

## ZYGOPETALINAE NOVAE ET CRITICAE (ORCHIDACEAE)

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**Abstract.** The new genus *Pridgeonia*, and eight new orchid species in the genera *Benzingia*, *Daiotyla*, *Dichaea*, *Ixyophora*, and *Pridgeonia*, all belonging to the subtribe Zygopetalinae, are described. Complete descriptions, with notes on etymology, habitat, and ecology, and discussion of phylogenetic affinities, are provided for each new taxon, supplemented with line drawings, photographs, digital composite plates, and distribution maps. New combinations and synonyms are proposed in the genera *Aetheorhyncha*, *Benzingia*, *Dichaea*, and *Ixyophora*. *Dichaea dressleri* and *Kefersteinia alata* are recorded and illustrated for the first time for the flora of Costa Rica. Keys for the genus *Benzingia* and the Costa Rican species of *Dichaea* are proposed.

**Keywords:** flora of Colombia, flora of Costa Rica, flora of Ecuador, flora of Nicaragua, new genus, new records, new species

The publication of the general treatment of subtribe Zygopetalinae (Orchidaceae) in *Genera Orchidacearum* (Pupulin et al., 2009), now 10 years ago, represented a unique opportunity to summarize our knowledge about this group of plants from the wet American tropics and to review in detail the circumscription of genera and the critical application of names of the over 400 species of this group as accepted today. Since then, new species and combinations have been proposed in the genera *Aganisia* Lindl. (Barros and Guimaraes, 2010), *Benzingia* Dodson ex Dodson (Romero-González and Dodson, 2010), *Dichaea* Lindl. (Bolsanello, 2010; Krahl et al., 2014; Valsko et al., 2014a,b; Archila Morales and Chiron, 2015; Campacci et al., 2015; Sambin and Chiron, 2015; Krahl et al., 2016; Archila Morales et al.,

2017; Pupulin and Karremans, in press), *Huntleya* Bateman ex Lindl. (Ortiz Valdivieso, 2004), *Kefersteinia* Rchb.f. (Carnevali Fernández Concha et al., 2015), *Koellensteinia* Rchb.f. (Hall et al., 2015), *Promenaea* Lindl. (Barberena and Barros, 2015), and *Zygopetalum* Hook. (Castro-Neto and Campacci, 2000).

Over the past decade I have maintained my interest in this group of plants and have continued to work on the systematics of Zygopetalinae, in particular on the native groups of Costa Rica and the Ecuadorean Andes.

Below, I introduce the results of these studies, proposing a number of new taxa, new combinations, and new records in seven genera of Zygopetalinae, which I present in alphabetical order.

### AETHEORHYNCHA DRESSLER

The monotypic genus *Aetheorhyncha* is superficially similar to *Chondroscaphe* (Dressler) Senghas & G. Gerlach in flower lip with a small, toothed callus in the center of the disc, but it lacks the distal callus that characterizes the latter. The flowers, held almost vertically, with a very narrow lip opening, the pubescent lamina of the lip with a strong median keel basal to the bilobed callus, and the narrow, truncate viscidium, distinguish the genus among other relatives in the *Chondrorhyncha* complex (Pupulin, 2009a) (Fig. 1, 6A, 30B).

1. *Aetheorhyncha andreettae* (Jenny) Dressler, *Lankesteriana* 5(2): 95. 2005.

Basionym: *Chondrorhyncha andreettae* Jenny, *Orchidee* (Hamburg) 40(3): 92. 1989.

TYPE: ECUADOR. Morona-Santiago: Cutucú, 900 m, 1987, *A. andreetta* s.n. (Holotype: CH).

Heterotypic synonym: *Chondrorhyncha panguensis* Dodson ex Harding, *Orquideología* 25(2): 166–169, 175–177. 2008, *syn. nov.*

TYPE: ECUADOR. Morona Santiago, cerca de Panguí, 1500 m, *C. H. Dodson 16003* (Holotype: MO).

When Harding (2008) described *Chondrorhyncha panguensis*, she mixed up several collections, including the photograph of a plant grown at Ecuagenera, Ecuador, the drawing of *Chondrorhyncha andreettae* Jenny that appeared in one of Dodson and Marmol de Dodson's (1989) accounts on the orchids of Ecuador, and a dried specimen collected at El Panguí, in Amazonian Ecuador, now conserved in the herbarium of the Missouri Botanical Garden (*C. H. Dodson*

This paper, which took 10 long years to be completed, would have not been possible without the human and logistic support of my friend José "Pepe" Portilla, and the activity of the Andean Orchid Research Center (CIOA, for the acronym of its name in Spanish, Centro de Investigación en Orquídeas de los Andes) of the now-dissolved University Alfredo Pérez Guerrero of Quito, Ecuador. At the CIOA, the assistance of my colleagues Hugo Medina Troyani and Gilberto Merino was substantial for documenting and understanding the exceedingly rich and difficult flora of the Ecuadorian Andes and Amazonia. Their unselfish and open-minded cooperation in the systematic work carried out at the CIOA cannot be acknowledged enough. In Costa Rica, I deeply acknowledge my colleagues at the Lankester Botanical Garden for the fruitful discussions on the taxonomy of Zygopetalinae and the continuous help with the fieldwork required for this study. Among them, I particularly want to thank Diego Bogarín, Melissa Díaz-Morales, Melania Fernández, and Adam P. Karremans. I would also like to thank Sara Poltronieri, who became an accomplished botanical illustrator at our research center, for the beautiful illustrations she contributed to this paper. The Ministry of Environment and Energy (MINAE) of the Republic of Costa Rica, and its National System of Protected Areas (SINAC), are acknowledged for extending the required permits to import material for study and to collect plants in the field, particularly in national parks.

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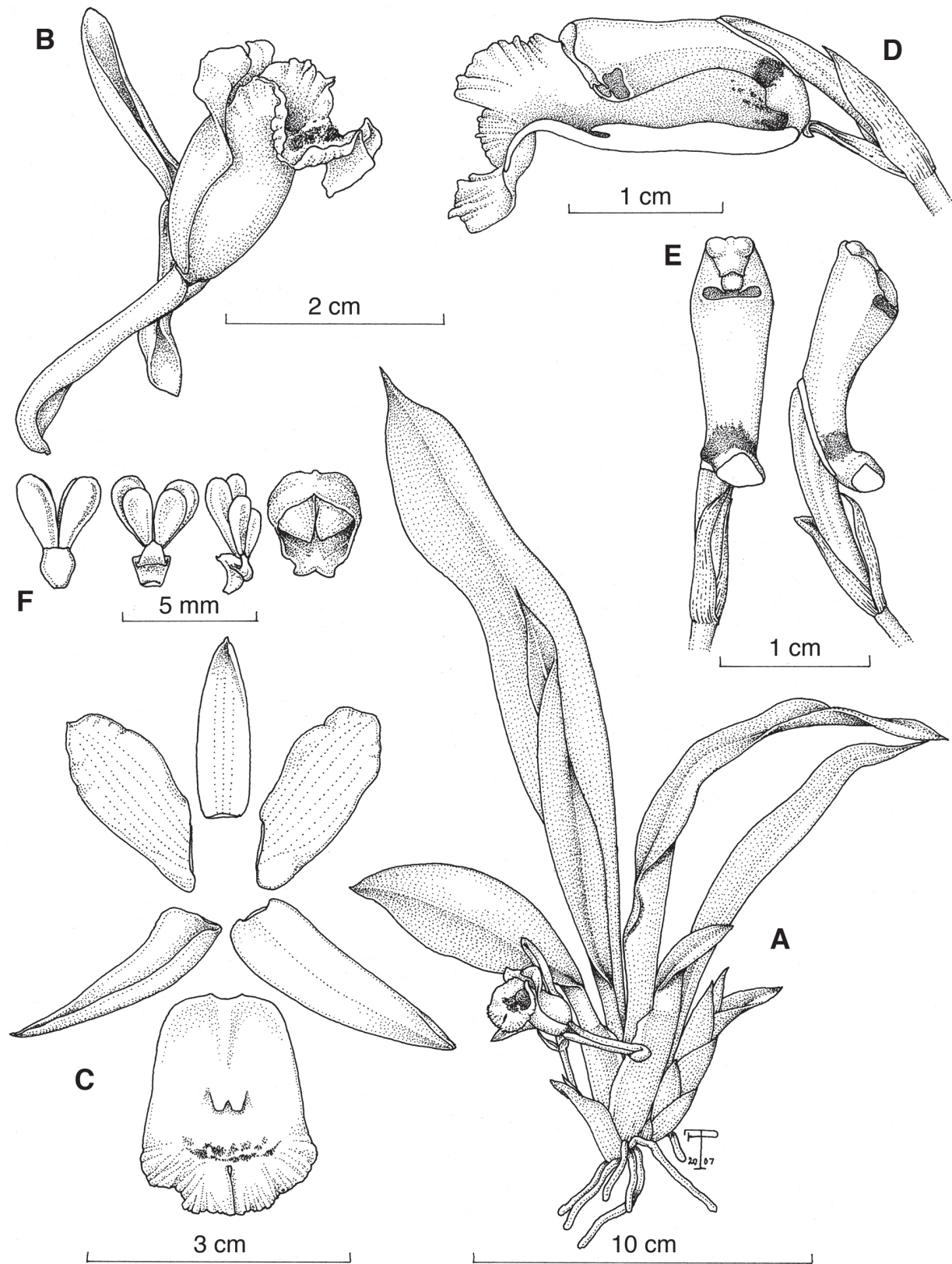


FIGURE 1. *Aetheorhyncha andreettae* (Jenny) Dressler. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, frontal and three-quarter views; **F**, pollinarium (three views) and anther cap. Drawn by F. Pupulin from *Pupulin 6560* (CIOA).



FIGURE 2. Holotype of *Chondrorhyncha panguensis* Dodson ex Harding (MO 3573348). Courtesy of the Herbarium, Missouri Botanical Garden.

16003) (Fig. 2). Harding (2008) compared *C. panguensis* with *C. velastigui* Dodson, from which it could supposedly be differentiated by the inrolled dorsal sepal (vs. concave), the relative lengths of the apical teeth of the callus, and the straplike shape of the leaves (vs. broad and “oval”). In describing the flower, Harding used characters from both the photograph of the plant cultivated at Ecuagenera and from Dodson’s notes affixed to the herbarium specimen, whereas measurements are mostly taken from the herbarium sheet and from Dodson and Marmol de Dodson’s (1989) description of *C. andreetae* in the *Icones Plantarum Tropicarum*. These measurements well correspond to those recorded for the holotype plant of *C. andreetae* (Jenny, 1989), whereas all the parts of the flowers in the species photographed at Ecuagenera are at least two times larger. As the plant photographed by Alex Portilla and the specimen collected

by Dodson at El Panguí are quite obviously two different taxa, the final result of Harding’s description is simply a chimaera. It is fortunate, however, that the author selected *Dodson 16003* as the holotype of *C. panguensis*, as this specimen belongs in fact to *Aetheorhyncha andreetae*, and the illusory organism described by Harding can be reduced into synonymy of the latter. The name, *C. panguensis*, as originally annotated in 1995 by Dodson on one of his specimens (i.e., *Dodson 16003*, MO), was an intended name for a species still undescribed at that time. After Jenny’s (1989) description of the same taxon as *Chondrorhyncha andreetae*, Dodson himself corrected the label of the herbarium specimen with the latter name in 1992. As to the yellow-flowered plant grown at Ecuagenera, whose flowers are among largest in the *Chondrorhyncha* complex, it is described in the following pages as *Pridgeonia insignis*.

#### BENZINGIA DODSON EX DODSON

### 2. *Benzingia chocoensis* (Uribe-Velez & Sauleda) Pupulin, *comb. nov.*

Basionym: *Chondrorhyncha chocoensis* Uribe-Velez & Sauleda, *New World Orch. Nomencl. Notes* 46: 2. 2018.

Uribe-Velez and Sauleda (2018) found that some of the characters of their new taxon would best fit *Stenotyla* Dressler (e.g. the presence of rudimentary pseudobulbs), whereas the narrowly oblong, gray-green leaves were consistent with *Benzingia*. As the authors concluded that the circumscription of the genera of the *Chondrorhyncha* complex proposed by Whitten and collaborators (2005) “cannot resolve the taxonomy” of the group (Uribe-Velez and Sauleda, 2018), they eventually opted for describing this species under a broad concept of *Chondrorhyncha* Lindl.

Nevertheless, the “groups” recovered by the analysis carried out by Whitten et al. (2005) are not only based on a genetic rationale but also present quite a strong consistency from both morphological and phylogeographic points of view (Pupulin, 2019). The species of the more basal groups in the *Zygopetalinae*, both those with plicate leaves close to *Warrea* Lindl. and those with conduplicate leaves close to *Zygopetalum* Hook., are truly pseudobulbous, so that the presence of probably nonfunctional pseudobulbs in the derivate group of species of the *Huntleya* clade should not be surprising, considering that it represents the ancestral condition in the subtribe. The author has personally observed vestigial pseudobulbs not only in *Stenotyla* but occasionally also in *Chaubardiella* Garay and *Warczewiczella* Rehb.f.

On the other hand, the vegetative and floral characters of *Chondrorhyncha colombiana* are inseparable from the diagnostic features of *Benzingia*, in particular the long-petiolate, narrow, pendent grayish-green leaves; the swept-back, basally inrolled lateral sepals; and the funnel-shaped lip provided with a broad callus almost occupying the entire basal half of the labellum. As the phylogenetic framework recovered by the studies of Whitten and collaborators

offers a consistent way to interpret the evolutive patterns in the subtribe and an acceptable model of morphologically diagnosable nomenclature, it is highly advisable not to have both a polyphyletic *Chondrorhyncha* and a paraphyletic *Benzingia* as a result of Uribe-Velez and Sauleda’s proposed nomenclature.

### 3. *Benzingia elvirae* Pupulin, *sp. nov.*

TYPE: ECUADOR. Morona-Santiago: Santiago de Tiwintza, forest remnants along the Río Santiago, 3°02'18"S, 78°02'27"W, 400–500 m, 2002, flowered in cultivation in the collection of Ecuagenera at El Panguí, 3 November 2007, *F. Pupulin 6899* (Holotype: CIOA-spirit)<sup>2</sup> Fig. 3, 6B.

*Species Benzingiae chocoensis* (Uribe-Velez & Sauleda) Pupulin *similis*, *sed habito ebulboso labello flavo duabus striis et macula magna puniceis notato, callo labelli bilobato apice in duo latera quadridentato plerumque differt; a Benzingiae estradae* (Dodson) Dodson *floribus sepalis petalisque albis immaculatis et labello macula punicea notato, petalis rotundis vel truncatis, labello truncato-emarginato, callo labelli denticulato recedit.*

An epiphytic, fan-shaped, cespitose, suberect to pendent herb without pseudobulbs, to 20 cm tall. *Roots* flexuous, glabrous, ca. 1 mm in diam. *Stem* abbreviated, completely enclosed by the conduplicate, rectangular, somewhat loose, fibrous leaf sheaths; the sheaths provided with hyaline-scarious margins, to 3 cm long. *Leaves* 5–6, articulate with the sheaths, narrowly elliptic-oblong, subsessile or narrowing into a very short petiole, acuminate, subcoriaceous, matte green, the margins loosely wavy, the central vein strongly prominent abaxially, the upper ones progressively longer, 12–18 × 2.2–3.1 cm. *Inflorescence* lateral, 1 per shoot, an arched-pendent, 1-flowered raceme to 6 cm long; peduncle terete, to 3 cm long, provided with an ovate, subacute, glumaceous, tightly clasping bract ca. 7 × 5 mm. *Floral bract* double, glumaceous, loose; the outer bract broadly

<sup>2</sup> Even though the Andean Orchid Research Center (Spanish acronym CIOA) formally ceased operations in 2012 with the dissolution of the University Alfredo Pérez Guerrero of Quito, to which it was ascribed, the Center’s herbarium and liquid material are conserved in its operational headquarters in Gualaquero, Cuenca, Ecuador, where Ecuagenera keeps them accessible to the public on request. An agreement is pending to transfer the herbarium to the Universidad Técnica Particular of Loja, Ecuador (HUTPL), where the materials would eventually be deposited for permanent curation.

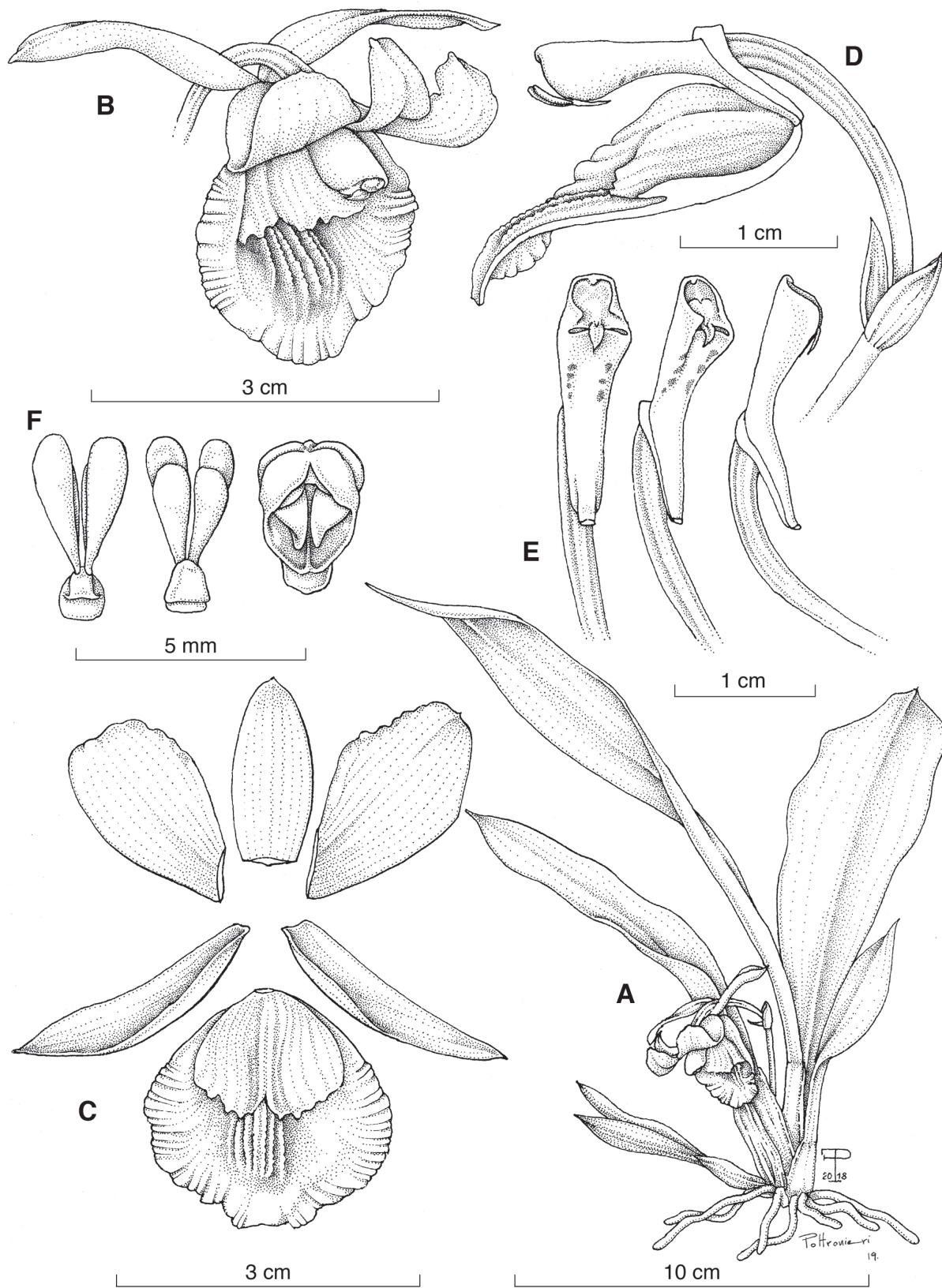


FIGURE 3. *Benzingia elvirae* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view (the lip longitudinally dissected); **E**, column, ventral, three-quarter, and lateral views; **F**, pollinarium (two views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from the holotype.

ovate, cucullate, acute, 8 x 6 mm; the inner bractlet smaller, lanceolate, acute, concave, 7.0 x 3.5 mm. Pedicellate *ovary* beret-subclavate, gently arching, round in section, apically provided with rounded, low wings, 2 cm long including the pedicel. *Flowers* spreading, showy, with sepals and petals creamy white, the lip yellow, fading to pale yellow along the margins, the central portion of the disk boldly striped with red, the callus bright yellow faintly suffused with red, the column cream with ventral reddish brown spots. *Dorsal sepal* lanceolate-elliptic, obtuse-rounded, the apex gently reflexed in natural position, 7-veined, 17 x 9 mm. *Lateral sepals* narrowly lanceolate-elliptic, acute to minutely apiculate, spreading-subreflexed, the labellar margin convolute to form a deeply concave-funneled base, 7-veined, 28 x 6-7 mm. *Petals* obliquely obovate, truncate-rounded, subporrect, inserted along the column foot, the apex gently reflexed, the apical margins subundulate, the inner margin irregularly erose, 11-veined, 25 x 15 mm. *Lip* faintly 3-lobed, transversely elliptic-obovate, truncate, slightly convex at apex, concave at the base, 25 x 26 mm, the margins irregularly minutely dentate, undulate-ruffled; the lateral lobes elliptic, basally suberect, spreading at apex, 23-24 mm long; midlobe transversely subrectangular, short, slightly reflexed, ca. 3 mm long; disc with 7 low, irregular, tuberculate lamellae running from the callus to the insertion of the midlobe; callus laminar, subrhreniform-rounded, bilobed, excised at the elevated apex, each half irregularly 4-dentate, decurring laterally on the body of the lateral lobes. *Column* semiterete, clavate, distinctly thickened at apex, 1.2 cm long, apically produced into massive, elliptic, parastigmatic wings; clinandrium low, subquadrate, with low rim; anther incumbent; stigma ventral, slit-like; rostellum obtrullate, apically acuminate, 2 mm long. *Pollinia* 4, lanceolate-pyriform, in 2 pairs dorsiventrally superposed, the ventral pair smaller, on a small trapezoidal stipe and a larger, obpeltate-triangular, hyaline viscidium.

**Eponymy:** the name of the species honors my wife, Elvira Salas Hidalgo, Ph.D., neurobiologist and biochemist, in recognition of her excellence as a scientist and of her patient support of my work.

**Distribution:** known only from the *locus typicus* in Amazonian Ecuador. To be expected in the adjacent regions of Peru (Map 1).

**Habitat and ecology:** lowland, tropical wet forest, epiphytic in secondary vegetation along pasture edges. Flowering has been recorded in November-December in cultivation.

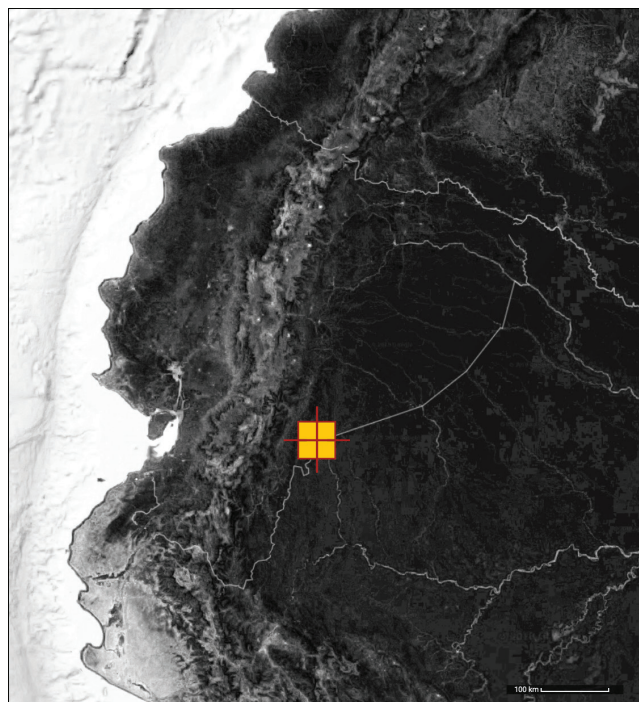
Species of *Benzingia* form a quite heterogenous group, from the point of view of both the vegetative habit and the morphology of flowers. Whereas the delicate-textured, matte, gray-green leaves, with the adaxial surface someway cellular-prismatic, are characteristic of most species, *B. estradae*, *B. hirtzii* Dodson (*typus generis*), and *B. thienii* (Dodson) P. A. Harding have grassy green, subcoriaceous, shiny leaves. Most species of *Benzingia* are truly pendent plants, with the leaves distinctly oblanceolate from a narrow and long petiole, but *B. estradae* and *B. hirtzii* have suberect to erect habit. The flowers of *Benzingia* are mostly resupinate, with the notable exception of *B. hirtzii*, which has nonresupinate flowers on short, erect inflorescences, somewhat reminiscent of those of *Chaubardiella* Garay.

*Benzingia elvirae* is most similar to *B. chocoensis*, from which it differs by the bulbous plant (vs. provided with a rudimentary pseudobulb), the flower with a yellow lip (vs. white) marked with two red stripes in the callus area and a large red blotch in front of the callus (vs. suffused with yellow, white), and the bilobed callus with 4 teeth on each side (vs. a single tooth). In habit it resembles *B. estradae* and *B. hirtzii*, with suberect plants and matte green, but not grayish-green, leaves; florally, however, it is very different from both these taxa, and is most similar to *B. reichenbachiana* and, especially, to *B. chocoensis*.

I propose the following key to the species of the genus:

#### KEY TO THE SPECIES OF *BENZINGIA*

- 1a. Flower nonresupinate; margins of the lip finely fimbriate ..... *B. hirtzii*
- 1b. Flower resupinate; margins of the lip entire to crenulate or serrulate ..... 2
- 2a. Lip deeply saccate-calciform, held erect toward the column, the basal margins involving the column, the apex provided with a narrow ligule, pointing up ..... 3
- 2b. Lip concave to shallowly saccate, the lateral lobes erect but not encircling the column, the apex bluntly obtuse to rounded, without terminal ligule, pointing down. .... 5
- 3a. Mouth of the lip open, wide, broadly elliptic ..... *B. palorae*
- 3b. Mouth of the lip narrow, circular. .... 4
- 4a. The lip yellow, with 2 teeth next to the apical ligule ..... *B. jarae*
- 4b. Lip white, without teeth next to the apical ligule ..... *B. caudata*
- 5a. Flowers spreading; lateral sepals reflexed, inrolled at the base into a false nectary ..... 6
- 5b. Flowers campanulate; lateral sepals spread but not reflexed, the basal margins not inrolled into a false nectary ..... 9
- 6a. Lip cymbiform, the distal margin involute ..... *B. thienii*
- 6b. Lip spreading, the distal margin flat to convex ..... 7
- 7a. Lateral sepals inrolled at apex forming a hook ..... *B. reichenbachiana*
- 7b. Lateral sepals reflexed but straight, not hook-shaped ..... 8
- 8a. Lip subquadrate when spread, white, suffused with yellow in the callus area; apex of the bilobed callus with a single tooth on each side ..... *B. chocoensis*
- 8b. Lip obovate-suborbicular when spread, yellow, suffused with 2 red stripes on the callus and with a red blotch in front of the callus; apex of the bilobed callus with 4 teeth on each side ..... *B. elvirae*
- 9a. Lip provided at apex with a distinct, triangular, up-curved lobe. .... *B. cornuta*
- 9b. Lip acute to blunt obtuse, without apical ligulate lobe ..... 10
- 10a. Callus in the basal half of the lip, bilobed excised ..... *B. estradae*
- 10b. Callus in the apical half of the lip, 4-toothed ..... *B. hajekii*



MAP 1. Distribution of *Benzingia elvirae* in Ecuador.

#### DAIOTYLA DRESSLER

Typified by *Chondrorhyncha albicans* Rolfe, *Daiotyla* is a genus of four to five species distributed from Costa Rica to Colombia, characterized by the broad, thick, fleshy, two-parted callus at the base of the lip, which extends to about the middle of the blade (Pupulin, 2006, 2009c). The generic name, from the Greek *daio*, divide, and *tyle*, knot, refers to the characteristic shape of the lip callus in *Daiotyla* species (Dressler in Whitten et al., 2005). The molecular analyses carried out by Whitten and collaborators (2005) strongly support *Daiotyla* as sister to *Stenia*, which it resembles in the oblong to oblanceolate, dark green leaves. The same clade also includes *Benzingia* and *Euryblema* Dressler, to which species of *Daiotyla* are similar in their wide, laminar callus. Species of *Daiotyla* occur as epiphytes in shady places in lowland to midmontane, evergreen wet forests at 250–1800 m elevation.

In my monograph of Zygopetalinae for *Flora Costaricensis* (Pupulin, 2010), I treated *Daiotyla albicans* as including two different states, the typical form with the callus tinged with pale yellow (Fig. 4A, 6C), and a form with the callus solidly blotched with purple-red (Fig. 4B, 6D), noting that the two morphs present minor but consistent differences in the shape of the callus and the size of the opening formed by the callus and the ventral surface of the column. As these differences seem to suggest that the flowers of the two morphs utilize a different color lure to attract pollinators and that the size of the lip mouth may effectively discriminate among the visiting insects able to remove the pollinarium (Fig. 4), it is advisable to give the two entities taxonomic recognition.

*Daiotyla albicans* is typified by a specimen flowered in the collection of Walter Rothschild, Tring Park, England, which was exhibited in 1896 at a meeting of the Royal

Horticultural Society and presented as a species of *Batemanian* from Costa Rica. Rolfe (1898) described the flowers as “white with a faint tinge of green in places,” and the holotype at Kew (K79617) confirms that the callus is of a light color. I therefore propose to give specific recognition to populations with solid purple callus as follows:

#### 4. *Daiotyla rhodotyla* Pupulin, *sp. nov.*

TYPE: COSTA RICA. Cartago: Turrialba, Río Pacuare, without specific locality, from the collection of W. Chacón at San Vito de Java, 14 November 2002, flowered in cultivation at the Lankester Botanical Garden, 19 May 2006, *F. Pupulin* 4372 (Holotype: JBL). Fig. 4B, 5, 6D.

*Species Daiotylae albicanti* (Rolfe) Dressler *similis, floribus magis campanulatis, callo labelli obovato-subquadrato mayore maculis magnis puniceis notato, carina humilis pinguis in disco, faucium ingresso angustiore, columna tenuis alibus minoribus duobus callis rotundatis in basi fornita, antherae cucullo ovato apiculato recedit.*

An epiphytic, fan-shaped, cespitose, suberect *herb* without pseudobulbs, to 10 cm tall. *Stem* abbreviated, completely enclosed by the conduplicate, triangular to subrectangular, deeply conduplicate leaf sheaths, the upper 1–2 foliaceous; the sheaths provided with hyaline margins, to 2 cm long. *Leaf* shortly petiolate, conduplicate, obovate-oblong, broadly obtuse to rounded, dark green, with a distinctly protruding adaxial mid-vein, 3.5–7.5 × 2.3–3.0 cm. *Inflorescence* lateral, from the axil of the lower sheaths, 1-flowered; peduncle terete, arched-pendent, to 3 cm long, with a single, triangular, adpressed bract near the base. *Floral bract* double, glumaceous, conduplicate, loose; the external one broadly ovate, 6 × 5 mm, the internal bractlet ligulate, 4 × 1 mm. *Ovary* to 2 cm long including the pedicel. *Flower* with sepals and petals white to pale cream, the disc suffused yellow, the callus of the lip tinged pale yellow with solid purple blotches. *Dorsal sepal* lanceolate, acute, conduplicate-folded and hooked at apex, 13 × 3 mm. *Lateral sepals* oblanceolate, acute, reflexed, strongly conduplicate-folded, hooked at apex, 21 × 9 mm. *Petals* obovate-elliptic, rounded, notched at apex, 17 × 11 mm. *Lip* obovate, obscurely 3-lobed, rounded-truncate, retuse, the apical margin finely crisped, the basal margins suberect, 23 × 20 mm; basal callus thickened, bilobed, obovate-subquadrate, apically deeply emarginate, ca. 8 × 13 mm; disc with a central, raised, rounded, cushionlike keel running from the apex of the callus to attachment of the midlobe. *Column* semiterete, straight, clavate, ca. 13 × 6 mm, with 2 raised calli at the base and a short foot ca. 2 mm long, produced toward the apex into a pair of triangular, massive stigmatic wings, the ventral surface flat to slightly concave, with transverse, slit-like narrow stigma; the anther incumbent, seated in a shallow clinandrium. *Anther cap* ovate, cucullate, 2-celled. *Pollinia* 4, in 2 pairs of different sizes, on a triangular, brownish, hyaline stipe, scarcely distinct from the ventral, elongate viscidium.

**Additional specimens examined:** COSTA RICA. Alajuela: San Ramón, Angeles, Cuenca del San Carlos, Zona Protectora Arenal-Monteverde, Río Peñas Blancas, sector Alemán, 900 m, 10.3-84.7500003, 1990-03-20 (flor blanca, labelo con una mancha púrpura en su interior), *E. Bello* 2012

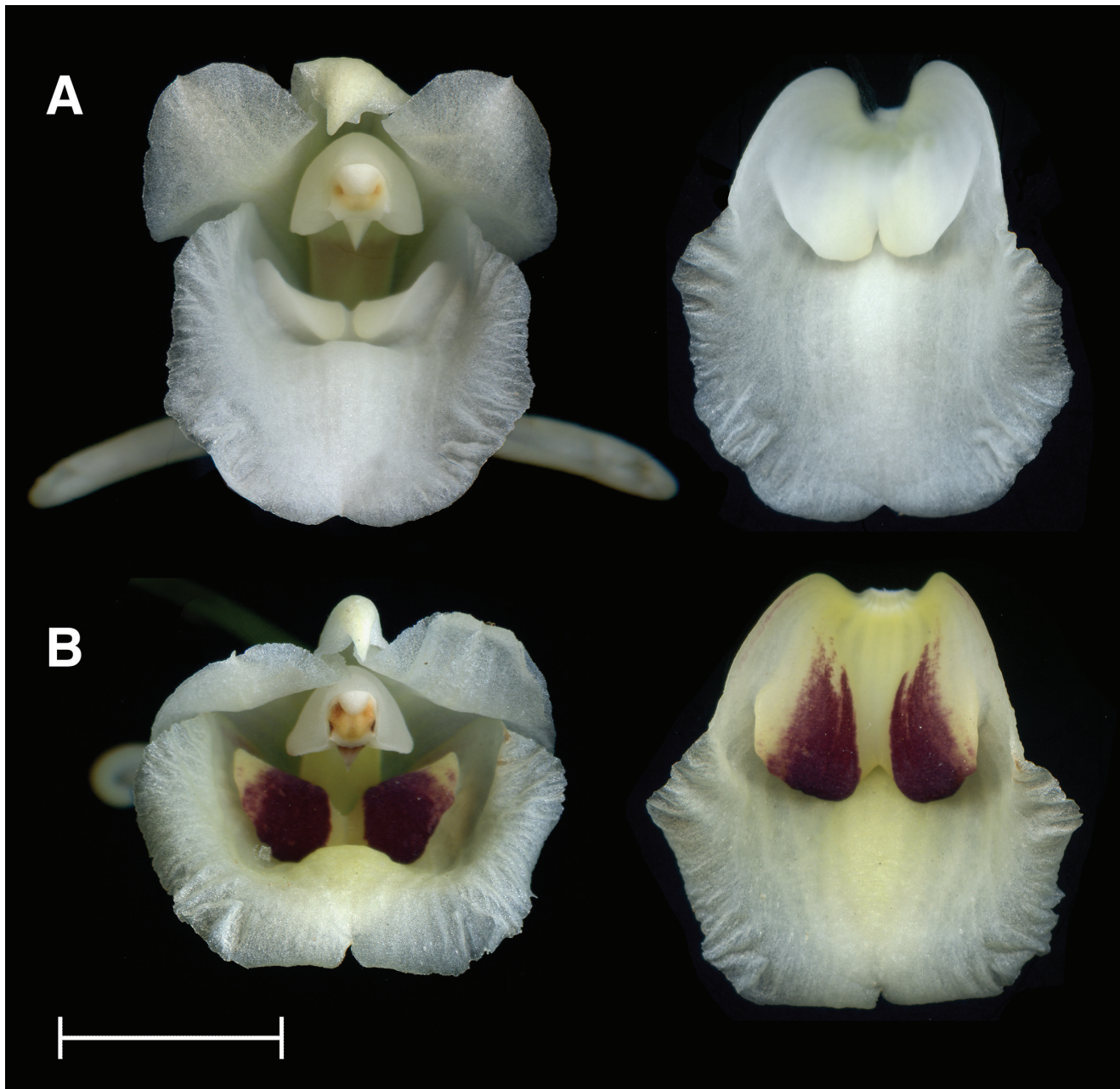


FIGURE 4. **A–B.** Comparison between *Daiotyla albicans* (**A**) and *D. rhodotyla* (**B**). Left, frontal view of the flowers. Right, lip partially spread. A, *Bogarín 6261*; B, *Pupulin 4372*. Scale bar = 1 cm. Photographs by F. Pupulin.

(CR); Alajuela: San Ramón, Peñas Blancas, Cuenca del San Carlos, Zona Protectora Arenal-Monteverde, Río Peñas Blancas, Sociedad IQPSA, Ston's., 800 m, 10.3166667-84.71666723, 1 Mar. 1990 (flor crema, centro del labelo púrpura), *E. Bello 1995* (CR).

**Etymology:** from the Greek *rhodos*, red, and *tylos*, knot or callus, in reference to the eminently red callus that easily characterizes the species.

**Distribution:** documented only from Costa Rica, where it is known from the Caribbean slopes of the Cordillera de Tilarán, south to to the medium basin of the Río Pacuare along the northeastern end of the Cordillera de Talamanca, at elevations between 700 and 1000 m

(Map 2). The photograph taken in Panama by Arturo Carrillo and identified as *D. crassa* (Dressler) Dressler (in Pfahl, 2018) likely illustrates a specimen of *Daiotyla rhodotyla*, possibly extending the range of the species to the south of Costa Rican border.

**Habitat and ecology:** like other species in the genus, *Daiotyla rhodotyla* is an uncommon epiphyte, known from a few localities in Costa Rica and possibly Panama. In Costa Rica, it has been recorded from the temperate wet forests and tropical rain forest along the Caribbean watershed of the Tilaran and Talamanca mountain ranges, at elevations between 700 and 1000 m. *Daiotyla albicans*, its sister species, is known from the Central Volcanic Cordillera in Costa Rica

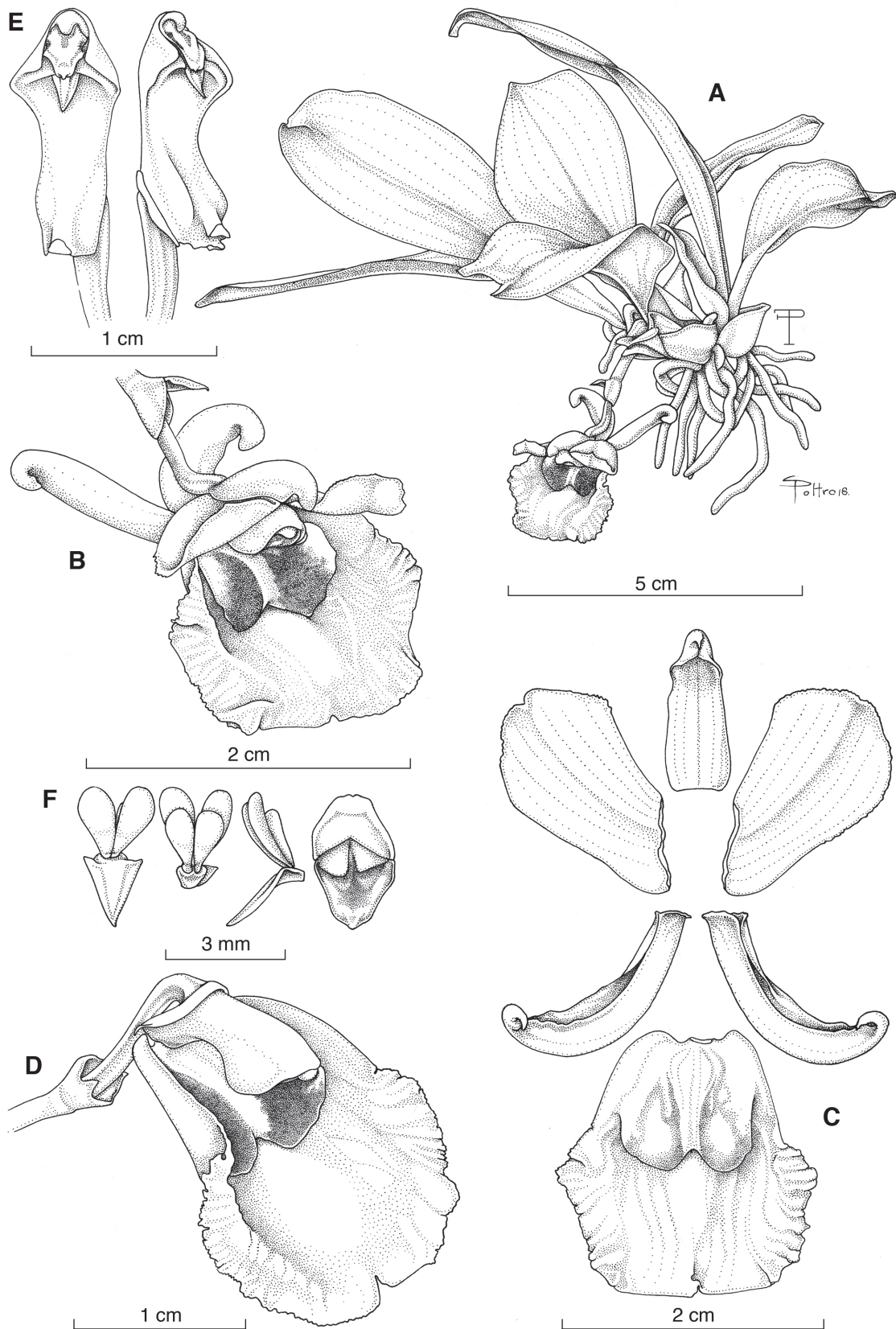


FIGURE 5. *Daiotyia rhodotyla* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, three-quarter view; **E**, column, ventral and three-quarter views; **F**, pollinarium (three views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from the holotype.

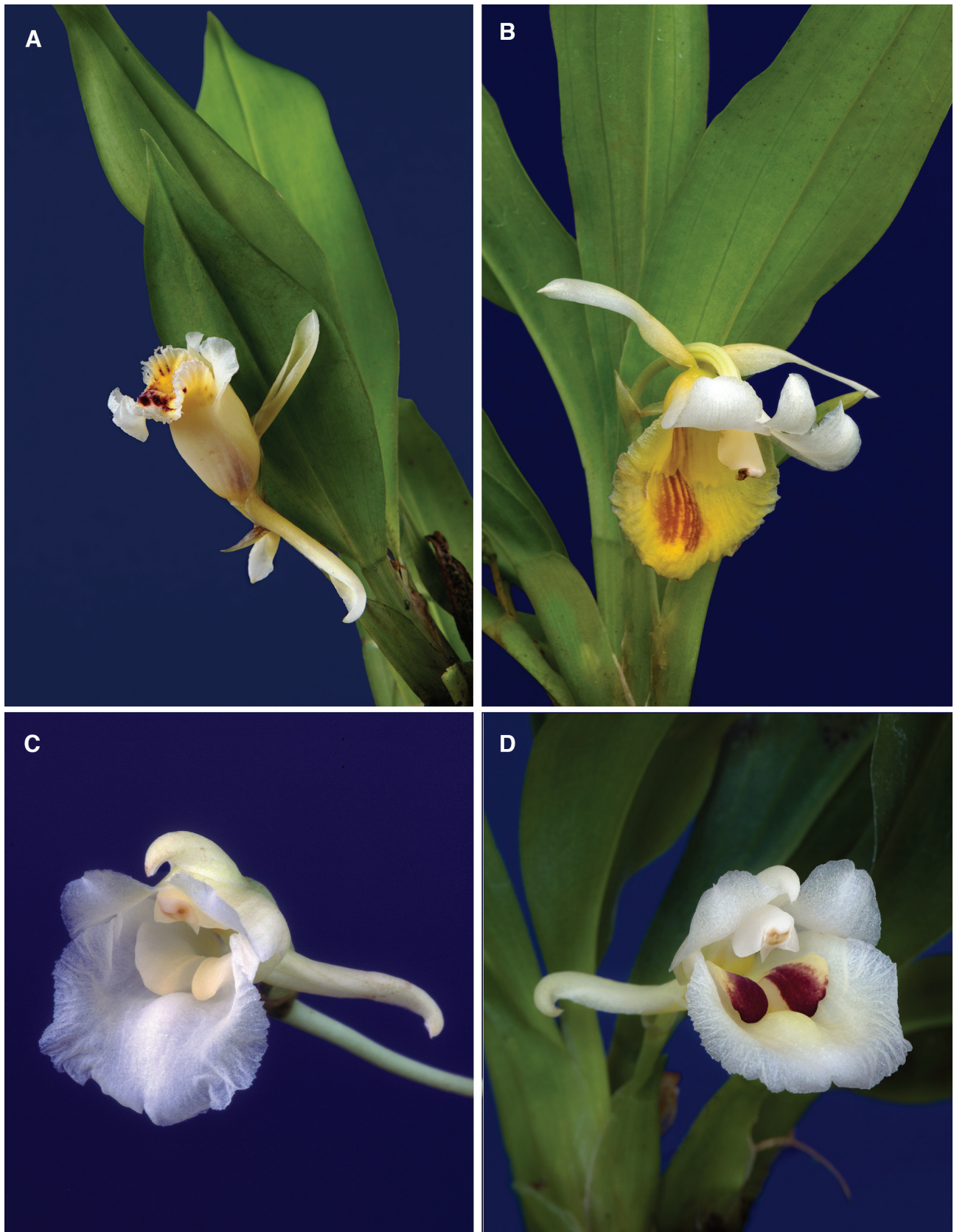
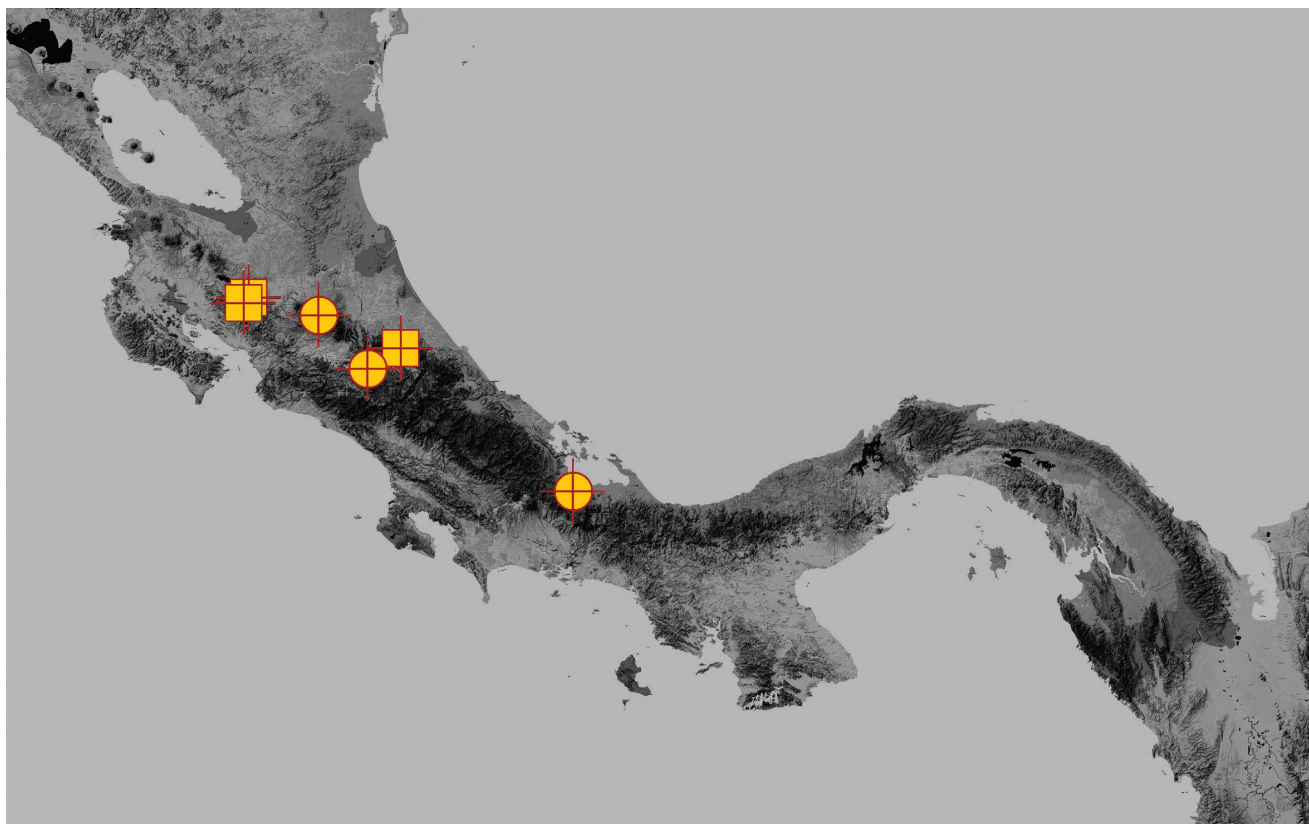


FIGURE 6. **A–D.** Flowers of Zygopetalinae species. **A,** *Aetheorhyncha andreettae* (Pupulin 6560); **B,** *Benzingia elviraе* (Pupulin 6899); **C,** *Daiotyla albicans* (Pupulin 3510); **D,** *D. rhodotyla* (Pupulin 4372). Photographs by F. Pupulin.



MAP 2. Distribution of *Daiotyla rhodotyla* (squares) and *D. albicans* (circles).

southward to the Atlantic slopes of the Chiriquí massif in Panama (Map 2). In its native habitats, the flowering of the species has been recorded from March to September.

*Daiotyla rhodotyla* is a close relative of *D. albicans*, with which it shares the general morphology of plant and flower. However, the flower of *D. rhodotyla* is somewhat more “cupped,” as the apical portion of the lip does not bend so distinctly as in *D. albicans* (Fig. 4A–B). Furthermore, the callus of the new species is obovate-subquadrate (vs. ovate), notably larger (9 × 11 vs. 7 × 9 mm), and its free portion almost twice as high (6 vs. 3 mm) (Fig. 4A–B). Together with the straighter shape of the lip and the distinctly raised median cushion of the disc, *D. rhodotyla* presents a much more reduced entrance to the “throat” of the flower, which lets us suppose that only smaller-sized bees can reach the chamber found beyond the callus. The callus lobes boldly blotched with solid purple (vs. white) may perhaps play a different role in the visual attraction of potential pollinators. The column of *D. rhodotyla* is notably more slender than that of *D. albicans*, with distinctly narrower stigmatic wings. It also has a pair of raised, round calli on the basal margins, which are absent in *D. albicans*. Finally, the shape of the anther cap is very different in the two species, being ovate and apiculate in *D. rhodotyla* and obovate, apically round, and retuse in *D. albicans* (Fig. 7).

#### DICHAEA LINDL.

The genus *Dichaea*, with some 110 species distributed from Mexico through Central America and the West Indies to Bolivia and Argentina (Pupulin, 2009d), proved to be

quite a difficult group for taxonomists. As a fairly common element of the shaded, understory forests all over the Neotropics, *Dichaea* species have been known to Western botanists since the end of the 18th century, when the first species were illustrated and described from French Guyana (Aublet, 1775), Jamaica (Swartz, 1788), and Peru (Ruiz and Pavón, 1798). However, due to the overall similarity of vegetative and floral morphology among the species, as well as a noteworthy plasticity in vegetative characters (Pupulin, 2005, 2007), modern authors have frequently opted for using a few, all-purpose old names in a very broad—and often incorrect—sense (Dressler and Folsom, 2005), or to simply ignore them, favoring the creation of new taxa with little discussion about evolutionary affinities. This situation still obscures the real diversity of the genus in Neotropical floras even in very recent treatments (see, for example, Szlachetko et al., 2012).

Furthermore, the flowers of *Dichaea* are, in general, ephemeral and do not conserve well in dried specimens, and in several species they present temporal activity during anthesis (which mostly endures three to four days) as a response to weather conditions and, probably, to the activity of their potential pollinators. When the climate is rainy, or simply cloudy, it is not rare that the single flower of a *Dichaea* just partially opens in the early morning and closes within one or two hours, repeating this behavior until it eventually wilts. Actually, the chances to collect a plant of *Dichaea* in flower, and with a flower open for scrutiny, are quite reduced in the field. The relative abundance of individuals and the relative paucity of flowers explain the large numbers

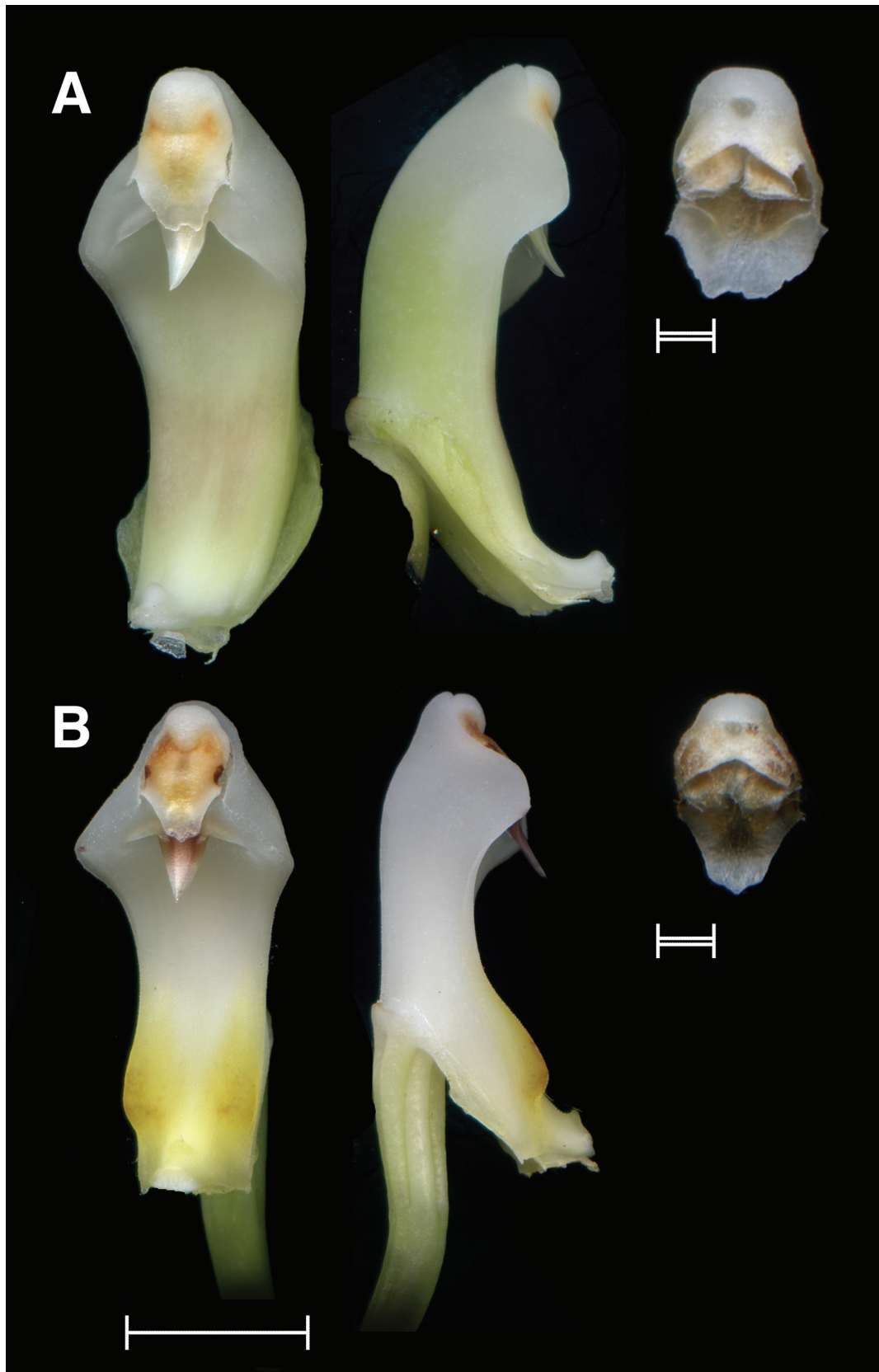


FIGURE 7. **A–B.** Comparison between the columns and the anther caps of *Daiotyta albicans* (**A**) and *D. rhodotyla* (**B**). **A**, *Bogarín* 6261; **B**, *Pupulin* 4372. Single bar = 1 cm; double bar = 1 mm. Photographs by F. Pupulin.

of sterile and undetermined plants of *Dichaea* found in any major herbarium, and perhaps the apparent "rarity" of some species as well.

During the last 10 years, scientists at the Lankester Botanical Garden, University of Costa Rica, have been engaged in a progressive evaluation of the taxonomic status and identity of *Dichaea* species in several American regions, with particular emphasis on the floras of Costa Rica and Ecuador. In the wake of this scrutiny, a number of the examined taxa remain to be fully understood by science or taxonomically clarified. Here I describe two new species of *Dichaea* sect. *Dichaea* from Costa Rica and Ecuador, and two new large species of sect. *Pseudodichaea* from the latter country. Furthermore, I discuss the identity of two other taxa of sect. *Pseudodichaea*; the South American *D. calyculata* Poepp. & Endl. (reducing *D. caveroi* into its synonymy); *D. dressleri* Folsom, previously known only from the original collection made in Panama, of which I present a new record and a complete botanical illustration based on a specimen from Costa Rica; and *D. fragrantissima* subsp. *eburnea*, which I propose here to treat at the specific rank.

#### DICHAEA SECT. DICHAEA

##### 5. *Dichaea elvirae* Pupulin, *sp. nov.*

TYPE: COSTA RICA. Puntarenas: Coto Brus, Sabalito, Zona Protectora Las Tablas, 13 km al noreste de Lucha, Sitio Coto Brus, entre Río Surá y Quebrada Sutú, Finca de Miguel Sandí, 8°56'46.1"N, 82°44'30.9"W, 1778 m, bosque pluvial montano bajo, epífitas en potreros arbolados, 6 Junio 2010, *D. Bogarín* & *A. P. Karremans* 7702 (Holotype: JBL). Fig. 8, 9A–B, 10.

*Species ad sectionem Dichaeam pertinens, ab omnibus speciebus generis Dichaeae Lindl. labello sessili callo magno totam basim replenti, hoc carina media humilis duabusque fossis lateralibus parvis vadis concavis notato distinguitur.*

Epiphytic, caespitose, pendent herb, suberect when young, up to 16 cm tall. *Roots* slender, flexuous, whitish, the apices green, ca. 1 mm in diam., produced from the short rhizome and the lower nodes of the stem. *Stem* terete (appearing strongly flattened by the shape of the sheaths), frequently branching, foliaceous, with 2 rows of alternate leaves, completely covered by the base of the leaf sheaths; sheaths subrectangular, conduplicate, ancipitous, somewhat loose, whitish green suffused with rose-purple, the veins neatly visible, marked pale purple, continuous with the leaf (non articulate). *Leaves* narrowly lanceolate, acute, minutely and finely apiculate abaxially, the midvein quite prominent on the underside, pale to medium green, sometimes suffused with pale purple on the lower surface, particularly on the midvein, the margins slightly convolute, minutely ciliate toward the apex, 2.0–3.2 × 4–6 mm, axially twisted to arrange dorsiventrally parallel to the stem, nonarticulate to the sheaths, so drying and rooting in place when old, eventually dissolving. *Inflorescence* single-flowered, produced singly or in groups of 2–3 flowers opening simultaneously or subsimultaneously, exerted from the axils of the leaves and flowering under the foliage, ca. 1 cm long; peduncle terete, provided with a minute, basal, triangular

bract ca. 2 mm long. *Floral bract* double, glumaceous, the outer bract broadly ovate, subacuminate, cucullate, 4.6 × 3.3 mm, the inner bractlet narrowly lanceolate, 2.5 × 0.5 mm. *Pedicellate ovary* terete-subclavate, round in section, echinate, 2 mm long, completely covered by dense, long, soft, papillose hairs, becoming stiff from a rounded, cuspidate base during maturation of the fruit. *Flowers* small for the genus, not completely spreading, exhibiting temporal activity during the 3–4 days of anthesis, the sepals and petals pale greenish yellow, flushed with chestnut brown along the veins, abaxially longitudinally flushed with brown along the middle, the lip white, the proximal half bright yellow, the column white with purple bands on the sides of the stigmatic cavity, the anther white, blotched with red on the sides of the apical margin or completely red. *Dorsal sepal* ovate acute, abruptly subacuminate, concave, the margins irregularly and minutely ciliate, 5-veined, the midvein keeled and microscopically erose abaxially, 4.8–5.0 × 3.0–3.2 mm. *Lateral sepals* obliquely asymmetrically ovate, acute, concave, the margins irregularly and minutely ciliate, 7-veined, the midvein keeled and microscopically erose abaxially, 5.2–5.8 × 3.3–3.5 mm. *Petals* lanceolate, abruptly subacuminate, the margins minutely ciliate, 3-veined, 5.0 × 2.6–2.8 mm. *Lip* sessile, obscurely 3-lobed, the hypochile transversely elliptic, fleshy-thickened, 3.5 × 5.8 mm, the epichile broadly sagittate-anchoriform, concave, broadly rounded at the apex, provided with a short, obtuse apicule, 5.5 × 2.5 mm, the apical margin microscopically papillose-ciliate, the lateral lobes short, rounded; the basal callus cushionlike, occupying the whole hypochile, bright yellow, 2.7 × 1.0 mm, with a low central keel flanked by 2 rounded, shallowly concave depressions. *Column* hemiterete, short, stout, suberect, 3.2 mm long, provided with a short, triangular, minutely papillose substigmatic ligule ca. 1 mm long; the clinandrium subcucullate, shallow, with thickened walls; the stigma transversely elliptic, the anther incumbent. *Anther cap* transversely reniform, subcucullate, shallowly 2-celled. *Pollinia* 4, transversely elliptic-complanate, in 2 superposed pairs of different size, on a elliptic-pyriform stipe and a triangular, hyaline viscidium. *Fruit* echinate, subspherical, ca. 1 × 1 cm.

**Additional specimens examined:** COSTA RICA. Puntarenas: Coto Brus, Sabalito, Zona Protectora Las Tablas, 13 km al noreste de Lucha, Sitio Coto Brus, entre Río Surá y Quebrada Sutú, Finca de Miguel Sandí, 8°56'46.1"N, 82°44'30.9"W, 1778 m, bosque pluvial montano bajo, epífitas en potreros arbolados, 20 abril 2010, *A. P. Karremans* & *J. Gemmel* 5359 (JBL); same locality and date, *A. P. Karremans* & *J. Gemmel* 5360 (JBL).

**Eponymy:** named for my wife Elvira Salas Hidalgo, to recognize her extraordinary contribution improving all aspects of my life and my work.

**Distribution:** currently known only from the southern, Pacific slopes of the Talamanca mountain range in Costa Rica, where populations have been found at 1700–1800 m elevation (Map 3). Because of the close proximity of the *locus typicus* to the border with Panama, the species is surely to be found in this country as well.

**Habitat and ecology:** populations of *Dichaea elvirae*

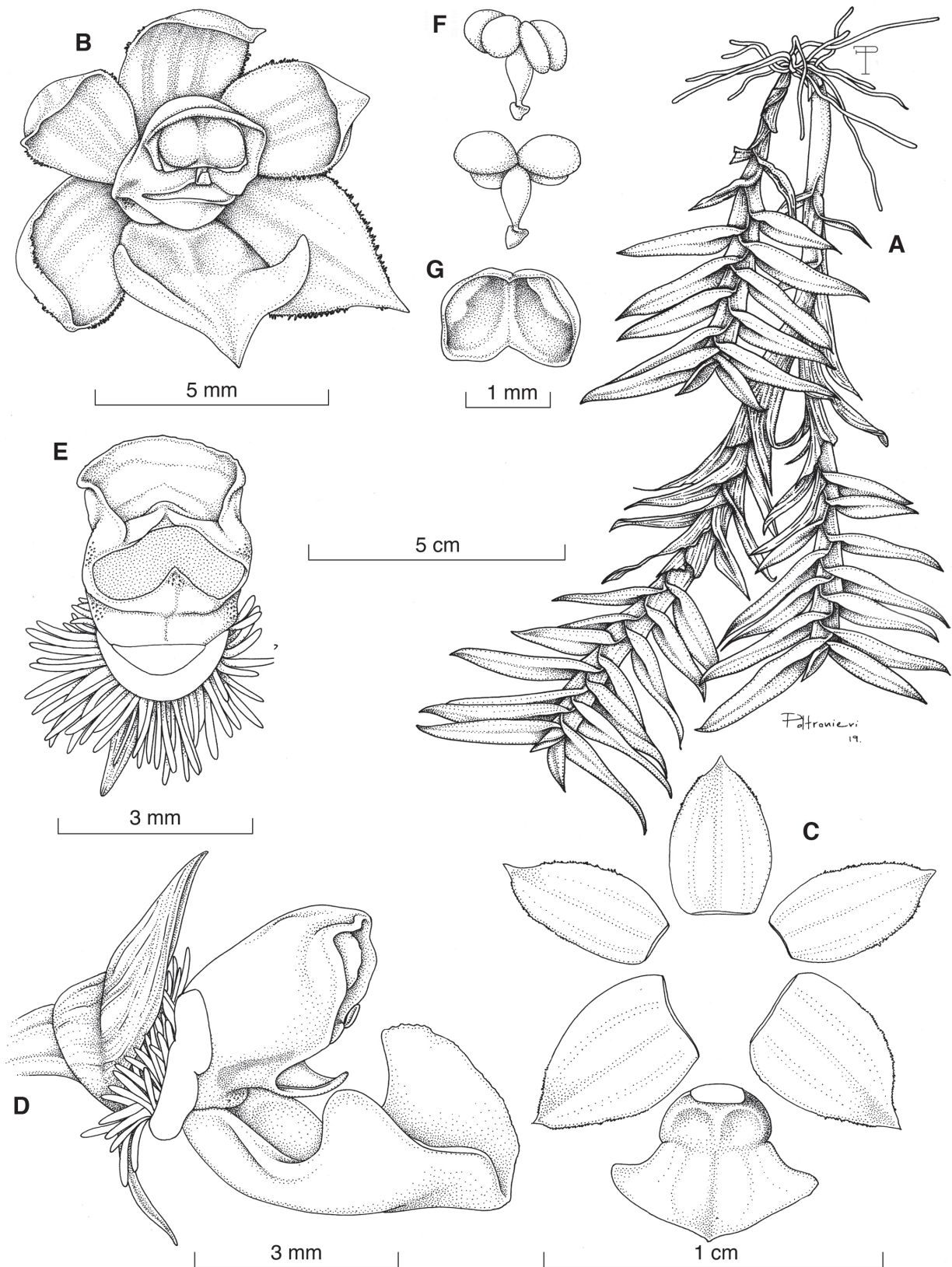


FIGURE 8. *Dichaea elvirae* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, ventral view; **F**, pollinarium (two views); **G**, anther cap. Drawn by F. Pupulin and S. Poltronieri from the holotype.



MAP 3. Distribution of *Dichaea elvirae*.

have been found growing epiphytically in shaded and partially exposed spots, in secondary mature vegetation and margins of primary woods, and in the lower mountain rainforest of the southern slopes of Talamanca mountain range in southern Costa Rica. Flowering has been recorded sporadically from August to December, with an apparent peak in August–September.

The flowers of *Dichaea elvirae* are most similar to those of a group of species close to the Jamaican *D. graminoides* (Sw.) Lindl, a species of sect. *Pseudodichaea* that has been traditionally treated as a widespread taxon ranging on the mainland at least from Mexico to the Guyanas and Colombia in South America. The species has never been documented from Costa Rica, and recent work on the “*Dichaea graminoides*” complex (Archila Morales and Chiron, 2015; Chiron et al., 2016) suggests that the species described by Swartz could be a strictly Antillean endemic, whereas several distinct taxa could be recognized in Central America as well as in northern South America. The combination of the habit with nonarticulate leaves (typical of sect. *Dichaea*), together with a lip provided with a large, cushionlike callus that occupies all of the proximal portion of the lip, made *D. elvirae* unique within the genus. The elevated callus presents two shallow, rounded cavities on the sides of a low, median keel that runs up to the callus front to merge into the lamina (Fig. 10). Whereas in most species of *Dichaea* the lip presents a distinct basal claw, which connects with the terminal, transversely triangular lamina, and may be quite long (as in *D. cogniauxiana* Schltr.), in a few taxa, it is distinctly sessile as in *D. elvirae* (i.e., *D. ancoragebia* C. Schweinf., *D. australis* Cogn., *D. campanulata* C. Schweinf., *D. graminoides*, *D. integrilabia* Valsko, Krahl & Chiron, *D. melunae* Archila & Chiron, *D. peruviansis* D.E.Benn. & Christenson, and *D. trichocarpa* (Sw.) Lindl.). Also, whereas the typical condition for the genus is that the hypochile is flat or slightly concave, a few species present

a keel or thickening at the base, sometimes running to the midportion of the lip, where the keel merges with the blade (i.e., *D. camaridioides* Schltr., *D. graminoides* (Sw.) Lindl., *D. hystricina* Rchb.f., *D. longipedunculata* D.E.Benn. & Christenson, *D. morrisii*, *D. tenuifolia* Schltr., and *D. tuerckheimii* Schltr.). Nevertheless, only in *D. graminoides* (which belongs to another section of the genus) is the general morphology of the lip somewhat comparable to that of *D. elvirae*, but in the latter the cushionlike callus completely occupies the hypochile, whereas in *D. graminoides* it is reduced to a central, raised, quite-sharp keel, decurring laterally toward the edges of the lateral lobes.

In the photograph of a *Dichaea* species from Escobar and collaborators’ series on Colombian orchids (Escobar, 1990), the lip looks quite similar to *D. elvirae* for the presence of a yellow basal callus on a flower produced by an apparently small-sized plant with nonarticulate leaves. The species was identified as *D. camaridioides* Schltr. (Escobar, 1990:115, upper photo; Morales et al., 2015), but in this species, the hypochile is thin, not thickened, and only in the central part of the disc there is a low keel running to the insertion of the epichile (Mansfeld, 1929).

#### 6. *Dichaea pseudohystricina* Pupulin & Neubig, *sp. nov.*

TYPE: ECUADOR. Without collecting locality, flowered in cultivation in the collection of Ecuagenera at Gualaceo, accession CIOA-000470 (Holotype: CIOA; Isotype: CIOA-spirit) Fig. 9C, 11.

*Species sectionis Dichaeae, a Dichaea hystricina* Rchb.f. *similissima, sed caulibus plerumque ramosis, foliis axialiter semper tortis, inflorescentiis multo brevioribus, sepalis abaxialiter glabris, hypochilo multo latiore ecalloso, epichili lobulis lateralibus triangularibus brevis rotundatis.*

Epiphytic, caespitose *herb* forming a mass of suberect to pendent, branched stems, up to 15 cm tall. *Roots* slender, flexuous, whitish, the apices green, ca. 0.7 mm in diam., produced from the short rhizome and the lower nodes of the stem. *Stem* terete (appearing slightly flattened by the shape of the sheaths), frequently branching, foliaceous, with 2 rows of alternate leaves, completely covered by the base of the leaf sheaths; sheaths subrectangular, conduplicate, slightly dilated at apex, long-ciliate along the margins, pale green continuous with the leaf (nonarticulate). *Leaves* lanceolate-elliptic, acute, abaxially provided with a minute apicule, medium green, densely ciliate along the margins, 4.5–9.0 × 2.0–2.5 mm, axially twisted to arrange dorsiventrally parallel to the stem, nonarticulate to the sheaths, so drying and rooting in place when old, eventually dissolving. *Inflorescence* single-flowered, produced singly, exerted from the axils of the upper leaves and flowering under the foliage, 3–4 mm long; peduncle terete, provided with a basal, triangular, adpressed bract ca. 0.5 mm long. *Floral bract* double, glumaceous, the outer bract cumulate, transversely ovate, acute, 1.5 × 2.2 mm, the inner bractlet narrowly lanceolate, 2.0 × 0.5 mm. *Pedicellate ovary* terete-subclavate, round in section, echinate, 2.2 mm long, apically covered by dense, long, soft, papillose hairs. *Flowers* of average size for the genus, spreading, without temporal activity, the sepals and petals cream, transversely striped

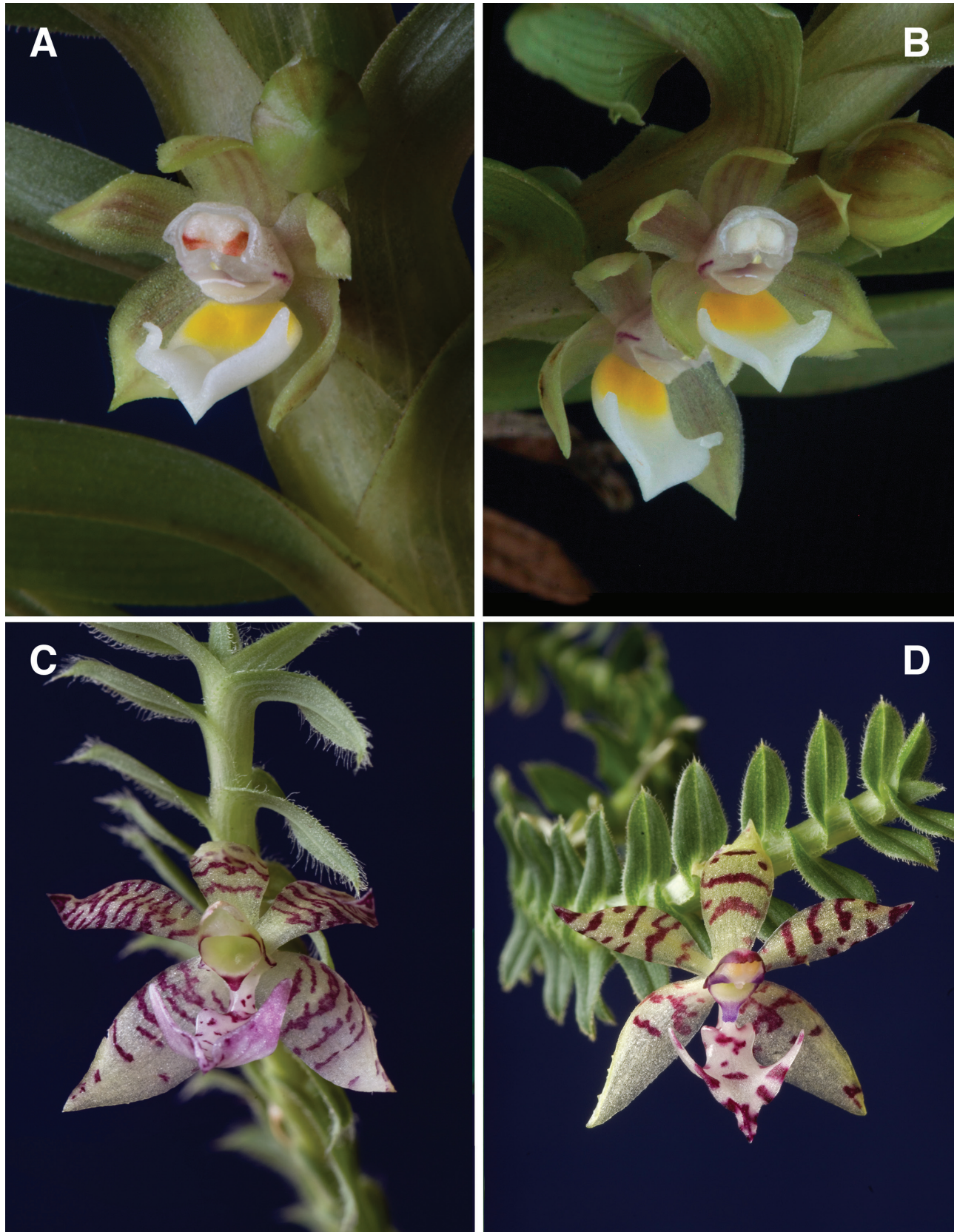


FIGURE 9. **A–D.** Species of *Dichaea* sect. *Dichaea*. **A–B,** *Dichaea elyirae* (Bogarín 7702 and Karremans 5359); **C,** *D. pseudohystricina* (CIOA-000470); **D,** *D. hystricina* (CIOA-000779). Photographs by F. Pupulin.



FIGURE 10. Lip of *Dichaea elvirae* in three-quarter, frontal, and lateral views. Microphotographs by F. Pupulin.

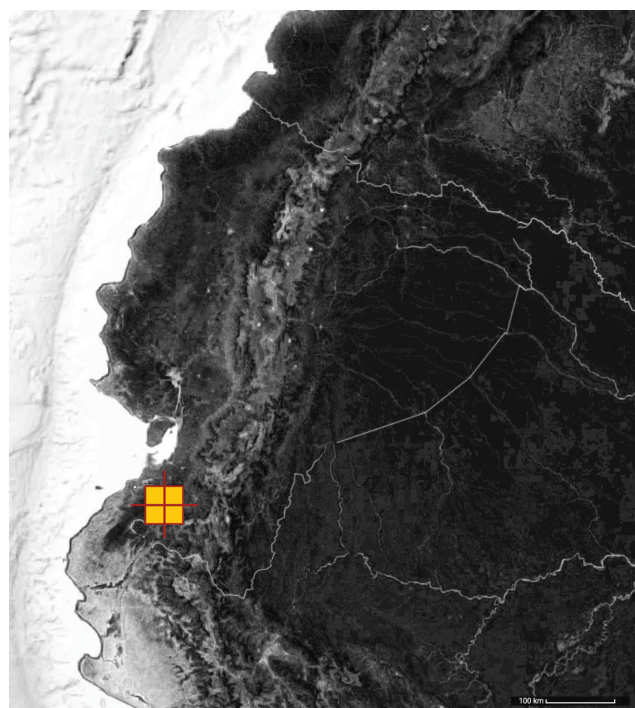
with purple-violet, the lip white, spotted and blotched with violet, particularly toward the ends of the midlobe extensions, the column greenish white, flushed with purple bands on the sides of the stigmatic cavity and the ligule, the anther white, becoming pale brown with age. *Dorsal sepal* narrowly elliptic, acute, concave, 3-veined, 15.0 × 3.0–3.5 mm. *Lateral sepals* obliquely asymmetrically elliptic, acute, concave, 5-veined, 15.0 × 5.5–6.0 mm. *Petals* oblanceolate from a short claw, acute to abruptly subacuminate, 3-veined, 10 × 4 mm. *Lip* shortly unguiculate, 3-lobed, 10 × 10 mm, the rectangular claw ca. 1 mm long, with a longitudinal, low, median keel, the hypochile subrectangular, humerate, thickened, the epichile sagittate-anchoriform, rounded, minutely apiculate, the lateral lobes narrowly triangular, rounded. *Column* hemiterete, suberect, broadest toward the base, 4.5 mm long, provided with a short, triangular, retrorse, minutely papillose substigmatic ligule ca. 0.7 mm long; the clinandrium subcucullate, shallow, with thin, irregularly denticulate walls; the stigma transversely elliptic, the anther incumbent. *Anther cap* transversely broadly elliptic, subcucullate, recuse, shallowly 2-celled. *Pollinia* 4, transversely ovate-complanate, in 2 superposed pairs of different size, on a narrowly ligulate stipe and a pelatet, hyaline viscidium. *Fruit* not seen.

**Additional specimens examined:** ECUADOR. El Oro: Around Villa Seca, 3°49'52.54"S, 80°01'25.28"W, 650 m, growing epiphytically, December 2016, grown in the collection of Ecuagenera, H. Medina 198 (CIOA).

**Etymology:** from the Greek *pseudo-*, “false, resembling,” in reference to its deceptive similarity to *D. hystricina*.

**Distribution and ecology:** known only from the pre-montane, warm regions along the western slopes of the Andes in southern Ecuador, at about 600–700 m of elevation (Map 4). The species flowers in cultivation from December to March, but it is probable that new flowers can be produced year-round as the new shoots reach maturity.

The discovery of new, cryptic species through comparison of DNA sequences has been evoked as one of the potential by-products of molecular analyses of the Orchidaceae. Actually, the probability of revealing new taxa through a random sampling of individuals, both collected or cultivated, in any given orchid genus is quite low. Even in a genus like *Stelis* Sw., likely one of the most diverse genera in the family with 1282 valid species recognized today, 645 of which have been described in the last 16 years (Damián and Karremans, 2016; Karremans 2016; Luer 2106a,b,



MAP 4. Distribution of *Dichaea pseudohystricina* in Ecuador.

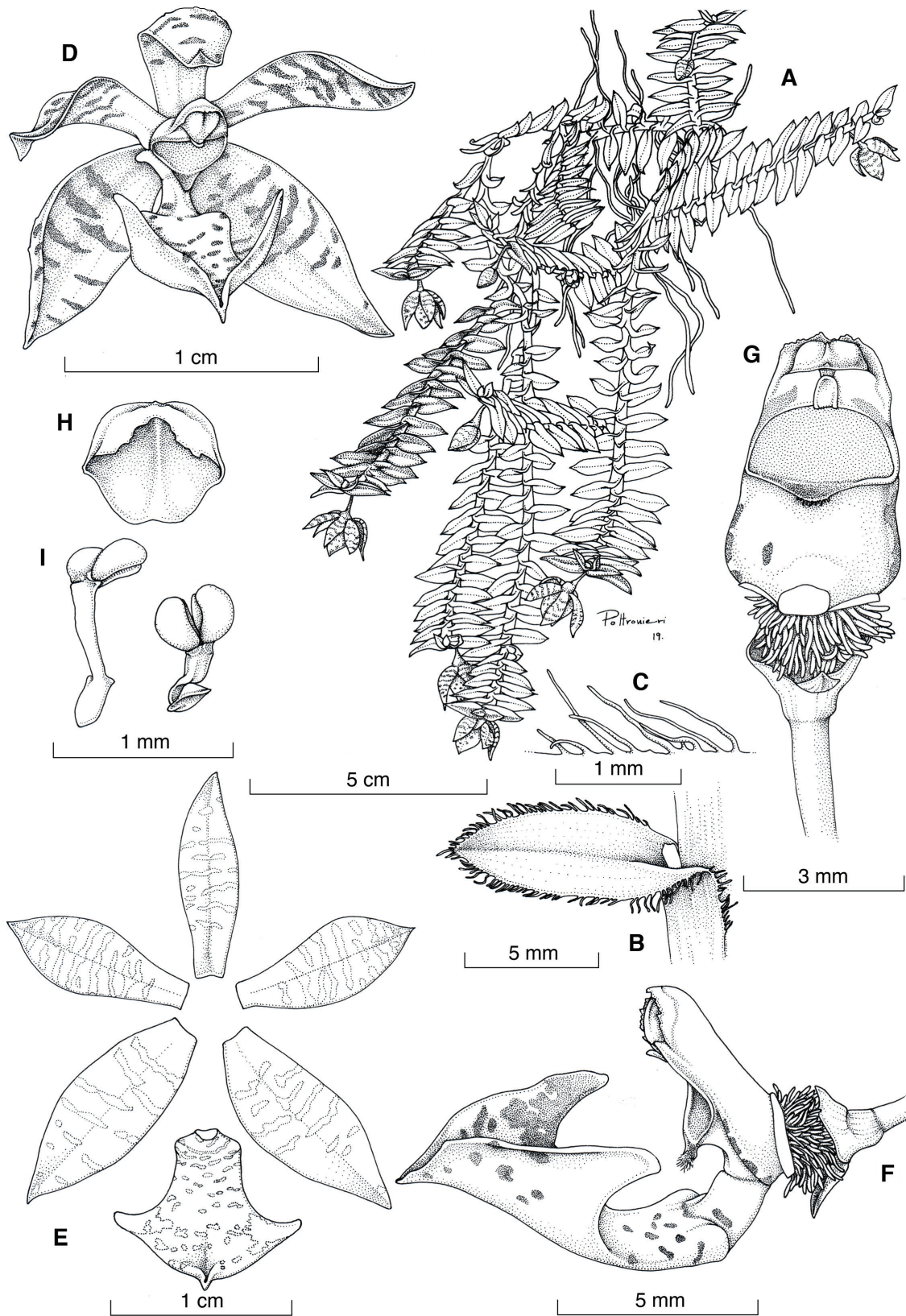


FIGURE 11. *Dichaea pseudohystricina* Pupulin & Neubig. A, habit; B, leaf; C, margin of the leaf; D, flower; E, perianth; F, column and lip, lateral view; G, column, ventral view; H, anther cap; I, pollinarium (two views). Drawn by F. Pupulin and S. Poltronieri from the holotype.

2107a,b, 2108a,b; Collantes et al., 2017; Karremans and Díaz-Morales, 2017), the astonishing number of individual plants would prevent any attempts at finding new species by chance through a blind sample of unassessed specimens. Pupulin et al. (1991) accounted for 295 individuals of *Stelis*, likely belonging to 5 morphospecies, on a single, medium-sized *Protium* sp. tree in the Reserva Forestal de San Ramón, Costa Rica (today Alberto M. Brenes Biological Reserve). Given the frequency per hectare of suitable phorophytes and the size of the Reserve (7800 ha), one may easily assume that this single protected area alone in Costa Rica can host more than 200 million plants of *Stelis*, certainly not a manageable size for any random trial. It was therefore rather surprising that a new, cryptic species of *Dichaea*, at first sight morphologically undistinguishable from the widespread and variable *D. hystricina* Rchb.f., could be effectively discovered thanks to the molecular analyses carried out by Kurt Neubig in the framework of his phylogenetic studies on the genus (Neubig et al., 2009). Whereas the three accessions of *D. hystricina* from Costa Rica grouped together in the phylogenetic tree, two specimens from Ecuador (*Neubig 6–2006* and *Whitten 2329*, both at FLAS) grouped together on a sister branch with high statistical support (as *D. sp. nov. 1* and *D. sp. nov. 2* in Neubig et al., 2009, fig. 2–3). I had the opportunity to study one of the plants that served as a voucher for the molecular analyses, and under a closer scrutiny *D. pseudohystricina* may be distinguished from its widespread relative by a set of morphologically diagnosable features. The stems of *D. pseudohystricina* are freely branching, contrasting with the mostly simple stems of *D. hystricina*; the leaves are always axially twisted, whereas in the latter species they are often spreading horizontally from the stem, so that it does not have a distinct “front”; the inflorescences are distinctly shorter (2.2 vs <10 mm); the sepals are glabrous, vs. abaxially covered with sparse warts; the hypochile is much broader, thickened but without the lateral knobs characteristic of *D. hystricina*; and the lateral lobes of the epichile are triangular, rounded, vs. narrowly triangular-filiform, acuminate, and retrorse.

Populations of the true *Dichaea hystricina* also exist in Ecuador. In the collection of Ecuagenera at Gualaceo, I documented a specimen that vouchers the species for that country:

**ECUADOR.** Esmeraldas: El Cristal, *legit* L. Lapo, 2000, accession No. CIOA-000779, 17 June 2008, *F. Pupulin 7064* (CIOA) (Fig. 9D).

#### DICHAEA SECT. PSEUDODICHAEA

The Swedish botanist Olof Peter Swartz (1760–1818) first described from Jamaica a stout plant of *Dichaea* with large, articulated leaves and large, fleshy flowers in 1799, as *Cymbidium muricatum* (Swartz, 1799, 1806). The relatively poor specimen conserved among the primary set of Swartz’s collections at the Swedish Museum of Natural History in Stockholm favored a general misunderstanding of his specific concept, and the name *Dichaea muricata* (Sw.) Lindl. was subsequently utilized in floristic treatments all over the Neotropics to refer to completely different species, belonging to a different section of the genus *Dichaea*.

With the discovery of a perfect type specimen among the Swartzian collections kept in the Reichenbach Herbarium in Wien (Pupulin, 2008), it became obvious that the traditional interpretations of the identity of *Cymbidium muricatum* were untenable and that the name coined by Swartz was the first valid and legitimate name for the species known in taxonomic literature as *D. morrisii* Fawc. and Rendle (1910), whose type also come from Jamaica. In order to avoid the necessity of correcting the established nomenclature used in the floristics of the Neotropical region, as well as the hundreds of specimens of large *Dichaea* of sect. *Dichaeopsis* annotated in the herbaria around the world, the latter name was conserved against the original one proposed by Swartz (Dressler and Folsom, 2005). With a proper typification of *Cymbidium muricatum* at hand, it became also clear that the diversity of *Dichaea* of sect. *Dichaeopsis*, relative to the identity of populations with tall plants and large flowers, had been grossly underestimated. In 2006, Robert Dressler and collaborators described two new Mesoamerican taxa of *Dichaea* with caducous leaves, *D. globosa* Dressler & Pupulin and *D. fragrantissima* subsp. *eburnea* Dressler & Pupulin (Dressler et al., 2006). The authors favored at that time the treatment of populations with immaculate flowers as a subspecies of *D. fragrantissima*, but the study of literally hundreds of individuals, and the documentation of a large number of them, without finding any evidence of intermediate forms blending into subsp. *fragrantissima* convinced me that the common taxon widespread on the Atlantic forest from Costa Rica to Panama deserves specific recognition. I am recognizing it here at the specific rank as follows:

**7. *Dichaea eburnea*** (Dressler & Pupulin) Endrés ex Pupulin, *comb. et stat. nov.*

Basionym: *Dichaea fragrantissima* subsp. *eburnea* Dressler & Pupulin, *Novon* 16(3): 340. 2006.

TYPE: COSTA RICA. Alajuela: San Ramón, Res. Biol. A. M. Brenes, fl. in cult. at Jard. Bot. Lankester, 13 June 2000, *M. Blanco 513* (Holotype: USJ). Fig. 12A.

Together with *Dichaea trulla* Rchb.f., this is the most common species of *Dichaea* sect. *Pseudodichaea* along the Caribbean drainage of the Costa Rican cordilleras, from where it ranges south to the Atlantic slopes of the Talamanca mountain range in Panama (Dressler et al., 2006; Bogarín et al., 2014). Both these species with large habit and flowers were beautifully illustrated from Costa Rica in Endrés’s early drawings (Pupulin et al., 2013). Endrés also proposed to his scientific mentor the name “*Dichaea eburnea*” and prepared a detailed botanical description of the new taxon, but Reichenbach never published it. In describing *D. fragrantissima* subsp. *eburnea*, Dressler et al. (2006) cited among the paratypes a Nicaraguan specimen (*Pipoly 5156*) from Cerro el Hormiguero. At that time, I had not seen the actual specimen at MO, but I realized that this same specimen was illustrated by Hamer in his treatment of the orchids of Nicaragua for *Icones Plantarum Tropicarum* (Hamer, 1982: pl. 654). The drawing by Hamer unequivocally shows a specimen of *D. morrisii*, with flowers marked with violet stripes and the lateral lobes of the lip reflexed. In his chapter

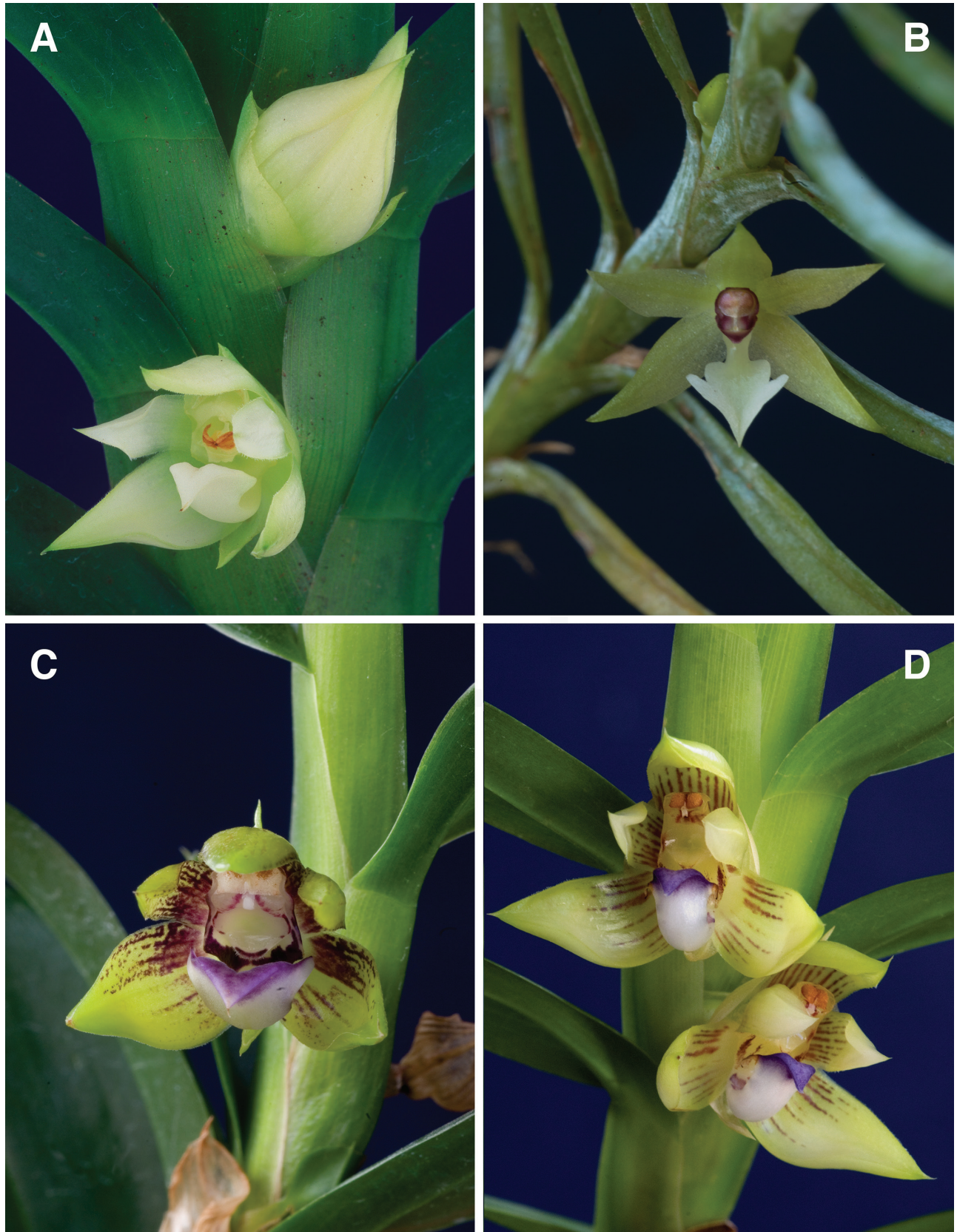
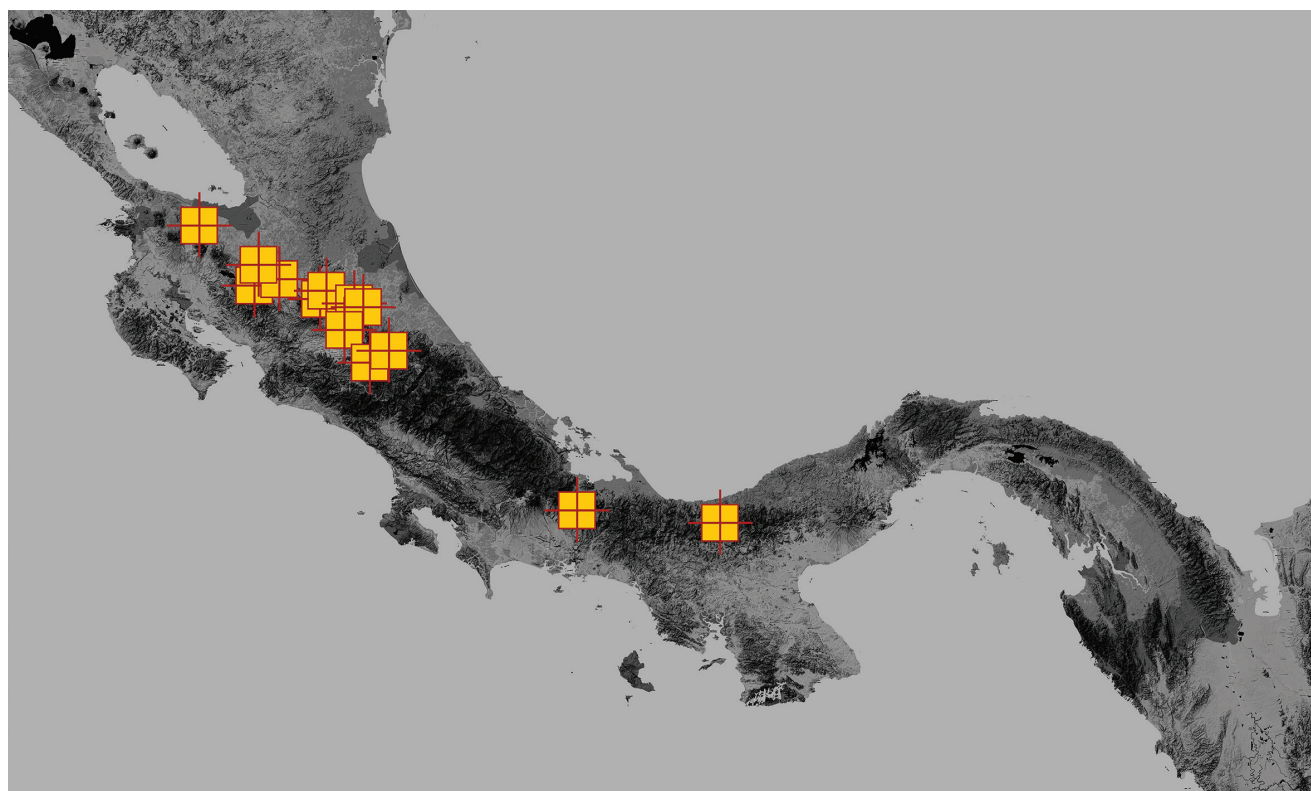


FIGURE 12. A–D. Species of *Dichaea* sect. *Pseudodichaea*. A, *Dichaea eburnea* (Blanco 513); B, *D. dressleri* (Pupulin 8343); C, *D. morrisii* (Pupulin 6552); D, *D. amazonica* (Pupulin 6978). Photographs by F. Pupulin.

MAP 5. Distribution of *Dichaea eburnea*.

of Orchidaceae for *Flora de Nicaragua*, Hamer (2001) still records this specimen as the only voucher of this taxon collected in Nicaragua, and in the absence of any further evidence, I exclude the presence of *D. eburnea* from that country.

**Distribution:** Costa Rica and Panama, at elevations between 200 and 1600 m (Map 5).

I will also take the opportunity to record for the first time the presence of *Dichaea dressleri* Folsom in Costa Rica. Until now exclusively known from the provinces of Chiriquí and Veraguas in Panama, *D. dressleri* is here recorded for the flora of Costa Rica on the basis of a collection from the vicinity of Buenos Aires in the southern region of the country, along the Pacific slopes of the Talamanca mountain chain.

8. *Dichaea dressleri* Folsom, Novon 16: 336. 2006.

TYPE: PANAMA. Chiriquí: forest near Fortuna Lake, just beyond bridge, 1100 m, 9 Apr. 1995, J.P. Folsom 11278A (Holotype: PMA; Isotypes: HNT, MO).

Among the species of sect. *Dichaeopsis*, characterized by the leaves articulated with the sheaths that cover the stem, *Dichaea dressleri* is most similar to *D. gracillima* C. Schweinf., known only from the type collection (Pupulin, 2007, 2010), from which it is distinguished by the shorter leaves and the larger flowers with a long-unguiculate lip

and short, retrorse lateral lobes. In habit, it also resembles *D. gomez-lauritoi* Pupulin, from the Caribbean belt of the Central Cordillera in Costa Rica, but the latter species has a muricate ovary (vs. glabrous in *D. dressleri*) and much wider sepals and petals, with a length:width ratio close to 3:7 (vs. 2:8), a lip cuneate at the base (vs. distinctly humerate), and a white gynostemium provided with an upward, apically hirsute ligule (vs. solid purple, the glabrous ligule projecting downward).

*Dichaea dressleri* is illustrated here on the basis of the following material:

**COSTA RICA.** Puntarenas: Buenos Aires, Buenos Aires, between Santa Rosa and Convento, shores of Quebrada Santa María, confluent of Río Cañas, 9°15'3.797"N, 83°22'33.968"W, 824 m, premontane wet forest, epiphytic on trees along the creek, 20 March 2013, F. Pupulin 8343, D. Bogarín, J. Cambroneró & A.P. Karremans (JBL) (Fig. 12B, 13, 14).

**Distribution:** Costa Rica and Panama, at elevations between 800 and 1200 m (Map 6).

With the additions of *Dichaea elvirae* and *D. dressleri*, as well as the recently described *D. auriculata* Pupulin & Karremans (in press) to the species recorded for the flora of Costa Rica, it could be useful including them all in a key to the species of the genus in Costa Rica:

KEY TO THE COSTA RICAN SPECIES OF *DICHAEA*

- 1a. Plants with articulate leaves, eventually deciduous; the peduncle usually straight; the hypochile of the lip glabrous ..... 2  
 1b. Plants with persistent leaves, rotting in place; the peduncle usually geniculate; the hypochile of the lip frequently ciliate along the margins ..... (sect. *Dichaea*) 15  
 2a. Ovary glabrous ..... 3  
 2b. Ovary muricate ..... (sect. *Pseudodichaea*) 8

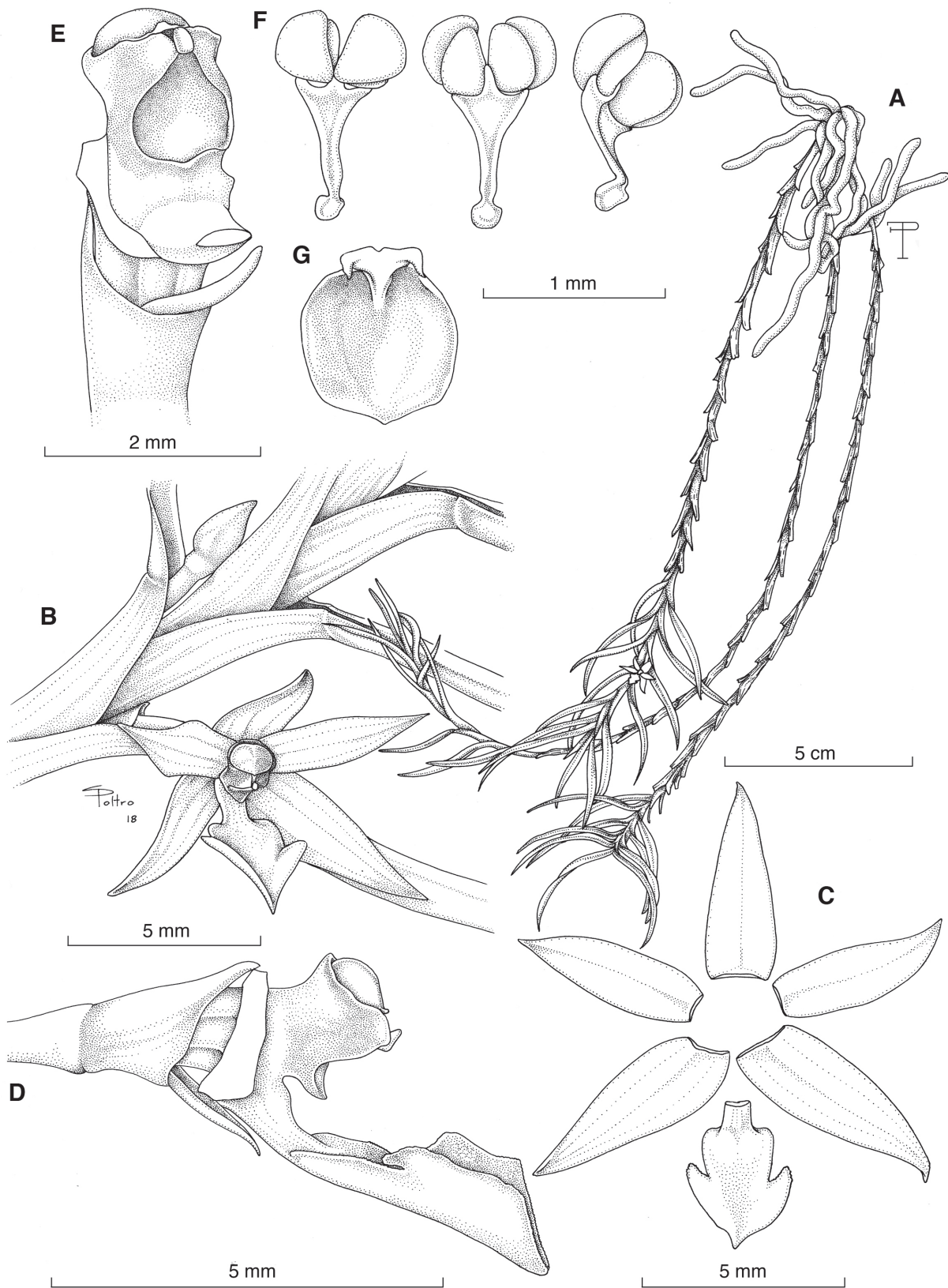


FIGURE 13. *Dichaea dressleri* Folsom. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, frontal and three-quarter views; **F**, pollinarium (three views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from *Pupulin 8343* (JBL).

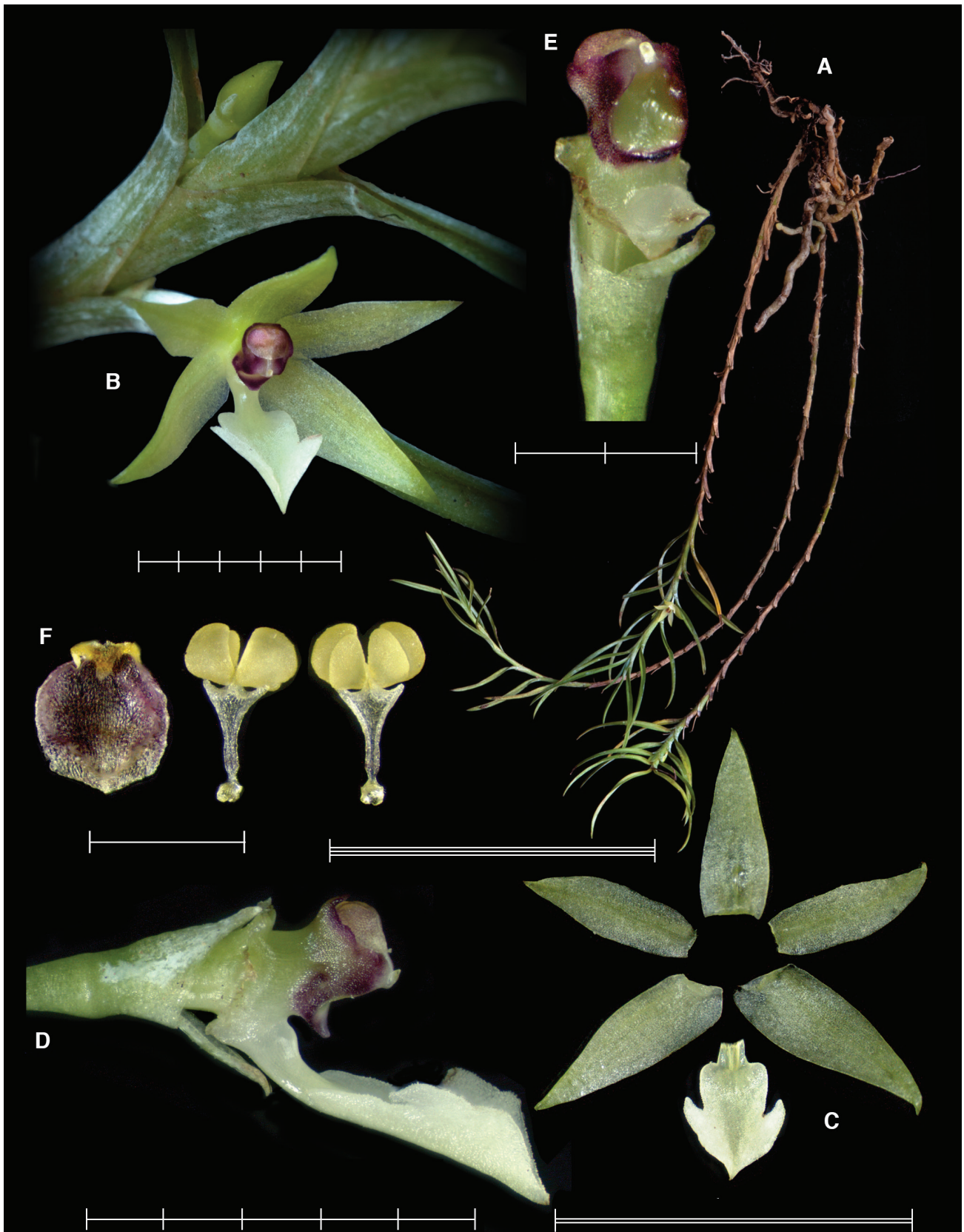


FIGURE 14. Lankester Digital Composite Plate of *Dichaea dressleri* Folsom. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, frontal and three-quarter views; **F**, pollinarium (three views) and anther cap. Single bar = 1 mm; double bar = 1 cm; triple bar = 1 dm. Prepared by F. Pupulin from *Pupulin 8343* (JBL).

KEY TO THE COSTA RICAN SPECIES OF *DICHAEA* CONT.

- 3a. Stems flattened; roots thick, produced only at the base of the stem; leaves ovate-elliptic, >7 mm wide . . . . . 4  
 3b. Stems terete; roots slender, basal and caulinar (the latter often cryptic within the leaf sheaths); leaves narrowly ligulate, <5 mm wide . . . . . 5  
 4a. Plants spreading to pendent; mature leaves <25 mm long; inflorescences produced in succession; flowers greenish white, variously spotted/  
 blotched with purple-red; petals much wider than sepals . . . . . *D. panamensis*  
 4b. Plants erect; mature leaves >40 mm long; inflorescences produced simultaneously; flowers ivory white; petals smaller than  
 sepals . . . . . *D. glauca*  
 5a. Plant tall, the stems up to 1 m long; leaves >7 cm long . . . . . *D. trulla*  
 5b. Plant small, the stems mostly <25 cm long; leaves <5 cm long . . . . . 6  
 6a. Lip with distinct, rounded auricles at the base . . . . . *D. auriculata*  
 6b. Lip sagittate, without basal auricles . . . . . 7  
 7a. Lateral sepals asymmetrically ovate, much broader than the dorsal sepal; epichile half the length of the hypochile . . . . . *D. gracillima*  
 7b. Lateral sepals lanceolate, subequal in width to the dorsal sepal; epichile as long as the hypochile . . . . . *D. dressleri*  
 8a. Plants small, with leaves <40 mm long and 7 mm wide; flowers membranaceous, spreading; margins of sepals and petals glabrous . . . . . 9  
 8b. Plants large, with leaves >50 mm long and 10 mm wide; flowers fleshy, not completely spreading; margins of sepals and petals ciliate . . . . . 13  
 9a. Stems borne suberect to erect, becoming arcuate with age; flowers very fragrant; sepals long-acuminate; epichile as wide as long;  
 infrastigmatic ligule glabrous . . . . . 10  
 9b. Stems borne pendent; flowers faintly fragrant or scentless; sepals acute to shortly acuminate; epichile much wider than long; infrastigmatic  
 ligule apically pubescent . . . . . 11  
 10a. Flowers ivory white, the stigmatic rim pale rose; flowers boldly blotched with purple; lateral lobes of the epichile triangular . . . . . *D. lankesteri*  
 10b. Flowers pale pink, spotted purple at the base of sepals and petals, the lip apically rose, the stigmatic rim purple; lateral lobes of the epichile  
 falcate . . . . . *D. amparoana*  
 11a. Leaves >4 (to 7) mm wide; flowers sparsely and finely spotted with pink; epichile truncate, the lateral lobes to 1.5 mm long. . . . . *D. elliptica*  
 11b. Leaves <3 mm wide; flowers concolorous white or boldly blotched with purple; the epichile obtuse to acute, the lateral lobes  
 2–3 mm long . . . . . 12  
 12a. Flowers white; sepals <6 mm long; lip with a short claw, 4.5 × 6 mm when spread, the lateral lobes rounded . . . . . *D. gomez-lauritoi*  
 12b. Sepals and petals greenish white blotched with purple, sometimes solidly purple; sepals >6.5 mm long; lip sessile, 6.5 × 7–8 mm when  
 spread, the lateral lobes acuminate . . . . . *D. acrolephara*  
 13a. Lateral lobes of lip <2.5 mm long, oblong from obtuse angles; ligule of column subquadrate, truncate or bifid; petals sublanceolate,  
 narrowly acute, widest basally; flowers ivory white with greenish apices . . . . . *D. eburnea*  
 13b. Lateral lobes of lip >2.5 (to 6.0) mm long, reflexed, acuminate; ligule of column triangular; petals ovate to obovate, widest distally; flowers  
 green marked with red-purple . . . . . 14  
 14a. Petals oblong-ovate, widest near middle, acute; claw of lip ligulate, 1–3 mm wide distally, with a distinct callus at base; ligule of column  
 correct; sepals and petals marked with lines basally. . . . . *D. morrisii*  
 14b. Petals distinctly obovate, widest above middle, apiculate; claw of lip broadly obovate, 6–8 mm wide distally, without basal callus; ligule of  
 column deflexed; sepals and petals usually blotched, rarely solid green . . . . . *D. globosa*  
 15a. Ovary glabrous . . . . . 16  
 15b. Ovary echinate, provided with variously shaped trichomes . . . . . 17  
 16a. Plant laxly pendent, the stems rarely branching, the leaves brownish green, undulate along the margins; flowers campanulate, pale green,  
 unspotted; the lip anchor-shaped, with a central, low keel at the base . . . . . *D. viridula*  
 16b. Plant creeping, the stems freely branching, the leaves medium green, with flat margins; flowers spreading, greenish white, spotted violet;  
 the lip ovate, with two lateral, basal calli . . . . . *D. tuerckheimii*  
 17a. Mature plants small, <20 cm long; the hypochile provided with distinct calli . . . . . 18  
 17b. Mature plants medium to large, >20 cm long; the hypochile variously shaped, but never with basal calli . . . . . 19  
 18a. Margins of the leaves entirely ciliate; the hypochile provided with two lateral, rounded knobs . . . . . *D. hystricina*  
 18b. Margins of the leaves ciliate only toward the apex; the hypochile provided a base, cushionlike callus . . . . . *D. elvirae*  
 19a. Stems terete, the sheaths tightly clasping . . . . . 20  
 19b. Stems flattened, the sheaths more or less loose . . . . . 21  
 20a. Plants pendent, the stems pointing downward; leaves thin-textured; petals obovate . . . . . *D. acostae*  
 20b. Plants often creeping, the stems developing in all directions along tree trunk; leaves coriaceous to succulent; petals ovate to broadly  
 ligulate . . . . . 21  
 21a. Roots slender, < 0.5 mm in diam.; leaves coriaceous; base of the hypochile rounded, disk-shaped . . . . . *D. trichocarpa*  
 21b. Roots thick 1 mm in diam.; leaves succulent; base of the lip cuneate . . . . . *D. squarrosa*  
 22a. Apex of the pendent stem upcurving; leaves very thin-textured; flowers mostly produced below foliage; peduncle straight;  
 lip subentire . . . . . *D. pendula*  
 22b. Apex of the pendent stem not upcurving; leaves subcoriaceous; flowers always produced above foliage; peduncle geniculate; lip with  
 distinct lateral lobes . . . . . 23  
 23a. Petals obovate . . . . . 24  
 23b. Petals ovate to lanceolate-elliptic . . . . . 26  
 24a. Leaves >2 cm long; sepals abaxially aculeate; lip upcurved toward the column; ligule retrorse . . . . . *D. dammeriana*  
 24b. Leaves <1 cm long; sepals abaxially glabrous; lip straight; ligule pointing forward — 25

KEY TO THE COSTA RICAN SPECIES OF *DICHAEA* CONT.

- 25a. Mature plants forming intricate mats, the stems highly branching; hypochile subacute, adaxially plain. . . . . *D. obovatipetala*
- 25b. Mature plants long, pendent, the stems rarely branching; hypochile subtruncate, minutely apiculate, adaxially provided with low tubercles among the main veins toward the apex. . . . . *D. sarapiquinsis*
- 26a. Column without infrastigmatic ligule . . . . . *D. eligulata*
- 26b. Column with a ligule projecting from the lower lobe of the stigma . . . . . 27
- 27a. Leaves with cross veining between main longitudinal veins . . . . . 28
- 27b. Leaves without cross veining . . . . . 29
- 28a. Leaves medium green with 2–3 cross veins; stems freely branching, plants forming mats; hypochile obcuneate . . . . . *D. costaricensis*
- 28b. Leaves dark olive-brown with many cross veins; stems not branching; hypochile with distinct . . . . . *D. filiarum*
- 29a. Leaves olive brown, mostly retrorse; pedicel to 20 mm long; ligule bifid at apex . . . . . *D. oxyglossa*
- 29b. Leaves medium green, spreading; pedicel to 14 mm long; ligule entire, acute to truncate . . . . . 30
- 30a. Flowers with sepals and petals gray-orange, marked purple; lateral lobes of the epichile spreading; ligule truncate . . . . . *D. poicillantha*
- 30b. Flowers with sepals and petals greenish white, often marked violet; lateral lobes of the epichile retrorse; ligule acute . . . . . 31
- 31a. Leaves widely elliptic, usually overlapping; sepals spotted violet; hypochile with distinct shoulders . . . . . *D. cryptarrhena*
- 31b. Leaves lanceolate elliptic, not overlapping; sepals mostly concolorous, or with a few spots near the base; hypochile obcuneate . . . . . *D. similis*

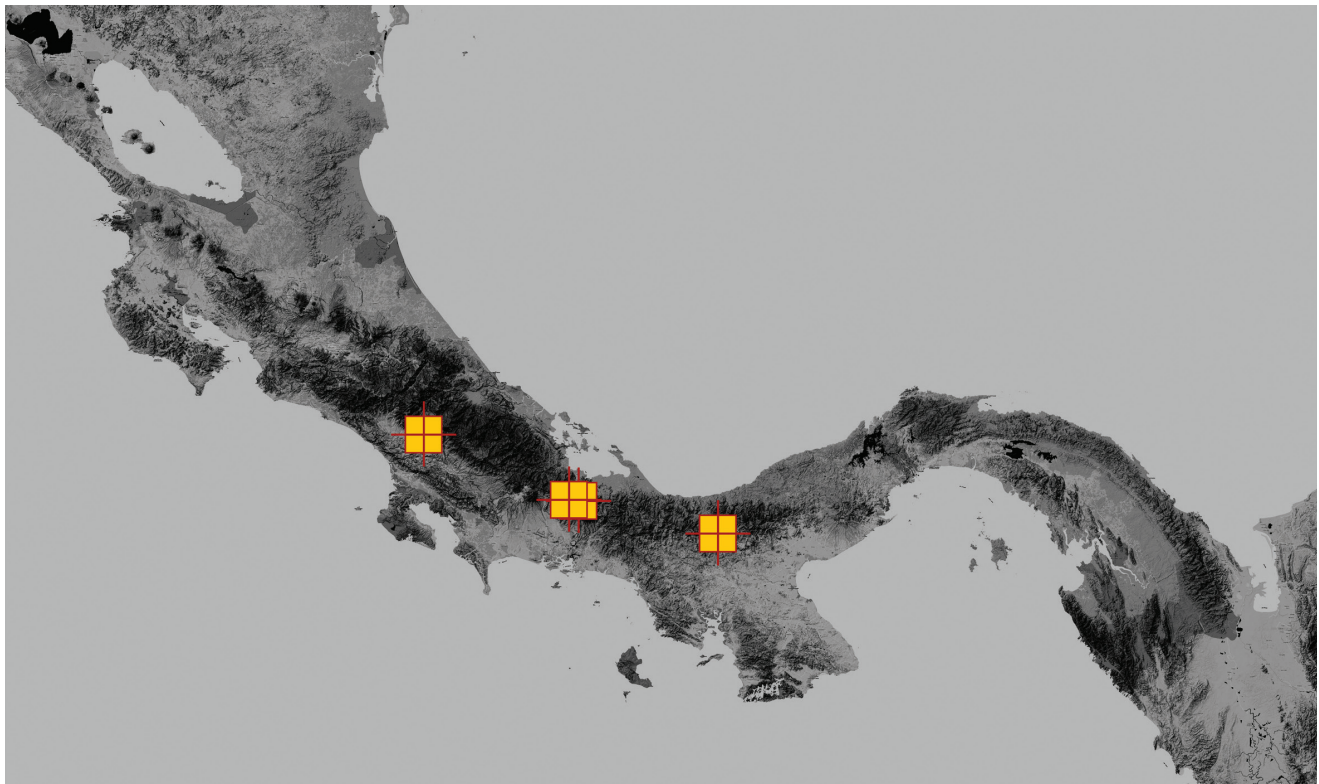
Although the diversity of *Dichaea* species with tall habit belonging to sect. *Pseudodichaea* is likely well understood in the southern region of Central America, where we account for five taxa (*D. eburnea*, *D. fragrantissima*, *D. globosa*, *D. morrisii*, and *D. trulla*), the composition of the Andean contingent still requires some further clarifications. Here both the names, *D. morrisii* and *D. trulla*, have been broadly used to identify any large *Dichaea* with short, elliptic leaves, and long, narrowly ligulate leaves, respectively.

9. *Dichaea morrisii* Fawc. & Rendle, J. Bot. 48: 107. 1910; *emend.* in W. Fawcett & A. B. Rendle, Flora of Jamaica 1: 139, plate 30, fig. 13–16. 1910. *Epithecia morrisii*

(Fawc. & Rendle) Schltr., Orchis 9. 26. 1915. *Dichaeopsis morrisii* (Fawc. & Rendle) Schltr. In Urban, Symbolae Antill. 8: 146. 1920.

SYNTYPES: JAMAICA. Mt. Moses, 3500 ft., *D. Morris s.n.* (*Jamaica Plants 2269*), designated by Ackerman (2014: 115) as the Lectotype (BM; Isolectotypes: NJ, K, W); JAMAICA. Hardware Gap, *G. E. Nichols s.n.* (BM; Isosyntypes: NJ, YALE).

In South America, *Dichaea morrisii* has been recorded from Venezuela (Dunsterville and Garay, 1959; Foldats, 1970), Colombia (Ortiz Valdivieso and Uribe Vélez, 2014: 334; Ortiz Valdivieso, 2016), Ecuador (Dodson and Marmol de Dodson, 1980a; Dodson and Escobar, 1993: 180), Peru



MAP 6. Distribution of *Dichaea dressleri*.

(Schweinfurth, 1961; Zelenko and Bermúdez, 2009), and Bolivia (Dodson and Vásquez, 1989; Vásquez et al., 2014). However, both Duntserville's drawings of specimens from Venezuela and the botanical plate prepared for Foldats's treatment of the Orchidaceae for *Flora de Venezuela* illustrate a completely distinct taxon, which differs from *D. morrisii* in almost every floral feature. I have not examined the specimens from Cuzco cited by Schweinfurth (1961: Vargas 2533, presumably at AMES), but the photograph of *D. morrisii* in Zelenko and Bermúdez (2009: 110) is misidentified and depicts a still-unnamed species, described hereafter as *D. amazonica*. Finally, the drawing published by Dodson and Vásquez (1989) to voucher *D. morrisii* in Bolivia, with its large, infundibuliform bracts of the peduncle, the short floral bract, and the very long lateral lobes of the epichile, illustrate under this name a species likely corresponding to *D. robusta* Schltr.

I may here substantiate the occurrence of the true *Dichaea morrisii* in Ecuador, on the basis of a specimen from the western slopes of the Andean chain:

**ECUADOR.** Azuay: road from Puerto Inca to Cuenca, between Corona de Oro and Luz Maria, 02°38'39.9"S, 79°27'00.3"W, 820 m, Pacific watershed of the Andes, lithophytic in deep layer of mosses on a steep bank along the roadside, 4 May 2007, *F. Pupulin 6552* & *J. Portilla* (CIOA) (Fig. 12C, 15).

**Distribution:** West Indies (Cuba, Dominican Republic, Haiti, Jamaica, and Tobago, according to Ackerman, 2014), Costa Rica, Panama, Colombia, Ecuador, and possibly Peru.

On the eastern side of the Andes in Ecuador, and likely in Peru, another species of sect. *Pseudodichaea* with large habit and flowers has been treated as *Dichaea morrisii* (i.e., Zelenko and Bermúdez, 2009), but it differs from the latter species in a number of significant features. I propose here to recognize it as a new species with the following name:

10. *Dichaea amazonica* Pupulin, *sp. nov.*

**TYPE:** ECUADOR. Morona-Santiago: Tumbes, 3°17'59.6"S, 78°34'26.9"W, ca. 1200 m, collected by H. Medina, December 2000, grown in the collection of Ecuagenera at Gualaceo (stems striped purple), 19 December 2007, *F. Pupulin 6978* (Holotype: CIOA). Fig. 12D, 16.

*Species sectionis Pseudodichaeae, Dichaea morrisii* Fawc. et Rendl *affinis, caulibus suberectis, vaginis foliarum plerumque purpureo striatis, floribus claviodoribus distincte grandioribus, pallenti ochraceis, sepalis lanceolatis, lateralibus subfalcatis, hypochilo brevior multoque latiore, marginibus basalibus columnae glabris recedit.*

Epiphytic, caespitose *herb*, erect when young, becoming pendent with erect apex when old, to over 1 m long. *Roots* filiform, ca. 1.0 mm in diam., exposed at the base of the stem, the caulinar roots completely hidden by the leaf sheaths. *Stems* compressed, simple, 15–110 cm long, 0.4–0.7 cm wide across conduplicate sheaths. *Leaves* articulate with the sheaths, closely spaced along stem, spreading, membranaceous, narrowly elliptic, subacute to obtuse, abaxially apiculate, medium green, 3.0–5.5 × 1.0–1.5 cm; sheaths loose, strongly complanate, ancipitous, the veins

neatly visible, often suffused with purple, 20–25 × 17–20 mm. *Inflorescence* solitary, 1-flowered, emerging below foliage, subpatent, 20–22 mm long, provided with a basal, cylindrical, tightly clasping bract, ca. 1 mm long. *Floral bract* double, the outer bract broadly transversely ovate, abruptly subacuminate, 9 × 14 mm, the inner bract linear-lanceolate, acuminate, 12 × 3 mm. *Pedicel* cylindrical, 2 mm long. *Ovary* 2.2–2.5 mm long, densely muricate. *Flower* ringent, the sepals and petals pale yellow, shiny, striped with red along the veins in the inner half; the lip white, the hypochile blotched with pale purple, the epichile solid violet on the adaxial side, white abaxially; column yellow, flecked with red on basal wings; strongly clove-scented. *Dorsal sepal* lanceolate, acuminate, fleshy, concave, dorsally subcarinate, the margins ciliate, 16 × 7 mm. *Lateral sepals* obliquely lanceolate-subfalcate, concave, acute, apically minutely mucronate, dorsally carinate, the margins ciliate, 18 × 1.0 mm. *Petals* lanceolate, with a distinct elliptic bulge on the basal half of the superior margin, acute to subacuminate, the margins hispid-ciliate, 13.0 × 4.5 mm. *Lip* 3-lobed, sagittate, sessile, 10 × 8 mm when spread, the hypochile linear, ca. 8 mm long, 4 mm wide, provided at the base with a central, low, short keel, flushing into the hypochile surface ca. 2 mm; the epichile triangular-sagittate, acute, 4 × 7 mm, the lateral lobes narrowly linear, acuminate, retrorse, to 2.5 × 0.4 mm. *Column* suberect, 11 mm long, with a indistinct foot; the clinandrium shallowly concave, entire; ligule broadly triangular, truncate, ciliate at apex, 1.0 × 1.4 mm. *Anther cap* transversely subrectangular, cucullate, flattened, 2-celled. *Pollinia* 4, ovate-rounded, in 2 superposed pairs of different size, on a cuneate-obflabellate, truncate stipe; viscidium hyaline, rounded, incurved. *Fruit* not seen.

**Additional specimen examined:** ECUADOR. Without collecting data, a plant from Ecuagenera, flowered in cultivation at Jardín Botánico Lankester, 12 January 2006, *F. Pupulin 5938* (JBL). Fig. 17A.

**Etymology:** named in reference to the known habit of the new species, on the eastern side of the Andean chain, known in Ecuador and Peru as the “*Amazonía*.”

**Distribution:** currently documented only from the southern, Amazonian region of Morona-Santiago in Ecuador, where several population have been recorded. A photograph in Zelenko and Bermúdez (2009), likely belonging to the same taxon, would extend southward the range of distribution of the species to Peru (Map 7).

**Habitat and ecology:** an epiphyte of secondary mature and secondary young vegetation along the eastern slopes of the Ecuadoran Andes, close to the Cordillera del Condor, where it has been recorded around 1200 m elevation. The region is characterized by a warm, humid, frequently cloudy climate, which supports a tropical wet forest. The strong scent of eugenol, the major volatile constituent of clove oil, is strongly correlated with euglossine bees pollination.

11. *Dichaea calyculata* Poepp. & Endl., Nov. Gen. Sp. Pl. 2: 4. 1838. Fig. 17B, 18.

**TYPE:** PERU. Crescit cum praecedentibus [... supra arbores Peruviae Orientalis ad Pampayaco]. Floret Julio. *S. Poeppig* & *L. Endlicher s.n.* (Holotype: W).

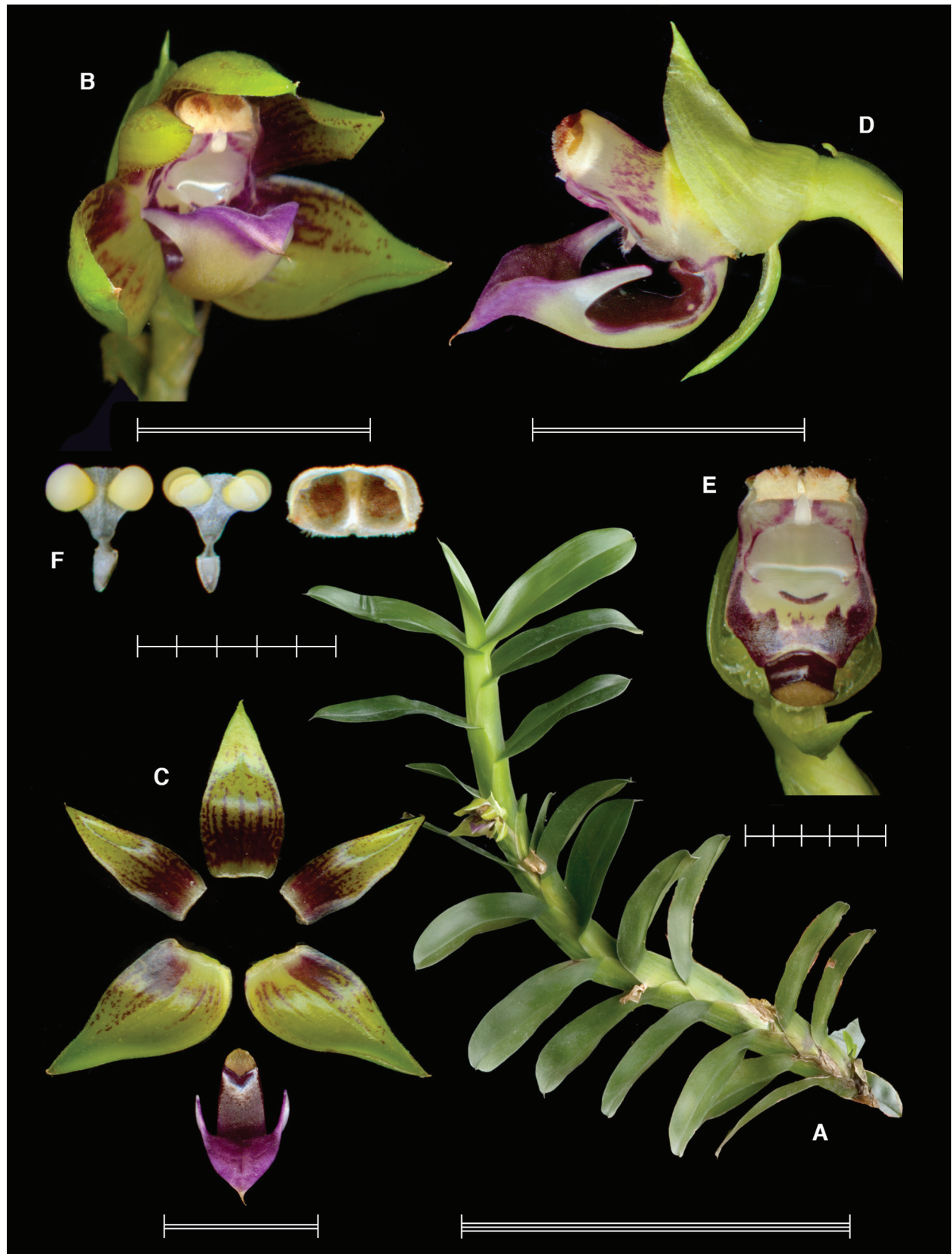


FIGURE 15. Lankester Digital Composite Plate of *Dichaea morrisii* Fawc. & Rendle. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, ventral view; **F**, anther cap and pollinarium (three views). Single bar = mm; double bar = cm; triple bar = dm. Prepared by F. Pupulin from *Pupulin* 6978.

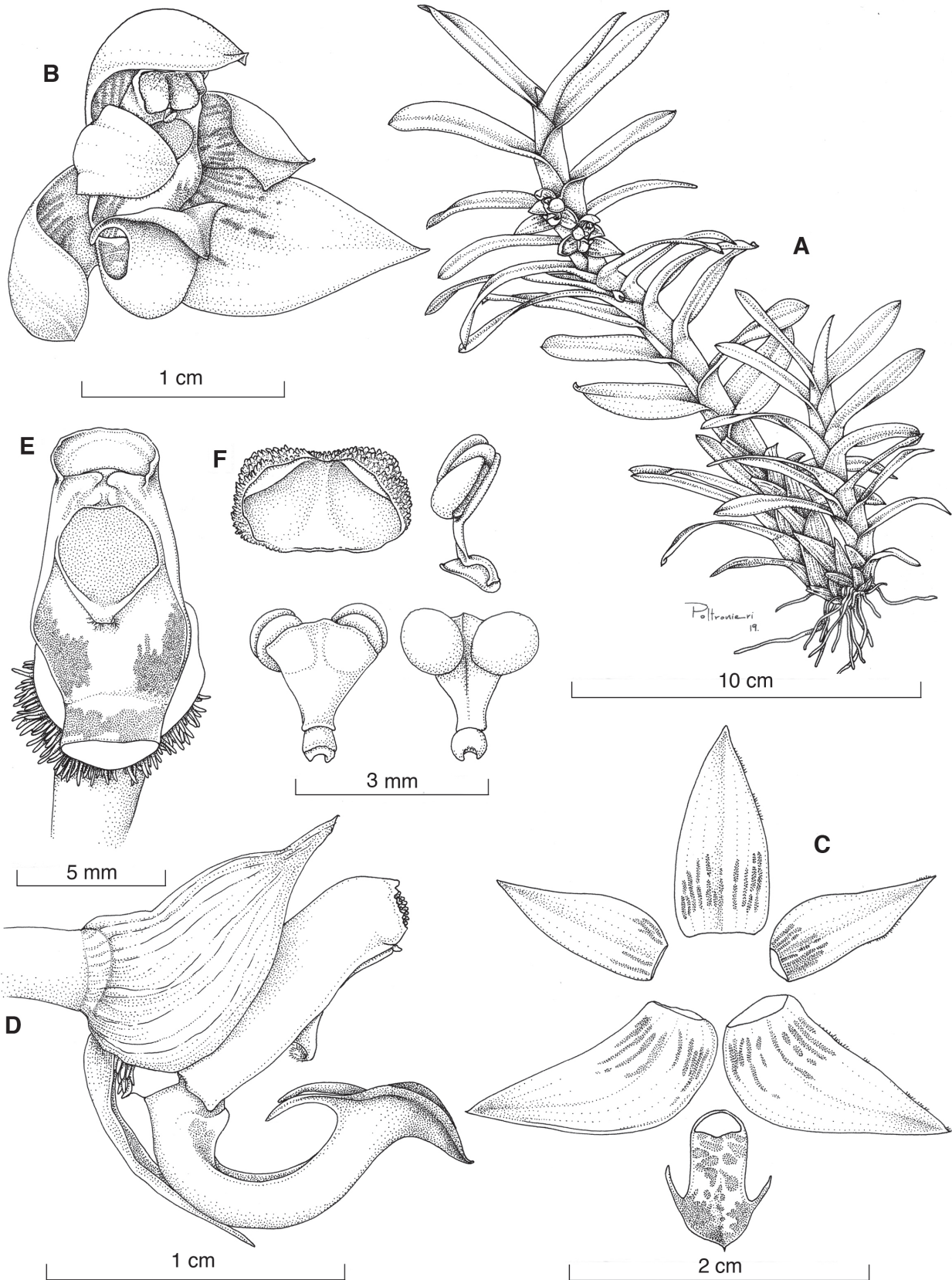


FIGURE 16. *Dichaea amazonica* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, ventral view; **F**, anther cap and pollinarium (three views). Drawn by S. Poltronieri from *Pupulin* 5938 (CIOA).

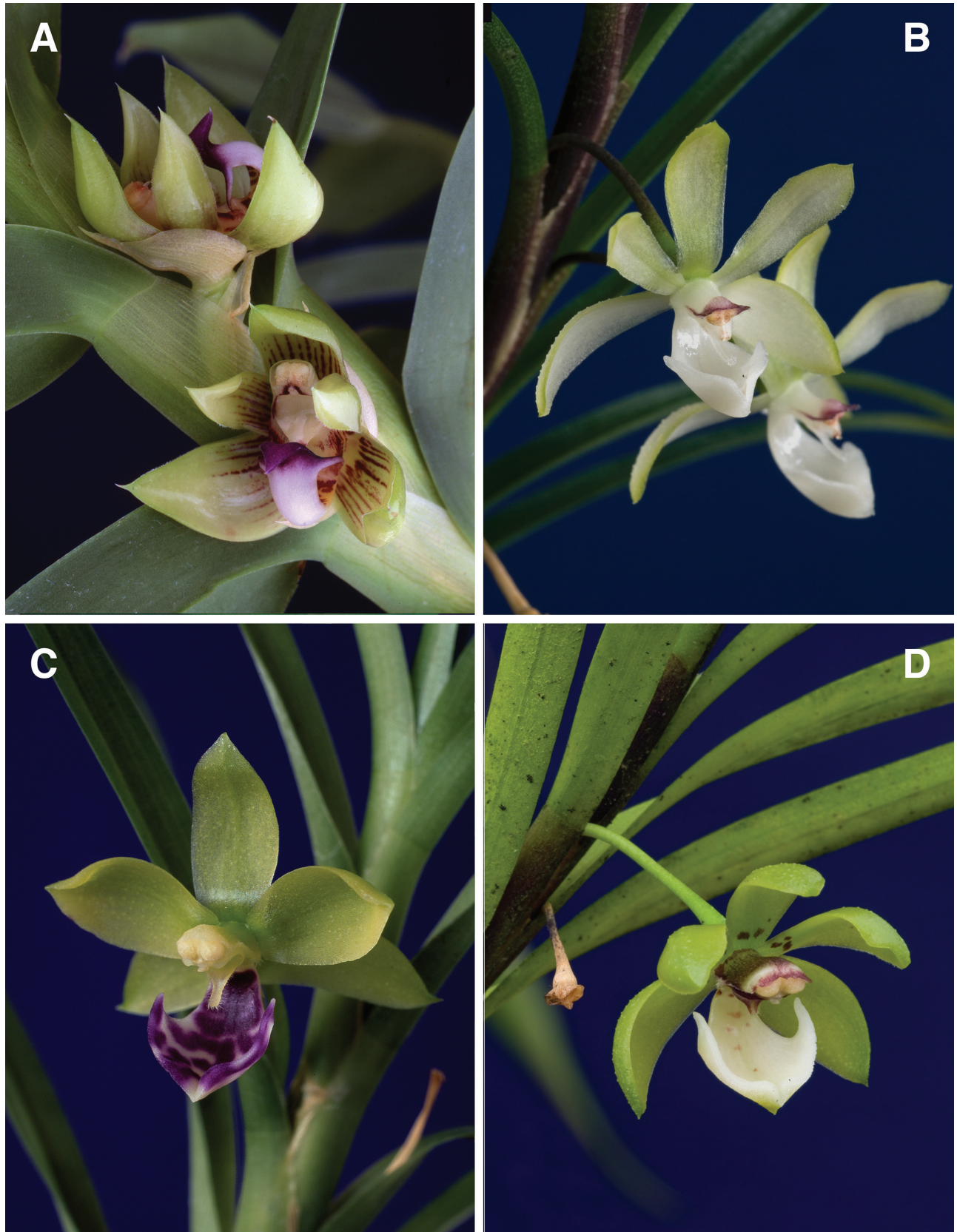
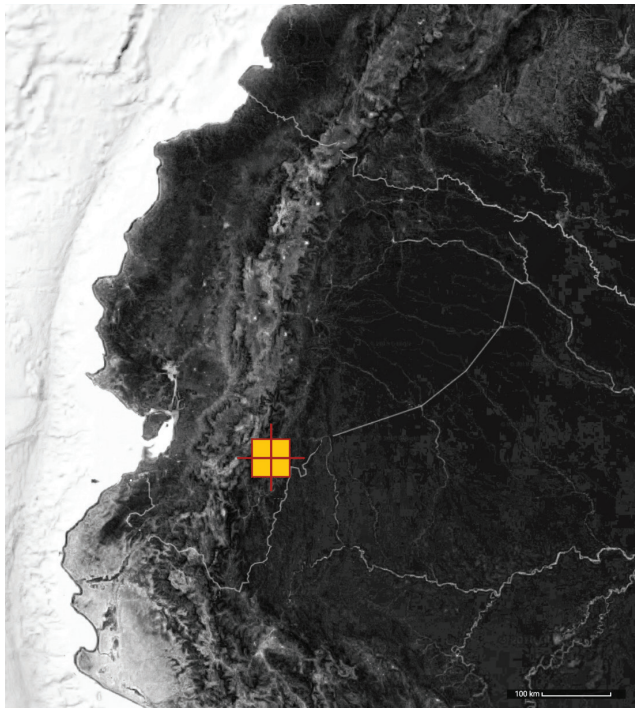


FIGURE 17. **A–D.** Species of *Dichaea* sect. *Pseudodichaea*. **A,** *Dichaea amazonica* (Pupulin 5938); **B,** *D. calyculata* (Pupulin 6923); **C,** *D. trulla* (Pupulin 6617); **D,** *D. superba* (Pupulin 6901). Photographs by F. Pupulin.



MAP 7. Distribution of *Dichaea amazonica*.

*Epithecia calyculata* (Poepp. & Endl.) Schltr., *Orchis* 9: 26. 1915.

Heterotypic synonym: *Dichaea coriacea* Barb. Rodr., *Gen. Sp. Orchid.* 2: 181. 1881, *syn. nov.*

SYNTYPES: BRAZIL: [Rio de Janeiro]; dans les montagnes de Rodeio. Fleurit en Octobre. *J. Barbosa Rodríguez s.n.* (not found; drawing of the syntype; tracings of the drawing from the syntype); BRAZIL: Santos, Herb. Brasil. Regnellian. Museo bot. Stokholm, *Mosén* 2957 (S).

*Epithecia coriacea* (Barb. Rodr.) Schltr., *Orchis* 9: 25. 1915, *syn. nov.*

*Dichaea australis* Cogn., *Fl. Bras.* 3(6): 498. 1906, *syn. nov.* *Epithecia australis* (Cogn.) Schltr., *Orchis* 9: 25. 1915, *syn. nov.*

SYNTYPES: BRAZIL: S. Catharina: Blumenau, *Gull s.n.* (?); *Müller s.n.* (B, destroyed); BRAZIL. in arboribus prope S. Paulo, *Comm. Geogr. e Geol. S. Paulo, A. Cogniaux 1780* in herb. Havn. (BR?; illustration of the syntype).

*Dichaea caveroi* D.E.Benn. & Christenson, *Icon. Orchid. Peruv. pl.* 629. 2001, *syn. nov.* TYPE: PERU. Condorcanqui, from area closely surrounding the Border Guard Post 'Alfonso Ugarte' PV-3, 1300 m, *M. Caverro B. ex Bennett 6441* (Holotype: Herb. Bennettianum, according to Bennett and Christenson 2001).

The long, suberect stems with narrowly linear, acinacyform, arcuate leaves, the small flowers produced simultaneously on relatively short peduncles, and the emarginate lip of *Dichaea caveroi* are indistinguishable from the features typical of *D. calyculata*. The latter taxon is not a synonym of *Dichaea trulla* Rchb.f. as it was treated by Dodson and Marmol de Dodson (1980b), Brako and

Zarucchi (1993), Stevens et al. (2001), and Zuloaga et al. (2008), as well as by eMonocot (2013) and other online taxonomic databases. *Dichaea trulla* has much larger flowers, with apple-green sepals and petals, and purple lip (Fig. 17C), which are produced singly and never simultaneously in groups.

## 12. *Dichaea superba* Pupulin, *sp. nov.*

TYPE: ECUADOR. Esmeraldas: San Lorenzo, Río Mataje, ca 1°12'40"N, 78°31'45"W, 300–600 m, collected by H. Medina, 2002, flowered in cultivation in the collection of Ecuagenera at El Pangui, 10 November 2007, *F. Pupulin 6901* (Holotype: CIOA). Fig. 17D, 19, 20.

*Species sectionis Pseudodichaeae, habito floreque cum Dichaeam trullam Rchb.f. congruentibus, foliis distincte longioribus angustioribusque, bractea floralis ovario non excedentis, bracteola plerumque occulta intus illa externa, sepalis petalisque concavis subringentibus, labello subacuto niveo lobuli lateralibus epichili anguste ligulatis et stipite pollinarii late rhombico-obtrullato recedit.*

Epiphytic, caespitose herb to 70 cm long. *Roots* filiform, ca. 1.0 mm in diam., exposed at the base of the stem, the caulinar roots produced at each internode completely hidden by the leaf sheaths. *Stems* rounded, simple, suberect when young, becoming pendent with age but with the apex suberect, 20–70 cm long, 0.5–0.8 cm wide across conduplicate sheaths. *Leaves* articulate with the sheaths, closely spaced along stem, spreading, succriaceous, narrowly linear, acuminate, dark green, 6.0–15.0 × 0.3–0.5 cm; sheaths addressed to the stem, slightly complanate, 20–40 × 10–16 mm. *Inflorescence* solitary, 1-flowered, emerging below foliage, subpatent, 13–17 mm long, provided with a basal, cylindrical, tightly clasping bract, ca. 1 mm long. *Floral bract* double, the outer bract tubular, obtuse, abruptly subacuminate, clasping, 2.5 × 5.0 mm when spread, the inner bractlet linear, acuminate, almost completely hidden by the outer bract, 2.5–2.8 × ca. 1 mm. *Pedicel* cylindrical, ca. 1 mm long. *Ovary* 1.0–1.5 mm long, glabrous. *Flower* spreading, the sepals and petals green, blotched at the base with reddish brown, sometimes spotted with pale purple throughout; the lip white, sometimes spotted with pale red, fading ivory toward the hypochile, where it is sparsely blotched with brown; column reddish brown, fading ivory toward the apex; anther cap cream colored, suffused with red. *Dorsal sepal* oblanceolate, acute, fleshy, concave, dorsally subcarinate, slightly bent over the column, 8 × 5 mm. *Lateral sepals* obliquely lanceolate-elliptic, concave, acute, apically minutely mucronate, dorsally subcarinate, 9 × 5 mm. *Petals* narrowly obovate, acute, concave, 8 × 5 mm. *Lip* 3-lobed, sagittate, sessile, 8 × 10 mm when spread, the hypochile obtuse, ca. 5 mm long, 6 mm wide at apex, provided at the base with a central, low, short keel, flushing into the hypochile surface ca. 2 mm; the epichile triangular-sagittate, acute, 3.5 × 10.0 mm, the lateral lobes narrowly linear, rounded, retrorse, ca. 2 × 1 mm. *Column* suberect, hemiterete, with a indistinct foot, 7.5 mm long, 4.5 broad around the stigma; the clinandrium shallowly concave, undulate; ligule triangular-cuspidate, subacuminate, ciliate at apex, 2.5 × 1.8 mm. *Anther cap* transversely subrectangular-rheniform, cucullate, 2-celled. *Pollinia*

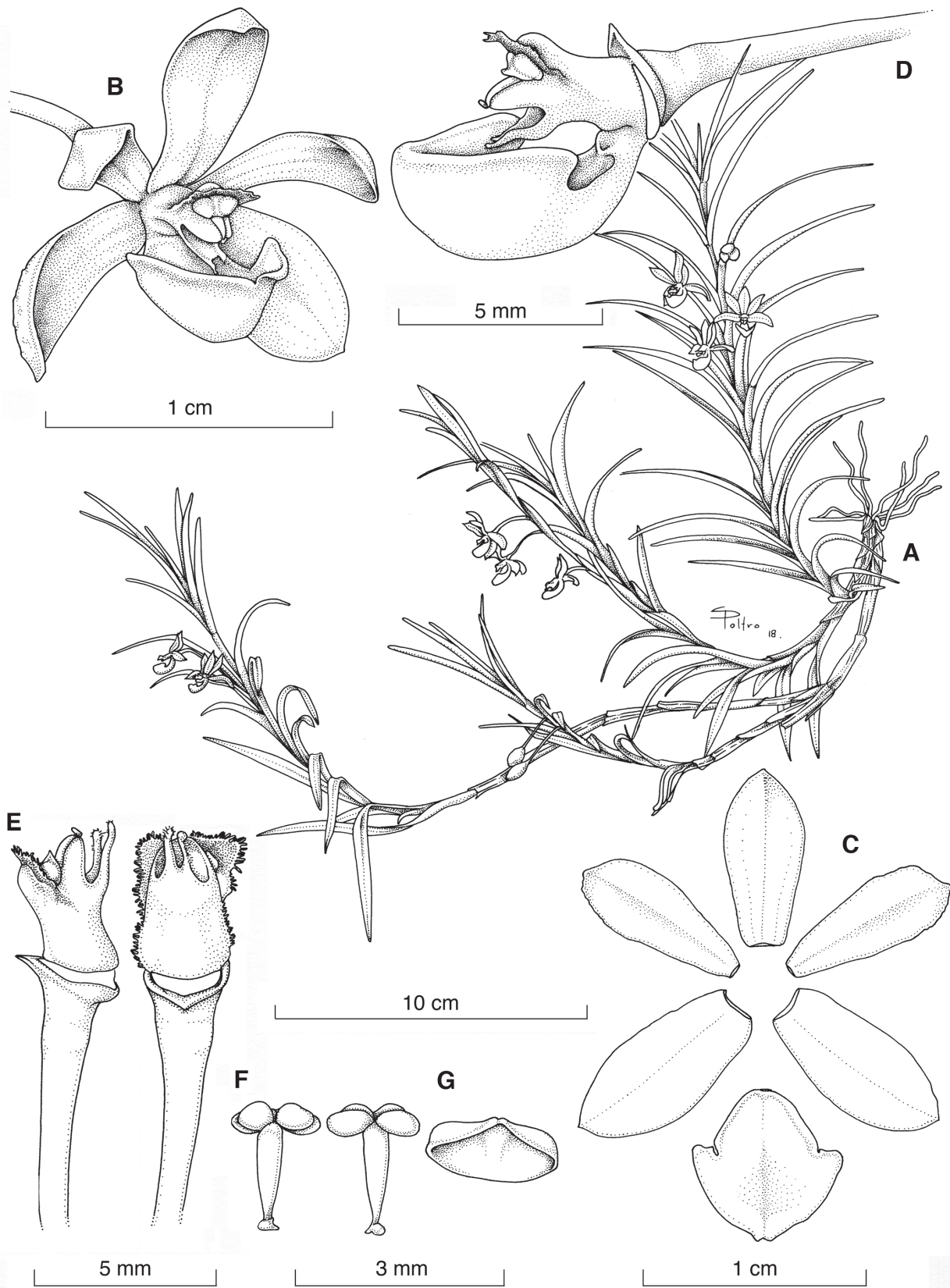


FIGURE 18. *Dichaea calyculata* Poepp. & Endl. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, lateral and ventral views; **F**, pollinarium (two views); **G**, anther cap. Drawn by S. Poltronieri from *Pupulin* 6923 (CIOA).

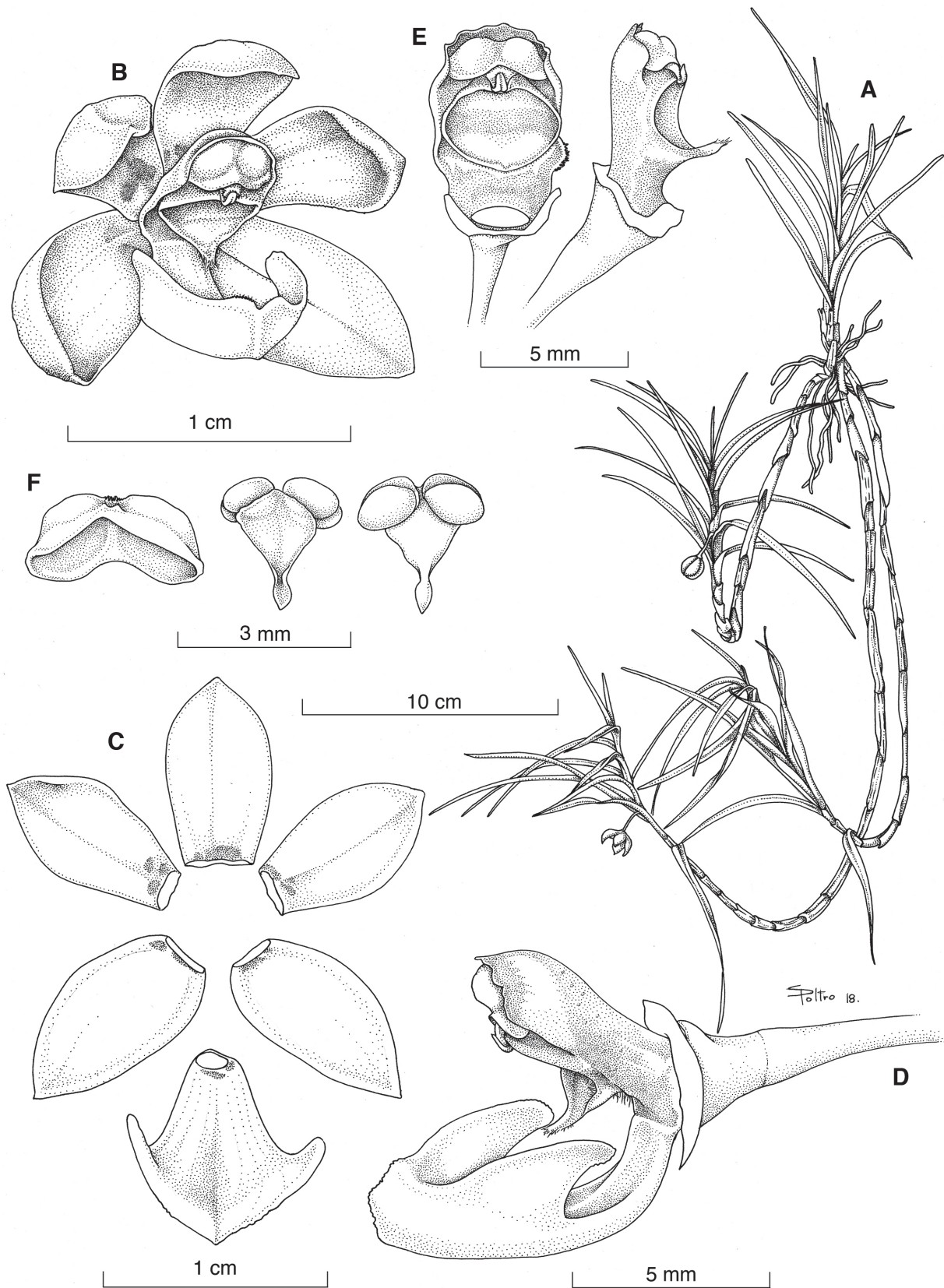


FIGURE 19. *Dichaea superba* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, ventral and lateral views; **F**, anther cap and pollinarium (two views). Drawn by F. Pupulin and S. Poltronieri from the holotype.

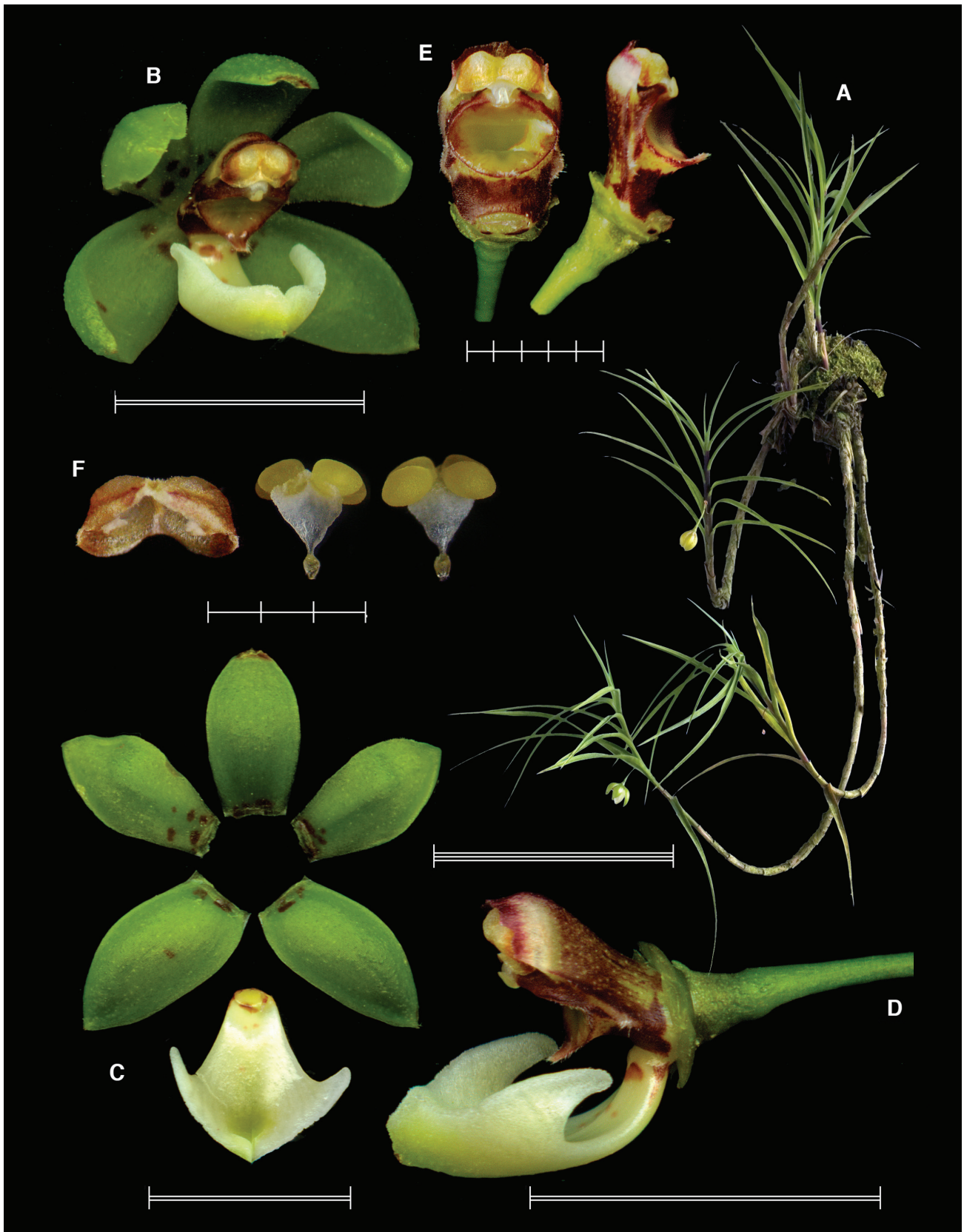


FIGURE 20. Lankester Digital Composite Plate of *Dichaea superba* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, ventral and lateral views; **F**, anther cap and pollinarium (two views). Single bar = mm; double bar = cm; triple bar = dm. Prepared by F. Pupulin from the holotype.

4, elliptic, in 2 superposed pairs of slightly different size, on a obrullate-rhombic, obtuse stipe; viscidium hyaline, obovate. *Fruit* not seen.

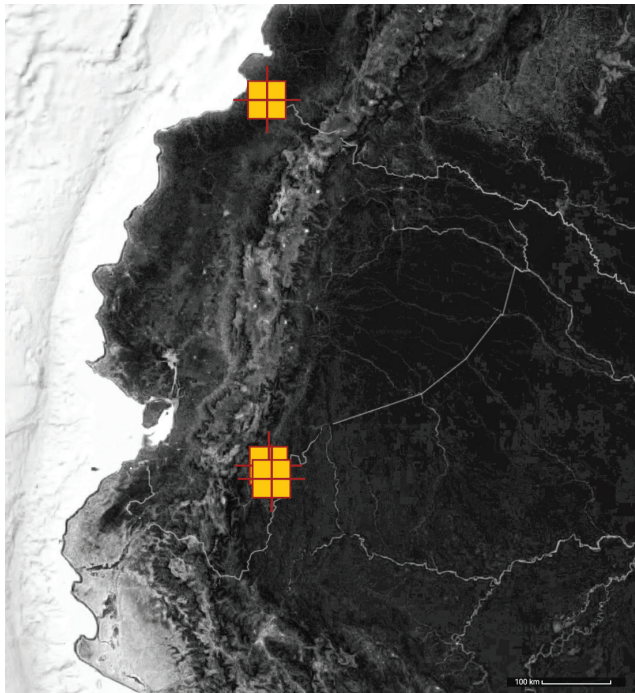
**Additional specimens examined:** ECUADOR. Zamora-Chinchipe: Pangui, Quebrada Pachicutza, 3°39'50.3"S, 78°34'09.7"W, 940 m, collected by H. Medina, December 2000, grown in the collection of Ecuagenera at Gualaceo, 18 December 2007, *F. Pupulin* 6977.

**Other material studied:** ECUADOR. Zamora-Chinchipe: Pangui, Río Chuchumbleza, 3°31'51"S 78°31'51"W, 750 m, grown in the collection of Ecuagenera at Gualaceo, 22 December 2007. Photograph (Fig. 25A), not conserved.

**Etymology:** from the Latin *superbus*, superb, magnificent, in allusion to the imposing habit of the tall plants and the fleshy, flower, large for the genus *Dichaea*.

**Distribution:** the species is known from documented collection on both watersheds of the Ecuadorean Andes, where it inhabits warm and wet regions of tropical forests at low to medium elevations (ca. 300–1000 m) (Map 8). The Río Mataje, *locus typicus* of the species, marks the border between the Ecuadorean province of Esmeraldas and Colombia, so that *Dichaea superba* must be certainly found also in the latter country. On the other side, the photograph of a Peruvian unidentified species in Zelenko and Bermúdez (2009: 110) surely represents the same species, which is probably widespread along the Andes at least from Colombia to Peru.

*Dichaea superba* is superficially similar to *D. trulla*, with which it shares the habit formed by very long stems that are foliaceous only toward the apex and become long and pendent with age (to 70 cm or more), the long and narrow, pointed leaves, and the comparatively large, solitary, quite fleshy, long-lasting flowers. In *D. Superba*, however, the



MAP 8. Distribution of *Dichaea superba*.

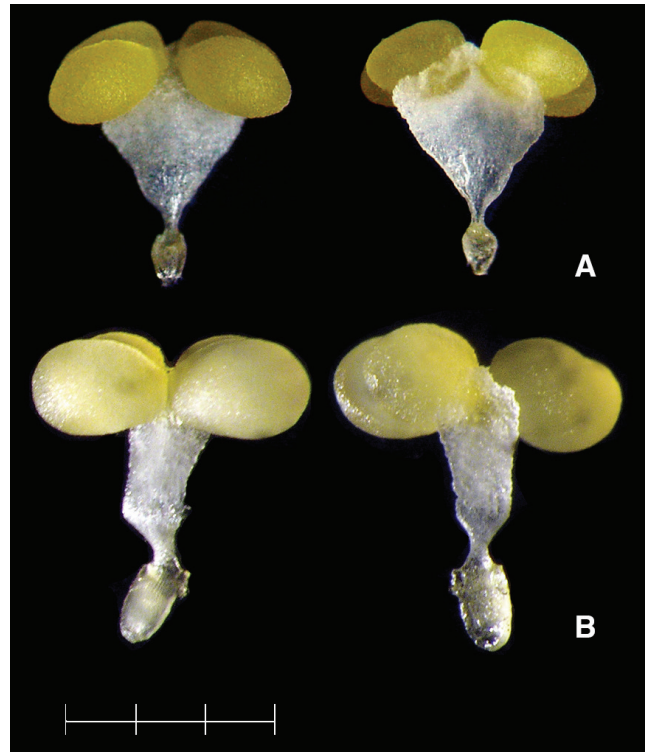


FIGURE 21. **A–B.** Comparison between the pollinaria of *Dichaea superba* and *D. trulla*. **A**, *D. superba* (*Pupulin* 6901); **B**, *D. trulla* (*Pupulin* 5319). Photographs by F. Pupulin.

leaves are distinctly longer and narrower (to 15.0 × 0.5 cm vs. 11.0 × 0.6 cm), the external floral bract does not exceed the length of the ovary (vs. longer) and the internal bractlet is almost completely hidden by the outer bract (vs. largely exposed), the sepals and petals remain subingent during anthesis (they become strongly reflexed at maturity in *D. trulla*), and the subacute lip is white or sparsely spotted with brownish red (vs. truncate, mostly solid violet), provided with narrowly ligulate lobes of the epichile (vs. triangular, short). Finally, the pollinaria of the two species are quite different (Fig. 21). The stipe of *D. superba* is rhombic-obtrullate, distinctly wider in the median-upper portion, where it is almost as broad as the width of two transversal pollinia, whereas in *D. trulla* the stipe is narrow and almost ligulate, apically less than half the width of that of *D. superba*; the viscidium of *D. superba* is obovate and small, vs. obpeltate and large in *D. trulla*.

At least on the Amazonian watershed of the Andes, the latter species is sometimes sympatric with *Dichaea superba*, as we documented with a collection from the Río Chuchumbleza (Zamora-Chinchipe: Pangui) (Fig. 25B).

Photographs and illustrations of *Dichaea tenuis* C.Schweinf. appearing on the Internet often mistakenly refer to *D. superba* (i.e., orchidspecies, Ecuagenera [Ecuador], and Agroriente [Peru] webages, among others). Nevertheless, *D. tenuis* is altogether a completely different species of sect. *Pseudodichaea*, with small plants less than 10 cm tall, acicular leaves ca. 10 mm long, and subglobe, small flowers with perianth parts as short as 3 mm (Schweinfurth, 1952).

*IXYOPHORA* DRESSLER

Robert Dressler created *Ixyophora* (in Whitten et al., 2005), typified by *I. viridiseipala* (Senghas) Dressler, to accommodate a group of Andean species previously treated under a broad concept of *Chondrorhyncha*, which the molecular analyses carried out by Whitten and collaborators recovered as sister of *Aetheorhyncha* and consecutively sister to *Chaubardiella* Garay (Whitten et al., 2005). Morphologically similar to *Warszewiczella* Rehb.f. (which is nested into a sister clade), *Ixyophora* is characterized by the callus of the lip reaching the middle of the blade but scarcely separate from it, not thick and fleshy, mostly widest basally and narrow distally, not thick and fleshy, and the column flat beneath. Also the stipe of the pollinarium is quite characteristic in *Ixyophora*, being narrowed between the viscidium and the pollinia. At that time, Dressler (in Whitten et al., 2005) transferred to *Ixyophora* *Chondrorhyncha carinata* Ortiz, which was included in the DNA analyses together with *I. viridiseipala* and *Chondrorhyncha aurantiaca*, Senghas & Gerlach, on the basis of morphological similarities. In 2008, Harding included in *Ixyophora* also *Chondrorhyncha luerorum* R. Vásquez & Dodson, which is morphologically very close to *I. aurantiaca* (Senghas & Gerlach) Dressler.

Curiously, *Chondrorhyncha velastiguii* Dodson, which is the closest species to the *typus generis* of *Ixyophora*, *I. viridiseipala*, and morphologically almost indistinguishable from it (if not for the very different color) (Fig. 22, 25C, 30C), escaped the attention of systematists and remained undisturbed within *Chondrorhyncha*, contributing to the polyphyly of the genus. As I already previously indicated the need for this transfer to resolve the paraphyly of *Ixyophora* (Pupulin, 2009b), here I formally propose the new combination:

13. *Ixyophora velastiguii* (Dodson) Pupulin, *comb. nov.* Fig. 23, 24, 25D, 30D.

Basionym: *Chondrorhyncha velastiguii* Dodson, *Icon. Pl. Trop.*, ser. 2, 5: pl. 419. 1989.

TYPE: ECUADOR. Tungurahua: Río Negro, road Baños-Puyo, 1300 m, 11 Mar 1963, *Dodson & Thien* 2358 (Holotype: SEL).

When Ortiz Valdivieso (2004) described *Chondrorhyncha carinata*, he made no express comparison of the new species with any other taxon of the group, basically diagnosing it for the presence of a minutely papillose keel on the underneath of the column, the 3- to 5-toothed callus, and details of

the rostellum. The closest species in the *Chondrorhyncha* complex were obviously *C. viridiseipala* and *C. velastiguii*, which I combined into *Ixyophora* here above. Bob Dressler (in Whitten et al. 2005) first recognized the affinities of *C. carinata* and transferred it to *Ixyophora*, which differs from other *Ixyophora* species not only for the presence of a distinct keel under the column but also for the structure of its callus. In *I. velastiguii*, *I. viridiseipala*, and *I. aurantiaca*, the free portion of the callus does not extend forward from the point of attachment of the callus to the lamina, forming something like a “suspended bridge” only in the frontal part. In *I. carinata*, on the contrary, the callus extends beyond the point of fusion with the blade, forming a sort of long tooth, which in turn is 2- to 3-toothed in front. Furthermore, the general outline of the lip is elliptic in *I. carinata*, whereas in the other species of *Ixyophora* it is distinctly obovate. We provide here a complete botanical illustration of *I. carinata*, from a plant grown in the rich collection of Ecuagenera in Gualaceo, to complement the quite schematic illustration originally provided by P. Ortiz Valdivieso (2004) when he described the species:

14. *Ixyophora carinata* (P. Ortiz) Dressler, *Lankesteriana* 5(2): 95. 2005.

COLOMBIA. Without further locality data, flowered in cultivation in the collection of Ecuagenera at Gualaceo, 17 Apr. 2008, *CIOA-00567* (CIOA). Fig. 26, 29A.

We also documented another Ecuadorian taxon in *Ixyophora*, whose characteristics are similar to those of *I. viridiseipala* but which differs from the latter in significant details. We describe it here as a species new to science that is described next.

15. *Ixyophora imitatrix* Pupulin, *sp. nov.*

TYPE: Ecuador. Without further locality data, flowered in cultivation in the collection of Ecuagenera at Gualaceo, 5 July 2008, *CIOA-00928* (Holotype: CIOA). Fig. 27, 29B.

*Species Ixyophora viridiseipala* (Senghas) Dressler *similis, sed habito minore foliis subsessilibus, labello elliptico subtrilobo, columna alba glabra apice multo dilatata carina parva laevis munita et stipite pollinarii late rhombico-obtrullatoplerumque recedit.*

Epiphytic, caespitose, small *herbs* without pseudobulbs. *Roots* terete, thick, to 4.5 mm in diam., produced from the short rhizome. *Stem* abbreviated, enclosed by 3–5 imbricating sheaths to 2 cm long, provided with hyaline,



FIGURE 22. A–E. Flowers of *Ixyophora viridiseipala*. A, *Pupulin* 5941 (JBL); B, *CIOA-s.n.* (not preserved); C, *CIOA-00492* (CIOA); D, *Pupulin* 6554 (CIOA); E, *Pupulin* 6979 (CIOA). Flowers not at the same scale. Photographs A, C–E, by F. Pupulin; B by G. Merino.

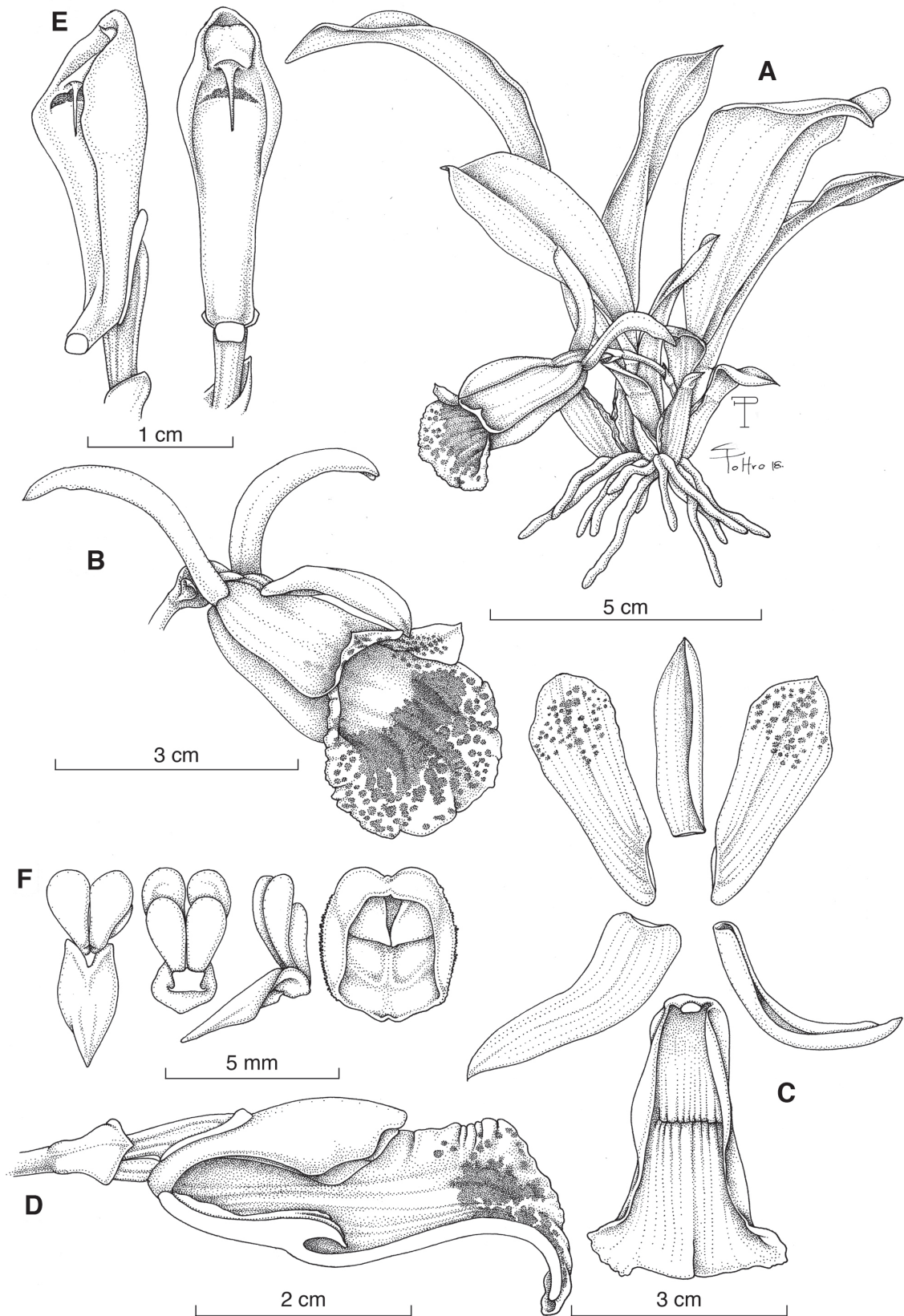


FIGURE 23. *Ixyophora velastiguii* (Dodson) Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, three-quarter and ventral views; **F**, pollinarium (three views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from *Pupulin* 6622 (CIOA).

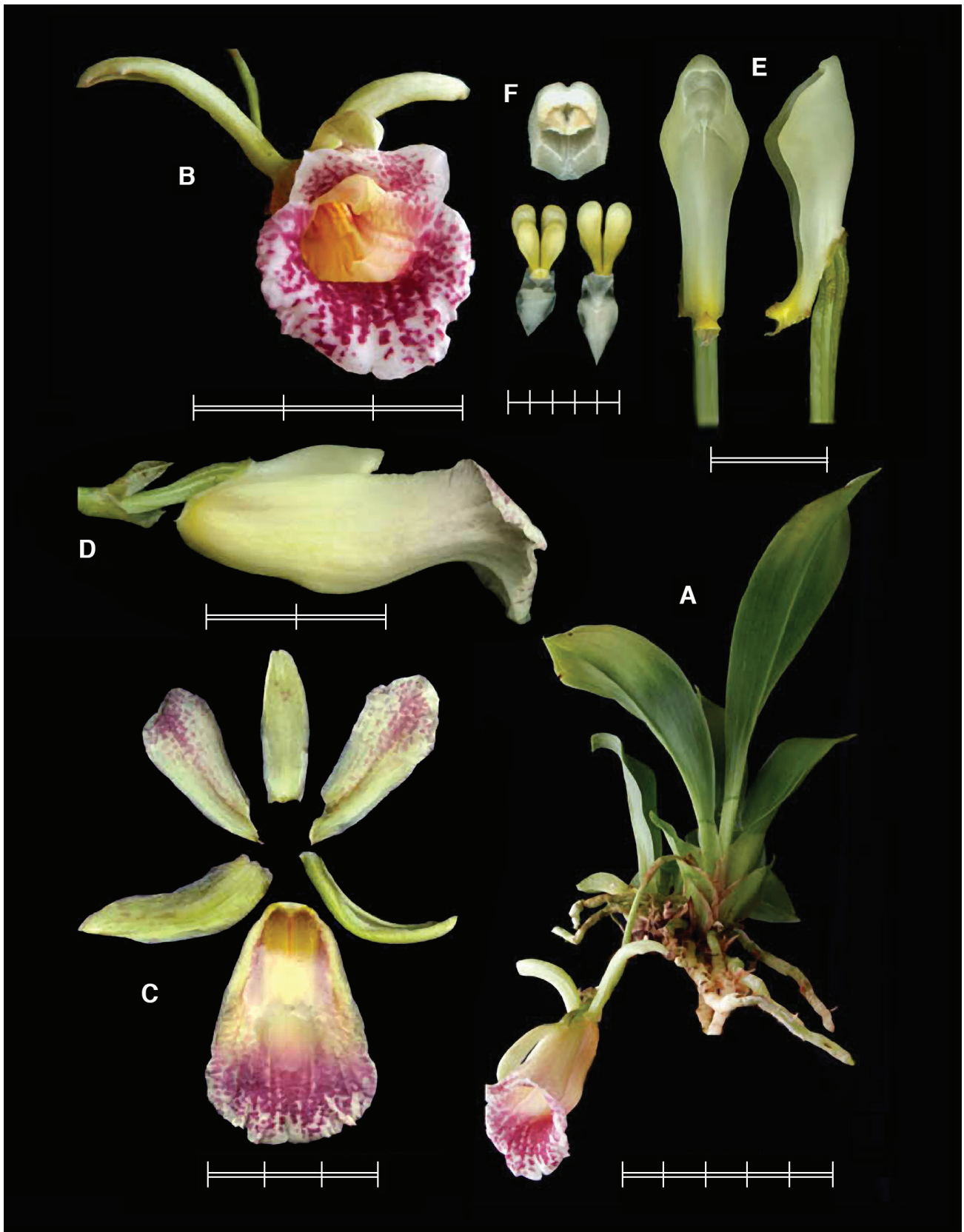


FIGURE 24. Lankester Digital Composite Plate of *Ixyophora velastiguii* (Dodson) Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, ventral and lateral views; **F**, anther cap and pollinarium (two views). Single bar = mm; double bar = cm. Prepared by Hugo Medina from *Pupulin* 6622 (CIOA).

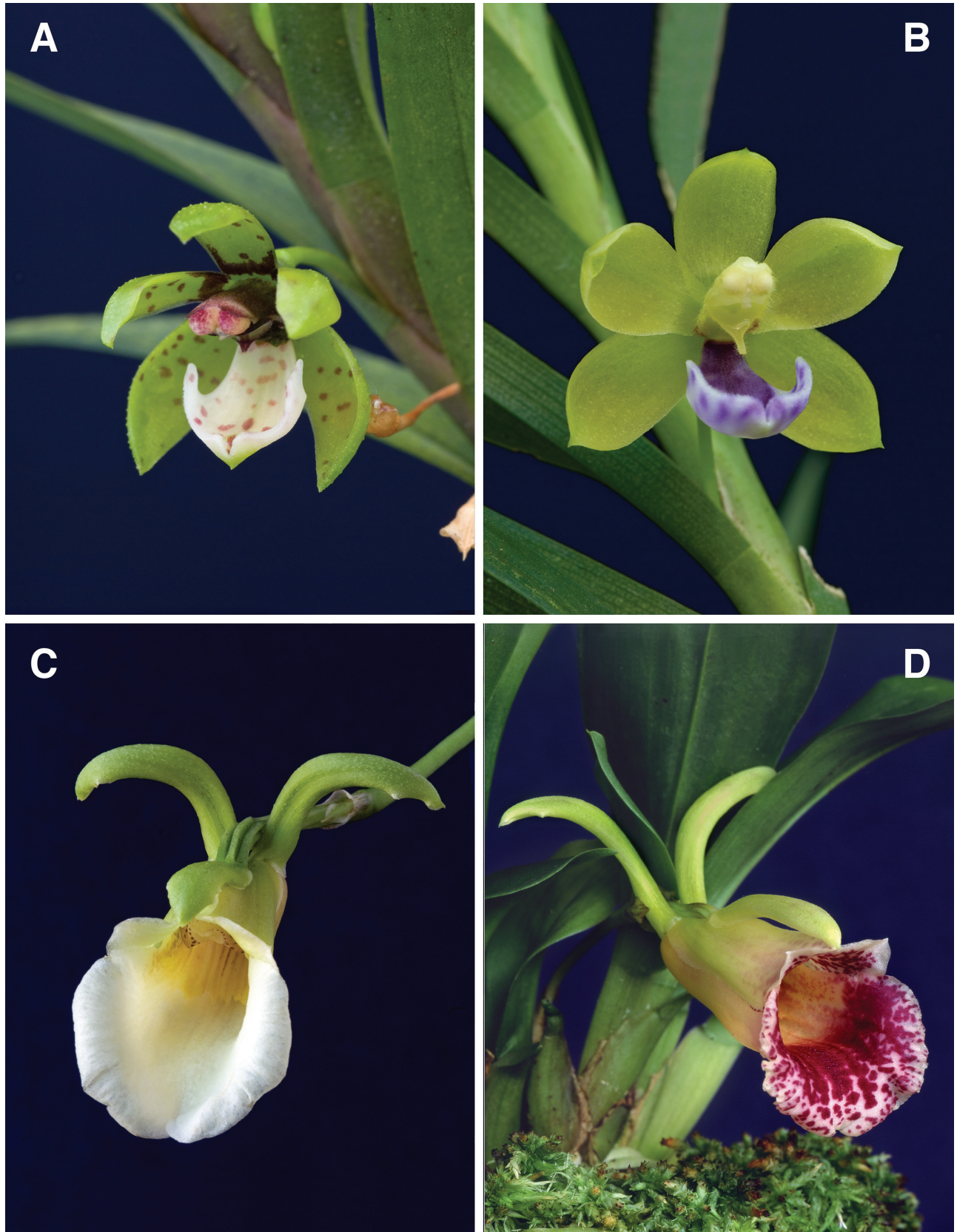


Figure 25. **A–D.** Species of Zygopetalinae. **A,** *Dichaea superba* from Pangui, Río Chuchumbeza (not conserved); **B,** *Dichaea trulla* (Pupulin 6976); **C,** *Ixyophora viridisepala* (CIOA-00492); **D,** *Ixyophora velastiguii* (Pupulin 6622). Photographs by F. Pupulin.

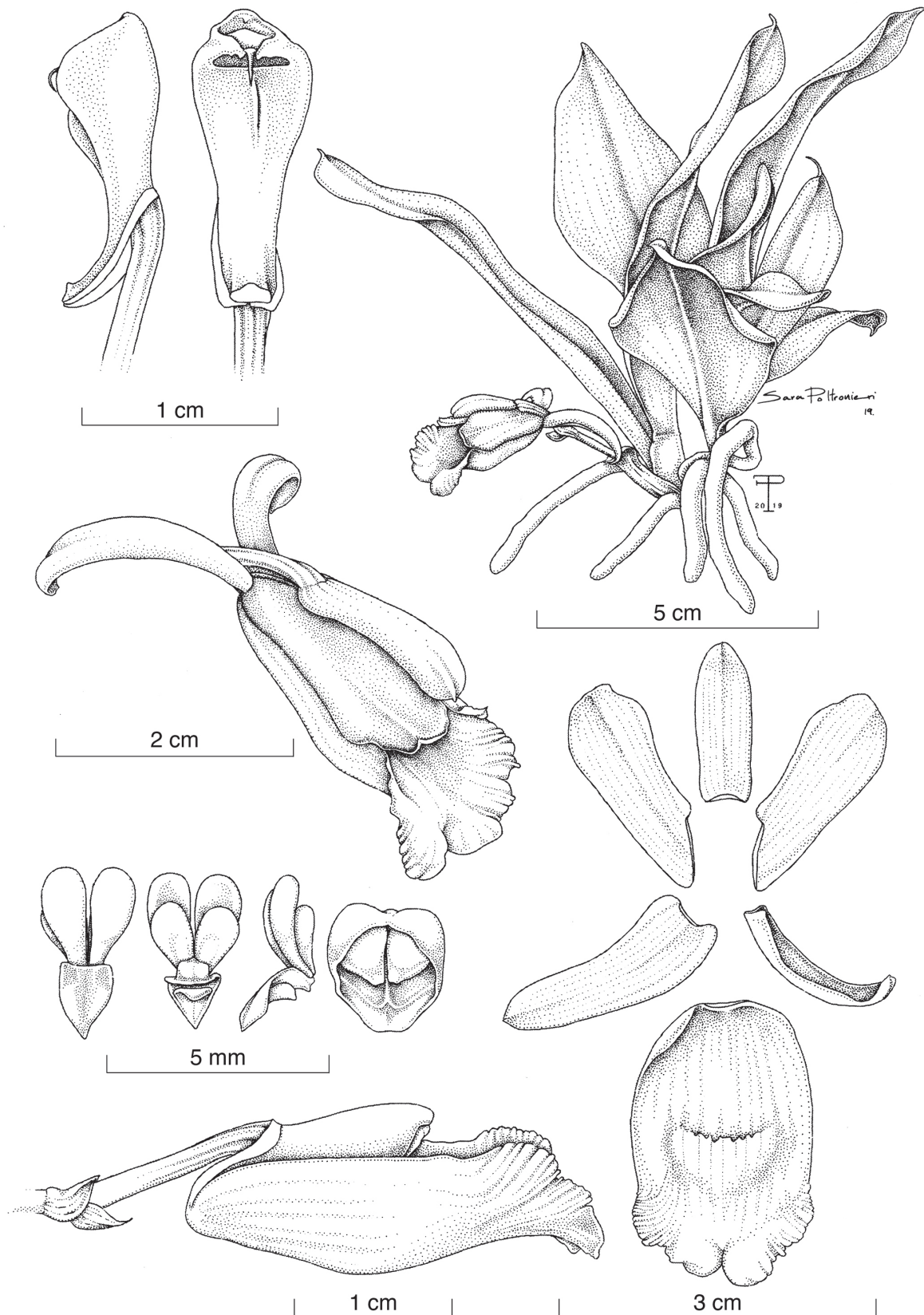


FIGURE 26. *Ixyophora carinata* (Ortiz) Dressler. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, lip, longitudinal section; **F**, column, lateral and ventral views; **G**, pollinarium (three views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from CIOA-00567 (CIOA).

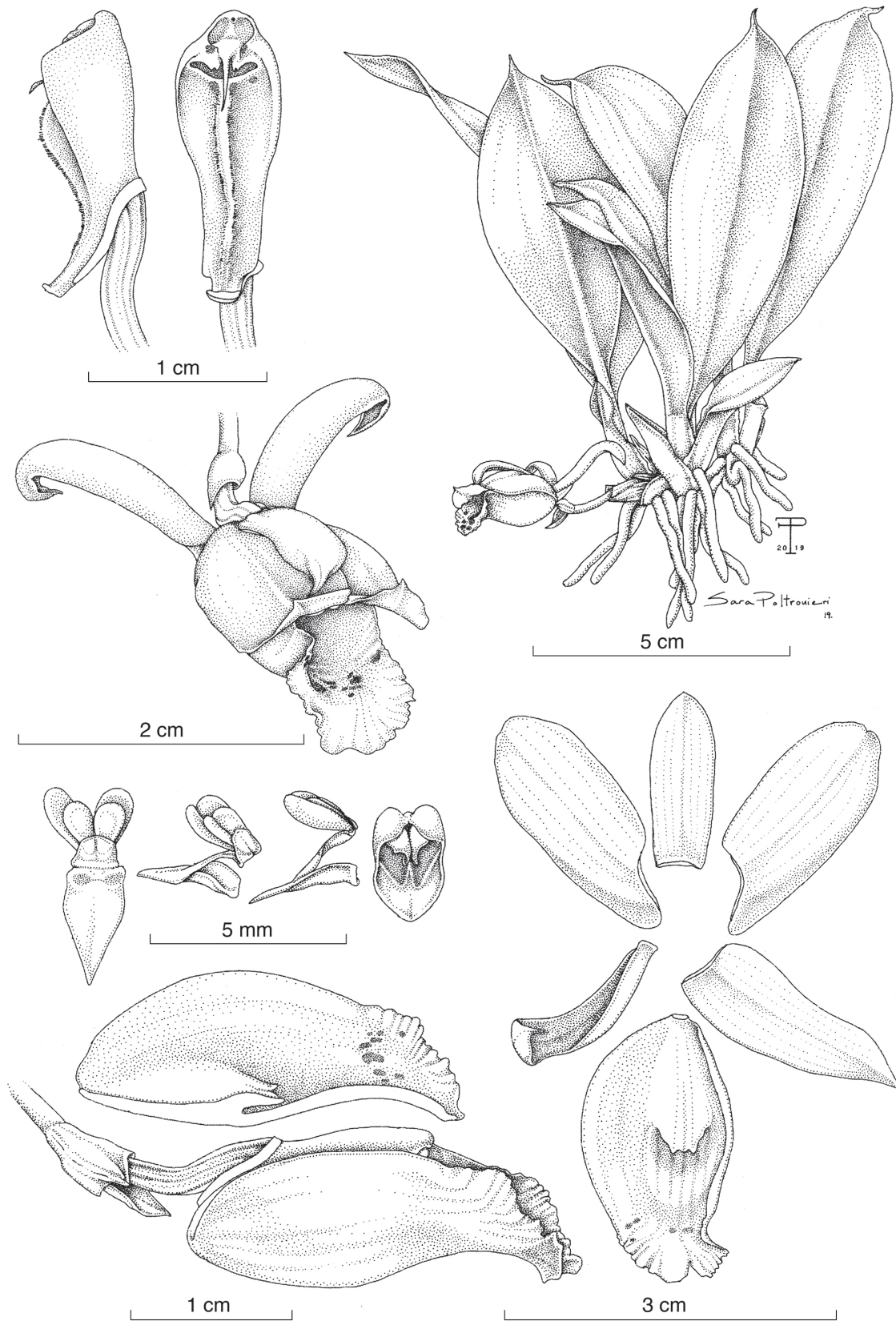


FIGURE 27. *Ixyophora imitatrix* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view; **E**, column, lateral and ventral views; **F**, pollinarium (three views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from the holotype (CIOA).

scarious margins, the upper ones foliaceous. *Leaves* conduplicate, articulate, membranaceous, oblanceolate-elliptic, acute, grass green, matte, 3.7–7.5 × 2.4–3.0 cm, narrowed at the base into a indistinct, conduplicate petiole, abaxially provided with a pronounced median keel and 2–3 lateral, obscure veins on each side. *Inflorescence* lateral, slender, 1-flowered, to 3 cm long, produced from the axil of the lower sheaths; the peduncle terete, suberect, provided with a triangular, acute bract to 6 mm long; floral bract scarious, double, conduplicate, much shorter than pedicellate ovary, the external one broadly ovate, acute, ca. 3 × 3 mm, the subopposite internal bractlet lanceolate, subacuminate, 4 × 3 mm. *Flowers* resupinate, ringent, with pale yellow sepals and petals, paler toward the apex, the lip yellow at the base, white at apex, the column white, bright yellow at the base, the anther cap white. *Dorsal sepal* free, incurved, bent over the porrect petals, linear-elliptic, obtuse, shortly apiculate, concave, 15 × 6 mm. *Lateral sepals* narrowly lanceolate-subfalcate, asymmetrical, obtuse, reflexed 180 degrees, apically subuncinate, strongly inrolled-folded at the base, 22 × 7 mm. *Petals* inserted along the margins of the column foot, obliquely oblong, obtuse-rounded, porrect, apically gently revolute, 22 × 8 mm. *Lip* articulate with the column foot, elliptic, obscurely 3-lobed, 27 × 17 mm, deeply concave, forming a distinct mentum on the median portion when seen laterally, the base rounded, the apex emarginate, the proximal margins erect, flanking the column, apically bent, the distal margins undulate; disc covered from the base to the mid-lip with a laminar, flat callus, adnate to the lamina up to the lateral margins of the apex, the free apex truncate, minutely and irregularly 5-toothed, forming a narrow and shallow pocket with the base of the blade. *Column* semiterete, straight, 16 mm long, 7.5 mm broad around the stigma, with a distinct foot ca. 5 mm long, strongly dilated at apex into large, elliptic, rounded stigmatic wings, provided with a low, rounded keel running from the middle to the stigmatic opening; the stigma transverse, narrow, slit-like; the rostellum acicular, with two short, round teeth on each side. *Anther cap* incumbent, cucullate, ovate, truncate, flattened, 2-celled. *Pollinia* 4, in 2 subequal pairs, on a broad, obpeltate, incurved, apically depressed, hyaline stipe and a scarcely distinct, ventral, subrectangular, hyaline viscidium.

**Etymology:** from the Latin *imitatrix*, a female imitator, for the strong resemblance of the new species with *Ixyophora viridisepala*.

**Distribution and ecology:** the plant that served as the type was originally collected in Ecuador, but no specific locality data were recorded at the time. In cultivation, the species flowers in June–July.

*Ixyophora imitatrix* is at first sight almost indistinguishable from *I. viridisepala*, with which it shares the general color scheme and the subtubular flower with the lateral sepals strongly reflexed. However, whereas *I. viridisepala* has long imbricating sheaths and petiolate leaves, the foliage of the new species looks almost sessile. Furthermore, the lip of *I. imitatrix* is distinctly 3-lobed-elliptic, almost subrectangular, whereas in *I. viridisepala* it is distinctly obovate. The column of *I. imitatrix* is white (vs.

feckled with purple), glabrous (vs. densely villose), strongly dilated around the stigma (vs. slightly dilated), and provided with a substigmatic low keel (vs. keel absent). Finally, the stipe of the pollinarium is broadly rhombic-obtrullate, vs. triangular in *I. viridisepala*.

*KEFERSTEINIA* RCHB.F.

16. *Kefersteinia alata* Pupulin, Harvard Pap. Bot. 8(2): 161. 2004.

TYPE: Panama. Bocas del Toro: road from David to Chiriquí Grande, around km. 74, ca. 450 m, epiphytic in premontane moist forest, 10 April 2001, flowered in cultivation at Gaia Botanical Garden, 18 August 2001, *F. Pupulin*, *D. Castelfranco* & *E. Salas 3119* (Holotype: USJ; Isotype: USJ-Spirit).

Up to now only recorded from the Caribbean watershed of the Chiriquí mountains in Panama, *Kefersteinia alata* is here documented for the first time for the flora of Costa Rica, on the basis of three collections from the lower Talamanca region, not far from the Caribbean Sea:

**COSTA RICA.** Limón: Amubri, Bris, 300 m West of the mouth of the Río Tskuí (a tributary of the Río Yorkín), 9°31'N, 82°52'W, collected by E. Carman, 28 July 2009, prepared from cultivation at the Lankester Botanical Garden, 30 July 2009, *F. Pupulin 7874* (JBL) (Fig. 28). Limón: Talamanca, Cahuita, ca. 1 km after the substation of ICE-Cahuita, finca of don Cipriano, shores of an affluent of orillas río Carbón toward a small waterfall, 9°43'19.87"N, 82°52'16.87"W, 107 m, tropical moist forest, 26 November 2014, flowered in cultivation at the Lankester Botanical Garden, 8 Aug. 2018, *F. Pupulin 8641* & *D. Bogarín* (JBL) (Fig. 29C); same locality, epífitas on fallen branches and vines, flowered in cultivation at the Lankester Botanical Garden, 20 Aug. 2018, *D. Bogarín 11252*, *N. Belfort* & *F. Pupulin* (JBL).

**Distribution and ecology:** tropical rain forests and premontane wet forests along the Atlantic watershed of the Talamanca mountain chain in southern Costa Rica and Western Panama, at elevations of 100–500 m (Map 9). The species flowers in July–August.

*Kefersteinia alata*, exclusively recorded from the tropical rain forests at low elevations in southern Talamanca, represents the species pair of *K. orbicularis* Pupulin, which is restricted to the low-to-medium elevations on the Pacific slopes of the Talamanca chain.

*PRIDGEONIA* PUPULIN

17. *Pridgeonia* Pupulin, *gen. nov.*

Herbae epiphyticae, caespitosae, acaules, foliis distichis conduplicatis inflorescentiisque lateralibus unijloris; flos insignis, tepalis labelloque manifestis, sepalis lateralibus reflexis basi profunde convolutis, petalis porrectis, labello magno trilobo, apice dilatato, expanso, geniculato, callo magno laminare humilis denticulato, in medio laminae fornito; columna hemiterete pilosa apice dilatata, stigma transversali angusto, rostello aciculare; pollinia 4 super stipitem obcuneiforme-cuspidatum viscidiumque peltatum uncinatum duobus dentibus acutis lateralis munitum.

**Type species:** *Pridgeonia insignis* Pupulin.

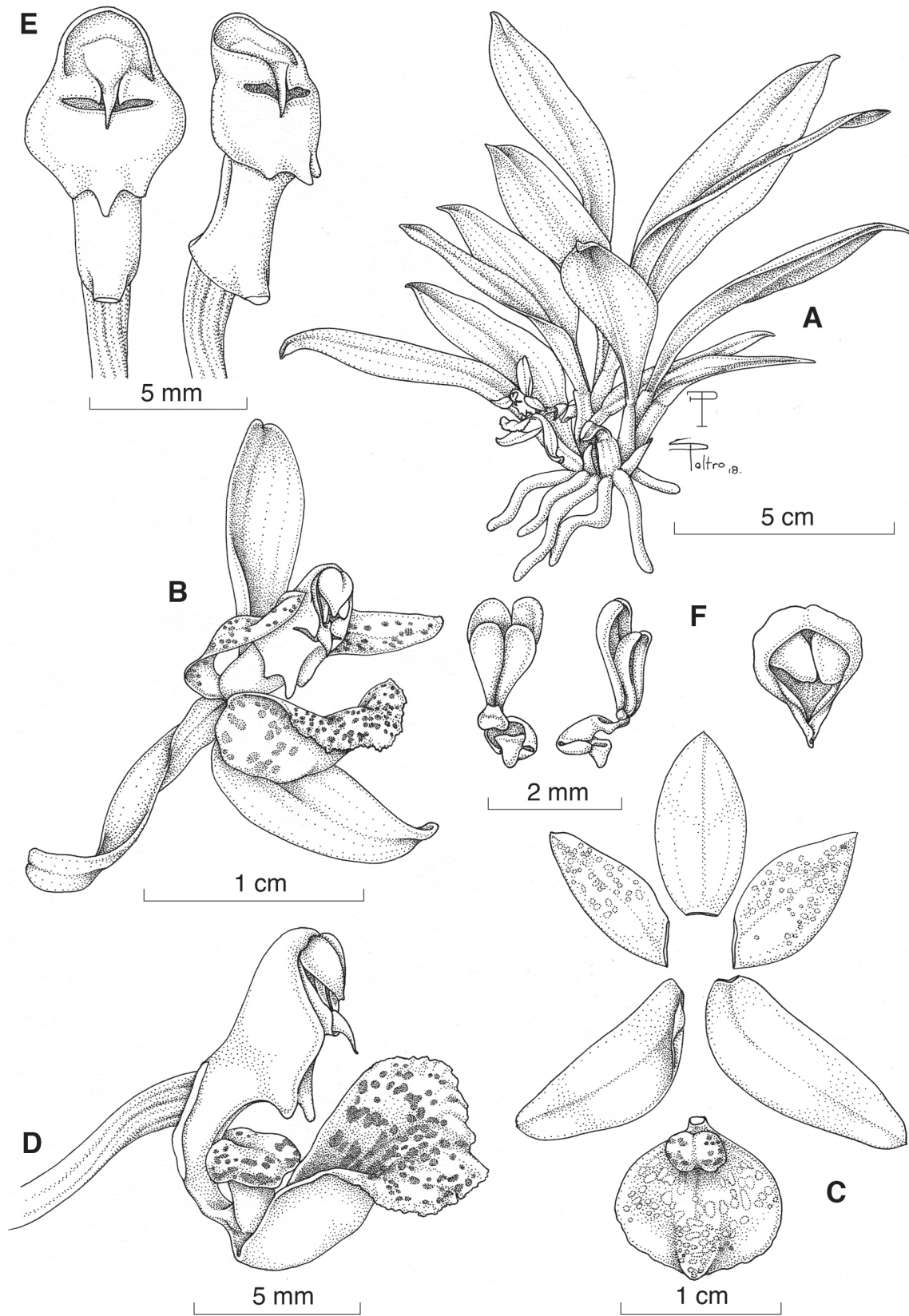


FIGURE 28. *Kefersteinia alata*. A, habit; B, flower; C, dissected perianth; D, column and lip, lateral view; E, column, ventral and three-quarter views; F, pollinarium (two views) and anther cap. Drawn by F. Pupulin and S. Poltronieri from *Pupulin 8343* (JBL).

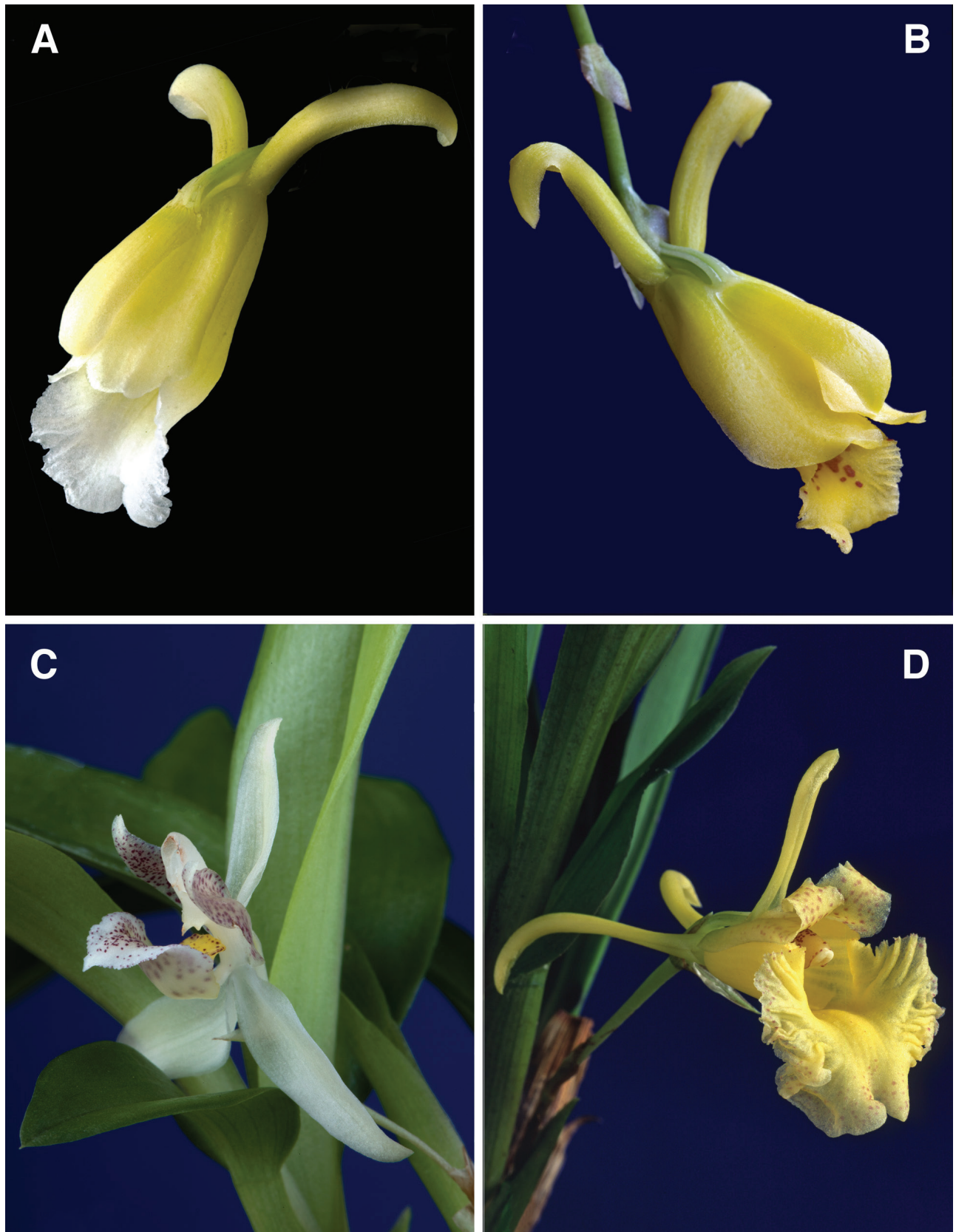


FIGURE 29. A–D. Species of Zygopetalinae. A, *Ixyophora carinata* (CIOA-00567); B, *Ixyophora imitatrix* (CIOA-00928); C, *Kefersteinia alata* (Pupulin 8641); D, *Pridgeonia insignis* (Pupulin 6605). Photographs by F. Pupulin.



MAP 9. Distribution of *Kefersteinia alata*.

**Eponymy:** the genus honors Alec M. Pridgeon, Ph.D., former Sainsbury Orchid Fellow at Jodrell Laboratory, Royal Botanic Gardens, Kew, in recognition of his outstanding career in scientific orchidology.

The flowers of *Pridgeonia* immediately call attention for their size and color, which make them some of the most striking flowers of the whole *Chondrorhyncha* group of the Zygopetalinae (Fig. 30). They are comparable in size to those of *Chondroscaphe* (Dressler) Senghas & G. Gerlach, *Cochleanthes* Raf., and *Euryblema* Dressler, and particularly bring to mind the latter for the shape of the flower and the beautiful foliage. They are born on short, patent to patent, single-flowered inflorescences, from rather stout, erect plants provided with long, oblong, dark green leaves, which are matte on both surfaces. Besides their larger sizes, the shape, color, and texture of the leaves (with the vein not protruding but clearly visible on both the abaxial and adaxial surfaces) are reminiscent of those of *Chaubardiella* Garay, *Aetheorhyncha*, and *Ixyophora*. Florally, *Pridgeonia* is very similar to *Ixyophora*, with the correct petals forming quite a narrow tube with the lip, whose lateral lobes are erect and flank the column, whereas the apex is spread-geniculate. Along with *Aetheorhyncha* and *Ixyophora*, the new genus presents a low, laminar callus in the center of the disc, the free part of which only occupies the central part of the lip, but the callus is much broader than that of *Aetheorhyncha* and it is not multiseriata as its lobes are erect and flank the column, although the apex is spread-geniculate as those of *Aetheorhyncha* and *Ixyophora*. The flowers are distinctly larger than those of any other species in *Aetheorhyncha*

and *Ixyophora* and of a bright yellow color, with the petals sometimes spotted with pale brown, a combination not found in any other species of the supposedly closest relatives. The column of *Pridgeonia* is unique for its ventral surface covered with a densely and finely pilose indumentum, more prominent at the base and more sparse toward the apex. The pollinarium has four large pollinia in two pairs of different sizes, mounted on a reddish brown, transversely rectangular stipe and a peltate viscidium provided with lateral, narrow, acicular extensions in the middle, which are unique among the genera of the *Chondrorhyncha* clade.

18. ***Pridgeonia insignis*** Pupulin, *sp. nov.*

TYPE: ECUADOR. Zamora-Chinchipec: Zumbi, 3°53'29"S, 78°46'43"W, ca. 1100 m, collected by G. Merino and H. Medina, 2003, flowered in cultivation in the collection of Ecuagenera at Gualaceo, 15 May 2007, *F. Pupulin* 6605 (Holotype: CIOA). Fig. 29D, 30A, 31.

*Herba epiphytica, caespitosa, acaulis, foliis oblanceolatis acuminatis indistincte petiolatis, inflorescentiae una vel duabus uniflorae; flos insignis, luteo, petalis labelloque rubro pallente notatis; sepalis marginibus involutis, postico erecto subuncinato, lateralibus reflexis; petalis oblongo-ellipticis obtusis porrectis; labello magno trilobo, elliptico-obovato, profunde emarginato, marginibus proximalibus erectis, apicaliter geniculato, callo magno laminare humilis denticulato in medio laminae fornito; columna hemiterete pilosa apice dilatata, stigma transversali angusto, rostello aciculare; pollinia 4, stipite obcuneiforme-cuspidato, viscidio peltato uncinato duobus dentibus acutis lateralis fornito.*



FIGURE 30. **A–I.** Comparison between the flower of *Pridgeonia* (A), those of other closely allied genera (B–G), and other large-flowered genera of the *Chondrorhyncha* complex (H–I). **A**, *Pridgeonia insignis* (Pupulin 6605); **B**, *Aetheorhyncha andreettae* (Pupulin 6560); **C**, *Ixyophora viridiseipala* (CIOA-00492); **D**, *Ixyophora velastiguii* (Pupulin 6622); **E**, *Chaubardiella subquadrata* (Pupulin 6614); **F**, *Warszewiczella lipscombiae* (Pupulin 8032); **G**, *Stenotyla picta* (Pupulin 4702); **H**, *Chondroscaphe yamilethae* (Pupulin 4637); **I**, *Euryblema anatumum* (Pupulin 5726). All the flowers at the same scale. Scale bar = 3 cm. Photographs by F. Pupulin.

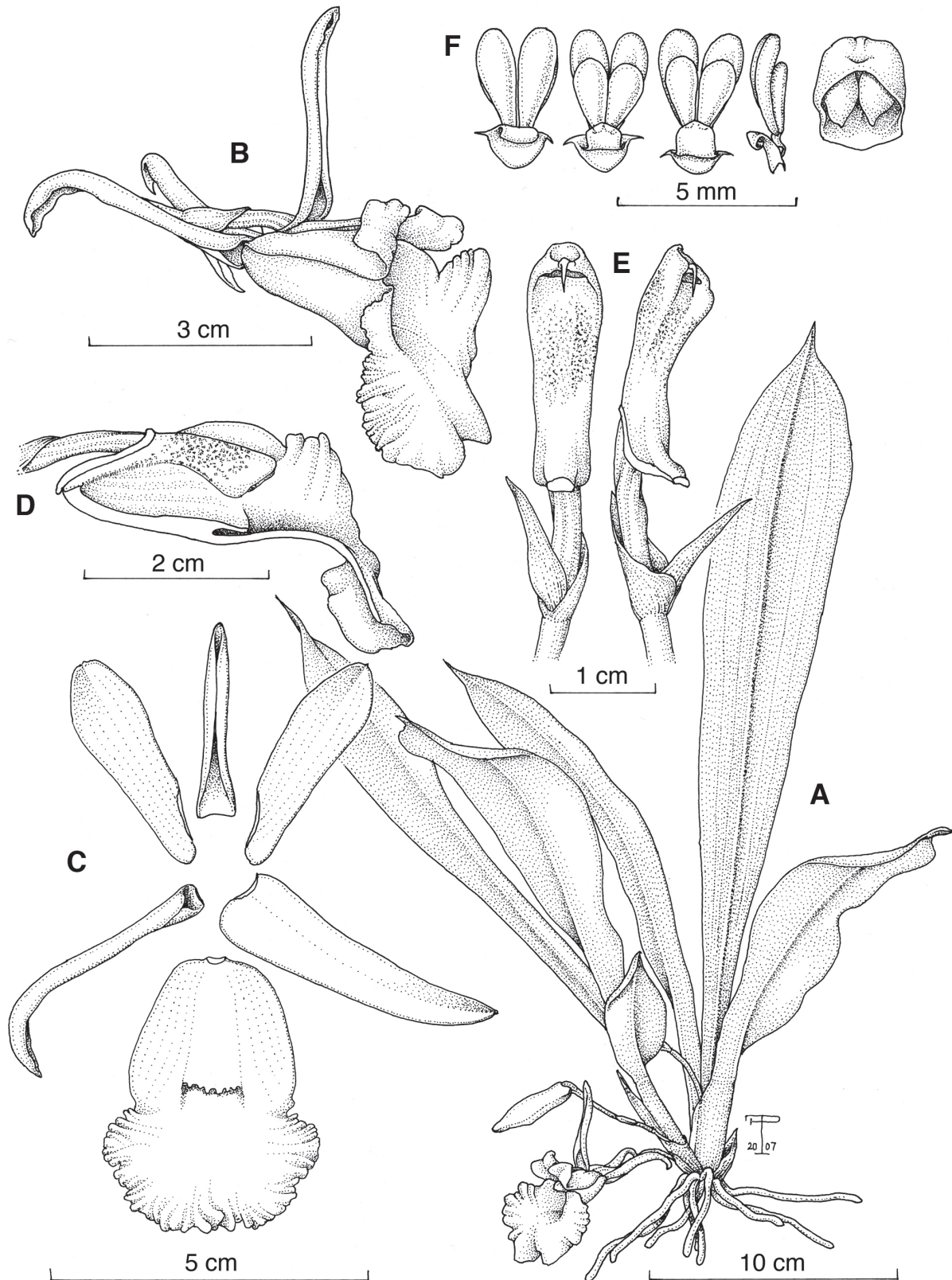
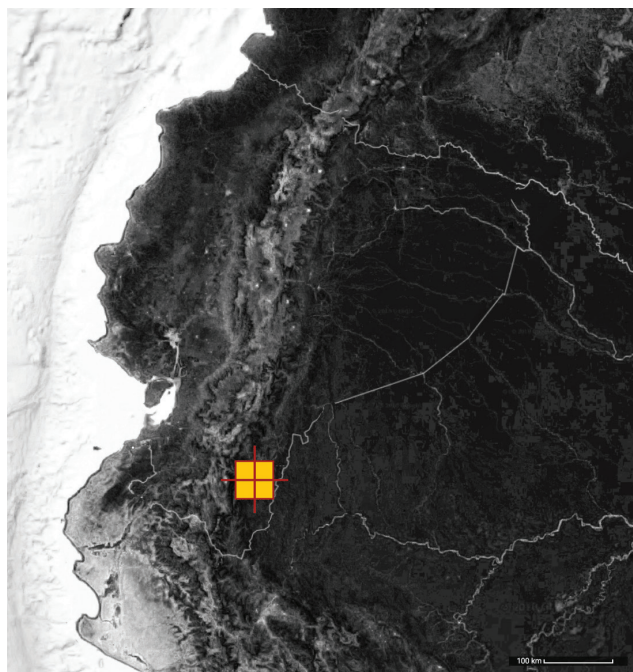


FIGURE 31. *Pridgeonia insignis* Pupulin. **A**, habit; **B**, flower; **C**, dissected perianth; **D**, column and lip, lateral view (the lip longitudinally dissected); **E**, column, ventral and three-quarter views; **F**, pollinarium (four views) and anther cap. Drawn by F. Pupulin from the holotype.

Epiphytic, caespitose *herbs* without pseudobulbs. *Roots* terete, thick, 2.5–3.0 mm in diam., produced from the short rhizome. *Stem* abbreviated, enclosed by 4–7 imbricating sheaths to 6.5 cm long, provided with hyaline, scarious margins, the upper ones foliaceous. *Leaves* conduplicate, articulate, membranaceous, oblanceolate to narrowly obovate, acuminate, grass green, 13–34 × 3.2–5.3 cm, narrowed at the base into a indistinct, conduplicate petiole, abaxially provided with a pronounced median keel and 2–3 lateral, obscure veins. *Inflorescence* lateral, slender, 1–2 per shoot, 1-flowered, to 8 cm long, produced from the axil of the lower sheaths; the peduncle terete, suberect to patent, provided with 2–3 narrow, conduplicate-tubuliform, acute bracts to 15 mm long; floral bract double, conduplicate, shorter than pedicellate ovary, the external one broadly ovate-suborbicular, shortly acuminate, 13 × 11 mm, the subopposite internal bractlet narrowly lanceolate, 11 × 3 mm. *Flowers* resupinate, large, no perfume detected, yellow, the petals sparsely spotted with pale brown, the column spotted and striped with reddish brown, the callus yellow. *Dorsal sepal* free, erect, narrowly lanceolate, acute to shortly acuminate, apically subuncinate, the lateral margins strongly inrolled-folded, 3.2 × 0.6–0.7 cm. *Lateral sepals* narrowly lanceolate, slightly subfalcate, asymmetrical, acute, reflexed 180 degrees, apically falcate-uncinate, strongly inrolled-folded, 4.0 × 1.2 cm. *Petals* inserted along the margins of the column foot, obliquely oblong-elliptic, obtuse, minutely apiculate, porrect, apically gently arcuate-revolute, 3.5 × 1.3 cm. *Lip* articulate with the column foot, elliptic-obovate, obscurely 3-lobed, 4.3 × 3.0 cm, the base rounded, the apex deeply emarginate, the proximal margins erect, flanking the column, apically deflexed, the distal margins crisped; disc with a low, flat, laminar callus, borne at the middle of the lip, apically provided with 2 acute teeth, and 2 lateral, shorter, rounded teeth on each side. *Column* semiterete, gently curved, 1.5 cm long, with a distinct foot ca. 8 mm long, slightly dilated at apex into inconspicuous stigmatic wings, pale yellow, fading bright yellow toward the base, irregularly spotted with purple, more densely toward the apex, adaxially densely pilose-hirsute toward the base; the stigma transverse, narrow, slit-like; the rostellum acicular. *Anther cap* incumbent, cucullate, subrectangular, flattened, 2-celled. *Pollinia* 4, in 2 subequal pairs, on a broad, obcuneiform-cuspidate, sigmoid, brown stipe and a shield-shaped, basally uncinata, hyaline,



MAP 10. Distribution of *Pridgeonia insignis*.

brown viscidium provided with 2 lateral, narrow, acute teeth at its widest point.

**Etymology:** from the Latin *insigne-insignis*, remarkable, distinguished, in reference to the remarkable flower, one of the largest flowers in the whole complex of Zygopetalinae genera and species allied to *Chondrorhyncha*.

**Distribution and ecology:** *Pridgeonia insignis* is known only from the wet region of Zumbi along the Amazonian watershed of the Andes in southern Ecuador, where it has been found in a tropical rainforests patch (Map 10). The species flowers in cultivation in May–June.

The first, unfortunate attempt at describing *Pridgeonia insignis* was done by Harding (2008), who in her proposal of *Chondrorhyncha panguensis*, and in the absence of any fresh material at hand for study, ended up mixing several collections and creating a chimaera. Fortunately, the type of *C. panguensis* selected by the author is a specimen of *Aetheorhyncha andreetae*, so that Harding's name has no nomenclatural effects on *Pridgeonia* (see discussion here above, under *Aetherorhyncha andreetae*).

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