *Inflorescence* 6.5–8.5 cm long, apical, erect, distichous, produced from the mature stem; *peduncle* 1.0 cm; *rachis* ca. 5.5–7.5 cm long, sinuous to straight, laterally compressed. *Floral bracts* 1.5 cm, longer than the ovary, widely ovate, acuminate, conduplicate, apically bent inwards. *Flowers* 5–7, simultaneous, non-resupinate, sub-secund, the lip always oriented towards the rachis, sepals, and petals pale apple green, the lip whitish. *Ovary* 8.0–8.5 mm, slightly arched, slightly inflated behind the perianth. *Sepals* free, ovate to broadly elliptic, coriaceous; *dorsal sepal* 11 × 3–4 mm, reflexed, laying on the ovary, obtuse; *lateral sepals* 12 × 6–7 mm, spreading, slightly oblique, concave, obtuse, with a prominent dorsal keel towards the apex, the margin of the keel serrulate. *Petals* 10–11 × 3.0 mm, reflexed, narrowly oblanceolate, apex rounded, margin minutely dentate towards the apex. *Lip* 18 × 15 mm, united to the column at the base, membranaceous, thin, reniform in general form, concave, bilobed, the base cordate, apex deeply emarginate, margin minutely dentate, the lobes of the lip transversely ovate, rounded; bicallose, the calli not evident. *Column* 6–7 mm, thickened, straight, with a pair of prominent rounded wings. *Clinandrium-hood* reduced, margin entire. *Anther* ovoid, apex bilobed, the 4-celled. *Pollinia* 4, obovoid, sub-equal, laterally compressed; caudicles longer than the pollinia, soft and granulose, viscarium semi-liquid, transparent. *Capsule* not seen.

Etymology: From the Latin *usurpator*, usurper, tyrant, an individual who takes over power by illegitimate means, in reference to this species which has been known under the name *Epidendrum bilobatum*, and thus replaced the identity of that species.

Habitat and distribution: This is a relatively common species around San Ramón and Tilarán, where it is found forming large clumps on trees in roadside pastures (Fig. 46). It grows at elevations between 700 and 1150 m.

Phenology: Recorded flowering for October to January.

Additional specimens examined: COSTA RICA: Alajuela: La Palma de San Ramón, 1150 m, 30 October 1922, *A.M. Brenes 379 (49)* (AMES). La Palma de San Ramón, 10 November 1924, *A.M. Brenes (89)1649* (AMES). Bosques del C. de Laguna, 7 November 1922, *A.M. Brenes 101* (AMES). Guanacaste: Quebrada Serena, southeast of Tilarán, ca. 700 m, 27 January 1926, *P.C. Standley 46292* (AMES). Ibid, *P.C. Standley 46341* (AMES), Ibid, *P.C. Standley 46341* (AMES). La Tejona, North of Tilarán, *P.C. Standley and J. Valerio 45981* (AMES). Tilarán, *Hágsater 7094* (AMO; pl. 914 in Hágsater and Sánchez-Saldaña 2007)

Epidendrum usurpator has long been confused with *E. bilobatum*. Perhaps this is because *E. usurpator* is a common epiphyte around San Ramón and Tilarán in Costa Rica where it forms large clumps, while *E. bilobatum* is quite rare and found only around the area of Cartago, and of which I know only two specimens: *Lankester 509* (AMES) from Cachí and *Karremans 664* (JBL) from Moravia de Chirripó. *Epidendrum usurpator* has similar flowers but can be distinguished from *E. bilobatum* by vegetative features, the plants are compact and denser, stems up to 20 cm long (vs. up to 30 cm long), the shorter leaves, 4.0–6.0 cm (vs. 11.0–12.5 cm), the flowers are different in color, the lip is whitish (vs. apple green), the smaller dorsal sepal larger (11 × 3–4 mm vs. 14 × 6 mm) and the lip is longer than wide (vs. wider than long).

Epidendrum usurpator as defined here should replace the concept of *E. bilobatum* of Hágsater and Sánchez-Saldaña (2007) and probably includes most of the specimens listed cited therein. However, those that I have not been able to personally inspect are not listed here.

Epidendrum vexillium Hágsater, Icon. Orchid. 3: t. 395. 1999.

TYPE: COLOMBIA: Risaralda: ltaurí, 1000 m, pressed 15 February 1993, *González sub E. Hágsater 8440* (Holotype, AMO).

Epiphytic, caespitose, *herb*, up to 21 cm tall including the inflorescence. Roots to 2 mm in diameter, basal, fleshy. *Stems* 5.7–11.2 cm long, simple, cane-like, laterally compressed, ancipitose, straight. *Leaves* 1–4, distichous, distributed on the apical half of the stems, coriaceous; leaf sheath 2.5–3.5 cm long, tubular, laterally compressed, ancipitose; blade 9.7–11.2 × 3.0 cm, blade articulated, elliptic, apex unequally bilobed. *Inflorescence* 9 cm long, apical, racemose, erect, congested; peduncle laterally compressed, ancipitose, bracts 2–3, sub-imbricate, conduplicate, acute. *Floral bracts* 2.5–3.5 cm long, imbricate, ancipitose. *Ovary* 1.7 cm long, inflated, cylindrical, elongate, clavate. *Flowers* 3–4, pale green throughout, nonresupinate, sub-secund. *Sepals* free, spreading, slightly revolute, broadly ovate, acute with an apical dorsal keel; dorsal sepal 1.1 × 0.6 cm; lateral sepals 1.3 × 0.7–0.8 cm. *Petals* 1.0 × 0.5 cm, free, spreading, elliptic, oblique, obtuse. *Lip* 1.5 × 1.5 cm, fused to the column, almost flat, sub-rectangular, sub-emarginate at the apex, ecallose, apically with a low carinate. *Column* 8 mm long, thick, broad. *Anther* ovoid, 4-celled. *Pollinia* 4, obovoid, laterally compressed, caudicles soft and granulose, viscidium translucent. *Capsule* not seen.

Etymology: From the Latin *Vexillium*, in military terms a military or naval ensign, in relation to the way the lip is positioned to exhibit it.

Habitat and distribution: Known to occur in Costa Rica, Panama, and Colombia.

Phenology: It was recorded blooming from October to February.

FIGURE 46. Photograph of *E. usurpator* Karremans in situ as it is commonly found covering solitary trees in pastures on the Tilarán mountain range. By APK.

Additional specimens examined: COSTA RICA. Alajuela: Upala, Bijagua, camino al P. N. Volcán Tenorio, potreros a orillas del camino con ascenso a parches de bosque, 10˚43'22.4"N, 85˚00'07.1"W, 720 m, bosque muy húmedo tropical transición a premontano, 14 December 2016, *M. Díaz, M. Cedeño, I. Chinchilla, A.P. Karremans and G. Rojas-Alvarado 293* (JBL-spirit, Fig. 47). PANAMA. El Llano - Cartí road, 8–10 km. No. of El Llano, 2 October 1976, *R.L. Dressler 5522* (AMO).

Epidendrum vexillium was previously known to occur in Colombia and Panama and is here reported from Costa Rica on the basis of a specimen collected close to Tenorio Volcano National Park in the north of the country. It is closely related to *E. circinatum* Ames and *E. concavilabium* C.Schweinf. but easily distinguished from both by the smaller flowers with a sub-rectangular lip, that is as long as wide, the slightly revolute, non-retrorse, sepals and petals, and the straight column and ovary.

Discussion

Pinheiro and Cozzolino (2013) suggest genus *Epidendrum* as a promising model system for evolutionary and ecological studies in the Neotropical region. Given its high species diversity, the broad biogeographical and ecological range, and the variation in morphology, chromosome numbers and ecological interactions, the genus presents a rich source for intriguing and yet unanswered questions. Considering the high degree of endemism, local radiation, and hybridization, *Epidendrum* is also a prime candidate to study speciation, divergence times and diversification patterns (e.g., Nóbrega et al., 2017; Pessoa et al., 2021). At the same time, it presents an enormous opportunity as a bioindicator, to study the effects of climate change and as a priority for local and global conservation efforts.

To achieve these goals, it is extremely important to correctly establish more precise species boundaries and diversity estimates in the genus. At the turn of the century, Hágsater et al. (1999) estimated genus *Epidendrum* included about 2000 species, despite only 1000 being formally described by then. Astonishingly, just two decades later we have reached 1800 described *Epidendrum* species, but the projection has also increased to about 2400 species since (Hágsater et al., 2016). Species that were previously thought to be common and variable across their broad distributions in the Neotropics, such as *Epidendrum difforme* Jacq., *E. nocturnum* Jacq. and *E. paniculatum* Ruiz & Pav., have turned out to represent large species complexes with many rare, local endemics. Similarly, *E. rugosum* and *E. sanchoi*, which have traditionally been considered common and broadly distributed taxa in Costa Rica, are shown here to represent many different species that are much more localized in their distribution.

On revising the Neotropical *Vanilla* species, Karremans et al. (2020) cautioned that the taxonomical inflation may have unexpected consequences that go beyond the exercise of formal naming species. Over-splitting of taxa hamper biogeographical and abundance studies and may also have serious implications for conservation biology. Taxonomic inflation may result in an overestimation in speciation rates, the underestimation of ecological preferences and distribution ranges, false interpretations of endemism and hotspots, skewed origin and diversification patterns, mistaken conservation priorities, and increased interest of collectors, among other issues. *Epidendrum* represents the exact opposite: a serious underestimation of the species diversity, which results in essentially the same issues regarding speciation, diversification processes, ecosystem development, and conservation priorities. Dealing with these undescribed and unrecognized species of *Epidendrum* is not merely a taxonomic problem, it rather has multiple unforeseen negative consequences and it is therefore a priority to close the gap between the described and projected diversity in the genus.

How does this relate to conservation? According to Fay (2018), one out of every 30 orchids species has been assessed for the IUCN Global Red List, and just over half of them fall into one of the categories of critically endangered, endangered, or vulnerable. Out of the 1800 species of *Epidendrum* currently recognized, only a very concerning 1.3 % have been assessed to date (IUCN 2021). The isthmus of Costa Rica and Panama has one of the highest concentrations of epiphyte species per area in the Neotropics and is a major evolutionary center for epiphytic plants in the world (Cascante-Marín and Nivia-Ruíz, 2013), and *Epidendrum* has been pointed out as the most important genus for endemics among flowering epiphytes in southern Central America. Ossenbach et al. (2007) estimated that 48% of the *Epidendrum* species registered for Costa Rica and Panama at the time had been recorded to occur within the limits of protected areas. Relatively speaking, those figures seem encouraging especially considering that only one out of every five species in the genus is listed as threatened by the authors. However, they emphasize on the necessity of updating species distribution information (Ossenbach et al., 2007). Cited among those species occurring in protected areas are *E. anoglossoides*, *E. bilobatum*, *E. microcardium*, *E. rugosum* and *E. sanchoi*, all of which have been recircumscribed here. As previously circumscribed these species were well covered in collections and protected areas, but all of the newly recognized species in these complexes are in fact quite poorly represented in both. They are a good example of how a different taxonomic interpretation can cause a sudden shift from a scenario where we have few broadly distributed and overall unthreatened species to a scenario where we have several potentially threatened species for which the population size, distribution and conservation status need to be urgently established.

Among the Orchidaceae, *Epidendrum* is consistently the most species rich genus in Neotropical countries (Table 2). Unexpectedly, this predominance is maintained on a local scale too, being the most diverse orchid genus occurring in and around protected areas across Costa Rica and Panama (Table 3). The total number of species clearly increases with elevation. But regardless of the mountain chain, watershed, elevational range, and forest type, *Epidendrum* is always the most species rich genus of the Orchidaceae. A recent checklist of vascular plants in La Amistad Biosphere Reserve, the third largest and most biodiverse biosphere

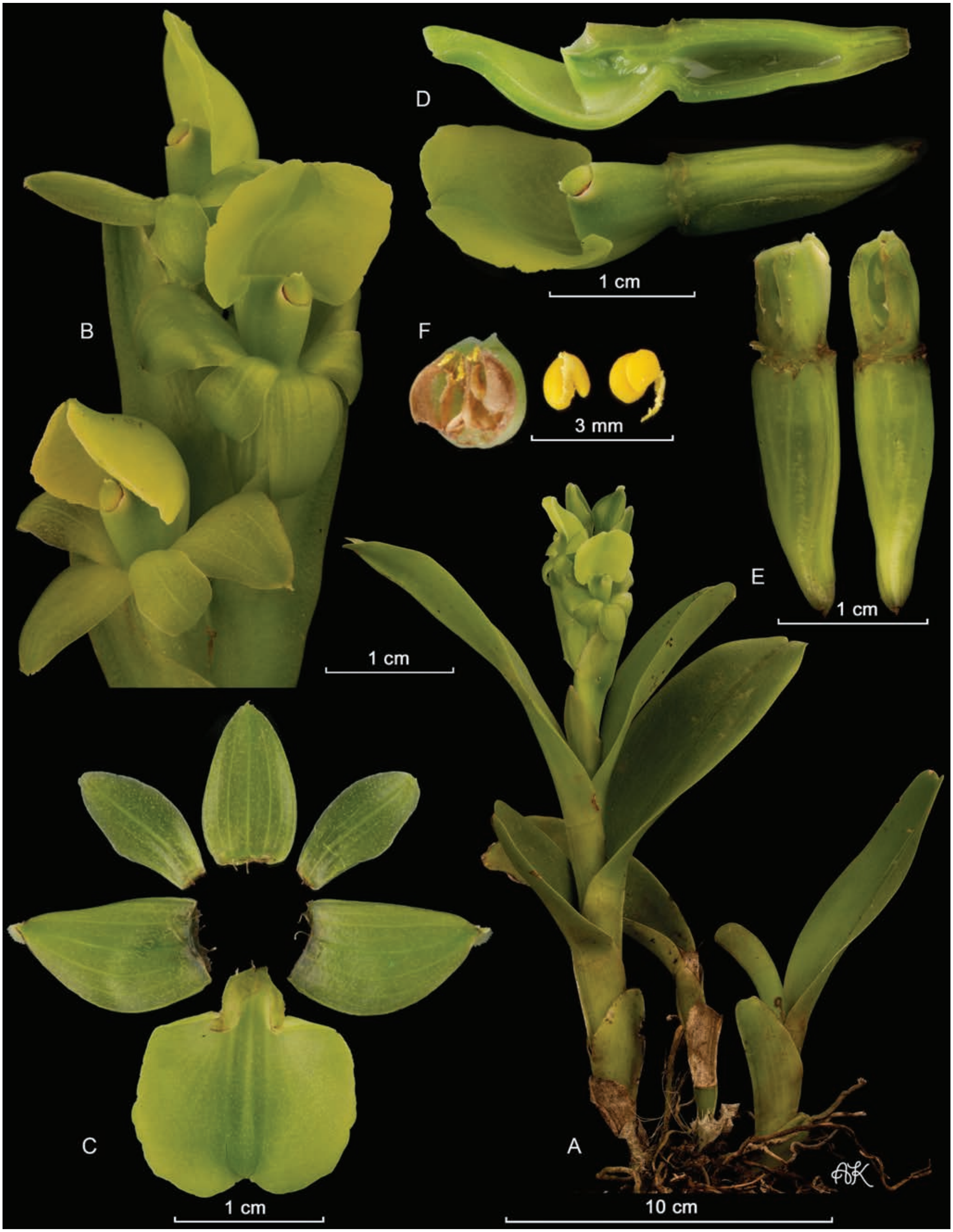

FIGURE 47. LCDP of *Epidendrum vexillium* Hágsater. **A**, Habit; **B**, Detail of the inflorescence; **C**, Dissected perianth; **D**, Lip and column lateral view and transversal section; **E**, Column lateral and ventral views; **F**, Anther cap and pollinarium views. By APK based on *Díaz 293* (JBL-spirit).

TABLE 2. Total *Epidendrum* species per country and rank among Orchidaceae.

COUNTRY	SPECIES	RANK	REFERENCE
Colombia	456	1	Bernal 2016
Ecuador	455	1*	Dodson 2004
Peru	338	1	Navarro Romo et al., 2020
Costa Rica	247	1	Current paper
Panama	207	1	Current paper
Bolivia	174	1	Vásquez et al., 2003
Venezuela	159	1	Carnevali et al., 2008
Brazil	125	2	Pessoa 2020
Mexico	125	1	Solano et al., ined.
Honduras	74	1	Vega et al., ined.
French Guiana	45	1	Sambin and Ravet 2021

* Genus *Pleurothallis* R.Br. appears first, but more than half of the species listed are now recognized to belong to other genera.

TABLE 3: *Epidendrum* species reported in and around protected areas in Costa Rican and Panama.

MOST SPECIOUS ORCHID GENUS	NUMBER OF SPECIES	ELEVATION RANGE	AREA	LOCATION	REFERENCE
Epidendrum	3	0–575 m	24 km^2	Cocos Island National Park, Pacific Ocean, Costa Rica	Bogarín et al. (2011)
Epidendrum	4	up to 575 m	23 km^2	Barra Honda National Park, North Pacific, Costa Rica	Bogarín and Pupulin (2021)
Epidendrum	9	up to 200 m	*4 km^2	Manuel Antonio National Park and Quepos, Central Pacific coast, Costa Rica	Pupulin (2001); Pupulin and Bogarín (2018)
Epidendrum	10	sea level	11 km^2	Cahuita National Park, South Caribbean coast, Costa Rica	Pupulin and Bogarín (2018)
*Epidendrum***	11	1500–1550 m	0.04 km^2	Monteverde cloud forest, Tilaran Mountain Range, Costa Rica	Ingram and Ferrell-Ingram (1996)
*Epidendrum***	15	ca. 35 m	16 km^2	La Selva Biological Station, Northern Caribbean Plains, Costa Rica	Atwood (1987)
Epidendrum	17	0–745 m	?	Golfo Dulce, Osa Peninsula, South Pacific, Costa Rica	Rakosy et al. (2013)
Epidendrum	22	1600–1850 m	7.5 km^2	La Carpintera, Central Valley, Costa Rica	Cascante-Marín and Trejos (2019)
Epidendrum	24	1300–2450 m	20 km^2	Bosque de Paz Orchid Reserve, Central Volcanic Range, Costa Rica	Muñoz and Kirby (2007)
Epidendrum	24	990–1300 m	2.3 km^2	Monumento Nacional Guayabo, Central Volcanic Range, Costa Rica	Karremans et al., unpubl. data
Epidendrum	50	0–3800 m	6500 km^2	La Amistad Biosphere Reserve, Talamanca Mountain Range, in southern Costa Rica and western Panama	Monro et al. (2017)

* Includes only MANP, not the surrounding areas.

** Genus *Pleurothallis* R.Br. is listed as first, but more than half of the species listed are now recognized to belong to other genera.

reserve in Central America, lists only 50 species of *Epidendrum* (Monro et al., 2017). La Amistad International Park (PILA), shared by Costa Rica and Panama is at the core of the biosphere. The Talamanca Mountains, in which PILA is situated, cover an area of ca. 10,000 km^2 bound by the Cerro de la Muerte in Costa Rica to the north and west and the volcanic massif of Chiriquí in Panama to the east and south. La Amistad Biosphere Reserve itself includes 6,500 km^2 of continuous forest with an elevational range between 0 and 3800 m, covering an extremely broad set of life/biodiversity zones (Fig. 48). It is especially rich in tropical montane and cloud forests which hold the highest abundance and diversity of epiphytic orchids (Cascante-Marín and Trejos, 2019). Not surprising, it is in or around the PILA where most of the novelties in *Epidendrum* have originated in recent years, including the majority listed in the current paper (Fig. 1, 8, 20, 25). That only 16% of the *Epidendrum* species recorded for Costa Rica and Panama are found in the largest and most biodiverse biosphere shared by the two countries surely is a wild underestimation. Especially when comparing the relative diversity of *Epidendrum* species found in much smaller areas (Table 3). It speaks about a pressing need of thorough sampling, identification, and estimation of distribution of *Epidendrum* species.

With the current changes incorporated, our estimates are 247 *Epidendrum* species for Costa Rica and 207 for Panama. In total, 310 different species of *Epidendrum* can be attributed to Costa Rica and Panama together, with 144 (46%) occurring in both countries. This places the countries of the isthmus only behind Colombia, Ecuador and Peru in absolute species numbers (Table 2), with these Andean countries spanning significantly larger territories. Bogarín et al. (2016) estimated the number of endemic *Epidendrum* species at 36.2% and 23.1% for Costa Rica and Panama respectively. However, when they are treated as a single biogeographical unit, we find that the percentage of

Figure 48. La Amistad Biosphere Reserve in the Talamanca mountain range in southern Costa Rica and western Panama is a well conserved and relatively unexplored biodiversity hotspot.

endemism increases to ca. 50% (Table 1). In other words, about 155 species of the *Epidendrum* found on the isthmus of Costa Rica and Panama grow nowhere else in the world. The assessment of threat level to these 155 endemic *Epidendrum* species, many of which grow at mid and high elevations in montane and cloud forests, should be a conservation priority for both countries. Especially considering that the effects of climate change are suggested to be more pronounced at higher elevations (Karmalkar et al., 2008), that epiphytes are more vulnerable (Benzing, 1998), and that some important orchid diversity hotspots and potentially suitable habitats have been shown to occur outside of protected areas (Crain and Fernández, 2020; Watteyn et al., 2020). After all, with great biodiversity comes great responsibility!

LITERATURE CITED

ATWOOD, J. T. 1987. The vascular flora of la Selva Biological Station, Costa Rica. Orchidaceae. Selbyana 10(1): 76–145.

BENZING, D. H. 1998. Vulnerabilities of tropical forests to climate change: the significance of resident epiphytes. Clim. Change 39: 519–540.

BERNAL, R. 2016. La flora de Colombia en cifras. Pages 115–137 in R. BERNAL, S. R. GRADSTEIN, and M. CELIS, EDS., *Catálogo de Plantas y Líquenes de Colombia I*. Universidad Nacional de Colombia, Bogotá.

BOGARÍN, D., and F. PUPULIN. 2021. The orchid flora of Barra Honda National Park, Nicoya, Guanacaste, Costa Rica. Harvard Pap. Bot. 26: 7–100.

BOGARÍN, D., A. P. KARREMANS, and F. PUPULIN. 2008. New species and records of Orchidaceae from Costa Rica. Lankesteriana 8(2): 53–74.

BOGARÍN, D., F. PUPULIN, C. ARROCHA, and J. WARNER. 2013. Orchids without borders: studying the hotspot of Costa Rica and Panama. Lankesteriana 13(1–2): 13–26.

BOGARÍN, D., Z. SERRACÍN, Z. SAMUDIO, R. RINCÓN, and F. PUPULIN. 2014. An updated checklist of the Orchidaceae of Panama. Lankesteriana 14(3): 135–364.

BOGARÍN, D., F. PUPULIN, E. SMETS, and B. GRAVENDEEL. 2016. Evolutionary diversification and historical biogeography of the Orchidaceae in Central America with emphasis on Costa Rica and Panama. Lankesteriana 16(2): 189–200.

BOGARÍN, D., J. WARNER, M. POWELL and V. SAVOLAINEN. 2011. The orchid flora of Cocos Island National Park, Puntarenas, Costa Rica. Bot. J. Linn. Soc. 166: 20–39.

CARNEVALI, G., G. GERLACH, and G. ROMERO. 2008. Orchidaceae. Páginas 753–789 en O. HOKCHE, P.E. BERRY and O. HUBER, EDS., *Nuevo Catálogo de la Flora Vascular de Venezuela*. Fundación Instituto Botánico de Venezuela Dr. Tobías Lasser, Caracas.

CASCANTE-MARÍN, A., and A. NIVIA-RUÍZ. 2013. Neotropical Flowering Epiphyte Diversity: Local Composition and Geographic Affinities. Biodiv. Conserv. 22: 113–125. https://doi.org/10.1007/s10531-012-0404-1

CASCANTE-MARÍN, A., and C. TREJOS. 2019. Diversidad y vulnerabilidad de la flora orquideológica de un bosque montano nuboso del Valle Central de Costa Rica. Lankesteriana 19(1): 31–55.

CRAIN, B., and FERNÁNDEZ, M. 2020. Biogeographical analyses to facilitate targeted conservation of orchid diversity hotspots in Costa Rica. Divers. Distrib. DOI: 10.1111/ddi.13062.

DÍAZ-MORALES, M., and A. P. KARREMANS. 2016. *Epidendra Nova Talamancana*. Phytotaxa 272(4): 248–256. http://dx.doi.org/10.11646/phytotaxa.272.4.2

DODSON, C. H. 2004. Ecuador orchid List. *Native Ecuadorian Orchids V*. Dodson Publishing, Sarasota, Florida. Pages 1112–1156.

FAY, M. F. 2018. Orchid conservation: how can we meet the challenges in the twenty-first century? Bot. Stud. 59(1): 16. http://doi.org/10.1186/s40529-018- 0232-z

FERNÁNDEZ, M., D. BOGARÍN, A.P. KARREMANS, and D. JIMÉNEZ. 2014. New species and records of Orchidaceae from Costa Rica III. Lankesteriana 13(3): 259–282.

HÁGSATER, E., and G. A. SALAZAR (EDS.). 1993. The genus *Epidendrum*. Part 1. "A century of new species in *Epidendrum*." Icon. Orchid. 2: pl. 101–200.

HÁGSATER, E., and L. SÁNCHEZ-SALDAÑA (EDS.). 2001. The genus *Epidendrum*. Part 3. "A third century of new species in *Epidendrum*." Icon. Orchid. 4: pl. 401–500.

———. 2004. The genus *Epidendrum*. Part 4. "A fourth century of new species in *Epidendrum*." Icon. Orchid. 7: pl. 701–800.

———. 2006. The genus *Epidendrum*. Part 5. "Species new & old in *Epidendrum*." Icon. Orchid. 8: i–xi, pl. 801–900.

———. 2007. The genus *Epidendrum*. Part 6. "Species new & old in *Epidendrum*." Icon. Orchid. 9: i–xiii, pl. 901–1000.

———. 2008. The genus *Epidendrum*. Part 7. "Species new & old in *Epidendrum*." Icon. Orchid. 11: i–xxvii, pl. 1101–1200.

———. 2009. The genus Epidendrum. Part 8. Species new & old in Epidendrum. Icon. Orchid. 12: pl. 1201–1300.

———. 2010. The genus *Epidendrum*. Part 9. "Species new & old in *Epidendrum*." Icon. Orchid. 13: i–xxii, pl. 1301–1400.

———. 2013. The genus *Epidendrum*. Part 10. "Species new & old in *Epidendrum*." Icon. Orchid. 14: i–iii, pl. 1401–1500.

———. 2015. The genus *Epidendrum*. Part 11. "Species new & old in *Epidendrum*." Icon. Orchid. 15(1): i–v, pl. 1501–1568.

———. 2016. The genus *Epidendrum*. Part 11. "Species new & old in *Epidendrum*." Icon. Orchid. 15(2): i, pl. 1569–1600.

HÁGSATER, E., and E. SANTIAGO. 2018a. The genus *Epidendrum*. Part 12. "Species new & old in *Epidendrum*." Icon. Orchid. 16(1): i–v, pl. 1601–1667.

———. 2018b. The genus *Epidendrum*. Part 12. "Species new & old in *Epidendrum*." Icon. Orchid. 16(2): i–v, pl. 1668–1700.

———. 2019. The genus *Epidendrum*. Part 13. "Species new & old in *Epidendrum*." Icon. Orchid. 17(1): i–viii, pl. 1701–1756.

———. 2020a. The genus *Epidendrum*. Part 13. "Species new & old in *Epidendrum*." Icon. Orchid. 17(2): i–v, pl. 1757–1800.

———. 2020b. The genus *Epidendrum*. Part 14. "Species new & old in *Epidendrum*." Icon. Orchid. 18(1): i–xx, pl. 1801–1848.

———. 2021. The genus *Epidendrum*. Part 14. "Species new & old in *Epidendrum*." Icon. Orchid. 18(2): i–ii, pl. 1849–1900.

HÁGSATER, E., J. GARCÍA-CRUZ, and L. SÁNCHEZ SALDAÑA. 2003. *Epidendrum*. Pages 101–169 in B. E. HAMMEL, M. H. GRAYUM, C. HERRERA, and N. ZAMORA, EDS., *Manual de Plantas de Costa Rica. Volumen III: Monocotiledóneas (Orchidaceae–Zingiberaceae)*. Missouri Botanical Garden Press, St. Louis.

HÁGSATER, E., L. SÁNCHEZ-SALDAÑA, and J. GARCÍA-CRUZ (EDS.). 1999. The genus *Epidendrum*. Part 2. "A second century of new species in *Epidendrum*." Icon. Orchid. 3: pl. 301–400.

HÁGSATER, E., E. SANTIAGO, and L. RODRÍGUEZ-MARTÍNEZ. 2016. *Epidendrum lasiostachyum* (Orchidaceae): a new Colombian species of the *Epidendrum macrostachyum* group. *Lankesteriana* 16: 27–37. http://dx.doi.org/10.15517/lank.v16i1.23621

Ingram, S., K. Ferrell-Ingram, and N. M. Nadkarni. 1996. Floristic composition of vascular epiphytes in a neotropical cloud forest, Monteverde, Costa Rica. Selbyana, 17(1), 88–103.

IUCN. 2021. The IUCN red list of threatened species; http://www.iucnredlist.org/ (accessed 1 September 2021).

Karmalkar, A. B., R. S. Bradley, and H. F. Diaz. 2008. Climate change scenario for Costa Rican montane forests. Geophys. Res. Lett. 35(11): L11702. http://doi.org/10.1029/2008GL033940

Karremans, A. P., and D. Bogarín. 2013. Costa Rica, land of endless orchids. Orchids (West Palm Beach) 82(7): 408–411.

Karremans, A. P., and E. Hágsater. 2010. Confusion in *Epidendrum brenesii* Schltr., and a new Costa Rican species: *Epidendrum sotoanum* (Orchidaceae: Laeliinae). Lankesteriana 9(3): 403–409.

Karremans, A. P., D. Bogarín, M. Fernández, C. M. Smith, and M. A. Blanco. 2012. New species and records of Orchidaceae from Costa Rica. II. Lankesteriana 12(1): 19–51.

Karremans, A. P., I. F. Chinchilla, G. Rojas-Alvarado, M. Cedeño-Fonseca, A. Damián, and G. Léotard. 2020. A reappraisal of Neotropical *Vanilla*. With a note on taxonomic inflation and the importance of alpha taxonomy in biological studies. Lankesteriana 20(3): 395–497.

Monro, A. K., D. Santamaría-Aguilar, F. González Brenes, O. Chacón, D. Solano, A. Rodríguez González, N. Zamora Villalobos, E. Fedele, and M. D. Correa A. 2017. A first checklist to the vascular plants of La Amistad International Park (PILA), Costa Rica-Panama. Phytotaxa 322(1): 1–283.

Muñoz, M., and S. H. Kirby. 2007. An orchid inventory and conservation project at Bosque de Paz Biological Reserve, Upper Rio Toro Valley, Alajuela, Costa Rica. Lankesteriana 7(1–2): 60–65.

Navarro Romo, W. C., H. R. Quispe-Melgar, and E. Hágsater. 2020. *Epidendrum curimarcense* (Orchidaceae), a new species from Central Peru. Lankesteriana 20(1): 7–13.

Nóbrega, S. R., A. L. F. Coelho, C. F. Verola, I. R. Costa, R. Vilaça, F. J. F. Luz, and W. F. Araújo. 2017. Chromosome variations and diversity of *Epidendrum ibaguense* Lindl. (Orchidaceae) on the Tepequém's Tepuy, Roraima, Brazil. Genetics and Molecular Research 16 (3): gmr16039754

Ossenbach, C., F. Pupulin, and R. L. Dressler. 2007. *Orquídeas del istmo centroamericano. Catálogo y estado de conservación. Orchids of the Central American isthmus. Checklist and conservation status*. Editorial 25 de Mayo, San José.

Pérez-Escobar, O.A., G. Chomicki, F. L. Condamine, A. P. Karremans, D. Bogarín, N. J. Matzke, D. Silvestro, and A. Antonelli. 2017. Recent origin and rapid speciation of Neotropical orchids in the world's richest plant biodiversity hotspot. New Phytologist 215: 891–905.

Pessoa, E.M. 2020. *Epidendrum* in Flora do Brasil 2020. Jardim Botânico do Rio de Janeiro.Disponível em: <http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB11518>. Accessed on: 30 October 2021.

Pessoa, E. M., J. M. P. Cordeiro, L. P. Felix, E. M. Almeida, L. Costa, Á. Nepomuceno, G. Souza, M. Chase, M. Alves, and C. Van den Berg. 2020. Too many species: morphometrics, molecular phylogenetics and genome structure of a Brazilian species complex in *Epidendrum* (Laeliinae; Orchidaceae) reveal fewer species than previously thought. Bot. J. Linn. Soc. 195(2): 161–188.

Pessoa, E. M., J. M. P. Cordeiro, L. P. Felix, P. Lemes, J. Viruel, M. Alves, M. W. Chase, and C. van den Berg. 2021. The role of Quaternary glaciations in shaping biogeographic patterns in a recently evolved clade of South American epiphytic orchids. Bot. J. Linn. Soc. 20: 1–15.

Pinheiro F., and S. Cozzolino. 2013. *Epidendrum* (Orchidaceae) as a model system for ecological and evolutionary studies in the Neotropics. Taxon 62: 77–88.

Pupulin, F. 2001. Addenda Orchidaceis Quepoanis. Lankesteriana 1(1): 1–28.

———. 2002. Catálogo revisado y anotado de las Orchidaceae de Costa Rica. Lankesteriana 4: 1–88.

———. 2010. *Orchidaceae werckleanae*: typification of Costa Rican orchid species described from collections by K. Wercklé. Bot. J. Linn. Soc. 163: 111–154.

Pupulin, F., and D. Bogarín. 2018. Orchids of Paradise: Exploring the lower Talamanca seashores of Costa Rica, the "Coast of Plenty" of Columbus. Orchids 87: 846–857.

Pupulin, F., and A. P. Karremans. 2010. Two new species and a new record of *Epidendrum* (Orchidaceae: Laeliinae) from Costa Rica. Selbyana 30(2): 195–202.

Pupulin, F., J. Aguilar, N. Belfort-Oconitrillo, M. Díaz-Morales, and D. Bogarín. 2021. *Florae costarricenses subtribui Pleurothallidinis (Orchidaceae) prodromus II*. Systematics of the *Pleurothallis cardiothallis* and *P. phyllocardia* groups, and other related groups of *Pleurothallis* with large vegetative habit. Harvard Pap. Bot. 26(1): 203–295.

Rakosy, D., M. Speckmaier, A. Weber, W. Huber, and A. Weissenhofer. 2013. *Orchids: Botanical Jewels of the Golfo Dulce Region, Costa Rica*. Verein zur Förderung der Tropenstation La Gamba, University of Vienna.

Sambin, A., and E. Ravet. 2021. *Les Orchidées de Guyane*. Editions Biotope, Mèze (France). 672 pp.

Vásquez, R., P. L. Ibisch, and B. Gerkmann. 2003. Diversity of Bolivian Orchidaceae—a challenge for taxonomic, floristic and conservation research. Org. Divers. Evol. 3: 93–102.

Watteyn, C., T. Fremout, A. P. Karremans, R. Pillco Huarcaya, J. B. Azofeifa Bolaños, B. Reubens, and B. Muys. 2020. *Vanilla* distribution modeling for conservation and sustainable cultivation in a joint land sparing/sharing concept. Ecosphere 11(3):e03056. 10.1002/ecs2.3056

Zambrano Romero, B.J., E. Hágsater, and R. Solano. 2021. Miscellaneous of new species in *Epidendrum* (Orchidaceae) from southwestern Ecuador. Phytotaxa 511(2): 111–147.

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NEW REPORTS OF *GALEANDRA* (ORCHIDACEAE) FROM MEXICO

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Abstract. Here we report two species as new for Mexico, *G. arundinis* and *G. sobralioides*, and discuss the report of *G. batemanii* for the state of Tabasco. A discussion of possible diagnostic characters of this genus and a key to the Mexican species also are presented.

The field of orchidology has been plagued by catch-all names for more than 200 years. These are species, usually described early on, which have become sorts of trash baskets where many other similar species, described or not, have been placed by convenience or because the group has not been carefully evaluated. Examples abound in the literature (e.g., *Cyrtopodium punctatum* (L.) Lindl., *Encyclia oncidioides* (Lindl.) Schltr., and *Epidendrum nocturnum* Jacq.). *Galeandra* Lindl. is not an exception: all Mexican galeandras were referred mistakenly to *Galeandra baueri* Lindl. until Rolfe (1892) recognized the obviously different *Galeandra batemanii* Rolfe (see also Pollard, 1974; Siegerist, 1983). More than a hundred years later Warford (1994) described *G. greenwoodiana*, a distinctive species that in the past had been confused with both *G. baueri* (Paxton, 1848) and *G. batemanii* (Linden, 1901; see Warford, 1994). Likewise, in Central America, plants of *Galeandra arundinis* G.A. Romero & Garay have been misidentified multiple times.

Galeandra arundinis was first described from Costa Rica, although it was known already from Belize to Panama but, not surprisingly, mostly confused with other species of the genus (see discussion below). Hitherto, the species had not been fully documented in Mexico.

Galeandra batemanii, according to one of the most recent accounts of the species (Warford, 1994), was thought to be “endemic to Mexico on the Gulf slope of the state of Oaxaca at an elevation of ca. 750 m” (see also Soto-Arenas and Salazar, 2004: 291). All well documented reports of this species, including the type, were collected in a relatively small area of the state of Oaxaca, west of the isthmus of Tehuantepec; photographic records (Beutelspacher Baigts, 2008, 2013; Beutelspacher Baigts and Moreno Molina 2018: 476) indicate its presence in Chiapas. Nonetheless, two of the authors (CMB and MAG) have documented flowering plants apparently referable to this same species in the state of Tabasco (González A. and Burelo R., 2012; see discussion below).

We were surprised when a plant collected in Municipio San Miguel de Chimalapa, in the Mexican state of Oaxaca, turned out to be, then, yet another previously unknown, undescribed species. It was first collected in Mexico in 1985 by Gerardo Salazar and cultivated by one of the authors (GC) starting in 1996. From this plant originated the image published in Hágsater et al. (2005: 145; see iconography below). Photographic plates and a line drawing were prepared to describe it but, in the interim, it was described as *Galeandra sobralioides* Archila & Chiron based on a plant collected in Guatemala.

The goal of the present contribution is to formally report the presence of *Galeandra arundinis* and *G. sobralioides* in Mexico, and to discuss the presence of *G. batemanii* in the state of Tabasco. We also discuss a possible case of introgression between *G. arundinis* and *G. batemanii* in the state of Tabasco and include a discussion of possible diagnostic characters and a key to the Mexican species of *Galeandra*.

Materials and Methods

Systematic work.

The study was conducted at the Oakes Ames Orchid Herbarium and the Centro de Investigación Científica de Yucatán, A.C. (CICY). Plants and materials in the field in Mexico were obtained under scientific permits (SGPA/DGVS/008421/18 and SGPA/DGGFS/712/2913/17) issued by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) to researchers at CICY.

Conservation assessment.

The conservation status of the *Galeandra* species was assessed using the IUCN Red List Criteria (IUCN, 2012). Because population data of these species was not available beyond casual observations, we relied mostly on the B criteria, geographical distribution assessed both as B1 (Extent of Occurrence) or B2 (Area of Occupancy), as implemented in GeoCAT (Bachman et al. 2011). We complemented these assessments with our own field experience, published data, and iconography, whenever available.

We thank the staff of AMO, JBL, MO, NY, and SEL for their invaluable help, B. Angell for her drawings, I. Ramírez-Morillo (CICY) for her comments on an earlier version of the text and for scrutinizing the final version, F. Hernández N. (CHIP) for allowing us to use his data and photographs, and G. A. Salazar (MEXU) for supplying a live plant of *G. sobralioides*. We are fortunate to have available the extraordinary drawings of Natalie Warford (1927–2013), many of which we publish here for the first time, her notes, and some of her preserved material of *Galeandra*.

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New reports

Galeandra arundinis G.A. Romero & Garay, Vanishing Beauty I: 326. 2005. TYPE: COSTA RICA. Alajuela: San Carlos, Guatuso, collected by Carlos Cambronero, August 1997, flowered in cultivation at the Lankester Botanical Garden, 12 October 2000, *sub M. Blanco 1639* (Holotype: USJ). Fig. 1–9.

Synonyms: *Galeandra archilae* Chiron, Revista Guatemalensis 15, No. 2: 11. 2012. TYPE: GUATEMALA. Alta Verapaz: Laguna Lachuá, *ex Hort*. Estación de Orquídeas de Guatemala, *F. Archila s.n.* (Holotype: BIGU, not seen).

Galeandra garifunae Archila & Chiron, Revista Guatemalensis 15, No. 2: 10. 2012. TYPE: GUATEMALA. Izabal: sobre palmeras a la orilla del mar Caribe, 3 m, December 2007, *F. Archila s.n.* (Holotype: BIGU, not seen).

Field and herbarium recognition: Plants epiphytic, found from Mexico (Tabasco, expected in Chiapas, Campeche, and Quintana Roo) to Panama (expected in Colombia), along Atlantic slopes, mostly in lowlands, often growing on “tasiste” (*Acoelorrhaphe wrightii* (Griseb. & H. Wendl.) H. Wendl. ex Becc., Arecaceae) and other palms (e.g., “Suyate,” *Brahea dulcis* (Kunth) Mart.; Pérez Mungía, 2015: 111); pseudobulbs narrowly fusiform, cane-like, in herbarium specimens up to 25 cm long; flower color varies from sepals and petals dark reddish-brown, the labellum externally yellowish striped dark burgundy, internally dark yellow, the apex dark reddish burgundy (the type, from Costa Rica), to sepals and petals yellowish-brown, stripped red toward the base, the labellum externally yellowish green, often stripped reddish brown toward and including the upturned spur, light pink toward the apex, internally yellowish-white at the base, including the upturned spur, light pinkish-red toward the apex (in most of its geographical range). The labellum has a distinct, narrowly triangular color pattern at the apex, which varies in color: it maybe undistinguishable in flowers with a dark labellum, but clearly discernable in the ones with a lighter tone. It is even more conspicuous in flowers with little or no pink pigmentation. As circumscribed here, all plants bearing narrowly fusiform to arundinoid pseudobulbs found from Mexico to Panama are referrable to *G. arundinis*. Here we present a series of drawings of flowers collected from Belize to Panama showing slight variations in the size and ornamentation of the labellum (see discussion below).

Etymology: From the Latin *Arundo*, reed, cane, and the Latin adjectival suffix *-inus*, indicating resemblance, in reference to the cane-like pseudobulbs.

Distribution: Along Atlantic slopes from Mexico (Tabasco, expected in southern Campeche, northern Chiapas, and southern Quintana Roo) to Panama.

Phenology: Herbarium records indicate that this species flowers from May to December. In cultivation, it flowers from July to January.

Additional material examined: BELIZE. Belize: originally and allegedly collected in the vicinity of Rockville Quarry, seasonally flooded savanna and low forest, 20 m; obtained in Chetumal, Quintana Roo *ex Hort*. G. Carnevali *sub G. Carnevali 7996* (AMES, CICY [fragment])]. El Cayo: Mountain Pine Ridge, San Agustin, on tree in pine uplands, epiphyte, fls. brownish, with margin of corolla purplish, July-August 1936, *C. L. Lundell 6691* (MICH). Toledo: Monkey River, near Cow Pen, in pine ridge, flowers pinkish, on tree in hammock, 17 September 1942, *P. H. Gentle 4154* (MICH). Sibun River, 2 February 1935, *P. H. Gentle 1510* (MICH). Stann Creek: Stann Creek Railway, on palm, sepals reddish brown, lip wine red shading to yellow, December 1939, *W. A. Schipp 878* (AMES, F); All Pines, handsome “epiphyte” more often to be found growing on *Acoelorrhaphe* palms, flowers brown, yellow, and pale mauve, occasional, 7 December 1930, *W. A. Schipp 590* (AMES, GH, MICH, NY); near Gracie Rock, 21 September 1936, *H. O’Neill 8347* (AMES, MICH, NY). **COSTA RICA.** Alajuela: vicinity of Los Chiles, Río Frio, 30–40 m, 1 August 1949, *R. W. Holm and H. H. Iltis 819* (A, AMES, MICH, P, U); without additional locality data, “sépalos y pétalos café rojizo, labelo blanco con borde rosado, con líneas café rojizo desde el nectario [spur] hasta 2/3 del labelo, olor a rancio,” *ex Hort*. Lankester Botanical Garden *sub J. Warner s.n.* (drawing, AMES). Guanacaste: Parque Nacional Guanacaste, La Cruz, Estación Pitilla, sendero Evangelista, 700 m, epífita, flores moradizas con rayas amarillas, *P. Ríos Castro 205* (INB); Area de Conservación La Cruz, Estación Pitilla, 700 m, epífita a 3 m, raices blancas esponjosa[s], sépalos pardo-claro, pétalos morados opaco, 11 September 1990, *C. Moraga 13* (INB). **GUATEMALA.** Alto Verapaz: Laguna Lachuá [type locality of *G. archilae*], “pseudobulbs slender, fusiform, tinged purple, sepals and petals yellow suffused and striped brown, lip whitish suffused with brown, apical third reddish-purple,” 20 February 1990, *ex Hort. W. del Pinal s.n. sub G. Salazar 5146* (AMES [drawing], AMO [spirits]). **HONDURAS.** Comayagua: Custeca, Siguatepeque, open mountain forest, epiphyte, 3700 ft [ca. 1120 m], petals and sepals bronze, lip light purple [at the apex], white shading to dark bronze [toward the spur], spur green, 15 October 1932, *J. B. Edwards 284* (AMES); El Tablón, San Luis, 2500 ft [ca. 758 m], epiphyte in palm tree, in dense palm thickets, petals and sepals bronze or greenish lavender, lip ruffled, tip lavender shading to bronze, at base, column white with vert. lavender stripes on under side, 30 May 1933, *J. B. Edwards 421* (AMES); Copán: vicinity of Santa Rosa de Copán, sepals and petals olive, lip limb pale rose purple, throat whitish, spur striped olive, 31 July 1978, collected *F. Mathews ex Hort*. Marie Selby Botanical Gardens 20-74-536 *sub J. D. Ackerman 1274* (F, SEL); same locality, “sepals and petals green-brown, lip pin kish, spur brown,” *F. Mathews s.n.*, *ex Hort*. Marie Selby Botanical Gardens, flowered 10 June 1975 (SEL 016837); same locality, “tepals brownish rose, spur green, lip white with rose border,” *F. Mathews s.n.*, *ex Hort*. Marie Selby Botanical Gardens, flowered September 1985 (SEL 055083); same locality, “sepals and petals yellow green, lip pink with spur stripws with maroon, column white” *F. Mathews s.n.*, *ex Hort.* Marie Selby Botanical Gardens, flowered 6 August 1976 (SEL 016474); same locality, “sepals and petals greenish brown, lip light pink, with darker pink at edges, spur stripped with green and brown,” *F. Mathews s.n.*, *ex Hort*. Marie Selby Botanical Gardens, flowered 12 August 1976 (SEL 017712); Francisco Morazán: El Hatillo, “sepals and petals brown, lip white, edge tinged lavender, spur brown,” *F. Mathews s.n., ex Hort*. Marie Selby Botanical Gardens, flowered 16 July 1976 (SEL 016505); Valle de los Ángeles, unos 3 km

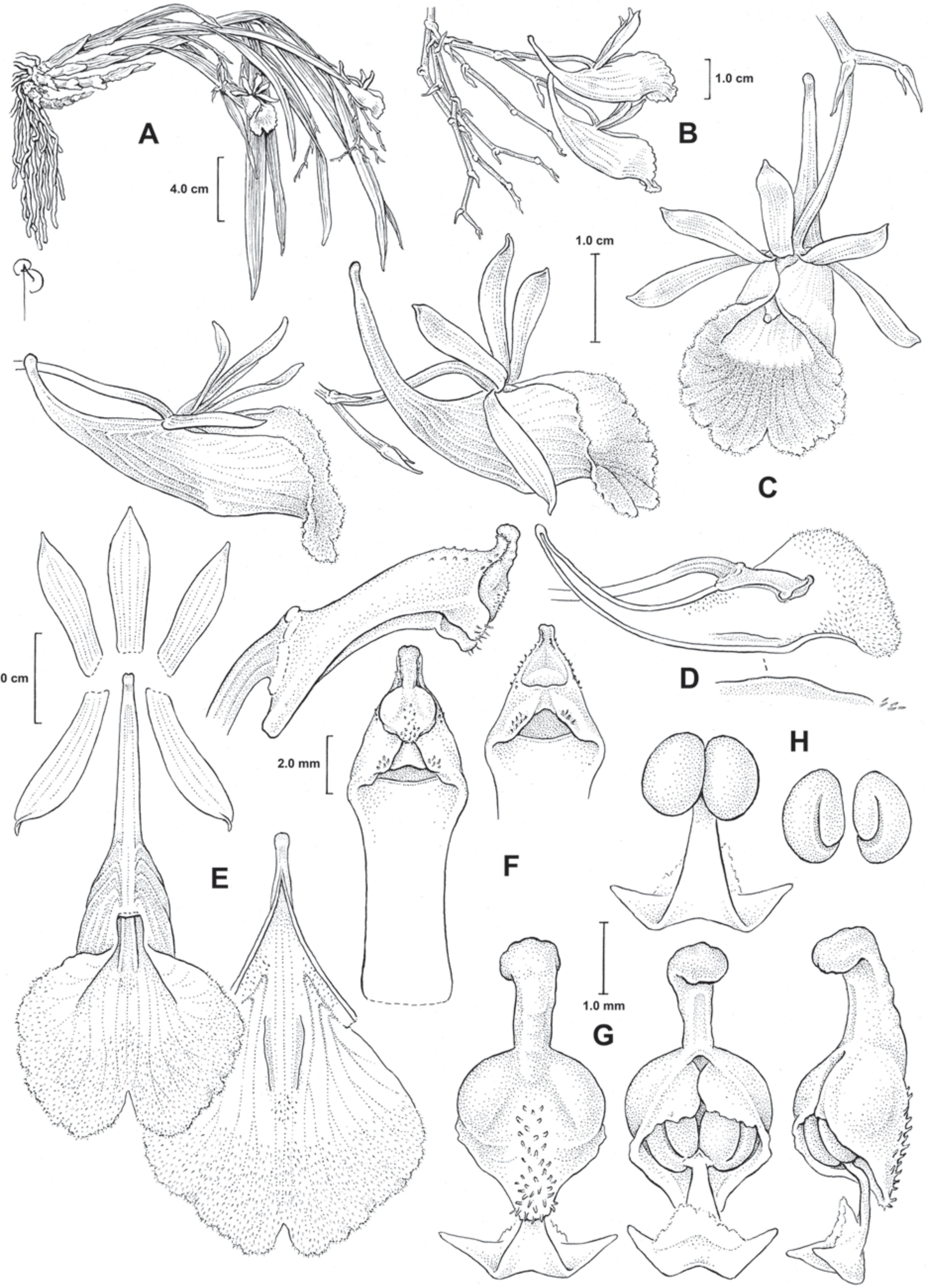

FIGURE 1. *Galeandra arundinis* G.A. Romero & Garay from Belize. **A**, Habit; **B**, inflorescence; **C**, views of the flower; **D**, sagittal section of the labellum; **E**, floral segments; **F**, column; **G**, views of the anther with pollinarium; **H**, pollinarium and pollinia. Drawn by B. Angell from material in spirits based on *Carnevali 7996* (CICY).

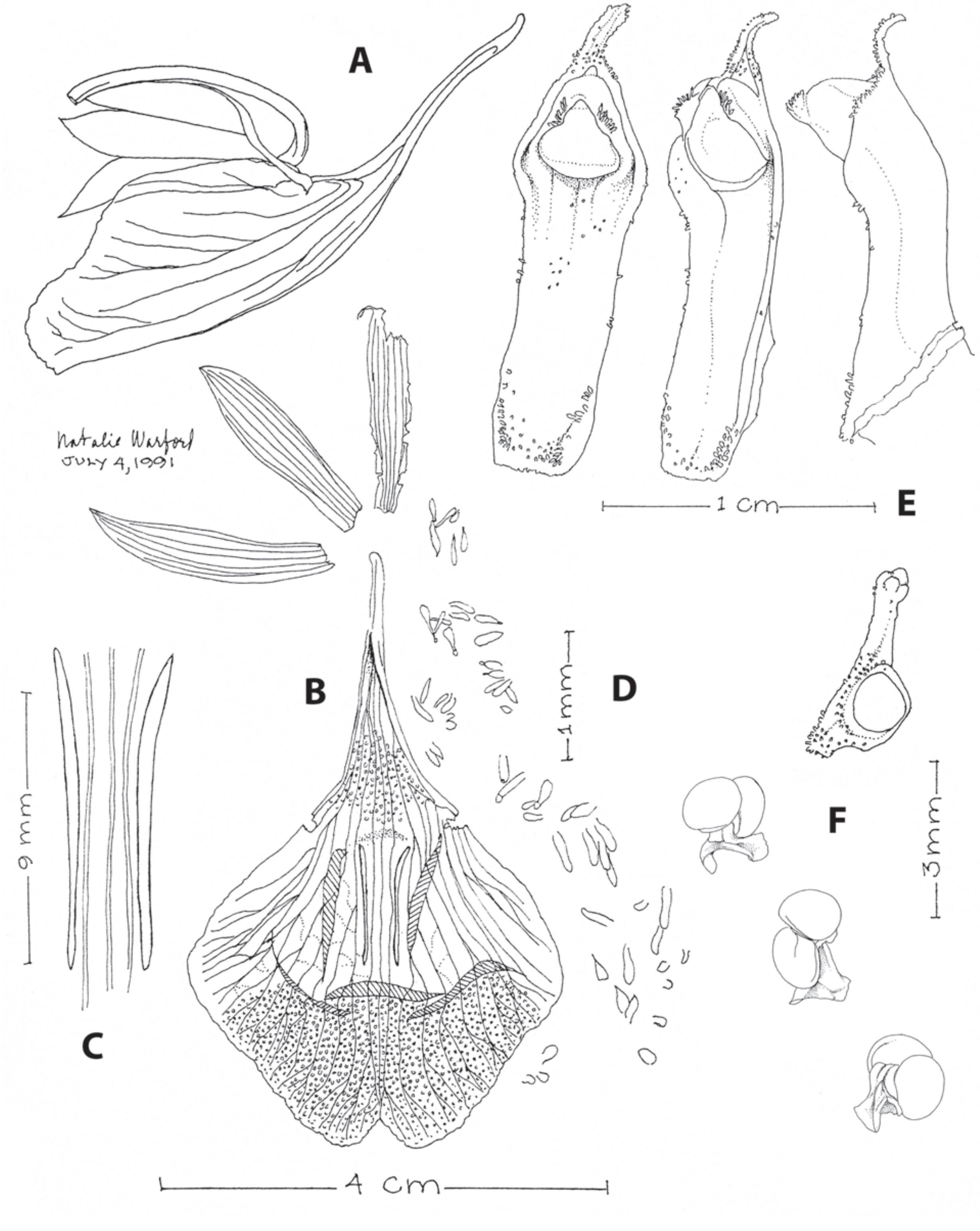

FIGURE 2. *Galeandra arundinis* G.A. Romero & Garay from Laguna Lachuá, Guatemala, type locality of *G. archilae* Chiron. **A**, flower profile; **B**, flower segments; **C**, keels and the three central nerves; **D**, trichomes; **E**, column; **F**, anther and views of the pollinarium. Drawn by N. Warford from material in spirits based on *Salazar 5146* (AMO).

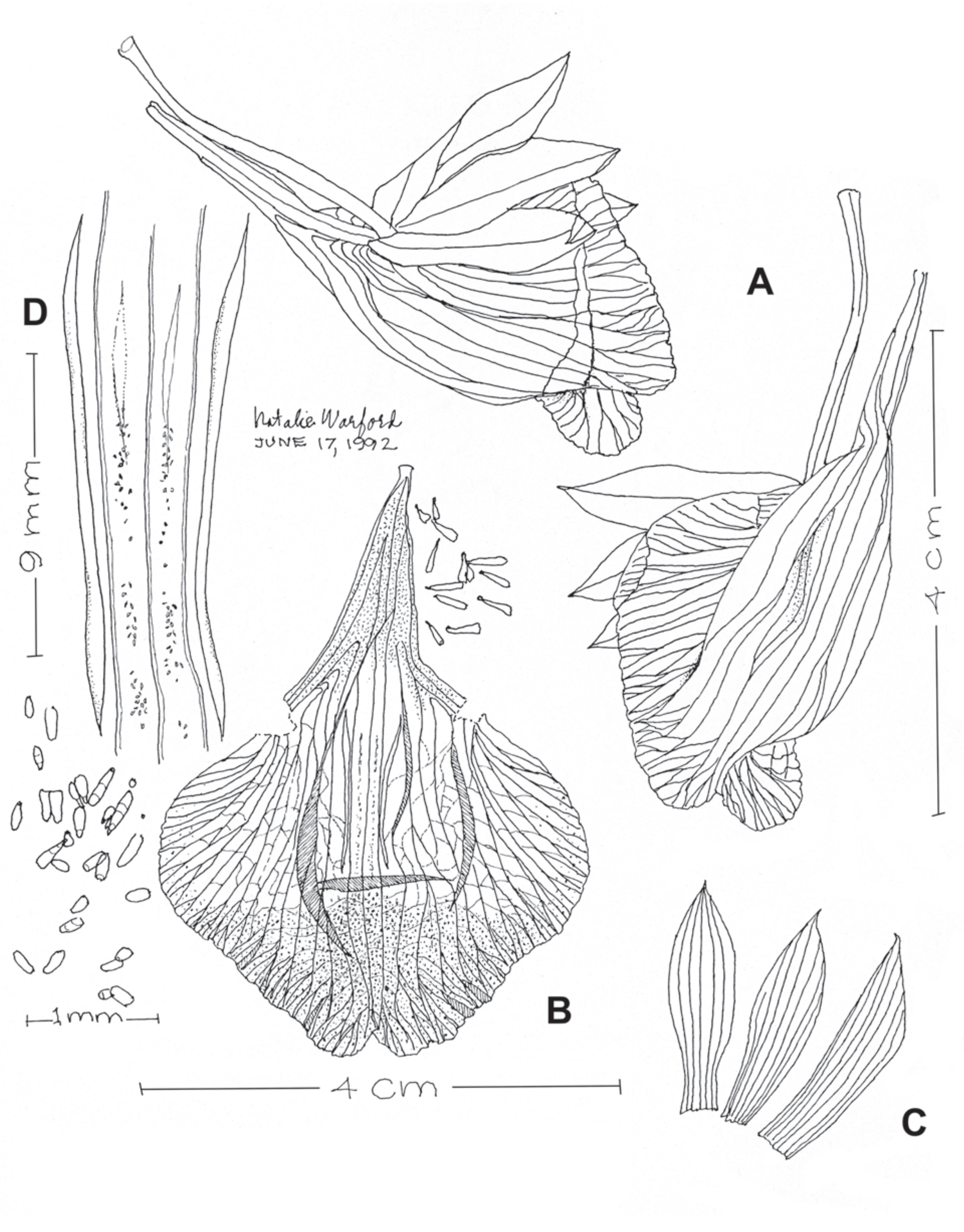

FIGURE 3. *Galeandra arundinis* G.A. Romero & Garay from Nicaragua. **A**, views of the flower; **B**, labellum, flattened; **C**, sepals and petal; **D**, keels and central nerves. Drawn from a hydrated flowers by N. Warford based on *Moore s.n.* (SEL).

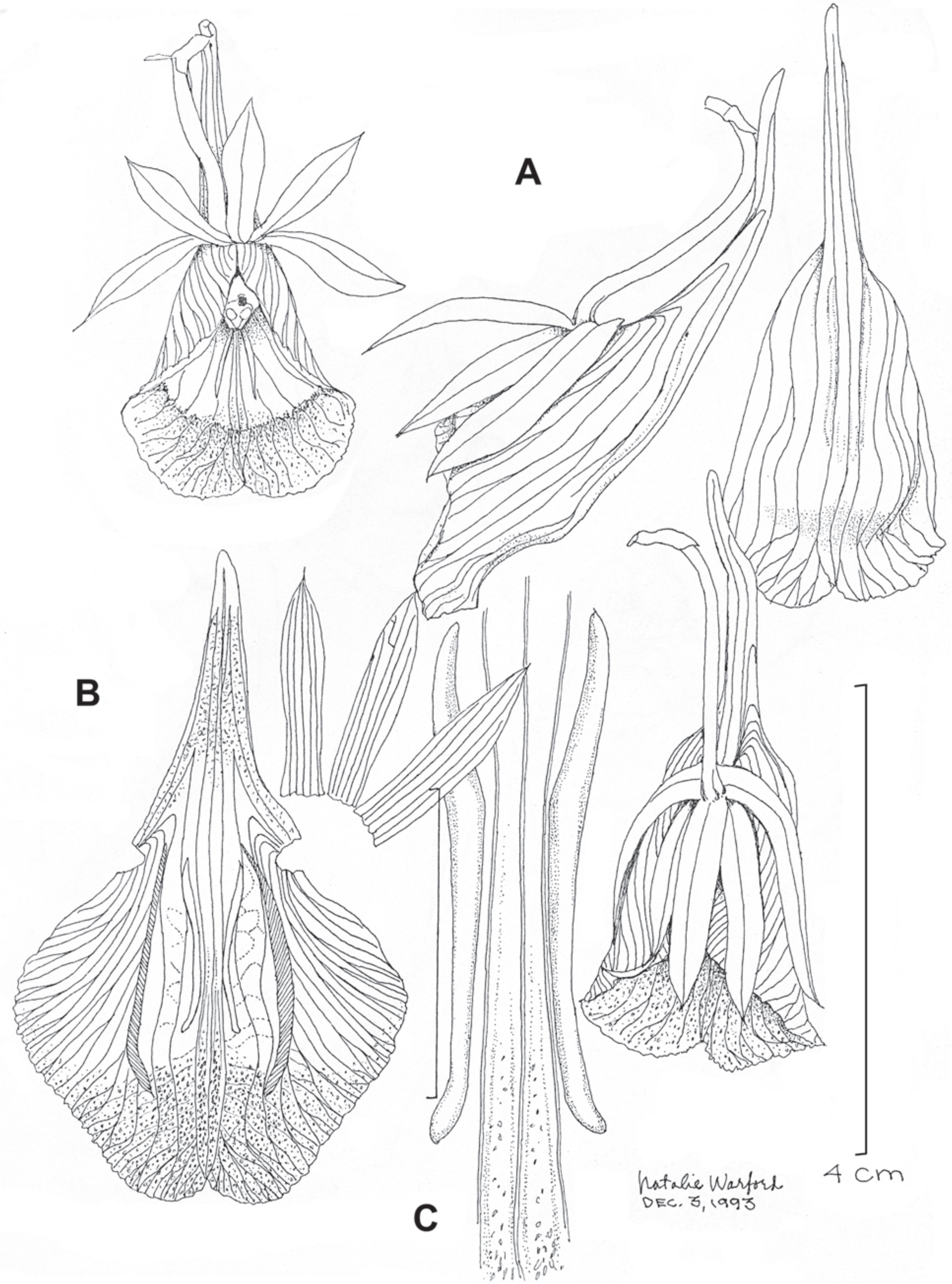

FIGURE 4. *Galeandra arundinis* G. A. Romero & Garay from Costa Rica. **A**, views of the flower; **B**, floral segments; **C**, keels and central nerves (scale 9.0 mm). Drawn from a flower in spirits by N. Warford based on *Warner s.n.* (voucher not preserved).

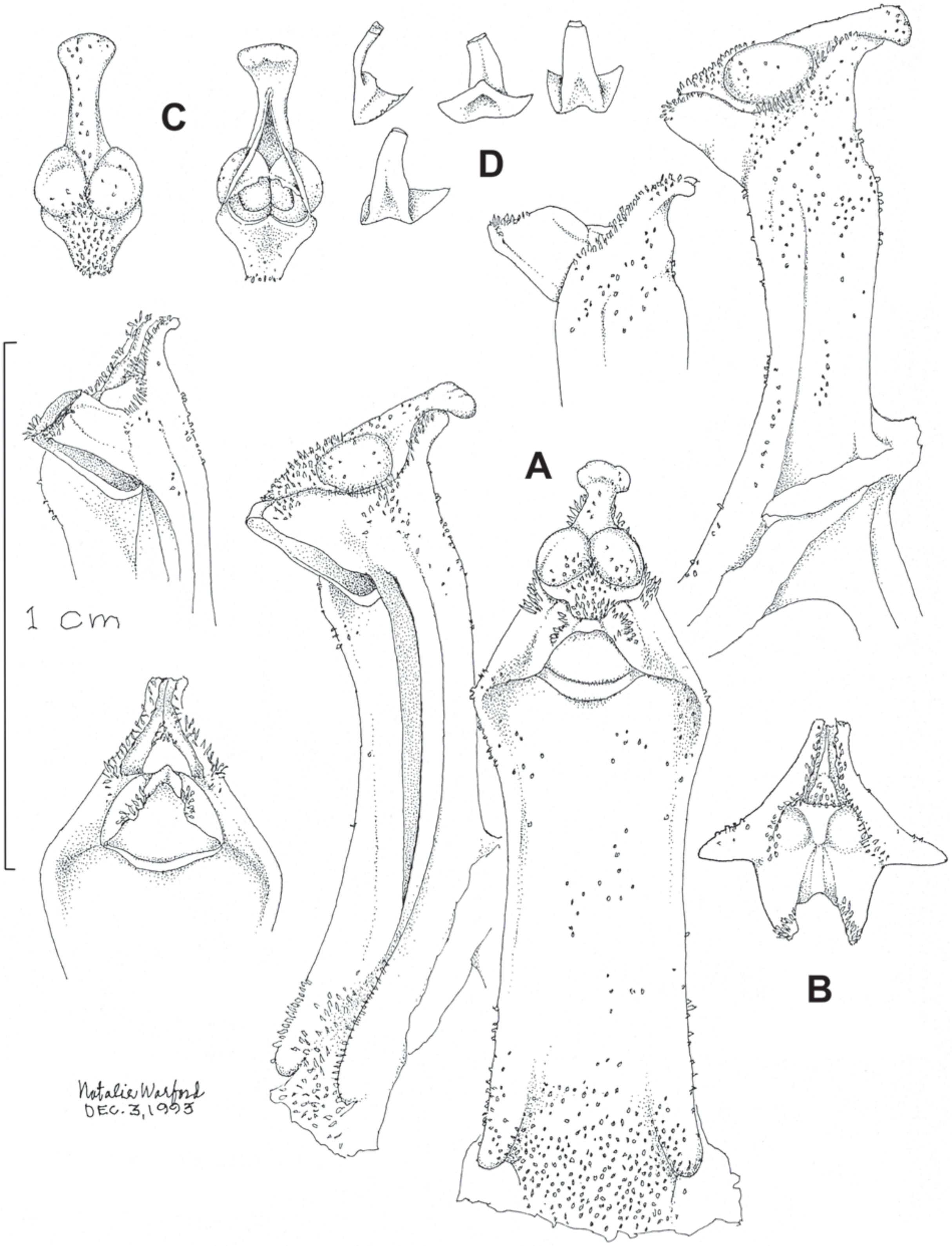

FIGURE 5. *Galeandra arundinis* G. A. Romero & Garay from Costa Rica. **A**, views of the column, with and without the anther in place; **B**, clinandrium; **C**, anther; **D**, views of stipe and viscidium. Drawn from a flower in spirits by N. Warford based on *Warner s.n.* (voucher not preserved).

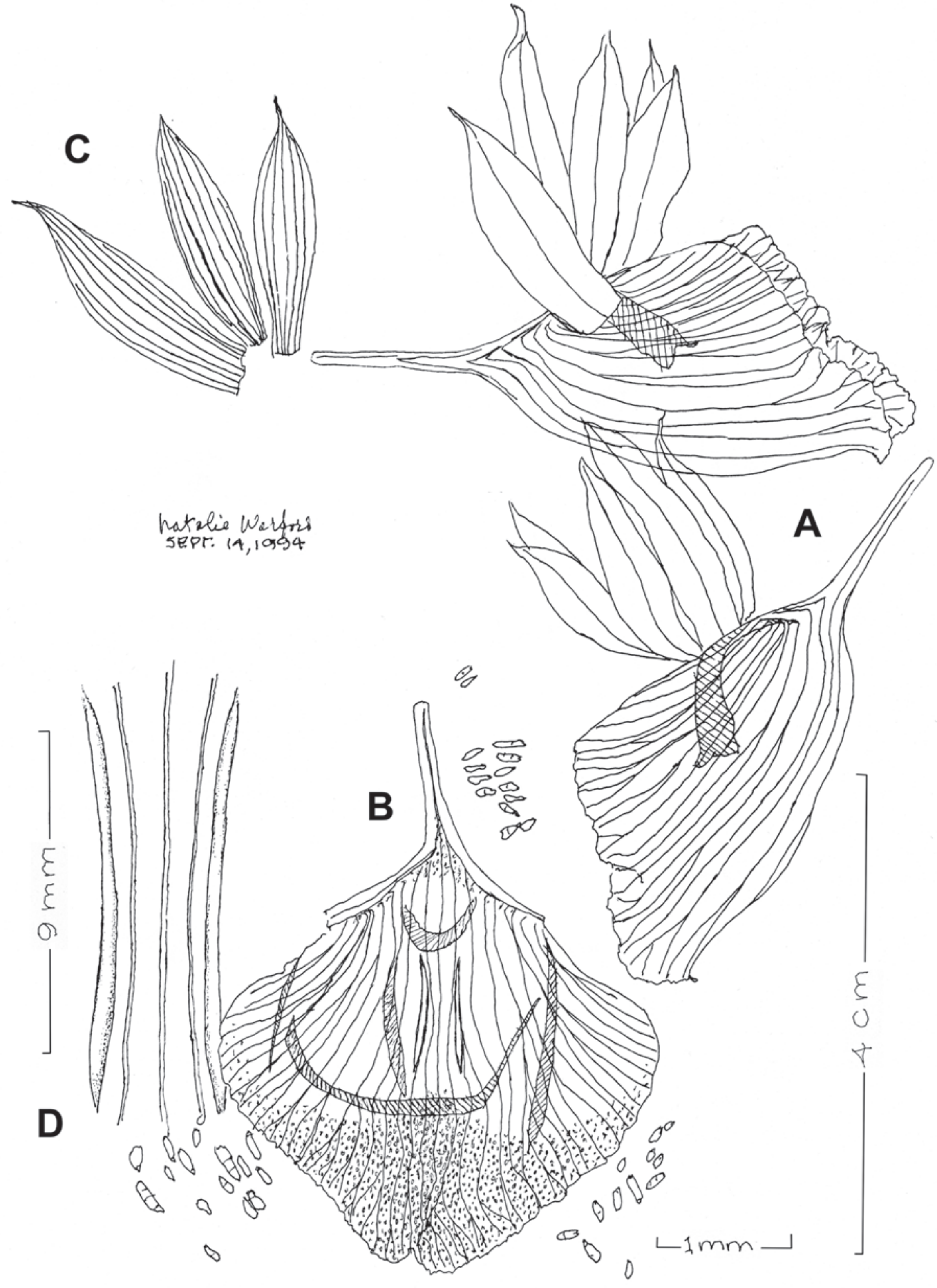

FIGURE 6. *Galeandra arundinis* G. A. Romero & Garay from Panama. **A**, views of the flower; **B**, labellum, flattened; **C**, sepals and petals; **D**, keels and central nerves. Drawn from a hydrated flower by N. Warford based on *von Wedel 2712* (AMES).

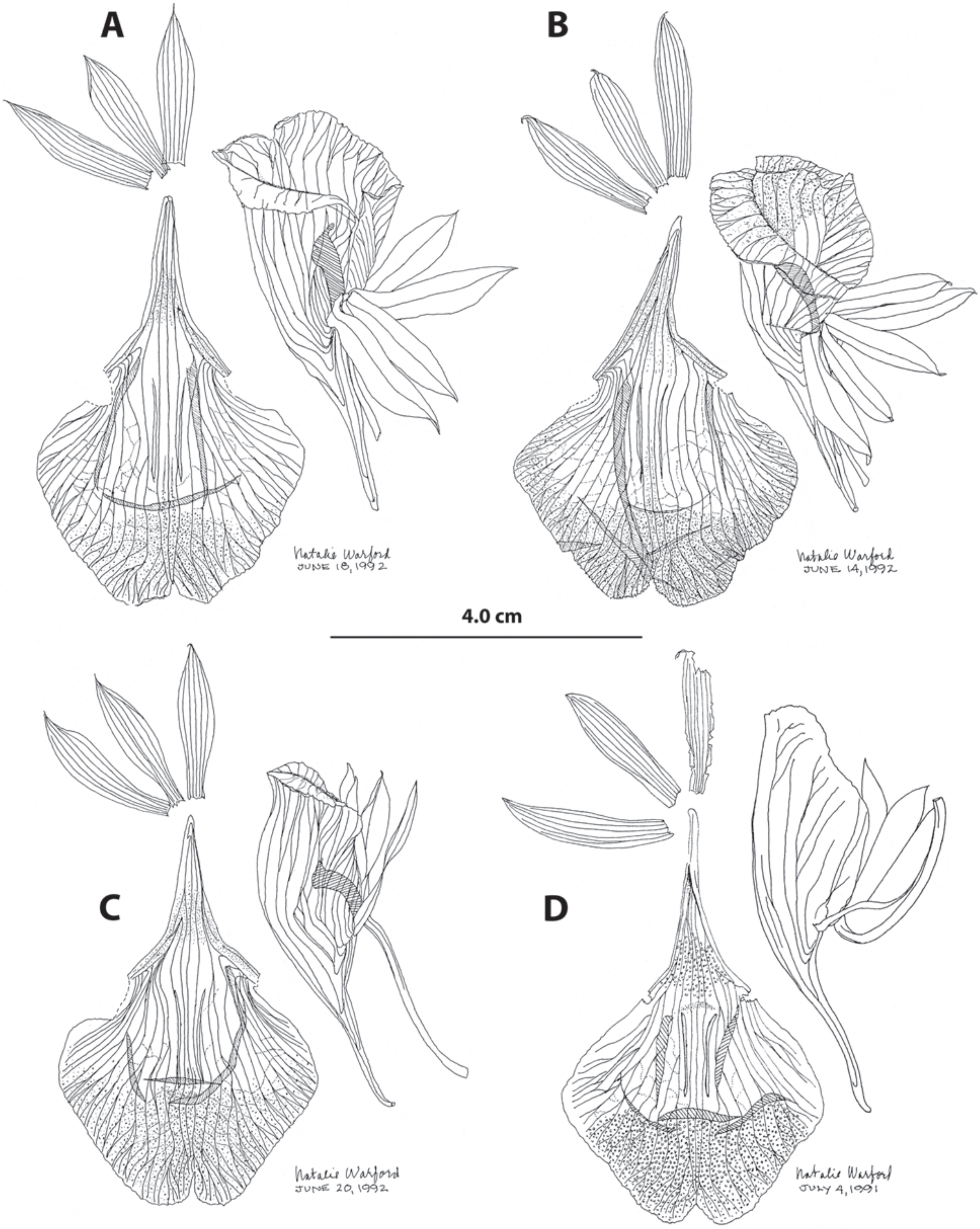

FIGURE 7. Labellum and floral profile of *Galeandra arundinis* G.A. Romero & Garay. Drawn by N. Warford from hydrated flowers based on **A**, Honduras, *Mathews s.n.* (SEL 055083); **B**, Honduras, *Mathews s.n.* (SEL 017712); **C**, Honduras, *Mathews s.n.* (SEL 016505); **D**, Guatemala, *Salazar 5146* (AMO).

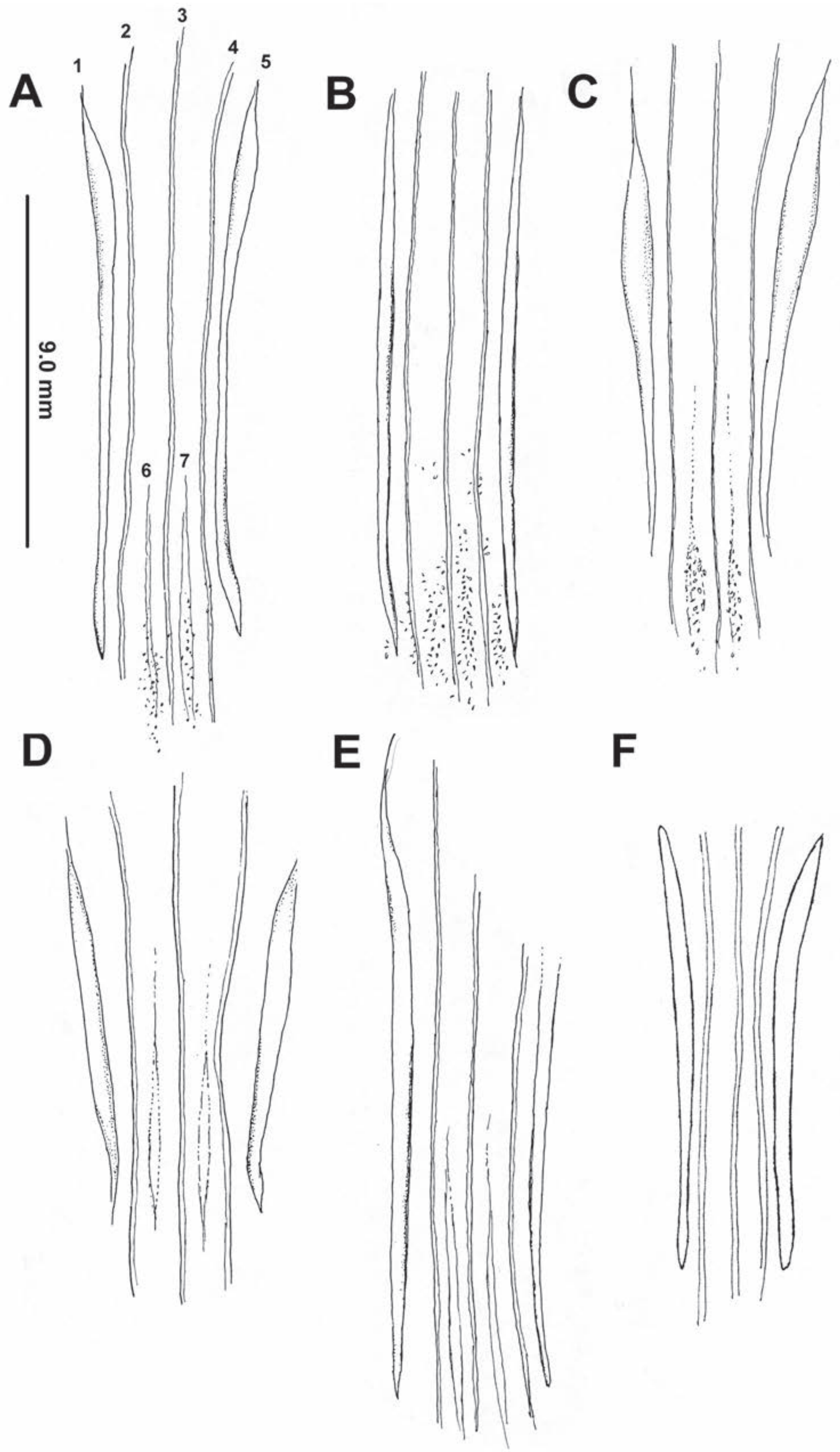

FIGURE 8. Keels of *Galeandra arundinis* G.A. Romero & Garay. Drawn by N. Warford based on **A**, Honduras, *Mathews s.n.* (SEL 055083); **B**, Honduras, *Mathews s.n.* (SEL 017712); **C**, Honduras, *Mathews s.n.* (SEL 016474); **D**, Honduras, *Mathews s.n.* (SEL 016837); **E**, Honduras, *Mathews s.n.* (SEL 016505); **F**, Guatemala, *Salazar 5146* (AMO). Numbers in A: 1, 5, keels; 3, labellum central nerve; 2, 4, first lateral nerves; 6, 7, lamellae.

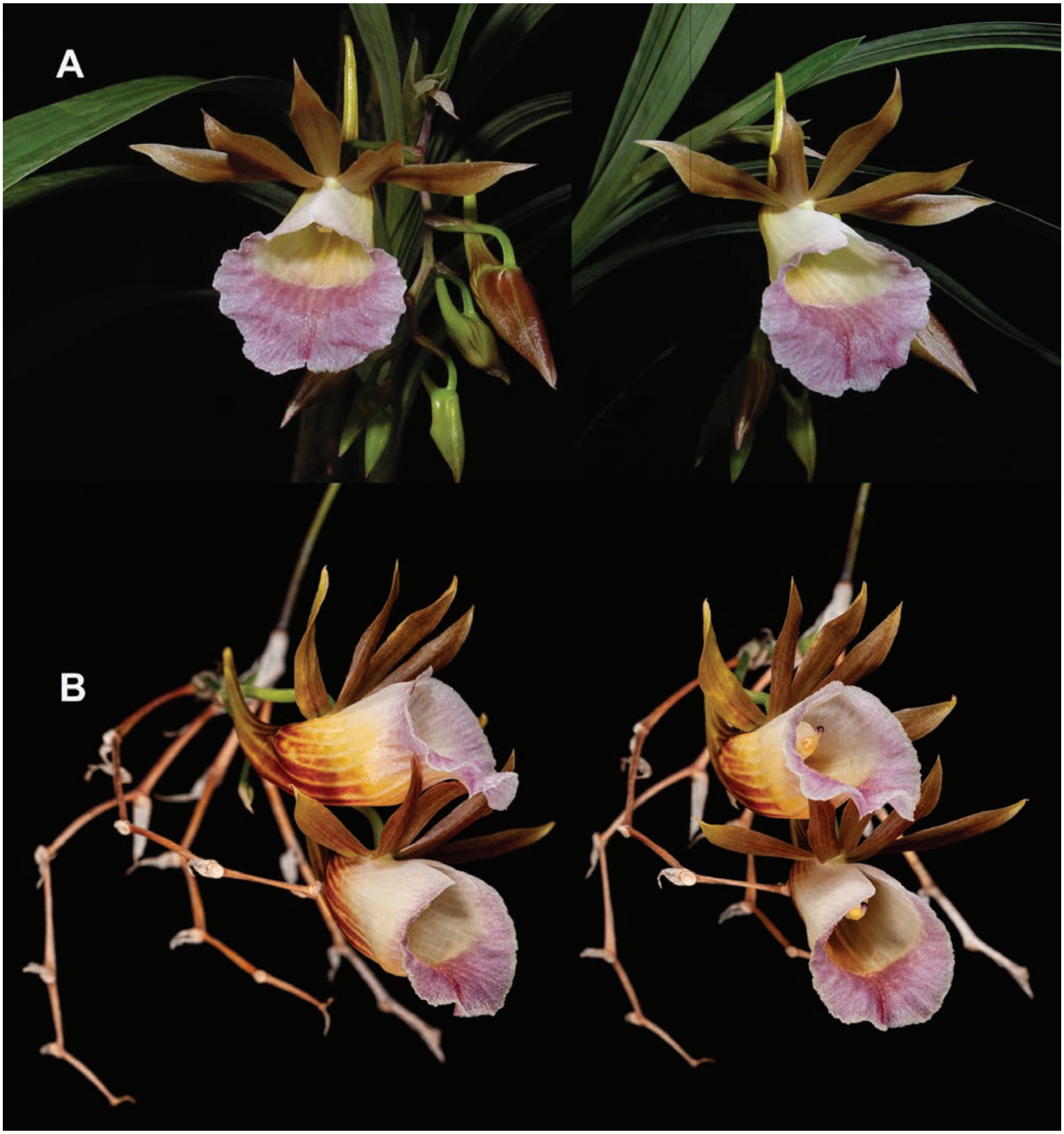

FIGURE 9. *Galeandra arundinis* G.A. Romero & Garay from Belize. **A**, early flowers (July 2013); **B**, late flowers two years later (December 2005). Notice changes in flower shape and color between seasons in flowers produced by the same plant; notice also the old inflorescence branches in B. A photographs by G. Carnevali; B by G. A. Romero-González. Based on *Carnevali 7996* (CICY). For scale, see Figure 1 herein.

al E del parque central, 1300–1350 m, 23 July 2009, *G. Carnevali & O. Moreno 7492* (CICY). Yoro: Concepción, 2500 ft [ca. 758 m], epiphyte, open mountain forest, petals and sepals light brown, lip light lavender, bag light brown with dark brown vertical stripes, column light brown, 14 August 1933, *J. B. Edwards 491* (AMES). **MEXICO.** Tabasco: [precise locality omitted], 8 m, *M. A. González & C. Burelo 50* (CICY, UJAT). **NICARAGUA.** Atlántico Norte: vicinity of junction of road Alamikamba with road between El Empalme and Limbaika, pine savanna and gallery forest, locally common on tips of *Acoelorrhaphe* trunks, leaf sheaths and bracts purple-spotted, pseudobulb round in cross-section, perianth except lip pale brown, all held erect above lip, mouth of lip pale purple, tube pale yellow, spur pale yellow with pale brown stripes, apparently scentless, 4 July 1982, *D. W. Stevens 21692* (MO); Atlántico Sur: Monkey Point, desembocadura del Caño El Pato, en el lado derecho, 1–10 m, 24 October 1981, *P. P. Moreno & J. C. Sandino 12316* (MO); Matagalpa: mountains E of Santa María de Ostuma, *A. H. Heller 1106* (drawing, SEL); Nueva Segovia: 7.6 km N of Ocotal-San Fernando highway along road toward Hacienda Las Brisas on Cerro Mogotón, E fork of road, along Caño El Zapote, 1095 m, pine forest on granite, broadleaf trees along steam, epiphyte, pseudobulb round in section, flowers dull brown and purple, 5 June 2014, *W. D. Stevens & O. M. Montiel 34707* (MO); Zelaya: sepals and petals brown, lip pink, spur striped with brown, column white, *E. Moore s.n., ex Hort.* Marie Selby Botanical Gardens, flowered 7 September 1976 (SEL). **PANAMA.** Bocas del Toro: Shepherd Island, vicinity of Chiriquí Lagoon, epiphyte, flowers maroon-red with purple edges, 20 September 1941, *H. von Wedel 2712* (AMES); in swamp near Almirante, 20 August 1962, *Hugo Nash 1962* (AMES).

Selected iconography: Williams (1946: 334, Fig. 147, as *Galeandra baueri*); Ames and Correll (1953: 473, Fig. 128, same illustration in Williams, 1946, again as *G. baueri*); Halcrow and Halcrow (ca. 1968: 71, as *G. baueri*); Hammer (1983, 1988, illustrating a plant from Nicaragua, as *G. batemanii*); Mora and Atwood (1992, illustrating a plant from Costa Rica, as *G. baueri*); McLeish et al. (1995: reverso of plate between pages 62–63, photograph 46; 64, Fig. 26, as *G. batemanii*); Nelson S. (2008: 1518, Fig. 743, as *G. batemanii*); van den Berghe and van den Bergue (2009: A72, as *G. dives* Rchb.f.); Pérez Munguía (2015: 110–111, as *G. batemanii*).

Conservation assessment: LC. The species has an EOO of 292,876.9 km^2 (that would qualify it as LC) and an AOO of 100.00 km^2 (which would qualify it as an EN). *Galeandra arundinis* is widespread, ranging for NE Panama into southeastern Mexico in Tabasco. Judging from the collection record, the species is apparently rare, and the populations are isolated and widely apart, but it is seldom vouchered and collected plants are most often brought into cultivation because of their horticultural appeal, and thus lost from scientific documentation. Collectors often mention that the plants are locally common and when not in flower they are fairly inconspicuous, contributing to its perceived rarity. There are many photographs uploaded on the WWW featuring this species, mostly identified as *G. batemanii* or *G. baueri* that witness to its being commoner that the formal record suggests. *Galeandra arundinis* tends to grow on *Acoelorrhaphe* palms that often occur in dense stands on soils flooded with brackish water or in other coastal or riparian ecosystems. However, several other collections come from other types of forests, including pine forests. It ranges from sea level to elevations of up to 1350 m, but it is more common below 500 m. Thus, being widespread, of a broad ecological range, and often occurring in mostly undisturbed ecosystems, we asses this species as Least Concern (LC).

Galeandra arundinis had been confused with at least two species before its formal description by Romero and Garay (2005), perhaps more often than any other species in the genus. It was first cited for Panama as *G. baueri* (Williams, 1939: 284; 1946: 332; 334, Fig. 147), thought to occur in Guatemala and Belize, without citing specimens, again, confused with *G. baueri* (Ames and Correll, 1953: 472, 474; 473, Fig. 128), from Honduras and Costa Rica, misidentified as *G. dives* Rchb.f. & Warsz. (see Siegerist, 1983; Puplin, 2013, respectively, the latter citing what would later be designated as the holotype of *G. arundinis*), from Mexico to northern South America as *G. baueri* (Mora and Atwood, 1992), and from Belize, again confused with *G. baueri* (Halcrow and Halcrow, ca. 1968: 70, figure on page 71) and later with *G. batemanii* (McLeish et al. 1995: 63, photograph 46; Bridgewater et al., 2006). Hammer (1883) reported it from Belize, Honduras, and Nicaragua, illustrating a specimen from Nicaragua (*Heller 10125*, SEL), as *G. baueri*. Later, in his comprehensive field guide to the orchids of Central America, Hammer (1988), extended its range to Mexico and Guatemala (and, surprisingly, to "The West Indies"), using the same illustration (*Heller 10125*, SEL), as *G. batemanii*. More recently, Nelson S. (2008: 816–817) reported three species of *Galeandra* for Honduras but, based on the references he cited, they all referred to *G. arundinis*; the same author (Nelson, 2010 [2013]) reported *G. arundinis* for Honduras, citing *Edwards 243* at AMES; van den Berghe and van den Bergue (2009: 63–64) reported it from Nicaragua as *G. dives* Rchb.f.; Bogarin et al. (2014), cited it correctly for Panama.

Ossenbach et al. (2007: 66) reported *Galeandra arundinis* for Costa Rica, and *G. dives* for Panama, Nicaragua, Honduras, Guatemala, Belize, and Mexico. Although it is possible that the latter could be found in Panama, since it was described from neighboring Colombia (no type locality reported in the protologue, but "Neu-Granada" and "N. Granada" in Reichenbach f., 1856: 323 and 1857: 35, respectively), it would appear that the reports for the rest of Central America are referable to *G. arundinis*. Plants of *G. dives* bear yellowish flowers, with a patch of parallel reddish bands that merge near, yet not reaching the margin of the labellum, as shown in Hooker (1853; Fig. 10 herein; also in Bateman, 1867), as *G. baueri* var. *floribus luteis*, and in Escobar (1972: 161) and Ospina and Dressler (1974: Fig. 143), in the latter two cases as *G. leptoceras* Schltr. There is also a specimen at K (*L. Schlim 994*, see appendix herein), also from Colombia, the flowers of which faintly, yet unambiguously show the same pattern of coloration. Sheet 26543 in "Reichenbach: Herb. Orchid." (W; see link in the appendix) shows a sketch of a flower with a "blotch" in the labellum central lobe but, again, well separated from the margin, and with speckles on the side lobes. In contrast, all the herbarium material and iconography from these countries (i.e., from Mexico to Panama), examined by the authors, show flowers with the labellum apex solid

FIGURE 10. *Galeandra dives* Rchb.f. & Warsz. as *G*. *baueri* var. *floribus luteis* (Hooker, 1853).

dark red (as in the type) to light purplish-red all along the margins of the labellum (in most of its geographical range); exceptionally, as mentioned before, the apex of the labellum can have little or no pigmentation at all.

Examining the specimen *Salazar 5148* (AMO), from the type locality of *Galeandra archilae*, we find no morphological features to distinguish it from *G. arundinis*. Based on the information furnished in the protologue of *G. archilae*, we are confident that both taxa are one and the same species. Furthermore, although we have not seen any actual material referable to *G. garifunae* or the type, based on the protologue and its type locality, we do not hesitate to place it in the synonymy of *G. arundinis*.

The labellum keels of *Galeandra arundinis* are fairly constant; the lamellae, however, can vary in herbarium specimens, either pressed and dried or kept in spirits (Fig. 1–8; see discussion below). We encouraged researchers to study this variation in the field, capturing detailed images *in vivo*. Flower color can vary tremendously, again, from dark to light pigmentation, even in the same plant in different years or flowering season, presumably as a response to light exposure and physiological status of the plant (Fig. 9; see discussion below).

Galeandra batemanii Rolfe, Gard. Chron. ser. 3, 12: 431. 1892. TYPE: MEXICO. Oaxaca: Kisatipa, 10 leagues from Melatepec [“apparently Quezaltepec... in the hills north of Tehuantepec, some 10–15 km west of Malacatepec,” *fide* McVaugh, 1985: 125, most likely San Miguel Quetzaltepec], *J. Ross ex Hort. G. Barker* (Holotype: K). Fig. 11–17.

For comprehensive descriptions, see Warford (1994) and Soto-Arenas and Solano Gómez (2007).

Field and herbarium identification: Plants epiphytic or occasionally lithophytic or subterrestrial, growing on forest litter, often growing on pines (*Pinus oocarpa* Schiede ex Schltdl., Pinaceae), in Oaxaca, or on *Acoelorrhaphe wrightii* in Tabasco; pseudobulbs thickened at the base, ovoid to piriform, flowers with a labellum “… rich ruby burgundy or slightly duller at the apex, usually with a narrow white margin or not…” (Warford, 1994: 46). Both in the field and the herbarium, flowers of *G. batemanii* are larger than the flowers of *G. arundinis* (Fig. 1–7 versus Fig. 11). However, if herbarium flowers have lost their rich burgundy pigmentation in the apex of the labellum and/or are not properly hydrated, and without pseudobulbs or precise locality, flowers of *G. batemanii* are almost indistinguishable from those of *G. arundinis* (see discussion below). *In vivo*, however, the two species can be easily distinguished by the color of the leaves (see key below).

Etymology: Named after James Bateman (1811–1897), naturalist, horticulturalist, and garden designer, who developed pioneer methods to grow orchids. He also was author of *The Orchidaceae of Mexico and Guatemala* where *G. batemanii* was depicted for the second time (Bateman, 1840).

Distribution: Hitherto endemic to Mexico, in the gulf drainage of Oaxaca, in Chiapas (Beutelspacher Baigts, 2008, 2013; Beutelspacher Baigts and Moreno Molina 2018: 476), and Tabasco (González Aguilar y Burelo Ramos, 2012); expected in Guatemala, perhaps the plant cited by Archila et al. (2012: 15, note). Bateman (1840), in fact, reported “... specimens more recently discovered by Mr. Skinner in Guatemala”. Notwithstanding, the border between Guatemala and Mexico changed considerably in the early 19th century (see Carnevali et al., 2018: 8–9), and it is possible that Skinner collected this species in what is currently Mexican territory.

Phenology: The only reliable reports of this species indicate that plants flower between May and July. The phenology reported by McVaugh (1985: 125), “Aug–Oct,” is attributable to *G. greenwoodiana* Warford.

Additional material examined: MEXICO. Chiapas: [precise locality omitted], 1500 m, July 2014, *F. Hernández N. 4530A* (CHIP). Oaxaca: “Talea [de Castro], 4,000 ft. [ca. 1200 m], epip., sepals ochre-violacé, labelle violâtre,” 1840s, *H. Galeotti 5271* (BR, K, P [several specimens, some without numbers, but presumably from the same gathering]); same locality, “parasitica in sylvis”, August 1842, *F. M. Liebmann 6943* (US); near [Santiago] Choapam, on fallen pine in open pine forest, 750 m, 25 May 1990, *O. Suárez and E. W. Greenwood 1122* sub *N. Warford 594* (AMO, drawings, photograph of flattened flower, AMES). Tabasco: [precise locality omitted], en vegetación riparia, creciendo sobre *Acoelorrhaphe wrightii,* 3 m, 3 May 2013, *M. A. González & C. Burelo 01* (CICY, UJAT).

Selected iconography: Lindley (1840b, as *G. baueri*; Fig. 12 herein); Bateman (1840, as *G. baueri*, Fig. 13 herein);[5] Warford (1994: 47, Fig. 5; 1999: 129, Fig. 2); Day’s Book (43, 17 August 1886, unpublished, image at AMES; includes a note from R. A. Rolfe: “is *G. batemanii,* Rolfe”); Paxton (1848,[6] as *G. baueri*, Fig. 14 herein); Warner et al. (1887, as *G. baueri*); Linden (1901, Fig. 15 herein);[6] Wiard, 1987: 175, photographs on the upper right;[7] Beutelspacher Baigts (2013: 69); Beutelspacher Baigts and Moreno Molina (2018: 476).

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[5] Reichenbach f. (1863) described Bateman’s plate as “*icon phantastica horribile florulenta foliis cauleque minus correctis*.” Rolfe (1892) pointed out that “… part of another plant has in some way crept into Mr. Bateman’s figure…” Bateman (1840; Fig. 13, herein), in fact, indicated that “… Mr. Barker’s plant produced flowers in the autumm of 1839, and from these, assisted by native specimens more recently discovered by Mr. Skinner in Guatemala, Miss Drake prepared the exquisite drawing from whence the accompanying plate is taken.” Later, Bateman (1867) admitted that “My vexation will therefore be imagined when—some years afterwards—one of Mr. Skinner’s plants flowered and, instead of the *Galeandra*, turned out to be a new *Epidendrum* (*E. lacertinum*), of which, besides being more numerous, the flowers were disposed in a manner totally different from those of the species it had simulated,” accounting perhaps for some of the thick, fusiform pseudobulbs depicted in Bateman’s plate. The pseudobulbs of *Epidendrum lacertinum* Lindl. are produced sequentially from the upper nodes of older pseudobulbs (E. Hágsater, personal communication to GAR-G, 2021); Lindley (1841), likewise, stated, in the protologue of the species, “it is stated to have the habit of *Galeandra baueri*....” Nevertheless, it should be pointed out that the upper, flowering pseudobulb shown in Bateman (1840), arose not from the basal but from one of the lower nodes of an old decaying pseudobulb, an uncommon but nonetheless documented strategy in plants of Catasetinae, where old, decaying pseudobulbs activate meristems on the nodes, from which normal pseudobulbs develop.

[6] Here we differ from Warford (1994: 46) and assign the early iconography in Paxton (1848; Fig. 14 herein) and Linden (1901; Fig. 15 herein) to *Galeandra batemanii* and not to *G. greenwoodiana*, based on the intense burgundy color of the labellum apex.

[7] The photograph on the upper right, although identified as *G. batemanii*, appears to depict a flower of *G. greenwoodiana*.

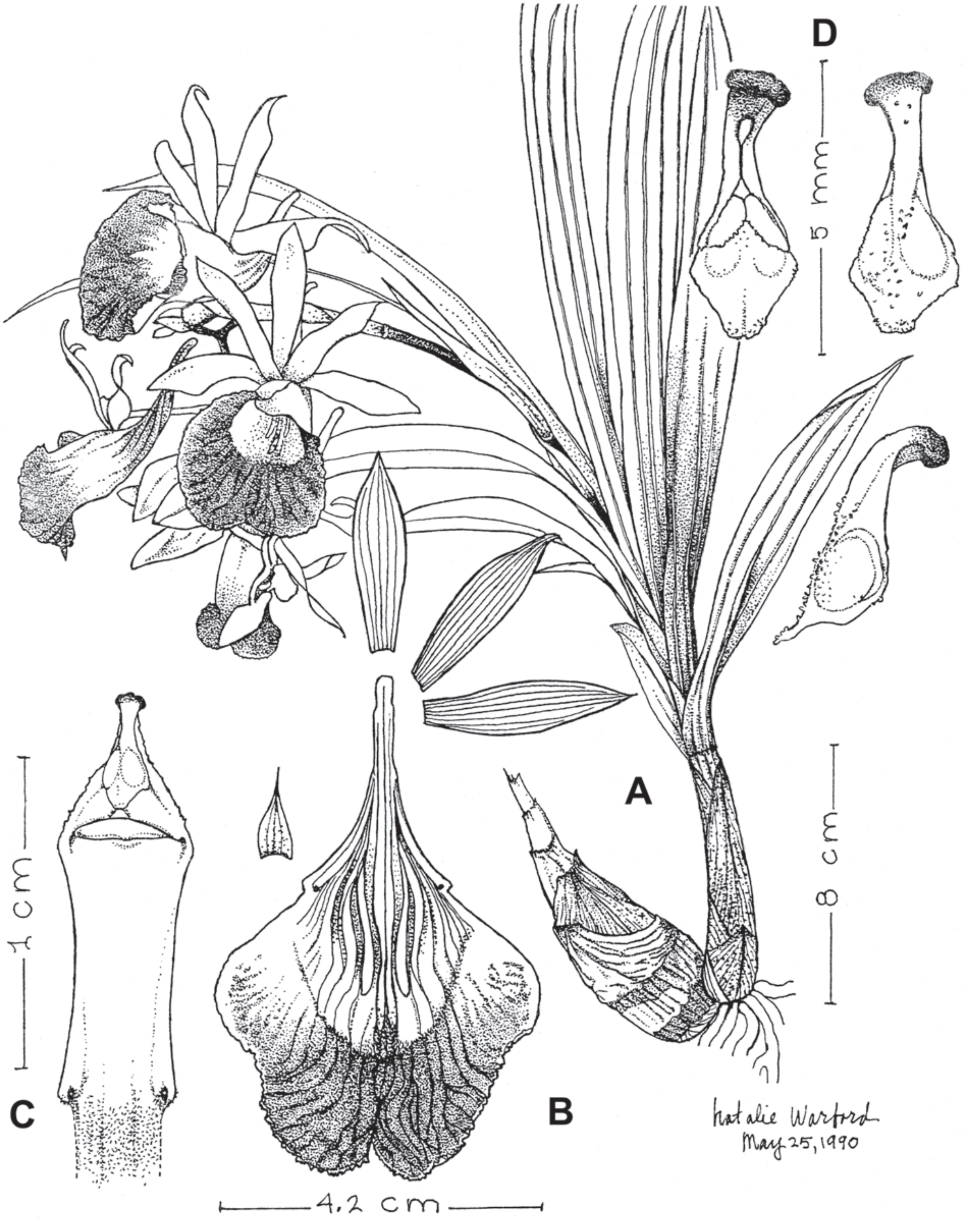

FIGURE 11. *Galeandra batemanii* Rolfe. **A**, Flowering plant; **B**, labellum, flattened, floral bract on the upper left; **C**, abaxial view of the column with pollinarium; **D**, views of the anther. Drawn by N. Warford from material in vivo based on *Warford 594* (AMO).

FIGURE 12. *Galeandra batemanii* Rolfe as *G. baueri* Lindl. (Lindley, 1840b).

FIGURE 13. *Galeandra batemanii* Rolfe as *G. baueri* Lindl. (Bateman, 1840).

FIGURE 14. *Galeandra batemanii* Rolfe as *G. baueri* Lindl. (Paxton, 1848).

FIGURE 15. *Galeandra batemanii* Rolfe (Linden, 1901).

FIGURE 16. Views of *Galeandra greenwoodiana* Warford and *G. batemanii* Rolfe. **A**, *G. greenwoodiana*; **B**, *G. batemanii*. Photographs by N. Warford based on the holotype, *Warford 543* (AMO) and *Warford 594* (AMO), respectively. Colors on this plate do not necessarily match the original colors of the flowers.

FIGURE 17. *Galeandra batemanii* Rolfe from Arroyo Negro, Chiapas, growing subterrestrially. Photograph by F. Hernández N. based on *F. Hernández N. 4530A* (CHIP).

Conservation assessment (IUCN): EN. *Galeandra batemani* has an EOO of 33782.6 km^2 (that would qualify it as NT) and an AOO of 24.0 km^2 (which would qualify it as an EN). The species meets criteria EN B2ab (i, ii) of the IUCN. It is known from five localities, and the AOO is 24.00 km^2. It is a rare species known with certainty from the Atlantic slope of the mountain ranges in and around the isthmus of Tehuantepec. It grows in pine forests, more rarely, as a lithophyte or subterrestrial and, in Tabasco, on *Acoelorrhaphe* palm stands. The habitat of the species is highly fragmented under natural conditions and is also simultaneously being severely threatened by anthropogenic activities, mainly slash-and-burn agriculture and extensive cattle ranching. It is also being illegally extracted from the field for horticultural purposes. None of the populations known reside in an area that is under any level of protection. Being such a horticulturally desirably subject, its rarity under cultivation and in the herbarium record witness to its rarity in the field. *Galeandra arundinis*, though with almost identical flowers and cultivation appeal, is much more common in the herbarium and photographic record and it is not under any perceived threat. For other notes on the conservation of this species, see Soto-Arenas and Solano-Gómez (2004).

Galeandra batemanii was long misidentified as *G. baueri* (e.g., Lindley, 1840b; Bateman, 1840; Paxton, 1848; Warner et al., 1887), until Rolfe (1892) described it, presenting convincing arguments to treat it as a distinct species (see also Bateman, 1867). Nonetheless, in the mid 20th century, Williams (1939) and generic treatments for the flora of Panama (Williams, 1946), Guatemala (Ames and Correll, 1953), and Mexico (Williams, 1951) placed *G. batemanii* under the synonymy of *G. baueri* (see also Klaassen, 1979). It was not until Pollard (1974) called attention to the differences between *G. batemanii* and what he circumscribed as *G. baueri*, which he distinguished based on the shape of the pseudobulbs, color of the lip, flowering time, and distribution:

Pseudobulbs slender, fusiform; lip pale colored, blooms in July; Southern Mexico, Central America, Colombia, Peru, Venezuela and French Guiana . . . . *G. baueri*

Pseudobulbs round to ovoid; lip with large purple spot at apex; blooms September, October; Nayarit, Mexico . . . . *G. batemanii*

However, reliable bibliographic and herbarium resources on *Galeandra* were then scarce and, while solving the *G. baueri* versus *G. batemanii* puzzle, misinterpreted other species: Pollard's "*G. batemanii*" would eventually be described as *G. greenwoodiana*, and his "*G. baueri*" included several species, including *G. arundinis*. Nevertheless, Pollard's contribution was critical:[8] it brought attention to the fact that species in the *G. batemanii* group were distinct and coherent: they currently conform a relative well supported subclade, sister to all other epiphytic galeandras except for *G. devoniana* R.H. Schomb. ex Lindl., which is itself sister to all the other member of the genus (Monteiro et al., 2010).

McVaugh (1985: 127) argued that "The plant from Nayarit appears to be conspecific with the one from Oaxaca, which is the true *G. batemanii*;" the plant from Nayarit would eventually be described as *G. greenwoodiana*.

According to Warford (1994, 1999), *Galeandra batemanii* is easily distinguished from *G. greenwoodiana* based on the differences of the labellum lobes *in vivo* (Fig. 16). In iconography, and in herbarium material (in these two last cases not always discernable), when the labellum is flattened, the lobes are almost symmetrical, rounded in the former, versus lobes markedly asymmetrical, one of them much larger than the other and half-rounded at the apex, in the latter (Fig. 17). Other characters that differ between these two species are listed in Table 1. Furthermore, *Galeandra batemanii* and *G. greenwoodiana* have disjunct distributions, the former from highlands in the Atlantic slopes of Oaxaca and Chiapas, east of the isthmus of Tehuantepec, and here reported from Tabasco, the latter from the Pacific slopes of Mexico from Nayarit to NW Oaxaca (see appendix for the southern, easternmost collection of *G. greenwoodiana*).

We include a drawing of a flower from the holotype of *G. batemanii* (Fig. 18), from a flower sent to L. A. Garay in 2004, which is now conserved at K in spirits.

Galeandra sobralioides Archila & Chiron, (as "*sobralioide*"), Revista Guatemalensis 15, No. 2: 12. 2012. TYPE: GUATEMALA. Departamento San Marcos: Bocacosta, sobre palmeras de coyolar [*Acrocomia aculeata* (Jacq.) Lodd. ex Mart.], 150 m, November 1995, *Fredy Archila s.n.* (Holotype: BIGU). Fig. 19–20.

We provide a full description of this species, to complement the one given in the protologue.

Plants epiphytic, vegetatively undistinguishable from its close relatives, *G. batemanii* and *G. greenwodiana*, *pseudobulbs* up to 122 mm long and 28.5 mm in diameter, perhaps the smallest of the group, covered with the *leaf sheaths* that eventually dry out and senesce. *Leaves* 6–7, deciduous, distichous, plicate, articulate; *lamina* linear lanceolate to linear elliptic, to 20 cm long and 2.5 cm wide. *Inflorescence* a multiflowered raceme, emerging from the developing pseudobulb, often flowering later from adventitious branches borne from one or more of the uppermost peduncle nodes; *peduncle* and *rachis* light

TABLE 1. Stable, distinguishing characters of *Galeandra batemanii* Rolfe and *G. greenwoodiana* Warford.[1]

	G. BATEMANII	*G.* GEENWOODIANA
Pseudobulbs	To 10 cm high, conic ovoid obclavate	To 25[–72] cm long, conic-ovoid to obclavate
Leaves	Up to 7, to 21 × 3 cm; dark green with a silken sheen	Up to 12, to 50 × 4 cm; medium, matte green
Rachis	Stout, 2 mm in diameter	Wiry, 1 mm in diameter
Peduncle bracts	To 6 cm long	To 14 cm long
Flower bracts	To 1.3 cm long	To 4 cm long
Labellum keels[2]	12–14 mm long	8–10 mm long
Labellum apex	Rich, bright burgundy	Pale, dull burgundy
Column	1 cm long, 4 mm wide[3]	1.2–1.3 cm long, 5 mm wide[3]

[1] From Warford (1991 [unpublished notes at AMES], 1994).

[2] In dry flowers.

[3] Across the wings.

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[8] Pollard's contribution also fueled E. D. Greenwood and N. Warford interest in the Mexican galeandras and, in fact, early N. Warford's notes at AMES show that she at first planned to describe her *G. greenwoodiana* as *G. pollardiana*.

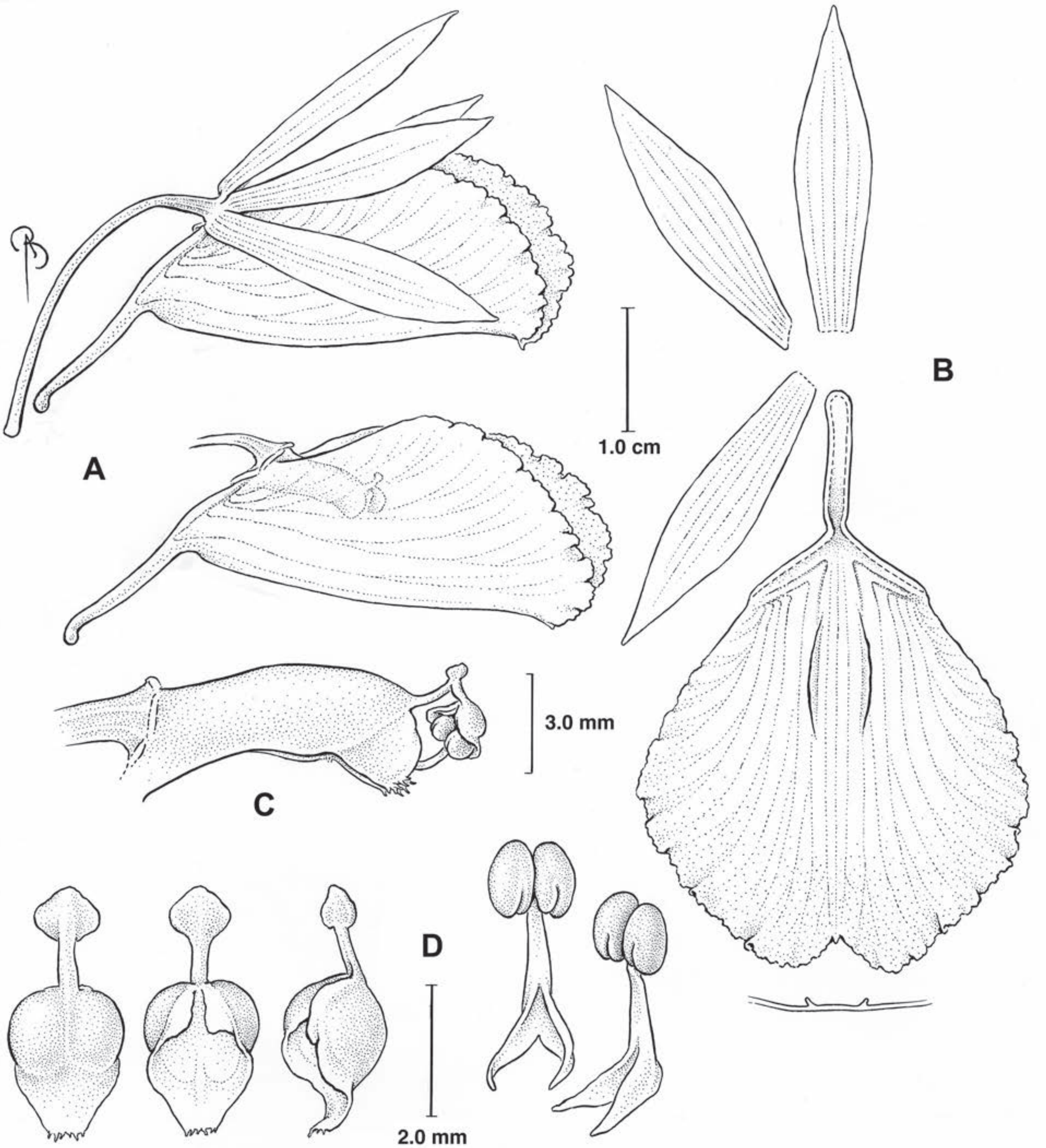

FIGURE 18. *Galeandra batemanii* Rolfe. **A**, side views of the flower; **B**, floral segments; **C**, side view of the column; **D**, views of the anther and pollinarium. Drawn from a hydrated flower by B. Angell based on the holotype (K).

green, often with red pigmentation; peduncle light green, 7.0 cm long, in diameter ca. 2.0 mm at the base, 1.5 mm at the apex; floral bracts 6–7 × 3–4 mm, becoming smaller distally along the rachis, ovate, shortly acuminate. *Flowers* showy, opening in succession, lasting a week to 10 days, and therefore it is often the case that several are at anthesis simultaneously, trumpet-shaped. *Sepals* and *petals* abaxially yellowish-green, suffused brown, adaxially yellowish green, striped brown at the base, suffused brown toward the apex, *dorsal sepal* lanceolate, acute, 21.7 × 6.4 mm, *lateral sepals* lanceolate, falcate, 22.3 × 6.7 mm, *petals* lanceolate, acute, 20.9 × 7.3 mm. *Labellum* saccate, widely infundibuliform, spurred, deeply bilobed, lobes subequal, ovate-subrhombic when spread; excluding the *spur*, in its apical three fifths deep purple, velvety, bearing unicellular trichomes, diminishing in density towards the lighter purple upper sides and absent

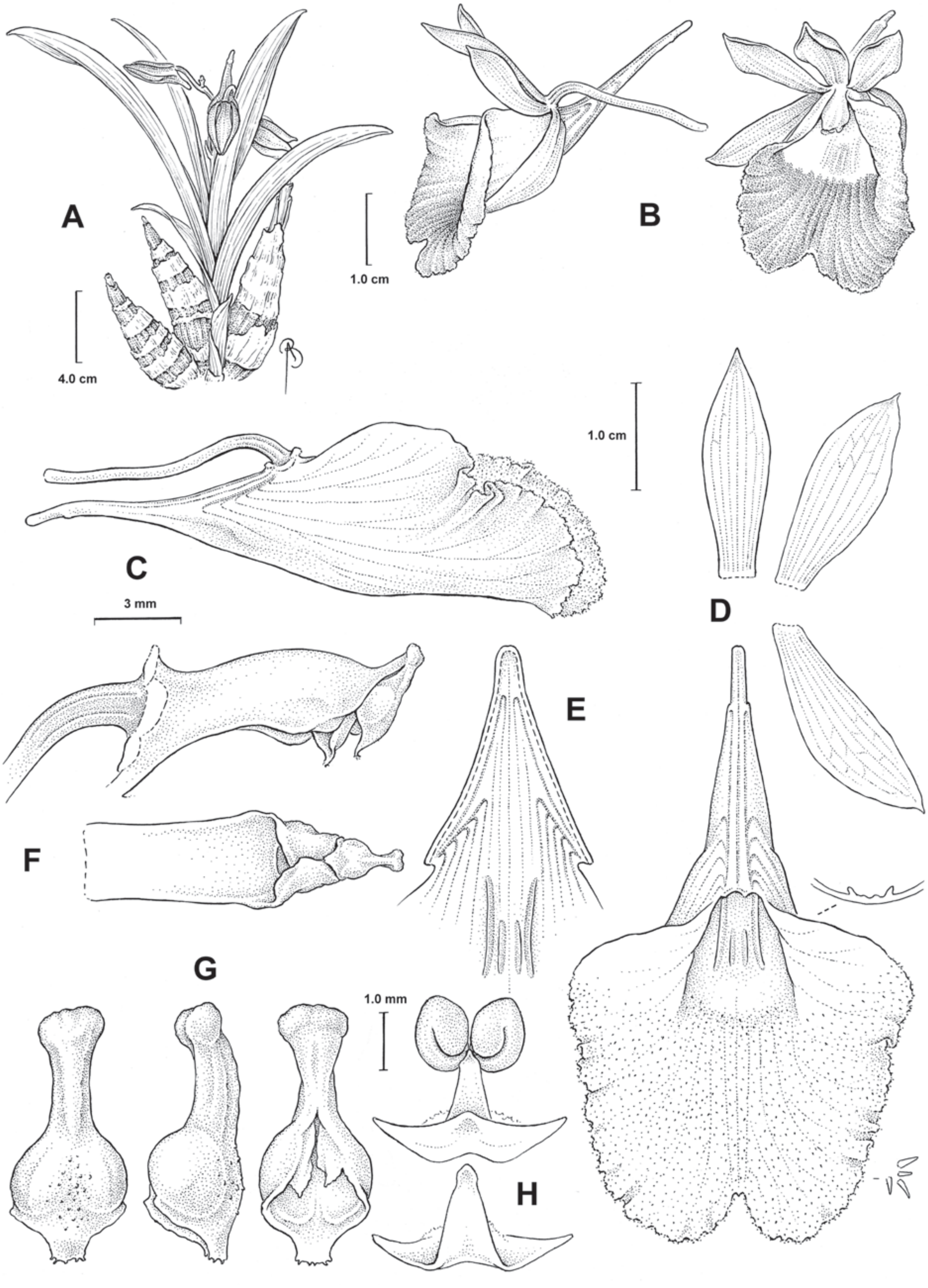

FIGURE 19. *Galeadra sobralioides* Archila & Chiron. **A**, habit, plant with flowers in bud; **B**, views of the flower; **C**, side view of the labellum; **D**, floral segments; **E**, spur, spread; **F**, view of the column; **G**; views of the anther; **H**, views of the pollinarium. Drawn from a flower in spirits by B. Angell based on *Carnevali 8596* (CICY).

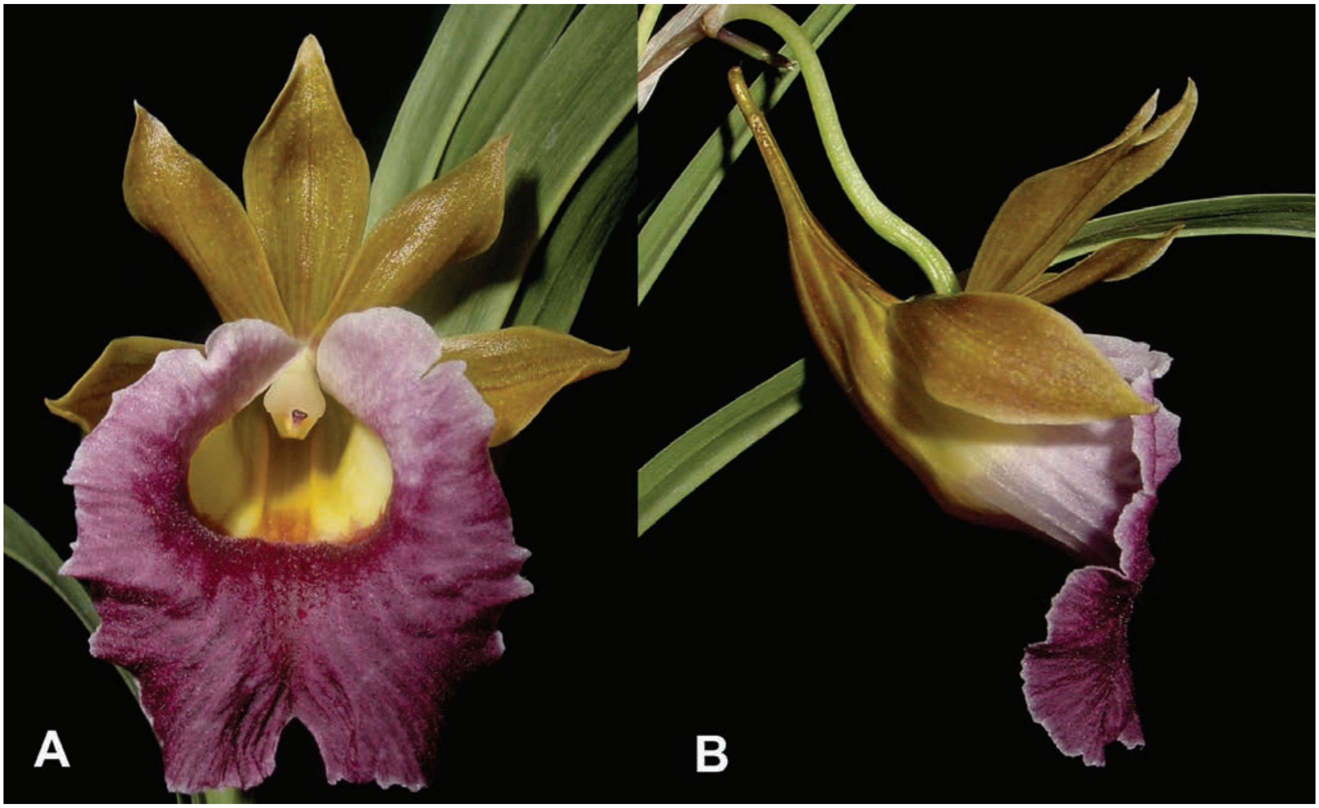

FIGURE 20. *Galeandra sobralioides* Archila & Chiron. **A**, front view; **B**, side view. Photographs by G. Carnevali based on *Carnevali 8596* (CICY). For scale, see Figure 18.

towards the yellow base, the apex strongly flared, the basal portion bearing two outer, conspicuous, yellow, waxy *keels* that curve outward toward the base, less so toward the apex, and two inner, slightly purple *thickenings* between the nerves, not surpassing the outer keels; including the spur and up to the edge of the longest lobe, 57.2 mm long, 31.8 mm at its widest point, *spur* narrowly infundibuliform, rigid, gently upturned or straight, yellowish-green, striped maroon, 18 × 22 mm long. *Column* glabrous, white with a few reddish spots at the base, gently arcuate, 9.5 × 3.5 mm, with a conspicuous foot, winged, clinandrium slightly upturn. *Anther* beaked, 4.6 × 2.1 mm, white, dark purple at the tip, the base scrotiform, the apex slightly bent, clavate, slightly bilobed at the tip. *Pollinarium* with viscidium, stipe, and two pollinia; viscidium subtriangular, white, extending at the sides into triangular hyaline arms; stipe laminar, when dried semi-tubular; pollinia ovoid, longitudinally cleft, yellow, hard, waxy, 1.3 × 1.1 mm. *Capsule* not seen (based on *Carnevali 8596*, CICY and *Carnevali 7356*, CICY, AMES).

Etymology: According to the authors, in reference to flowers of the genus *Sobralia* Ruiz & Pav. (Orchidaceae), and the Latin adjectival suffix *-oides*, indicating resemblance.

Distribution: Hitherto known from Pacific slopes in southern Mexico and northern Guatemala, along southern slopes of the Sierra Madre de Chiapas, west of the isthmus of Tehuantepec, in Oaxaca at 1000–1300 m, in Guatemala at 150 m; expected in the intervening Mexican state of Chiapas.

Phenology: in cultivation in Mérida, Yucatán, Mexico, plants of *Galeandra sobralioides* flowered in April–June. The protologue does not state flowering time.

Additional material examined: MEXICO. Oaxaca: Municipio San Miguel Chimalapa: Arroyo El Caracol, al pie del Cerro Guayabitos al N de Benito Juárez, selva mediana subcaducifolia riparia (ladera arriba hay encinar tropical y *Pinus oocarpa*), ca. 1000–1200 m, única planta vista, en tronco caido sobre el arroyo, ambiente sombreado y húmedo; cerca *Maxillaria variabilis*, *Lycaste aromatica*, *Scelochilus*, *Notylia*, *Stanhopea*, *Catasetum integerrimum*, 25 julio 1996, *G.A. Salazar, S. Maya, O. Rocha & L. Cabrera 5651 ex hort. sub G. Carnevali 8596* (CICY; AMES [fragment]); same locality and genotype, flowering under cultivation, 17 May 2002, *G. Carnevali 7356* (CICY; AMES, fragment); same locality, bosque con mezcla de tropicales (*Bursera*) con elementos de bosque mesofilo (*Cedrela*), pendientes fuertes, suelo amarillo arcilloso, 31 july 1986, *S. Maya 3689* (CHAPA); Cerro de la Division, ca. 5 km al E de Benito Juarez, ca. 39 km en linea recta al NNE de San Pedro Tapanatepec, 1400–1600 m, bosque mesofilo de montaña de *Quercus*, *Calophyllum*, *Podocarpus*, *Liquidambar*, pendiente suave, suelo negro, 4 mayo 1985, *S. Maya 1607* (CHAPA).

Iconography: Hágsater et al. (2005: 145, as *G. aff. batemanii*);[9] Monteiro et al. (2010: Fig. 5F, plant with flowers in bud, photograph by G. Carnevali, based on

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[9] The photograph appearing in Hágsater et al. (2005) and Archila et al. (2012) was originally taken by G. Carnevali, see Fig. 19A herein, based on *Carnevali 8596*).

Carnevali 8596, as *G. batemanii*); Archila et al. (2012: verso of plate inserted between pages 18–19, as "*Galeandra sobraliolide* Archila & Chiron").

Conservation assessment (IUCN): EN. *Galeandra sobralioides* has an EOO of 1661.4 km^2 (that would qualify it as EN taxon) and an AOO of 12.0 km^2 (which would qualify it as an EN species). The species meets criteria EN B2ab (i, ii) of the IUCN. It is known from three, possibly only two locations, separated by 310–320 km, one in Guatemala and two in SE Mexico (which are so close to each other as to possibly be considered the same). The species is rare, even at these localities. The intervening area between the Mexican and Guatemalan populations has not been thoroughly explored and with certainty more populations are to be expected. The very imprecise type locality in San Marcos, Guatemala ("Bocacosta") is in an area that has been heavily perturbed by extensive cattle ranching developments and it is hard to assess what the status of the species is there, but judging from the paucity of collections it must also be very rare. The type locality is described by the authors of the species as " … hot subtropical, very wet forests on palms at elevations around 150 meters …. hot growing epiphyte …" The known populations in Mexico occur in medium-height riparian forests and in evergreen tropical forests at 1200–1400 m (Soto-Arenas & Solano, 2007; personal observations). These forests are mostly inaccessible and still fairly well preserved but slash-and burn agriculture and extensive cattle ranching are making inroads in the area. The fact that the species is known from such widely diverging ecological settings suggests that *G. sobralioides* may eventually be found under conditions intermediate between those of the Mexican and Guatemalan populations and has a broader ecological and geographical range. The species has obvious horticultural appeal with its relatively large, showy flowers and if these populations become accessible to "materos," (commercial plant collectors), they are likely to be severely striped from nature.

Galeandra sobralioides is closely related to *Galeandra batemanii* and *G. greenwoodiana* (see distribution of these two species above, under *G. batemanii*). *Galeandra sobralioides* is known only from a few plants collected in the general area of Los Chimalapas, in eastern Oaxaca, in Pacific slopes, where it has been found at altitudes above 1000 m, reaching sometimes 1300 m. The type from Guatemala was collected at a much lower elevation (100 m).

Galeandra batemanii, *G. greenwoodiana*, and *G. sobralioides* share a distinctive vegetative character, ovoid to piriform, relatively heavy pseudobulbs (Warford, 1994, personal observation of the authors, but see Table 1 and discussion below). Furthermore, the leaf sheaths are green when young but later are allegedly speckled with dark red, particularly along the edges and the articulation (as reported in the protologue), a character they share with some South American species (e.g., *G. macroplectra* G. A. Romero & Warford), and with *G. arundinis*. According to Warford (1994), however, "*G. greenwoodiana*… is … generally more robust [than *G. batemanii*] when living plants of the same age are compared, growing to as much as 72 cm versus about half that for *G. batemanii*" (see table 1 herein). One of the authors (GC) cultivated a plant of *Galeandra sobralioides* for five years and this species is apparently even smaller than *G. batemanii*.

Galeandra sobralioides (Fig. 19–20) is most easily distinguished *in vivo* from its closest relatives by its solid dark purple, highly flared, deflexed apex of the labellum (sometimes with faint white stripes, with a narrow white band along the margin; the labellum is only slightly deflexed in *G. batemanii* and *G. greenwoodiana*). Furthermore, it also differs from *G. greenwoodiana*, which also grows in the Pacific slopes of Oaxaca, but further north and apparently at lower elevations, on the western side of the isthmus of Tehuantepec, in the almost symmetrical lobes of the labellum (versus highly asymmetrical in *G. greenwoodiana*) and the gently upturn or straight spur (versus deflexed or hooked in *G. greenwoodiana*). In the herbarium, the relative size of the lobes of the labellum and the spur should be discernible in dry flowers and should easily distinguish *G. sobralioides* from *G. greenwoodiana*; likewise, in re-hydrated and carefully dissected flowers, the two low, inner lamellas, not thickened at the apex and not surpassing the outer keels, and the relatively longer labellum, the shorter sepals and petals, and the slightly falcate lateral sepals should distinguish *G. sobralioides* from *G. batemanii* (compare Fig. 11 and 18 versus 19).

DISCUSSION

The general shape of flowers in *Galeandra* is relatively uniform, with little variation within the clades and subclades recovered by Monteiro et al. (2010). In fact, flower shape is so well conserved within subclades that many closely related species cannot be distinguished without having precise localities, descriptions (including fragrance: see discussion below), color photographs, and carefully done dissections and drawings. Pseudobulb shape is also highly conserved within clades, and, in the one that includes all the epiphytic galeandras, we find two general shapes: narrowly fusiform, cane-like in the South American clade, that presumably includes *G. arundinis*, and enlarged at the base, somewhat piriform (Lindley, 1840b; Bateman, 1840; Paxton, 1848; Warford 1994), ovoid to almost spherical (Warner et al., 1887; Linden, 1901) in the Mexican subclade. The fusiform, cane-like shape is considered the ancestral state, as observed in *Galeandra devoniana*, sister species to all other galeandras (Monteiro et al., 2010).

Williams (1939: 248) questioned, somewhat ambiguously, whether pseudobulb shape (fusiform, cane-line versus enlarged at the base, piriform to ovoid) was a constant, conserved character:

"Rolfe distinguished *G. batemanii* as having 'a short ovoid pseudobulb, and a dull purple lip' and *G. baueri* as having 'a slender fusiform pseudobulb, and a pale-coloured-lip.' Most of the Mexican and British Honduran material examined has slender pseudobulbs, but the shape seems to depend on age, the younger ones being slender, the older ones thicker" (Williams 1939: 284).

It is unclear whether this author had examined material of the Mexican galeandras: in 1939 he was curator of the Oakes Ames Orchid Herbarium where, at this moment, there are only recently accessioned specimens of this group,[10] or what meant when he said "… the younger ones being slender, the older ones thicker", which is the case in *Galeandra arundinis*: young pseudobulbs, in fact, are *in vivo* generally slender, older ones, can be narrowly fusiform. As for "slender" versus "thicker", the following authors appear to have interpreted them as "narrowly fusiform, cane-like" versus "enlarged at the base, piriform".

Edward W. Greenwood (January 1973, unpublished notes at AMES) wrote "Although I have seen in the field only the Nayarit plant (*G. batemanii*), the sample was sufficiently large to make Williams' suggestion that very young pseudobulbs are slender, older ones are thick, seems most unlikely. Even the very small pseudobulbs at that location were heavy". Pollard (1974: 170) soon followed with the following most perplexing statements: "In 1964, my friend Walter Miller sent me live plants which his men in [San Juan] Juquila Mixes [ca. 16°53'N 95°53'W, 1480 m], Oaxaca, had collected north and east of the village, I later flowered these plants for several years. There were several pseudobulbs on each of the two plants and in no case was there any indication of age producing swelling at the base of the although the back bulbs were of age. All were slender, irrespective of age. These plants I would consider to be *G. baueri* even though 1000 miles from the type locality. During the past year, I have received two more plants from the same area, they also have slender pseudobulbs without any sign of swelling at the base. These plants should bloom in July as they are now in bud." The plants from Nayarit mentioned by Greenwood would eventually be described as *G. greenwoodiana*.

Although Pollard did not give much detail about the plants from the vicinity of San Juan Juquila Mixes and did not give a precise account of the color photographs with which he illustrated his article, Greenwood (July 1977, unpublished notes, AMES) later met with Walter Miller and found out that the plants had been found on pines and rocks. A flower of these gatherings, flattened on paper, is preserved at AMO: the floral segments are described as "sepals and petals yellowish-brown, green on tips, lip purple at front, grading to yellow to brown, column pale green, purple at apex tip." Warford (1994: 49) referred the plants from San Juan Juquila Mixes to *G. batemanii*. Warford drew another flower from San Juan Juquila Mixes, probably from another card sent to her by E. W. Greenwood: her drawing lacks the details of her other work, due to their loss due to the preservation method (floral segments attached to paper using non-archival transparent tape, which yellowed with age and hides the minute detail of flowers preserved in spirits or rehydrated from herbarium material).

Relevant to the topic, Warford (1991, unpublished notes, AMES) wrote "Although *Suarez 1122*, the plant [of *G. batemanii*] sent to Warford in 1989, had produced ovoid pseudobulbs in its habitat [Choapam, Oaxaca], the plant produced a fusiform pseudobulb while in cultivation at sea level in Puerto Vallarta [Jalisco]; a most confounding development, but undoubtedly brought by unnatural cultural conditions. The development must be mentioned as it may be an ancestral, latent manifestation".

Two of the authors (CMB and MAG) collected galeandras in the state of Tabasco, growing on *Acoelorrhaphe wrightii*, that included plants bearing pseudobulbs from piriform to fusiform, cane-like pseudobulbs, bearing flowers typical of *G. arundinis* (labellum apex light rose to light purple, spur bent upwards) or *G. batemanii* (larger flowers, labellum apex dark burgundy, spur bent downwards).

It should be emphasized that plants of *Galeandra arundinis* do not "universally" bear fusiform, cane-like pseudobulbs. Infrequently, one can find pseudobulbs slightly enlarged toward the base, as in *Heller 1106* (SEL), from Nicaragua, the oldest pseudobulb of which apparently was somewhat piriform, the two most recent ones definitely fusiform (Hammer, 1983, 1988), and *O'Neill 8347* (NY), from Belize, which also shows a pseudobulb somewhat enlarged toward the base (see appendix for link to this specimen); however, the specimen from the same gathering at AMES shows fusiform pseudobulbs, as all other specimens from Belize to Panama cited above under *G. arundinis*. A photograph of a plant from Honduras, Puerto Lempira (see link in Appendix 1), no doubt representing *G. arunidinis*, also shows a basally thickened pseudobulb.

Here are two cases of plants that apparently bear *Galeandra arundinis* pseudobulbs but produce *G. batemanii* flowers (the plants from San Juan Juquila Mixes) or *G. batemanii* pseudobulbs that bear *G. arundinis* flowers (the ones from Tabasco), and isolated cases of plants of *G. arundinis*, throughout its range, bearing roundish pseudobulbs.

These discrepancies in pseudobulb shape in *G. arundinis* and *G. batemanii* may be due to any of the following factors, or a combination thereof: 1) that pseudobulb shape is a plastic, not genetically fixed character, and different shapes are triggered by environmental variables, both in nature and in cultivation; or 2) genetic introgression.

The first hypothesis is not supported by the evidence observed in herbarium specimens. "Nature is not perfect," someone must have said. Natural variation is expected, but the overall pattern is clear: *Galeandra arundinis*, as it names implies, tends to have cane-like pseudobulbs, deviating occasionally. However, the pyriform pseudobulbs of the *G. arundinis* population in Tabasco could support the second hypothesis, which should be investigated.

VEGETATIVE, REPRODUCTIVE, AND ECOLOGICAL CHARACTERS IN GALEANDRA

Size of mature, flowering pseudobulbs.

They can vary a great deal. Those of *Galeandra devoniana* can vary from 20 cm to close to two m in height ("… five to six feet high...": R. H. Schomburgk in Lindley, 1840a). Thus, plant height, although does not vary in most species as dramatically as in *G. devoniana*, is not a diagnostic character in this genus.

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[10] In fact, other than the recent accessions in AMES, no herbarium in the United States appears to have specimens of species of the Mexican clade, except for *Liebmann 6943* (US, cited above), perhaps a testimony of the rarity of these species in nature (and of the reluctacy from orchid growers to press them.)

Leaf number, size, shape, and color.

Leaf number, length, and width varies a great deal throughout the genus, being relatively numerous, short, and narrow in *G. devoniana,* supposedly the ancestral characters and, in narrowness, shared with the terrestrial species and the South American subclade (based on Monteiro et al. 2010, and the authors' personal observations). although leaf width and average length appears to be closely associated with the age of the plant, and therefore with its reproductive status, the Mexican galeandras, including *G. arundinis*, differ in leaf width and leaf color: both *G. arundinis* and *G. greenwoodiana* have relatively wider leaves, matte green in color, whereas *G. batemanii* and *G. sobralioides* have narrower leaves, dark green with a silken sheen (see key below).

Flower size and color.

Flower size remains more or less constant *in vivo* when comparing what mature, well-grown plants bear, with minimal variation, although depauperate plants in cultivation may produce noticeably smaller flowers. Also, the same inflorescence may carry flowers of different sizes, depending upon de age of the inflorescence, whence the last, most distal flowers tend to be somewhat smaller than earlier, more proximal flowers. In herbarium material, the actual state of the fresh material (flowers not at full anthesis, at full anthesis, or wilting), how it is pressed and dried, and later, how it is hydrated, can affect the size of the flowers considerably.

Flower color can vary somewhat within a species and even in the same plant in the same flowering season or between years (Fig. 9). Nonetheless, overall, over several flowering seasons, it is generally a diagnostic character. Warford (1999: 133; see figure 7 versus 16 therein) reported plants of *Galeandra greenwoodiana* with yellowish flowers, which she attributed to "... age or environmental stress;" the same plant later produced flowers with the expected light burgundy labellum. Two of the authors (GAR-G and GC) also have observed yellowish flowers in *G. macroplectra*, whitish-cream to yellowish green at anthesis, no doubt attributable to age (Romero and Warford, 1995). See Warford (1994: 46) for discussion of trichomes and flower color. Readers are cautioned to carefully consider the color of flowers presented on Internet, as deviations from the "original" colors, for multiple reasons (including monitor settings), are common.

Carinae (keels) versus lamellae.

Keels have a corneous, waxy texture, are inornate, in cross section subtriangular, arquate, marginally acute, in some cases (e.g., *G. blattiodora* G.A. Romero & C. Gómez), apically with a serrate tooth, and are readily discernable in live, alcohol-preserved, and pressed and dried herbarium material. Their number, two in the Mexican species treated here, is fairly constant in most species. In contrast, lamellae are thickenings found along and between the central nerves, often covered and surrounded by trichomes; they are discernable in some species *in vivo*, but may or not persist in re-hydrated, herbarium material. Their presence on the labellum can vary a great deal, from being absent at all to thickenings along and in between the central nerves. However, when comparing fresh flower to flowers kept in spirits or hydrated flowers from herbarium material, it is difficult to assess this variation, which could be caused by the preservation method. We have found ambiguities in description published in protologues and floras: "… *Lip*… with two parallel ridges inside the tube" (McLeish et al., 1995: 63), yet the line drawing (McLeish et al., 1995: 64, Fig. 26) shows four "ridges"; according to Archila and Chiron (2012: 13), the labellum has "… dos protuberancias de la parte media hacia atrás", shown in Fig. 1 (Archila and Chiron 2012: 14), yet, the flower depicted on the color plate inserted between pages 18 and 19 shows two slight thickenings between the keels, also present in *Carnevali 8596* (Fig. 19A, same photograph, by G. Carnevali, at a greater resolution).

Flower fragrance and pollination.

This topic has been little studied in *Galeandra*. According to Dressler (1981: 254), "the pollinaria of *Galeandra* have been found on *Euglossa* and large anthophorid bees." Warford (1991, unpublished notes, AMES) reported the mid-morning fragrance of *G. batemanii* and *G. greenwoodiana* as "... faint floral in both species but with slightly different overtones; odour at night was acidic;" she added: "Neither species... was naturally pollinated in open air cultivation although their pollinaria were removed... on a number of occasions. The plants were watched so closely during the daylight hours that it was suspected that a night flyer was responsible..." Waldo and Roubik (1986: 427, Table 1 therein) reported several genera and species in Anthophoridae[11] from light traps on Barro Colorado Island, and Warford's suspected night flier may be in fact one of these bees, flying at dim-light or darkness (see also Wcislo and Tierney, 2009). Chase and Hills (1992: 44, Table 1), for *Galeandra*, reported both male and female euglossine bee pollinators. Romero and Warford (1995) reported male euglossine bees as pollinators of *G. macroplectra* (*Euglossa ignita* Smith, *E. imperialis* Cockerell, and *Eulaema moczaryi* (Friese)) and *G. magnicolumna* G.A. Romero & Warford (*Eulaema cingulata* (Fabricius), *E. meriana* (Olivier), and *E. nigrita* Lepeletier, in the latter case, both male and female bees). These two species of *Galeandra* have subtle, pleasant fragrances. A population that was at first referred to *G. macroplectra* was later described as *G. blattiodora* (Romero-González and Gómez, 2014). The latter became apparent only after the authors had plants with flowers, which had a distinct, repugnant fragrance; later, diagnoseable morphological characters were documented and the species was formally described (Romero-González and Gómez, 2014); what pollinates this species is unknown. Nonetheless, fragrance, as in other species groups of Catasetinae, may not be a reliable diagnostic character (e.g., all species in *Catasetum* section *Catasetum* have basically

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[11] Readers should be aware of changes in the circumscription of this family.

the same fragrance, and attract the same pollinators: genetic isolation is attained *via* differences in phenology and/or geographic isolation).

Variation in the orientation and size of the spur.

Little has been discussed about this character. We have seen abundant collections as well as images of *G. arundinis* from across its broad geographical distribution and are aware of the great deal of variation of this character found within the species. It is rarely completely straight. Usually, it is slightly and gradually upcurved at an angle of ca. 20–30° relative to the main body of the labellum, often with the narrowest portion of the apex taking a sharper upcurve or even, bending downwards. In flowers from some plants (e.g., *Carnevali & Moreno 7492*, from Honduras), the whole labellum gradually but sharply bends at a 45–55° angle whereas a specimen from Tabasco (photograph by M.A. González) has the labellum sharply upturned until the tip of the spur is facing forward. Nonetheless, we have been unable to detect any pattern to this variation, and it seems to vary even within populations of the species. Warford (1994) described the spur of *Galeandra greenwoodiana* as “typically hooked, occasionally not” and the one of *G. batemanii* as “typically gently curved upward, rarely straight or hooked.” Romero and Warford (1995) reported that, in both *Galeandra macroplectra* and *G. magnicolumna*, “the relative size of the spur may vary... from at least twice to more than twice as long as the lamina.”

Symmetry of the labellum lobes.

Few *Galeandra* flowers have perfectly symmetrical lobes, especially in the Mexican species: one of the apical lobes is, to some degree, slightly (*G. batemanii* and *G. sobralioides*) to conspicuously longer than the other (*G. greenwoodiana*).

Presence absence of an apiculus.

“An apiculus between the apical lobes may be produced but may be absent during drier periods; it does not seem that, in *Galeandra*, the presence or absence of an apiculus is a dependable taxonomic character” (Warford, 1994: 44). Likewise, the superposition of the sepals and petals can vary a great deal within a population or even between the flowers in the same inflorescence and it does not appear to be a reliable diagnostic character.

Hosts.

Some species show clear host preferences (e.g., *G. devoniana* for palm trees, including *Leopoldinia* spp. and *Mauritia aculeata* H.B.K. according to H. R. Schomburgk in Lindley, 1840a; personal observation, GAR-G). *Galeandra arundinis* has been found growing on *Acoelorrhaphe wrightii* in Belize and other portions of its geographical range, and *G. batemanii*, in Oaxaca, found on pine trees or occasionally as a lithophyte, whereas *G. greenwoodiana* has been found on the palms *Sabal rosei* Bacc. and *Cryosophila nana* (Kunth) Blume. Both *G. batemanii* and *G. sobralioides* have also been collected growing on live or dead pine trunks; *G. batemanii* has even beem found growing on the litter of gently sloped *Pinus*-savanna. However, most *Galeandra* species seem to be, as in other genera of Catasetinae, largely opportunistic as far as hosts are concerned.

The following key should assist in the identification of the four known Mexican galeandras.

KEY TO THE SPECIES OF GALEANDRA FOUND IN MEXICO

1a. Pseudobulbs cane-like, narrow to widely fusiform to cylindrical; labellum, in Mexican plants, light pinkish-red at the apex, plants from the lowlands on the Atlantic slopes in Tabasco, expected in Quintana Roo, Chiapas, and Campeche . . . . *G. arundinis*

1b. Pseudobulbs ovoid to pyriform, noticeably enlarged toward the base; labellum apex from light to dark burgundy; plants from Tabasco, Chiapas, Oaxaca on the Atlantic and Pacific slopes 2

2a. Leaves, *in vivo*, medium matte green; labellum apex light burgundy, labellum lobes usually distinctly asymmetrical, one being conspicuously longer than the other, not rounded at the apex; spur generally deflexed or hooked, rarely straight; plants from the Pacific slopes of the Sierra Madre del Sur . . . . *G. greenwoodiana*

2b. Leaves, *in vivo*, dark green with a silken sheen; labellum apex dark burgundy, labellum lobes rounded, symmetrical to only slightly asymmetrical; spur gently upturned or straight, rarely deflexed (but see discussion on orientation of spur above); plants from the Atlantic slopes of Tabasco or the both the Atlantic and Pacific slopes of Oaxaca 3

3a. Apex of the labellum slightly or no deflexed at all, *in vivo*, inner lamellae thickened at the apex and surpassing the outer keels; plants from the Atlantic slopes . . . . *G. batemanii*

3b. Apex of the labellum strongly deflexed; *in vivo*, inner lamellae not thickened at the apex and never surpassing the outer keels; plants from Pacific slopes . . . . *G. sobralioides*

LITERATURE CITED

AMES, O. AND D. S. CORRELL. 1953. Orchids of Guatemala. Fieldiana: Botany 26, No. 2: 472–474.

ARCHILA M., F., G. CHIRON, AND V. BERTOLINI. 2012. Descubrimientos en los humedales de Guatemala—nuevas especies para el género *Galeandra*/Orchidaceae. Revista Guatemalensis 15, No. 2: 6–18.

BACHMAN, S., J. MOAT, A. HILL, J. TORRE, AND B. SCOTT. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. ZooKeys 150: 117–126. DOI: 10.3897/zookeys.150.2109

BATEMAN, J. 1840. *Galeandra baueri*. The Orchidaceae of Mexico and Guatemala t. 19.

———. 1867. *Galeandra dives*. A Second Century of Orchidaceous Plants. L. Reeve & Co., London.

BEUTELSPACHER BAIGTS, C. R. 2008. Catálogo de las orquídeas de Chiapas. Lacandonia 2, No. 2: 25–122. Available at: https://docplayer.es/19509232-Catalogo-de-las-orquideas-de-chiapas.html

———. 2013. Guía de Orquídeas de Chiapas, 2ª edición. Asociación Mexicana de Orquideología, Ciudad de México.

———. AND I. MORENO MOLINA. 2018. Las Orquídeas de Chiapas. CHINOIN and Instituto de Biología, UNAM, Ciudad de México.

Bogarin, D., Z. Serracín, Z. Samudio, R. Rincón, and F. Pupulin. 2014. An updated checklist of the Orchidaceae of Panama. Lankesteriana 14, No. 1: 135–364.

Bridgewater, S. G. M., D. J. Harris, C. Whitefoord, A. K. Monro, M. G. Penn, D. A. Sutton, B. Sayer, B. Adams, M. J. Balick, D. H. Atha, J. Solomon, and B. K. Holst. 2006. A preliminary checklist of the vascular plants of the Chiquibul forest, Belize. Edinburgh Journal of Botany 63, No. 2–3: 269–321.

Carnevali, G., E. A. Pérez-García, C. L. Leopardi-Verde, J. L. Tapia-Muñoz, W. R. Cetzal-Ix, I. M. Ramírez-Morillo, and G. A. Romero-González. 2018. The *Encyclia ambigua* complex (Laeliinae, Orchidaceae), a synopsis and notes on *Encyclia virens* and *Epidendrum alatum*. Phytotaxa 372, No. 1: 1–21.

Chase, M. W. and H. G. Hills. 1992. Orchid phylogeny, flower sexuality, and fragrance seeking. BioScience 42: 43–49.

Dressler, R. L. 1981. The Orchids—Natural History and Classification. Harvard University Press, Cambridge, Massachusetts.

Escobar, R. 1972. Especies colombianas de difícil cultivo I. Orquideología 7: 151–154, 159–162.

González A., M. A. and C. M. Burelo R. 2012. Nuevo sitio de distribución de *Galeandra batemanii*, una orquídea amenazada de México. Mesoamericana (Panama) 16, No. 2: 192–193.

Hágsater, E., M. A. Soto, G. Salazar, R. Jiménez, M. López, R. Dressler. 2005. Las Orquídeas de México. Productos Farmaceúticos, S.A. de C.V., D.F., México.

Halcrow, M. and M. L. Halcrow. ca. 1968. Orchids of Belize. Government Printer, Belize.

Hammer, F. 1983. *Galeandra batemanii* Rolfe. Orchids of Nicaragua Part 2. Icones Plantarum Tropicarum 8: t. 746.

———. 1988. *Galeandra batemanii* Rolfe. Orchids of Central America—An Illustrated Field Guide. Selbyana 10, Supplement: t. 274.

Hooker, W. J. 1853. *Galeandra baueri* var. *floribus luteis*. Curtis's Botanical Magazine 79: t. 4701.

IUCN. 2012. IUCN Red List Categories and Criteria: Version 3.1. Second edition. Gland, Switzerland and Cambridge < https://portals.iucn.org/library/node/10315> accessed 5 May 2018.

Klaassen, A. 1979. Het geslacht *Galeandra* Ldl. Orchideeën 41, No. 2: 64–66.

Linden, L. 1901. *Galeandra batemanii* Rolfe. Lindenia 16: 21, t. 729.

Lindley, J. 1840a. *Galeandra devoniana*. Sertum Orchidaceum t. 37.

———. 1840b. *Galeandra baueri*. Edwards's Botanical Register 26: t. 49.

———. 1841. *Epidendrum lacertinum*. Edwards's Botanical Register 27: misc. page 53.

McLeish, I., N. R. Pearce, and B. R. Adams ["with contributions by J. S. Beiggs]. 1995. Native Orchids of Belize. A. A. Balkema, Rotterdam.

McVaugh, R. 1985. Orchidaceae. Flora Novo-Galiciana: a Descriptive Account of the Vascular Plants of Western Mexico 16. University of Michigan Press, Ann Arbor.

Monteiro, S. H. N., A. Selbach-Schnadelbach, R. P. de Oliveira, and C. van den Berg. 2010. Molecular phygenetics of *Galeandra* (Orchidaceae: Catasetinae) based on plastid and nuclear DNA sequences. Systematic Botany 35, No. 3: 476–486.

Mora, D. E. and J. T. Atwood. 1992. *Galeandra baueri* Lindley. Icones Plantarum Tropicarum 15: t. 1435.

Nelson S., C. H. 2008. Catálogo de las Plantas Vasculares de Honduras: Espermatofitas. Secretaría de Recursos Naturales y Ambiente, Tegucigalpa.

———. 2010 [2013]. Adiciones y comentarios a la flora de Honduras. Ceiba 51, No. 2: 70–88.

Ospina H., M. and R. L. Dressler. 1974. Orquídeas de las Américas. Litografía Arco, Bogotá.

Ossenbach, C., F. Pupulin, and R. L. Dressler. 2007. Orquídeas del Itsmo Centroamericano—Catálogo y Estado de Conservación/ Checklist and Conservation Status—Orchids of the Central American Isthmus. Editorial 25 de Mayo, Montes de Oca, Costa Rica.

Paxton, J. 1848. *Galeandra baueri* Lindl. Paxton's Magazine of Botany 14, No. 169: 49.

Pérez Munguía, D. E. 2015. Orquídeas nativas de Honduras 1. Ediciones Ramses, Tegucigalpa.

Pollard, G. E. 1974. El género *Galeandra* en México—The genus *Galeandra* in Mexico. Orquídea (Méx.) 4, No. 6: 163–168, 168–171.

Pupulin, F. 2002. Catálogo revisado y anotado de las Orchidaceae de Costa Rica. Lankesteriana No. 4: 1–88.

Reichenbach *filius*, H. G. 1854. Orchideae Warscewiczianae recientores. Bonplandia 2, No. 8: 96–102.

———. 1856. Stipulae Orchidaceae Reichenbachianae intra "Folia" Lindleyana intraaxillares. Bonplandia 4: 321–330.

———. 1857. Catalog der Orchideen-Sammlung von G. W. Schiller zu Ovelgönne an der Elbe, third edition. F. H. Nestler & Melle, Hamburg.

———. 1863. *Galeandra baueri*. Walpers—Annales Botanices Systematicae 6, Fasc. 5: 649.

Rolfe, R. A. 1892. Gardeners's Chronicle ser. 3, 12, No. 302: 430–431.

Romero, G. A. and N. Warford. 1995. Three new *Galeandra* (Orchidaceae: Cyrtopodiinae) species from the Venezuelan Guayana. Lindleyana 10, No. 2: 75–91.

Romero-González, G. A. and L. A. Garay. 2005. *Galeandra arundinis*. Pages 325–326 in F. Pupulin, ed., Vanishing Beauty I. Editorial de la Universidad de Costa Rica, San José, Costa Rica.

———. and C. Gómez. 2014. Novelties in the orchid flora of Venezuela VII. Cymbidieae, Catasetinae. Notes on *Galeandra* (Orchidaceae), including a new species. Harvard Papers in Botany 19, No. 2: 203–217.

Siegerist, E. S. 1983. *Galeandra*—A case of Taxonomic confusion. American Orchid Society Bulletin 52, No. 2: 159–162.

Soto-Arenas, M. A. and G. A. Salazar. 2004. Orquídeas. Pages 271–295 in A. J. García-Mendoza, M. J. Ordoñez, and M. Briones-Salas, eds., Biodiversidad de Oaxaca. Instituto de Biología, UNAM-Fondo Oaxaqueño para la Conservación de la Naturalez-World Wildlife Fund, Mexico.

———. and A. R. Solano-Gómez. 2007. Ficha técnica de *Galeandra batemanii*. In M. A. Soto-Arenas, compilator, Información actualizada sobre las especies de orquídeas del PROY-NOM-059-ECOL-2000. Instituto Chinoin A.C., Herbario de la Asociación Mexicana de Orquideología A.C. Bases de datos SNIB-CONABIO. Proyecto No. W029. México, D.F. Also available, presented in a different format, at: https://aprenderly.com/doc/3204683/galeandra-de-bateman-galeandra-batemanii-

van den Bergue, E. P. and I. Gurdian de van den Bergue. 2009. Orchid of Nicaragua—Field Guide. Gobierno de Reconciliación y Unidad Nacional, USAID, MARENA, Managua, Nicaragua. Available at: https://pdf.usaid.gov/pdf_docs/pbaaf654.pdf

Waldo, H. and D. W. Roubik. 1986. Nocturnal bee abundance and seasonal bee activity in a Panamanian Forest. Ecology 67, No. 2: 426–433.

Wcislo, W. T. and S. M. Tierney. 2009. Behavioural environments and niche construction: the evolution of dim-light foraging in bees. Biological Reviews 84: 19–37.

Warford, N. 1994. The Mexican galeandras (Orchidaceae). Lindleyana 9, No. 1: 39–49.

———. 1999. Pictorial notes—*Galeandra batemanii* and *Galeandra greenwoodiana*. Orchid Digest 63, No. 3: 129–133.

Warner, R., B. S. Williams, and T. Moore. 1887. *Galeandra baueri*. The Orchid Album 6: t. 267.

Wiard, L. A. 1987. An Introduction to the Orchids of Mexico. Comstock Publishing Associates, a Division of Cornell University Press. Ithaca, New York, U.S.A, and London, U.K.

Williams, L. O. 1939. Orchidaceae. Pages 279–287 in R. E. Woodson, Jr. and R. J. Seibert, Contributions toward a Flora of Panama III. Annals of the Missouri Botanical Garden 26, No. 4: 265–324.

———. 1946. Orchidaceae, *Galeandra* Lindl. Flora of Panama Part III, fascicle 3: 232, 334–335.

———. 1851. *Galeandra* Lindl. The Orchidaceae of Mexico. Ceiba 1, No. 3: 213.

APPENDIX

SPECIMENS CITED BUT NOT LISTED IN THE TEXT

Galeandra arundinis G.A. Romero & Garay
Puerto Lempira, Honduras, photograph by Delmer Jonathan (as *G. baueri*):
https://www.inaturalist.org/observations/40657788

Belize, *O'Neill 8347*
AMES:
https://s3.amazonaws.com/huhspecimenimages/JPG/02389153.jpg

MICH:
https://www.gbif.org/tools/zoom/simple.html?src=//api.gbif.org/v1/image/unsafe/https%3A%2F%2Fquod.lib.umich.edu%2Fcgi%2Fi%2Fimage%2Fapi%2Fimage%2Fherb00ic%3A1650585%3AMICH-V-1650585%2Ffull%2Fres%3A0%2F0%2Fnative.jpg

NY:
http://sweetgum.nybg.org/science/vh/specimen-details/?irn=4406086

Galeandra batemanii Rolfe
Chiapas, photograph by Diego Manzano:
https://www.inaturalist.org/observations/9265903

Galeandra dives Rchb.f. & Warsz. COLOMBIA ["N^{lle} Grenade"]: S^{ta} Martha…, Minca, 1000 m, "fl. pétales & sépales jaune & pourpre, labelle jaune avec une grande macule pourpre", July 1853, *L. Schlim 994* (K000364037).

This specimen was identified, by R. A. Rolfe, as "No doubt *G. dives* Rchb. f. et Warscew."

Although this species is often cited under the sole authorship of Reichenbach f., this author clearly stated, in his introduction to *Orchideae Warscewiczianae recientores* (Reichenbach f., 1854: 96) "Wir schätzen uns glücklich, hier die Beschreibung einer Anzahl der von unserm Freunde, Herrn J. v. Warscewicz entdeckten Arten unter unserer gemeinschaftlichen Autorität…"; "We are happy to present here the description of a number of species discovered by our friend, Mr. J. v. Warscewicz, under our collective authority."

Galeandra dives Rchb.f. & Warsz. at W:
https://www.gbif.org/occurrence/1230761845

The first page of Bateman (1867) is also shown on this image.

Galeandra greenwoodiana Warford, Lindleyana 9, No.1: 39. 1994. TYPE. MEXICO. Nayarit: near the Pacific coast, epiphytic on Sabal rosei Bacc. palm, 300 m, 24 June 1989, N. Warford & J. C. Amezcua 543 (Holotype: AMO; Isotype: AMES). Oaxaca: near Candelaria [Loxicha], on thorny dwarf palm, 300 m, flowers have somewhat darker pigmentation of the labellum apex (darker dull burgundy but show the distinctive labellum apex of this species: one of the lobes longer; slit-bilobate), 28 January 1993, *O. Suárez, E. W. Greenwwood & N. Warford 1644A* (AMES, AMO); same locality and information, *O. Suárez, E. W. Greenwwood & N. Warford 1644B* (AMES).

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A NEW SPECIES OF *NEEA* (NYCTAGINACEAE: *PISONIEAE*) FOR THE FLORA OF COLOMBIA

Gerardo A. Aymard-Corredor[1]

Abstract. *Neea gustaviaefolia*, a new species from the wet forests from "Sierra de La Macarena" and upper "Guaviare" river regions of Colombia (Guaviare and Meta departments) is described, illustrated, and its morphological relationships are discussed. This new species is a small tree of 6 m tall, on the basis of its alternate, oblanceolate larger leaves and a shorter terminal cymes inflorescence, verticillate (with three opposite primary branches), it does not appear to be closely allied to any other *Neea* species. This new species shares several other features with five species (*N. alumnorum, N. brevipedunculata, N. floribunda, N. itanhaensis and N. verticillata*). Morphologically, however, it is comparable to *N. alumnorum* and *N. itanhaensis* but it differs in its leaves, inflorescences, staminal perianth, and stamens number. In addition, ecological, floristic, and geological notes about the "La Sierra de La Macarena are included. A key for identifying species of *Neea* to Colombia is also provided. *Neea gustaviaefolia* is remarkable for its alternate, larges leaves (30–65 × 10–20 cm), in an otherwise predominantly opposite, small to medium (4–25 × 2–8 cm) leaved genus, and it increases to 27 the number of species of the genus to Colombia flora.

Keywords: *Neea*, Nyctaginaceae, "Sierra de La Macarena," alternate leaves, wet forest

Resumen. *Neea gustaviaefolia* de bosques húmedos de la Sierra de La Macarena y la cuenca alta del río Guaviare de Colombia (departamentos de Guaviare y Meta) es descrita, ilustrada, y sus relaciones morfológicas son discutidas. Por sus hojas alternas, grandes, oblonceoladas y la inflorescencia cimas verticiladas, muy corta terminales (con tres ramas primarias opuestas), *Neea gustaviaefolia* no se relaciona con ninguna de las otras especies de *Neea*. Esta nueva especie comparte algunos caracteres morfológicos con cinco especies (*N. alumnorum, N. brevipedunculata, N. floribunda N. itanhaensis, N. verticillata*). Sin embargo, morfológicamente, es comparable con *N. alumnorum* and *N. itanhaensis* de las cuales difiere en sus hojas, inflorescencias, perianto estaminal, y el número de los estambres. Se presentan notas ecológicas, florísticas y geológicas acerca de la Sierra de La Macarena y una clave de las especies del género en Colombia. *Neea gustaviaefolia* es notable por sus hojas alternas, muy grandes, en un género donde predominan las hojas opuestas, de tamaños pequeño a mediano. Este nuevo hallazgo eleva a 27 el número de especies del género para la flora de Colombia.

Palabras claves: *Neea*, Nyctaginaceae, Sierra de La Macarena, hojas alternas, bosques húmedos

Neea Ruíz & Pav. (1794: 52), is a genus considered part of Nyctaginaceae, Pisonieae (Heimerl, 1934; Douglas and Spellenberg, 2010; Rossetto et al., 2019a, Rossetto and Caraballo-Ortiz, 2020). It is the most diverse and representative genus in Nyctaginaceae, distributed throughout tropical and subtropical areas around the world, with ca. 400 species and thirty-one genera (Bittrich and Kühn, 1993; Douglas and Manos, 2007). The genus has a Neotropical distribution and ranges from southern Florida, central to southern Mexico through Central America, the Caribbean, Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil, Bolivia and Paraguay (Damascena and Coelho, 2009 Onwards; Ulloa Ulloa et al., 2018 Onwards) and comprises ca. 84 species (World Checklist of Vascular Plants; kew.org).

Neea is most diverse throughout the Amazon and Guayana bioregions, where the species are found in lowland ("terra firme") vegetation and montane forests. Several species are found over rocky slopes and oligotrophic soils derived from the Precambrian crystalline basement of the Guayana Shield (e.g., *N. grandis* Steyerm. & Maguire, *N. neblinensis* Steyerm. & Maguire), and drained by black waters rivers (e.g., *N. clarkii* Steyerm., *N. mapourioides* Steyerm.) on non-flooded forests known as "caatinga Amazonica", "campina" or "campinarana" (Steyermark and Aymard, 2003; da Silva Costa et al., 2021). The remaining species appear to require more specific habitats, like foothills in the low to medium altitude (500–1500 m) mountains of the Andes, along the Pacific Coast of Colombia and Ecuador, the dry forests, and xerophytic ecosystems a well. Several species have wide geographic distributions (e.g., *N. amplifolia* Donn. Sm., *N. divaricata* Poepp. & Endl., *N. floribunda* Poepp. & Endl., *N. ovalifolia* Spruce ex J. A. Schmidt), whereas others are endemic to particular geographical areas, such as some species found only in Caribbean islands (Ulloa Ulloa et al., 2018 Onwards), or in Southeast Brazil (Furlan & Giulietti, 2014; Rossetto et al., 2019b; Rossetto and Ferraz, 2020).

Ethnobotanical information about *Neea* in the lowlands is not commonly found in the literature. Burger (1983) reported that the fruits of *Neea* ssp. are used for coloring in Costa Rica. The bark of *Neea brevipedunculata* Steyerm., *N. clarkii* Steyerm., *N. mapourioides* Steyerm. and *N. robusta*

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Steyerm. is crushed and used by Arawak groups (i.e., Baniwa, Kuripako) in the upper Rio Negro region of Colombia and Venezuela to treat snake, spider, and ant bites. These species are known with the local name of "Palo de culebra" (Steyermark and Aymard, 2003). Guillermo Klug observed that the Indians of the Putumayo and Caquetá departments, Colombia paint their teeth black with the leaves of *N. parviflora* Poepp. & Endl. by chewing them, to preserve them from infection. Also, he noticed that these Indians have very sound and strong teeth, this taxon is known as "Yanamuco" (*G. Klug 1955*, MO; Jan-Feb 1931).

Neea is characterized by its dioecious condition, the leaves are commonly opposite, sometimes verticillate, rarely alternate, and the staminate perianth is usually urceolate, sometimes tubular to ellipsoid or infundibuliform with the stamens included, the pistillate perianth has stigmas only rarely exserted, and the pistil sessile or narrowed at the base.

Neea is closely related to *Guapira* Aublet (1775: 308): both genera have unarmed stems and branches and fleshy anthocarps. These two genera have traditionally been treated as distinct taxa based on the shape of the staminate perianth and the stamen position in the perianth, which is exserted in *Guapira* and inserted in *Neea* (Standley, 1937; Burger, 1983; Steyermark and Aymard, 2003; Harling, 2010). Burger (1983) was the first to recommend that both genera should be united under *Guapira*. Molecular evidence indicates that these genera form a single lineage (Douglas and Manos, 2007; Rossetto et al., 2019a), and that exserted stamens is a homoplastic character (Rossetto et al., 2019a). However, other researchers (Chagas and Costa Lima, 2020) considered that these studies are based on a small sample of species (20%), and the resulting data still do not represent a robust phylogenetic support to demonstrate that these entities should be merged. Nevertheless, morphologically, *Guapira* and *Neea* can be distinguished by the state characters presented in Burger (1983), Harling (2010), Pool (2001), DeFilipps and Maina (2003) and Steyermark and Aymard (2003).

Throughout the years, *Neea* has been infamously known to be one of most difficult genera among Neotropical flowering plant genera (Standley, 1931; Douglas and Spellenberg. 2010). These authors pointed out that many diagnostic characters are not well represented in herbarium specimens, which, combined with the relatively sparce collections of these often-dioecious plants, has meant that species in this genus remain poorly understood. In addition, most exsiccatae differ in one or several characters from one another, but without any discernible coordination (Harling, 2010), and many mis-identified collection have been accumulated in herbaria for decades (Steyermark, 1987). These authors assumptions partially are true. Nonetheless, after studying this group for the last two decades, it is obvious that an additional problem is the absence of experts in this group (*Pisonieae*) that are familiar with the bulk of the ca. 190 species.

Steyermark and Aymard (2003) identified two taxonomically useful inflorescence characters that separate species: 1) inflorescence cauliflorous or ramiflorous on the old stem versus inflorescence axillary or terminating the stem or its branches; 2) the junction of lowest axes of inflorescences with summit of peduncle enlarged, 2.5–4 mm wide versus the junction of lowest axes of inflorescence with summit of peduncle not manifestly enlarged, 0.8–2 mm wide.

No comprehensive monograph of *Neea* has been completed, although the genus has been largely treated for Flora of Peru (Standley, 1937), Flora of Guatemala (Standley and Steyermark, 1946), Flora of Panama (Woodson et al., 1961), Flora of Belize and Petén region (Lundell, 1962), Flora of Costa Rica (Burger, 1983), Flora de Nicaragua (Pool, 2001), Flora of the Guianas (DeFilipps and Maina, 2003), Flora of the Venezuelan Guayana (Steyermark and Aymard, 2003), *Manual de Plantas de Costa Rica* (González-Ramírez, 2007), Flora of Ecuador (Harling, 2010), and Flora of Brazil (Furlan & Giulietti, 2014).

The present contribution increases the number of *Neea* species known from Colombia (to 27 species) and Venezuela (29), the two countries with the highest number of species in the genus. In this geographical and taxonomical context, *N. spruceana* Heimerl is treat here as diferent from *N. oppositifolia* Ruiz & Pav., *N. laetevirens* Standl. is considering a synonymy of *N. psychotrioides* Donn. Sm., *N. divaricata* Poepp. & Endl. and *N. virens* Poepp. ex Heimerl are recognized as validate species, and the record of *N. nigricans* Fawc. & Rendle is based in Choisy (1849).

Material and Methods

This work is based on morphological (using a dissecting stereomicroscope) and herbarium studies in COAH, COL, GH, HUA, MO, NY, MEDEL, PORT, and VEN (herbarium codes after Thiers, 2019). Perhaps one of the most commonly consulted public datasets (Global Biodiversity Information Facility (GBIF; www.gbif.org) was not used in this work since recent research has found that 29–90% of the records are potentially erroneous, with large variation across taxonomic groups (Zizka et al., 2020). However, the world checklist of vascular plants (WCVP) was consulted: this dataset is a comprehensive list of scientifically described plant species, compiled over four decades, from peer-reviewed literature, authoritative scientific databases, herbaria and observations, then reviewed by experts (Govaerts et al., 2021).

Historical taxonomic literature on *Neea* was examined using Biodiversity Heritage Library website (http://www.biodiversitylibrary.org). In particular, the protologues in Choisy (1849), Schmidt (1872), Heimerl (1891, 1897, 1914, 1932, 1934), and Huber (1909) were examined. Current bibliography on *Neea* were scrutinized, mainly the treatments of Nyctaginaceae in the Flora of the Guianas (DeFilipps and Maina, 2003), the Flora of the Venezuelan Guayana (Steyermark and Aymard, 2003), the Flora of Ecuador (Harling, 2010) and Flora of Brazil (Furlan & Giulietti, 2014). Also, the checklists: *Nuevo Catálogo de la Flora Vascular de Venezuela* (Aymard, 2008), *Catálogo de plantas y líquenes de Colombia* (Bernal, 2016) and *Catálogo de las plantas con flores de la Amazonia colombiana*

(Infante-Betancour and Rangel-Ch., 2018) were reviewed. Type specimens of *Neea* species involved in this study were examined using on-line images from JSTOR Global Plants (https://plants.jstor.org/). In addition, International Plant Names Index (https://www.ipni.org/) and Tropicos (http://legacy.tropicos.org/Home.aspx) were also consulted to update the current nomenclature and geographical information.

The specific terminology for vegetative characters, vestiture description, inflorescences, flowers, and fruit morphology follow Font-Quer (2001), Harris and Harris (2006), and Endress (2010).

To determine the conservation status of *N. gustaviaefolia* (according to IUCN categories and criteria; IUCN, 2017), the extent of occurrence (EOO) and area of occupancy (AOO) were calculated using the supporting Red List threat assessments with GeoCAT (Bachman *et al*. 2011), constantly updated through the https://www.kew.org/science/our-science/projects/geocat-geospatial-conservation-assessment-tool.

TAXONOMY

Neea gustaviaefolia Aymard, *sp. nov.*
TYPE: COLOMBIA. Meta. Sierra de La Macarena, sector Oriental, selvas densas entre los ríos Güejar y Sansa, 2°52'N; 73°54'O, 500–1000 m, 24 Agosto 1950 (fl), *Jesús Medardo Idrobo 481* (Holotype: COL). Fig. 1–2.

Neea gustaviaefolia can be distinguished from all other species previously described for the genus by the combination of the following characters: small tree, ca. 6 m tall, oblanceolate leaves, secondary veins 15–17; canaliculate on the upper surface, elevated on the lower surface, inflorescence with shorter and stout penducle, 10–40 × 4–7 mm, compound by terminal cymes, with three opposite, verticillate primary branches, staminal perianth tubular, sparsely ferrugineous pubescent outside and stamens 9.

Small *tree* 6 m tall, 6–10 cm diameter; branches glabrous, fistulous, striate, bark flaking off when mature. *Leaves* alternate, glabrous, pale green (olive) to brown when dried and opaque on both surfaces, blades 40–46 × 10–15 cm, coriaceous, oblanceolate, glabrous on both surfaces, with sparsely yellow dots on the lower surface, apex acute, base acute-attenuate, margins entire, revolute, venation pinnate; midvein and secondary veins canaliculate on the upper surface, elevated on the lower surface; secondary veins brochidodromous, 15–17 pairs, arcuated and convergent towards margin and linking 5–7 mm to the margin, tertiary veinlets obscure on the upper surface, elevate on the lower surface, forming large areoles, petiole stout, 1.5–2.5 × 0.3–0.5 cm. *Staminate inflorescences,* 7–10 × ca. 11 cm, terminal cymes, erect, peduncle 1–4 cm × 0.4–0.7 mm, thickened, striate, glabrous; with three opposite, verticillate primary branches, 4–4.5 × 0.2–0.4 cm, glabrous, each branch with two basal bracts (lanceolate, ca. 3 × ca. 1 mm, glabrous), these branches, above formed 2–4 alternate secondary axes, 8–16 mm long, shortly dense ferrugineous, bearing a solitary flower or groups of three flowers born along the length of these axes. bracts at base of secondary axis lanceolate, ca. 1 mm long, ferrugineous on both sides. *Staminate perianth* sessile, subtended by 1–3 bracteoles, often unequal at flower base, 0.50–0.60 mm long, acute, covered with ferrugineous trichomes outside, glabrous inside; perianth 3–4 × 1–1.5 mm, tubular, sparsely adpressed ferrugineous outside, more dense at the base, glabrous inside, 5-lobed, open lobes acute; stamens 9, included, filaments 0.5–1 mm long, unequal, connate at the base, glabrous, anthers 0.5–0.8 mm, oblong, glabrous; pistillode ca. 2 mm long, glabrous. *Pistillate flowers* and anthocarps not seen.

Phenology: this new species has been collected with flowers in bud and open flowers in June and August.

Etymology: the epithet *gustaviaefolia* is coined after the large and oblonceolate leaves of the species that resemble the leaves of the great majority of the species of the genus *Gustavia* L. (Lecythidaceae).

Distribution and ecology: the species is hitherto known to occur in primary or secondary wet forest at 100–1000 m elevation, located in "Serranía de La Macarena" and SE of San José del Guaviare, in the Meta and Guaviare departments (Fig. 2). The type locality, the "Serranía de La Macarena" is an isolated mountain range separated by about 40 km at their northern extreme from the East Andes. The range, ca. 120 km long and 30 km wide, is oriented from north to south. The highest elevation reaches 1,250 m, the highest point of the Orinoquia region. According to Pinson et al. (1962) and Díaz-Merlano (2016), the basement rocks on the east side of the Macarena include the Precambrian granite of the Guyana shield in the Guaviare River valley, and the San José del Guaviare region. The rocks of the shield are overlayed by sandstones and conglomerates of the Vaupés formation of lower Paleozoic to the lower Oligocen age. The origin of the Macarena range is associated with the dragging of a block of the Cordillera Oriental with a rupture plane related to the Algeciras-La Uribe faults. The proposed boundary of the Orinoquía-Amazonia watersheds allows the segregation of the set of blocks associated with the Amazon from Southwest to Northeast with the Amazonas, Putumayo, Caquetá and Vaupés blocks or mountain range block. Therefore, the boundary between the two natural regions is marked by the beginning of the Inírida block that together with the Guaviare, Vichada, Tomo and Arauca blocks define (based on the watersheds), the Amazonian and Orinocense regions of Colombia (Jaramillo and Rangel-Ch., 2014; Rangel-Ch. and Infante-Betancour, 2018). This natural region is well known by its four interesting biogeographical types of vegetation: the lowland a medium forests with presence of numerous Amazonian and Guayana elements (e.g., *Calycophyllum spruceanum* (Benth.) Hook. F ex K. Schum., Rubiaceae; *Justicia macaranensis* Leonard, Acanthaceae; *Petrea maynensis* Huber, Verbenaceae), the Andean region closely relate with the slopes of the Colombian Eastern Cordillera, the Orinoquia savannas, and a sector dominated by tepui-like vegetation, located on top of La Macarena mountains (Stevenson et al., 2004). A phytosociological study performed in this region (Romero-V. et al., 2011),

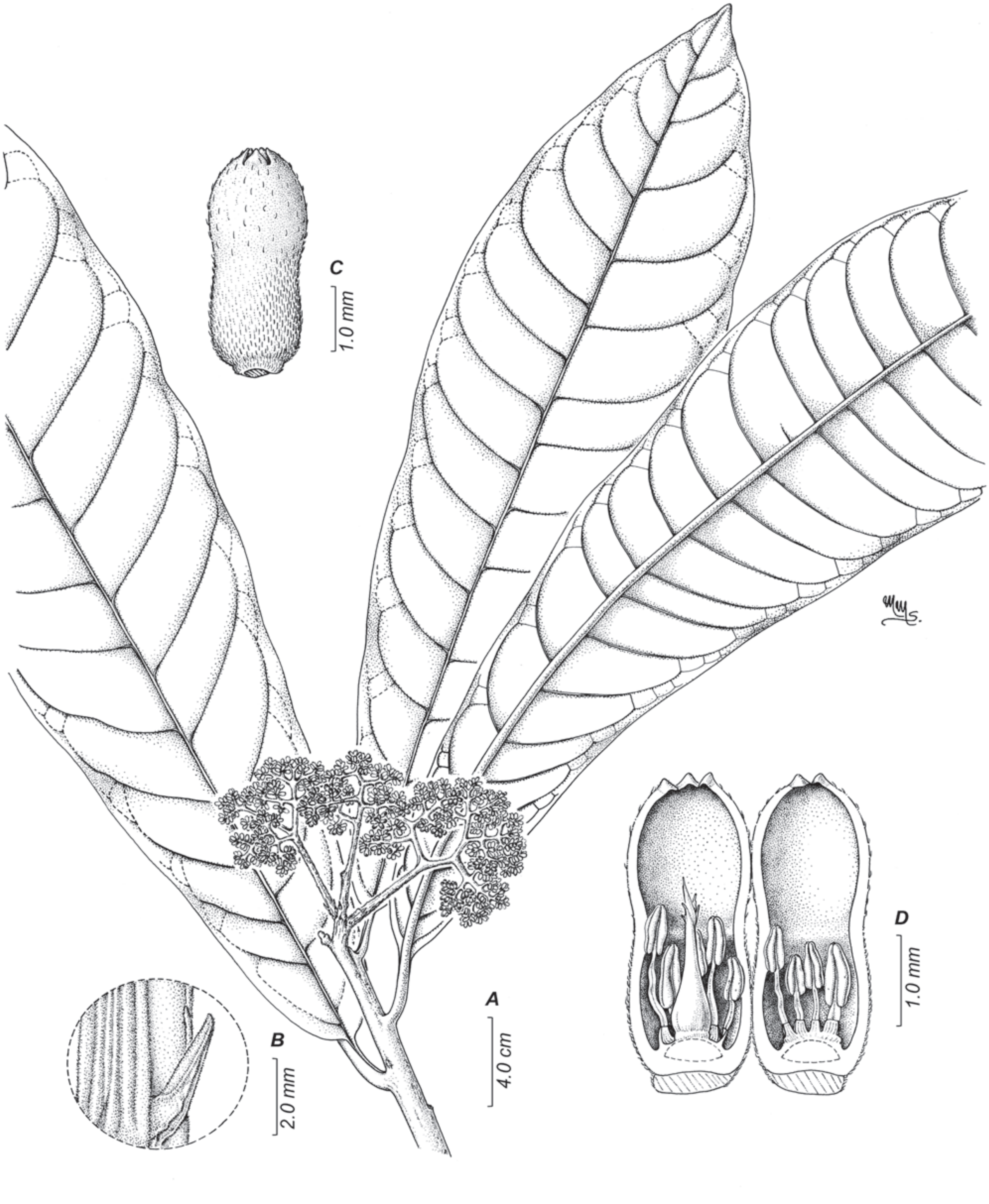

FIGURE 1. *Neea gustaviaefolia* Aymard **A**, habit showing the branch of staminate plant and larger oblanceolate alternate leaves; **B**, basal bract located on primary branches; **C**, frontal view of the staminate perianth bud; **D**, inside the staminate perianth in longitudinal section showing the stamens and the sessile pistillode. Based on the holotype.

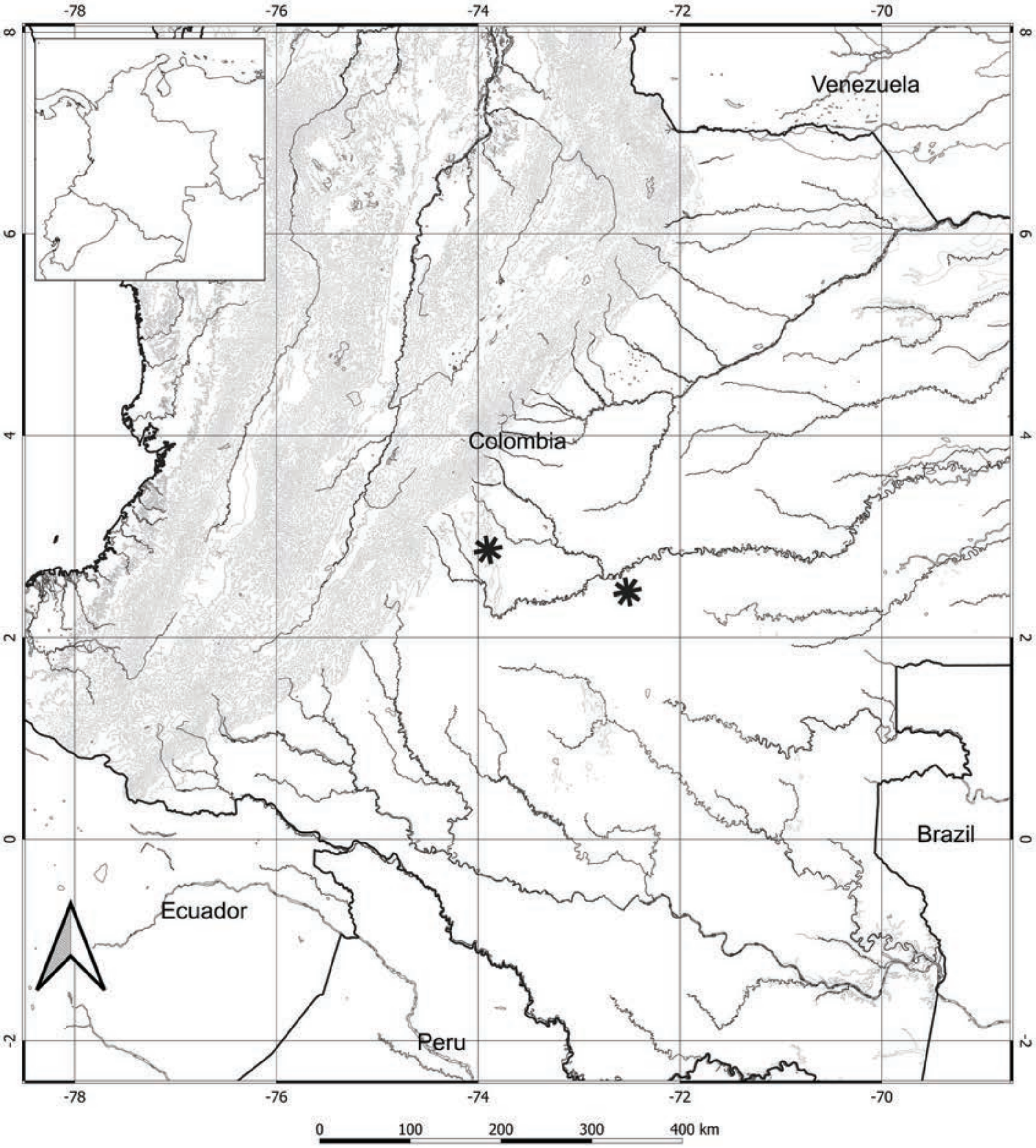

FIGURE 2. Geographical distribution of *Neea gustaviaefolia* Aymard.

classified the forest vegetation as a large formation made up of palm communities of *Socratea exhorriza* (Mart.) H. Wendl. (Arecaceae) and *Iryanthera hostmannii* (Benth.) Warm (Myristicaceae). This sintaxonomic unit encompasses two formations: (1) forests located between 475–550 m dominated by *Batocarpus orinocensis* H. Karst. (Moraceae) and *Pseudosenefeldera inclinata* (Müll. Arg.) Esser (Euphorbiaceae) and (2) palm communities at 380–450 m dominated by *Syagrus orinocensis* (Spruce) Burret (Arecaceae) and *Virola elongata* (Benth.) Warm. (Myristicaceae).

Colombia has among the highest plant diversity, types of vegetation, and number of endemic species in the world (Rangel-Ch., pers. com., 2021). Infante-Betancour and Rangel-Ch. (2018a) reported 760 species, in 411 genera and 95 families of plants for "Sierra de La Macarena," in only 1.472 collections that covered 1.087 km^2. This highly diversity is associated by the interrelation among the Andes system, with the Orinoquia and Amazonian complexes (Infante-Betancour and Rangel-Ch. (2018b). It is one the less documented world's biodiversity hotspots and yet is threatened by road building, deforestation, and general degradation (for a review see: Murillo-Sandoval et al., 2021).

Additional specimen examined: COLOMBIA. Guaviare: San José de Guaviare, vereda Triunfo II, Finca El Silencio de Juan Gordillo, bosque secundario, 02˚27'3.96"N; 72˚31'4.2"W, 200 m, 25 June 2003. *Rene López-L., Mario Coy & Armando Lucena 8255* (COAH).

Conservation status. Currently, this species is only known from the type and one additional collection, and it is reported here as rare species. However, under IUCN (2017) guidelines two localities constitute deficient data (DD) to determine its conservation status. Nevertheless, it should be regarded as Endangered (EN) based on the criterion B1ab(iii)+2ab(iii), due to the lower number of known localities (two) and to it smaller estimated Area of Occupancy, with just 12,000 km^2, an estimated Extent of Occurrence of 120.406 km^2 (IUCN, 2017), and the continuous deforestation and degradation of the ecosystems of the "Sierra de La Macarena" and the area located south of San José de Guaviare. These areas had been highly deforested during the last five decades, especially in the years through the post-conflict period. This expansion happens more quickly and without regulation, with significantly greater agricultural and cattle ranching patch sizes due the emergence of illegal land uses, that unfortunately accelerate land cover change in the coming years (for a review see: Murillo-Sandoval et al., 2021). Although conservation status assessments can still be carried out for species with such low numbers of collections (Rivers *et al*. 2011), it may be hard to determine whether an appearance of rarity in a species is due to the lack of data or to its actual rarity. In addition, the region where *N. gustaviaefolia* was found, *"Parques Nacionales Naturales Sierra de La Macarena y Tinigua"* are apparently well protected by Colombian National Park service (*Parques Nacionales Naturales de Colombia*).

Given its alternate (in a predominantly opposite-leaved genus), oblanceolate larger leaves and a shorter terminal cymes inflorescence, verticillate (with three opposite primary branches), it does not appear to be closely allied to any other *Neea* species. However, this new species does share several features with five species (*N. alumnorum* M.Pignal, Soares Filho & Romaniuc*, N. brevipedunculata* Steyerm. *N. floribunda* Poepp. & Endl*., N. itanhaensis* E. F. S. Rossetto & J. R. Ferraz *and N. verticillata* Ruiz & Pav.). By its inflorescence structure (shorter penducle with three opposite verticillate primary branches) and larger, oblonceolate alternate leaves, *N. gustaviaefolia* represents a unique combination of features that does not occur in any species of the genus. According with Rossetto et al. (2019b), only four species so far have verticillate inflorescences (*N. amplexicaulis* Dwyer & M.V.Hayden*, N. pendulina* Heimerl, *N. uleana* (Heimerl) Furlan, *N. theifera* Oerst.). Morphologically, this new species is relatively comparable to *N. alumnorum* M.Pignal, Soares Filho & Romaniuc from Bahia state, Brazil (Pignal et al., 2013)) and *N. itanhaensis* E. F. S. Rossetto & J. R. Ferraz from São Paulo state, Brazil (Rossetto et al., 2019b). Nevertheless, it differs from the five species mentioned (*N. alumnorum, N. brevipedunculata, N. floribunda, N. itanhaensis and N. verticillata*) in the vegetative and reproductive characters discussed in the diagnosis, in Table 1, and to Colombian taxa in the following key.

KEY TO SPECIES OF *NEEA* FOUND IN COLOMBIA

(MODIFIED FROM STEYERMARK AND AYMARD, 2003; ENDEMIC SPECIES INDICATED WITH THE SYMBOL "◆").

1a. Leaves alternate 2

1b. Leaves opposite, subopposite, verticillate or subverticillate in whorls of 3 or 4 5

2a. Inflorescence cauliflorous on the old stem or ramiflorous. . . *N. floribunda* (Amazonas, Antioquia, Caquetá, Guaviare, Meta, Putumayo, Vaupés)

2b. Inflorescence axillary or terminating the stem or its branches 3

3a. Leaves coriaceous, oblanceolate, 40–46 × 10–15 cm, secondary veins 15–17, impressed and canaliculate on the upper surface; brown when dried; inflorescence subumbellate . . . . *N. gustaviaefolia* (Guaviare, Meta) ◆

3b. Leaves thickly papyraceous, charthaceous or subcoriaceous, elliptic to broadly-elliptic or obovate-rotundate, 7.5–30 × 2.5–12 cm, secondary veins 6–10, obscure or slightly evident on the upper surface, bright-green, yellow or yellowish-green; inflorescence corymbose or paniculate 4

4a. Tree 10 m tall: leaves elliptic, elliptic-rotundate or obovate-rotundate, thickly papyraceous or subcoriaceous, apex long-caudate, acumen ca. 2 cm long, secondary veins 10–12; inflorescence paniculate; peduncle stout, ca. 4.5 × 0.3–0.4 cm . . . . *N. darienensis* (Antioquia and Chocó department)

4b. Shrub to treelet to 6 m tall: leaves elliptic to broadly-elliptic, charthaceous, apex acute to acuminate, acumen ca. 1 cm long; secondary veins 6–8; inflorescence corymbose; peduncle 1–2(-5.6) × 0.2 cm. . . . . . . *N. virens* (Amazonas, Antioquia, Caquetá, Chocó, Magdalena, Putumayo)

5a. Leaves verticillate, subverticillate or ternate. 6

5b. Leaves opposite or subopposite. 13

6a. Inflorescence cauliflorous on the old stem or ramiflorous 7

6b. Inflorescence axillary or terminating the stem or its branches 8

7a. Leaves oblong-elliptic to elliptic or broadly elliptic, apex acute to cuspidate; peduncle 0.5–3 cm long; anthocarp 1.6–2 cm long, oblong-ellipsoid . . . . *N. floribunda* (Amazonas, Antioquia, Caquetá, Guaviare, Meta, Putumayo, Vaupés)

7b. Leaves lanceolate, lanceolate-elliptic to narrowly elliptic or oblanceolate, apex acuminate; peduncle 4–6 cm long; anthocarps 1.4–1.7 cm long, oblong. . . . . *N. verticillata* (Amazonas, Caquetá, Meta)

8a. Branches, petioles, leaves on the lower surface (more evident in the midrib and secondary veins), inflorescences and bracteoles densely ferrugineous tomentose . . . . *N. woronowii* (Chocó, Santander) ◆

8b. Branches, petioles, leaves on the lower surface, inflorescences and bracteoles glabrous, sparsely puberulent or minutely adpressed-ferrugineous 9

9a. Leaves lanceolate, lanceolate-elliptic to narrowly elliptic or oblanceolate; anthocarps 1.4–1.7 cm long, oblong . . . . *N. verticillata* (Amazonas, Caquetá, Meta)

9b. Leaves elliptic, narrowly elliptic, obovate-elliptic, oblanceolate or oblong; anthocarps 0.4–1.2 cm long. 10

Key to species of *Neea* found in Colombia cont.

10. Leaves membranaceous to chartaceous; inflorescence 10–17 cm long, with a slender, filiform and elongate rachis, ca. 0.5 mm wide 11

10b. Leaves coriaceous; inflorescence 2–8 cm long, rachis stout, 1–3 mm wide 12

11a. Leaves oblong to elliptic, 12–25 × 5–9 cm; staminate perianth tubular anthocarp ellipsoid to obovoid . *N. laxa* (Amazonas, Guaviare, Meta)

11b. Leaves narrowly elliptic, elliptic or oblanceolate; 4–12 × 2–4 cm: staminate perianth ovoid-urceolate; anthocarp ellipsoid or narrowly ovoid . . . . . *N. delicatula* (very probably in Antioquia and Chocó departments; in Darién, Colombian-Panamanian border).

12a. Staminate perianth tubular-elliptic; pistillate perianth tubular; anthocarps broadly ellipsoid or lanceolate . . . . . *N. psychotrioides* (Antioquia, Cauca, Chocó, San Andrés, Providencia y Santa Catalina, Valle?)

12b. Staminate perianth urceolate, sometimes infundibuliform; pistillate perianth suburceolate, campanulate or infundibuliform; anthocarps narrowly ellipsoid or oblong . . . . . *N. spruceana* (Amazonas, Antioquia, Casanare, Guaviare, Guianía, Meta, Putumayo)

13a. Leaves sessile or nearly so, the petiole 1 mm long; inflorescence terminal, or both axillary and terminal on the stem. 14

13b. Leaves petiolate, the petiole 0.3–6.5 cm long; inflorescence either cauliflorous on the old stem, ramiflorous, axillary or terminal on the branches 15

14a. Leaves usually obtuse at base; young stem with subspreading rufous-brown hairs; inflorescence both axillary and terminal on the stem. . . . . . *N. ignicola* (Vichada)

14b. Leaves amplexicaul, clasping the stem, base rotundate-truncate or cordate; young stem glabrous; inflorescence terminal . . . . . *N. amplexicaulis* (Chocó)

15a. Inflorescence cauliflorous on the old stem 16

15b. Inflorescence axillary or terminating the stem or its branches 20

16a. Staminate perianth urceolate, ferrugineous basaly outside; stamens 5–13 . . . . . *N. verticillata* (Amazonas, Caquetá, Meta)

16b. Staminate perianth tubular, subinfundibuliform or infundibuliform, glabrous or minutely sparsely puberulent outside; stamens 6–9. 17

17a. Leaves ovate, ovate-elliptic, ovate-lanceolate or lanceolate, 4–15 × 1.5–6 cm; main secondary veins 16–25, subhorizontal or ascending at an angle < 20˚ . . . . . *N. ovalifolia* (Guaviare, Guianía?, Magdalena)

17b. Leaves oblanceolate-elliptic, oblanceolate, lanceolate-elliptic, obovate, oblong, or oblong-ovate, 8–45 × 3–18 cm, main secondary veins 8–14, ascending at an angle usually > 30˚. 18

18a. Leaves 8–12.5(–15) × 2.5–4.5(–5.5) cm; staminate perianth subinfundibuliform; stamens 8 . . . . . *N. clarkii* (Caquetá, Guian*ía*?)

18b. Leaves 10–45 cm long × 3.5–16 cm; staminate perianth tubular or infundibuliform; stamens 7–10. 19

19a. Principal secondary leaf veins 6–8 each side, slightly elevated on lower surface; staminate perianth infundibuliform . . . . . *N. brevipedunculata* (Antioquia, Guianía)

19b. Principal secondary leaf veins 8–12 each side, conspicuously elevated on lower surface; staminate perianth tubular . . . . . *N. floribunda* (Amazonas, Antioquia, Caquetá, Guaviare, Meta, Putumayo, Vaupés)

20a. Leaves broadly rounded or submarginate at the apex, obovate or elliptic-obovate; perianth subcampanulate; anthocarps usually costate or striate longitudinally . . . . . *N. obovata* (Amazonas, Caquetá, Guianía, Vaupés)

20b. Leaves mainly acute to acuminate or long-caudate at the apex, of shapes other than above; perianth mainly tubular to ellipsoid, subinfundibuliform, infundibuliform, campanulate, suburceolate or urceolate; anthocarps not costate or striate longitudinally 21

21a. Main secondary veins of leaf blades 17–26 each side. 22

21b. Main secondary veins of leaf blades generally 6–16 each side. 25

22a. Stems and branches hirsute or hirtellous; leaves hirsute to reddish hirsute-tomentose on the lower surface; inflorescences densely reddish hirsute with patent trichomes 23

22b. Stems and branches glabrous or sparsely pilose; leaves, glabrous or ferrugineous puberulent on the lower surface; inflorescences sparsely ferrugineous. 24

23a. Leaves bullate on the upper surface, all blade hirsute to hirtellous on the lower surface; bracteoles filiform, ciliate at margin, staminate perianth 5–8 × 3–6 mm . . . . . *N. hirsuta* (Bolívar)

23b. Leaves not bullate on the upper surface; midrib and secondary veins hirsute on the lower surface; bracteoles oblong to lanceolate, glabrous to puberulous; staminate perianth 3–4 × ca. mm. . . . . . *N. parviflora* (Amazonas, Caquetá, Chocó, Putumayo)

24a. Leaves ovate, ovate-elliptic, ovate-lanceolate or lanceolate, main secondary veins subhorizontal or ascending at an angle < 20˚, relatively close together, 3–4 mm apart; petioles 5–19 mm long . . . . . *N. ovalifolia* (Guaviare, Guianía?, Magdalena)

24b. Leaves oblong-elliptic, main secondary veins ascending at an angle usually > 30˚, petiole ca. 8 mm long . *N. constrictoides* (Cundinamarca)

25a. Branches, petioles, leaves on the lower surface (more evident in the midrib and secondary veins), inflorescences and bracteoles densely ferrugineous tomentose . . . . . *N. woronowii* (Chocó, Santander) ◆

25b. Branches, petioles, leaves on the lower surface, inflorescences and bracteoles glabrous, sparsely puberulent or minutely adpressed-ferrugineous. 26

26a. Staminate perianth ferrugineous-puberulent or moderately ferruginous-pubescent toward base. 27

26b. Staminate perianth glabrous, tomentose, sometimes sparsely puberulous near base, or minutely papillate apically. 28

27a. Leaves lanceolate-elliptic or oblanceolate-elliptic, densely black punctate on the lower surface; bracteoles subtending the flowers ovate-deltoid, 3–4 mm long, densely ferrugineous tomentose outside; staminate perianth subinfundibuliform, moderately ferruginous-pubescent. . . . . . *N. clarkii* (Caquetá, Guianía?)

27b. Leaves oblong to oblong-elliptic, without black puntactions on the lower surface; bracteoles subtending the flowers linear-lanceolate, ca. 1 mm long, sparsely brown-puberulous outside; staminate perianth oblong-urceolate, sparsely ferruginous-puberulent . . . . . *N. divaricata* (Amazonas, Antioquia, Bolívar, Guaviare, Huila, Putumayo, Risaralda, Valle)

Key to species of *Neea* found in Colombia cont.

28a. Leaves with secondary veins 6–16; inflorescence paniculately or corymbiform and irregularly branched; staminate perianth 4–10 × 1.5–4 mm. 29

28b. Leaves with secondary veins 5–7; inflorescence umbellately or trichotomously branched; staminate perianth 2–3.5 × 0.8 mm 38

29a. Leaves yellow, yellowish, green-yellowish or yellow-brown when dried, shiny on the upper surface 30

29b. Leaves green, dark green, dark brown or black when dried, dull on the upper surface 32

30a. Leaves elliptic, broadly-elliptic, elliptic-rotundate or obovate-rotundate; inflorescence with short a thick raquis, 1–6.5 cm long, 1–4 mm wide 31

30b. Leaves elliptic-lanceolate, oblong-lanceolate, oblong, elliptic, ovate-elliptic or ovate; inflorescence with a slender, longer and filiform and elongate rachis, 8–17 cm long, ca. 0.5 mm wide wide 32

31a. Leaves elliptic, elliptic-rotundate or obovate-rotundate, thickly papyraceous or subcoriaceous; peduncle ca. 4.5 cm long, 3–4 mm wide... *N. darienensis* (Antioquia and Chocó department)

31b. Leaves narrowly to broadly oblong-elliptic, membranaceous, peduncle 1.5–6 cm long, ca. 1.0 mm wide. . . . . *N. virens* (Amazonas, Antioquia, Caquetá, Chocó, Magdalena, Putumayo)

32a. Leaves elliptic-lanceolate or oblong-lanceolate, 5–23 × 2–9 cm; petiole 2–10 mm long: inflorescence corymbiform, 3–5 × ca. 4 cm; staminate perianth broadly urceolate, yellow, yellowish or green, 5–5.5 cm long, glabrescent outside . . . . *N. anisophylla* (Cundinamarca, Magdalena)

32b. Leaves oblong, elliptic, ovate-elliptic or ovate, 15–31 × 5–16 cm; petiole 0.6–5 cm long; inflorescence paniculate, 10–17 × 2–3 cm; staminate perianth tubular, purple to red, 5–10 mm long, sparsely puberulent outside. . . . . *N. laxa* (Amazonas, Guaviare, Meta)

33a. Leaves 4–7 × 1.2–4 cm; petioles 4–6 mm long; branches, petioles and inflorescences white tomentellous; inflorescence ca. 2 cm long, staminate perianth 4–5 × ca. 1 mm . . . . *N. nigricans* (Bolívar, San Andrés, Providencia y Santa Catalina)

33b. Leaves longer than 10 × 6 cm; petioles 1–6.5 cm long; branches, petioles and inflorescences glabrous or minutely adpressed ferrugineous; inflorescence longer than 5 cm long, staminate perianth 4–10 × 1–3 mm. 34

34a. Leaves abruptly narrowed to the apex, tapering gradually to the base, staminate perianth 6–10 mm long, oblong-urceolate or tubular-elliptic 35

34b. Leaves acute, acuminate to cuspidate or obtuse at the apex, rounded, cuneately-acute or short-cuneate at the base, staminate perianth 4–7 mm long, urceolate, suburceolate, tubular or tubular-ellipsoid 36

35a. Staminate perianth oblong-urceolate, sessile to subsesille, pedicels ca. 1 mm long; pistillate perianth infundibuliform; anthocarps ellipsoid . . . . *N. amplifolia* (Antioquia, Chocó, Magdalena)

35b. Staminate perianth tubular-elliptic, pedicellate, pedicels 2–4 mm long, pistillate perianth tubular; anthocarps broadly ellipsoid or lanceolate. . . . . *N. psychotrioides* (Antioquia, Cauca, Chocó, San Andrés, Providencia y Santa Catalina, Valle?)

36a. Leaves broadly elliptic, sometimes orbicular, 15–30 × 8–18 cm, tertiary veinlets evanescent on upper leaf surface; staminate perianth tubular, ellipsoid, bracteoles subtending the flowers ca. 1 mm long, linear to linear-lanceolate . . . . *N. macrophylla* (Amazonas, Antioquia, Caquetá, Guaviare, Meta, Putumayo, Vaupés)

36b. Leaves obovate, elliptic-lanceolate or elliptic-oblong, 8–24 × 4–9.4 cm, tertiary veinlets conspicuously reticulate and subelevated on upper leaf surface; staminate perianth urceolate, suburceolate, sometimes subinfundibuliform 37

37a. Leaves coriaceous, petioles 1—3.5 cm long: bracteoles subtending the flowers ca. 2 mm long, deltoid; staminate perianth suburceolate; stamens 9–10 . . . . *N. robusta* (Amazonas, Caquetá, Guaviare, Guianía, Meta, Vaupés)

37b. Leaves membranaceus to subcoriaceous, 0.4–1.5 cm long; bracteoles subtending the flowers 0.5–1 mm long, triangular-lanceolate; staminate perianth urceolate, sometimes infundibuliform; stamens 5–6 . . . .*spruceana* (Amazonas, Antioquia, Casanare, Guaviare, Guianía, Meta, Putumayo)

38a. Junction of lowest axes of inflorescences with summit of peduncle enlarged, 2.5–4 mm wide . . . . *N. clarkii* (Caquetá, Guianía?)

38b. Junction of lowest axes of inflorescence with summit of peduncle not manifestly enlarged, 0.8–2 mm wide. 39

39a. Staminate perianth 3–4.5 × 1.5 mm, densely ferrugineus tomentose outside; petiole and young stem sparsely puberulent; leaves drying brown; principal secondary veins 10–12 each side. . . . .*N. sebastianii* (Caquetá, Guianía)

39b. Staminate perianth 6.5–7 × 2.8–3 mm, with minute, sparse to moderate ferruginous outside; petiole and young stem glabrous; leaves drying blackish brown; principal secondary veins 6–8 each side . . . . *N. mapourioides* (probably Guianía, it has been collected just across the Colombia border in San Carlos de Río Negro, Amazonas state, Venezuela)

TABLE 1. Comparison of diagnostic morphological characters of *Neea gustaviaefolia* Aymard and related species (based on Pignal et al., 2013).

CHARACTER	*N. ALUMNORUM*	*N. BREVIPENDUNCULATA*	*N. FLORIBUNDA*	*N. GUSTAVIAEFOLIA*	*N. ITANHAENSIS*	*N. VERTICILLATA*
Habit	Small to medium tree, 2.5–8(–20.5) m tall	Small to medium tree, 6–20 m tall	Shrubs to small tree 3–6 m tall	Small tree, ca. 6 m tall	Shrubs to small trees, 1.5–5.0 m tall	Small tree, 4–6 m tall
Leaves disposition	Alternate, rarely sub-verticillate	Opposite	Opposite, sub. verticillate, rarely alternate	Alternate	Opposite	Verticillate, opposite, sometimes alternate
Leaves shape and size	Oblanceolate, elliptic or ovate; 36–63 × 8–13.5 cm	Ovate, oblanceolate, or elliptic-oblong; 10–22 × 5–12.5 cm	Ovate-elliptic or oblanceolate; 15–42 × 7.5–13.8 cm	Oblanceolate; 40–46 × 10–15 cm	Oblanceolate, elliptic or obovate-elliptic; 11.5–37.5 × 4–11cm	Oblong-lanceolate or elliptic-oblong; 25–40 × 7–10.5 cm
Secondary veins	(17–)20(–23); impressed on the upper surface, elevated on the lower surface	6–8; impressed on the upper surface; slightly elevated on the lower surface	6–7; elevated on both surfaces	15–17; canaliculate on the upper surface, elevated on the lower surface	12–20; impressed on the upper surface, elevated on the abaxial surface	14–15; elevated on both surfaces
Inflorescence attachment	Cauliflorous	Cauliflorous on the old stem or ramiflorous	Cauliflorous on the old stem or ramiflorous, sometimes terminal	Terminal	Terminal	Terminal
Inflorescence disposition	Penducle 2.5–4 cm; primary branches opposite or subopposite	Penduncle 1–1.5 cm long: primary branches subfasciculate or subumbellate	Penducle 0.5–3 cm; primary branches subopposite	Penducle 1–4 cm long; with three opposite verticillate primary branches	Penducle ca. 12.5 cm long; with three-five opposite verticillate primary branches	Penduncle 4–6 cm long; primary branches alternate to subopposite
Staminate perianth	Urceolate; ca. 7 × 4 mm, glabrescent	Tubular; ca. 3.7 × 1.5 mm, glabrous	Urceolate; ca. 5 × 3 mm, puberulent	Tubular; 3–4 × 1–1.5 mm, sparsely pubescent	Ellipsoid urceolate; 8–11 × 8–4.5 mm, glabrescent	Tubular; 3 × 1.6 mm, puberulent
Stamen	8–9	7	6(–9)	9	6–8	unknown

Literature Cited

Aublet, M. F. 1775. Histoiredes plantes de la Guiane Françoise 1. Didot, Paris.

Bachman, S., J. Moat, A. W. Hill, J. Torre and B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. ZooKeys 150: 117–126.

Bernal, R. 2016 (continuously updated). Nyctaginaceae. Pages 1709–1713 in R. Bernal, S. R. Gradstein, and M. Celis, eds., *Catálogo de plantas y líquenes de Colombia*. Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá. Available at www.catalogoplantasdecolombia.unal.edu.co. (accessed August 20, 2021).

Bittrich, V. and U. Kühn. 1993. Nyctaginaceae. Pages 473–486 in K. Kubitzki, J. G. Rohwer, and V. Bittrich, eds., *The Families and Genera of Flowering Plants* 2. Springer-Verlag. Berlin, Germany.

Burger, W. C. 1983. Family 65. Nyctaginaceae. In W. C. Burger, ed., Flora Costaricensis. Fieldiana, Botany 13 (n.s): 180–199.

Chagas, E. C. O. and J. L Costa-Lima. 2020. Re-evaluation of some *Guapira* (Nyctaginaceae) names: a new species, nomenclatural changes and typifications. Systematic Botany 45: 173–182.

Choisy, J. D. 1849. Nyctaginaceae Juss. Pages 425–458 in A. P. De Candolle, ed., Prodromus Systematis Naturalis Regni Vegetabilis 13. Masson, Paris.

Damascena, L. S. and A. O. P. Coelho. 2009. Neotropical Nyctaginaceae. In W. Milliken, B. Klitgärd, and A. Baracat eds., Neotropikey–Interactive key and information resources for flowering plants of the Neotropics. Available from: http://www.kew.org/science/tropamerica/neotropikey/families/Nyctaginaceae.htm (accessed August 19, 2021).

da Silva Costa, D., N. F. S. Rossetto, and M. Henrique. 2021. *Neea campanulata* (Nyctaginaceae: Pisonieae), a new species from humid forests, Pará State, Brazil. Kew Bulletin.

DeFilipps R. A. and S. L. Maina. 2003. Nyctaginaceae, Pages 23–55 in M. J. Jansen Jacobs, ed., Flora of the Guianas, Fascicle 22 (series A). Royal Botanic Gardens, Kew.

Díaz-Merlano, J. M. 2016. El Escudo Guayanés en Colombia. Un mundo perdido. Banco de Occidente. Cali, Colombia.

Douglas, N. and P. Manos. 2007. Molecular phylogeny of Nyctaginaceae: Taxonomy, biogeography, and characters associated with a radiation of xerophytic genera in North America. American Journal of Botany 94(5): 856–872.

Douglas, N. and R. Spellenberg. 2010. A new tribal classification of Nyctaginaceae. Taxon 59(3): 905–910.

Endress, P. K. 2010. Disentangling confusions in inflorescence morphology: Patterns and diversity of reproductive shoot ramification in angiosperms. Journal of Systematics and Evolution 48: 225–239.

Font-Quer, P. 2001. *Diccionario de Botánica*. Ediciones Península, Barcelona, España.

Furlan, A. and A. M. Giulietti. 2014. A tribo *Pisonieae* Meisner (Nyctaginaceae) no Brasil. Boletim de Botânica da Universidade de São Paulo 32: 145–268.

González-Ramírez, J. 2007. Nyctaginaceae. Pages 785–796 in B. E. Hammel, M. H. Grayum, C. Herrera and N. Zamora, eds., *Manual de plantas de Costa Rica, Vol. 6*. Monogr. Syst. Bot. Missouri Bot. Gard..

Govaerts, R., E. N. Lughadha, N. Black, R. Turner and Alan Paton. 2021. The World Checklist of Vascular Plants, a continuously updated resource for exploring global plant diversity. Scientific Data 8: 215. doi.org/10.1038/s41597-021-00997-61

Harling, G. 2010. Nyctaginaceae. In G. Harling and C. Persson, eds., Flora of Ecuador, 86. University of Göteborg. Göteborg, Sweden.

Harris, J. G. and M. W. Harris. 2006. *Plant Identification Terminology: An Illustrated Glossary*. Spring Lake Publishing, Spring Lake, Utah.

Heimerl, A. 1891. Nyctaginaceae. In Symbolæ ad floram Brasiliæ centralis cognoscendam. E. Warming, ed., Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjøbenhavn 1890: 158–163.

———. 1897. Beiträge zur Systematik der Nyctaginaceen. Jahresbericht der K. K. Staats ober-Realschule zu Steyr 23: 1–40.

———. 1914. Nyctaginaceae. In R. Pilger, ed., Plantae Uleanae novae vel minus cognitse. Notizblatt des Königl. Botanischen Garten und Museums zu Berlin: 126–132.

———. 1932. Nyctaginaceae. In N. Y. Sandwith ed., Contributions to the flora od tropical America XII. Kew Bulletin 1932: 220–221.

———. 1934. Nyctaginaceae, In A. Engler and K. Prantl eds., Die Natürlichen Pflanzenfamilien: 86–134.

Huber, J. 1909. Materiaes para a Flora Amazonica VII. Duckeanae austro-guyanenses. Bol. Belém Mus. Paran. Emilio Goeldi 5: 347–351.

Infante-Betancour, J., and J. O. Rangel-Ch. 2018a. Catálogo de las plantas con flores de la Amazonía colombiana. Pages 171–1008 in O. J. Rangel-Ch., ed., *La Riqueza Vegetal de la Amazonía de Colombia*. Fundación Natura, Bogotá, Colombia.

Infante-Betancour, J., and J. O. Rangel-Ch. 2018b. Riqueza de las plantas con flores en las subregiones piedemonte, Serranía de La Macarena y formaciones guayanesas de la Amazonía de Colombia. Pages 95–120 in O. J. Rangel-Ch., ed., *La Riqueza Vegetal de la Amazonía de Colombia*. Fundación Natura, Bogotá, Colombia.

IUCN. 2017. Guidelines for using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee (accessed August 20, 2021). Available at http://www.iucnredlist.org/documents/ RedList Guidelines.pdf.

Jaramillo-J., A. and J. O. Rangel-Ch. 2014. Las unidades del paisaje y los bloques del territorio de la Orinoquia. Pages 101–152. In J. O. Rangel-Ch., ed., *Colombia Diversidad Biótica XIV. La región de la Orinoquia de Colombia*. Universidad Nacional de Colombia, Instituto de Ciencias Naturales. Bogotá, Colombia.

Lundell, C. L. 1962. Plantae Mayanae-V. Wrightia 2: 21–36.

Pignal, M., A. de Oliveira Soares Filho and S. Romaniuc Neto. 2013. Une nouvelle espèce de *Neea* Ruiz & Pav. (Nyctaginaceae) de la forêt atlantique de l'état de Bahia (Brésil). Adansonia, 35(1): 19–31.

Pinson, W. H., Jr., P. M. Hurley, E. Mencher and H. W. Fairbairn. 1962. K-Ar and Rb -Sr Ages of Biotites from Colombia, South America. Geological Society of America Bulletin 73: 907–910.

Pool, A. 2001. Nyctaginaceae. In W. D. Stevens, C. Ulloa Ulloa, A. Pool and O. M. Montiel, eds. Flora de Nicaragua. Monographs in Systematic Botany from the Missouri Botanical Garden 85: 1581–1592.

Rangel-Ch., J. O. and J. Infante-Betancour. 2018. Aspectos generales sobre la Amazonía de Colombia. Pages 1–20 in J. O. Rangel-Ch., ed., *La Riqueza Vegetal de la Amazonía de Colombia*. Fundación Natura, Bogotá, Colombia.

Rivers, M. C., L. Taylor, N. A. Brummitt, T. R. Meagher, D. L. Roberts, and E. N. Lughadha. 2011. How many herbarium specimens are needed to detect threatened species? Biological Conservation 144(10): 2541–2547.

Romero-V., M. V., G. Téllez-M. and E. E. Cantillo. 2011. Composición florística y patrón de la estructura de la vegetación en el sector nor-oriental de la serranía de la Macarena, San Juan de Arama-Meta. Pages 391–420 in J. O. Rangel-Ch., ed., Colombia Diversidad Biótica XI. *Patrones de la estructura y de la riqueza de la vegetación en Colombia*. Instituto de Ciencias Naturales, Universidad Nacional de Colombia. Bogotá, Colombia.

Rossetto, E. F. S., A. D. Faria, P. M. Ruas, C. F. Ruas, N. A. Douglas, and J. E. L. S. Ribeiro. 2019a. Clarifying generic delimitation in Nyctaginaceae tribe *Pisonieae* after more than a century of taxonomic confusion. Botanical Journal of the Linnean Society 189: 378–396.

———., P. de Oliveira Santos, D. Silva Costa and J. R. Ferraz. 2019b. *Neea itanhaensis* (Nyctaginaceae, Pisonieae), a new species from São Paulo State, Brazil. Phytotaxa 415(4): 225–232.

———. and M. A. Caraballo-Ortiz. 2020. Splitting the *Pisonia* birdcatcher trees: re-establishment of *Ceodes* and *Rockia* (Nyctaginaceae, Pisonieae). PhytoKeys 152: 121–136.

———. and J. R. Ferraz. 2020. *Guapira siqueirae* (Nyctaginaceae, Pisonieae), a new species from Espírito Santo State, Brazil. Phytotaxa 460(2): 143–148.

Ruiz-López and J. A. Pavón. 1794. *Florae Peruvianae, et Chilensis Prodromus*. Imprenta de Sancha, Madrid, España.

Murillo-Sandoval, P. C., E. Gjerdseth, C. Correa-Ayram, D. Wrathall, J. Van Den Hoek, L. M. Dávalos and Robert Kennedy. 2021. No peace for the forest: Rapid, widespread land changes in the Andes-Amazon region following the Colombian civil war. Global Environmental Change 69: doi.org/10.1016/j.gloenvcha.2021.102283

Schmidt, J. A. 1872. Nyctaginaceae. Pages 345–476 in Flora Brasiliensis, vol. XIV, pars II, C. F. P. von Martius and A. G. Eichler, eds. Monachii [Munich] and Lipsiæ [Leipzig]: Frid. Fleischer in Comm.

Standley, P. C. 1931. Studies of American plants: Nyctaginaceae. Field Museum Botanical Series 8: 304–311.

———. 1937. Nyctaginaceae, Flora of Peru. Publications of the Field Museum of Natural History (Botanical Series) 13(2/2): 518–546.

———. and J. A. Steyermark. 1946. Nyctaginaceae. In P. C. Standley and J. A. Steyermark eds., Flora of Guatemala—Part IV. Fieldiana, Botany 24(4): 174–192.

Steyermark, J. A. 1987. Flora of the Venezuelan Guayana—III. Annals of the Missouri Botanical Garden 74: 609–658.

———. and G. A. Aymard. 2003. Nyctaginaceae. Pages 101–119 In J. A. Steyermark, P. E. Berry, K. Yatskievych and B. K. Holst, eds., *Flora of the Venezuelan Guayana*, vol. 7 (Myrtaceae–Plumbaginaceae). Missouri Botanical Garden. St. Louis, Missouri, U.S.A.

Stevenson, P.R., M. Suescún and M. J. Quiñones. 2004. Characterization of forest types at the CIEM, Tinigua Park, Colombia. Field Studies Fauna Flora Macarena Colombia 14: 1–20.

Thiers, B. 2019 [continuously updated]). *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. Available from: http://sweetgum.nybg.org/science/ih/ (accessed 19 August 2021)

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. (2018 Onwards]. *An Integrated Assessment of Vascular Plants Species of the Americas* (online updates). http://legacy.tropicos.org/projectwebportal.aspx?pagename=Home&projectid=83 (accessed August 18, 2021).

Woodson R. E. Jr., R. W. Schery and H. J. Kidd. 1961. Nyctaginaceae, In *Flora of Panama*. Part IV. Fascicle IV. Annals of the Missouri Botanical Garden 48: 51–65.

Zizka, A., F. Antunes Carvalho, A. Calvente, M. R. Baez-Lizarazo, A. Cabral, J. F. Ramos Coelho, M. Colli-Silva, M. Ramos Fantinati, M. Ferreira Fernandes, T. Ferreira-Araújo, F. G. L. Moreira, N. M. da Cunha Santos, T. A. Borges Santos, R. C. dos Santos-Costa, F.C. Serrano, A. P. Alves da Silva, A. de Souza Soares, P. G. Cavalcante de Souza, E. C. Tomaz, V. Fonseca Vale, T. L. Vieira and A. Antonelli. 2020. No one-size-fits-all solution to clean GBIF. *PeerJ* 8. e9916. doi.org/10.7717/peerj.9916.

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LECTOTYPIFICATION OF *PHOEBE PUWENENSIS* (LAURACEAE)

YONG YANG [1, 2] AND DAVID E. BOUFFORD[3]

Abstract. The type collection of *Phoebe puwenensis* consists of 18 specimens in the herbarium of Nanjing Forestry University (NF). Of those specimens, *W. C. Cheng 30001* (NF2004054), which bears the notation "sp. nov." and also a handwritten diagnosis, is chosen as the lectotype.

Keywords: Lauraceae, lectotypification, nomenclature, *Phoebe puwenensis*

Cheng (Cheng et al., 1963) described and validly published *Phoebe puwenensis* W. C. Cheng from southern Yunnan, China. The name and the species are accepted in both *Flora Reipublicae Popularis Sinicae* (Lee and Wei, 1982) and the *Flora of China* (Wei and van der Werff, 2009). In publishing *Phoebe puwenensis* Cheng (1961) designated *W. C. Cheng 30001* in the herbarium of Nanjing Forestry College (now University) (NF) as the type. We found that instead of a single holotype, however, there are 18 specimens of the type collection in the herbarium of Nanjing Forestry University. Because no single specimen was designated as the holotype, following the *Shenzhen Code* (Turland et al., 2018), the name has to be lectotypified with one of them. Among the 18 specimens, four (NF2004049, NF2004050, NF2004053 and NF2004054) have an annotation label by W. C. Cheng dated 16 March 1958 with the inscription "sp. nov." According to annotations by C. S. Chao in October, 1980, the remaining 14 specimens were also verified as *P. puwenensis*. The four specimens annotated by W. C. Cheng, however, should be considered as the original materials studied by Cheng. Among the four specimens, specimen NF2004054 (Fig. 1) bears an annotation label with not only "sp. nov.," but also with a short, handwritten diagnosis in Chinese that distinguishes *P. puwenensis* from *P. sheareri* (Hemsl.) Gamble. We believe that this specimen was not only studied by Cheng, but is the specimen that he intended to designate as the holotype. As a result, we lectotypify the name *P. puwenensis* with *W. C. Cheng 30001*, NF2004054 (Fig. 1).

TYPIFICATION

Phoebe puwenensis W. C. Cheng, Sci. Silv. Sin. 8(1): 3. 1963.

TYPE: CHINA. Yunnan: Xishuangbanna, Puwen, in evergreen forests, alt. ca. 800 m, 1 April 1957, *W. C. Cheng 30001* (Lectotype, designated here: NF2004054 (Fig. 1); isolectotypes: NF2004037, NF2004038, NF2004039, NF2004040, NF2004041, NF2004042, NF2004043, NF2004044, NF2004045, NF2004046, NF2004047, NF2004048, NF2004049, NF2004050, NF2004051, NF2004052, NF2004053).

DISCUSSION

Although *Phoebe puwenensis* was earlier described as *Phoebe sheareri* (Hemsl.) Gamble var. *longepaniculata* H. Liu (1934), based on *A. Henry 12922* (Holotype: P; isotype: NY) from Simao (now Pu'er Shi), Yunnan, China, and cited by Cheng et al. (1963) under *P. puwenensis*, names outside of their rank have no priority (*Shenzhen Code*, Art. 11.2, Turland et al., 2018). The name *P. sheareri* var. *longepaniculata* H. Liu is therefore a heterotypic synonym of *P. puwenensis*.

LITERATURE CITED

LIOU, H. 1934. *Lauracées de Chine et d'Indochine*. Hermann & Cie, Paris.

CHENG, W. C., S. Y. CHANG, T. HONG, C. D. CHU, AND C. S. CHAO. 1963. Species novae et nomines emendata arborum utilium Chinae. Sci. Silv. Sin. 8: 1–14.

LEE, S. K., AND F. N. WEI. 1982. *Phoebe* Nees. Pages 89–119 in H. W. LI, ED., *Flora Reipublicae Popularis Sinicae, Vol. 31*. Science Press, Beijing.

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) Adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017*. Regnum Vegetabile 159. Koeltz Botanical Books, Glashütten. DOI https://doi.org/10.12705/Code.2018

WEI, F. N., AND H. VAN DER WERFF. 2009. *Phoebe* Nees. Pages 18–200 in Z. Y. WU, P. R. RAVEN, AND D. Y. HONG, EDS., *Flora of China, Vol. 7*. Science Press, Beijing and Missouri Botanical Garden Press, St. Louis.

An image of the lectotype collection of W. C. Cheng (Fig. 1), along with images of all the isotypes, is on the website of the Chinese Virtual Herbarium (CVH; http://www.cvh.ac.cn/). This study was supported by the National Natural Science Foundation of China [grant nos. 31970205 and 31770211] and *Metasequoia* funding from Nanjing Forestry University.

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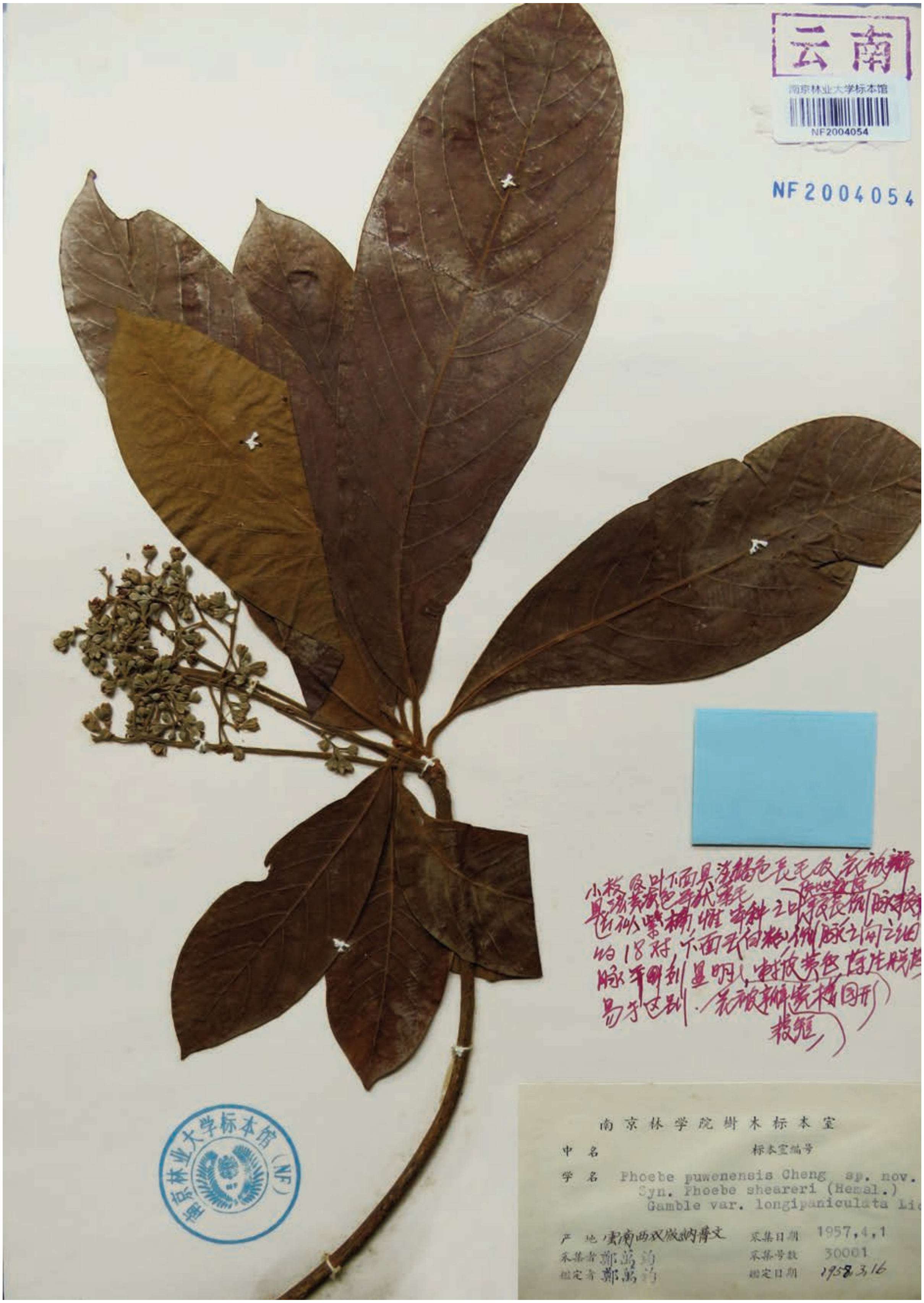

FIGURE 1. Lectotype of *Phoebe puwenensis* W. C. Cheng (*W. C. Cheng 30001*, NF2004054).

FIVE NEW RECORDS OF *SIDA* SECT. *MALACROIDEAE* (MALVACEAE, MALVOIDEAE) FROM CAATINGAS OF THE BRAZILIAN NORTHEASTERN REGION

Sabrina Soares Figueiredo[1] and José Iranildo Miranda de Melo[1,2]

Abstract. This work has as objectives to report five new records in *Sida* section *Malacroideae* (Malvaceae) for Caatinga vegetation from the Brazilian northeastern: *Sida anomala*, *S. caulorrhiza*, *S. dureana*, *S. paradoxa*, and *S. simpsonii*. Data on geographic distribution and reproductive phenology as well as comments on morphological characters for species recognition are provided.

Keywords: Brazilian flora, distribution, Malvaceae, new records

Resumo. O objetivo deste trabalho é reportar cinco novos registros em *Sida* sect. *Malacroideae* (Malvaceae) para a vegetação de caatinga do Nordeste brasileiro: *Sida anomala* A.St.-Hil., *S. caulorrhiza* Krapov., *S. dureana* Krapov., *S. paradoxa* Rodrigo e *S. simpsonii* Krapov. Dados de distribuição geográfica e fenologia reprodutiva bem como comentários sobre os caracteres morfológicos para o reconhecimento das espécies são fornecidos.

Palavras-chave: Distribuição, flora brasileira, Malvaceae, novos registros

Malvaceae *sensu lato* are one of the largest families of angiosperms and currently contains all the representatives of the ancient families Bombacaceae, Tiliaceae, Sterculiaceae, and Malvaceae (*senso stricto*) (APG IV). Currently, the family is represented by nine subfamilies, including Malvoideae Burnett, which encompasses approximately 110 genera and 1,730 species (Alverson, 1998; APG I, 1998; Bayer; Kubitzki, 2003).

Despite the large number of genera and species in this subfamily, *Sida* L. stands out for its taxonomic diversity combined with the wide worldwide distribution of its species. This genus has ca. 200 species and is distributed in Australia, Brazil, Colombia, Honduras, Mexico, and the United States of America (Fryxell, 1997; Krapovickas, 2003; Tropicos, 2021). Furthermore, *Sida* is found in all regions and phytogeographic domains in Brazil, with ca. 103 species recorded (*Flora do Brasil*, 2020), and thus this country represents one of the main centers of diversity of the genus.

Sida is divided into 12 sections (Krapovickas and Esteves, 2003), among which *Sida* sect. *Malacroideae*, which is represented by 23 species in South America (Krapovickas 2007; 2012). The species of *Sida sect. Malacroideae* have as main morphological characteristics a herbaceous habit or rarely shrubby, stems that vary from erect, prostrate or decumbent; spatulate, lanceolate leaves; solitary flowers or flowers in inflorescences, calyx covered by stellate trichomes, glabrous stem tube or with simple or stellate trichomes and apicular fruits, with stellate trichomes (Krapovickas, 2007).

The purpose of this article is to report five new records of *Sida* sect. *Malacroideae* (Malvaceae) from Brazilian northeastern.

MATERIAL AND METHODS

The Northeastern region of Brazil has occupies an extension of 1.561.177.80 Km², which corresponds to approximately 18.3% of its entire territory (IBGE, 2016) (Fig. 1). In this region, the predominant vegetation is Caatinga (Fig. 2), which occupies practically the entire northeast region of the country, with some areas in the state of Minas Gerais (Prado, 2003).

Monthly collections were carried out from November 2018 to November 2019 to obtain fertile specimens (with flowers and/or fruits) of the species of *Sida* sect. *Malacroideae* in Caatinga areas of Northeastern Brazil.

The samples obtained were pressed and, in parallel, flowers and fruits were stored in 70% alcohol. After pressing, the samples were placed to dry in an oven at 50°C for a period of 24 hours. The usual techniques for collection and dried process in taxonomic studies were based on Hickey and King (2000). The specimens were incorporated into the Herbarium Manuel de Arruda Câmara (HACAM) of the State University of Paraíba, *Campus* I, Campina Grande, Paraíba State, Northeastern Brazil.

To carry out this study, the authors examined collections in Brazilian physical herbaria and foreign herbaria as well as material from their own collections. The new records were detected in the collections of the ALCB, ASE, EAC, HUEFS, JPB and MAC herbaria, and in materials obtained in the field in areas of Caatinga from Northeastern Brazil.

Five new records were found for the Caatingas of the Northeastern Brazil: *Sida anomala* A.St.-Hil., *S. caulorrhiza* Krapov., *S. dureana* Krapov., *S. paradoxa* Rodrigo, and *S. simpsonii* Krapov.

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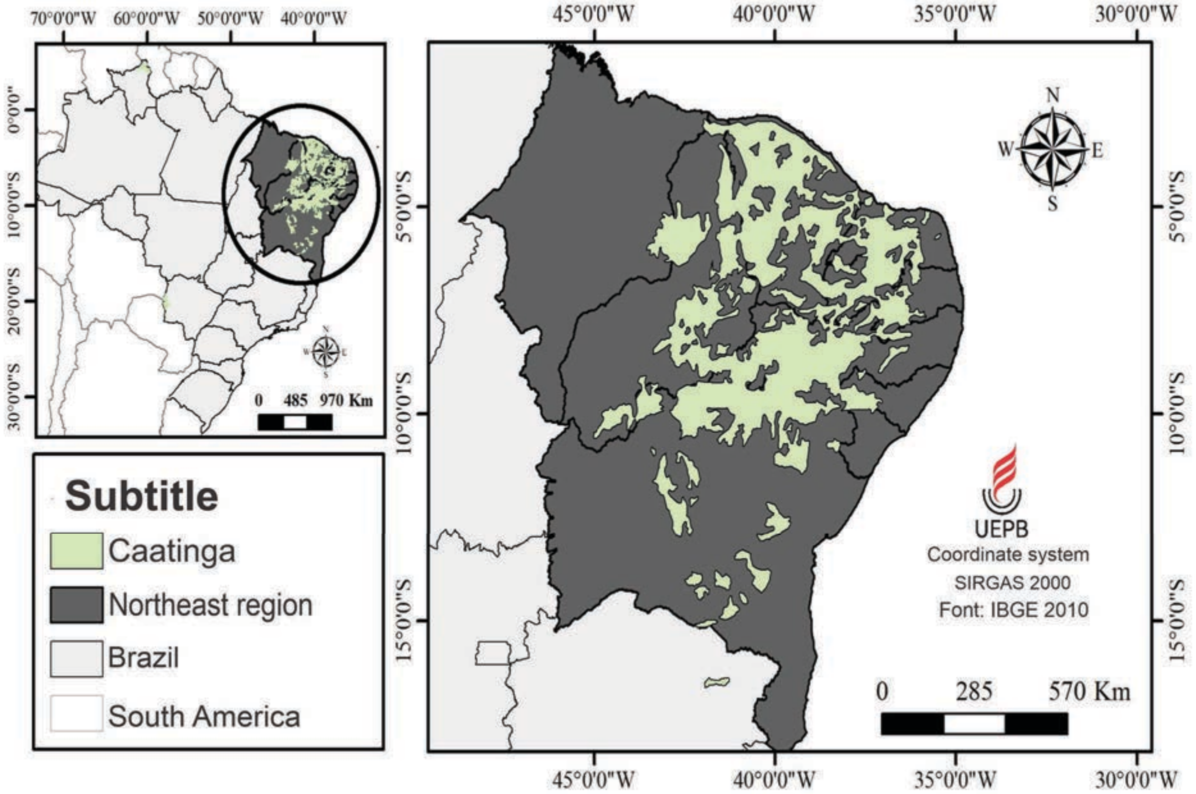

FIGURE 1. Study area, Caatinga of the Northeast region from Brazil. (Map by Gilbevan Ramos de Almeida).

1. ***Sida anomala*** A.St.-Hil., Flora Brasiliae Meridionalis (quarto ed.) 1(4): 140, pl. 33. 1825. (16 Nov 1825) (Fig. 3). TYPE: PARAGUAY, Paraguaria septentrionalis, *E. Hassler* 7508 (Holotype: BM [BM000545620], photograph).

Distribution and habitat: *S. anomala* is distributed in Bolivia, Brasil, Argentina and Uruguay (Krapovickas, 2007). In Brazil, the species was found in the Pampa and Pantanal phytogeographical domains, in this work, *S. anomala* is a new record for the Caatinga vegetation being recorded in the states of Alagoas and Paraíba.

Phenology: Flowering and fruiting in April, May, June and August.

Additional specimens examined: BRAZIL. Alagoas, Pão de Açúcar, 20 May 2007, fl., fr., *R. P. Lyra-Lemos, G. Araújo & L. Palmeira 10319* (MAC); Ibidem, 15 June 2000, fl., fr., *R. P. Lyra-Lemos 4782* (MAC). Ceará, without municipality, August 1988, fl., fr., *A. Fernandes s.n.* (15653 EAC). Paraíba, Cabaceiras, Sítio Bravo, 14 April 1992, fl., fr., *V. L. & C. F. Martins 91* (JPB).

This species can be easily recognized by the staminal tube with stellate and simple trichomes and the fruit with arista of radial stellate trichomes with 10-13 branches at the apex of the aristae.

2. ***Sida caulorrhiza*** Krapov., Bonplandia (Corrientes) 16 (3–4): 228–230, 10. 2007. (Fig. 4)
TYPE: BRAZIL, Goiás, Mun. Flores de Goiás, caminho para Rio dos macacos, *W. L. Werneck, C. L. Cristóbal & A. Krapovickas* 930 (Holotype: CEN, not seen; Isotype: SP [SP001133], photograph).

Distribution and habitat: This species is distributed in Brazil and Paraguay (Krapovickas, 2007). In Brazil, distributed only in the state of Goiás in the phytogeographic domain of the Cerrado. In this work, this species is a new record for Brazil and Caatinga vegetation being recorded in the states of Paraíba and Sergipe.

Phenology: Flowering and fruiting in March and May.

Additional specimens examined: BRAZIL. Paraíba, Piancó, 18 May 2019, fl., fr., *S. S. Figueiredo & M. L. Mamede 61* (HACAM). Sergipe, Tomar do Geru, Pastagem, 19 March 2014, fl., fr., *F. B. Gonçalves 14* (ASE).

This species can be recognized by the yellow corolla, staminal tube with simple trichomes, and fruit with glandular and pedicellate trichomes.

3. ***Sida dureana*** Krapov., Bonplandia (Corrientes) 16(3–4): 235, f. 13. 2007. (Fig. 5).
TYPE: PARAGUAY, Amambay, Col. San Antonio, *A. Schinini, J. Molero, R. Duré & M. Quintana* 35556 (Holotype: CTES [CTES0013613], photograph).

Distribution and habitat: This species is distributed in Bolivia, Brazil, and Paraguay (Krapovickas, 2007). In Brazil, distributed only in the state of Mato Grosso do Sul in the phytogeographic domain of the Pantanal (Flora do Brasil, 2020). In this work, this species is a new record for Brazilian Northeastern and Caatinga vegetation being recorded in the states of Alagoas, Ceará, Paraíba and Piauí.

Phenology: Flowering and Fruiting in February, March, April, May, July, August and September.

Additional specimens examined: BRAZIL. Alagoas, Água Branca, Morro do Craunã, 09 August 2009, fl., *E. C. O. Chagas 4810* (MAC); Arapiraca, 20 July 1982, fl., fr., *R. P. Lyra & M. N. R. Staviski 585* (MAC). Ceará, Aiuaba, Estação Ecológica, Lagoa do Rosílio, 22 March 1984, *E. Nunes s.n.*

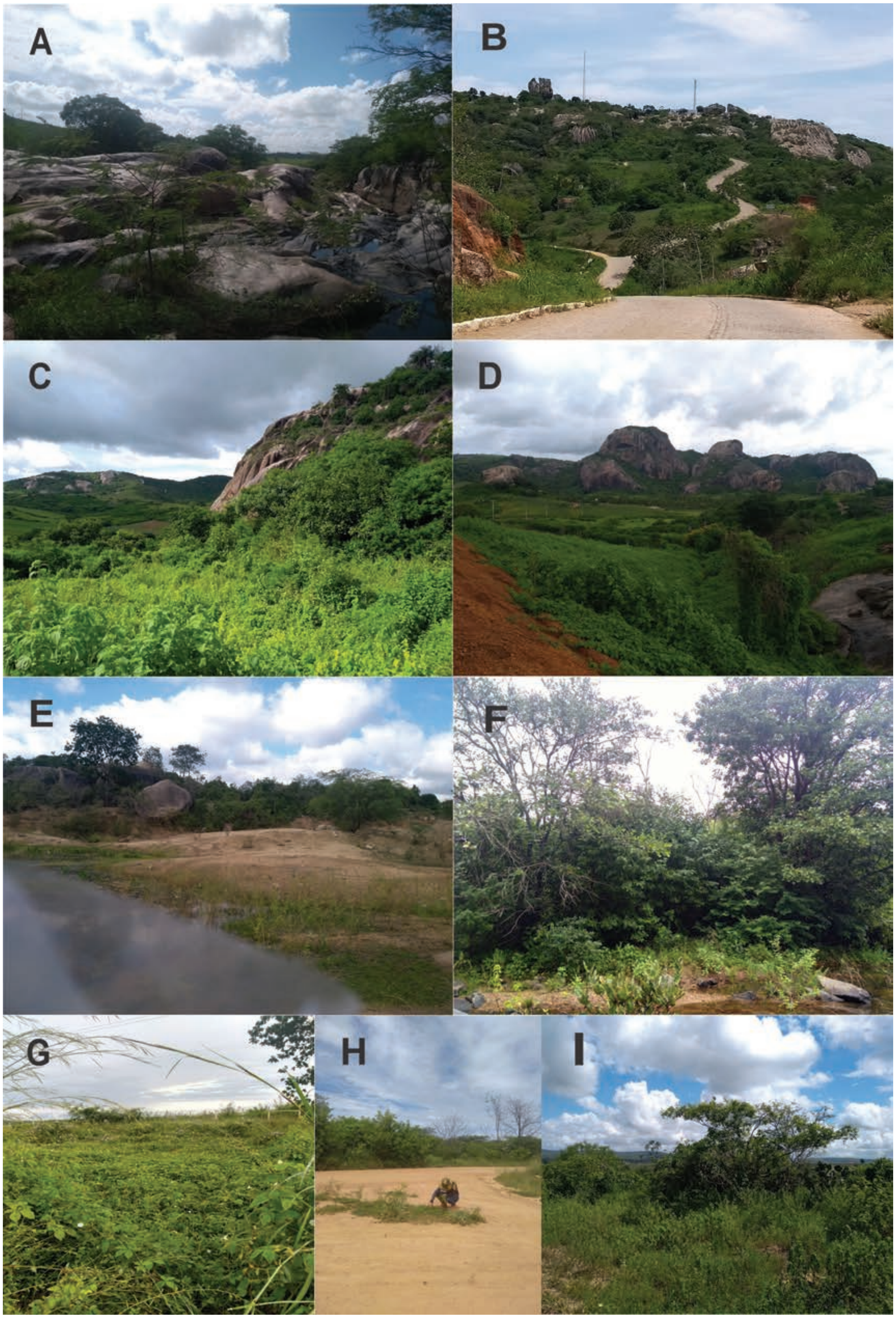

FIGURE 2. Environments of occurrence of the species of *Sida* sect. *Malacroideae* in Caatinga areas in Northeastern Brasil. **A**, Pedra de Ingá, municipality of Ingá/Paraíba State; **B**, Pedra de Santo Antônio, municipality of Fagundes/Paraíba State; **C**, rocky outcrop, municipality of Passa e Fica/Rio Grande do Norte State; **D**, Parque Estadual Pedra da Boca, municipality of Araruna/Paraíba State; **E**, Área de Proteção Ambiental (APA) do Cariri, municipality of Boa Vista/Paraíba State; **F**, trail, municipality of Conceição/Paraíba State; **G**, roadside, municipality of Piancó/Paraíba State; **H**, roadside, municipality of Sertânia/Pernambuco State; **I**, roadside, municipality of Arara/Paraíba State.

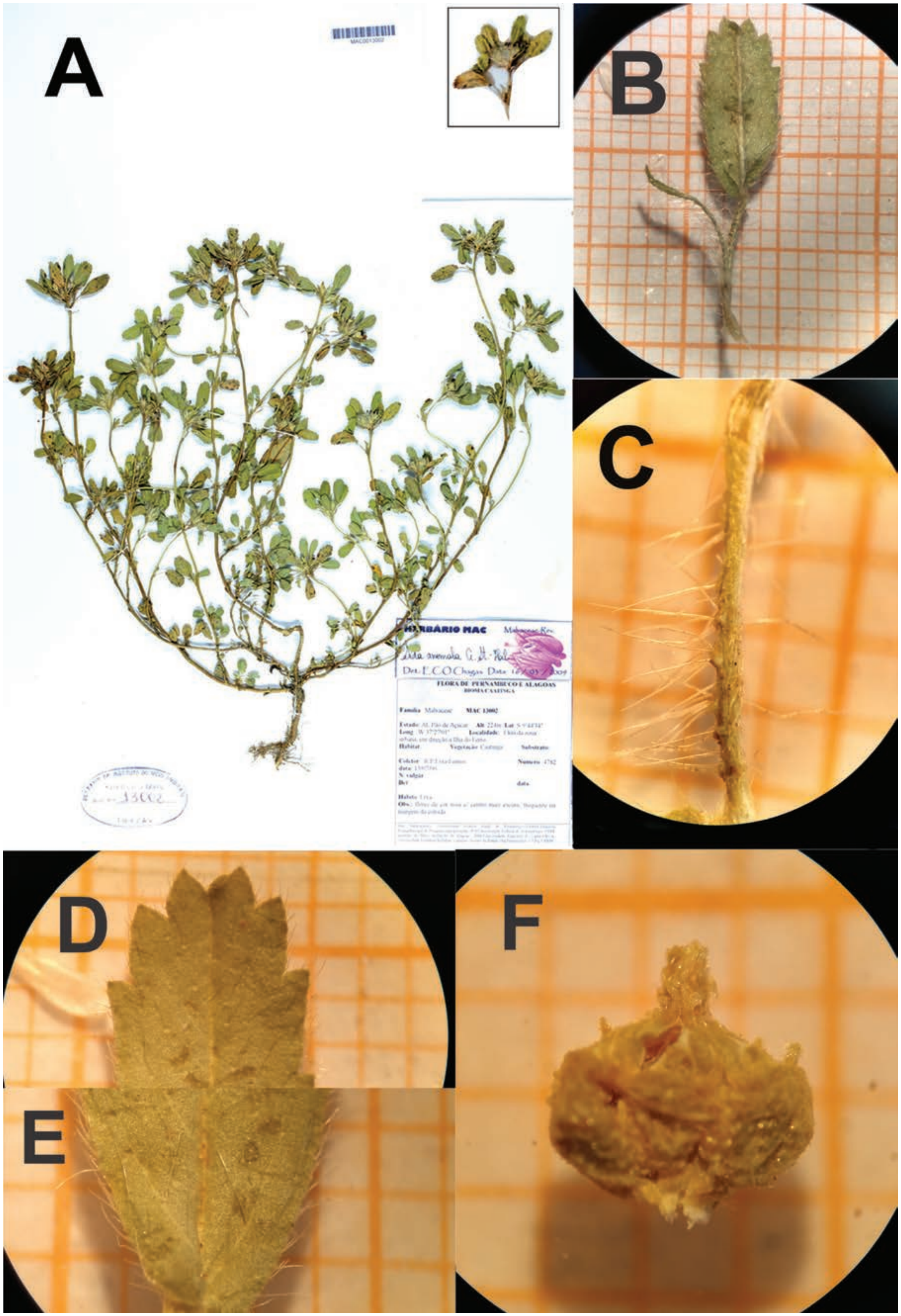

FIGURE 3. Specimen of *Sida anomala* belonging to the Herbarium MAC (Instituto do Meio Ambiente do Estado de Alagoas). **A**, reproductive branch; **B**, leaf blade, abaxial surface (starry trichomes); **C**, stipule (showing stellate and simple trichomes); **D**, apex of the leaf blade, adaxial surface with simple trichomes; **E**, leaf blade base, adaxial surface; **F**, fruit.

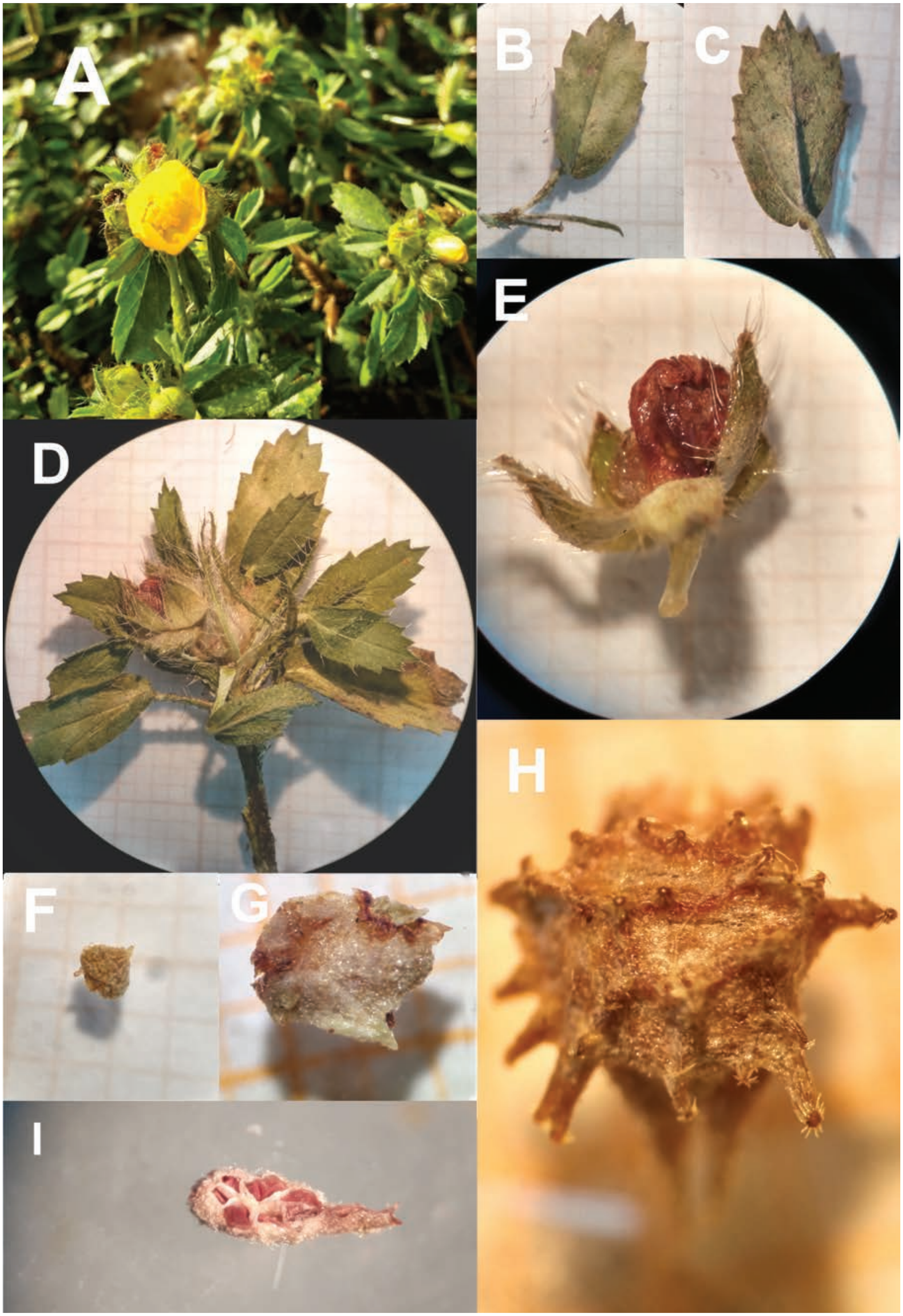

FIGURE 4. *S. caulorrhiza*. **A**, habit; **B**, leaf blade, adaxial surface (showing sparse starry trichomes); **C**, leaf blade, adaxial surface (showing starry trichomes); **D**, inflorescence; **E**, flower; **F**, ovary, **G**, fruit; **H**, fruit valve (showing aristae with stellate radial trichomes); **I**, ovary, in cross section.

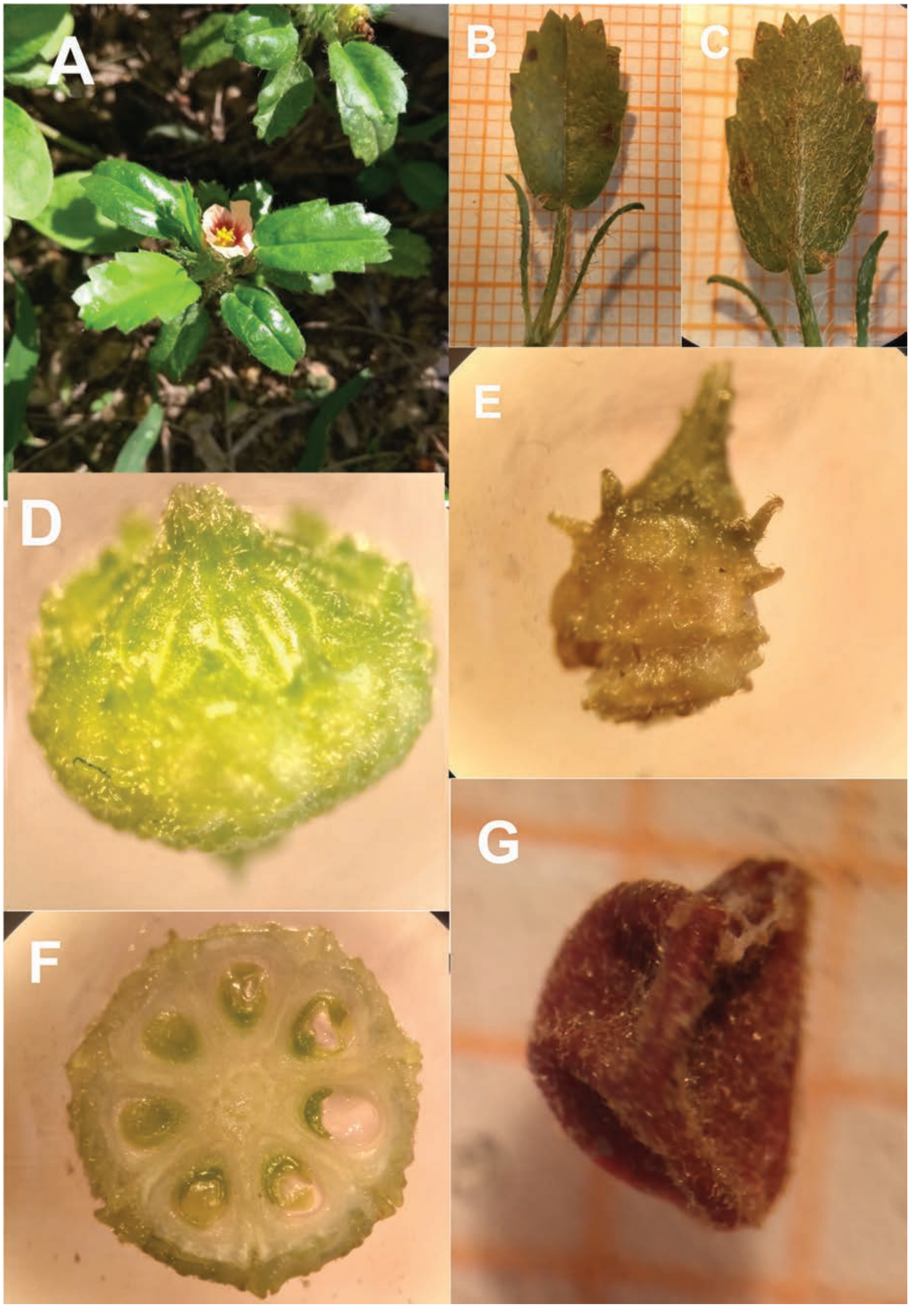

FIGURE 5. *S. dureana*. **A**, habit; **B**, leaf blade, adaxial surface (showing sparse ciliated trichomes); **C**, leaf blade, abaxial surface (showing starry trichomes); **D**, fruit; **E**, mericarp; **F**, fruit, in cross section; **G**, seed.

(EAC 12399); Fortaleza, *Campus* do Pici, 26 September 1980, *L. Z. Almeida s.n.* (EAC 2603); Parambu, Altamira, 19 March 2016, *M. R. K. G. Mota 06* (EAC); Santa Quitéria, Fazenda Itatiaia, 26 April 1984, fl., fr., *A. Fernandes s.n.* (EAC 12480); Senador Pompeu, Catolé, 29 August 1992, fl., fr., *E. B. Souza s.n.* (EAC 20121); Sobral, Distrito de Taperuaba, Unidade de Conservação Refúgio de Vida Silvestre da Andorinha (REVIS), 24 February 2017, fr., *E. B. Souza 4410* (EAC). Paraíba, Campina Grande, Universidade Estadual da Paraíba, *Campus* I, 18 March 2019, fl., fr., *S. S. Figueiredo 70* (HACAM). Piauí, Oeiras, Chapada Grande, 03 March 1983, fl., fr., *A. Fernandes s.n.* (EAC 11813).

This species can be recognized by the two aristae at the apex of the fruit, on the body of the fruit small aristae each one with 1 stellate trichomes at the apex, besides glandular trichomes short pedicellate, and in the lateral portion the arista are larger with 1 stellate radial trichome of 10–15 branches.

4. ***Sida paradoxa*** Rodrigo, Notas del Museo de la Plata, Botánica 2(14): 105, f. 1, 2. 1937.
TYPE: ARGENTINA, Corrientes, Arroyo las Garzas, *A.P. Rodrigo* 605 (Holotype: LP [LP004335]) photograph)

Distribution and habitat: *S. paradoxa* is distributed in Argentina and Brazil (Krapovickas, 2007). *S. paradoxa* is distributed in Argentina and Brazil. In Brazil is distributed only in the state of Rio Grande do Sul. In this work, this species is a new record for Pernambuco and Caatinga from Brazilian Northeastern being recorded in the state of Pernambuco.

Phenology: Flowering and fruiting in March.

Additional Specimen examined: BRASIL. Pernambuco, Ouricuri, terreno baldio, 23 March 1987, *J. L. S. Lima 359a* (ALCB, HUEFS).

This species can be recognized by the stems with stellate, 5–7 branched trichomes, the leaf blades glabrous on the adaxial surface but covered with stellate trichomes on the abaxial one, the corolla purple to lilac rose, and the glabrous staminal tube.

5. ***Sida simpsonii*** Krapov., Bonplandia (Corrientes) 16 (3–4): 246–248, f. 16, map. 2007. (Dec 2007).
TYPE: BRAZIL, Mato Grosso, Mun. S. Antônio do Levérger, *G. Hatschbach* 36090 (Holotype: CTES [CTES0013619], photograph).

Distribution and habitat: *S. simpsonii* is endemic from Brazil (Krapovickas, 2007), restricted to the state of Mato Grosso in the phytogeographic domain of the Pantanal (*Flora do Brasil*, 2020). This species is a new record for the Caatinga vegetation being recorded in the states of Ceará and Piauí.

Phenology: Flowering and fruiting in March, April, May, June and July.

Additional specimens examined: BRAZIL. Ceará, Aiuaba, Estação Ecológica, 30 April 1981, fr., *P. Martins s.n.* (EAC 10259); Ibidem, 24 April 2013, fl., fr., *M. I. B. Loiola 2034* (EAC); Ibidem, Lagoa do Rosílio, 11 April 1991, fl., fr., *M. A. Figueiredo 139* (EAC); Caucaia, Fazenda Invernada, 29 July 1989, fr., *M. A. Figueiredo s.n.* (EAC 16503); Crateús, Grajaú, 28 April 2007, fr., *L. P. Amaral-Neto 83* (EAC); Ibidem, Serra das Almas, 09 May 2002, fr., *F. S. Araújo 1514* (EAC); Graça, Sítio Santa Clara, 14 May 2017, fr., *F. F. Araújo 204* (EAC); Ibidem, 06 July 2016, fl., fr., *F. F. Araújo 38* (EAC); Irauçuba 06 June 2007, fl., fr., *C. D. S. Pessoa 62 and 72* (EAC); Ibidem, Fazenda Aroeira, 18 May 2002, fl., fr., *E. Trigueiro s.n.* (EAC 31638); Ibidem, Cacimba Salgada, 21 April 2001fl., fr., *G. B. Oliveira s.n.* (EAC 31809); Quixadá, Fazenda Não Me Deixes, 15 April 2000, fl., fr., *R. C. Costa s.n.* (EAC 32026); Ibidem, 15 April 2000, fl., fr., *R. C. Costa s.n.* (EAC 32027); Pentecoste, Fazenda Experimental Vale do Curu, 07 April 2016, fr., *R. R. Miranda 127* (EAC); São Gonçalo do Amarante, Dunas do Pecém, 13 July 2004, fl., fr., *A. V. Vieira s.n.* (EAC 34219). Piauí, Alegre-Tianguá, 16 March 2011, fl., fr., *E. Silvestre s.n.* (EAC 50245).

This species can be recognized by the corolla with reddish pink petals and the staminal tube with simple trichomes.

Literature Cited

Alverson, W., K. Karol, D. Baum, M. Chase, S. Swensen, R. McCourt, and K. Sytsma. 1998. Circumscription of the Malvales and relationships to order Rosidae: evidence from *rbcl* sequence data. *American Journal of Botany* 85: 876–887.

APG I. 1998. An ordinal classification for the families of flowering plants. *Annals of the Missouri Botanical Garden* 85: 531–887.

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.

Bayer, C. and K. Kubitzki. 2003. Malvaceae. Pages 225–311 in K. Kubitzki and C. Bayer, eds., Flowering Plants – Dicotyledons: Malvales, Capparales and Non-betalain Caryophyllales. Springer, Berlin.

Flora do Brasil 2020. 2021. *Instituto de Pesquisas Jardim Botânico do Rio de Janeiro*. Available at: http://reflora.jbrj.gov.br/reflora/floradobrasil/FB105004 (accessed June 15, 2021).

Fryxell, P. A. 1997. The American genera of Malvaceae II. *Brittonia* 49: p. 204–269

Hickey, M. and C. King. 2000. *The Cambridge Illustrated Glossary Of Botanical Terms*, p. 227.

IBGE (Instituto Brasileiro de Geografia e Estatística). 2012. Manual técnico da vegetação brasileira. *Manuais técnicos em geociências*, Rio de Janeiro, pp. 60–62.

IBGE (Instituto Brasileiro de Geografia e Estatística). 2016. Censo demográfico população de habitantes. Available at: http://www.sidra.ibge.gov.br (accessed June 3, 2021).

Krapovickas, A. and G. L. Esteves. 2003. Malvaceae. Pages in Zappi, D. C. et al. Lista das Plantas vasculares de Catolés, Chapada Diamantina, Bahia, Brasil. *Boletim de Botânica da Universidade de São Paulo* 21: 379.

———. 2007. Las especies de *Sida* Secc. *Malacroideae* (Malvaceae) del Cono Sur de Sudamérica. *Bonplandia* 16: 209–253.

———. 2012. Novedades en las secciones *Cordifoliae*, *Distichifolia*, *Malacroidea*, *Muticae* y *Nelavaga* del género *Sida* (Malvaceae). *Bonplandia* 21: 77–92.

Prado, D. E. 2003. As Caatingas da América do Sul. Pages 3–73 in Leal, I. R., M. Tabarelli and J. M. C. Silva, eds., *Ecologia e Conservação da Caatinga*. Ed. Universitária da UFPE, Recife. PPGB/UFRPE).

Tropicos.org. *Missouri Botanical Garden*. Available at: http://www.tropicos.org (accessed June 2, 2021).

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NOTE ON THE TYPIFICATION OF *PIAROPUS* (PONTEDERIACEAE) AND ON THE VALIDATION OF “*TOXICODENDRON* SECT. *VENENATA* GILLIS”

Kanchi N. Gandhi[1]

Abstract. The typification of the genus name *Piaropus* (*Pontederiaceae*) and the Validation of the sectional name “*Toxicodendron* sect. *Venenata* Gillis” are addressed.

Keywords: *Eichhornia*, *Piaropus*, *Pontederia* subg. *Oshunae*, *Rhus* sect. *Venenatae*, *Toxicodendron* sect. *Venenata*, type

In 1837, Rafinesque proposed the new genus *Piaropus* and included three syntype species: *P. azureus* (Sw.) Raf. (*Pontederia azurea* Sw.), *P. mesomelas* Raf. (superfluous for *Ponterderia crassipes* Mart.), and *P. tricolor* Raf. The typification of the genus name is discussed below.

Nathaniel L. Britton (1859–1934) was one of the founding members of the then practiced American Code, which recognized the first cited species name of a new genus as the type species, and such designations have been treated as a mechanical method of selection and rejected (Shenzhen Code Art. 10.6). However, the Code made an exception as noted here: “A type chosen using a largely mechanical method of selection is superseded by any later choice of a different type not made using such a method, unless, in the interval, the supersedable choice has been affirmed by its adoption in a publication that did not use a mechanical method of selection” (Art. 5).

In 1918, Britton cited *Pontederia azurea* as the type species for *Piaropus*. In contrast, (Farr et al. 1979: 1337) listed the type as “*non designatus*”.

Pellegrini and Horn published *Pontederia* subgenus *Oshunae* M. Pell. & C.N. Horn (in Pellegrini et al., 2018), with its type as “*Pontederia crassipes* Mart. ≡*Eichhornia crassipes* (Mart.) Solm” and synonym as “*Piaropus* Raf., Fl. Tellur. 2: 81. 1837, *nom. rej*. Type species. *Piaropus mesomelas* Raf., *nom. Illeg*. (≡ *Pontederia crassipes* Mart.).”

It is noted here that Pellegrini and Horn’s type citation for *Piaropus* differs from that of Britton’s type designation, that these authors did not use the phrase “designated here” (*hic designatus*) or an equivalent, and that their citation does not constitute an act of typification (see Art. 7.11). A search was made to check whether any pre-2000 botanical publication cited *Pontederia crassipes* as the type, but none was found.

The Shenzhen Code Appendix III (Wiersema et al., accessed October 31, 2021, https://naturalhistory2.si.edu/botany/codes-proposals/display_new.cfm) shows the following:

Eichhornia Kunth, Eichhornia: 3. 1842 [*Ponteder.*]. *Typus*: *E. azurea* (Sw.) Kunth (*Pontederia azurea* Sw.) (*typ. cons.*).	(≡) *Piaropus* Raf., Fl. Tellur. 2: 81. Jan–Mar 1837 (*typ. des.*: Britton, Fl. Bermuda: 64. 1918).

Whether the triple (≡) sign associated with *Piaropus* could be considered as an equivalence of the phrase “designated here” for an affirmation of Britton’s designation of type, McNeill (E), In a personal discussion, remarked that it could; he further emphasized that the equivalency applies if the affirming author explicitly cited the type of the homotypic genus name to which the identity sign points. McNeill’s assessment on the triple sign was accepted by Turland, Greuter, and Wiersema. Turland mentioned that the triple sign was first used in the St. Louis Code Appendix III (Greuter et al., 2000). Wiersema added that in 1874, Pfeiffer designated *E. azurea* as the lectotype of *Eichhornia*.

In other words, both *Eichhornia* and *Piaropus* have the same type, i.e., *Pontederia azurea*, and *Piaropus* cannot be a heterotypic synonym of *Pontederia* subg. *Oshunae*.

Accordingly, the type citations are shown here:

Eichhornia Kunth, *Eichhornia, Gen. Nov.* [Diss.] 1842 (*nom. cons.*).
Type: *E. azurea* (Sw.) Kunth (*Pontederia azurea* Sw.) (vide Pfeiffer, Nomencl. Bot. 1(2): 1174. 1874-75).

Piaropus Raf., Fl. Tell. 2: 81. Jan-Mar 1837 (‘1836’) (*nom. rej.*).
Type: *P. azureus* (Sw.) Raf. (*Pontederia azurea* Sw.) (*vide* Britton, Fl. Bermuda: 64. 1918; affirmed by Greuter et al., 2000: 238)
≡*Eichhornia* Kunth 1842 (*nom. cons.*)

Pontederia subg. **Oshunae** M. Pell. & C.N. Horn, Phytokeys 108: 61. 2018.
Type: *Pontederia crassipes* Mart. ≡*Eichhornia crassipes* (Mart.) Solms
*Piaropu*s Raf., Fl. Tellur. 2: 81. 1837, p.p. (excluding the type); A. Haines, Stantec Bot. Notes 15: 4. 2020.

I extend my thanks to W. Greuter (B), J. McNeill (E), N. J. Turland (B), and J.n H. Wiersema (US) for their remarks on the typification of the genus name *Piaropus*; and to Anthony R. Brach (A, GH) for helpful comments on the manuscript.

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VALIDATION OF *TOXICODENDRON* SECT. *VENENATA*

In 1881, Engler proposed the sectional name *Rhus* sect. *Venenatae* Engl., and the type species is *R. venenata* DC., a superfluous illegitimate name for *R. vernix* L.

For a forthcoming volume of Flora of North America, consisting of the family Anacardiaceae, Susan Pell and Gandhi noted the following. Gillis (1971: 72, 163) recognized "*Toxicodendron* section *Venenata*" and distinguished it from *T.* sect. *Toxicodendron* and *T.* sect. *Simplicifolia* Gillis. He, however, did not treat "sect. *Venenata*" and remarked that he considered it "too large and diverse a group to include at the present time," and therefore, Gillis's intended composition of it is unclear. Furthermore, he did not provide a Latin diagnosis/description, reference to *Rhus* sect. *Venenatae*, or cite a type for the sectional name. Therefore, "*Toxicodendron* section *Venenata*" remains an invalid name. Nevertheless, perhaps unaware of its invalidity, the sectional name has been referenced in numerous subsequent publications, e.g., Nie et al. (2009: 417–418, 421, 426–427). The sectional name is validated here.

Toxicodendron sect. *Venenata* (Engl.) Pell & Gandhi, *comb. & stat. nov.*

Basionym: *Rhus* sect. *Venenatae* Engl., Bot. Jahrb. Syst. 1(4): 379. 1881.

Type: *R. venenata* DC., illegitimate (*R. vernix* L., *T. vernix* (L.) Kuntze)

The epithet *Venenatae* is a plural feminine adjective agreeing with the gender of *Rhus*, whereas *Venenata* is a plural neuter adjective agreeing with the gender of *Toxicodendron*.

LITERATURE CITED

FARR, E. R., J. A. LEUSSINK, AND F. A. STAFLEU (EDS.). 1979. *Index nominum genericorum* (*plantarum*). Regnum Vegetabile 100–102. Bohn, Scheltema & Holkema, Utrecht.

GILLIS, W. T. 1971. The systematics and ecology of poison-ivy and the poison-oaks (*Toxicodendron*, *Anacardiaceae*) Rhodora 73: 72–159, 161–237.

GREUTER, W., J. MCNEILL, F. R. BARRIE, H.-M. BURDET, V. DEMOULIN, T. S. FILGUEIRAS, D. H. NICOLSON, P. C. SILVA, J. E. SKOG, P. TREHANE, N. J. TURLAND, AND D. L. HAWKSWORTH, EDS., 2000. International Code of Botanical Nomenclature (Saint Louis Code) adopted by the Sixteenth International Botanical Congress St Louis, Missouri, July–August 1999. Regnum Vegetabile 138. Koeltz Botanical Books, Königstein. https://www.bgbm.org/iapt/nomenclature/code/SaintLouis/0000St.Luistitle.htm

NIE, Z. L., SUN, H., MENG, Y. AND WEN, J. 2009. Phylogenetic analysis of *Toxicodendron* (Anacardiaceae)and its biogeographic implications on the evolution of north temperate and tropical intercontinental disjunctions. J. Syst. Evol. 47(5): 416–430. doi: 10.1111/j.1759-6831.2009.00045.x

PELLEGRINI, M. O. O., C. N. HORN, R. F. ALMEIDA. 2018. Total evidence phylogeny of Pontederiaceae (Commelinales) sheds light on the necessity of its recircumscription and synopsis of *Pontederia* L. Phytokeys 108: 25–83.

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, EDS., 2018. *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017.* Regnum Vegetabile 159. Koeltz Botanical Books, Glashütten. https://doi.org/10.12705/Code.2018

HISTORIC DISCOVERY OF A NEW SPECIES OF *LUVUNGA* (RUTACEAE) FROM MINDANAO, SOUTHERN PHILIPPINES

Kean Roe F. Mazo[1] and Arkady A. Tahil[2,3,4]

Abstract. After 113 years since the only *Luvunga* species was described from the Philippines and after 36 years since the latest species of the genus was formally described from Sabah, Borneo, a species new to science of *Luvunga* from Zamboanga del Norte, Southern Philippines, *L. subanense*, is described and illustrated. The new species differs from similar species, *L. philippinensis* and *L. crassifolia*, by having longer thorns, longer petioles and an inflorescence of four-flowered cymes. It further distinguishes from its most similar species, *L. philippinensis*, by having nine stamens (vs. 10), shorter filaments (4–4.5 mm vs. 6 mm) and ovoid ovary (vs. oblong) which is globular in cross-section (vs. quadrangular). Figures, a table of comparing the new species to *L. philippinensis* and *L. crassifolia*, notes on distribution, habitat and conservation status are provided. This novelty brings the total number of *Luvunga* species to 15 of which four are found in the Philippines.

Keywords: *Luvunga philippinensis*, Mindanao, morphology, Rutaceae, taxonomy, Zamboanga

Rutaceae comprise of about 150 genera that are usually trees and shrubs distributed in both tropical and temperate regions. Leaf character in this family can be alternate or opposite and simple or compound while the inflorescence can be solitary or in fascicles, axillary or terminal, and regular or perfect. Two closely related genera with unusual habit in this family, *Luvunga* Buch.-Ham. ex Wight & Arn. and *Paramigna* Wight, are clambering woody lianas that have retrorse or sometimes strongly recurved thorns that act as anchorage to the branches of trees (Swingle, 1943). All species in the genus *Luvunga* in particular, exhibit this habit that allows the plants to climb to the canopy of tropical evergreen forests. The genus *Luvunga* is composed of at least 14 species, all of which are very similar morphologically. In general, species within the genus are characterized by having 3-foliate leaves, very long wingless petioles and clusters of scented flowers in the leaf axils. In contrast to the genus is well-characterized and easily recognizable, the majority of the species are not clearly distinguishable (Stone, 1985), perhaps because reproductive characters of several species in the genus were not known or poorly. For example, the flowers of *L. calophylla* Kurz. were unknown up until recently, and the majority of the accounts for various species lacks uniformity in the description of their floral characters such as number of stamens, length of filament and calyx, and shape of the ovary both externally and in cross-section. There is also a lack of documentation on the size of flowers in almost all species. Despite being poorly described, some species are distinguishable by their unique vegetative characters. For example, *L. motleyi* Oliv. has the longest petiole within the genus which can reach up to 30.5 cm, while *L. borneensis* Hochr. is the only species with distinctly broadly elliptical leaflets and *L. papuana* Lauterb. as the only species with thorns being coiled in a spiral manner. Another example is *L. monophylla* (DC.) Mabb which is the only species in the genus with leaves being exclusively simple rather than compound. Undoubtedly the only *Luvunga* species with unique floral character, *L. minutiflora* B.C. Stone, is the latest species described in the genus from the district of Sandakan, Sabah, Borneo, in 1985: it has very small flowers, perhaps the smallest in the genus.

Species of *Luvunga* are found in India, Sri Lanka, Indochina, Sumatra, Java, Timor, Malay peninsula, Borneo, the Philippines, Australia, and New Guinea. In the Philippines, only three species of *Luvunga* are recorded (Pelser *et al*., 2011 onwards): *L. monophylla*, *L. philippinensis* Merr. and *L. scandens* (Roxb.) Buch.-Ham., none of which are endemic to the Philippines. In fact, *L. philippinensis* has a patchy distribution from Palawan to Western Mindanao and extends downwards to Borneo. Described by Merrill in 1908 from Zamboanga (probably Zamboanga del Sur), *L. philippinensis* was the only *Luvunga* species originally described from the Philippines.

In the course of taxonomic study of flora in Zamboanga del Norte, a species of *Luvunga* was encountered, collected and studied, tentatively identified as *L.* cf. *philippinensis* due to similarities on vegetative characters. Thorough examination of materials was carried out by the authors and the specimens (see Appendix) appeared to be distinct from *L. philippinensis*. After extensive comparison, this unidentified species found no match among the all known species within the genus, and it is herein formally described and illustrated.

Luvunga subanense K.R. Mazo & Tahil, *sp. nov.* TYPE: PHILIPPINES. Mindanao, Zamboanga Del Norte Province: municipality of Leon B. Postigo, Brgy. Tinuyop, 8°3'56.34"N, 122°55'50.54"E, 330 m, 14 February 2021, *K. R. Mazo 30* (Holotype: PNH; Isotypes: CEBU, CMUH). Fig. 1–2.

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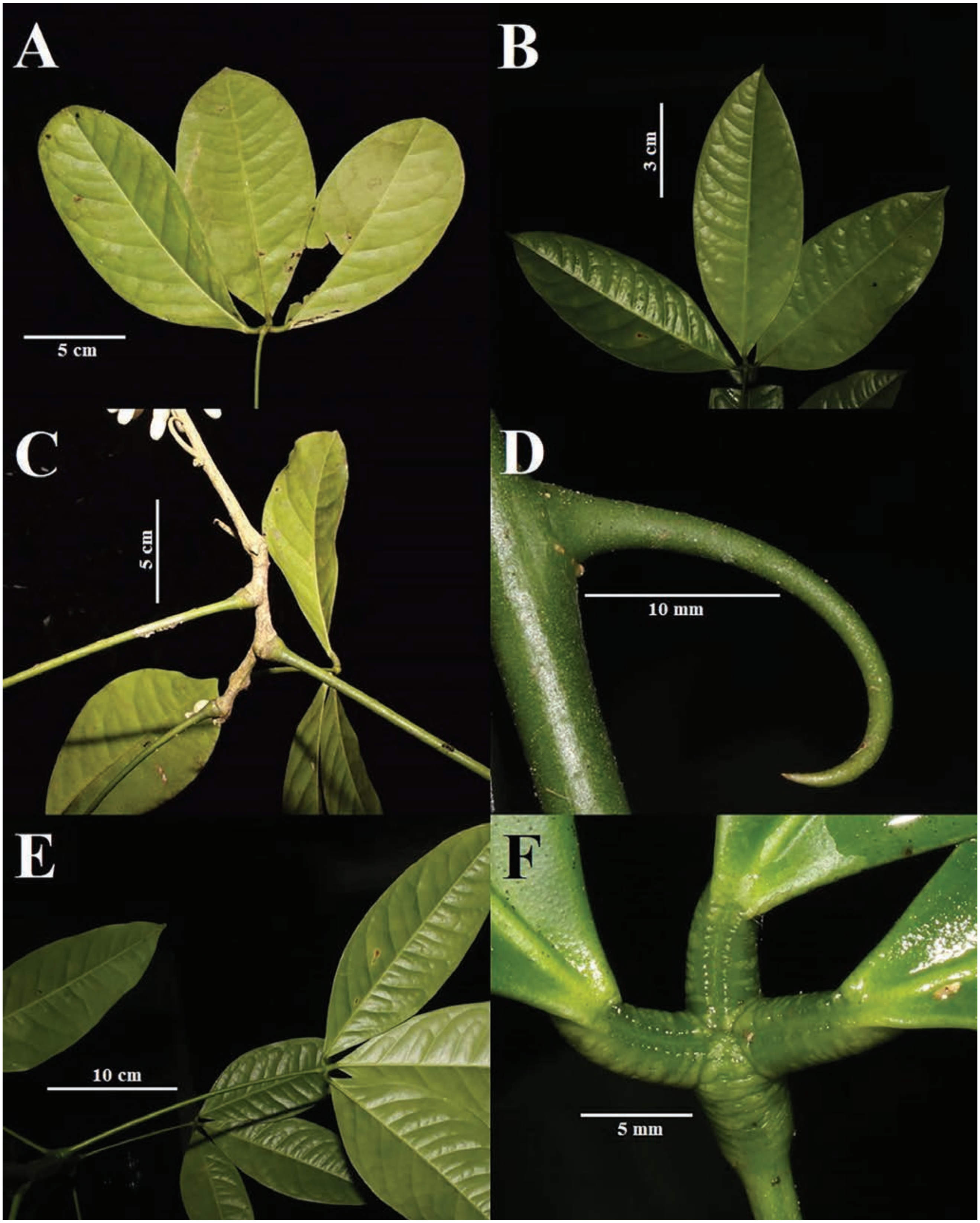

FIGURE 1. *Luvunga subanense* K.R. Mazo & Tahil. **A**, broadly elliptic leaflets; **B**, oblong-elliptic leaflets; **C**, branch showing swollen base of petiole and attachment; **D**, arcuate thorn; **E**, petiole; **F**, petiolules. Based on the holotype.

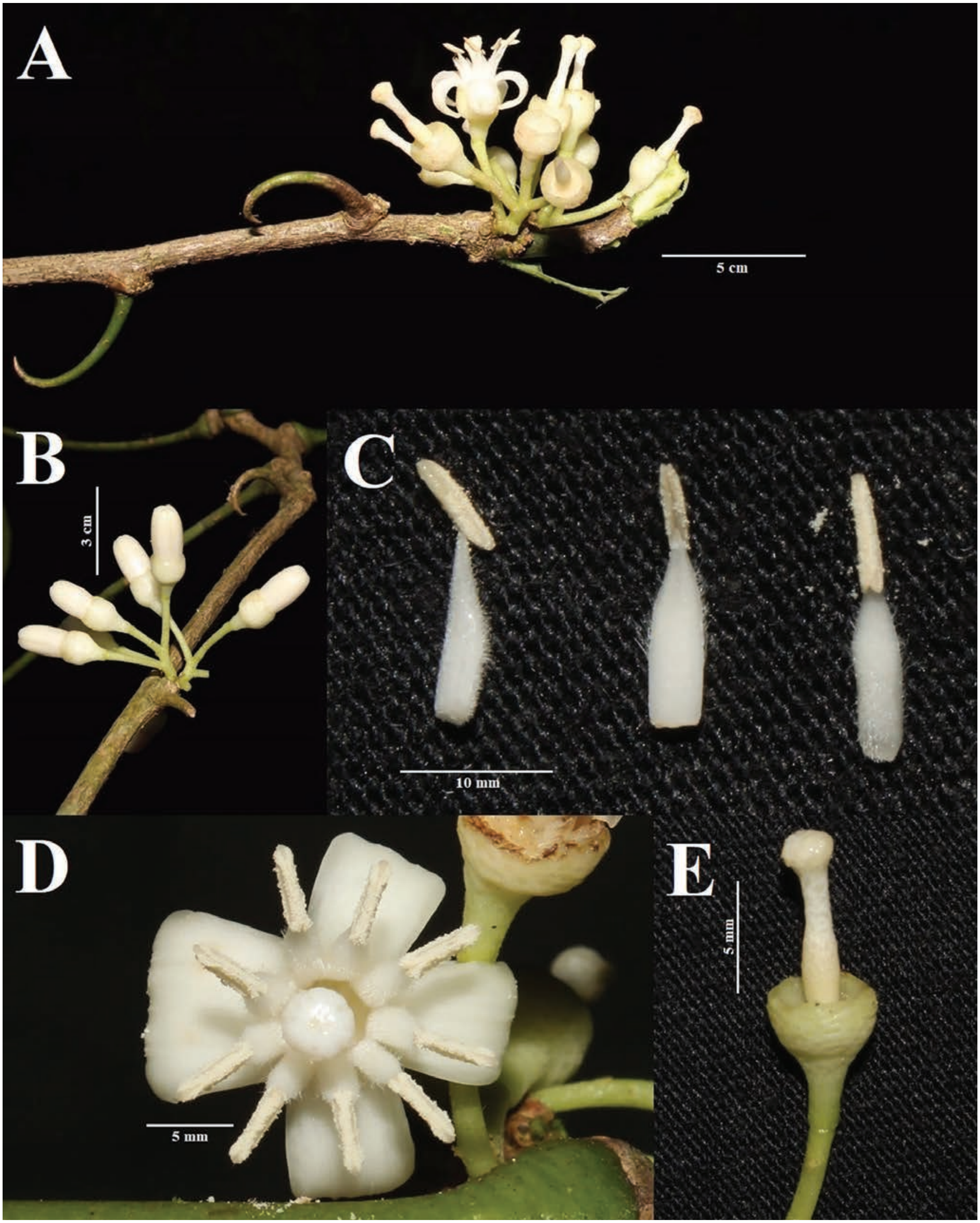

FIGURE 2. *Luvunga subanense* K.R. Mazo & Tahil. **A**, branch showing the inflorescence and arcuate thorns; **B**, flower buds; **C**, filaments and anthers; **D**, anterior close-up view of a flower showing the number of pubescent stamens and strongly reflexed petals; **E**, stipe, calyx, style and stigma. Based on the holotype.

A similar species to both *L. philippinensis* Merr. and *L. crassifolia* Tan. by having generally oblongate leaflets and pubescent filaments, but differing in the length of thorns (2.5–3.0 vs. 1.2–1.5 vs. 2.0–2.5 cm) and petioles (14–24 vs. 9–13 vs. 11–14.5 cm) and the number of flower being produced in each cyme (4 vs. 3 vs. 6). It is further distinguished from a much closer species, *L. philippinensis*, by having nine stamens (vs. 10), shorter filaments (4–4.5 vs. 6 mm) and ovoid ovary (vs. oblong) which is globular in cross-section (vs. quadrangular).

Scandent *shrub* up to 20 m tall, thorns distinctly arcuate, slightly dilated at the base, usually 2–3 mm in diameter, tapering toward the tip, 2.5–3.0 cm long; *bark* grayish to brown; young branch green, glabrous, becoming darker when mature. *Petiole* green, 14–24 cm × 1.5–4.5 mm in diam., glabrous, swollen at and apex and base, distinctly swollen base raised by 3–5 mm from the branch surface where it is connected, terete; *petiolules* furrowed at the surface, connected to the base of lamina, corrugated below, 3.5–9 × 2–4.3 mm, dark green, glabrous; *leaflets* 3, narrow, subcoriaceous, adaxial surface grass green, glossy, paler abaxially; terminal leaflets 15–28 × 7–10 cm, lateral leaflets 11.5–24 × 5.5–10 cm, glabrous, all blades oblong-elliptic or rarely broadly elliptic, base acute, apex acuminate, the acumen rounded, margin entire; midrib 0.8–1.0 mm in diameter, glabrous, light green, lateral veins 9–15 in each side, visible on both surfaces, much more conspicuous below, venation reticulate, tertiary veins almost inconspicuous. *Inflorescence* racemose cymes, consistently 4–flowered, axillary, borne on the branches below or sometimes away from the leaves, 2.7–3 cm long; cymes often paired into two, joining basally from a slightly swollen structure where they arise, 4–5 mm in diameter, but occasionally bears more than two cymes in cluster; pedicel 1–1.5 mm long, terete, pastel green, glabrous; peduncle 4–6.5 mm long, terete, pastel light green, glabrous. *Flowers* relatively large, 2–2.2 × 3.0 cm, divaricately borne along the cyme axis, fragrant; *Calyx* cupuliform, obscurely 5-toothed, 5–5.4 mm wide, 2.5 high, foveate, gradually tapering towards the stipe which is 3.2 mm long and articulated at the end before the peduncle; *Petals* 4, white, 9–11 × 4.5–6.6 mm, elliptic-oblong, imbricate, apically truncate, strongly arcuately reflexed. *Stamens* 9, connate; *filaments* 4–4.5 × 1.3–1.5 mm, ensiform, intensely pubescent; anthers erect, oblong, 2.8–3.0 mm long, basifixed, dehiscing longitudinally. *Ovary* globose to ovoid, glabrous, with 4 locules, 3.2 mm long, 1.6 mm thick, globular in cross-section. *Style* 7.7 mm, foveate, white; stigma capitate. *Fruit* not observed.

Etymology: This taxonomic novelty is named in honor of the indigenous Subanen people of Zamboanga Peninsula.

Distribution and habitat: *Luvunga subanense* is only known in the disturbed tropical lowland forest of barangay Tinuyop, Leon B. Postigo, Zamboanga del Norte, the Philippines along the river at elevation from 300–330 m elevation.

Phenology: This species has been observed flowering in the month of January and February.

Conservation Status: *Luvunga subanense* is currently known only from its type of locality based on three specimens studied. The information on the range of distribution of the species is still lacking. Thus, we proposed Data Deficient (DD) category (IUCN, 2019) for this species.

Luvunga subanense resembles *L. philippinensis* and *L. crassifolia* by having oblongate leaflets and pubescent filaments in general. The maximum number of lateral veins in *L. subanense* is similar to that of *L. crassifolia* (up to 15) while fewer in *L. philippinensis* (10 vs. 15). The length of the thorns is comparable among the three species. While the thorns in *L. philippinensis* is shorter of up to 1.5 cm only, the thorns of *L. subanense* are relatively longer than those of *L. crassifolia* (2.5–3.0 vs. 2.0–2.5 cm). In addition to the difference on thorn length, examination of herbarium specimens revealed that the thorns of *L. subanense* and *L. crassifolia* are thinner and more flexible that those of *L. philippinensis*. Discernable from the materials examined, unlike the thorns of *L. subanense* and *L. philippinensis*, the thorns of *L. crassifolia* are remarkably coiled at least once but not reaching to the degree as in the thorns of *L. papuana*. *Luvunga subanense* has the longest petiole (14–24 vs. 9–13 vs. 11–14.5 cm) among the three species and the second species in the genus, after *L. motleyi* which petioles can reach up to 30.5 cm. The merosity of flower in the cyme of the three species is dissimilar and this perhaps poses significance in species delimitation. *L. philippinensis* was described by Merrill (1908) in having three flowers in its racemose cymes which are fragrant and small. *Luvunga subanense* cymes bear consistently four flowers which are divaricately borne along the axis. The number of flower in the inflorescence of *L. crassifolia* was not mentioned in the original description of the species. However, Swingle (1943) noted some characters after examining a specimen identified by Tanaka as "*L. crassifolia*" in the herbarium of the Arnold Arboretum which shows an infructescence with six fruits, evidently indicating identical number of its flowers. Therefore, *L. subanense* is readily distinguishable from *L. philippinensis* and *L. crassifolia* by having longer thorns, significantly longer petioles, and the production of four flowers in its inflorescence.

Considering *L. philippinensis* as the most closely related species to *L. subanense* is undisputable as both are identical in shape of lamina, leaf base and leaf apex, having the calyx cupiliform which is obscurely toothed and these two species are sympatric, both shares geographic distribution in Zamboanga peninsula of the Island of Mindanao. On the other hand, *L. crassifolia* is distributed in Malay peninsula and the Islands of Borneo and Sumatra and is readily recognizable from *L. subanense* and *L. philippinensis* by having obtuse leaf base and rounded leaf apex. Despite the major diagnostic features presented above that recognizes *L. subanense* from *L. philippinensis* and *L. crassifolia*, the new species further distinguishes from *L. philippinensis* by having nine stamens (vs. 10), shorter filaments (4–4.5 vs. 6 mm) and ovoid ovary (vs. oblong) which is globular in cross-section (vs. quadrangular). A comparison of diagnostic characters of *L. subanense*, *L. philippinensis* and *L. crassifolia* is presented in Table 1.

TABLE 1. Morphological differences between *L. subanense, L. philippinensis* and *L. crassifolia*.

Character	***L. SUBANENSE***	***L. PHILIPPINENSIS***	***L. CRASSIFOLIA***
Shape of lamina	Oblong to oblong-elliptic (rarely broadly elliptic)	Oblong to oblong-elliptic**	Obovate or oblong-ovate**
Length of thorns	2.5–3.0 cm	1.2–1.5 cm*	2.0–2.5 cm*
Length of petiole	14–24 cm	9–13 cm**	11–14.5 cm**
Leaf base	Acute	Acute**	Obtuse**
Leaf apex	Acuminate	Acuminate**	Rounded**
No. of pairs of lateral veins	9–15	8–10**	12–15**
No. of flowers in a cyme	4	3**	6**
No. of stamen	9	10**	Unknown
Length of filament	4–4.5 mm	6 mm**	Unknown
Ovary shape	Ovoid	Oblong**	Unknown
Ovary shape (in cross-section)	Globular	Quadrangular**	Unknown

* Based on specimens examined (see Appendix).
** Based on Swingle (1943).

LITERATURE CITED

IUCN. 2019. Guidelines for using the IUCN red list categories and criteria. Version 13. Prepared by the Standards and Petitions Subcommittee. Available at: http://www.redlist.org/documents/RedListGuidelines.pdf (accessed 23 July 2021)

MERRILL, E.D. 1908. New or noteworthy Philippine plants VI. The Philippine Journal of Science 3: 233.

PELSER, P. B., J. F. BARCELONA, AND D. L. NICKRENT (EDS.). 2011 onwards. *Co's Digital Flora of the Philippines*. Available at: www.philippineplants.org. (accessed April 20, 2021).

STONE, B. C. 1985. New and Noteworthy Paleotropical Species of Rutaceae. Proceedings of the Academy of Natural Sciences of Philadelphia 137, No. 2: 213–228.

SWINGLE, W. T. 1943. The Botany of *Citrus* and its wild relatives of the Orange subfamily. Pages 129–474 in H. J. WEBBER AND L. D. BATCHELOR, EDS., The Citrus Industry 1: History, Botany, and Breeding. University of California, Berkeley.

LUVUNGA SPECIMENS EXAMINED FOR MORPHOLOGICAL COMPARISON

Luvunga philippinensis Merr.

PHILIPPINES. District of Zamboanga, Mindanao, May 1913, *E. D. Merrill 8139* (K000736068)

Luvunga crassifolia Tan.

INDONESIA. Sungal Posang, Sintang, Kalimantan, Borneo, April 1994, *A. C. Church, U. W. Mahyar, I. Indah & Hamzah 1036* (L4151220). MALAYSIA. Tasik Kenyer, Hulu Terengganu, Terengganu, August 2017, *A. Julius 56137* (L4174131); Perias, West Kelantan, July 1964, *T. C. Whitmore 4214* (L2117193); Perias, West Kelantan, July 1967, *T. C. Whitmore 4159* (L2117201)

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A TAXONOMIC SYNOPSIS OF CORDIACEAE AND HELIOTROPIACEAE (BORAGINALES) FROM URUGUAY

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Abstract. The present study provides a taxonomic synopsis of Cordiaceae and Heliotropiaceae (Boraginales) for Uruguay. In order to gain full comprehension of the Uruguayan species in these groups, we examined collections at MVFA, MVJB and MVM, CTES, and SI, consulted virtual collections at F, K, NL-L, NL-U, and P, and studied the online collections hosted by the Herbário Virtual da Flora e dos Fungos-Reflora. We accept 19 species, six of which belong to Cordiaceae (*Cordia* and *Varronia*, each with three species) and 13 to Heliotropiaceae (*Euploca* with four species, *Heliotropium* with seven species, and *Myriopus* with two species). *Euploca filiformis* and *E. krapovickasii* are recorded for the first time for Uruguay. We provide identification keys for the recognition of each family and their species, a list of selected specimens, and comments on the morphology, distribution and phenology of each species.

Keywords: Cordiaceae, distribution, diversity, Heliotropiaceae, South America, Uruguay

Uruguay is biogeographically included in the Chacoan Domain, associated with the Pampean Province (Cabrera and Willink, 1973). It is the smallest South American country, with an area of 176.215 km^2 and divided into 19 departments. Marchesi et al. (2013) observed that Uruguay's geology and geomorphology serve as a basis on which the different types of soil and vegetation develop. The country's position in southeastern South America, at the mouth of Río de la Plata—the continent's second-largest river basin—and its climate are also crucial determining factors for the Uruguayan flora. The Uruguayan territory consists of a very rich soil mosaic with a broad and complex hydrographic network, which allows a wide variety of environmental conditions and great floristic diversity, despite its reduced area (Marchesi et al., 2013).

The local flora diversity's is also explained by the country's transitional nature, serving as the austral limit to several species from the State of Paraná (Brazil) and as the eastern limit to several species from the Chaco domain (Brussa and Grela, 2007), intermixed with grassland species from the Pampa domain (Marchesi, 2005). From a floristic point of view, Uruguay is paradoxically one of the least understood South American countries, with studies focusing on the taxonomy of few families or groups of angiosperms and ferns and allies. However, according to Brussa and Grela (2007), the country's vascular flora is represented by 2400 species.

Thus, amidst the scarcity of taxonomic studies for the vascular flora of Uruguay, especially regarding the order Boraginales, we present a synopsis of Cordiaceae and Heliotropiaceae in Uruguay (Boraginales, following the familial classification proposed in Luebert et al., 2016). We provide identification keys for the recognition of each family and their species, a list of specimens seen, and comments on the morphology, distribution and phenology of each species. This study also aims to contribute with the knowledge on the diversity and distribution of austral South America.

Materials and Methods

The characterization of Uruguay's flora and vegetation (Fig. 1) can be found in Brussa and Grela (2007). The taxonomic study was mainly based on the morphological analysis of specimens housed at CTES, F, K, MVFA, MVJB, MVM, NL-L, NL-U, and P (acronyms according to Thiers, continuously updated). These analyzes were complemented by the online collections hosted at the portal "Herbário Virtual da Flora e dos Fungos-Reflora". Species identification was based on the examination of original publications, type specimens available through the JSTOR-Global Plants portal, Mesoamerican and South American floras, and taxonomic revisions (Johnston, 1928, 1930; Taroda and Gibbs, 1986a, b, 1987; Melo and Semir, 2008, 2010; Cavalheiro et al., 2011; Melo et al., 2018; Miller, 2013; Vieira et al., 2015). Morphological terminology follows Radford et al. (1974) and Gonçalves and Lorenzi (2007). Authors of taxon names follow Brummitt and Powell (1992) and Melo et al. (Flora do Brasil 2020).

Key to the studied families of Boraginales from Uruguay

1a. Commonly caespitose subshrubs, shrubs or trees; inflorescences spike-like, globose or globose-glomerulate; styles bifid, stigmas 2, 2-forked, clavate to capitate . . . . Cordiaceae

1b. Erect, ascending or prostrate herbs and subshrubs, shrubs or lianas or climbing shrubs; inflorescences scorpioid, mostly many-flowered; stigma 1, conically elongate, entire or slightly parted at apex . . . . Heliotropiaceae

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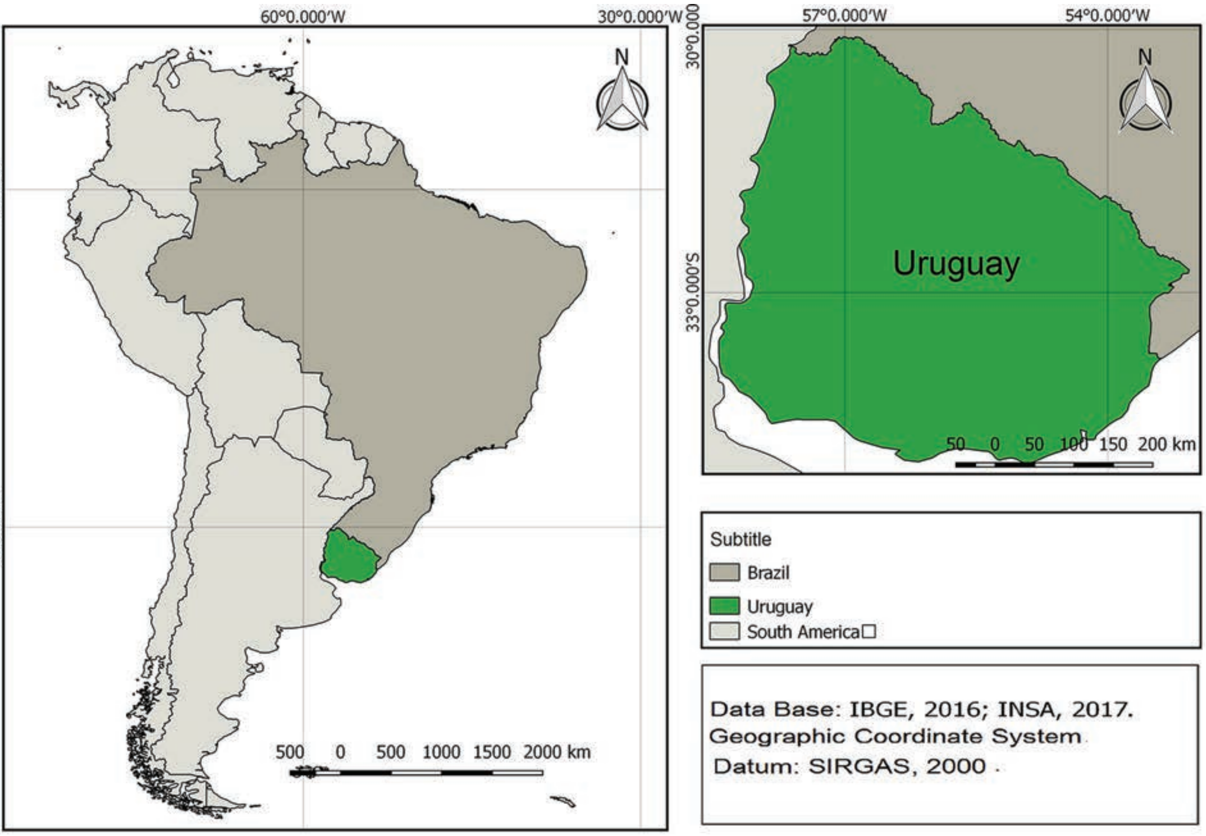

FIGURE 1. Map of the study area.

KEY TO THE SPECIES OF CORDIACEAE FROM URUGUAY

1a. Trees; inflorescences thyrsoid or paniculiform 2
1b. Shrubs; inflorescences spike-like or globose-glomerulate 4
2a. Fruit subtended by a persistent and accrescent calyx . . . . *Cordia americana*
2b. Fruits not subtended by a persistent and accrescent calyx 3
3a. Branches with stellate hairs; inflorescences congested; calyx costate . . . . *Cordia trichotoma*
3b. Branches glabrous; inflorescences lax; calyx smooth . . . . *Cordia ecalyculata*
4a. Inflorescences spike-like . . . . *Varronia curassavica*
4b. Inflorescences globose-glomerulate 5
5a. Inflorescences terminal . . . . *Varronia paucidentata*
5b. Inflorescences terminal and axillary . . . . *Varronia polycephala*

Cordiaceae R. Br. ex Dumort., Anal. Fam. Pl.: 25. 1829. Type: *Cordia* L.

Arranged in two genera, with ca. 350 species occurring along the tropical and subtropical regions of the world. Cordiaceae has Central America and northern South America as its diversity centers, with few species recorded for temperate zones. The family is characterized by its undivisive endocarp, stigma with four lobes, and plicate cotyledons (Gottschling, 2003; Miller and Gottschling, 2007; Stapf, 2007).

1. ***Cordia*** L., Sp. Pl. 1: 190. 1753. Type: *Cordia myxa* L.

A genus presenting ca. 250 species and Pantropical distribution, with diversity centers in the West Indies, northern South America, and Africa (Miller and Gottschling, 2007). It is represented in Uruguay by three species: *C. americana*, C. *ecalyculata*, and *C. trichotoma*.

1.1. ***Cordia americana*** (L.) Gottschling & J.S. Mill., Syst. Bot. 31(2): 364. 2006.

Basionym: *Patagonula americana* L., Sp. Pl. 1: 149. 1753. TYPE: Dillenius, Hort. Eltham. t. 226, f. 293. 1732 (Lectotype, designated by Miller in Jarvis et al., 1993). Fig. 2 a–b.

Vernacular name: Guayubira

Additional specimens examined: URUGUAY. **Artigas:** Campo Verdún, Rincon de Sepulturas, 21 September 2003, (fl), *Brussa et al. s.n.* (MVJB 20319); Cuareim, Isla Brasilera, 28 October 2003, (fl), *Brussa s.n.* (MVJB 23481); orillas del Río Cuareim, March 1938, (fl), *Lombardo s.n.* (MVJB 12308); río Cuareim al oeste de la desembocadura, 19 January 2004, (fl), *Brussa et al. s.n.* (MVJB 21524); 09 March 1901, (fl), *Berro s.n.* (MVFA 1516, MVM s.n.); March 1917, (fl), *Berro s.n.* (MVFA 8584). **Montevideo:** 01 September 1921, (fl), *Herter 4994* (NL-L 2761896);

FIGURE 2. Species of Cordiaceae from Uruguay. **A–B**, *Cordia americana* (L.) Gottschling & J.S. Mill.; **C,** *C. trichotoma* (Vell.) Arráb. ex Steud.; **D**, *Varronia curassavica* Jacq.; **E**, *V. polycephala* Lam.

Parque Santiago Vásquez, October 1958, (fl), *Lombardo s.n.* (MVJB 12307).

Distribution: It is found growing in seasonally dry forests in two disjunctive populations. The first in Southern Brazil, northern Argentina and Paraguay, while the second ranges from southern Bolivia and areas surrounding northern Argentina (Gottschling and Miller, 2006).

Phenology: Collected in bloom in January, February, March, September and October.

Cordia americana is easily recognized by its fruits with accrescent and deeply divided calyx with five rotate lobes and its abaxially glabrous leaves.

1.2. ***Cordia ecalyculata*** Vell., Fl. Flumin.: 96. 1825[1829]. TYPE: Not located.

Additional specimen examined: URUGUAY. **Rivera**: Camino de Tranqueras a Paso de Ataques, al noroeste del Paso Piraña, 11 November 2006, (fl, fr), *Brussa & Grela s.n.* (MVJB 25070).

Distribution: *Cordia ecalyculata* is recorded for Argentina, Brazil and Paraguay, growing in montane, submontane, gallery and semideciduous forests (Stapf, 2007).

Phenology: Blooms and fruits in November.

Notes: Characterized by its leaves glabrous on both sides, globose floral buds, calyx three or four erect lobes, and glabrous fruits.

1.3. ***Cordia trichotoma*** (Vell.) Arráb. ex Steud., Nom. ed. 2: 419. 1840.

Basionym: *Cordiada trichotoma* Vell., Fl. Flum. Icon. 2: 156. 1831. TYPE: Not located. Fig. 2c.

Additional specimens examined: URUGUAY. **Colonia:** Colonia Valdense, 15 May 2005, (fl, fr), *Brussa & Nin s.n.* (MVJB 22747). **Montevideo:** Vivero del Parque Rivera, 02 March 2001, (fl), *Brussa s.n.* (MVJB 22832).

Distribution: From Northeastern Brazil to Bolivia and from Paraguay to northern Argentina, from the sea level to 1,000 m altitude (Miller, 2013).

Phenology: Found in bloom in March and in bloom and fruit in May.

Cordia trichotoma has stellate hairs, costate calyx, flowers 1.4–1.9 cm long, corolla lobes with a subtruncate apex.

2. ***Varronia*** P. Browne, Civ. Nat. Hist. Jamaica: 172. 1756. Type: *Varronia humilis* Jacq., designated by Borhidi *et al.* (1988).

A genus with ca. 100 species distributed throughout the Neotropics, reaching desert areas in the U.S.A. (Arizona) and Argentina. It has Mexico and Brazil as its main diversity centers (Miller and Gottschling, 2007). In Uruguay, it is represented by three species: *V. curassavica*, *V. paucidentata*, and *V. polycephala*.

2.1. ***Varronia curassavica*** Jacq., Enum. Syst. pl.: 14. 1760. TYPE: "Plukenet, 329, t. 221 f. 3". EPYTYPE: ANTILLAS HOLANDESAS. Curaçao, arid situations, near sea level, 29 March 1927, *E.P. Killip & A.C. Smith 21058* (NY01361049!) (lectotype and epitype, designated by Silva and Melo, 2019). Fig. 2d.

Additional specimens examined: URUGUAY. **Rocha:** Balneario Antoniópolis, 20 February 2003, (fl, fr) *Brussa s.n.* (MVJB 22939); Benicio Pereira, Ruta 10 km 259, 22 September 2001, (fl, fr), *Delfino et al. s.n.* (MVJB 21429); Cabo Polonio, Cañada, May 2001, (fl, fr), *Delfino s.n.* (MVJB 20268); March 1959, (fl, fr), *Legrand s.n.* (MVM 4457); 23 March 1961, (fl, fr), *Legrand s.n.* (MVM 4603); Cabo Santa María, 06 February 1938, (fl), Rosengurtt (MVFA B-2479, F 950312); Cerro Chato, 22 April 2004, (fl, fr), *Bonifacino et al. 1122* (MVFA); Cerro Verde, 29 July 2012, (fl, fr), *Delfino & O'Neill s.n.* (MVJB 28222); Fortaleza del Santa Teresa, 30 April 1937, (fl), *Lombardo s.n.* (MVJB 12290); March 1938, (fl, fr), *Lombardo s.n.* (MVJB 12289); Laguna Negra, 02 April 1987, (fl, fr), *Delfino s.n.* (MVJB 20625); 06 October 1985, (fl, fr), *Paz s.n.* (MVM 2136); 19 January 1965, (fl, fr), *Brescia & Marchesi s.n.* (F 1629410, MVFA 3980); Parque San Miguel, 15 December 1985, (fl, fr), *Brussa et al. s.n.* (MVJB 20609); Playa de la Aguada, balneario la Paloma, 05 January 2005, (fl), *Brussa s.n.* (MVJB 26346); Playa Grande, 28 Feruary 2007, (fl, fr), *Callero s.n.* (MVJB 26107); 08 June 1985, (fl, fr), *Majó s.n.* (MVJB 20590); próximo a la Laguna Negra, Estância El Palmar, de Raul Rubio, cerca de Castilhos, 19 March 1977, (fl, fr), *Marchesi s.n.* (MVFA 13097); Santa Teresa, 08 May 1951, (fl, fr), *Legrand s.n.* (MVM 3727); November 1931, (fl, fr), *Herter 7802* (AMD 40943, F 864831).

Distribution: *Varronia curassavica* ranges from southeastern Mexico, through Panama and the West Indies, to northeastern South America (Gibson, 1970).

Phenology: Blooms and fruits throughout the year.

Varronia curassavica is easily recognized by its lanceolate leaves with attenuate base and serrate margins, inflorescences spike-like, and calyx with lobes ovate-lanceolate with trullate apex.

2.2. ***Varronia paucidentata*** (Fresen.) Friesen, Bull. Soc. Bot. Genève 1931-2, Ser. II. 24: 173. 1933.

Basionym: *Cordia paucidentata* Fresen., Fl. Bras. (Martius) 8(1): 25. 1817. TYPE: BRAZIL. Rio Grande do Sul, 1816-1821, *A. Saint-Hilaire C2 2667* (Neotype: P03862610, designated by Silva and Melo, 2019).

Additional specimens examined: URUGUAY. **Rivera:** Cerro Aurora, 12 February 1961, (fl), *Rosengurtt s.n.* (MVFA 8464); cerros del Gobierno, 10 December 1907, (fl), *Berro s.n.* (MVFA 4945). **Salto:** Río Arapey, 28 January 1937, (fl), *Rosengurtt 996* (MVFA, MVM).

Distribution: From northeastern Paraguay, Argentina, Uruguay and Central-Western and Southern Brazil (Johnston, 1930; Taroda and Gibbs, 1986b).

Phenology: Blooms from December to February.

It can be easily recognized by its sessile leaves, leaf-blades oblanceolate with dentate to crenate margins, and its globose inflorescences.

2.3. ***Varronia polycephala*** Lam., Tabl. Encycl. 1: 418. 1791. TYPE: Not located. Fig. 2e.

Additional specimens examined: URUGUAY. **Colonia:** Carmelo, Balneario Zagarzazú, 13 May 2005, (fl, fr), *Delfino & Muñoz s.n.* (22400); 20 November 1924, (fl, fr), *Cabrera 3246* (MVM 23306); Concepción del Uruguay: 28 March 1872, (fl, fr), *Lorentz s.n.* (L 2750818); Isla de San Gabriel, 06 January 1902, (fl), *Berro s.n.* (MVFA 1757, MVM 2343); Martín Chico, 07 April 1992, (fl, fr), *Izaguirre et al. s.n.* (MVFA 21288); Riachuelo, Februaru 1930, (fl), *Herter 1329* (MVM 5572, NL-U 1157674); Río de la Plata, Establecimiento El Precursor, 23 November 2008, (fl, fr), *Piñeiro et al. s.n.* (MVJB 26975). **Río Negro:** Chilano, November 1914, (fl, fr), *Berro s.n.* (MVFA 7722). **Salto:** Salto Grande, Isla de Abajo, 10 May 1978, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 15501). **Soriano:** Isla del Vizcaíno, 23 January 1908, (fl, fr), *Berro s.n.* (MVFA 4424). **Tacuarembó:** Gruta de los Helechos, 15 October 1986, (fl), *Brussa et al. s.n.* (MVJB 20562); 25 March 2006, (fl, fr), *Brussa s.n.* (MVJB 23802).

Distribution: Widely distributed throughout tropical

America to La Plata river, being found in Argentina, Brasil, Paraguay, and Uruguay (Johnston, 1930).

Phenology: Blooms from January to March and from October to November.

Varronia polycephala can be easily differentiated by the remaining species of the genus recorded for Uruguay by its shortly-paniculate or globose-glomerulate, delicate inflorescences, or flowers occasionally solitary, calyx lobes with apex acute to filiform, corolla 3.5–4 mm long, and inconspicuous lobes.

Heliotropiaceae Schrad., Comment. Soc. Regiae Sci. Gött. Recent. 4: 192. 1819. Type: *Heliotropium* L.

Consisting of four genera and ca. 450 species distributed in tropical and subtropical zones globally, but more diverse in seasonally dry environments. The family is morphologically recognized b its entire and conic stigma with a ring at base (Diane et al., 2004; Hilger and Diane, 2003). In Uruguay, it is represented by three genera and 12 species: *Euploca* (three species), *Heliotropium* (seven species), and *Myriopus* (two species).

Key to the species of Heliotropiaceae from Uruguay

1a. Lianas or climbing shrubs; inflorescences scorpioid, many-flowered; flowers secund; fruits drupaceous, 4-lobed 2

1b. Herbs, subshrubs or shrubs, prostrate, ascending or erect; inflorescences scorpioid, (few–) many-flowered; flowers never secund; fruits schizocarpic, with 2–4 nutlets 3

2a. Inflorescences axillary, lax .... *Myriopus breviflorus*

2b. Inflorescences terminal and axillary, congested .... *Myriopus paniculatus*

3a. Inflorescences with or without bracts; nutlets 4 4

3b. Inflorescences without bracts; nutlets 2 7

4a. Plants cinereous; branches sericeous; inflorescences without bracts .... *Euploca procumbens*

4b. Plants cinereous or not; branches strigose; inflorescences with bracts 5

5a. Bracts leaf-like, lanceolate, externally glabrous, internally puberulous; calyx lobes of two different sizes, the 3 smaller 2–2.2 × 0.5 mm, the 2 larger 3 × 0.6 mm, externally strigose .... *Euploca ocellata*

5b. Bracts bracteose, elliptic or subulate 6

6a. Bracts villose on both sides, margins ciliate; calyx lobes of three different sizes, the one smaller 2–2.3 × 0.8 mm, the two intermediate 3.2 × 0.5 mm, the two larger 3.7 × 0.8 mm, with hyaline wings, externally villose, margins villose, internally glabrous .... *Euploca krapovickasii*

6b. Bracts subulate, opposite to the flowers, externally and internally glabrescent, not ciliated on the margins; calyx lobes with two sizes four lobes with 1.8-2.3 × 0.2-0.4 mm, ovate, one with 2-2.6 × 0.8-1 mm, elliptical to largely elliptical, glabrescent externally and internally .... *Euploca filiformis*

7a. Leaves sessile 8

7b. Leaves petiolate 10

8a. Leaf-blades slightly crass to crass; inflorescences few-flowered .... *Heliotropium curassavicum* var. *argentinum*

8b. Leaf-blades membranous to chartaceous; inflorescences many-flowered 10

9a. Corolla lobes suborbicular, ovary ca. 1 mm long, stigma entire, depressed conic .... *Heliotropium amplexicaule*

9b. Corolla lobes emarginate, ovary 0.5–0.7 mm long, stigma slightly bifid, penicillate .... *Heliotropium phylicoides*

10a. Petioles sulcate, partially winged 11

10b. Petioles subcylindric, cylindric or sulcate, not winged 12

11a. Leaf-blades adaxially bullate; stigma clavate; fruits with nutlets parallel .... *Heliotropium elongatum*

11b. Leaf-blades adaxially flat; stigma subcapitate; fruits with nutlets divergent .... *Heliotropium indicum*

12a. Plants with a mixture of simple and malpighiaceous hairs; leaf-blades discolorous, base attenuate, margins entire, sometimes slightly sinuate; corolla sublageniform, stamens inserted the same level as the stigma .... *Heliotropium transalpinum*

12b. Plants with a mixture of simple and eglandular hairs; leaf-blades concolorous, base cuneate, margins entire; corolla infundibuliform, stamens inserted above the stigma .... *Heliotropium nicotianifolium*

3. ***Euploca*** Nutt., Trans. Amer. Philos. Soc. ser. 2, 5: 189. 1836. Type: *Euploca convolvulacea* Nutt.

Euploca comprises ca. 150 species distributed mainly in the tropical and subtropical regions of the globe (Melo pers. observ.), having Africa, Australia and tropical America as its diversity centers (Diane et al., 2004). In Uruguay, It is represented by four species: *E. filiformis*, *E. krapovickasii*, *E. ocellata*, and *E. procumbens*.

3.1. ***Euploca filiformis*** (Lehm.) J.I.M. Melo & Semir, Kew Bull. 64(2): 288. 2009.

Basionym: *Heliotropium filiforme* Lehm., Gött. Gel. Anz.: 1515. 1817. TYPE: VENEZUELA. Orinoco, Crescit Crescit in arenosis fluminis Apures, inter villam El Diamante et pagum San Fernando, *A. J. A. Bonpland & F.W.H. A. von Humboldt 1203* (Holotype: P [00670717]).

Additional specimen examined: URUGUAY. **Artigas:** Cochilla Yacaré Cururú, stony grassland, 08 April 1997, (fl, fr), *Pedersen 18291* (F 2217385, MBM 242820, NL-U 1170508, SI 47778).

Distribution: Occurs since Mexico and Central America, including West Indies, reaching Argentina (Frohlich, 1978) and Brazil (Melo and Semir, 2010), being recorded for the first time for Uruguay.

Phenology: Blooms and fruits in April.

Species morphologically related to E. procumbens, especially in its general aspect. However, it was distinguished from E. procumbens by the presence of bracts in the inflorescence, these filiforms to subulate, by the leaf blade, which varies from elliptical, lanceolate, oblanceolate to linear, with attenuated base and, mainly, by the glandular stigma at the base.

3.2. ***Euploca krapovickasii*** J.I.M. Melo & Semir, Kew Bull. 64(2): 288. 2009. TYPE: BRAZIL. Rio Grande do Sul: Alegrete, Jan. 1973, *A. Krapovickas et al. 22780* (Holotype: CTES [0013242]).

Additional specimens examined: URUGUAY. **Salto:** ROU-31, Km 114-12-, 16 January 1995, (fl, fr), *Pedersen 16191* (F 2286496). **Tacuarembó:** Cuchilla de Laureles, 07 March 2004, (fl, fr), *Bonifacino 1071* (MVFA).

Distribution: Until the present study, this species was considered endemic to the State of Rio Grande do Sul, Brazil (Melo and Semir, 2010), being recorded for the first time for Uruguay.

Phenology: Blooms and fruits in March.

Morphologically similar to *E. ocellata*, being differentiated by its lingulate corolla lobes, ovate-triangular anthers, and conic stigma.

3.3. **Euploca ocellata** (Cham.) J.I.M. Melo & Semir, Kew Bull. 64(2): 285. 2009.

Basionym: *Heliotropium ocellatum* Cham., Linnaea 4: 463. 1829. TYPE: BRAZIL. Brazilia meridionalis, *F. Sellow 3579* (Holotype: B, destroyed; photograph F [017335]; Isotypes: BR, E, HAL, K, L, M, P).

Additional specimens examined: URUGUAY. **Artigas:** 05 February 1958, (fl, fr), *Rosengurtt s.n.* (MVFA 7202). **Rivera:** Alrededores de Rivera, lugar elebado, 19 February 1968, (fl, fr), *Lema s.n.* (MVFA 6994); Termas del Arapey, 15 January 1957, (fl, fr), *Rosengurtt, Del Puerto & Marchesi s.n.* (MVFA 10557). **Tacuarembó:** Arroyo Laureles, 17 February 1968, (fl, fr), *Lema s.n.* (MVFA 6930).

Distribution: Found in the State of Rio Grande do Sul (Southern Brazil) and Argentina (Melo and Semir, 2010).

Phenology: Found in bloom and fruits in January and February.

It can be recognized mainly by its inflorescences with bracts, corolla lobes narrowly elliptic, and stigma narrowly conic.

3.4. ***Euploca procumbens*** (Mill.) Diane & Hilger, Bot. Jahrb. Syst. 125(1): 48. 2003.

Basionym: *Heliotropium procumbens* Mill., Gard. Dict. 8: 10. 1768. TYPE: COLOMBIA. Carthagena, *W. Houstoun s.n.* (Holotype: BM [000953065]). Fig. 3a.

Additional specimens examined: URUGUAY. **Artigas:** Estancia El Ombu Mallo, 12 April 1978, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 15329). **Cerro Largo:** 09 March 1935, (fl, fr), *Herter 954* (U 1170550). **Salto:** Espinillar, 18 February 1965, (fl, fr), *Del Puerto, Izaguirre & Rezzano s.n.* (MVFA 2148); 27 March 1962, (fl, fr), *Del Puerto s.n.* (MVFA 1906); Paso Yacaré, 10 December 1962, *Arrilaga, Izaguirre & Laguardia s.n.* (MVFA 1503). **Treinta y Tres:** Ciudad Treinta y Tres, Bosque ribereño, 23 January 1967, (fl, fr), *Rosengurtt & Del Puerto s.n.* (MVFA 10678).

Distribution: Widely distributed, ranging from the USA to Argentina, including the West Indies (Melo and Semir, 2010).

Phenology: Blooms and fruits throughout the year.

It is easily recognized by its cinereous and sericeous branches, inflorescences without bracts, corolla tube the same length or slightly shorter than the calyx, corolla lobes obovate, and stigma pubescent.

4. ***Heliotropium*** L., Sp. Pl. 1: 130. 1753. Type: *Heliotropium indicum* L.

The genus comprises ca. 200 species with a cosmopolitan distribution but preferably occurring in semi-arid zones. Its main diversity centers are the Turkish-Iranian region and South America (Al-Shehbaz, 1991), especially the Andes (Melo pers. observ.). In Uruguay, it is represented by seven species: *H. amplexicaule*, *H. curassavicum* var. *argentinum*, *H. elongatum*, *H. indicum*, *H. nicotianifolium*, *H. phylicoides*, and *H. transalpinum*.

4.1. ***Heliotropium amplexicaule*** Vahl, Symb. Bot. 3: 21. 1794. TYPE: URUGUAY. Montevideo, November 1767, *P. Commerson s.n.* (Holotype: C [10008720]; Isotype: P). Fig. 3b.

Additional specimens examined: URUGUAY. **Colonia:** Riachuelo, 24 March 1937, (fl, fr), *Cabrera 4021* (F 890695); Molino Quemado, 12 October 1957, (fl, fr), *Arrilaga s.n.* (MVFA 689). **Durazno:** Rincón del Bonete, 07-08 December 1963, (fl, fr), *Arrilaga, Izaguirre & Del Puerto* (MVFA 1889). **Lavalleja:** En matorral de orilla de carretera, Abra de Zabaleta, ruta 81, 34°31'49"S and 55°18'46"W, 28 January 1998, (fl, fr), *Marchesi s.n.* (MVFA 28089). **Rio Negro:** Estancia Nueva Melhem, 29-30 December 1965, (fl, fr), Del *Puerto & Marchesi s.n.* (MVFA 5758). **Tacuarembó:** Paso de los Toros, 25 February 1936, (fl, fr), *Herter 6704* (F 864900, SI 96704). Without locality: *s.d.*, *Felippone 1918* (SI 2055).

Distribution: Endemic to South America, ranging from Bolivia, Argentina, Uruguay and Brazil (Melo and Semir, 2008).

Phenology: Recorded in bloom and fruits from October to March.

Similar to *H. phylicoides* and *H. nicotianifolium*, mainly due to the presence of glandular hairs. It is distinguished from both species by its amplexicaulous leaf-blades, corolla lobes suborbicular, ovary globose, and stigma depressed conic.

4.2. ***Heliotropium curassavicum*** *var.* ***argentinum*** I.M. Johnst., Contr. Gray Herb. 81: 15. 1928. TYPE: ARGENTINA. Chaco, Las Palmas, Oct. 1917, *P. Jörgensen 2243* (Holotype: GH [00097612]; Isotypes: A, SM).

Additional specimens examined: URUGUAY. **Canelones:** 23 March 1967, (fl, fr), *Rosengurtt s.n.* (MVFA 10875). **Maldonado:** Punta del Este, 13 January 1900, (fl, fr), *Osten s.n.* (MVM 4058). **Montevideo:** Plata, 26 April 1852, (fl, fr), *M. Courbon 1836* (P 3852675); 09 December 1876, (fl, fr), *Fruchard s.n.* (P 3852671); 29 January 1965, (fl, fr), *Marchesi s.n.* (MVFA 4036). **Rocha:** Cabo Polonio, January 2001, (fl, fr), *Figueredo s.n.* (MVJB 10229). **San José:** Delta del Tigre San José, en terreno salado, 14 February 1965, (fl, fr), *Marchesi s.n.* (MVFA 1344). Without locality: *s.d.*, *A. St.-Hil. 2249* (K).

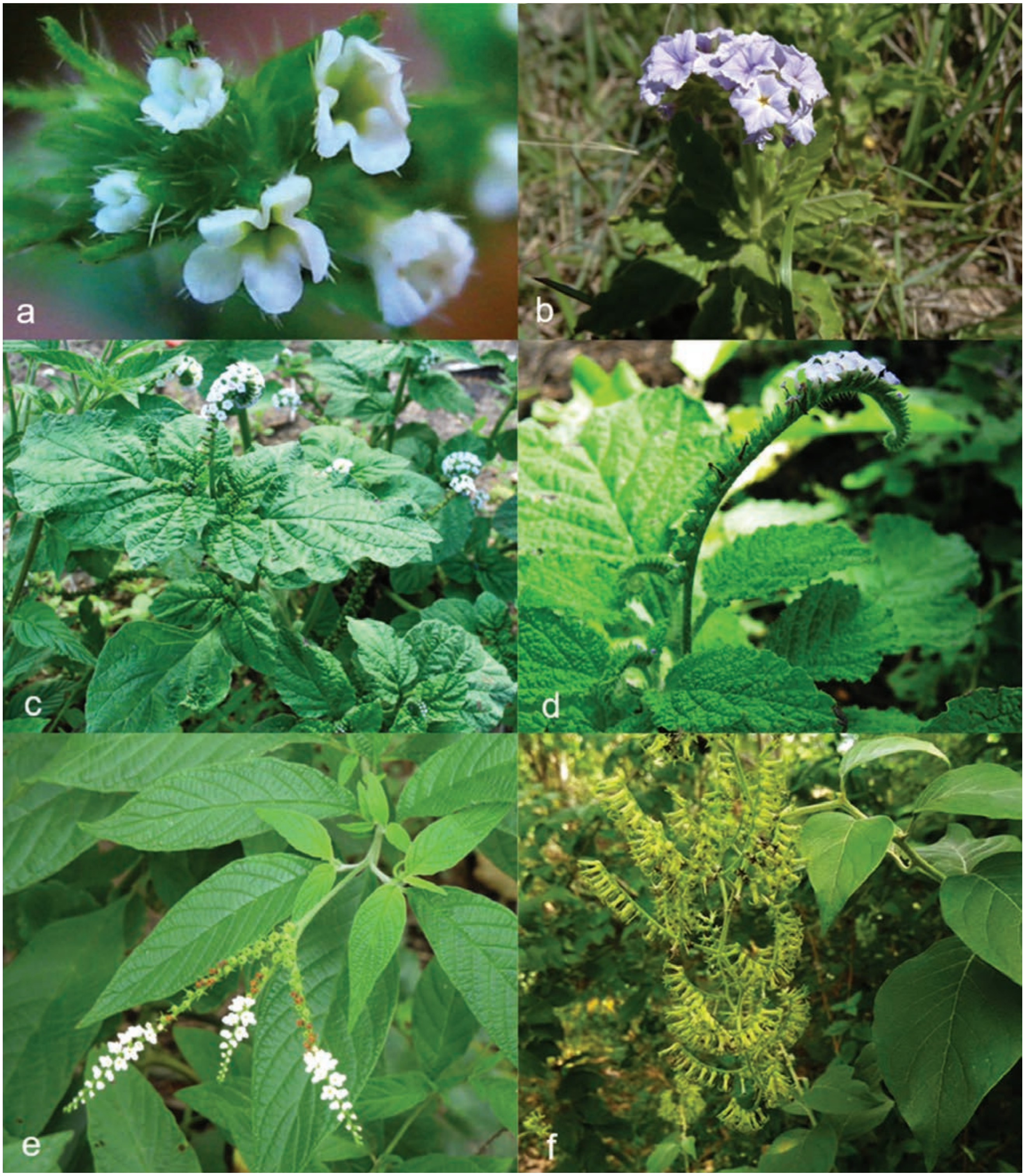

FIGURE 3. Species of Heliotropiaceae from Uruguay. **A**, *Euploca procumbens* (Mill.) Diane & Hilger; **B**, *Heliotropium amplexicaule* Vahl; **C**, *H. elongatum* (Lehm.) I.M. Johnst.; **D**, *H. indicum* L.; **E**, *H. transalpinum* Vell.; **F**, *Myriopus paniculatus* (Cham.) Feuillet.

Distribution: Argentina, Brazil, and Uruguay (Melo and Semir, 2008).

Phenology: Fertile from January to April and December.

It can be differentiated from the remaining species of the genus by its strigose to villose branches, leaf-blades linear and slightly crass to crass, and revolute margins.

4.3. ***Heliotropium elongatum*** (Lehm.) I.M. Johnst., Contr. Gray Herb. 81: 18. 1928.

Basionym: *Tiaridium elongatum* Lehm., Asperifolien 1: 16. 1818; **Ícones** 10. t. 6. 1821. TYPE: BRAZIL. in locis arenosis Brasiliae, *s.d.*, *s.c.* (Holotype: MEL [233335]; Isotype: B). Fig. 3c.

Additional specimens examined: URUGUAY. **Artigas:** Isla Rica, rio Uruguay, May 1938, (fl, fr), *Lombardo 3116* (MVJB 12300). **Cerro Largo:** January 1926, (fl, fr), *C. Osten s.n.* (MVM 18458). **Paysandú:** 08 May 1964, (fl, fr), *Del Puerto & Marchesi 3484* (F 1714228, MVFA *s.n.*). **Salto:** Espinillar, 27 March 1962, (fl, fr), *Del Puerto s.n.* (MVFA 1907); 18 February 1965, (fl, fr), *Izaguirre & Rezzano s.n.* (MVFA 2137).

Distribution: Bolivia, Paraguay, Argentina, Uruguay, and Brazil (Melo and Semir, 2008).

Phenology: Collected in bloom and fruit from January to May.

It is easily confused with *H. indicum*, differing by its adaxially bullate leaf-blades, clavate stigma, and most importantly, by its mitriform fruits with parallel nutlets.

4.4. ***Heliotropium indicum*** L., Sp. Pl. 1: 130. 1753. TYPE: Herb. Hermann 1: 9, no. 70. (Lectotype: BM-00061256, designated by Mill. in Cafferty and Jarvis, 2004). Fig. 3d.

Additional specimens examined: URUGUAY. **Artigas:** costa del río Uruguay, al norte de Bella Unión, 30°11'40"S and 57°37'90"W, 30 October 2003, (fl, fr), *Brussa s.n.* (MVJB 23480). **Cerro Largo:** Estancia San Victoriano, orilla de arrozal, en parte arenosa, 17 January 1986, (fl, fr), *Del Puerto s.n.* (MVFA 18045). Banda Oriental de Uruguay, 01 January 1816, (fl, fr), *A. St.-Hil. 2554* (P 3877780).

Distribution: Widely distributed in the tropical regions of the globe (Miller, 1988).

Phenology: Fertile in October and January.

Easily recognized by its divergent nutlets.

4.5. ***Heliotropium nicotianifolium*** Poir., Encycl. méth. bot. suppl. 3: 23. 1813. TYPE: ARGENTINA. Ex agro Bonariensis, circa Buenos Ayres, *P. Commerson s.n.* (Holotype: MPU [019716]).

Additional specimens examined: URUGUAY. **Florida:** ruta 6, Arroyo Illescas, 33°22'36"S and 55°35'50"W, 15 January 1998, (fl, fr), *Grela, González & Jaurena s.n.* (MVFA 27479). **Paysandú:** Estación experimental Mario Cassinoni, 28 February 1969, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 8341). **Río Negro:** Estancia Nueva Mehlem, 29-30 December 1965, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 5815). **San Jose:** Azaratí, 17 March 1957, (fl, fr), *Arrilaga s.n.* (MVFA 608).

Distribution: Bolivia, Paraguay, Argentina, Uruguay, and Brazil (Pérez-Moreau, 1979).

Phenology: Recorded with flowers and fruits from December to March.

It can be recognized, mainly, by its leaf-blades with a cuneate base and entire margins, infundibuliform corolla, and stamens inserted at the same level as the stigma.

4.6. ***Heliotropium phylicoides*** Cham., Linnaea 4: 460. 1829. TYPE: BRAZIL. Brasilia merid., *s.d.*, *F. Sellow s.n.* (Holotype: B, destroyed; photograph F [017338]).

Additional specimens examined: URUGUAY. **Artigas:** November 1927, (fl, fr), *Herter 992* (CTES, SI 82589). **Lavalleja:** 29 November 2001, (fl, fr), *Seijo 2581* (CTES, SI). **Paysandú:** ruta 90, Pandule, al Oeste de cañada Cueva del Tigre, Estancia El Refugio, 32°20'S and 57°23'W, 26 November 1991, (fl, fr), *Marchesi & Armand-Ugon s.n.* (MVFA 20561). **Río Negro:** El Greco, 06 April 1994, (fl, fr), *Solís Neffa et al. 98* (CTES, F 2160499). **Rivera:** ruta 29, 22 February 1991, (fl, fr), *Izaguirre et al. s.n.* (MVFA 20187); ruta 6, 10 km al S de Vichadero, 20 October 1992, (fl, fr), *Izaguirre et al. s.n.* (MVFA 21045). **Salto:** 24 November 2001, (fl, fr), *Seijo 2387* (CTES, SI). **Tacuarembó:** Estancia El Infiernillo, Gruta de los Cuervos, 08 November 1987, (fl, fr), *Denis & Scarlato s.n.* (MVJB 21305); Cuchilla Santo Domingo, 13 March 1990, (fl, fr), *Izaguirre et al. s.n.* (MVFA 19708).

Distribution: Found in Argentina, Uruguay, and Brazil (Pérez-Moreau, 1979).

Phenology: Blooms and fruits from October to March.

Morphologically similar to *H. amplexicaule*, differing by its emarginate corolla lobes and penicillate stigma with slightly bifid apex.

4.7. ***Heliotropium transalpinum*** Vell., Fl. Flumin.: 68. 1829 [1825]. TYPE: [BRAZIL]. Rio de Janeiro: Campis apricis transalipinis habitat. Prope Pagnum Boavista ofendi, [J. M. de C.] *Vellozo*. Fig. 3e.

Additional specimens examined: URUGUAY. **Artigas:** San Gregorio, 30 March 1962, (fl, fr), *Del Puerto s.n.* (MVFA 2040); 13 March 1963, (fl, fr), *Del Puerto s.n.* (MVFA 2424). **Salto:** Isla Redonda, río Uruguay, 30 October 1978, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 15951).

Distribution: From Mexico to Argentina, including the West Indies and Brazil (Pérez-Moreau, 1979; Frohlich, 1981).

Phenology: Fertile in March and October.

It can be recognized by its branches with a mixture of simples and malpighiaceous hairs, corolla sublangeniform and cylindric, conic and costate stigma, and fruits slightly to strongly cleft at the sides.

5. ***Myriopus*** Small, Man. S.E. Fl. [Small]: 1131. 1933. Type: *Myriopus volubilis* (L.) Small.

The genus comprises ca. 20 species, with diversity centers in Central and South America (Diane et al., 2004). In Uruguay, it is represented by two species: *M. breviflorus* and *M. paniculatus*.

5.1. ***Myriopus breviflorus*** (DC.) Luebert, Darwiniana n.s. 4(2): 193. 2016.

Basionym: *Tournefortia breviflora* DC., Prodr. 9: 520. 1845. TYPE: BRAZIL. Rio, *s.d.*, *P.W. Lund s.n.* (Holotype: Not located; Isotype: P [03525470]).

Additional specimens examined: URUGUAY. **Cerro Largo:** Sarandí de Barceló, 09 January 1980, (fl, fr), *Brescia et al. 26* (MVFA 16490). **Rocha:** Parque San Miguel, 06 October 1965, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 5262); Parque Santa Teresa, January 1954, (fl, fr), *Lombardo s.n.* (MVJB).

Distribution: Endemic to South America, most commonly found on the Brazilian coast, from the State of Minas Gerais to Santa Catarina, but also extending inland to the State of Acre (Brazil), Paraguay, Peru, and Uruguay (Johnston, 1930; Luebert and Frohlich, 2016).

Phenology: Recorded with flowers and fruits in January and October.

It can be recognized by its axillary inflorescences, delicate flowers, and linear corolla lobes.

5.2. ***Myriopus paniculatus*** (Cham.) Feuillet, J. Bot. Res. Inst. Texas 2(1): 264. 2008.

Basionym: *Tournefortia paniculata* Cham., Linnaea 4: 468. 1829. TYPE: BRAZIL. Brazil equinocial, *F. Sellow s.n.* (Holotype: G [00236172]). Fig. 3f.

Additional specimen examined: URUGUAY. **Salto:** Isla Ceibal, Río Uruguay, al S de Constitución, 29 October 1978, (fl, fr), *Del Puerto & Marchesi s.n.* (MVFA 15891).

Distribution: Recorded for Guayana, Colombia, western Peru, Bolivia, Paraguay, Argentina, and Brazil (from the State of Amazonas to Rio Grande do Sul) (Johnston, 1930; Cavalheiro et al., 2011).

Phenology: Recorded in bloom and fruit in October.

It can be recognized by its axillary and terminal paniculate inflorescences, corolla tube longer than 3 mm long, and corolla lobes shortly-ovate to lanceolate.

LITERATURE CITED

AL-SHEHBAZ, I. A. 1991. The genera of Boraginaceae, the southeastern United States. J. Arnold Arbor., Suppl. ser. 1: 1–69.

BORHIDI, A, E. GONDÁR, AND Z. S. OROSZ-KOVÁCS. 1988. The reconsideration of the genus *Cordia*. Acta Bot. Hung. 34, No. 3–4: 375–423.

BRUMMITT, R. K., AND C. E. POWELL. 1992. Authors of plant names. Royal Botanic Gardens, Kew.

BRUSSA, C. A., AND I. A. GRELA. 2007. Flora arbórea del Uruguay: con enfásis en las especies de Rivera y Tacuarembó. Cofusa/Gráfica Mosca, Montevideo.

CABRERA, A. L., AND A. WILLINK. 1973. Biogeografía de América Latina. Editorial de la Organización de los Estados Americanos, Washington DC.

CAFFERTY, S., AND C. E. JARVIS. 2004. TYPIFICATION OF LINNEAN PLANT NAMES IN BORAGINACEAE. TAXON 53, No. 3: 799–805.

CAVALHEIRO, L, N. T. RANGA, AND A. FURLAN. 2011. *Tournefortia* L. (Boraginaceae): espécies do Brasil extra-amazônico. Hoehnea 38, No. 2: 221–242.

DIANE, N, H. FÖRTHER, H. H, HILGER, AND M. WEIGEND. 2004. Heliotropiaceae. Pages 62–70 in K. KUBITZKI, ED., Families and Genera of the Flowering Plants. Springer, Berlin.

FROHLICH, M. W. 1978. Systematics of *Heliotropium* sect. *Orthostachys* in Mexico. Ph.D. dissert., Harvard University, Cambridge, Massachusetts.

FROHLICH, M. W. 1981. *Heliotropium*. Pages 70–104 in D. L. NASH AND N. P. MORENO, EDS., Flora de Veracruz: Boraginaceae. Instituto Nacional de Investigaciones sobre Recursos Bióticos, Xalapa.

GIBSON, D. N. 1970. Flora of Guatemala: Boraginaceae. Botany 24: 111–167.

GONÇALVES, E. G., AND H. LORENZI. 2007. Morfologia vegetal: organografia e dicionário ilustrado de morfologia das plantas vasculares. Instituto Plantarum de Estudos da Flora, Nova Odessa.

GOTTSCHLING, M. 2003. Phylogenetic analysis of selected Boraginales. Ph.D. dissert., Freie Universität, Berlin.

GOTTSCHLING. M., AND J. S. MILLER. 2006. Clarification of the taxonomic position of *Auxemma*, *Patagonula* and *Saccelium* (Cordiaceae, Boraginales). Syst. Bot. 31, No. 2: 361–367.

HILGER, H. H., AND N. DIANE. 2003. A systematics analysis of Heliotropiaceae (Boraginales) based on trnL and ITS1 sequence data. Bot. Jahrb. Syst. 125, No. 1: 19–51.

JARVIS, C. E., F. R. BARRIE, D. M. ALLAN, AND J. L. REVEAL. 1993. A list os Linnean generic names and their types. Regnum Veg. 127. International Association for Plant Taxonomy, Königstein.

JOHNSTON, I. M. 1928. Studies in the Boraginaceae VII. The South American species of *Heliotropium*. Contrib. Gray Herb. Harvard Univ. 81: 3–73.

JOHNSTON, I. M. 1930. Studies in Boraginaceae 8: Observations on the species of *Cordia* and *Tournefortia* known from Brazil, Paraguay, Uruguay and Argentina. Contrib. Gray Herb. Harvard Univ. 82: 3–89.

JSTOR-GLOBAL PLANTS.. Accessed January 20, 2021. https://plants.jstor.org/

LUEBERT, F., AND M. W. FROHLICH. 2016. Four new combinations in Argentinian Heliotropiaceae. Darwiniana 4. No. 2: 192–194.

LUEBERT, F, L. CECCHI, M. W. FROHLICH, M. GOTTSCHLING, C. M. G., K. E. HASENSTAB-LEHMAN, H. H. HILGER, J. S. MILLER, M. MITTELBACH, M. NAZAIRE, M. NEPI, D. NOCENTINI, D. OBER, R. G. OLMSTEAD, F. SELVI, M. G. SIMPSON, K. SUTORÝ, B. VALDÉS, G. K. WALDEN, AND M. WEIGEND. 2016. Familial classification of the Boraginales. Taxon 65, No. 3: 502–522.

MARCHESI, E. 2005. Características del ambiente receptor, IFC. Pages 17–26 in E. MARCHESI, ED., Flora y vegetación del Uruguay. Proyect Orion. Environmental Impact Assessment. Montevideo.

MARCHESI, E, E. ALONSO, C. BRUSSA, L. DELFINO, M. GARCÍA, AND F. HARETCHE. 2013. Plantas vasculares. Pages 26–71 in E. MARCHESI, E. ALONSO, C. BRUSSA, L. DELFINO, M. GARCÍA, AND F. HARETCHE, EDS., Especies prioritarias para la conservación en Uruguay: Vertebrados, moluscos continentales y plantas vasculares. SNAP/DINAMA/MVOTMA y DICYT, Montevideo.

MELO, J. I. M., AND J. SEMIR. 2008. Taxonomia do gênero *Heliotropium* L. (Heliotropiaceae) no Brasil. Acta Bot. Bras. 22, No. 3: 754–770.

MELO, J. I. M., AND J. SEMIR. 2010. Taxonomia do gênero *Euploca* Nutt. (Heliotropiaceae) no Brasil. Acta Bot. Bras. 24, No. 1: 111–132.

MELO, J. I. M, R. C. PAULINO, R. OLIVEIRA, AND D. D. VIEIRA. 2018. Flora of Rio Grande do Norte, Brazil: Boraginales. Phytotaxa 357, No. 4: 235–260.

MELO, J.I.M, M. N. S, STAPF, T. S. SILVA, F. C. P. COSTA, P. CARDOSO, W. PICANÇO, AND A. CABRAL. 2020. Flora do Brasil: Boraginaceae. Flora do Brasil 2020, Rio de Janeiro; http://floradobrasil.jbrj.gov.br

Miller, J. S. 1988. A revised treatment of Boraginaceae for Panama. Ann. Missouri Bot. Gard. 75, No. 2: 456–521.

Miller, J. S. 2013. A revision of *Cordia* section *Gerascanthus* (Boraginales: Cordiaceae). J. Bot. Res. Inst. Tex. 7, No. 1: 55–83.

Miller, J. S., and M. Gottschling. 2007. Generic classification in the Cordiaceae (Boraginales): resurrection of the genus *Varronia* P.Br. Taxon 56, No. 1: 163–169.

Pérez-Moreau, R. L. 1979. Boraginaceae. Pages 209–229 in A. Burkart, ed., Flora Ilustrada de Entre Ríos, Argentina 6, No. 5. Instituto Nacional de Tecnología Agropecuária, Buenos Aires.

Ranga, N. T, J. I. M. Melo, and L. C. Silva. 2012. Boraginaceae. Pages 117–142 in M. G. L. Wanderley, G. J. Shepherd, T. S. Melhem, A. M. Giulietti, and S. E. Martins, eds., *Flora Fanerogâmica do Estado de São Paulo*. Fundação de Amparo à Pesquisa do Estado de São Paulo/Instituto de Botânica de São Paulo, São Paulo.

Silva, T. S., and J. I. M. Melo. 2019. New synonym, new combination and typifications in *Varronia* (Cordiaceae, Boraginales). Phytotaxa 411, No. 4: 293–300.

Stapf, M. N. S. 2007. Avaliação da classificação infragenérica de *Cordia* L. (Cordiaceae) e revisão taxonômica de *Cordia* sect. *Pilicordia* DC. para o Brasil. Ph.D. dissert., Universidade Estadual de Feira de Santana, Feira de Santana.

Taroda, N., and P. E. Gibbs. 1986a. Studies on the genus *Cordia* L. (Boraginaceae) in Brazil. A new infrageneric classification and conspectus. Rev. Bras. Bot. 9, No. 1: 31–42.

Taroda, N., and P. E. Gibbs. 1986b. A revision of the Brazilian species of *Cordia* subgenus *Varronia* (Boraginaceae). Notes Roy. Bot. Gard. 44, No. 1: 105–140.

Taroda, N., and P. E. Gibbs. 1987. Studies on the genus *Cordia* L. (Boraginaceae) in Brazil. An outline taxonomic revision of subgenus *Myxa* Taroda. Hoehnea 14: 31–52.

Thiers, B. [continuously updated]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium, New York; http://sweetgum.nybg.org/ih/

Vieira, D. D, J. I. M. Melo, and A. S. Conceição. 2015. Boraginales Juss. ex Bercht. & J. Presl in the Ecoregion Raso da Catarina, Bahia, Brazil. Biota Neotrop. 15, No. 3: 1–17.

A NOTE ON THE IDENTITY OF *CIRRHOPETALUM ROSEOPUNCTATUM* (ORCHIDACEAE)

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Abstract. *Cirrhopetalum roseopunctatum* is illustrated from the type specimen. It is found to be conspecific with the later *Cirrhopetalum annamense*. In *Bulbophyllum* the combined entities must be known as *B. annamense* due to the earlier *B. roseopunctatum* Schltr.

Keywords: Bulbophyllum, Cirrhopetalum roseopunctatum, Orchidaceae

The genus *Bulbophyllum* Thouars (Orchidaceae) with over 2000 species is second only to *Epidendrum* L. in size. It is an aptly named genus because many of the species may be characterised by having a bulb and a leaf (though some are 2–3 leaved). For the most part the flowers have a hinged lip designed to tip the visiting insect against the column during the pollination process. The species discussed here belongs to section *Cirrhopetalum* (Lindl.) Rchb.f., currently a group of about nine species distributed from Africa to the Pacific (Vermeulen et al. 2015).

Bulbophyllum annamense (Garay) Sieder & Kiehn, CITES Orchid Checkl. 5: 406. 2009.

Basionym: *Cirrhopetalum annamense* Garay, Harvard Pap. Bot. 4, 1: 306. 1999.

TYPE: VIETNAM. Annam, Prenh [Prenn on sheet], 1000 m, 1954, *T. Sigaldi 144* (*C.R.S.T. 151*) (Holotype: P 00362049 as *Cirrhopetalum roseopunctatum*, image seen). Fig. 1.

Heterotypic synonyms: *Bulbophyllum pulchrum* N.E. Br. var. *cliftonii* Gurney Fowler, Gard. Chron. s. 3: 136. 21 Aug. 1909 [Illustrated: Hort., Orch. Review 17: 328, b/w photo. Nov. 1909].

TYPE: WITHOUT ORIGIN. Exhibited R.H.S. London, 17 August 1909, *cult. Messrs. Charlesworth & Co. s.n.* (Holotype: lost).

Cirrhopetalum roseopunctatum Garay, Hamer & Siegerist, Lindleyana 10, 3: 179. 1995 *syn. nov.*

TYPE: VIETNAM. Langbian Plateau, fl. in cult. 1990, *L.V. Tempera s.n.* (Holotype: AMES, spirit).

Bulbophyllum schwarzii Sieder & Kiehn, Ann. Naturhist. Mus. Wien, B. 112: 316. 2011.

Usage synonyms: *Bulbophyllum picturatum auct. non* Lindl., Seidenf., Dan. Bot. Ark. 29, 1: 123, f. 62. 1974.

Bulbophyllum eberhardtii auct. non (Gagnep.) Seidenf., Seidenf., Opera Bot. 114: 285, f. 188. 1992.

Not *Bulbophyllum roseopunctatum* Schltr. 1913 (Papua New Guinea. Section *Polymeres*).

Distribution: Vietnam.

This beautiful species may be recognised by its umbels of pinkish-white flowers variously spotted and maculated throughout with darker pinkish-purple, relatively large flowers (lateral sepals 25–30 mm long), the broadly elliptic dorsal sepal adorned with an apical, clavate thread and two short side threads, the petals vary from cuneate to obliquely ovate, usually with some apical threads, but occasionally shorter hairs adorn the margins, the lip with raised basal lateral lobes, and the stout column with two ventral wings, whilst its brachia are variously bidentate apically.

Garay et al. (1995) described *Cirrhopetalum roseopunctatum* based on a Vietnamese plant cultivated by Lucien Tempera. However they illustrated the species with a sketch by Fritz Hamer based on an herbarium specimen in Paris (*T. Sigaldi 98 TS =17/SM* [P 00362050, image seen]). In 1999 Garay reconsidered the identity of the specimen figured as *Cirrhopetalum roseopunctatum* and referred it to a new taxon *C. annamense*. Apparently, the latter differs in the color of the flowers, shape of the lateral sepals and shape of the lip. The only available image of the original *Cirrhopetalum roseopunctatum* is a photograph on the internet from the Garay archive that depicts the type plant in flower. From this we deduced that *C. roseopunctatum* was not that much different from *C. annamense,* however proof of their synonymy could not be determined until critical details were elicited from the spirit-preserved type of the former.

Bobbi Angell has been kind enough to delineate the type of *Cirrhopetalum roseopunctatum* (Fig. 1) and her drawing shows it to have all the critical characters of *Bulbophyllum annamense* listed above. We did not find any differences in flower color, lateral sepal shape, or lip shape that allow for the recognition of more than one species.

Literature Cited

Garay, L.A. 1999. Orchid species currently in cultivation. Harvard Pap. Bot. 4, 1: 301-319.

———. F. Hamer, E. S. Siegerist. 1995. *Inquilina Orchidacea. Orchidaceae Plaerumque Levyanae*. Lindleyana 10, 3: 174-182.

Vermeulen, J. J., P. O'Byrne, and A. Lamb. 2015. *Bulbophyllum* of Borneo. Natural History Publications (Borneo). Kota Kinabalu, Malaysia.

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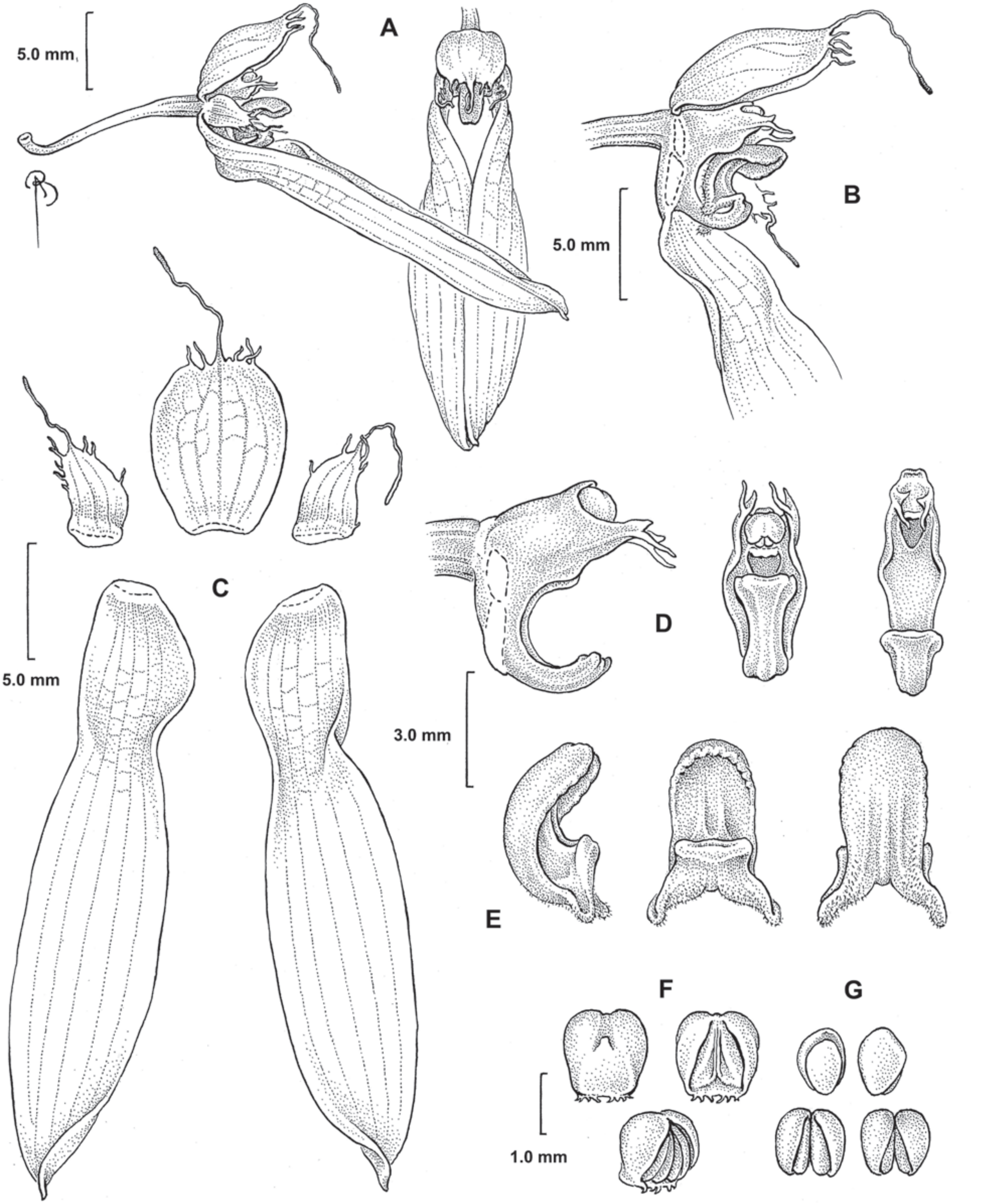

FIGURE 1. *Bulbophyllum annamense* (Garay) Sieder & Kiehn. **A**, View of the flower; **B**, side view of the flower after removal of a petal and a ateral sepal; **C**, sepals and petals; **D**, view of the column; **E**, views of the labellum; **F**, views of the anther; **G**, view of the pollinia. Drawing by B. Angell based on the holotype of *Cirrhopetalum roseopunctatum* Garay et al. (1995) at AMES, *non Bulbophyllum roseopunctatum* Schltr. (1913).

A NEW SPECIES OF *CORDIA* SECT. *GERASCANTHUS* (CORDIACEAE) FROM A BRAZILIAN SEMIARID REGION

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Abstract. *Cordia obtusiloba*, a new species of *Cordia* section *Gerascanthus* (Cordiaceae), currently known to the hypoxerophytic caatinga of the state of Sergipe, Brazil, is described and illustrated. A distribution map, data on phenology, and conservation assessment are provided.

Keywords: Boraginales, Brazilian Northeastern, diversity, flora

Cordiaceae is a monophyletic family of the order Boraginales (Gottschling et al., 2005; Miller and Gottschling, 2007; BWG, 2016). Cordiaceae includes two genera, *Cordia* L. and *Varronia* P. Browne, together comprising approximately 350 species distributed in tropical and subtropical regions of the world, but predominantly in the Neotropics (Miller, 2001). In Brazil, both *Cordia* (57 species, 29 endemic) and *Varronia* (36 species, 21 endemic) are distributed in all phytogeographic domains (Amazon, Cerrado, Caatinga, Atlantic forest, Pampa and Pantanal) (Flora do Brasil, 2020).

Cordiaceae is morphologically characterized by a style with four stigmatic lobes, plicate cotyledons, undivided endocarp and the fruit being a drupe (Miller and Gottschling, 2007; BWG, 2016). *Cordia* overall includes tree species, with leaf margin entire or dentate in the apical portion, broad paniculate or cymose inflorescences, and white, creamy, yellow, orange or red flowers (Miller and Gottschling, 2007; Stapf, 2007), being *C. trichotoma* (Vell.) Arráb. ex Steud. one species economically important. Currently, six sections are recognized to the genus: *Cordia* sect. *Cordia* L., *C.* sect. *Gerascanthus* (P. Browne) G. Don, *C.* sect. *Rhabdocalyx* A.DC., *C.* sect. *Pilicordia* A.DC., *C.* sect. *Superbiflorae* Taroda and *C.* sect. *Myxa* Endl. (Stapf, 2007; Miller, 2013).

During a taxonomic study of *Cordia* sect. *Gerascanthus* (Cordiaceae) in Northeastern Brazil, an unprecedented species for science was found in herbarium collections. For the new species, *Cordia obtusiloba*, a description, illustrations, conservation status, data on phenology, and distribution are provided.

Materials and Methods

This work was based on herbaria collections, and during taxonomic studies in Brazilian northeastern were consulted approximately 1,500 specimens in seventeen herbaria collections. At the MOSS and PEUFR collections we found an undescribed taxa of *Cordia* sect. *Gerascanthus*. The diagnosis and descriptions of the new species was based on specimens of the two above-cited herbaria, and digitized collections available at the Reflora-Virtual Herbarium of the Flora and Fungi (Flora do Brasil, 2020). All acronyms follow Thiers (continuously updated). Morphological terminology for the descriptions follows Radford et al. (1974). Protologues and type specimens (photographs deposited in JSTOR Global Plants) of *C. trichotoma* and *C. alliodora* were compared to the new species. The specialized literature for *Cordia* sect. *Gerascanthus* was consulted (Miller, 2013; Guimarães et al., 2016). The conservation status assessment was based on the guidelines of the IUCN (International Union for Conservation Nature) Red List categories and criteria (IUCN, 2017).

Description

Cordia obtusiloba Pedro-Silva, T.S. Silva & J.I.M. Melo, *sp. nov.*
TYPE: BRAZIL. Sergipe: Nossa Senhora da Glória, 6 August 1982, *E.M. Carneiro 419* (Holotype: MOSS; Isotype: PEUFR). (Fig. 1–2).

Shrubs to trees. Branches cylindrical, pubescent, lenticellate. *Leaves* alternate, petiolate; petiole 0.3–1.4 cm long; leaf blade 2.1–10.8 × 3.4–0.8 cm, chartaceous, lanceolate, pubescent with simple and stellate trichomes; base acute to rounded and slightly asymmetric; margins entire; apex obtuse; eucamptodromous venation. *Inflorescences* 2.3–2.5 cm long, panicle, pedunculated; peduncle 2.5–3.2 long, tomentose. *Flowers* 1–1.2 cm long, monoclinous, dichlamydeous, actinomorphic; pedicel ca.

The authors thank the curators of MOSS for the loan of specimens, and PEUFR for allowing to consult their collections. We thank Regina Carvalho for preparing the illustrations and Erimágna Rodrigues for preparing the distribution map. The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) provided an undergraduate scholarship for L. Pedro-Silva (Proc. No. 134747/2019-4) as well as a Ph.D. scholarship for T. S. Silva (Proc. No. 141011/ 2017-3), and a Productivity Research Fellowship, recently awarded to J. I. M. Melo (Proc. No. 303180/2019-6).

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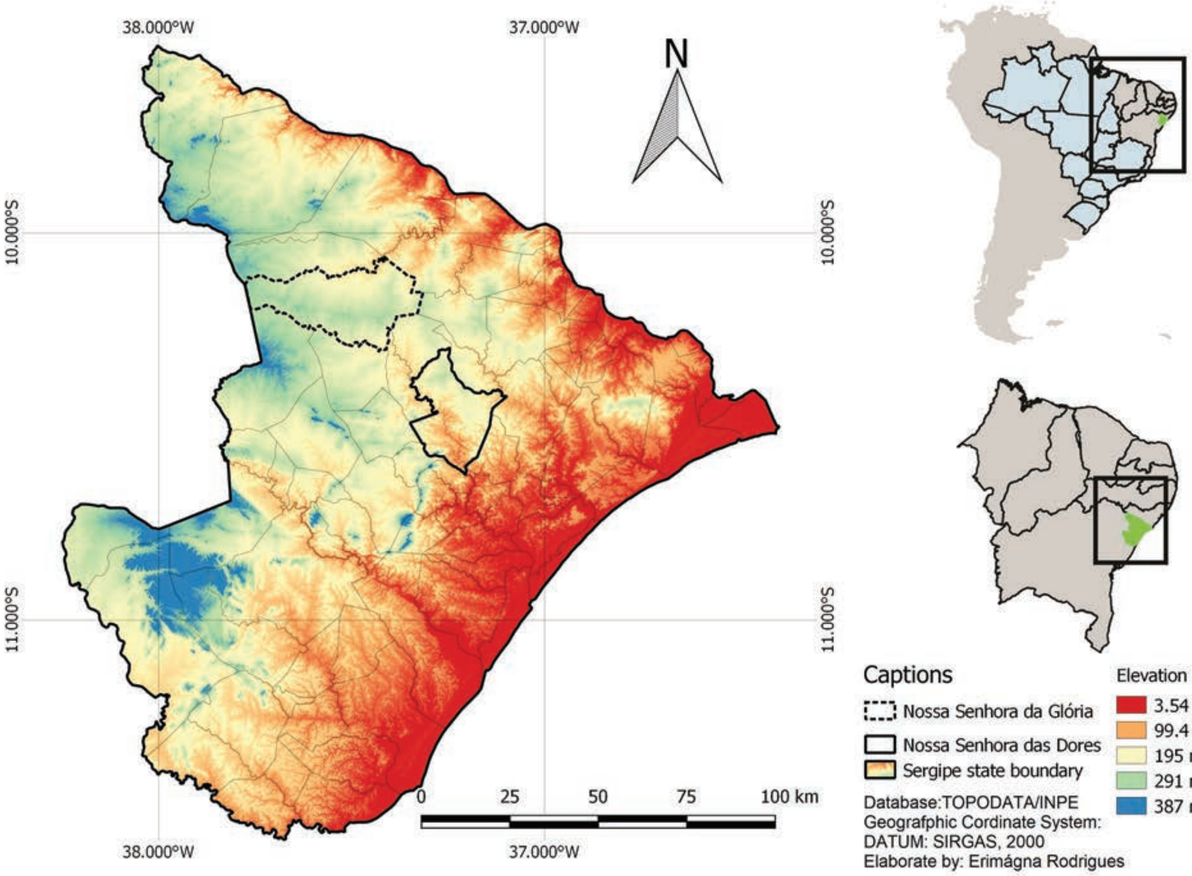

FIGURE 1. Known distribution of *Cordia obtusiloba* Pedro-Silva, T.S. Silva & J.I.M. Melo.

0.1 cm long; calyx 7 × 4 mm long, gamosepalous, tubular-cylindrical, externally tomentose with simple and stellate trichomes, internally sericeous with simple trichomes, apex acuminate; corolla ca. 16 mm long, infundibuliform, five lobes presenting 10 × 5 mm, obtuse, glabrous. Stamens five, epipetalous, homodynamous, filaments ca. 6 mm long, pilose on the corolla insertion with thickening in the middle portion; anthers oblongs ca. 2 mm long. Ovary ca. 2 mm long, slightly piriform, 4–locular, with 1 ovule per locule, presence of white glands in cross section, nectariferous disk present, axillary placentation; style ca. 10 mm long; stigmatic branches 2–2.5 mm long, erect. *Fruits* not seen.

Etymology: The specific epithet refers to the obtuse apex lobes of the corolla.

Distribution and Ecology: This species is recorded for two municipalities (Nossa Senhora das Dores and Nossa Senhora da Glória) associated to the hypoxerophytic caatinga in the semiarid region of the Sergipe state, northeastern Brazil at altitudes of 99 to 291 meters.

Phenology: Flowering in August.

Preliminary conservation status: It was collected for the first time four decades ago by E.M. Carneiro and, more recently, in 2014, by L.A.S. Santos in Nossa Senhora da Glória, and Nossa Senhora das Dores respectively. Our studies revealed only two specimens, making it impossible to assess the conservation status. For this reason, *C. obtusiloba* is classified as Data Deficient (DD), following the International Union for Conservation Nature criteria (IUCN, 2017).

Cordia obtusiloba is a representative of *C.* sect. *Gerascanthus* and morphologically it is similar to *Cordia alliodora* for the presence of stellate trichomes, tubular-cylindrical calyx, margin of the leaf entire, and costate calyx, but differs from this species for the absent ant domatia, lanceolate leaves, base acute and slightly asymmetric, apex of corolla lobes obtuse, and filaments pilose on the corolla insertion and thick in the middle portion.

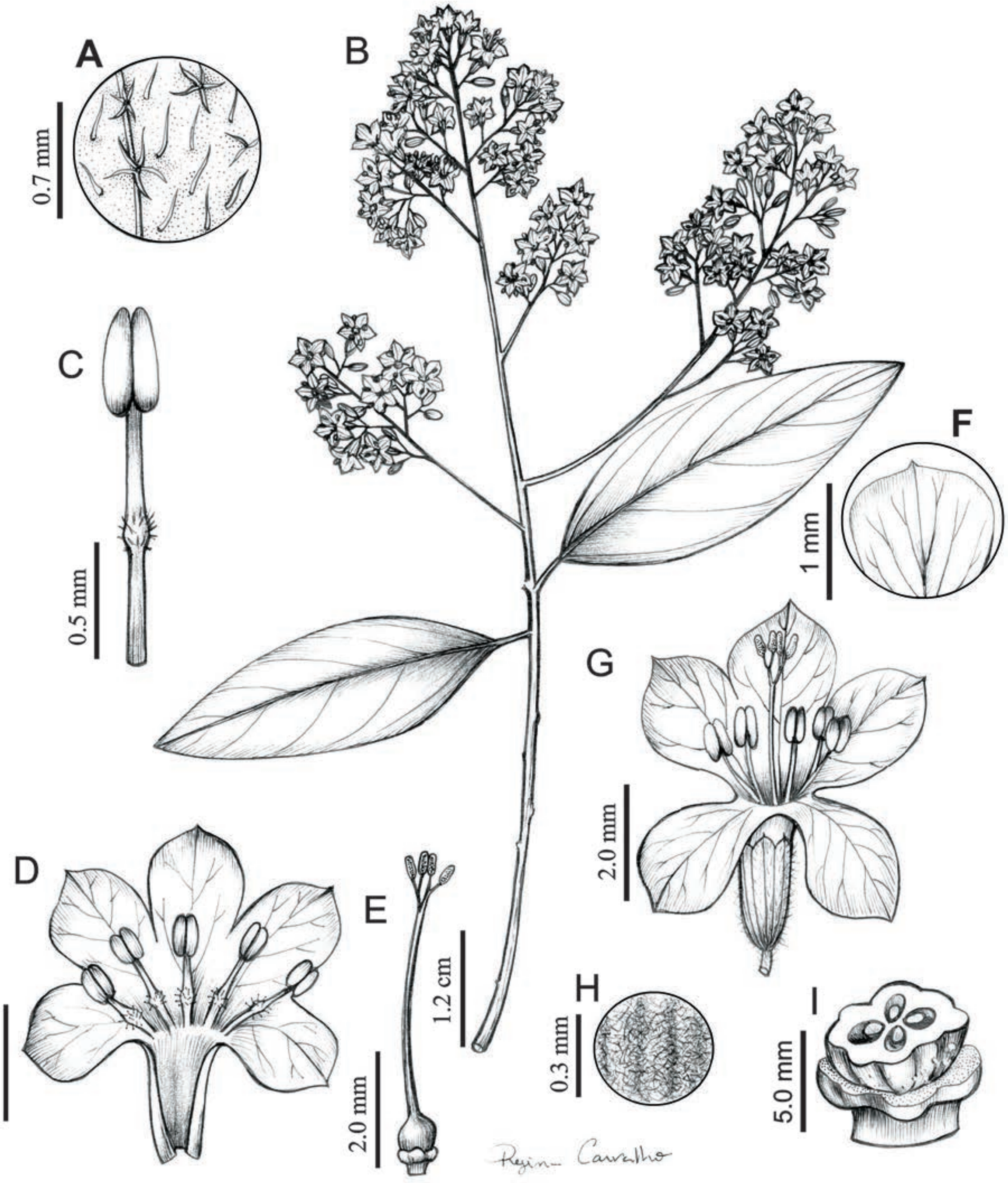

FIGURE 2. *Cordia obtusiloba* Pedro-Silva, T.S. Silva & J.I.M. Melo. **A**, detail of leaf surface; **B**, flowering branch; **C**, stamen; **D**, open corolla; **E**, gynoecium; **F**, detail of the obtuse apex of the corolla; **G**, flower; **H**, detail of the calyx; **I**, cross section showing glands in the gynoecium. Line drawings by Regina Carvalho based on the holotype.

LITERATURE CITED

BWG—BORAGINALES WORKING GROUP. 2016. Familial classification of the Boraginales. Taxon 66: 502–522.

FLORA DO BRASIL 2020 (2020) *Jardim Botânico do Rio de Janeiro*, Available from: http://floradobrasil.jbrj.gov.br/ (accessed May 19, 2021)

GOTTSCHLING, M., J. S. MILLER, M. WEIGEND, AND H. H. HILGER. 2005. Congruence of a phylogeny of Cordiaceae (Boraginales) inferred from ITS1 sequence data with morphology, ecology, and biogeography. Annals of the Missouri Botanical Garden 92: 425–437.

GUIMARÃES, E. F., N. T. RANGA AND J. I. M. MELO. A new species of *Cordia* (Cordiaceae) for the state of Minas Gerais, Brazil. Anales del Jardín Botánico de Madrid 73: 1–3.

IUCN, 2017. Guidelines for using the IUCN red list categories and criteria, version 13. Standards and Petitions Subcommittee. Available from: http://www.iucnredlist.org/documents/RedListGuidelines.pdf (accessed May 19, 2021).

MILLER, J. S. 2001. New Boraginaceae from tropical America 4: three new species of *Cordia* from South America. Novon 11: 421–428.

MILLER, J. S. AND M. GOTTSCHLING. 2007. Generic classification in the Cordiaceae (Boraginales): resurrection of the genus *Varronia* P.Br. Taxon 56: 163–169.

MILLER, J. S. 2013. A revision of *Cordia* section *Gerascanthus* (Boraginales: Cordiaceae). Journal of the Botanical Research Institute of Texas 7: 55–83.

RADFORD, J. S., W. C. DICKISON, J. R. MASSEY AND C. R. BELL. 1974. *Vascular Plant Systematics*. Harper and Row Publishers, New York.

STAPF, M. N. S. 2007. Avaliação da classificação infragenérica de Cordia L. (Cordiaceae) e revisão taxonômica de Cordia sect. Pilicordia DC. para o Brasil. Thesis. Universidade Estadual de Feira de Santana, Feira de Santana.

THIERS, B. [continuously updated]. *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium, Available from: http://sweetgum.nybg.org/ih/

REDISCOVERING *TERNSTROEMIA KILLIPIANA* (PENTAPHYLACACEAE, *S.L.*), A COLOMBIAN ANDES SPECIES NOT COLLECTED SINCE 1926: ITS GEOGRAPHIC DISTRIBUTION AND CURRENT CONSERVATION STATUS

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Abstract. *Ternstroemia killipiana*, a species endemic to Cordillera Oriental of Colombia, was collected by Ellsworth P. Killip in 1926, and described by Clarence E. Kobuski in 1942. Since this date, this taxon it had not been recollected until the new collection reported here. A full description based on recent collection from "Serranía de Las Quinchas" (middle Magdalena river), Boyacá department, which for the first time includes detailed information on calyx and the corolla, an illustration, and an updated key to the 15 species of *Ternstroemia* reported from Colombia are provided. The presence of *T. killipiana*, and other endemic plant species, on both slopes of the Cordillera Oriental demonstrates the important role of intensive biological explorations in understudied areas, and also suggests that plant diversity on the middle Magdalena river slopes has not been thoroughly sampled.

Keywords: Pentaphylacaceae, *Ternstroemia,* "Serranía de Las Quinchas," middle Magdalena river, Endemism, Cordillera Oriental, Colombia

Resumen. *Ternstroemia killipiana*, una especie endémica de la Cordillera Oriental de Colombia, fue colectada por Ellsworth P. Killip en el año 1926 y descrita por Clarence E. Kobuski en 1942. Desde esa fecha la especie no había sido observada hasta la nueva colección citada en la presente contribución. Se presenta una descripción completa, basada en la colección de la "Serranía de Las Quinchas" (medio Río Magdalena), departamento de Boyacá, y por primera vez se incluye información detallada del cáliz y la corola y una ilustración; asimismo, se presenta una clave para las 15 especies de *Ternstroemia* registradas para Colombia. La presencia de *T. killipiana* y otras especies de plantas endémicas en ambas vertientes de la Cordillera Oriental, demuestra el importante papel de las exploraciones biológicas intensivas en áreas pocos estudiadas, y a la vez, sugiere que la diversidad de plantas en las vertientes del medio río Magdalena, todavía no ha sido suficientemente estudiada.

Palabras claves: Pentaphylacaceae, *Ternstroemia,* "Serranía de Las Quinchas," medio río Magdalena, Endemismo, Cordillera Oriental, Colombia

Ternstroemia Mutis ex L. f. (Mutis, 1781[1782]: 264) is a Pantropical genus, found in tropical and subtropical areas of America, Africa, Australia, China, India, and Southeast Asia, with one species in Korea and Japan; overall encompassing between 100–170 species (Grande Allende, 2018, 2020 [2021]; Cheek et al., 2019). The highest diversity is found in the Neotropics region (between 102–105 species; *fide* Ulloa Ulloa et al., 2018 Onward, WCVP Onward, 2021).

The genus has been traditionally treated as a member of the Theaceae D. Don (Verdcourt, 1962), but phylogenetic studies have greatly altered concepts of the conventional Theaceae group (e.g., Weitzman et al., 2004; Su et al., 2011; Rose et al., 2018; Grande Allende, 2019; Frost and Lagomarsino, 2021). As a result, several genera previously placed in that family are presently in Pentaphylacaceae Engler *nom. cons.* or Ternstroemiaceae Mirb. ex DC. The first name with preference over the later when considered as a sole taxon (Culham, 2007; Stevens, 2001 Onwards). However, Pentaphylacaceae s.s. (including only *Pentaphylax euryoides* Gardner & Champ., a polymorphic species from Southeast Asia), is the sister group of tribes Frezierieae and Ternstroemieae, which constitute a monophyletic clade traditionally considered as Ternstroemiaceae. These two morphologically distinct groups, thus, should be treated as separate families (Grande Allende, 2019, 2020 [2021]).

Ternstroemia is characterized by its evergreen shrubby to arboreal habit, hermaphrodite or androdioecious. The leaves alternate but often clustered at the apex of branchlets, and pseudoverticillate. The flowers are axillar and solitary, pedunculate, and subtended by normally developed nomophylls or grouped in partially defoliated portions of the current-year shoots, seldom on floriferous brachyblasts. Stamens 15–>100, in 1 to several whorls. Ovary superior, (1–) 2–4(–5)-loculed with 2–5(–many) ovules per locule, placentation axillar; style 1 or (rarely) 2, entire or apically 2(–4)-lobed, forming with the prolonged apex of the ovary a styloid; stigma punctiform or peltate. Fruit is a capsule

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with either subvalvular or circumscissile dehiscence. Seeds reniform, laterally compressed, covered by red or purple papillae (Grande Allende, 2018, 2019, 2020 [2021]).

The genus has a remarkable ecological plasticity; several species appear to require habitats that are more specific. The taxa are found from lowland ("terra firme") vegetation (e.g., *T. krukoffiana* Kobuski), to montane forests (e.g., *T. acrodantha* Kobuski & Steyermark; *T. camelliifolia* Linden & Planchon). Several species are found over rocky slopes or tabletop mountains called "tepuis," over oligotrophic soils derived from the Precambrian crystalline basement of the Guayana Shield (i.e., *T. crassifolia* Benth., *T. discoidea* Gleason, *T. duidae* Gleason, *T. dura* Gleason, *sensu* Berry and Weitzman, 2005; *T. tepuiensis* J.R. Grande), and in white sand open vegetation drained by black waters rivers (e.g., *T. campinicola* B. M. Boom; *sensu* Boom, 1989). Some species have wide geographic distributions (e.g., *T. candolleana* Wawra, *T. pungens* Gleason, *T. verticillata* Klotzsch ex Wawra), whereas others are endemic to particular geographical areas, such as some species found only in Caribbean islands (e.g., *T. cernua* Griseb.; *sensu* Ulloa Ulloa et al., 2018 Onwards), or in Northeast Brazil (i.e., *T. bahiensis* J. Vieira & D. Sampaio; *sensu* Vieira et al., 2021).

Ternstroemia killipiana was collected by Ellsworth P. Killip during his 1926–27 trip to Colombia (Killip, 1927), and later described by Clarence E. Kobuski in 1942. No additional specimens of this species were available for examination until the second and last authors identified an additional collection gathered in 2021 in "Serranía de Las Quinchas" by a team of botanists from the project untitled: "Investigación de la biodiversidad de Boyacá: complementación y síntesis a través de gradientes altitudinales e implicaciones de su incorporación en proyectos de apropiación social de conocimiento y de efectos de cambio climático."

Ternstroemia is represented by 15 species in Colombia, instead of 10 species as previously recorded in the "Catálogo de plantas y líquenes de Colombia" (Gradstein, 2016): *T. congestiflora* Triana & Planch., *T. distyla* Gleason, *T. killipiana, T. oleifolia* Wawra and *T. urophora* Kobuski were not included.

MATERIAL AND METHODS

This work is based on morphological analysis (using a dissecting stereomicroscope) and on the examinations of online collections at A, COL, GH, HUA, MO, NY, US (herbarium codes after Thiers, 2019), and the WCVP Onward (2021).

To evaluate the morphology of the flowers, herbarium material was rehydrated and boiled in a solution of hot water mixed with dish wash detergent until flowers were sufficiently soft and malleable to be examined under a dissecting microscope.

In addition, historical and current taxonomic literature on *Ternstroemia* was examined using Biodiversity Heritage Library website (http://www.biodiversitylibrary.org), in particular the protologue of the species in Kobuski (1942). Current bibliography on *Ternstroemia* was studied, mainly the treatments for the Flora of the Venezuelan Guayana (Berry and Weitzman, 2005), and the checklist: *Catálogo de plantas y líquenes de Colombia* (Gradstein, 2016). Type specimens of *Ternstroemia* species involved in this study were examined using on-line images from JSTOR Global Plants (https://plants.jstor.org/). Finally, the International Plant Names Index (https://www.ipni.org/) and Tropicos (http://legacy.tropicos.org/Home.aspx) were also consulted to update the current nomenclature and geographical information.

The specific terminology for vegetative characters, vestiture description, inflorescences, flowers, and fruit morphology follow Font-Quer (2001), Harris and Harris (2006), and Endress (2010).

To determine the conservation status of *T. killipiana* (according to IUCN categories and criteria; IUCN, 2017), the extent of occurrence (EOO) and area of occupancy (AOO) were calculated using the supporting Red List threat assessments with GeoCAT (Bachman *et al*. 2011), constantly updated through the https://www.kew.org/science/our-science/projects/geocat-geospatial-conservation-assessment-tool.

TAXONOMY

Ternstroemia killipiana Kobuski, J. Arnold Arb. 23: 341. 1942. TYPE: COLOMBIA. Santander: Mesa de Los Santos [ca. aprox. 6.9425˚N, 73.0358˚W], "Tree 25–30 ft. [ca/ 8–10 m], dense woods", 1500 m, 11–16 December 1926, *E. P. Killip & A. C. Smith 15294* (Holotype: GH; Isotypes: A, NY, US). Fig. 1.

Small *tree* 7–10 m tall; branches terete, glabrous, brown. *Leaves* pale green or brown when dried, opaque on both surfaces, blades 7–10 × 2–4 cm, coriaceous, oblong-elliptic o oblong-obovate, glabrous on both surfaces, sparsely punctate on the lower surface, apex acuminate, base attenuate, margins entire or slightly crenate-serrulate, venation pinnate, brochidodromous; midvein canaliculate on the upper surface, plane or slightly elevated on the lower surface; secondary veins obscure, 10–12 pairs, petiole 5–10 mm long. *Flowers* (on immature state) solitary, axillar, glabrous, peduncles 5–10 mm long, recurvate, bracteoles 2, ca. 2 × 1.5–2 mm, subopposite, ovate-triangular, apiculate, rigid-coriaceous, brown, margins glandular-denticulate. *Sepals* 5, subequal, outer sepals 2, 2–3 × 1.5–2 mm, broadly-oblong, base slightly adnate, rigid-coriaceous, glabrous on both sides, margins glandulose-denticulate, middle sepal 1, ca. 3 × ca. 1.5 mm, oblong, rigid-coriaceous, one of the margins glandulose-denticulate, inner sepals 2, 2.5–3 × ca. 2 mm, broadly ovate, cucullate, membranaceous, white, glabrous on both sides, margins entire, scarious. *Petals* 5, subequal, 1–2 × 1–1.5 mm, basely connate, tube ca. 1/3 of the corolla total length, oblong at the base, ovate at the apex, apex acuminate, white, glabrous and reticulate on both sides. *Stamens* ca. 60, 1.5–2.5 mm long, filaments 0.3–0.8 mm long, in 2 whorls, unequal, laminar, slightly connate at the base, glabrous, anthers 1.2–1.5 mm long, linear, glabrous, connective apiculate or submuticous; ovary conical, ca. 1.5 mm long, ca. 2 mm diameter basally, glabrous, 2-locular,

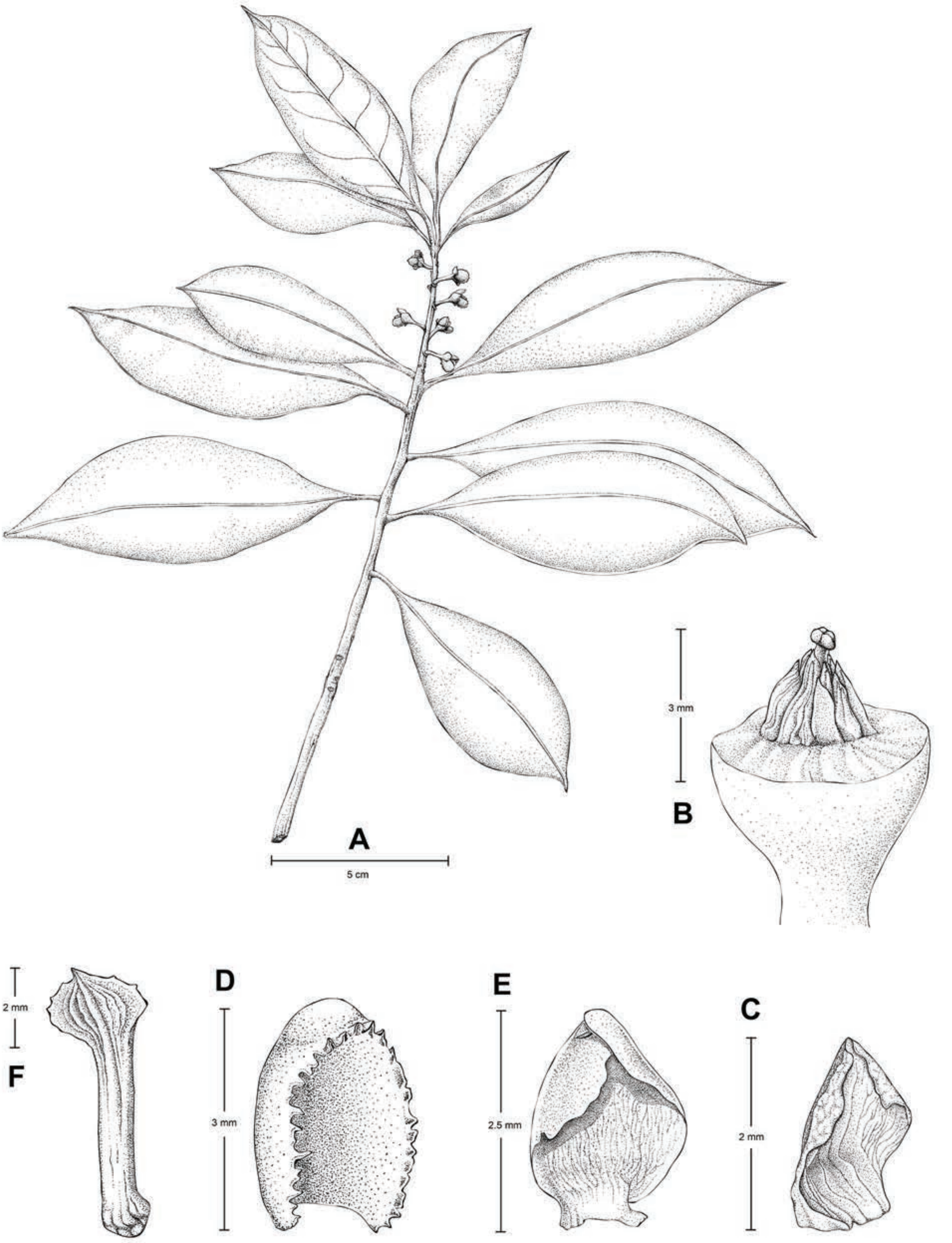

FIGURE 1. *Ternstroemia killipiana* Kobuski **A**, habit showing the branch and the solitary flowers; **B**, detail of a flower showing the stamens and the stigma, the bracteoles, sepals and petals were removed, **C**, ventral view of a corolla lobe, **D**, ventral view of the outer sepal showing the glandulose-denticulate margin, **E**, ventral view of the inner sepal, **F**, bracteole on peduncle. Drawn by A. Valenzuela Zúñiga based on the additional specimen.

2-ovules by locule, style ca. 0.8 mm long, glabrous, stigma punctiform, 2-lobulate. *Fruit* not seen.

Distribution and ecology: the species is hitherto known to occur on primary or secondary wet forest at 1000–1500 m elevation, located in "Serranía de Las Quinchas" and "Mesa de Los Santos", in the Boyacá and Santander departments (Fig. 2). The "Serranía de las Quinchas" is placed in Magdalena Valley biogeographical region, which is located on the western slope of the Cordillera Oriental, in the western sector of the department of Boyacá, and borders the departments of Santander and Cundinamarca, between 380–1500 m (Bohórquez-Osorio et al., 2020). The middle Magdalena river natural region is well known by its interesting plant diversity and types of low (100–250 m), foothill (300–500 m) and medium forest (600–1200 m) (Balcázar et al., 2000; Restrepo et al., 2016) and an extensive rural tradition in the knowledge of useful plants (Bohórquez-Osorio et al., 2020). In addition, the region harbor many Amazonian, biogeographical Chocó or "Chocó biogeográfico," and Mesoamerican elements (Balcázar et al., 2000), the presence of several Colombian endemic genera (i.e., *Orphanodendron* Barneby & J.W. Grimes [Leguminosae], *Romeroa* Dugand [Bignoniaceae]) and numerous endemic taxa (i.e., *Andira chigorodensis* T.R. Penn. [Leguminosae], *Aphelandra fernandezii* Leonard, [Acanthaceae], *Ephedranthus colombianus* Maas & Setten [Annonaceae]).

Additional specimen examined: COLOMBIA. Boyacá. Otanche. Parque Regional Nacional "Serranía de las Quinchas", selva húmeda mesotérmica del medio río Magdalena, 5°48'39.6"N; 74°15'15.3"W, 1035 m, 15 June 2021, *M. Escobar, D. Rodríguez, J. García & P. Hernández 498* (COL, UPTC).

Conservation status: currently, this species is only known from the type and one additional collection, and it is reported here as rare species. However, under IUCN (2017) guidelines two localities constitute deficient data (DD) to determine its conservation status. Nevertheless, it should be regarded as Critically Endangered (CR) due to the lower number of known localities (two), and its smaller estimated Area of Occupancy, with less 0,001 km^2, an estimated Extent of Occurrence of 8,000 km^2 (IUCN, 2017). Also, the conservation of these forests are in risks due the continuous deforestation and degradation of the "Serranía de Las Quinchas" and their surrounding areas on middle Magdalena river. These areas had been highly deforested during the last six decades mainly by selective logging activities (Restrepo et al., 2016) and the conversion of the forests for livestock cattle and illicit crops. However, the region where *T. killipiana* was found, *"Parque Natural Regional Serranía de Las Quinchas"* is apparently well protected by Corpoboyacá, a regional institution in charge of protected areas in Boyacá department.

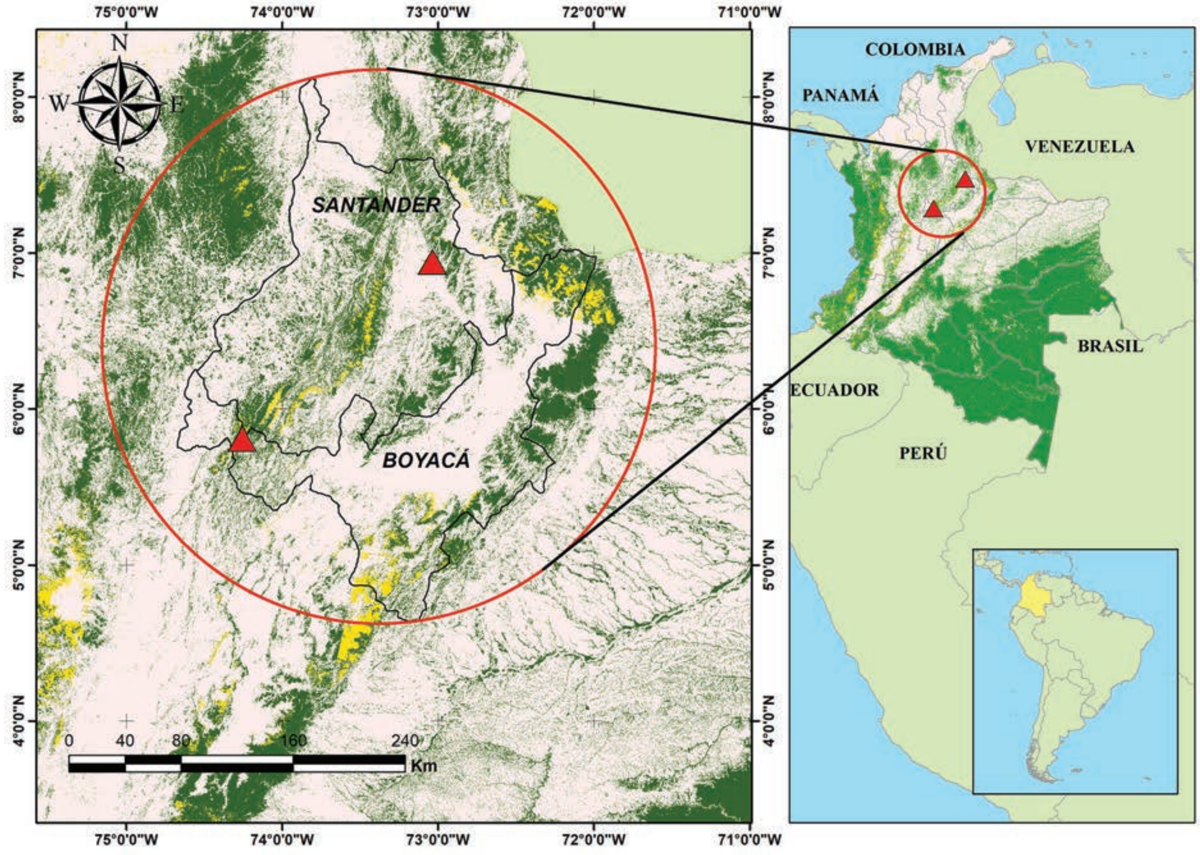

FIGURE 2. Geographical distribution of *Tersntroemia killipiana* Kobuski.

Key to species of *Ternstroemia* as yet reported for Colombia

1a. Stigma punctiform o subpunctiform; sepals ovate to suborbicular; stamens conspicuously apiculate, the apicules notably longer than 1/10 the length of the anthers; filaments *ca.* 1/3 the total length of the stamens; fruits with subvalvular dehiscence 2

1b. Stigma peltate; sepals orbicular; stamens discretely apiculate, the apicules blunt and not exceeding 1/10 the length of the anthers; filaments ≤ 1/4 the total length of stamens; fruits with either subvalvular or circumscissile dehiscence 8

2a. Sepals acuminate; petals conspicously acute; style bifid (rarely trifid) in its upper half; stigma punctiform . . . . *T. pungens* (Caquetá, Guianía, Vaupés)

2b. Sepals obtuse or rounded, rarely acute; anthers conspicously apiculate; style entire or subentire; stigma punctiform (in some specimens of *T. campinicola* and *T. oleifolia*, the stigmatic lobes are extended, giving the appearance of a peltate stigma) 3

3a. Leaf blades with flat margins, crenate or entire, punctate below, usually < 5 cm long, coriaceous, hyphodromous; petioles inconspicuous (usually < 5 mm long) 4

3b. Leaf blades with revolute margins, punctate to crenate-serrulate, usually > 5 cm long, coriaceous or chartaceous; secondary venation evident, but sometimes obscure; petioles conspicuous (≥ 5 mm long) 6

4a. Leaf blades widely to narrowly obovate, crenate, apically rounded and emarginate; hypophyll wrinkled when dry . . . . *T. verticillata* (Amazonas, Caquetá)

4b. Leaf blades elliptic to obovate-elliptic, entire, apically obtuse or acute (rarely rounded and emarginate); hypophyll smooth when dry 5

5a. Leaf baldes elliptic to obovate-elliptic; upper leaf surface with a conspicuously impressed midvein . . . . *T. campinicola* (Caquetá, Guaviare, Guianía, Vaupés)

5b. Leaf blades narrowly elliptic; the midvein not evident . . . . *T. oleifolia* (Caquetá, Vaupés)

6a. Leaf blades elliptic to oblong-elliptic, abruptly acuminate, with 10–12 pairs of secondary veins; outer sepals ovate, apically acute or acuminate . . . . *T. urophora* (Guianía)

6b. Leaf blades elliptic, oblong-obovate or oblanceolate, discretely acuminate, with <10 pairs of veins; outer sepals broadly ovate, apically obtuse or rounded 7

7a. Leaf blades oblanceolate, 6.0–8.5 × 1.5–2.5 cm; peduncles 1.5–2.5 cm long . . . . *T. mutisiana* (Antioquia, Chocó)

7b. Leaf blades elliptic or oblong-obovate, 7–10 × 2–4 cm; peduncles 0.5–1 cm long . . . . *T. killipiana* (Boyacá, Santander)

8a. Leaf blades 9–16 × 5–8 cm; sepals 11–13 × 11–14 mm; fruits reaching 2 cm diam. . . . . *T. macrocarpa* (Boyacá, Cundinamarca, Risaralda, Santander, Norte de Santander)

8b. Leaf blades 2–10(–12) × 1.5–5 cm; sepals 5–8 × 6—8 mm; fruits smaller, seldom exceeding 1 cm diam. 9

9a. Leaf blades elliptic; fruits with circumscissile dehiscence . . . . *T. distyla* (Caquetá, Guianía)

9b. Leaf blades elliptic to obovate; fruits with subvalvular dehiscence 10

10a. Leaf blades relatively small, 2–6 cm × 1.5–2.5 cm, apically rounded 11

10b. Leaf blades relatively large, 5–10(–12) × 2–5 cm, for the most part with an obtuse, acute or acuminate apex 12

11a. Petioles 3–5 mm long; peduncles 5–10 mm long, stout . . . . *T. meridionalis* (Antioquia, Boyacá, Cundinamarca, La Guajira, Magdalena, Meta, Norte de Santander, Tolima)

11b. Petioles *ca.* 5 mm long; peduncles 1.0–1.5 mm long, slender . . . . *T. cuneifolia* (Antioquia)

12a. Penduncles 0.4–10 cm long 13

12b. Peduncles 1.2–1.7 cm long 14

13a. Leaf blades 6–10(–12) × 3–5 cm; stamens >100 . . . . *T. camelliifolia* (Magdalena, Quindío)

13b. Leaf blades 5–8 × 2–3 cm; stamens *ca.* 60 . . . . *T. congestiflora* (Boyacá)

14a. Leaf blades punctate, apically obtuse; peduncles 1.2–1.5 cm long; sepals 5–6 cm long; stamens *ca.* 100 . . . . *T. clusiifolia* (Antioquia)

14b. Leaf blades crenate-serrulate, apically acuminate; peduncles 1.5–1.7 cm long; sepals 6–8 × 7–8 mm; stamens > 200 . . . . *T. lehmannii* (Antioquia)

Literature Cited

Bachman, S., J. Moat, A. W. Hill, J. de la Torre J & B. Scott. 2011. Supporting red list threat assessments with GeoCAT: geospatial conservation assessment tool. *ZooKeys* 150: 117–126.

Balcázar, M. P., J. O. Rangel.Ch. and E. L. Linares-C. 2000. Diversidad florística de la Serranía de Las Quinchas, Magdalena medio (Colombia). Caldasia 22, No. 2: 191–224.

Berry, P. E. and A. L. Weitzman. 2005. Ternstroemiaceae. Pages 300–308 in P. E. Berry, K. Yatskievych and B. K. Holst, eds., Flora of the Venezuelan Guayana 9. Missouri Botanical Garden Press, San Luis.

Boom, B. 1989. New species of *Ternstroemia* (Theaceae) from the Guayana Highland. Brittonia 41: 136–142.

Bohórquez-Osorio, A., T. Ulian and M. Diazgranados. 2020. Guía de plantas útiles de le Serranía de las Quinchas. Ecología, Economía y Ética, Rutas Turísticas por los Bosques y la Paz. Royal Botanic Gardens, Kew; E3, UK.

Cheek, M., P. M. Haba, G. Konomou and X. M. Van Der Burgt. 2019. *Ternstroemia guineensis* (Ternstroemiaceae), a new endangered cloud forest shrub with neotropical affinities from Kounounkan, Guinea, West Africa. Willdenowia 49, No. 3: 351–360.

Culham, A. 2007. Pentaphylacaceae. Pages 248–249 in V. H. Heywood, R. K. Brummitt, A. Culham and O. Seberg, eds., Flowering plant families of the world. Firefly Books, London.

Endress, P. K. 2010. Disentangling confusions in inflorescence morphology: Patterns and diversity of reproductive shoot ramification in angiosperms. Journal of Systematics and Evolution 48: 225–239.

Font-Quer, P. 2001. *Diccionario de Botánica*. Ediciones Península, Barcelona, España.

Frost, L. and L. Lagomarsino. 2021. More-curated data outperforms more data: Treatment of cryptic and known paralogs improves phylogenomic analysis and resolves a northern Andean origin of *Freziera* (Pentaphylacaceae). *bioRXiv* 2021.07.01.450750. doi: https://doi.org/10.1101/2021.07.01.450750.

Gradstein, S. R. 2016. *Ternstroemia* (Pentaphylacaceae) 2016 (continuously updated). Pages 2052–2054 in R. Bernal, S. R. Gradstein, and M. Celis, eds., *Catálogo de plantas y líquenes de Colombia*. Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá. Available at www.catalogoplantasdecolombia.unal.edu.co. (accessed September 28, 2021).

Grande Allende, J. R. 2018. *Sertulum Ternstroemiacearum* II: *Ternstroemia tepuiensis* J. R. Grande Allende, sp. nov. *(Ternstroemiaceae),* especie nueva del Escudo Guayanés. Anales del Jardín Botánico de Madrid 75, No. 1: e066. https://doi.org/10.3989/ajbm.2486Título

———. 2019. Estudio sistemático del género *Ternstroemia* Mutis ex L.f. (Ternstroemiaceae) para el área del Escudo Guayanés (Brasil, Colombia, Guayana Francesa, Guyana, Surinam y Venezuela). PhD Thesis. Facultad de Ciencias, Universidad Central de Venezuela. Caracas, Venezuela.

———. 2020 [2021]. *Sertulum Ternstroemiacearum* IV. Sinopsis del género *Ternstroemia* (Ternstroemiaceae) en Brasil, incluyendo novedades taxonómicas, nomenclaturales y corológicas. Acta Botanica Venezuelica 43, No. 1–2: 43–109.

Harris, J. G. and M. W. Harris. 2006. *Plant Identification Terminology: An Illustrated Glossary*. Spring Lake Publishing, Spring Lake, Utah.

IUCN. 2017. Guidelines for using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee. Available at http://www.iucnredlist.org/documents/RedList Guidelines.pdf. (accessed September 29, 2021).

Killip, E. P. 1927. Report of the Killip-Smith botanical expedition to Colombia, 1926-1927. Journal of New York Botanical Garden 28: 205–220.

Kobuski, C. E. 1942. Studies in the Theaceae, XII. Notes on the South American species of *Ternstroemia*. Journal Arnold Arboretum 23: 298–343.

Mutis, J. C. B. 1781[1782]. Supplementum Plantarum 39: 264.

Restrepo, I. C., A. M. Aldana and P. R. Stevenson. 2016. Dinámica de bosques en diferentes escenarios de tala selectiva en el Magdalena medio (Colombia). Colombia Forestal 19, No. 2: 71–83.

Rose, J. P., T. J. Kleist, S. D. Löfstrand, B. T. Drew, J. Schönenberger and K. J. Sytsma. 2018. Phylogeny, historical biogeography, and diversification of angiosperm order Ericales suggest ancient Neotropical and East Asian connections. Molecular Phylogenetic and Evolution 122: 59–79.

Stevens, P. F. 2001 [continuously updated]: Angiosperm Phylogeny Website. Version 14, Published at http://www.mobot.org/MOBOT/research /APweb/ [accessed September 28 2021].

Su, Y. W. Liao, T. Wang, Y. Sun, Q. Wei and H. Chang. 2011. Phylogeny and evolutionary divergence times in *Apterosperma* and *Euryodendron*: Evidence of a Tertiary origin in southern China. Biochemical Systematic and Ecology 39: 769–777.

Thiers, B. 2019. (Continuously updated). Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Gardenís Virtual Herbarium. Available from: http://sweetgum.nybg.org/ih/. (accessed September 28, 2021).

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. 2018 (continuously updated). An integrated assessment of vascular plants species of the Americas (accessed September 28, 2021). http://legacy.tropicos.org/Project/VPA

Verdcourt B. 1962. Theaceae. Pages 1–8 in C. E. Hubbard and E. Milne-Redhead E., eds, Flora of tropical East Africa. Crown Agents for Overseas Governments & Administrations, London.

Vieira, A. J., D. S. Silveira, V. M. M. Jordão and J. P. Soares-Silva. 2021. Taxonomic novelties in Pentaphylacaceae: Four new species of *Ternstroemia* from Brazil. Neodiversity 14: 3–18.

WCVP, 2021. World Checklist of Vascular Plants, version 2.0. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; http://wcvp.science.kew.org/. (accessed October 02, 2021).

Weitzmann, A. L., S. Dressler and P. F. Stevens. 2004. Ternstroemiaceae. Pages 450–460 in K. Kubitzki, ed., *The Families and Genera of Flowering Plants* 6. Springer-Verlag, Berlin.

A NEW SPECIES OF *CARPOTROCHE* (ACHARIACEAE) FROM HONDURAS AND NICARAGUA

Daniel Santamaría-Aguilar,[1,2,4] Indiana M. Coronado,[3]
Ronald L. Liesner,[4] and Alexandre K. Monro[5]

Abstract. *Carpotroche caceresiae,* a newly delimited species from the Caribbean drainage of Honduras and Nicaragua, is described and illustrated and its extinction threat assessed as Near Threatened (NT) according to IUCN criteria. *Carpotroche caceresiae* has previously been confused with *C. platyptera,* a species characterized by a densely pubescent lower leaf surface and red fruits lacking crests between the wings; in contrast, *C. caceresiae* has sparsely pubescent lower leaf surface and green fruits with crests between the wings. *Carpotroche crassiramea* and *C. glaucescens*, typified with Costa Rican material, and hitherto included in the synonymy of *C. platyptera,* are treated here as distinct morphological identities; a list of the specimens examined and referred to these names are provided.

Keywords: *Carpotroche platyptera*, Flacourtiaceae, Herbaria, Malphigiales, Mesoamerica, Taxonomy, Ecuador

Prior to phylogenetic analyses of DNA sequence data, the core eudicot Rosid I family Achariaceae Harms. were considered to comprise small shrubs, acaulescent and creeping herbs of the monospecific genera *Acharia* Thunb., *Ceratiosicyos* Nees and *Guthriea* Bolus (Hutchison, 1969; Chant, 1985; Goldberg, 1986), restricted to South Africa. Phylogenetic analyses of DNA sequence data, however, led to a radical re-circumscription of several genera traditionally placed in Flacourtiaceae and suggested that Achariaceae should be expanded to include several genera of trees and shrubs of tropical and subtropical Africa, Australia, Asia, and the Americas.

Chase et al. (2002) classified Achariaceae into four tribes and 30 genera: Acharieae (three genera), Pangieae (11 genera), Erythrospermeae (five genera), and Lindackerieae (11 genera). Of these, *Chiangiodendron* T. Wendt (Pangieae tribe), *Carpotroche* Endl., *Kuhlmanniodendron* Fiaschi & Groppo, *Lindackeria* C. Presl and *Mayna* Aubl. have been documented from the Neotropics, all of which are in the Lindackerieae (Chase et al., 2002; Sosa et al., 2003; Fiaschi and Groppo, 2008; Groppo et al., 2010). Lindackerieae are recognized by the following combination of morphological characters: segments of the perianth organized asymmetrically; sepals usually imbricate and separated from the petals; petals lacking an adaxial basal scale and, greater in number and longer, than the sepals; a floral disc lacking glands; numerous stamens with more or less linear anthers; a unilocular ovary with parietal placentation; and fruits that are usually winged, with spines or slight ribs (Chase et al., 2002; Fiaschi and Groppo, 2008; Groppo et al., 2010).

Carpotroche is notable for its winged, usually cauliflorous fruits that can be green, white, orange, red or a combination thereof (Fig. 1). As a relatively charismatic component of the forest understory, *Carpotroche* is well represented in herbarium collections (especially with fruits). Diagnostic morphological characters for *Carpotroche* include, stipulate leaves that lack translucent dots or lines and that are usually clustered towards the branch tips; petiole including a pulvinus at both ends; odoriferous, unisexual, polygamo-monoecious or -dioecious flowers with more petals than the sepals; numerous stamens; pubescent filaments; a pistil with 4–8 (–10) capitate or lacerated stylodes and late dehiscent capsular fruits with smooth, vertical or winged ridges (Sleumer, 1980; Alford, 2003, 2009; Fiaschi and Groppo, 2008; Groppo et al., 2013).

The current taxonomy of *Carpotroche* is based on Sleumer's Flora Neotropica treatment of Flacourtiaceae (1980) according to which the genus comprises 11 species, nine of which occur in South America and two in Central America [*C. longifolia* (Poepp.) Benth. and *C. platyptera*

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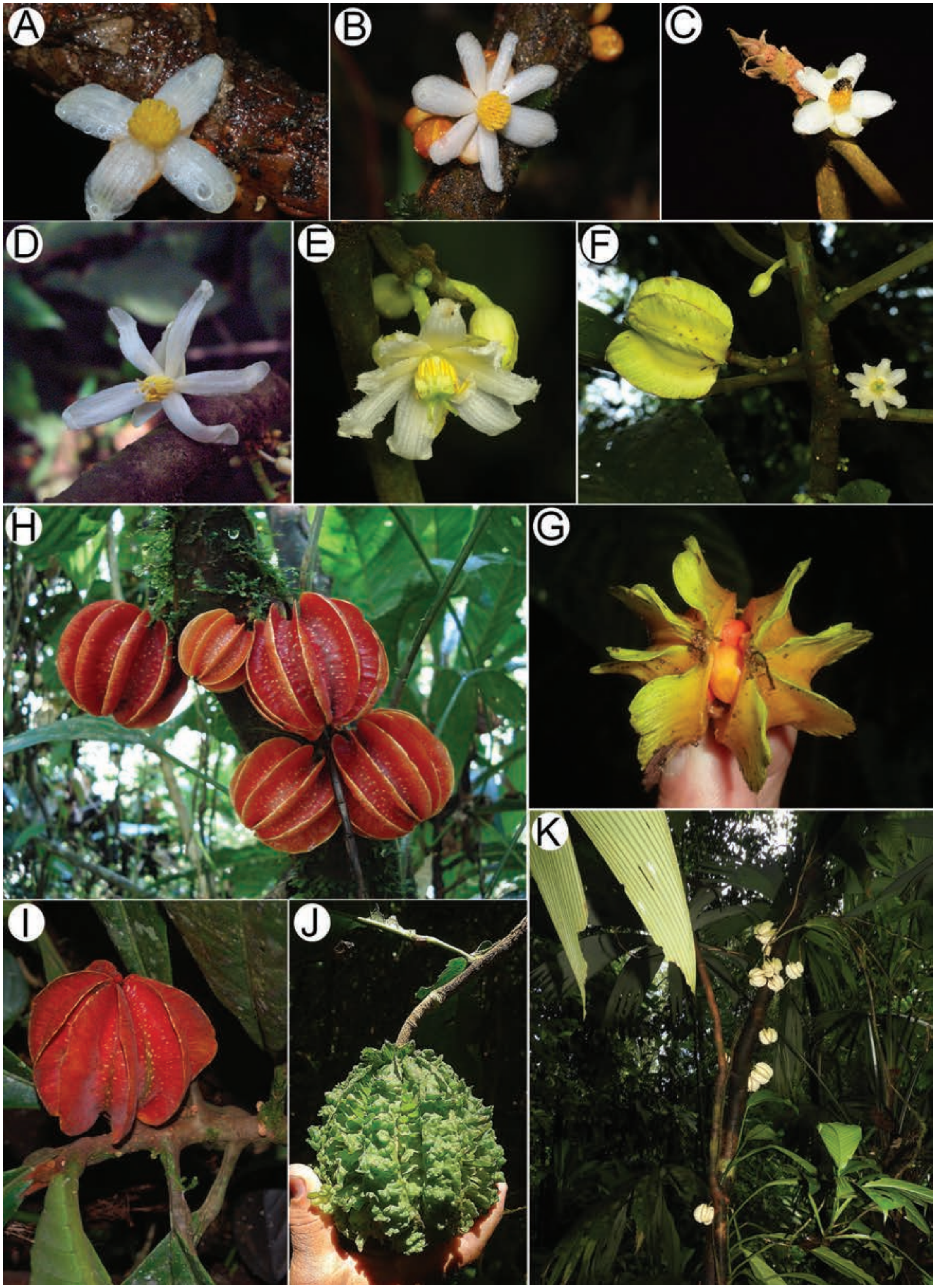


FIGURE 1. Some morphological character of flowers and fruits in *Carpotroche* Endl. **A**, *Carpotroche* sp. from Caribbean slope of Costa Rica (*A. K. Monro et al. 6538*); **B**, *Carpotroche crassiramea* (*N. Zamora et al. 4864*). **C**, *Carpotroche* sp. from Península de Osa, Pacific slope of Costa Rica (not herbarium specimens seen for these photographs, but taken in that region); **D**, *Carpotroche caceresiae* D. Santam. (*I. Coronado et al. 4408*); **E–G**, *Carpotroche ramosii* (Cuatrec.) Cuatrec. (not herbarium specimens seen for these photographs, but taken in Ecuador); **H–I**, *Carpotroche* sp. from Caribbean slope of Costa Rica, probably correspond with *C. crassiramea* Pittier (not herbarium specimens seen for these photographs, but taken in Veragua, Liverpool, Limón). J. *Carpotroche brasiliensis* (Raddi) Endl.; I, *Carpotroche crassiramea* (not herbarium specimens seen for these photographs). Images by Alex K. Monro (A–B, I), Reinaldo Aguilar (C, K), Indiana Coronado (D), Andreas Kay (E–G), Juan Mata-Lorenzen (H), Alex Popovkin (J).

Pittier]. *Carpotroche longifolia* is known from Panama (and South America), and *C. platyptera* Pittier from Guatemala (collections were not examined), Honduras, Nicaragua, Costa Rica, and Panama. *Carpotroche longifolia* and *C. platyptera* usually grow below 1000 m elevation, in humid or submontane forests (Sleumer, 1980). Sleumer (1980) described *Carpotroche froesina* Sleumer, endemic to Brazil and excluded *C. apterocarpa* Kuhlmann, the latter currently considered a species of *Kuhlmanniodendron* (Groppo et al., 2013).

Sleumer also placed two names in synonymy with *C. platyptera*: *C. crassiramea* Pittier and *C. glaucescens* Pittier (Pittier, 1909), all three of which are typified with Costa Rican material. Sleumer's of *Carpotroche* was adopted by several flora treatments. For example, *Flora de Nicaragua* (Pool, 2001), *Manual de Plantas de Costa Rica* (González, 2010), and *Árboles de Costa Rica* (Zamora Villalobos et al., 2017). We, however, consider them distinct taxa. In addition, our own field and herbarium observations suggest that several specimens from the Pacific slope (Fila Costeña, Península de Osa, Tarrazú) and Caribbean slopes of Costa Rica (e.g., Hitoy-Cerere, Uatsi, Suretka) and Panama (El Llano-Cartí road) require further study (D. Santamaría-Aguilar et al. in prep.). With the proposal of this new species and the reestablishment of two names, the genus is composed by 14 species.

Materials and Methods

Approximately 500 physical and digital herbarium specimens of *Carpotroche* were examined from BM, CR (including ex INB), GH, HULE, K, LSCR, LSU, MO, and NO (acronyms follow Thiers 2021 [continuously updated]). All type specimens were consulted. Of these, specimens from CR and MO comprised the majority of the material examined for this study. The following digital collections or virtual herbaria were used: F (https://collections-botany.fieldmuseum.org/), JSTOR Global Plants (http://plants.jstor.org), P (http://www.mnhn.fr), MEXU (https://datosabiertos.unam.mx/biodiversidad/), INCT (http://inct.splink.org.br). Images of specimens not available online were provided by: EAP and HUH. Label information of specimens studied and housed at CR and MO are available online via the ECOBIOSIS (http://ecobiosis.museocostarica.go.cr/index.aspx), HERBARIO (https://biodiversidad.museocostarica.go.cr/) and TROPICOS (http://www.tropicos.org/). When the coordinates and/or elevation were not included on the herbarium label, but were present in the TROPICOS database, the values from TROPICOS are included in brackets. Dot-distribution maps were compiled from studied specimens and generated with SimpleMappr (Shorthouse, 2010).

Species descriptions are based primarily on herbarium specimens. When necessary, flowers from herbarium specimens were rehydrated before measurement. A ruler was used to measure all morphological parts and trichomes were measured with a micrometer calibration tool (1div = 1mm) under a dissecting stereoscope (Bausch & Lomb). Colour of flowers and fruits, phenology, elevation, vernacular names and uses were observed from herbarium specimens. Field observations by the first author were made in the Osa Peninsula, Fila Matama, and La Selva Biological Stations of Costa Rica.

Taxonomy

Carpotroche caceresiae D. Santam., *sp. nov.*
TYPE: NICARAGUA. Jinotega: Mpio. [Municipio] del Cua Bocay, Reserva de Bosawas, comunidad de San Andrés, Caño Susumwas, 180 m, 14°22'N, 085°03'W, 30 June 2005 (imm. fr.), *I. Coronado, M. Barrios, G. Pérez and M. Mercado 1953* (Holotype: MO [5989394] [barcode MO-1690017]; Isotypes: HULE [23576], P [barcode P04782022; image]). Fig. 2, 3, 4A–B, 5A.

This new species is morphologically similar to *Carpotroche longifolia* (Poepp.) Benth. with respect to its whitish to greenish fruits that are longitudinally winged and possessing numerous crests between the wings, and the leaves, whose abaxial surface is short-pubescent. *Carpotroche caceresiae* can be distinguished from *C. longifolia* by the wings of the fruit having an entire or weakly sinuate margin (vs. deeply lacerate).

Shrub or small *tree*, 1.5–8 (–15) m high; *bark* smooth, brown-grey (*S. Blackmore* and *M. Chorley 4184*). *Young branches* 0.4–0.6 (–1.2) cm diameter, terete, sparsely lenticellate, the distal portions pubescent, trichomes of two classes, 0.2–0.3 (–0.5) mm, straight or apically uncinate, whitish or red-brown, the other a sparse to dense under-layer of smaller brown trichomes; stipules (0.15–) 0.4–0.9 × (0.1–) 0.15–0.3 cm, usually deltoid, both surfaces densely pubescent, trichomes brown, paler on the adaxial surface. *Leaves* spirally arranged; petioles (1.5–) 3–6.1 (–8.5) cm, occasionally fistulate, with a pulvinus towards the apex, pubescent as young branches, flattened, the adaxial surface occasionally weakly corrugated, abaxially rounded; laminae 19–48.5 × 5.8–13.3 cm, oblanceolate to obovate or obovate-elliptic; upper surface usually glabrous but occasionally with whitish trichomes on the midrib and lateral nerves; lower surface sparsely pubescent, trichomes 0.1–0.3 mm, whitish or red-brown; midrib flattened on the upper surface and raised on the lower surface, pubescent with two classes of trichomes, major trichomes whitish, minor trichomes brown; lateral veins (12–) 16–23 pairs, flat to weakly raised on the upper surface, raised on the abaxial surface, weakly curved, ascending; tertiary veins parallel, raised on the abaxial surface; quarternary veins reticulate; base cuneate; apex acuminate; margin usually serrate, with 19–40 teeth, the teeth (1–) 1.5 (–2) mm, each tooth bearing a small gland, the gland glabrous or pubescent. *Staminate inflorescences* in leaf axils, fasciculate, bearing 1–5 flowers, few of which are well developed at any one time; flowers bisexual, solitary, apparently cauliforous. *Staminate flowers* pedicellate, pedicel 1.5–2.5 mm in bud, pubescent; sepals 2, white when fresh, ca. 6 × 4 mm, ovate; abaxial surface pubescent, occasionally glabrous towards the margins, with two classes of trichomes, one widespread, whitish, adpressed or erect and uncinate (at their apex), the other sparse to dense, brown; adaxial surface glabrous; petals

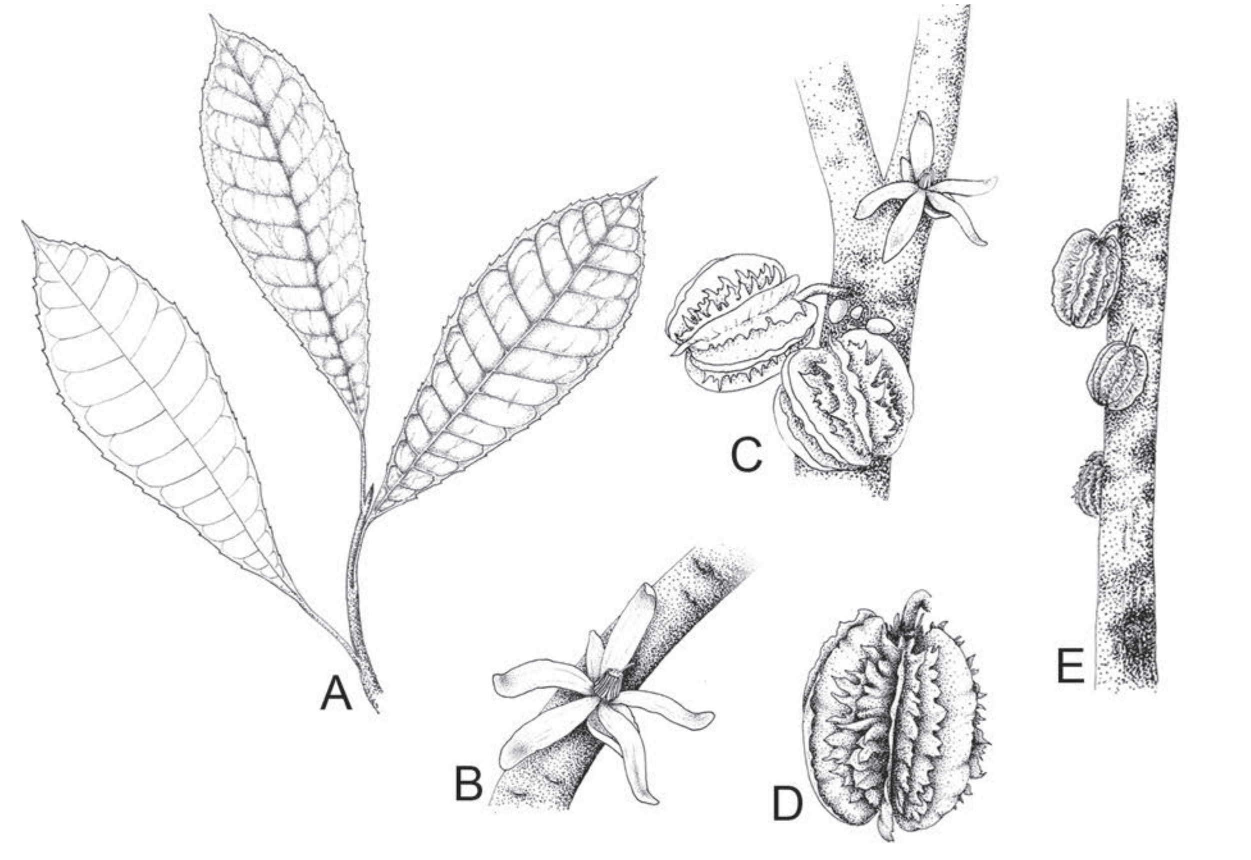


FIGURE 2. *Carpotroche caceresiae* D. Santam. **A**, leaves; **B**, hermaphrodite flowers; **C**, hermaphrodite flowers and fruits; **D**, stem with fruits; **E**, fruit detail showing wings and crests. Illustration by Alex Mauricio Campos, A from *I. Coronado et al. 1953* (MO); B and C of the photographs *I. Coronado and A. Fernández 4408;* D of photography *I. Coronado and A. Fernández 4736-A*.

5 or 6, 4–11 mm in length, white, oblong-elliptic; abaxial surface sparsely pubescent, the trichomes concentrated on the central portion for almost all its length, whitish to transparent; adaxial surface glabrous or sparsely pubescent; stamens 18–21; filaments ca. 0.5 mm, densely pubescent; anthers ca. 3 mm in length, yellow, locellate, densely pubescent, the trichomes whitish yellow; gynoecium absent. *Hermaphrodite flowers* pedicellate, pedicel ca. 6 mm at anthesis, pubescent; sepals 2, white, ca. 10 × 4.5 mm, oblong-elliptic; petals 5, ca. 10 mm in length, white, oblong-elliptic, indument as in staminate flowers; stamens 18–21, yellow; filaments ca. 2 mm in length, densely pubescent; anthers ca. 5 mm in length, locellate, densely pubescent, trichomes whitish-pale yellow; gynoecium ca. 5 × 2.5 mm, ovoid, pubescent, trichomes whitish, with a sparse to dense under layer of smaller brown trichomes, 6-costate; styles 4, ca. 2.5 mm in length, glabrous; stigma glabrous, subcapitate, not lacerated. *Fruiting* pedicel 8–17 mm long; fruit (0.9–) 1.7–3.7 × 0.7–3.3 cm, ellipsoid to subglobose, longitudinally winged, yellowish, cream or lime-green when fresh, usually cauliflorous, pubescent throughout, two classes of indument, one of sparsely distributed larger, whitish, apically uncinate trichomes, the other of densely distributed, smaller, brown trichomes; crests numerous, more or less triangular, distributed in the depressions between wings, the crests 0.2–0.9 cm high depending on the degree of fruit maturity; styles occasionally persistent, glabrous or pubescent; the wings 6–8, spaced 0.5–1.4 cm apart, 0.8–1.3 cm high at their midpoint, erect, chartaceous, margin entire to weakly sinuate; pericarp 0.1–0.2 cm de thick; seeds ca. 36 per fruit, ca. 1 × 0.6–0.7 cm, the fresh pulp described as being orange; testa yellowish to cream when dry, weakly rugose, sparsely pubescent, trichomes whitish.

Phenology: *Carpotroche caceresiae* flowering material has been collected from January to April; immature fruit have been collected January to February and May to July; mature fruits have been collected April to July and October.

Distribution and habitat: *Carpotroche caceresiae* has been collected in very wet undisturbed forest on the Caribbean coast of Honduras (Atlántida, Gracias a Dios, Yoro) and Nicaragua (Atlántico Norte, Jinotega) at altitudes of 0–600 m (Fig. 6). Based on this habitat and distribution it may be that this species also occurs in the Honduran departments of Olancho and Colón, the Guatemalan departments of Izabal and the Belizean District of Toledo.

Extinction threat assessment: We document 28 gatherings from 15 localities below. The associated locality data allows us to assess the species under criterion B of the IUCN Red List system. The EOO based on these gatherings

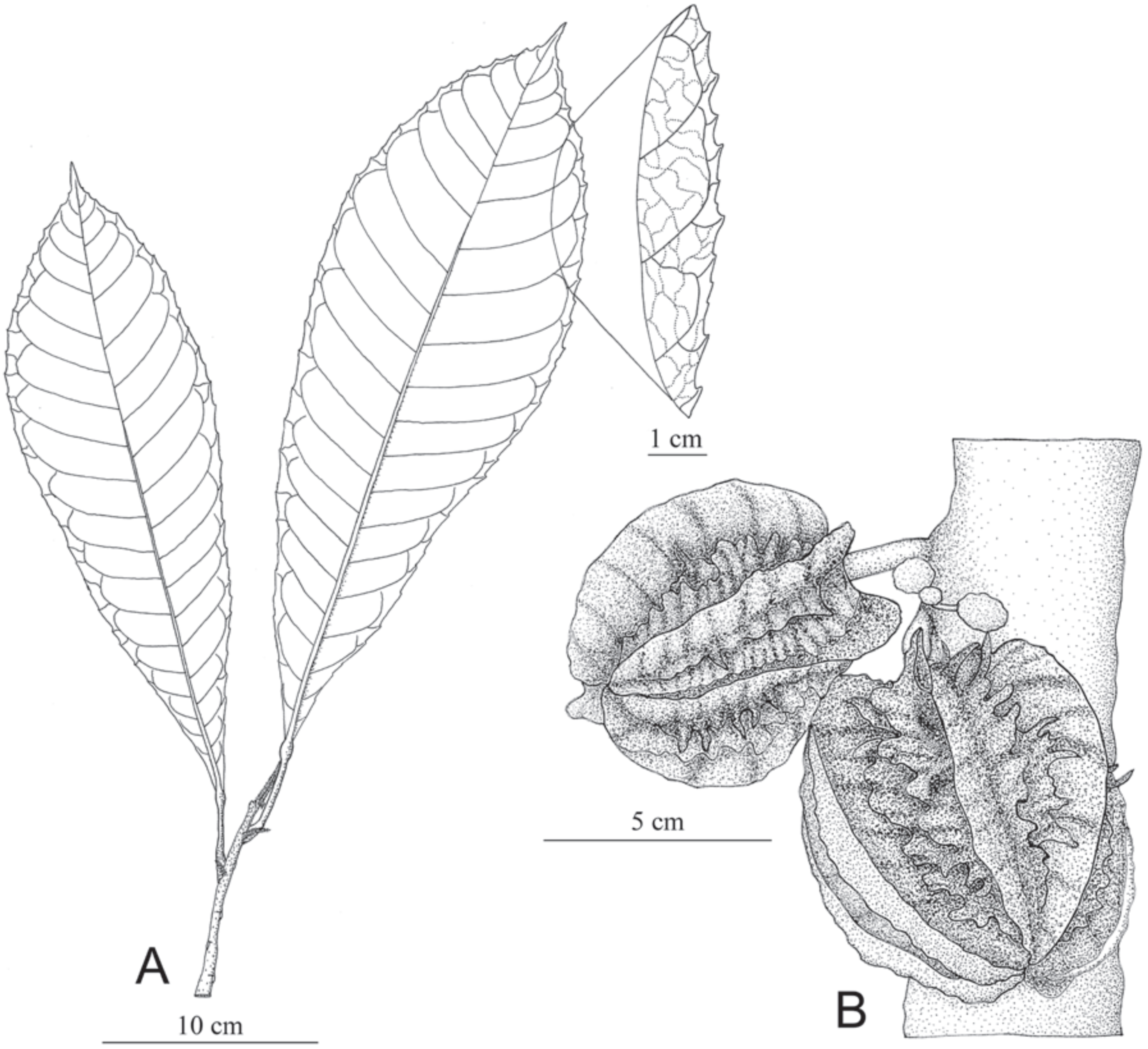


FIGURE 3. *Carpotroche caceresiae* D. Santam. **A**, leaf and margin detail; **B**, fruits. Illustration by Isler. F. Chinchilla, A from a image of the specimen *I. Coronado et al. 1953* (MO); B of photography *I. Coronado et al. 4636*.

is 35,134 km^2, which is above the threshold of 20,000 km^2 for Endangered (EN). The corresponding AOO is 60 km^2, with a cell width of 2 km as recommended by IUCN (2012). This is also below the threshold for EN (<500 km^2). Using the ProtectPlanet layer in GeoCAT (Bachman et al., 2011) we estimate that ca 40% of the EOO falls within the protected areas, Reserva Biológica Río Plátano, Reserva Biológica Tawahka, Parque Nacional Patuca and Reserva Natural Bosawas. The Global Forest Watch (2014) interactive map suggests that between 2001 and 2015, 8.6% of the EOO was deforested which suggests an active threat of deforestation (Criteria B, subcriteria C). Within the protected areas, however, there has been negligible deforestation.

Whilst the AOO is <500 km^2, only one subcritera (C) applies and so *Carpotroche caceresiae* cannot be considered Endangered. We therefore assess this species as Near Threatened (NT) based on the number of known localities and a decline in the EOO as a result of active deforestation that will lead to a risk of extinction in the future.

Eponymy: This species is named in memory and recognition of the bravery of Berta Isabel Cáceres Flores (1971–2016), one of 123 environmental activists assassinated in retaliation for their opposition to environmental destruction and loss of indigenous land in Honduras, between 2009 and 2016 (Global Witness, 2017). Berta Cáceres (Fig. 7), in particular, was murdered because of her opposition to the Agua Zarcas hydroelectric project. She won the Goldman Environmental Prize in 2015.

Additional specimens examined: HONDURAS. Atlántida: Cordillera Nombre de Dios, Quebrada Grande on lower north slope of Pico Bonito, 25 May 1985 (imm. fr.), *S. Blackmore and M. Chorley 4184* (BM); Tela, Lancetilla, 03 August 1929 (fr.), *W. N. Bangham 233* (A-image); Lancetilla, 22 June–27 July 1929 (fr.), *A. M. Chickering 89* (F-image); base of N slope of Pico Bonito, E of new CURLA (Centro Universitario Regional del Litoral Atlántico) camp building on the Quebrada Grande, ca. 1/3 km above its confluence with the río Bonito, ca. 10 km southwest of La

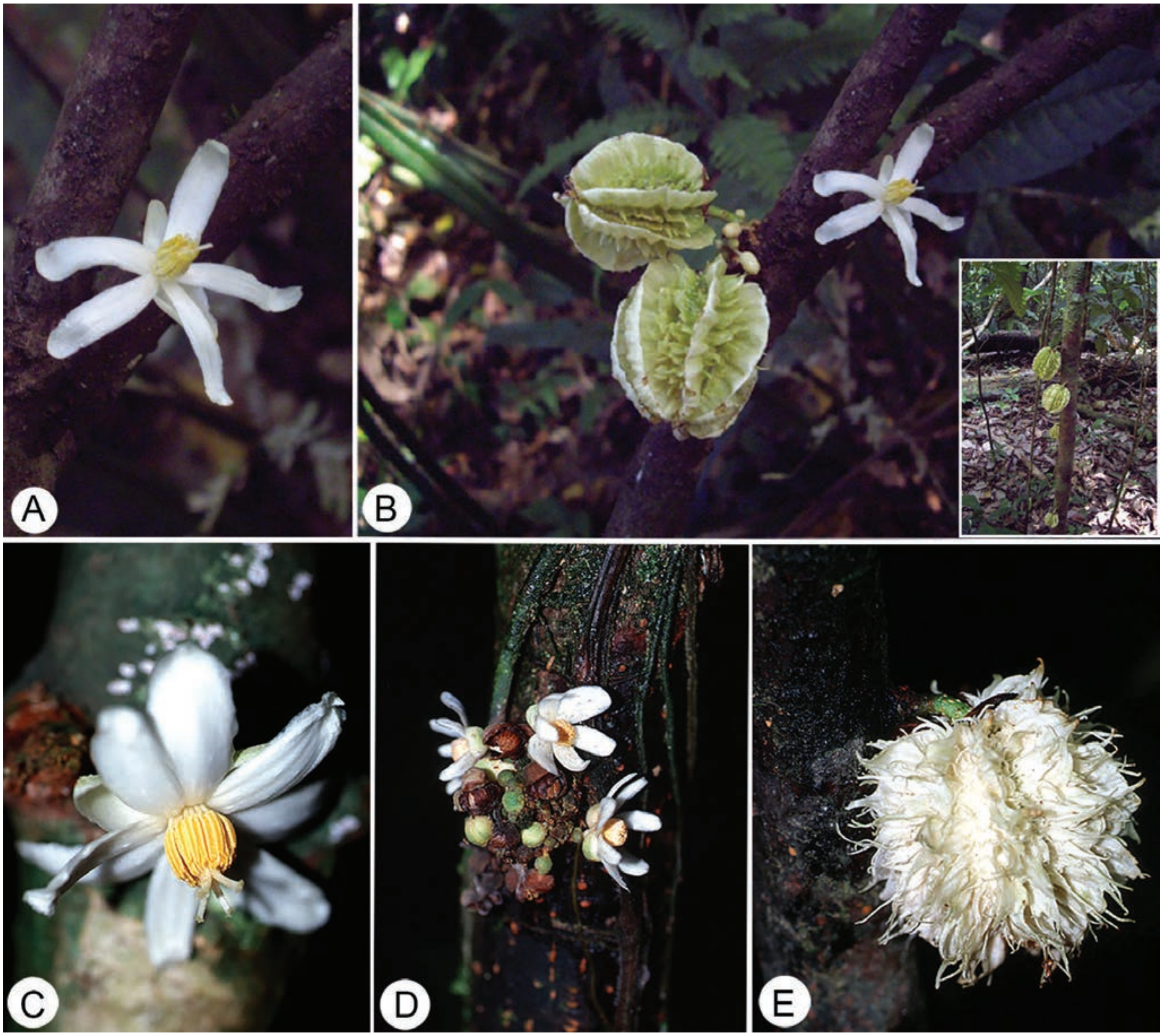


FIGURE 4. *Carpotroche caceresiae* D. Santam. **A**, hermaphrodite flowers; **B**, branch with hermaphrodite flower and fruits, insent stem and fruits). *Carpotroche longifolia* Benth. **C**, hermaphrodite flowers; **D**, flowers on the stem; **E**, fruits showing conspicuously lacerated wings. Images by Indiana Coronado (A–B, from *I. Coronado and A. Fernández 4408*, B inset from *I. Coronado and A. Fernández 4736-A*); and Robin Foster (C–E).

Ceiba, Parque Nacional Pico Bonito, 15˚42'N, 086˚51'W, 160 m, 03 February 1993 (♂ fl., fr.), *R. Evans 1047* (EAP-image, MO); ibid, 140 m, 08 February 1993 (fr.), *R. Evans 1565* (EAP-image, MO); La Ceiba, río Bonito, [15˚42'00"N, 086˚51'00"W], 15 January 1978 (st.), *C. Perry 38* (MO); montaña Lancetilla, cerca de El Portillo, 3 km al sur de Lancetilla, 500 m, 19 March 1962 (fr.), *A. Molina 10460* (EAP-image, F-image); Lancetilla Valley, 03 August 1929 (fr.), *F. M. Salvoza 817* (A-image); Tela, Lancetilla, [15˚44'00"N, 087˚27'00"W], 30 m, 18 August 1979 (fr.), *C. Soto 1* (MO); at base of hills south vicinity of San Alejo near río San Alejo, 150–270 m, 22–27 April 1947 (imm. fr.), *P. C. Standley 7608* (EAP-image); Lancetilla Valley, near Tela, 20–600 m, 06 December 1927–20 March 1928, *P. C. Standley 52627* (fr.), *53096* (fl. bud), *55539* (fl. bud) (A-image, US-image); Lancetilla, 200 m, 26 April 1947 (imm. fr.), *L. O. Williams and A. Molina 13063* (EAP-image); hills back of Lancetilla, 1000 ft [305 m], 15 July 1934 (fr.), *T. G. Yuncker 4584* (A-image, NY); La Ceiba, Puente Alto, [15˚37'39"N, 086˚24'24"W], 800–1000 ft [265–335 m], 19 July 1938 (fr.), *T. G. Yuncker et al. 8522* (BM, GH-image, MO, NY-2 sheets). Gracias a Dios: [Brus Laguna], alrededores del río Plátano, 15˚30'55"N, 084˚43'00"W, [0–5 m], 17–23 May 1973 (fr.), *A. F. Clewell and G. Cruz 4083* (EAP-image, MO, U-image); [Brus Laguna], quebrada El Sargento, 80 m, 15˚03'00"N, 084˚50'00"W, 26 January 1994 (♂ fl.), *P. R. House 1823* (BM, MO); Cabecera de Unawas, 1 km al sureste de Krausirpe, pie de montaña de Wimpi, 15˚03'N, 084˚50'W, 90 m, 19 March 1994 (fl. bud), *P. R. House 1891* (BM-2 sheets); al norte de Krausirpe, 15˚03'N, 084˚50'W, 90 m,

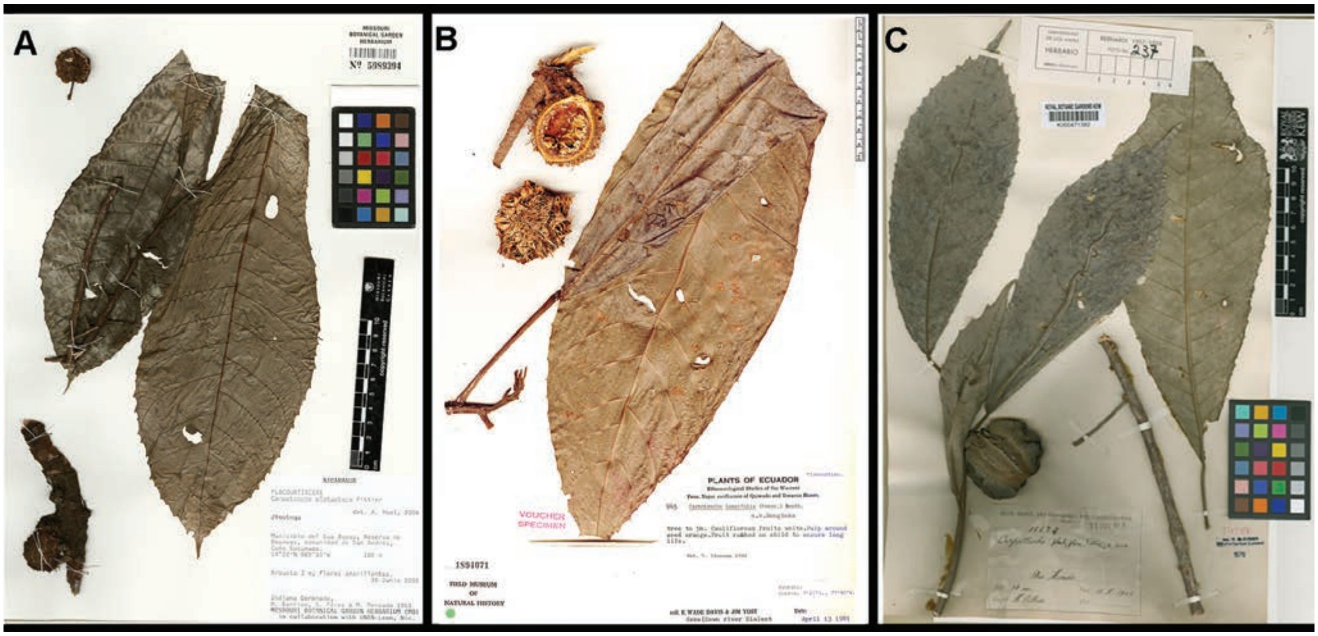


FIGURE 5. Comparison of herbarium specimens. **A**, *Carpotroche caceresiae* D. Santam. (*I. Coronado et al. 1953*); **B**, *C. longifolia* Benth. (*E. W. Davis and J. Yost 945*); **C**, *C. platyptera* Pittier (C, *H. F. Pittier 16634*). Photographs courtesy of Missouri Botanical Garden (A), Field Museum (B), and Royal Botanic Gardens, Kew (C).

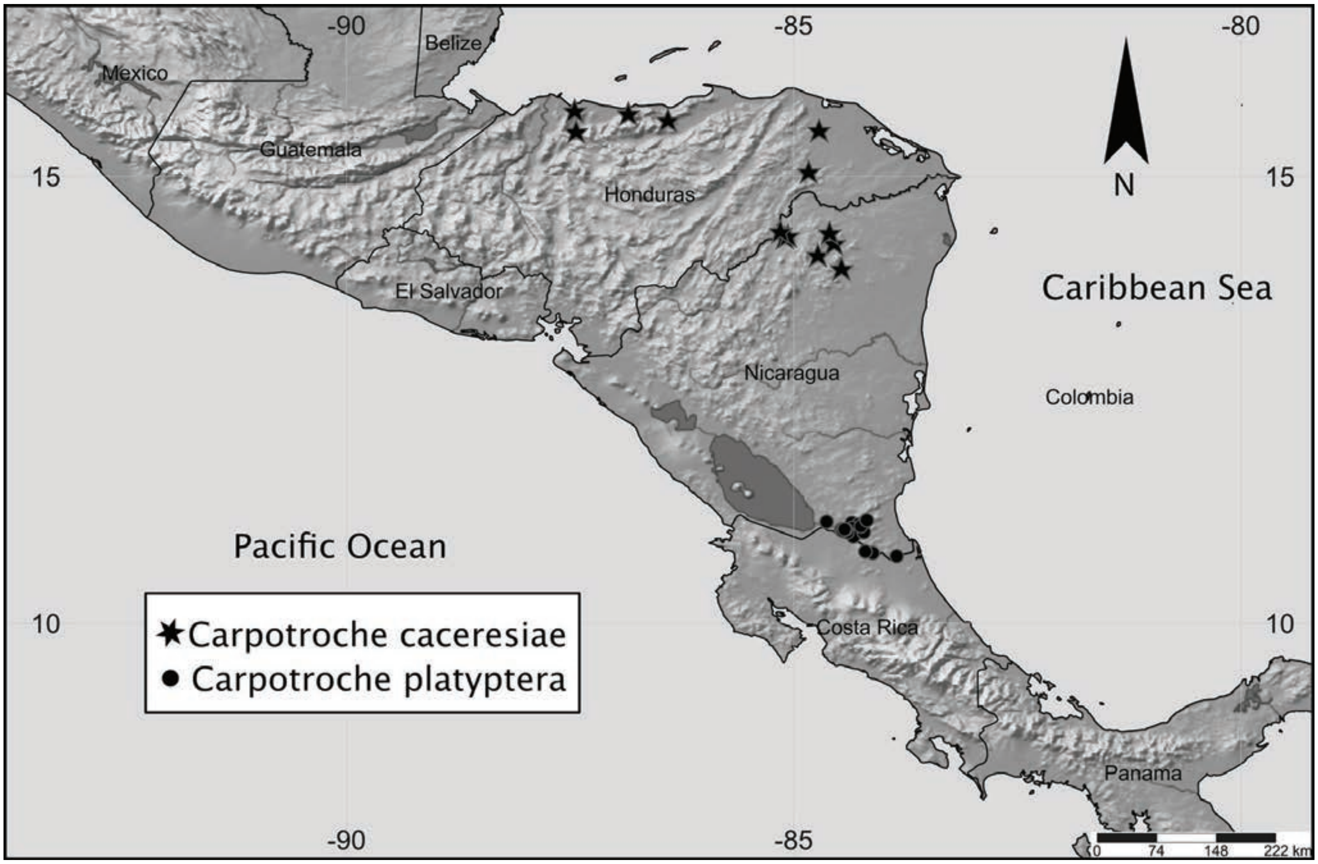


FIGURE 6. Distribution of *Carpotroche caceresiae* D. Santam. and *C. platyptera* Pittier in Nicaragua.

FIGURE 7. Berta Isabel Cáceres Flores (1971–2016). Courtesy by Michelle Meola.

07 March 1995 (fl. bud), *P. R. House 2272* (BM, MO). Yoro: Foot hills of the Cordillera Nombre de Dios, S of San José de Texiguat and the western side of the canyon of río Texiguat, 250–350 m, 15°30'00"N, 087°26'00"W, 15 May 1991 (fr.), *G. Davidse et al. 34409* (MO); margen E de río Guam-Guam, 2 km S de San José de Texiguat, 290 m, 05 August 1991 (fr.), *R. Zuñiga 1508* (EAP-2-sheets [imagen], K-2 sheets). NICARAGUA. Atlántico Norte [Zelaya]: Mpio. [Municipio] de Bonanza, Territorio Mayangna Sauni-As-Musawas, 14°06'59"N, 084°43'49"W, 50–150 m, 07 March 2003 (♂ bud. fl.), *C. Aker et al. 862* (MO); 7 km NW of Rosita, near a copper mine, [13°58'N, 084°28'W, 175 m], 17 August 1977 (fr.), *A. Danin 77-17-3* (MO); Mpio. [Municipio] Rosita, 15 km al NE del Poblado de Sahsa, 14°12'N, 084°09'W, 50–100 m, 23 May 1994 (imm. fr.), *R. Rueda and A. Grijalva 1467* (HULE, MO); Cerro Banacruz, 13°48'N, 084°24'W, 200–350 m, 10 July 1997 (fr.), *R. Rueda and I. Coronado 6654* (HULE, MO); Mpio. [Municipio] de Waspan, Reserva Bosawas, entre el cerro la Francia y la cima del Hill Tara (Asang, nuhni), 14°15'N, 084°33'W, 300 m, 20 January 1996 (imm. fr.), *R. Rueda et al. 3966* (HULE, MO); Reserva Bosawas, sobre el río Waspuk, 300 m después del rápido Wavla Kumbas, luego oeste hasta el cerro Suyakno Tuná Azan, 14°22'N, 084°36'W, 130–562 m, 02 October 1996 (fr.), *R. Rueda et al. 5037* (HULE, MO). Jinotega: Mpio. [Municipio] de Wiwilí, Reserva de Bosawas, comunidad de San Andrés, Caño Pilawas, 162 m, 14°19'00"N, 085°06'00"W, 03 April 2005 (st.), *I. Coronado et al. 1276* (MO); zona de conservación de Bosawas, comunidad de San Andrés, entre el transecto Yulu y caño Pilawas, 14°20'00"N, 085°04'00"W, 200 m, 06 March 2008 (⚥ and fr.), *I. Coronado and A. Fernández 4408* (HULE, MO); Reserva Biológica de Bosawas, comunidad de Inipuwas, sobre el transecto Limsi, 14°23'00"N, 085°09'00"W, 170 m, 28 June 2008 (fr.), *I. Coronado and A. Fernández 4736-A* (MEXU-image, MO).

Common name and uses: In Honduras *Carpotroche caceresiae* is known as "altis" (*P. R. House 1823, 1891, 2272*), "cacao de monte" (*C. Perry 38*), and in Nicaragua as "sipi kuku parah" (*C. Aker et al. 862*). Label information for *P. R. House 1823,* indicates that oil is extracted from the fruit but without specifying its use.

Carpotroche caceresiae can be diagnosed by the combination of whitish to pale green, 6–8 winged fruits whose wings have entire to weakly sinuate margins, and the depressions between whose wings are populated by numerous small triangular crests (0.2–0.9 cm high), hermaphrodite flowers with the combination of narrow petals, long filaments and entire (not lacerated) stigmas. The leaves with dentate laminae, and lower surface pubescence comprising minute hairs.

With respect to the whitish to pale green fruit with small crests between the wings *Carpotroche caceresiae* is similar to *C. brasiliensis* (Raddi) Endl., which has dextrorse or sinistrorse wings (vs. vertical in *C. caceresiae*), and *C. longifolia* (Poepp.) Benth., which has dentate, fimbriate or lacerate wings (vs. wings being entire or weakly sinuate in *C. caceresiae*) (Fig. 4C–E, 5A, B).

Material of *Carpotroche caceresiae* from Honduras has been previously attributed to *C. platyptera* (Fig. 5C, 10), by several authors (e.g., Standley 1930, 1931 [see plate XLVII]; Yuncker 1940; Molina Rosito 1975; Nelson 2008), none of whom cited herbarium specimens. In addition, of the specimens from Honduras cited by Sleumer (1980) in his monograph, we were not able to locate *Record* and *Kuylen 69* or *Wilson 298*, while *P. C. Standley 54875, 54885* (F-image) corresponds to material of *Meliosma* sp. (Sabiaceae). The remainder of the collections cited by Sleumer correspond to *C. caceresiae*. We therefore conclude that *C. platyptera* is absent from Honduras.

According to our delimitation of the species in Nicaragua, *C. platyptera* is known only from the south (Río San Juan Department) whilst *C. caceresiae* occurs in the north of the country (Atlántico Norte and Jinotega Departments, Fig. 6).

Of the 11 species accepted by Sleumer (1980), *C. platyptera* is restricted to Central America (Nicaragua, Panama (?), and the Caribbean side of Costa Rica) and unique in having red, pink or orange fruits when fresh (*C. ramosii* is sometimes described as having a similar coloration). The remaining species of *Carpotroche* have fruits that are yellowish, cream or lime-green (see Table 1). Curiously, the red/orange fruits are found only on the Caribbean slope of the Mesoamerican region. Whilst *Carpotroche platyptera* has been attributed to Ecuador (Sleumer 1980; León-Yánez 1999), most of the material cited (e.g. *Y. Mexia 8436,* MO, U-image, US-image) corresponds to *C. ramosii* (Fig. 1E–G).

Our revision of herbarium material did not recover any clear morphological differences between the flowers of *C. caceresiae* and *C. longifolia* or *C. platyptera*. This is not surprising given the state of preservation of these delicate flowers in herbarium material. For the purposes of recovering such differences we recommend that researchers collect flowering material in spirit and that they take macro images of the flowers.

It should be noted that the flower dimensions given here should be considered as underestimates since most of the examined specimens were in bud, broken or wrinkled to the point that rehydration was problematic.

The key presented below is mainly based on herbarium specimens from Costa Rica. Carpotroche longifolia was not included in the key because physical specimens from Panama were not located.

PRELIMINARY KEY TO THE SPECIES OF *CARPOTROCHE* IN MESOAMERICA

1a. Lamina lower surface densely pubescent, the indument covering all of the surface and soft to the touch . . . . *C. platyptera*

1b. Lamina lower surface sparsely pubescent, the indument not covering all of the surface and not apparent to the touch 2

2a. Fruits yellowish, cream or lime-green when fresh, with crests between the wings . . . . *C. caceresiae*

2b. Fruits reddish, pink or orange when fresh, without crests between the wings 3

3a. Laminae (33.5–) 51–64 × (10.5–) 13–18.5 cm, base long cuneate; twigs bearing leaves (0.5–) 0.8–1.2 cm thick; stipules 0.9–1.7 cm long . . . . *C. crassiramea*

3b. Laminae 15.5–35 × 3.7–11 (–13.5) cm, base cuneate; twigs bearing leaves 0.3–0.6 cm thick; stipules 0.2–0.4 (–0.6) cm long . . . . *C. glaucescens*

TABLE 1. Species of *Carpotroche* with green/white fruits. Information from Sleumer 1980, except where otherwise specified.

SPECIES	Nº SEPALS ♂ FLOWERS	Nº PETALS ♂ FLOWERS	STAMENS	STYLODES	STIGMAS	FRUIT BROAD (cm)	FRUIT Nº OF WINGS	FRUIT TUBERCLED BETWEEN WINGS	FRUIT MARGEN WINGS	FRUITS WING COVERING	REGION
C. amazonica Mart. ex Eichler	2 or 3 (rarely 4)	9	50–60	10	Somewhat lacerate distaly	5.8	10	Yes	Entire	Covering each other	SA
C. brasiliensis (Raddi) Endl.	3	9 (–12)	50–60	5–7	Subcapitate, cristate-lobulate	(4.4–) 5–8.7[%]	(8–) 10–14	No	Dextrorse or sinistrorse wings or crests	Partly covering each other	SA
C. caceresiae D. Santam.	2	5–6	18–21	4	Subcapitate, not lacerate		6–8	Yes	Entire to slightly wavy	Not covering each other	CA
C. crispidentata Ducke	3	8 or 9	40	ca. 5	Lacerate	3–7[#]	10–12	No	Irregularly obtusely crisped-dentate	Not covering each other	SA
C. froesiana Sleumer	3	6	Numerous	Not described	Not described	2	Not described	No	Entire to slightly wavy	Partly covering each other	SA
C. grandiflora Spruce ex Eichler	3	9–10	ca. 80	Not described	Not described	ca. 6	(10–) 12 (–14)	No	Entire	Partly covering each other	SA
C. integrifolia Kuhlm.	2	5 or 6	20–25	4	Bipartite and a little lacerate distally	1.8–2.3	6	No	Entire	Not covering each other	SA
C. longifolia Benth.	2 or 3	(5–) 6–7 (–10)	Numerous	5–6	Subcapitate	2.5–4	9–12	Yes	Dentate, fimbriate or lacerate	Not covering each other	CA, SA
C. pacifica (Cuatrec.) Cuatrec.**	(2) 3	7	32	5 (in fruit)	Not described	4	10	No	Dentate	Not covering each other	SA
C. ramosii (Cuatrec.) Cuatrec.**	3	5	20	4	Smooth	2.5	8	No	Entire	Not covering each other	SA
C. surinamensis Uittien	3	6–7	30–40	4 or 5	Lacerate-palmatifidd distally	3–4 (–5?)	8–10	Not described	Subentire, revolute	Not covering each other	SA

** from Cuatrecasas 1944; [#]from Zmarzty 2007; [%]from Achariaceae in Flora do Brasil 2020. Region CA=Central America; SA=South America.

A list of representative specimens of *Carpotroche crassiramea*, *C. glaucescens*, and *C. platyptera* is presented below.

Carpotroche crassiramea Pittier. Contr. U.S. Natl. Herb. 12: 180. 1909. TYPE. COSTA RICA. [Limón]: In forest around Banana River near Port Limon, [s.d.] May 1903 (fl., fr.), *[O. F.] Cook & [C. B.] Doyle 424* (Holotype: US [accesion number: 474262; barcode: US00114644], image). Fig. 8.

Additional specimens examined: COSTA RICA. Limón: San Miguel de Sixaola, 09˚33'60"N, 082˚38'20"W, 40 m, 03 March 1999 (fr.), *E. Alfaro 2078* (CR); Banana River, [s.d.] 1903 (fr.), O. F. Cook & C. B. Doyle s.n. (US-474763, image); Ca. 8 km en línea recta suroeste de Bananito Sur, 09˚49'23"N, 083˚03'45"W, 75 m, 05 November 2016 (imm. fr.), *B. Hammel and I. Pérez 27195* (CR); Finca Selva Bananito, a lo largo del Río Carbón, 09˚49'30"N, 083˚03'50"W, 100 m, 13 April 2008 (fr.), *B. Hammel et al. 24707* (CR-2 sheets); Sector Gandoca, entrada al muelle de la laguna Gandoca, 09˚35'18"N, 082˚32'17"W, 1 m, 08 October 2002 (imm. fr.), *J. González 2247* (CR); Manzanillo, siguiendo el camino del "gobierno," hacia Punta Mona, hasta laguna innominada (de aguas turbias), 09˚38'21"N, 082˚39'03"W, 0–70 m, 30 January 2003 (fr.), *J. González et al. 2814* (CR); Puerto Viejo, Punta Uva, Finca Tabacón, 09˚37'30"N, 082˚41'40"W, 50–100 m, 5 June 1996 (fr.), *R. González et al. 184* (CR); Fila Matama, Cerro Muchilla, Falda NW, Río Bananito, Selva Bananito Lodge, 09˚49'30"N, 082˚03'50"W, 100 m, 25 January. 2001 (fr.), *J. F. Morales 7737* (CR); Parque Nacional Tortuguero, 2 km al Sur de Tortuguero, 10˚31'N, 083˚30'W, 4 m, 13 October 1998 (fr.), *R. Robles 2110* (CR); Cerro Muchilla, fila Matama, entrando por el pueblo El Progreso, 09˚47'50"N, 083˚05'90"W, 850 m, 09 April 1989 (fr.). *R. Robles and A. Chacón 2734* (CR); río Blanco, Las Brisas de Veragua, propiedad de Veragua Rain Forest, trayecto entre el restaurante y el serpentario, 09˚55'28"N, 083˚11'28"W, 387 m, 01 March 2011 (fr.), *J. Sanchéz et al. 2218* (CR); Valle de La Estrella, propiedad de Selva Bananito Lodge, 09˚49'84"N, 082˚04'23"W, 133 m, 12 April 2011 (fr.), *J. Sánchez et al. 2302* (CR); Valle La Estrella, Fila Matama, ca. 11 km SW del Pueblo de Aguas Zarcas, alrededores del campamento El Hotel, 09˚49'04"N, 083˚09'31"W, 800–900 m, 01 November 2007 (fr.), *A. Rodríguez et al. 11617* (CR); Fila Matama, cerca de 11 km SW del pueblo de Aguas Zarcas, camino que lleva al rancho El Hotel, 09˚49'26"N, 083˚09'42"W, 700–800, 19 October 2007 (fr.), *D. Santamaría 6499, 6507* (CR); on trail to Point 2, forest close to edge of field adjoining Bananito Lodge, 09˚49'07"N, 083˚04'04"W, 130 m, 25 March 2010 (fr.), *D. Solano et al. 6175* (CR); Point 6, forest close to edge of field adjoining Bananito Lodge, 09˚49'01"N, 083˚04'06"W, 100 m, 24 March 2010 (fr.), *N. Zamora et al. 4864* (CR).

Carpotroche glaucescens Pittier. Contr. U.S. Natl. Herb. 12: 178. 1909. TYPE. COSTA RICA. [Limón]: Grape Point, coast of Talamanca, [s.d.] September 1900, *H. Pittier 14019* [as *14089* in the original description] (Holotype: US [accesion number: 577934; barcode US00114648, image]). Fig. 9.

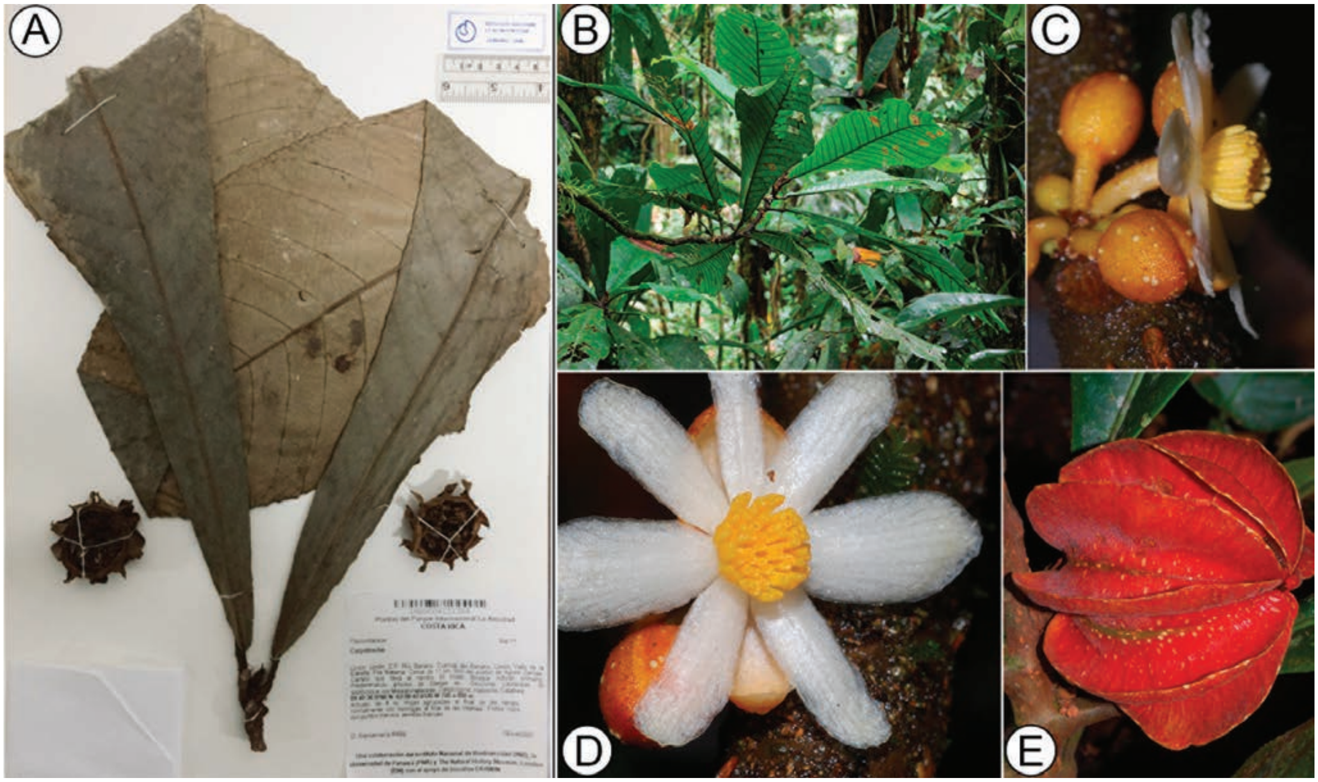


FIGURE 8. *Carpotroche crassiramea* Pittier. **A**, herbarium specimen; **B**, branch with leaves; **C**, Floral bud and open flower in lateral view; **D**, flower; **E**, fruit. Images by Museo Nacional de Costa Rica (A; *D. Santamaría 6499,* CR); Alexandre K. Monro *(*B–E; *N. Zamora et al. 4864*).

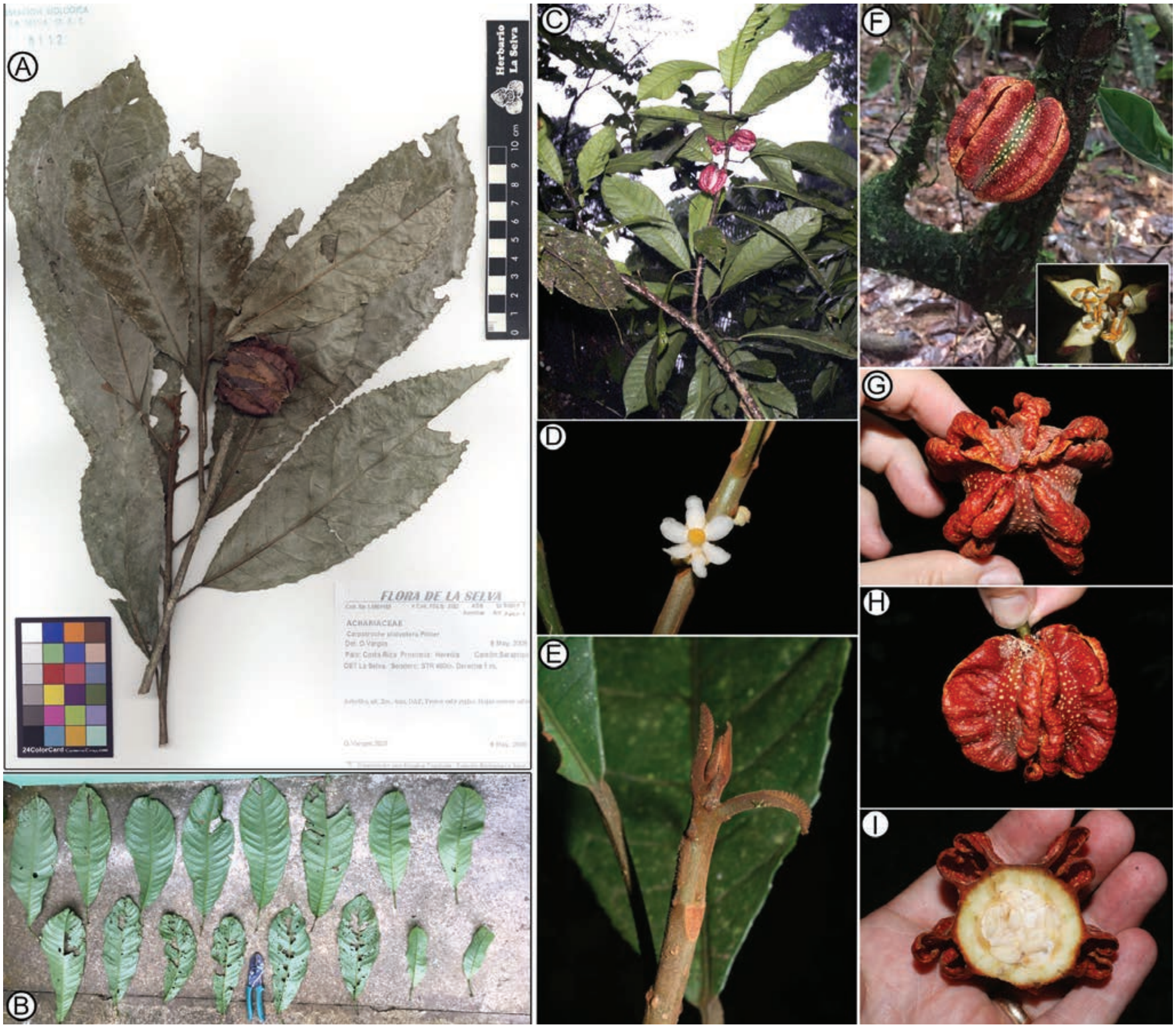
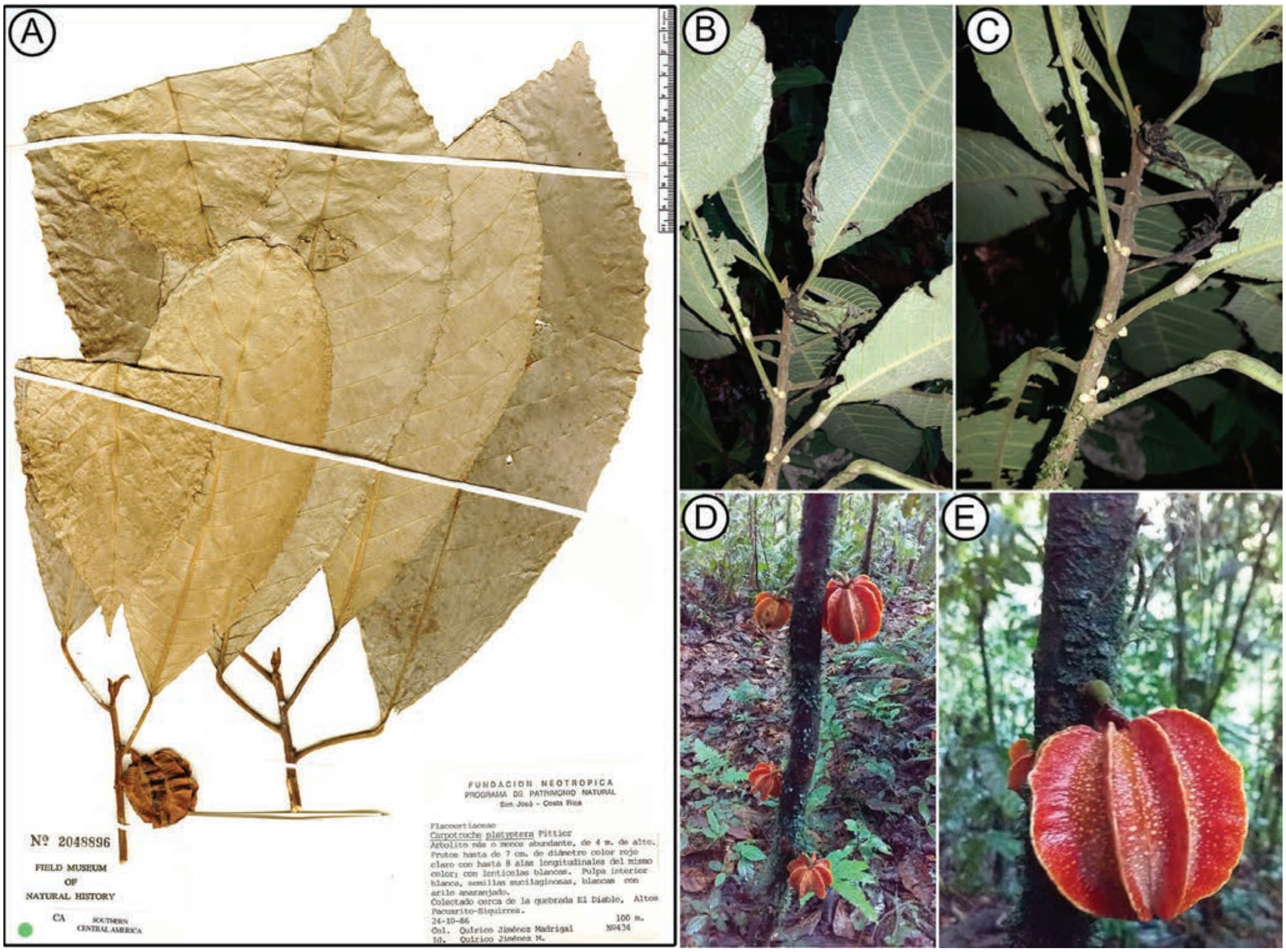


Figure 9. *Carpotroche glaucescens* Pittier. **A**, herbarium specimen; **B**, leaf variations; **C**, branch with fruits; **D**, flower; **E**, branch apex; **F**, fruit in the trunk and seeds (insert); **G**, fruit, front view; **H**, fruit, lateral view; **I**, fruit, cut. Images by Flórula Digital de La Estación Biológica La Selva (A; *O. Vargas 2027*, LSCR); D. Santamaría-Aguilar (B, F);) Orlando Vargas (C and F insert); Robbin Moran (E and G–I). Photos B–I taken at La Selva Biological Station).

Additional specimens examined: COSTA RICA. Heredia: Parque Nacional Braulio Carrillo, estación Magsasay, Sarapiquí, 10˚24'18"N, 084˚03'30"W, 200 m, 05 July 1990 (fl. bud), *D. Acevedo 124* (CR); Parque Nacional Braulio Carrillo, sector Magsasay, del cruce del río Peje 900 m por el transecto altitudinal, cruce a La Selva, 10˚24'09"N, 084˚02'37"W, 200–208 m, 07 May 2009 (fl. bud), *L. Acosta and J. Blanco 11175* (CR); Parque Nacional Braulio Carrillo, Estación Biológica Magsasay, 10˚24'03"N, 084˚03'03"W, 200 m, 23 June 1990 (fr.), *E. Alcázar 105* (CR.); original wet forest and cocoa plantation on the property of Dr. L. Holdridge, about 2 km upstream on the Rio Puerto Viejo, 10˚25'N, 083˚59'W, 100 m, 05–06 January 1967 (fr.), *W. Burger and G. Mata 4166* (CR); ibid, 05–06 January 1967 (fl. bud), *W. Burger and G. Mata 4251* (CR); Magsasay, Finca de Bernardo Gómez, 700 m, 21 January 1983 (fr.), *I. A. Chacón 195* (CR); Parque Nacional Braulio Carrillo, estación Magsasay, detrás de la estación, 10˚14'05"N, 084˚03'10"W, 150 m, 29 September 1990 (fr.), *A. Fernández 85* (CR-2 sheets); r*ío* Peje, estación Magsasay, orillas del sendero a la poza de los Padres, 10˚24'18"N, 084˚03'30"W, 200 m, 26 September 1992 (fr.), *A. Fernández 390* (CR); Parque Nacional Braulio Carrillo, estación El Ceibo, sendero a la toma de agua, 10˚20'00"N, 084˚04'00"W, 450–550 m, 15 March 2003 (fl. bud), *J. González 3206* (CR); OET La Selva, sendero STR de 5000 a 6200 m, 24 August 2004 (fl. bud), *J. González and D. Solano 6867* (LSCR); OET La Selva, sendero oriental, hasta la intersección con el sendero Holdridge y Sábalo Esquina, 10 September 2004 (fr.), *J. González and D. Solano 6922* (LSCR-2 sheets);

OET La Selva, sendero SOC de 0–1450 m, 08 July 2008 (fl. bud), *J. González 7684* (LSCR); La Virgen, Estación Biológica La Tirimbina, sendero Ajillo, 06 June 2008 (fl. bud), *J. González et al. 9872* (LSCR); La Virgen, Estación Biológica La Tirimbina, sendero Botarrama, 24 June 2008 (fr.), *J. González 9887* (LSCR); ibid, 19 November 2008 (fl. bud), *J. González 10478* (LSCR); ibid, 11 March 2009 (fr.), *J. González 10640* (LSCR); Finca La Selva, the OTS Field Station, south boundary, along Q. [Quebrada] El Salto, 100 m, 02 March 1980 (fr.), *B. Hammel 7947* (LSCR, NY); Finca La Selva, along the east loop trail, 10˚26'N, 084˚01'W, [0–100 m], 12 February 1974 (fl. bud), *G. S. Hartshorn 1367* (CR, LSCR); La Selva, camino Lindero Sur, 10˚26'00"N, 084˚02'00"W, 0–100 m, 01 October 2003 (fl. bud), *R. Kriebel et al. 3990* (CR); La Selva Research Field Station of OTS, SRI trail between 300 and 500, 10˚26'00"N, 084˚02'00"W, 100 m, 14 May 2002 (fr.), *L. Landrum 10230* (CR); Istarú Farm, La Tirimbina, 220 m, 17 September 1971 (fr.), *R. W. Lent 2141* (CR, NY); camino de Puerto Viejo a río Frío, 10˚15'39"N, 083˚53'25"W, 100 m, 02 September 1993 (fr.), *V. Ramírez et al. 86* (CR); Bijagual, camino a la estación Magsasay, 10˚24'00"N, 084˚05'20"W, 200 m, 14 January 1994 (fr.), *V. Ramírez et al. 214* (CR-2 sheets); OET La Selva, sendero CEN 100, 01 July 2004 (fr.), *D. Solano 1156* (LSCR); Rara Avis, ca. 15 km al suroeste de Horquetas, alrededores del Hotel y Quebradita "Charral," 10˚17'N, 084˚02'W, 400 m, 20 September 1989 (fr.), *O. Vargas 147* (CR); OET La Selva, sendero STR 480, 08 May 2008 (fr.), *O. Vargas 2027* (LSCR); Finca La Selva, the OTS field stations, sendero Suroeste at 1050, 100 m, 17 June 1995 (fl. bud), *M. K. Whitson 117* (CR); Finca La Selva, the OTS field stations, El Peje trail at 600 m, 100 m, 17 Jun. 1995 (fr.), *R. L. Wilbur and T. Mowbray 64682* (CR). Limón: Pococí. R. N. F. S. Barra del Colorado, Sardinas, 10˚38'38"N, 084˚44'10"W, 15–20 m, 12 December 1992 (fl. bud), *F. Araya 174* (CR-2 sheets); R. N. F. S. Barra del Colorado sector Cor[c]orí, 10˚35'40"N, 084˚45'00"W, 100 m, 08 October 1990 (fr.), *E. Rojas 198* (CR); Parque Nacional Tortuguero, estación Agua Fría, sendero Agua Fría hasta entrada Sendero Aguacate, 10˚26'40"N, 084˚34'40"W, 20 m, 01 December 1990 (fr.), *J. Solano 278* (CR-2 sheets); Puerto Viejo along the road to El Muelle, 10˚28'N, 083˚58'W, 100 m, 08 January 1967 (fl.,



FUNDACION NEOTROPICA
PROGRAMA DE PATRIMONIO NATURAL
San José - Costa Rica

Flacourtiaceae
Carpotroche platyptera Pittier
Arbolito más o menos abundante, de 4 m. de alto. Frutos hasta de 7 cm. de diámetro color rojo claro con hasta 8 alas longitudinales del mismo color; con lenticelas blancas. Pulpa interior blanca, semillas mucilaginosas, blancas con arilo anaranjado.
Colectado cerca de la quebrada El Diablo, Altos Pacuarito-Siquirres.
24-10-86 100 m.
Col. Quirico Jiménez Madrigal Nº434
Id. Quirico Jiménez M.

FIGURE 10. *Carpotroche platyptera* Pittier. A, Herbarium specimen collected in the vicinity of the type locality; **B**, Leaf base, venations; **C**, Branch with flowers buds; **D–E**, Fruits. Images by Field Museum (A; *Q. Jiménez 434*, F); B–E by Isidro Chacón, without voucher specimen, but taken in La Alegría, Alto la Botella de Siquirres, place where this species has been collected previously (e.g. *J. González et al. 8074,* LSCR).

fr.), *W. Burger and G. Mata 4319* (CR); Fila Matama, San Juan de Chirripocito de Pococí, 09°53'30"N, 084°11'30"W, 400 m, 12 March 1995 (fr.), *A. Rodríguez 628* (CR).

Carpotroche platyptera Pittier. Contr. U.S. Natl. Herb. 12: 178. 1909. TYPE. COSTA RICA. [Limón]: [Matina] Rio Hondo, plains of Santa Clara, 15 February 1903 (fr.), *H. Pittier 16634* (holotype: US [accesion number: 578981; barcode US00114651], image!; Isotypes: K! [barcode: K000471382], P [barcode: P04693053], image!). Fig. 10.

Additional specimens examined: NICARAGUA. Río San Juan: Santa Crucita de la Gloria, 5 km al NE de Sábalos, 11°03'N, 084°25'W, 70 m, 26 February 1984 (fr.), *P. P. Moreno 23374* (MO, P-2 sheets, image); La Gloria, 3.5 km al NE del poblado de Boca de Sábalo, 11°03'N, 084°26'W, 70 m, 20 March 1985 (fr.), *P. P. Moreno 25455* (MO, P-image). COSTA RICA. Alajuela: Río Peñas Blancas canyon, Nene Castro farm, 4 km NW of La Tigra, 10°22'00"N, 084°37'00"W, 200 m, 08 September 1994 (fl. bud), *W. Haber 11860* (CR); Guatuso, asentamiento campesino La Garroba, 10°45'N, 084°52'W, 80–100 m, 09 November 1987 (fr.), *G. Herrera 1179* (CR); Boca Tapada, finca Daniel Murillo, parcela # 9, 10°42'02"N, 084°13'08"W, 200–300 m, 06 July 2005 (st.), *D. Santamaría et al. 2305* (CR); San Carlos, Boca Tapada, Laguna de Lagarto lodge, 10°38'47"N, 084°02'33"W, 50 m, 05 December 2004 (fr.), *D. Solano 1503* (CR). Cartago: 24 km NE of Turrialba on hwy to Limón, then E at Tres Equis on jeep road 1.5 km, 09°58'N, 083°34'W, 450–525 m, 10 May 1983 (fr.), *R. Liesner et al. 15350* (CR, MBM-image). Limón: [Bonilla], La Colombiana Farm of the United Fruit Co, [10°09'00"N, 083°34'48"W], 70 m, 06–07 March 1924 (fr.), *P. C. Standley 36751* (US-image); ibid, 06–07 March 1924 (fl. bud), *P. C. Standley 36851* (US-image); ibid, 06–07 March 1924 (fr. probably in the envelope), *P. C. Standley 36860* (US-image); ibid, 06–07 March 1924 (fl. bud), *P. C. Standley 36953* (US-image); finca Montecristo, on the Río Reventazón below Cairo, [10°07'N, 83°32'W], 25 m, 18–19 February 1926 (fl. bud), *P. C. Standley and J. Valerio 48471* (US-image); ibid, 18–19 February 1926 (fl. bud), *P. C. Standley and J. Valerio 48547* (US-image); ibid, 18–19 February 1926 (fl. bud), *P. C. Standley and J. Valerio 48558* (US-image); ibid, 18–19 February 1926 (fl. bud), *P. C. Standley and J. Valerio 48585* (US-image); ibid, 18–19 February 1926 (fl. bud., fr.), *P. C. Standley and J. Valerio 48588* (US-image); ibid, 19 February 1926 (fl. bud), *P. C. Standley and J. Valerio 48788* (US-image); [Matina], Finca La Lola, Madre de Dios, [10°06'N, 83°23'W], 50–75 m, 25 March 1949 (fr.), *L. Holdridge 2526* (CR); P. N. [Parque Nacional] Barbilla, sendero Topoyiyo, 10°59'25"N, 083°26'30"W, 300 m, 05 May 1999 (fr.), *E. Mora 320* (CR, NY); Siquirres, cerca de la quebrada el Diablo, Altos de Pacuarito, [10°06'N, 083°28'W], 100 m, 24 October 1986 (fr.), *Q. Jiménez 434* (CR, F-image); La Alegría, Alto la Botella, 800–1000 m, 11 August 2006 (fls. bud., imm. fr.), *J. González et al. 8074* (LSCR); Siquirres, en las colinas montañosas, 17 October 1973 (fr.), *L. J. Poveda 725* (CR); Finca de don J. Berrocal, 60–70 m, 04 October 1986 (fr.), *N. Zamora et al. 1305* (CR-2 sheets).

Literature Cited

Alford, M. H. 2003. Claves para los géneros de Flacourtiaceae de Perú y del Nuevo Mundo. Arnaldoa 10(2): 19–38.

———. 2009. Achariaceae Neotropikey, Interactive key and information resources for flowering plants of the Neotropics (online). In W. Milliken, B, Klitgård and A. Baracat. http://www.kew.org/science/tropamerica/neotropikey/families/Achariaceae.htm.

Bachman S., J. Moat, A. W. Hill, J. de la Torre, B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. Pages 117–126 in V. Smith, and L. Penev eds., *Infrastructures for data publishing in biodiversity science*. ZooKeys 150: 117–126.

Chant, S. R. 1985. Achariaceae. Pages 108–109 in V. H. Heywood, ed., *Las Plantas con Flores/Flowering Plants of the World*. Versión en español. Editorial Reverté, Barcelona, España.

Chase, M. W., S. Zmarzty, M. D. Lledo, K. J. Wurdack, S. M. Swensen and M. F. Fay. 2002. When in Doubt, Put It in Flacourtiaceae: A Molecular Phylogenetic Analysis Based on Plastid rbcL DNA Sequences. Kew Bull. 57(1): 141–181.

Cuatrecasas, J. 1944. Notas a la Flora de Colombia, VI. Revista Acad. Colomb. Ci. Exact. 21(6): 32–67.

Ecobiosis. Museo Nacional de Costa Rica, Portal Nacional de Biodiversidad http://ecobiosis.museocostarica.go.cr/index.aspx (accessed June 2021).

Fiaschi, P. and M. Groppo. 2008. *Kuhlmanniodendron* Fiaschi & Groppo, a new eastern Brazilian genus of Achariaceae sensu lato segregated from *Carpotroche* Endl. (formerly included in Flacourtiaceae). Bot. J. Linn. Soc. 157(1): 103–109.

Field Museum. Botanical Collections Database, https://collections-botany.fieldmuseum.org/ (accessed June 2021).

Flora do Brasil. 2020. Achariaceae in Flora do Brasil 2020 em construção. Jardim Botânico do Rio de Janeiro. Available in: <http://reflora.jbrj.gov.br/reflora/floradobrasil/FB34> (accessed January 5, 2021).

Global Forest Watch. 2014. Interactive Map. World Resources Institute. www.globalforestwatch.org (accessed June 2017).

Global Witness. 2017. Honduras: the deadliest country in the world for environmental activism. Report. Available in: https://www.globalwitness.org/en/campaigns/environmental-activists/honduras-deadliest-country-world-environmental-activism/

Goldberg, A. 1986. *Classification, Evolution, and Phylogeny of the Families of Dicotyledons*. Smithsonian Contr. Bot. 1–314.

González, J. 2010. Flacourtiaceae. Pages 782–816, in B. E. Hammel, M. H. Grayum, C. Herrera and N. Zamora eds., *Manual de Plantas de Costa Rica. Dicotiledóneas (Clusiaceae–Gunneraceae) Vol. V.* Monogr. Syst. Bot. Missouri Bot. Gard.

Groppo, M., P. Fiaschi, M. L. F. Salatino, G. C. T. Ceccantini, F.A. dos Santos, C. F. Verola and A. Antonelli. 2010. Placement of *Kuhlmanniodendron* Fiaschi & Groppo in Lindackerieae (Achariaceae, Malpighiales) confirmed by analyses of rbcL sequences, with notes on pollen morphology and wood anatomy. Pl. Syst. Evol. 286: 27–37.

Groppo, M., B. Favaretto, C. da Silva, J. Jardim, and P. Fiaschi. 2013. A New Species of *Kuhlmanniodendron* (Lindackerieae, Achariaceae) from Eastern Brazil and the Systematic Position of the Genus in Achariaceae. Syst. Bot. 38(1): 162–171.

Herbario. http://www.specify7.museocostarica.go.cr:8080/specify-solr/Herbario/ (accessed June 2021).

Herbário Virtual da Flora e dos Fungos (INCT). http://inct.splink.org.br (accessed June 2021)

Hutchison, J. 1969. *Evolution and phylogeny of flowering plants: Dicotyledons; facts and theory*. Academic Press inc., Berkeley Square, London.

IUCN. 2012. IUCN Red List Categories and Criteria, Version 3.1. Second edition. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.

JSTOR Global Plants. http://plants.jstor.org (accessed June 2021).

León-Yánez, S. 1999. Flacourtiaceae. Pages 484–487 in P. M. Jørgensen and S. León-Yánez eds., *Catalogue of the Vascular Plants of Ecuador* Vol. 75, Monogr. Syst. Bot. Missouri Bot. Gard.

Molina Rosito, A. 1975. Enumeración de las Plantas de Honduras. Ceiba 19(1): 1–118.

Muséum national d'Histoire naturelle - Paris. https://science.mnhn.fr/institution/mnhn/collection/p/item/search/form?lang=en_US (accessed June 2021).

Nelson, C. H. 2008. *Catálogo de las Plantas Vasculares de Honduras*. Secretaría de Recursos Naturales y Ambiente, Tegucigalpa, Honduras.

Pool, A. 2001. *Carpotroche*. In W. D. Stevens, C. Ulloa, A. Pool and O. M. Montiel eds., *Flacourtiaceae*. *Flora de Nicaragua*. *Angiospermas (Fabaceae–Oxalidaceae)* 2: 1086–1087. Monogr. Syst. Bot. Missouri Bot. Gard.

Shorthouse D. P. 2010. SimpleMappr, an online tool to produce publication-quality point maps. Retrieved from http://www.simplemappr.net (accessed June 2017).

Sleumer, H. O. 1980. Flacourtiaceae. Flora Neotropica. 22: 1–499.

Sosa, V., M. W. Chase and C. Barcenas. 2003. *Chiangiodendron* (Achariaceae): An Example of the Laurasian Flora of Tropical Forests of Central America. Taxon 52(3): 519–524.

Standley, P. C. 1930. A Second List of the Trees of Honduras. Trop. Woods 21: 9–41.

———. 1931. Flora of the Lancetilla Valley, Honduras. Publ. Field Mus. Nat. Hist., Bot. Ser. 10: 1–418.

Thiers, B. 2021 (continuously updated). *Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff*. *New York Botanical Garden's Virtual Herbarium*. http://sweetgum.nybg.org/ih/ (accessed May 15, 2021).

Tropicos. Missouri Botanical Garden. <https://tropicos.org> (accessed June 2021).

Mexu. Universidad Nacional Autónoma de México. Dirección General de Repositorios Universitarios, Universidad Nacional Autónoma de México. Portal de Datos Abiertos UNAM, Colecciones Universitarias. https://datosabiertos.unam.mx/ (accessed June 2021).

Yuncker, T. 1940. Flora of the Aguan Valley and the Coastal Regions near La Ceiba, Honduras. Publ. Field Mus. Nat. Hist., Bot. Ser. 9(4): 243–346.

Zamora Villalobos, N., Q. Jiménez Madrigal, L. J. Poveda Álvarez. 2017. *Árboles de Costa Rica/Trees of Costa Rica*. Vol. IV. Editorial Tecnológico de Costa Rica, Cartago, Costa Rica.

Zmarzty, S. 2007. Flora da Reserva Ducke, Amazonas, Brasil: Flacourtiaceae. Rodriguésia 58(3): 663–694.

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DECAISNINA SAMAENSE (LORANTHACEAE): A NEW MISTLETOE SPECIES FROM SIMUNUL ISLAND, PHILIPPINES

ARKADY A. TAHIL[1,2]

Abstract. *Decaisnina samaense*, a new species of Loranthaceae from the Island of Simunul, Southern Philippines, is hereby described and illustrated. It is distinguished from all *Decaisnina* species by having narrowly lanceolate and narrowly ovate-lanceolate leaf laminae with a remarkable acuminate apex, flower buds being globularly inflated at the base with corolla color being yellow in the lower half and pastel green in the upper half and often blackish at the tip, and inflorescence consistently produce both triads and peduncles along the axis. It is related to *Decaisnina stenopetala* and *D. zollingeri* by exhibiting globular inflation at the base of the flower buds but differs from the two by having longer bracts, longer anthers, and the free part of the filament shorter. *Decaisnina samaense* is hereby assessed as Critically Endangered (CR B1, B2a&c, D).

Keywords: *Decaisnina*, globular inflation, Loranthaceae, Mistletoe, Simunul Island, taxonomy

Commonly known as Mistletoes, species in Loranthaceae are aerial hemiparasitic plants growing on shrubs and trees, often spreading along the host by epicortical roots or runners, and nodes not articulated, glabrous or producing stellate or verticillate indumentum; the petiolate leaves can be opposite or alternate, without stipules, the leaf blade simple, pinnately veined with margin entire. Inflorescence of this family can be axillary or terminal, racemes, spikes or umbels (Huaxing and Gilbert, 2003). In *Decaisnina* Tieghem in particular, the flower buds are born in simple dichasium or triads with a simple bract subtending each flower (Barlow, 1993). This is one of the diagnostic features of the genus *Decaisnina* in which the inflorescence is brush-like in appearance as a result of having aggregated flower buds borne in triads turning upwards on their peduncles. Distributed in the islands of Indonesia, Philippines, Papua New Guinea, Australia, Tahiti and Marquesas islands, the genus has hermaphroditic flowers, usually regularly and basically choripetalous and are commonly 6-merous. Flower buds are sometimes inflated in the basal part and the inflation can be very remarkable or weak to form a distinct nectar chamber (Barlow, 1993). The weak but conspicuous inflation of basal part of the corolla bud has been documented in some species such as *Decaisnina aherniana* (Danser) Barlow (Danser, 1935), *D. cumingii* (Tieghem) Barlow (Barlow, 1993), *D. miniata* (Danser) Barlow (Elmer, 1913) and *D. ovatifolia* (Merrill) Barlow (Merrill, 1909). The inflation is weak to conspicuous which shows the corolla base being inflated below (but not globular) then gradually tapering towards the tip of the bud.

A remarkable form of inflation is documented in *D. stenopetala* (Oliver) Barlow and *D. zollingeri* (Tieghem) Barlow (Danser, 1931). The inflation in these two species is characterized by a very conspicuous globular swelling in the base of corolla, followed by slight or weak constriction above followed by a slight inflation. Surprisingly, during a taxonomic study of plants in the island of Simunul in Southern Philippines, a species of *Decaisnina* was encountered that showed striking globular inflation similar to that of *D. stenopetala* and *D. zollingeri*. However, aside from having yellow flower buds, it has other characters distinguishable from the two related species and the rest of the species in the genus (see Appendix). Moreover, this is the first account of globular inflation among the Philippine species of *Decaisnina*. Assuming that these morphological differences are an indication of reproductive isolation, the *Decaisnina* species from Simunul Island is described as new species here under a biological species concept (Mayr, 2000), and adds to the growing number of *Decaisnina* species in the Philippines.

Decaisnina samaense Tahil, *sp. nov.*
TYPE: PHILIPPINES. Mindanao: Sulu archipelago, Simunul Island, Bakong, 4°53'27"N, 119°47'39"E, secondary forest, 5 m, 18 July 2021, *A. Tahil 420* (Holotype: CEBU; Isotypes: CAHUP, CEBU). Fig. 1–2.

Species nova affinis Decaisnina stenopetala (Oliver) Barlow *et Decaisnina zollingeri* (Tieghem) Barlow *similis, sed foliis paene lanceolatis et paene ovatis-lanceolatis apud praeclarum acuminatae apex, alabastra quod globosam inflatam apud quod fundamen apud corolla color flavor in minus medium et pastellus viridi in superiores medium, saepe nigricans apud apex et inflorescentiae fructus tum triadorum et pedunculus secus axis constantius, bracteis 3–4.5 mm longis, antheris 5–6.5 mm longis et liberis pars autem filamentorum 2–2.2 mm longis distinguita.*

This discovery is dedicated to the late Dr. Filemon Romero, a professor Emeritus and former chancellor of the Mindanao State University – Tawi-Tawi and a pioneering scientist and environmentalist of the Tawi-Tawi province whose fruitful life was cut short during the pandemic. The author is greatly indebted to the herbarium staffs of K, B, MO and P for providing useful high quality images of their specimens via their publicly accessible databases, to the Ministry of Environment, Natural Resources and Energy for the issuance of necessary permits for this study, to A. I. Tahiluddin for the assistance during the fieldwork in Simunul Island, to the two anonymous reviewers for their constructive criticisms, and to M. R. T. Samsuya for the support and endless encouragement.

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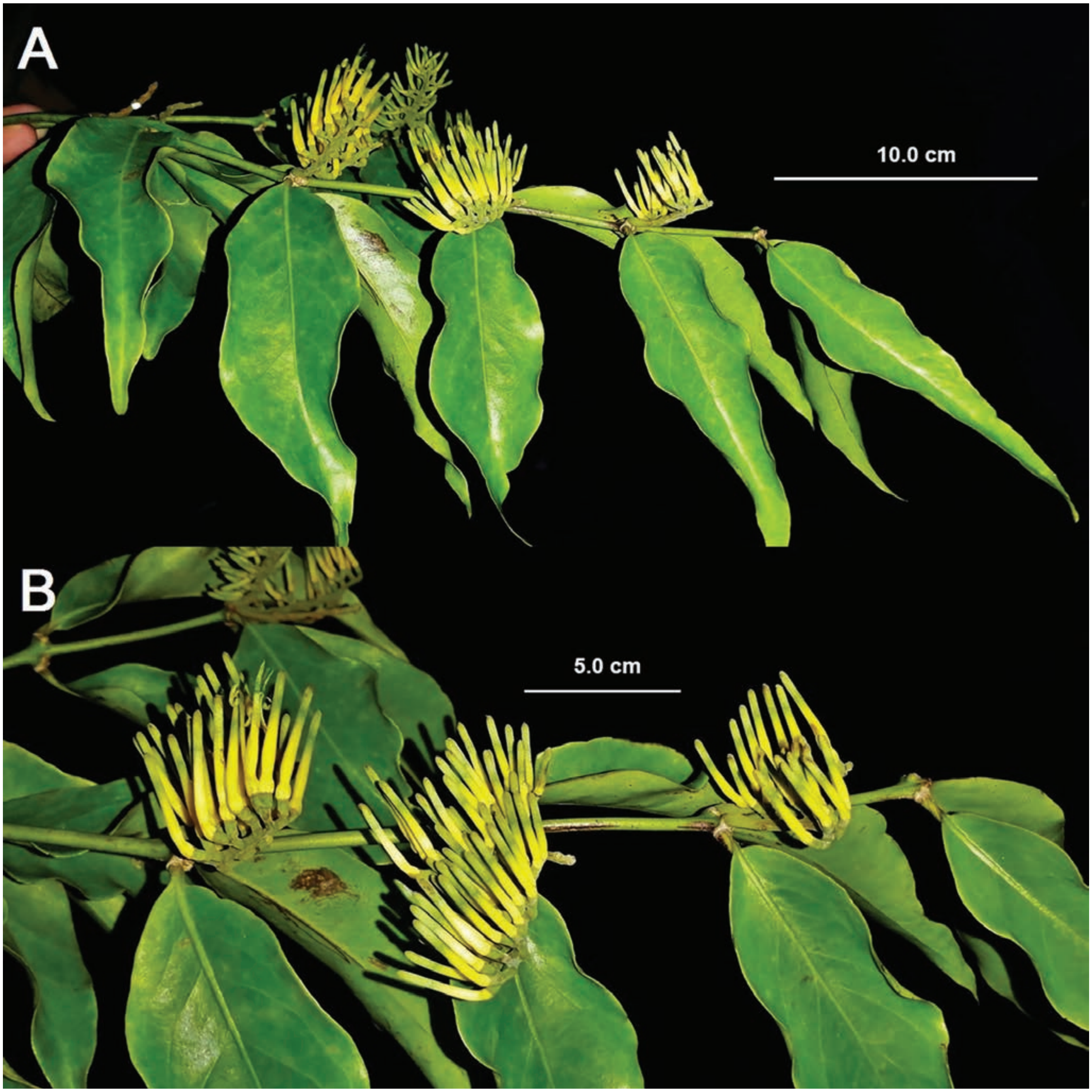

FIGURE 1. *Decaisnina samaense* Tahil. **A**, plant showing a branch with leaves and and inflorescences; **B**, close-up view showing the number of pairs of inflorescences. Based on the holotype.

Plant hemiparasitic with no epicortical runners. *Stems* robust, slightly flattened to terete, glabrous, pastel green when young, becoming dark brown upon maturity, 50–70 cm long; internodes slightly flattened, 5–8 cm long. *Leaves* bifacial, decussate, evenly placed; lamina distinctly narrowly lanceolate and narrowly ovate-lanceolate, (11–)12–22(–24) × 5–7.5(–9) cm, subcoriaceous, up to 1 mm thick, apex remarkably acuminate, tapering towards the elongated tip, base rounded or obtuse, adaxial glabrous, green to light green in color, very glossy, abaxial glabrous, pastel green; margin slightly flattened, glabrous; midvein glabrous at both sides, remarkably raised from the leaf lamina especially from the lower half, secondary veins slightly to remarkably raised from the leaf lamina, tertiary veins inconspicuous; petiole subterete, flattened at the surface, twisted once, glabrous, 4–5 × 2–2.5 mm, 1.8–2 mm thick. *Inflorescence* axillary, racemes of decussate triads and pedicels, four to six per axil, usually in pair per node, flowers pedicellate, bract at the base of inflorescence absent; axis minutely pubescent with very small whitish hairs which are almost inconspicuous, slender, soft, 35–40 × 4.5–5 mm, bearing 4–5 pairs of triads and 1–2 pairs of peduncles after the triads distributed along the entire length; peduncle of triads and peduncle of flower buds not in triads 3–5.5 mm long, highly deciduous upon

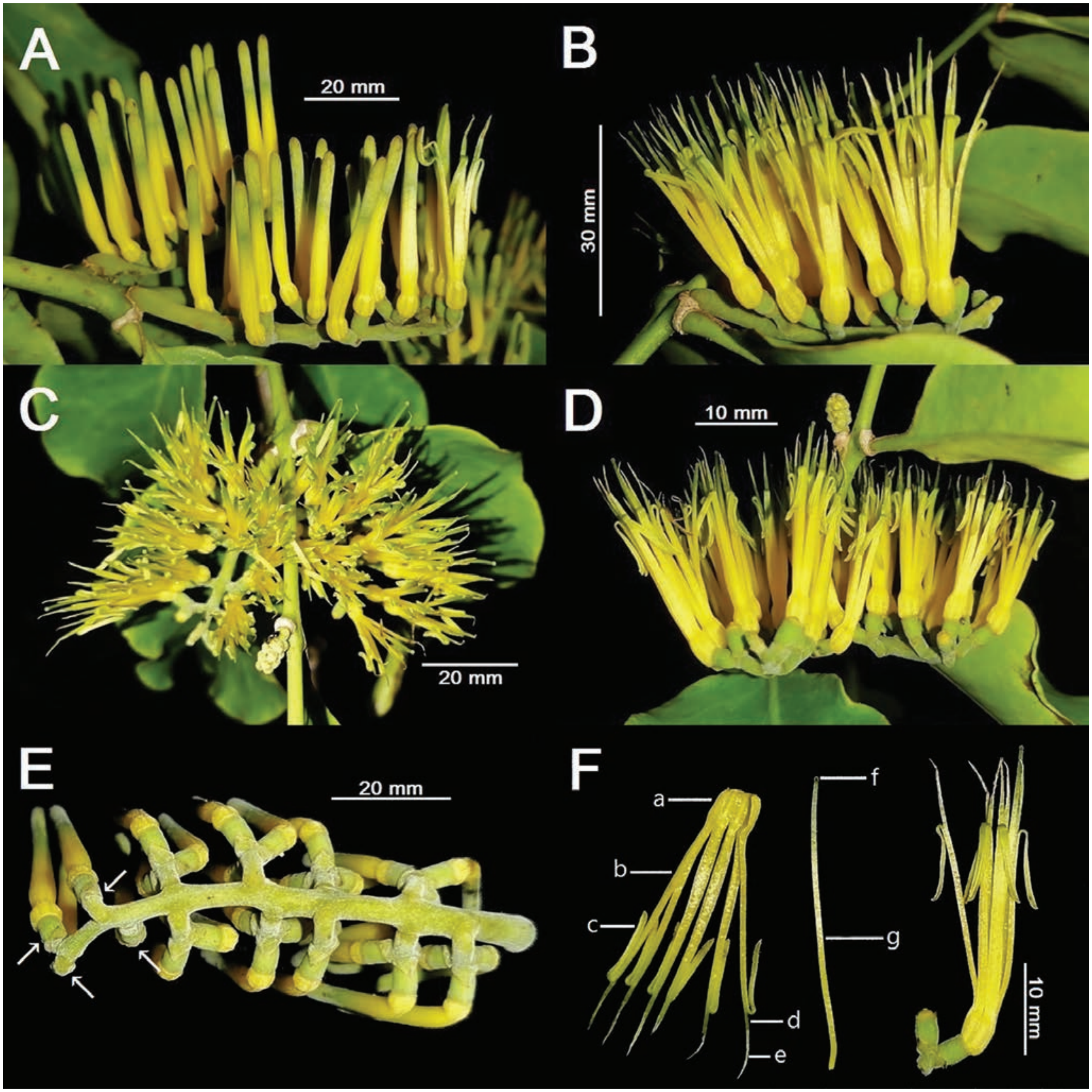

FIGURE 2. *Decaisnina samaense* Tahil. **A**, young flower buds showing globular inflation at the base; **B**, flower buds at anthesis; **C**, adaxial view of reflexed flower buds; **D**, a pair of inflorescences; **E**, abaxial view of the inflorescence showing five pairs of triads and two pairs of peduncles (arrows) along the axis; **F**, dissected flower bud (**a**, Globular inflated base; **b**, Corolla; **c**, Corolla lobes; **d**, Free part of the filament; **e**, Anther; **f**, Stigma; **g**, Style). Based on the holotype.

maturity; pedicels of all lateral flower buds 4–4.5 mm long; bracts spreading, acute, 3–4.5 mm wide and long. *Ovary* subspherical, 1–2 mm long, glabrous, green; calyx limb erect, dull in color, glabrous, 0.4–0.5 × 1.5–2 mm. *Corolla* in the mature bud robust, cylindrical, with globular inflation at the base (2–2.5 mm), slightly constricted above the globular inflation, slightly inflated after the slight constriction, minutely pubescent with very small whitish hair, 28–30 mm long, apex blunt; petals bright yellow, glossy, up to 22 mm from the base, pastel green above and often blackish at the tip (0.4–0.6 mm), minutely pubescent with very small whitish hairs outside, glabrous inside, reflexed at anthesis 8–9 mm from the tip, corolla lobes 8.5–9.2 mm long, bright yellow, coherent as a tube 4–5 mm after the globular inflated base. Corolla splits deep up to 25 mm from the tip to the lower part of the bud. *Anthers* basifixed, immobile, 5–6.5 mm long, apex acute, free part of the filaments 2–2.2 mm long, glabrous. *Style* slender, cylindrical, consistent in diameter all throughout except the upper 4–5 mm from the stigma which slightly reduces in diameter, light yellow in the lower half and pastel green above; *stigma* spherical, slightly smaller in diameter than most part of the style, dark green, glabrous. *Fruits* and *seeds* not observed.

Additional specimens examined: PHILIPPINES. Mindanao: Sulu archipelago, Simunul Island, Bakong, 4˚53'27"N, 119˚47'39"E, 5 m, 18 July 2021, *A. Tahil 421* (CEBU). Tubig Indangan, 4˚89'66"N, 119˚84'10"E, 4 m, 19 July 2021, *A. Tahil 422* (CAHUP).

Habitat and distribution: *Decaisnina samaense* is known only from the small Island of Simunul. All the collections were found in the secondary forest of the island at 0-5 m above sea level. The area is dominated by *Psychotria* sp. (Rubiaceae) and *Melicope* sp. (Rutaceae). The species was found infecting and growing only on *Melicope* sp.

Conservation status: *Decaisnina samaense* has been collected few times, all in distributed secondary forests of the Simunul island which occupies a total area of only less than 5 km^2. Most parts of the forest are already converted for agriculture and none of these have any protected status. There is also an apparently increasing density of local settlers in the island. Since only few populations were documented from its type locality and the species is restricted only in the Simunul Island, following the Red List Criteria of the International Union for the Conservation of Nature, the species is hereby considered as Critically Endangered (CR B1, B2a&c, D; IUCN 2017).

Etymology: The epithet of this taxonomic novelty honors the indigenous Sama people of the Simunul Island.

Decaisnina samaense is closely related to *D. stenopetala* and *D. zollingeri* due to the globular inflation in the base of its flower buds. These three species also produce numerous pairs of triads in their inflorescences. However, the combination of characters present in *D. samaense* clearly demonstrates its distinctiveness from these two species and the rest of the species in the genus. *Decaisnina samaense* is readily distinguishable from all *Decaisnina* species by having narrowly lanceolate and narrowly ovate-lanceolate leaf lamina with remarkable acuminate apex, flower buds being globularly inflated at the base with corolla color being yellow in the lower half and pastel green in the upper half and often blackish at the tip and inflorescence produce both triads and peduncles along the axis. Moreover, the consistent production of both triads and peduncles in the axis of the inflorescence of *D. samaense* is unique among the species of *Decaisnina*. The axis produces 4–5 pairs of triads and followed by the production of 1–2 pairs of peduncles each bearing a single flower bud that is highly deciduous upon maturity. *D. samaense* further differs from its related species *D. stenopetala* and *D. zollingeri* by having the longest bract (3–4.5 mm vs. 1–1.5 mm vs. 1 mm), longest anther (5–6.5 mm vs. 3–4 mm vs. 3 mm) and shortest free part of the filament (2–2.2 mm vs. 4–5 mm vs 3.5 mm).

LITERATURE CITED

Barlow, B. A. 1993. Conspectus of the genera *Amylotheca*, *Cyne*, *Decaisnina*, *Lampas*, *Lepeostegeres*, and *Loxanthera*. Blumea 38: 70–101.

Danser, B. H. 1931. The Loranthaceae of the Netherlands Indies. Bull. Jard. Bot. Buitenzorg III, 11: 233–519.

———. 1935. A revision of the Philippine Loranthaceae. The Philippine Journal of Science 58, No. 1: [page range].

Elmer, A. W. 1913. *Loranthus* from Mt. Urdaneta. Leaflets of Philippine Botany 6: 1959–1971.

Huaxing, Q. And M. G. Gilbert. 2003. Flora of China 5: 220–239.

IUCN. 2017. Guidelines for using the IUCN red list categories and criteria. Version 13. Prepared by the Standards and Petitions Subcommittee. Available from: http://www.redlist.org/documents/RedListGuidelines.pdf (accessed July 23, 2021)

Mayr, E. 2000. The biological species concept. In Q. D. Wheeler and E. Meier, eds., Species concepts and phylogenetic theory: a debate. Columbia University Press, New York.

Merrill, E. D. 1909. A revision of Philippine Loranthaceae. Philippine Journal of Science 4: 129–153.

APPENDIX

DECAISNINA SPECIMENS EXAMINED FOR MORPHOLOGICAL COMPARISON

Decaisnina aherniana Merr. (Barlow). PHILIPPINES. Mt. Apo, Todaya, District of Davao, Mindanao Island, September 1909, *A. D. E. Elmer 11747* (B100295029, K000848325).

Decaisnina amplexicaulis (Danser) Barlow. PHILIPPINES. Mt. Candoon, Bukidnon, Mindanao Island, June--July 1920, *M. Ramos & G. Edaño 38740* (B100295040, K000848332).

Decaisnina confertiflora (Merr.) Barlow. PHILIPPINES. Leyte, Visayas, 30 May 1915, *C. A. Wenzel 1249* (MO799668).

Decaisnina congesta Barlow. AUSTRALIA. State forest Reserve, Bridle L.A., 12 January 1978, *B. Gray 1168* (MO3816959).

Decaisnina crassilimba (Merr.) Barlow. PHILIPPINES. Mt. Umingan, Nueva Ecija province, Luzon Island, August--September 1910, *M. Ramos & G. Edaño 26409* (K000848329).

Decaisnina cumingii (Tiegh.) Barlow. PHILIPPINES. Locality not specified, "Manille", date not specified, 1894, *Cuming 1969* (P00756232); Mt. Apo, Todaya, District of Davao, Mindanao Island, May 1909, *A. D. E. Elmer 10617* (K0008483334).

Decaisnina djamuensis (Krause) Barlow. PAPUA NEW GUINEA. Locality not specified, 21February 1908, *R. Schlechter 17319* (B100295059); West Irian, Baliem valley path, Wamena-Wellesey, 26 August 1966, A. J. G. H. *Kostermans & W. Soegeng 569* (P06619651).

Decaisnina forsteriana (J.A. Schultes & J. Schultes) Barlow. FIJI. Locality not specified, Fiji Island, date not specified, 1865--1873, *B. Seemann 210* (P00641756). MARQUESAS. Locality not specified, Marquesas Island, February 20, 1975, *R. L. Oliver & P. A. Schafer 3183* (P05097039).

Decaisnina hollrungii (Schumann) Barlow. PAPUA NEW GUINEA. Kaiser Willhelmsland, New Guinea, 19 December 1889, *M. Hollrung 188* (B100295046, K000848310).

Decaisnina miniata (Danser) Barlow. PHILIPPINES. Mt. Urdaneta, Cabadbaran, Agusan del Norte province, Mindanao, July 1912, *A. D. E. Elmer 13276* (MO749619); Surigao province, Mindanao Island, April 1919, *M. Ramos & J. Pascasio 34376* (P06584298).

Decaisnina ovatifolia (Merr.) Barlow. PHILIPPINES. Locality not specified, Bohol, Visayas, August--October 1923, *M. Ramos 43262* (P06584289).

Decaisnina revoluta (Merr.) Barlow. PHILIPPINES. Mt. Polis, Ifugao, Luzon Island, February 1913, *R. C. McGregor 19688* (P06584283).

Decaisnina signata (F. Mueller ex Bentham) Tieghem. AUSTRALIA. Carpentana, Northern Australia. Date not specified, 1802, *R. Brown 2956* (K000848397).

Decaisnina signata (F. Mueller ex Bentham) Tieghem. AUSTRALIA. Quail Island, Northern Australia, date not indicated, *G. Bentham 392* (K000848398).

Decaisnina stenopetala (Oliver) Barlow. INDONESIA. Lepo-Lepo, Celebes, date not indicated, *Danser 1927* (P06619623); North Celebes, precise locality not specified, June 1975, *A. B. Meyer 1223* (K000848313).

Decaisnina sumbawensis (Tiegh.) Barlow. PHILIPPINES. Locality not specified, Bohol, July 1906, *R. C. McGregor 1277* (B100295038); Todaya, Mt. Apo, District of Davao, Mindanao Island, August 1909, *A. D. E. Elmer 11304* (K000848330); Mt. Urdaneta, Cabadbaran, Agusan del Norte province, Mindanao Island, July 1912, *A. D. E. Elmer 13405* (K000848333).

Decaisnina triflora (Spanoghe) Tieghem. INDONESIA. Locality not specified, Isle de Timor, date not specified, *B. H. Danser 335* (P00235940); precise locality not specified, Coupang-ile Timor, date not specified, 1838--1840, *M. Hombron 1841* (P06619624).

Decaisnina viridis (Merr.) Barlow. PHILIPPINES. Lamao River, Mt. Mariveles, Bataan, Luzon Island, March 1905, *T.E. Borden 2938* (P00756228); precise locality not specified, Bontoc, Luzon Island, 26 August 1916, *M. Vanoverbergh 1256* (P00756226).

Decaisnina zollingeri (Tieghem) Barlow. INDONESIA. Macassar, Celebes, precise date not specified, 1935, *B. H. Danser 3295* (P06619587, P06619590, P06619591).

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CORRECTION OF COLLECTION NUMBER CITATIONS IN PROTOLOGUES OF FOURTEEN NAMES OF CHINESE PLANTS

YUN LIN,[1] CHAO LI[2] AND ZHI-RONG YANG[3,4]

Abstract. According to Article 9.2 of International Code of Nomenclature for algae, fungi, and plants (ICN, Shenzhen Code, 2018), the errors of collection number in the protologues of 14 names of Chinese plants were corrected, including *Bauhinia bohniana* (Fabaceae), *Bauhinia dioscoreifolia* (Fabaceae), *Brassaiopsis glomerulata* var. *brevipedicellata* (Araliaceae), *Deutzia coriacea* (Saxifragaceae), *Fissistigma capitatum* (Annonaceae), *Gymnadenia monophylla* (Orchidaceae), *Hibiscus venustus* var. *integrilobus* (Malvaceae), *Hibiscus wangianus* (Malvaceae), *Hydrangea fulvescens* (Hydrangeaceae), *Ilex chuniana* (Aquifoliaceae), *Ilex corallina* Franch. var. *macrocarpa* (Aquifoliaceae), *Lonicera montigena* (Caprifoliaceae), *Morinda hupehensis* (Rubiaceae), *Neonauclea tsaiana* (Rubiaceae). The holotypes of the 14 names are deposited in the Harvard University Herbaria.

Keywords: Chinese plant, collection number error, protologue

The Harvard University Herbaria include six integrated herbaria: the Herbarium of the Arnold Arboretum (A); Economic Herbarium of Oakes Ames (ECON); Oakes Ames Orchid Herbarium (AMES); Farlow Herbarium (FH); Gray Herbarium (GH); and the New England Botanical Club Herbarium (NEBC). The current collections contain more than five million specimens and over 100 thousand type specimens of vascular plants. Of special interest are more than 10,000 type specimens of Chinese plants.

With the support of the National Plant Specimen Resource Center Project (NPSRC) and the Chinese Virtual Herbarium (CVH) project, we undertook a review from 2018 to 2021 of the Chinese type specimens in the Harvard University Herbaria. During our review we discovered some errors in the citation of collection numbers that need to be corrected. This paper presents the numbers incorrectly cited in the protologues and gives their correct citation. Another paper, 'Correction of date errors in the protologues of eighteen taxon names from China, was recently published in this journal (Lin et al., 2021).

We reviewed the literature and examined all the electronic images of type specimens of Chinese plants from A and AMES; following ICN Art. 9.2 "If a designation of holotype made in the protologue of the name of a taxon is later found to contain errors (e.g. in locality, date, collector, collection number, herbarium code, specimen identifier, or citation of an illustration), these errors are to be corrected provided that the intent of the original author(s) is not changed" (Turland et al., 2018).

We herewith correct the collection errors in the protologues of 14 names of taxa described from China. The 14 names are arranged alphabetically by the genus wherein they are currently placed. This is followed by a brief discussion. Images of the specimens at A and AMES are linked to the barcodes cited in the following text.

1. ***Bauhinia bohniana*** L. Chen (Fabaceae), J. Arnold Arbor. 19(2): 129. 1938. TYPE: China. Yunnan Province: Lijiang Hsien [Xian], eastern slopes of Lijiang Snow Range, May-October 1922, *J. F. Rock 3905* (Holotype: A [00059758]).

The name *Bauhinia bohniana* L. Chen (Chen, 1938) was validly published with the type designated as *Rock "2905"* in A. However, the specimen in A annotated "*Bauhinia bohniana* spec. nov., det. Luetta Chen, March 1938," "Type," and matching all other details of the protologue bears the collection number *J. F. Rock 3905*. Therefore, the original type citation is erroneous and is to be corrected.

2. ***Bauhinia dioscoreifolia*** L. Chen (Fabaceae), J. Arnold Arbor. 20(4): 438. 1939. TYPE: China. Hainan Province: Dongfang City, Kumyun, 7 September 1936, *S. K. Lau 27852* (Holotype: A [00059761]).

The name *Bauhinia dioscoreifolia* L. Chen (Chen, 1939) was validly published with the type designated as *S. K. Lau "27552"* in A. However, the specimen in A annotated "*Bauhinia dioscoreifolia* sp. nov.," "Type," and matching all other details of the protologue bears the collection number *S. K. Lau 27852*. Therefore, the original type citation is erroneous and is to be corrected.

3. ***Brassaiopsis glomerulata*** (Bl.) Regel var. ***brevipedicellata*** H. L. Li (Araliaceae), Sargentia 2: 59. 1942. TYPE: China. Yunnan Province: Gongshan Hsien [Xian], Kiukiang Valley, alt. 1600 m, 21 November 1938, *T. T. Yu 21056* (Holotype: A [00094876]).

The name *Brassaiopsis glomerulata* (Bl.) Regel var. *brevipedicellata* H. L. Li (Li, 1942) was validly published with the holotype designated as *T. T. Yu "20156"* in A. However, the specimen in A annotated "*Brassaiopsis glomerulata* var. *brevipedicellata* var. nov." and matching all other details of the protologue bears the collection

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number *T. T. Yu 21056*. Therefore, the original type citation is erroneous and is to be corrected.

4. *Deutzia coriacea* Rehd. (Hydrangeaceae) in Sargent, Pl. Wilson. 1(1): 9. 1911. TYPE: China. Sichuan [now Chongqing City]: Wuxi Hsien [Xian] [now Taning], alt. 610 m, 27 June 1910, *E. H. Wilson 4487* (Holotype: A[00042669]).

The name *Deutzia coriacea* Rehd. (Rehder, 1911) was validly published with the type designated as *E. H. Wilson "4481"* in A. However, the specimen in A annotated "*Deutzia coriacea* Rehd., n. sp." and matching all other details of the protologue bears the collection number *E. H. Wilson 4487*. Therefore, the original type citation is erroneous and is to be corrected.

5. *Fissistigma capitatum* Merr. ex H. L. Li (Annonaceae), J. Arnold Arbor. 26(1): 60. 1945. TYPE: China. Guangxi [Zhuangzu Zizhiqu: Chen-pien (=Napo Hsien [Xian]), 19 November 1935, *S. P. Ko 56073* (Holotype: A [00039313]).

The name *Fissistigma capitatum* Merr. ex H. L. Li (Li, 1945) was validly published with the type designated as *S. P. Ko "56075"* in A. However, the specimen in A annotated "*Fissistigma capitatum* Merr. sp. nov.," "Type," and matching all other details of the protologue bears the collection number *S. P. Ko 56073*. Therefore, the original type citation is erroneous and is to be corrected.

6. *Gymnadenia monophylla* Ames & Schltr. (Orchidaceae), Repert. Spec. Nov. Regni Veg. Beih. 4: 43. 1919. TYPE**:** China. Sichuan Province: Songpan Hsien [Xian], alt. 3660 m, August 1910, *E. H. Wilson 4722* (Holotype: AMES [00099641]).

The name *Gymnadenia monophylla* Ames & Schltr. (Ames & Schltr., 1919.) was validly published with the type designated as *E. H. Wilson "4723"* in AMES. However, the specimen in AMES annotated "*Gymnadenia monophylla* Ames & Schltr. n. sp.," "Type," and matching all other details of the protologue bears the collection number *E. H. Wilson 4722*. Therefore, the original type citation is erroneous and is to be corrected.

7. *Hibiscus venustus* Bl. var. ***integrilobus*** S.Y. Hu (Malvaceae), Fl. China Family 153: 49. 1955. TYPE: China. Taiwan Province: Hengchun, 6 November 1918, *E. H. Wilson 11053* (Holotype: A [00052836]).

The name *Hibiscus venustus* Bl. var. *integrilobus* S.Y. Hu (Hu, 1955) was validly published with the type designated as *E. H. Wilson "11055"* in A. However, the specimen in A annotated "*Hibiscus venustus* var. *integrilobus* v. n.," "Type," and matching all other details of the protologue bears the collection number *E. H. Wilson 11053*. Therefore, the original type citation is erroneous and is to be corrected.

8. *Hibiscus wangianus* S.Y. Hu (Malvaceae), Fl. China Family 153: 55. 1955. TYPE: China. Yunnan Province: Luh-shuen (= Pu'er Xian), alt. 750 m, November 1936, *C. W. Wang 80943* (Holotype: A [00052837]).

The name *Hibiscus wangianus* S.Y. Hu (Hu, 1955) was validly published with the type designated as *C. W. Wang "80945"* in A. The specimen in A annotated "*Hibiscus wangianus* sp. n.," "Type," and matching all other details of the protologue bears the collection number *C. W. Wang 80943*. Therefore, the original type citation is erroneous and is to be corrected.

9. *Hydrangea fulvescens* Rehd. (Hydrangeaceae) in Sargent, Pl. Wilson. 1(1): 39. 1911. TYPE: China. Sichuan [now Chongqing City]: Wushan Hsien [Xian], July 1900, *E. H. Wilson 1373* (Holotype: A[00042800]).

The name *Hydrangea fulvescens* Rehd. (Rehder, 1911) was validly published with the type designated as *E. H. Wilson "1393"* in A. However, the specimen in A annotated "*Hydrangea fulvescens* Rehd. n. sp.," "Type," and matching all other details of the protologue bears the collection number *E. H. Wilson 1373*. Therefore, the original type citation is erroneous and is to be corrected.

10. *Ilex chuniana* S. Y. Hu (Aquifoliaceae), J. Arnold Arbor. 32(4): 397. 1951.TYPE**:** China. Hainan Province: Ding'an Hsien [Xian], 28 December 1933, *C. Wang 35904* (Holotype: A [00046741]).

The name *Ilex chuniana* S. Y. Hu (Hu, 1951) was validly published with the type designated as *C. Wang "33904"* in A. However, the specimen in A annotated "*Ilex chuniana* sp. nov.," "Type," and matching all other details of the protologue bears the collection number *C. Wang 35904*. Therefore, the original type citation is erroneous and is to be corrected.

11. *Ilex corallina* Franch. var. ***macrocarpa*** S. Y. Hu (Aquifoliaceae), J. Arnold Arbor. 31(1): 67. 1950. TYPE**:** China. Hubei Province: Jianshi Hsien [Xian], 8 September 1934, *H. C. Chow 1556* (Holotype: A [00049442]).

The name *Ilex corallina* Franch. var. *macrocarpa* S. Y. Hu (Hu, 1950) was validly published with the type designated as *H. C. Chow "155"* in A. However, the specimen in A annotated "*Ilex corallina* Franch. var. *macrocarpa* var. nov.," "Type," and matching all other details of the protologue bears the collection number *H. C. Chow 1556*. Therefore, the original type citation is erroneous and is to be corrected.

12. *Lonicera montigena* Rehd. (Caprifoliaceae) in Sargent, Pl. Wilson. 1: 143. 1911. TYPE: China. Sichuan Province: Precise locality not known, alt. 3965-4270 m, June 1904, *E. H. Wilson 3754 c* (Holotype: A [00056619]).

The name *Lonicera montigena* Rehd. (Rehder, 1911) was validly published with the type designated as *E. H. Wilson "375 c"* in A. However, the specimen in A annotated "*Lonicera montigena* Rehd. sp. n.," "Type," and matching all other details of the protologue bears the collection number *E. H. Wilson 3754 c*. Therefore, the original type citation is erroneous and is to be corrected.

13. *Morinda hupehensis* S. Y. Hu (Rubiaceae), J. Arnold Arb. 32: 400. 1951. TYPE: China. Hubei Province: Enshi City, 29 October 1934, *H. C. Chou 1815* (Holotype: A [00096320]).

The name *Morinda hupehensis* S. Y. Hu (Hu, 1951) was validly published with the type designated as *H. C. Chou "1818"* in A. However, the specimen in A annotated "*Morinda hupehensis* S. Y. Hu," "Holotype," and matching all other details of the protologue bears the collection number *H. C. Chou 1815*. Therefore, the original type citation is erroneous and is to be corrected.

14. *Neonauclea tsaiana* S. Q. Zou (Rubiaceae), J. Arnold Arb. 69: 73. 1988. TYPE: China. Yunnan Province: Che-li (= Jinghong City), alt. 1100 m, October 1936, *C. W. Wang 79373* (Holotype: A [00061092]).

The name *Neonauclea tsaiana* S. Q. Zou (Zou, 1988) was validly published with the holotype designated as *C. W. Wang "39373"* in A. However, the specimen in A annotated "*Neonauclea tsaiana* S. Q. Zou," "Type," and matching all other details of the protologue bears the collection number C. *W. Wang 79373*. Therefore, the original type citation is erroneous and is to be corrected.

LITERATURE CITED

CHEN, L. 1938. New species of *Bauhinia* from China. Journal of the Arnold Arboretum 19, No. 2: 129–133.

————. 1939. Notes on Chinese *Bauhinia* with description of three new species. Journal of the Arnold Arboretum 20, No. 4: 437–439.

HU, S.-Y. 1950. The genus *Ilex* in China, III. Journal of the Arnold Arboretum 31 (1): 39–80.

————. 1951. Notes on the Flora of China, I. Journal of the Arnold Arboretum 32 (4): 390–402.

————. 1955. Flora of China, Family 153, Malvaceae. Published by the Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts.

LI, H.-L. 1942. The Araliaceae of China. Sargentia 2: 1–134.

————. 1945. New Kwangsi Plants. Journal of the Arnold Arboretum 26, No. 1: 60–66.

LIN, Y, Y.-L. HAN, AND Q. SUN. 2021. Correction of date errors in the protologues of eighteen taxon names from China. Harvard Papers in Botany 26, No. 1: 115–118.

P'EI, C. 1932. The Verbenaceae of China. Memoirs of the Science Society of China 1 (3): 1–193.

REHDER, A. 1911a. Caprifoliaceae. Pages 106–144 in C. S. SARGENT, ED., *Plantae Wilsonianae 1*. The University Press, Cambridge, Massachusetts.

————. 1911b. Deutzia. Pages 6–24 in C. S. SARGENT, ED., *Plantae Wilsonianae 1*. The University Press, Cambridge, Massachusetts.

————. 1911c. Hydrangea. Pages 25–41 in C. S. SARGENT, ED., *Plantae Wilsonianae 1*. The University Press, Cambridge, Massachusetts.

TURLAND, N. J., WIERSEMA, J. H., BARRIE, F. R., *et al*. 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile 159. Glashutten: Koeltz Scientific Books.

ZOU, S.-Q. 1988. A new species of *Neonauclea* (Rubiaceae) from Yunnan, China. Journal of the Arnold Arboretum 69, No. 1: 73–76.

Page 480 intentionally left blank.

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