A SECOND LOOK AT THE GENUS *SIGMATOSTALIX* (ORCHIDACEAE: ONCIDIINAE) IN COSTA RICA

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Abstract. A new taxonomic treatment of the genus *Sigmatostalix* in Costa Rica is presented. All the species are described and illustrated, and a key is provided for identification of Costa Rican taxa. Three new species are described. *Sigmatostalix cardioglossa* and *S. savegrensis* are related to the Mesoamerican group close to *S. picta*, but lack retrorse lobules on the lip lamina. *Sigmatostalix cardioglossa* has a cylindrical, non-canaliculate claw, and a 3-mamillate callus on the disc. *Sigmatostalix savegrensis* presents lateral sepals connate to the middle, entire, rheniform lamina of the lip, and open, semicircular callus. *Sigmatostalix hymenantha* is lectotypified, its taxonomic concept is reconsidered and Costa Rican material previously referred to this taxon is described as *S. integrilabris*. *Sigmatostalix integrilabris* is a close relative of *S. adamsii* (a species here excluded from Costa Rican flora), from which it can be distinguished by the much wider lamina of the lip provided with a smaller callus, and the long column with small apical wings.

Keywords: Orchidaceae, Oncidiinae, Systematics, *Sigmatostalix*, *Sigmatostalix cardioglossa*, *Sigmatostalix hymenantha*, *Sigmatostalix integrilabris*, *Sigmatostalix savegrensis*, Costa Rica.

With the publication of the volume on Orchidaceae treating subtribes Maxillariinae and Oncidiinae for the *Flora Costaricensis* (Atwood & Mora-Retana 1999), most of the genera of these difficult groups were elucidated. However, during the preparation of the taxonomic treatment of *Sigmatostalix* Rchb.f. for *Flora Mesoamericana* (Pupulin, in prep.), the author had the opportunity to critically review most of the material examined by previous authors for their understanding of the genus, and some new interpretations seem to be necessary.

Sigmatostalix species in Costa Rica mostly fall into two rather recognizable groups, roughly characterized by the sessile (at most cuneate) or distinctly clawed base of the lip. Among the species provided with a long lip claw, the most problematic group is that related to the South American *S. picta* Rchb.f., an assemblage including a large number of closely related species whose distribution ranges from southern Mexico to Peru and Bolivia (Schweinfurth 1961, Dodson & Bennett 1989, Dodson & Vásquez 1989, Espejo Serna & López-Ferrari 1998). Species in the *S. picta* group present a distinct, more or less channeled claw on the lip, abruptly diverging into a cordate, peltate or rheniform lamina, which usually bear two retrorse lobules. At the joining point between claw and lamina, which some authors interpreted as the apex of claw (e.g. Königer 1995) but that better corresponds to the disc of the lip, a rather massive callus is present. The actual function of this callus is unknown, but its position in front to the distal extremity of the channeled claw suggests it plays a role in collecting the oil secreted by the elaiophore situated at the base of the column, so interacting with pollinators' behavior.

Sigmatostalix picta was originally described by Reichenbach (1864) on the basis of a collection from Quito, Ecuador (the type, *Jamieson s.n.*, W). In subsequent years, *S. eliae* Rolfe, *S lunata* Schltr., *S. caqueteana* Schltr., and *S. buchtienii* Krzl. were also described from South America (Rolfe 1908, Schlechter 1916, 1924, Kränzlin 1928), and in more recent times *S. ariasii* Kgr., *S. bicallosa* Garay, *S. crescentilabia* C. Schweinf., *S. hermansiana* Kgr., *S. lutzii* Kgr., and *S. marinii* Kgr. were added to the Andean group of species close to *S. picta* (Schweinfurth 1947, Garay 1951, Königer 1995a, 1995b, 1999). In his monograph on *Sigmatostalix*, Schlechter (1919) used the presence of a distinct claw of the lip to separate *Sigmatostalix s.s.* from his new proposed genera *Petalocentrum* and *Roezliella*, both characterized by a sessile lip, but this generic treatment was considered suspiciously by Kränzlin (1922) and definitively disclaimed by Schweinfurth (1949) as well as subsequent

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Harvard Papers in Botany, Vol. 8, No. 1, 2003, pp. 35–59.

authors (i.e., Schweinfurth 1961, Dressler 1981, 1993, Brako & Zarucchi 1993, among others). Dressler (1993) accepted the name *S. guatemalensis* for populations with strongly stalked lip and subquadrate-ovate lamina of the lip, excluding *S. picta* from synonymy with Mesoamerican species.

In the treatment of Costa Rican *Sigmatostalix*, Mora-Retana (1999) preferred to recognize *S. picta* in a broad sense, reducing into synonymy under that species most of the names published for Central American taxa (Schlechter 1911, Rolfe 1916, Kränzlin 1922). However, lip and callus morphology in South American populations referable to *S. picta* prevents such a conclusion (see *infra*, under the treatment of *S. guatemalensis* Schltr.). In *S. picta* the lamina of the lip is rheniform to subtriangular with the two retrorse, falcate lobes inserted nearly at midpoint of the lamina basal margins, and the canaliculate claw ends into a cup shaped, calceolate pouch where the oil is collected. In Mesoamerican taxa, on the contrary, the lip lamina is ovate to cordate or peltate (if rheniform, lacking lateral lobes), the lateral lobes (when present) are inserted on the outer portion of the basal margins of lamina, and the claw extends into a open callus. The species Christenson and Lee (2002: 317) recently illustrated under the name *S. picta* should be referred to *S. guatemalensis*. Comparing living and dried specimens of Mesoamerican *Sigmatostalix* which have been referred to the *S. picta* group, they can be assigned to four different species (all recorded from Costa Rica), none of which share the characters set that is typical of South American populations of *S. picta sensu stricto.*

Among Costa Rican species with sessile lip, some early species misinterpretations obscured actual relationships in the group. *Sigmatostalix hymenantha* Schltr., long considered as a rather common element of Costa Rican and Panamanian forests, is here reconsidered at the light of close examination of Schlechter's protologue and the extant type illustration kept at AMES. The finding of a single Costa Rican specimen of *S. picturatissima* Kraenzl. allowed inclusion of the country within the distribution range of this eminently South American species.

KEY TO COSTA RICAN SPECIES OF THE GENUS *SIGMATOSTALIX*

1a. Lip unguiculate 2
1b. Lip sessile 8
2a. (1). Claw short, < 1/5 of lip length; flowers small (sepals < 3 mm long) . . . . . 4. ***S. hymenantha***
2b. Claw long, ± 1/3 of lip length; flowers larger (sepals > 5 mm long) 3
3a. (2). Lamina of lip strongly deflexed 4
3b. Lamina of lip continuous with claw, not deflexed 5
4a. (3). Lateral lobes of lip falcate, acute, yellow . . . . . 11. ***S. unguiculata***
4b. Lateral lobes of lip straight, obtuse, white . . . . . 9. ***S. pseudounguiculata***
5a. (3). Lamina of lip with distinct retrorse lobules 6
5b. Lamina of lip without retrorse lobules 7
6a. (5). Callus ovate, short, obtuse to rounded . . . . . 3. ***S. guatemalensis***
6b. Callus triangular, long, acuminate . . . . . 8. ***S. poikilostalix***
7a. (5). Lamina of lip cordate . . . . . 2. ***S. cardioglossa***
7b. Lamina of lip rheniform . . . . . 10. ***S. savegrensis***
8a. (1). Lip distinctly 3-lobed; callus without apical teeth or ligule . . . . . 7. ***S. picturatissima***
8b. Lip simple; callus with apical teeth or ligule 9
9a. (8). Callus concave, cup-shaped . . . . . 5. ***S. integrilabris***
9b. Callus convex, massive 10
10a. (9). Lamina of lip flabellate; callus subequal to lamina of lip . . . . . 1. ***S. brownii***
10b. Lamina of lip suborbicular; callus much smaller than lamina . . . . . 6. ***S. macrobulbon***

SPECIES DESCRIPTION

1. *Sigmatostalix brownii* Garay, Caldasia 10: 236. 1968. TYPE: PANAMA. without precise locality. Cultivated in Miami by Mr. *Henry Brown* s.n. (holotype, AMES, photo). Fig. 1.

Plant epiphytic, small, cespitose, erect, to about 15 cm tall. **Roots** filiform, glabrous, about 1 mm in diameter. **Pseudobulbs** reddish-brown, ovate, laterally compressed, unifoliate at apex, surrounded at the base by 2–4 distichous, foliaceous sheaths, 3–4 cm long, 0.8–1.5 cm wide. **Leaves** green, subcoriaceous, narrowly lanceolate-oblong, acute, to 15 cm long, 0.5–1.0 cm wide. **Inflorescence** lateral, to 18 cm long, a panicle with several condensed

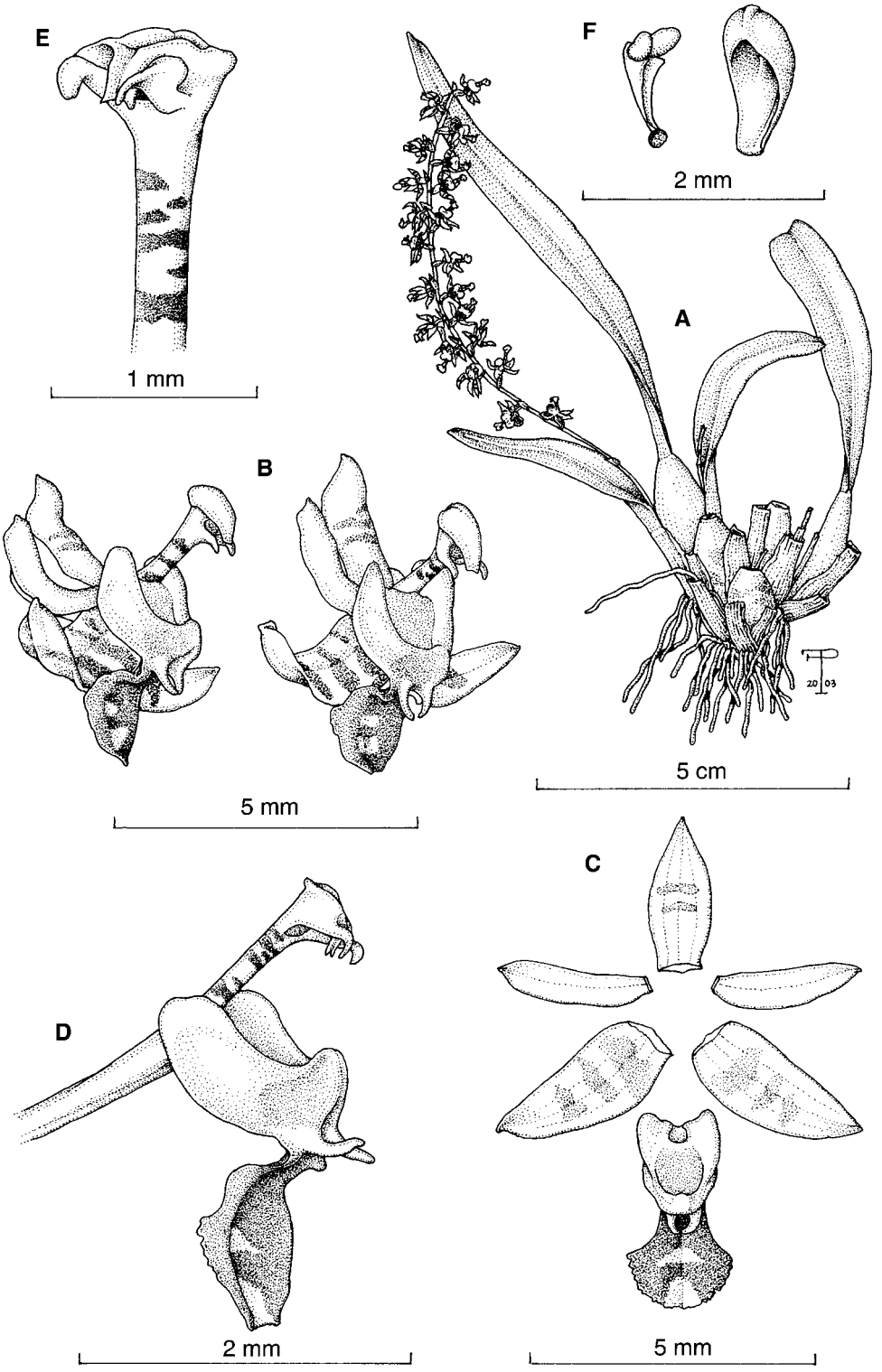

FIGURE 1. *Sigmatostalix brownii* Garay. A. Habit. B. Flower, two views. C. Dissected perianth. D. Column and lip, lateral view. E. Column, abaxial view. F. Pollinarium and anther cap. Based on: *Pupulin 4254* (USJ).

branches (appearing racemose) to 0.6 cm long, the flowers emerging from dense clusters of bracts. **Floral bracts** short, membranaceous, ovate, acute, 1 mm long. **Pedicellate ovary** linear-clavate, 2 mm long including the pedicel. **Flowers** spreading, pale green, the sepals barred with reddish-brown, the lip purplish red. **Dorsal sepal** lanceolate-oblong, acute, subacuminate, concave, to 3 mm long, 1 mm wide. **Lateral sepals** free, reflexed, obliquely lanceolate-subfalcate, acute, apiculate, 3 mm long, 1 mm wide. **Petals** lanceolate-subfalcate, acute, 2.5 mm long, 0.6 mm wide. **Lip** sessile, geniculate, elliptic-ovate, obtuse, shortly apiculate, 3 mm long, 2 mm wide; the flabellate lamina concave, recurved, the margins crenulate; disc with a fleshy, massive, ovate, convex callus extending from the base to lower half of the lip, the margins projecting into two distinct teeth in front. **Column** short, terete, straight to slightly curved, dilated at apex, 2 mm long, with a pair of linear-falcate wings. **Anther cap** decumbent, narrowly elliptic-ovate, cucullate, keeled along the middle, obscurely 2-celled. **Pollinia** 2, obpyriform, on a clavate stipe; viscidium rounded.

Habitat and Ecology: *Sigmatostalix brownii* grows as an epiphyte in tropical, premontane and lower montane moist to wet forest at 50–1100 m elevation, where it is an uncommon element on partially shaded branches and twigs in disturbed vegetation, as well as in primary forest in Península de Osa. Flowering occurs from September to December.

Distribution: Costa Rica and Panama.

Additional specimens examined: COSTA RICA. Puntarenas: Coto Brus, San Vito de Coto Brus, road from Río Grande de Térraba to San Vito, about 6 km before San Vito town, finca of W. Chacón, ca. 8˚50'N, 83˚00'W, 1100 m, flowered in cultivation in W. Chacón collection, 14 November 2002, *F. Pupulin 4254* (USJ). Península de Osa. Lomas antes de bajar a Rancho Quemado, Fila del Cerro Chocuaco. Bosque primario. 8˚40'50"N, 83˚32'45"W. 250–300 m. Epífita en una ramita seca, caída, cubierta de musgo. 16 November 1993. *Carlos O. Morales 737, R.L. Dressler, K. Dressler, B. Hammel & R. Aguilar* (USJ). Without collecting data, cultivated in San Isidro de Pérez Zeledón, *V. Juárez-Pérez s.n.* (USJ); without collecting data, flowered at the Orchid Exhibition of Alajuela, 28 October 1999 (photo).

The massive, convex callus at the base of the lip, ending in two lateral teeth, and the geniculate lamina, easily distinguishes *S. brownii* among close relatives in Mesoamerica. Vouchers of *S. brownii* so far recorded for Costa Rica (Mora-Retana 1999, Pupulin 2002) were from cultivated material flowered in mixed collections without locality data. However, the inclusion of Costa Rica in the distribution range of *S. brownii* is substantiate on the basis of two specimens from the southern regions of Coto Brus, not far from Panamanian border, and Osa (C.O. Morales, pers, comm.).

2. ***Sigmatostalix cardioglossa*** Pupulin, *sp. nov.* TYPE: COSTA RICA. San José: Pérez Zeledón, San Ramón Norte, trail to Cerro Pelón, 9˚25'N 83˚44'W, 1050 m, lower montane moist forest, secondary mature and primary vegetation, collected by J. Cambronero and F. Pupulin, flowered in cultivation, 3 December 2001, *F. Pupulin 3499* (holotype, USJ; clonotype in cultivation at Jardín Botánico Lankester, Universidad de Costa Rica). Fig. 2.

Species Sigmatostalici pictae Rchb.f. *similis, planta parviore ungue labelli cylindrica non canaliculata lamina intera cordata apiculata callo non cyathiformi antice tri-mammillato differt.*

Plant epiphytic, cespitose, erect, small, to 8 cm tall. **Roots** filiform, flexuous, glabrous, about 1 mm in diameter. **Pseudobulbs** elliptic-ovate, compressed, unifoliate at apex, surrounded at the base by 3–5 distichous, foliaceous and non-foliaceous sheaths, 1.5–2.3 cm long, 0.7–1.2 cm wide, green flushed with purple-brown. **Leaves** subcoriaceous, linear-ligulate, obliquely bilobulate at apex, to 7.5 cm long, 1 cm wide, the base narrowing into a conduplicate petiole to 1 cm long. **Inflorescence** lateral, erect-spreading, slender, apparently secund, much longer than leaves, up to 22 cm long, the successive flowers subtended by clusters of papyraceous bracts. **Floral bracts** lanceolate, acute, scarious, subequal to pedicel, about 6 mm long. **Pedicellate ovary** slender, to 7 mm long including the pedicel. **Flowers** yellow blotched with reddish brown. **Sepals** free, narrowly lanceolate-elliptic, acuminate, strongly reflexed, 8 mm long, 2.0–2.3 mm wide. **Petals** lanceolate-ligulate, acuminate, reflexed, 7.5 mm long, about 1.7 mm wide. **Lip** long-unguiculate, the fleshy claw linear, cylindric, dilated toward the apex into two lateral, triangular, obtuse, flattened

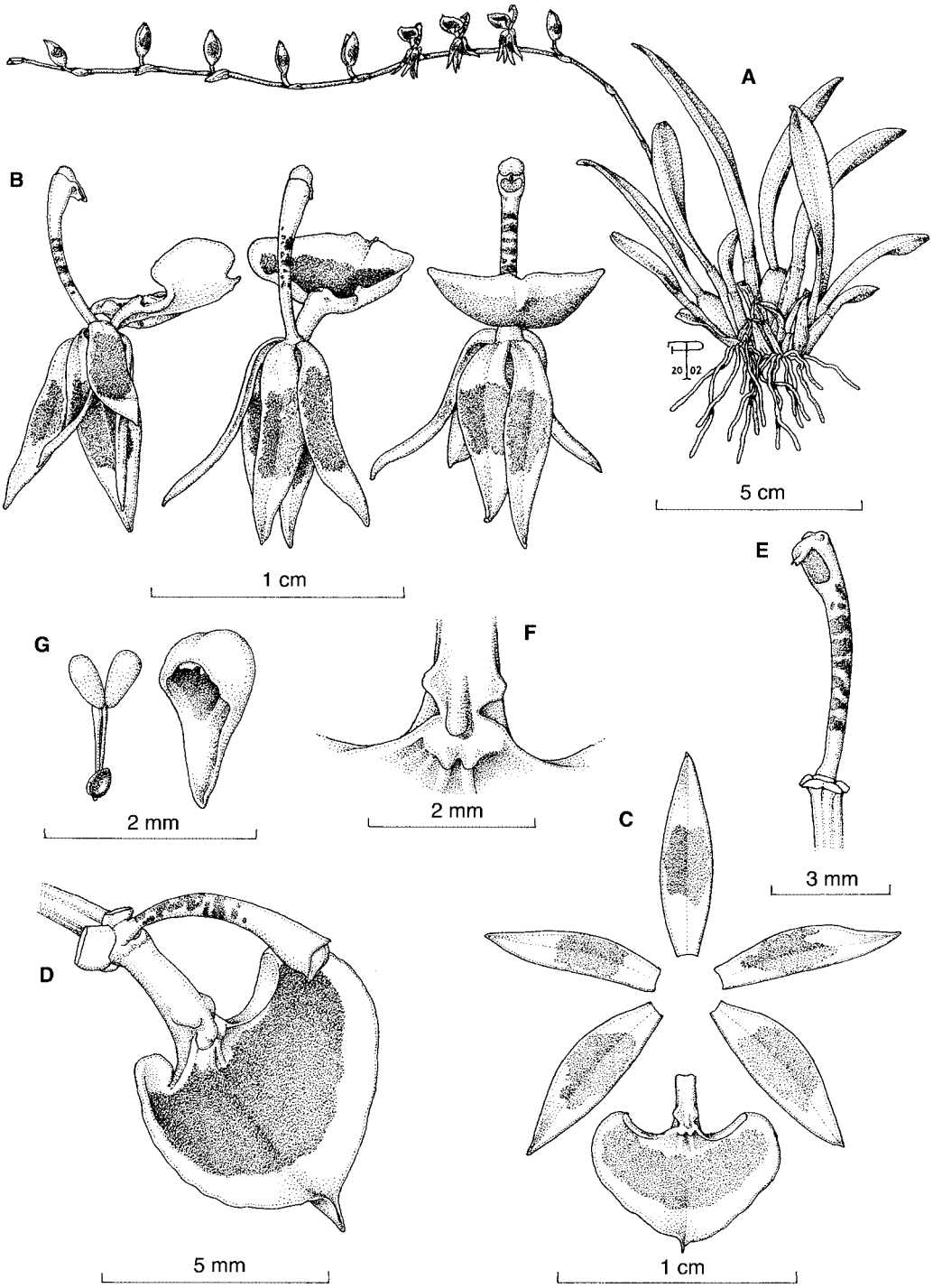

FIGURE 2. *Sigmatostalix cardioglossa* Pupulin. A. Habit. B. Flower, three views. C. Dissected perianth. D. Column and lip, lateral view. E. Column, abaxial view. F. Callus. G. Pollinarium and anther cap. Based on: *Pupulin 3499* (USJ). Drawn from the holotype.

teeth, 2 mm long, 1 mm wide, the lamina entire, cordate, apiculate, 5 mm long, 8 mm wide; disc with a very short, widely elliptic, 3–mamillate, rounded callus. **Column** slender, terete, arcuate, dilated at apex into a porrect, triangular, shortly bifid rostellum, 6 mm long. **Anther cap** ovate, narrowly acute, 2-celled. **Pollinia** 2, elliptic-obovate, on an elliptic, infolded stipe; viscidium obpeltate.

Habitat and Ecology: Epiphytic in premontane moist forest at about 1000 m elevation. *Sigmatostalix cardioglossa* is uncommon on shaded branches and twigs in primary and secondary mature vegetation. Flowering occurs at least in November and December.

Distribution: Only known from the type collection in Costa Rica.

Etymology: From the Greek *cardio*-, heart, and *glossa*, tongue, lip, in reference to the heart-shaped lip.

Sigmatostalix cardioglossa has the smaller habit among Mesoamerican species of the *S. picta* group. The cylindric claw of the lip lacking a central channel, the tri-mammillate callus at the base of the lip, and especially the cordate lamina without any lateral lobe, easily distinguish this species from its Costa Rican relatives.

3. ***Sigmatostalix guatemalensis*** Schltr., Repert. Spec. Nov. Regni Veg. 10: 253. 1911. TYPE. GUATEMALA. Alta Verapaz: Cobán, 1350 m, *H. Türckheim II-2103* (holotype, B, destroyed; lectotype [Christenson 1996], US, photo; topotype, *H. Türckheim 350*, W). Fig. 3.

Synonym: *Sigmatostalix costaricensis* Rolfe, Bull. Misc. Inform. 78. 1916; Bot. Mag. t. 8825. 1919. TYPE: COSTA RICA. Without precise locality, 1915, flowered in cultivation at Kew, December 1915, *C.H. Lankester s.n.* (holotype, K, not seen).

Usage synonym: *Sigmatostalix picta* of authors, *non* Rchb.f. 1864.

Plant epiphytic, cespitose, erect, to 20 cm tall. **Roots** filiform, flexuous, glabrous, about 1 mm in diameter. **Pseudobulbs** ovate to elliptic-ovate, compressed, unifoliate at apex, surrounded at the base by 4–6 distichous, foliaceous and non-foliaceous sheaths, 1.7–4.0 cm long, 0.7–1.9 cm wide, usually green flushed with purple, rarely purple. **Leaves** subcoriaceous, linear-oblong to lanceolate-elliptic, obtuse to subacuminate, to 13 cm long, 1.8 cm wide. **Inflorescence** lateral, erect, slender, laxe, usually much longer than leaves, up to 35 cm long, the flowers produced on short, fasciculate, lateral branches, subtended by dense clusters of bracts. **Floral bracts** elliptic-ovate, apiculate, scarious, shorter than pedicel, about 5 mm long. **Ovary** slender, 8–10 mm long including the pedicel. **Flowers** yellow blotched with reddish brown, rarely entirely yellow. **Sepals** free, lanceolate, subobtuse to acute to subacuminate, strongly reflexed, 7–9 mm long, 1.5–2.5 mm wide; the **lateral sepals** sometimes shortly connate at the base for about 2 mm. **Petals** lanceolate-ligulate, acute, reflexed, 7–9 mm long, 1.7–2.6 mm wide. **Lip** long-unguiculate, the fleshy claw linear, dilated at apex into a transversal trapezoidal plate, 3 mm long, 1.2 mm wide, the lamina 3-lobed, 6 mm long, 5 mm wide; basal lobules triangular-falcate, acute, introrse, the involute inner margins thickened; midlobe widely ovate to suborbicular, obtuse to shortly emarginate, minutely apiculate; disc with a short triangular-sagittate, rounded, suberect callus. **Column** slender, terete, arcuate, dilated at apex into a porrect rostellum, about 7 mm long. **Anther cap** narrowly ovate, 2-celled. **Pollinia** 2, obpyriform, on a clavate stipe; viscidium peltate.

Habitat and Ecology: A rather frequent epiphyte in premontane and lower montane moist forest, at 800–1800 m elevation. *Sigmatostalix guatemalensis* is usually found on shaded branches covered with mosses in mature vegetation. Flowering mostly occurs from (June) September to December.

Distribution: Mexico to Colombia and Venezuela.

Additional specimens examined: COSTA RICA. Alajuela: San Ramón, Los Angeles, 10˚08'N 84˚28'W, 1300–1350 m, 21 Sept. 1993, *J. Gómez-Laurito 12470* (USJ); between Los Angeles de San Ramón and Catarata, 850–1100 m, 16 June 1983, *K. Barringer 3189* (SEL). Cartago: Turrialba, Parque Nacional Tapantí, October 1992, *D.E. Mora-Retana s.n.* (USJ); Reserva Tapantí, vertientes arriba de Quebrada Seca, 29 November 1984, *R.L. Dressler & Biología 200* (USJ); Parque Nacional Tapantí, 8 October 1993, *D.E. Mora-Retana s.n.* (USJ); *ca.* 2.5 km north of Tapantí, 1500–1600 m, 5 December 1975, *Utley & Utley 3543* (SEL); Vicinity of Cachí, Reventazón valley, 4000 ft., flowered in the collection of Mr. C. Lankester, 26 November 1946, *P.H. Allen 3859* (SEL). Guanacaste: road to San Gerardo from Sta. Elena, 10˚21'N 84˚48'W, 1550–1800 m, December 1989, *J.T.*

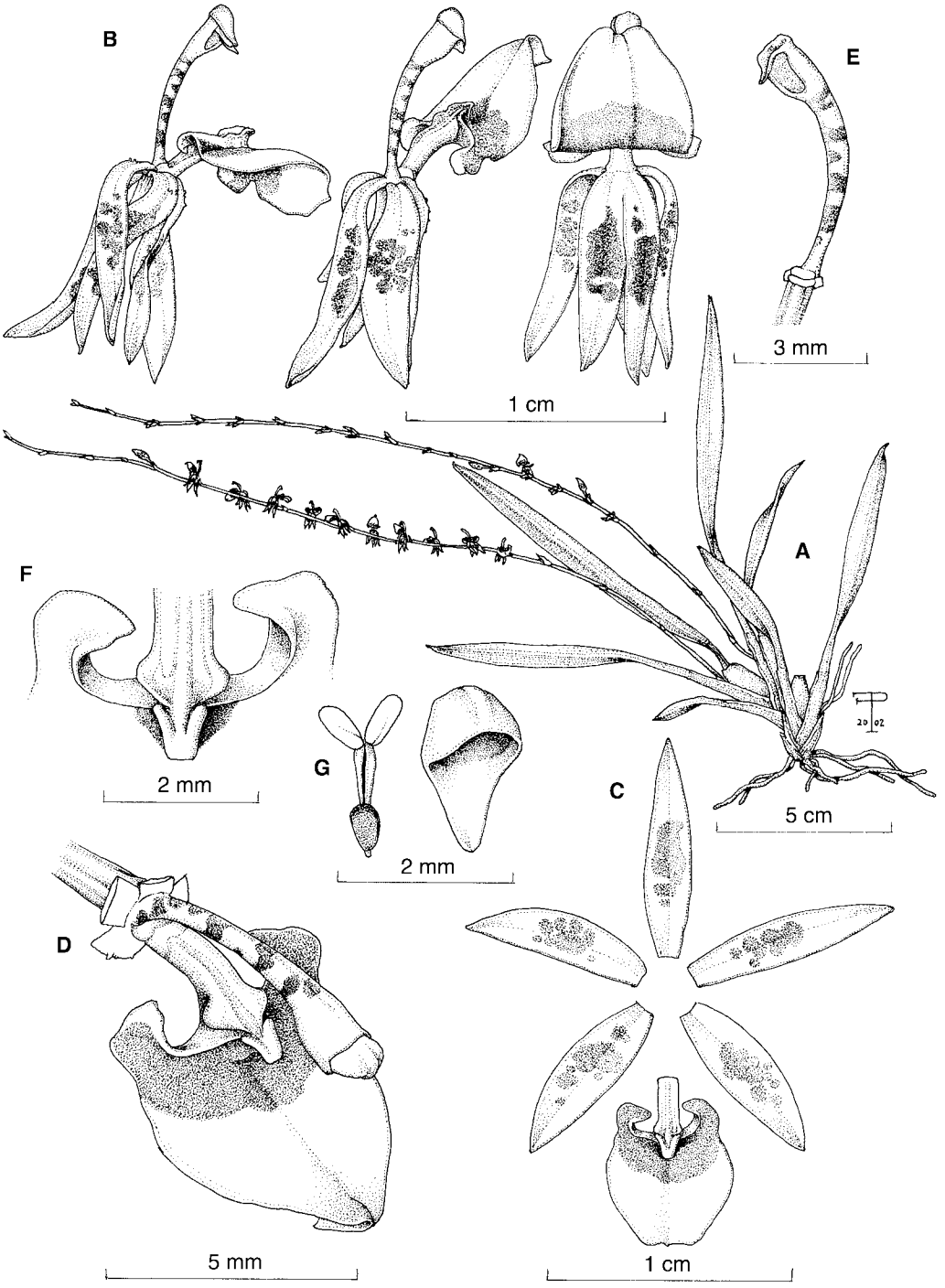

FIGURE 3. *Sigmatostalix guatemalensis* Schltr. A. Habit. B. Flower, three views. C. Dissected perianth. D. Column and lip, three-quarters view. E. Column, three-quarters view. F. Callus. G. Pollinarium and anther cap. Based on: *Mora-Retana s.n.* (USJ).

Atwood & W. Morris 4094 (SEL). Heredia: Cinchona, Sarapiquí, 16 October 1992, *D.E. Mora-Retana s.n.* (USJ).

Species of the *S. guatemalensis* complex in Costa Rica and Mesoamerica were treated as a broad *S. picta* Rchb.f. (Mora-Retana 1999) on the basis of gross similarities in floral morphology. However, *S. picta* is a very distinctive taxon endemic of South American Andes, where it is a rather frequent species in Ecuador (the type, Quito, forest of Nanegal, *Jamieson s.n.*, W. Azuay: Duran-Tambo, *Luer & Córdoba 1483*, SEL; between Guayaquil and Cuenca, *Luer et al. 1483*, SEL. Bolivar: Balzapamba, *Dodson 50*, SEL; between Guaranda and Caluma, *Luer & Dalström 7272*, SEL. Carchí: Río Blanco, *Dodson 297*, SEL. Cotopaxi: El Palmar, *Luer & Kent 315*, SEL, *Luer et al. 859*, SEL; from Queredo to Latacunga, *Dodson 5524*, SEL; east of El Palmar, *Dodson & Gentry 10239*, SEL, *Holm-Nielsen et al. 2951*, SEL. El Oro: 10 km west of Piñas, *Dodson et al. 9340*, SEL; Piñas, *Walter 79943*, SEL. Pichincha: 28 km east of Santo Domingo, *Luer et al. 544*, SEL; 5 km east of Alluriquin, *Madison s.n.*, SEL, *Madison 4057*, SEL. Puyo: Pastaza, *Perry s.n.*, SEL. Zamora: km 42 road to Zamora, *Dodson & Thien 819*, SEL. Without precise locality, *Ibáñez s.n.*, USJ-Spirit). Unlike other species from Central America, the claw of lip in *S. picta* present a rather deep channel, ending into a cyathiform, rounded callus, where the oil secreted at the base of column is collected (Dodson & Dodson 1980). Moreover, the lamina of lip of *S. picta* is broadly rheniform and provided with two falcate, introrse lobules, which are inserted grossly at midpoint of the basal margins of the lip (fig. 4), a set of characters that has no parallels among Mesoamerican taxa.

Mora-Retana (1999) considered color variation a reliable character to distinguish *S. picta* in a broad sense from *S. guatemalensis*, but the latter occurs in two color forms, with flowers totally yellow and yellow blotched with reddish brown, throughout all its range from Guatemala to Colombia. In Cobán area in Guatemala, as well as in Mexico (Williams 1951), it is apparently more common in the variant lacking red pigmentation (type of *S. guatemalensis*, *Türkheim II-2103*, US), whereas the blotched form is more frequent southward.

4. ***Sigmatostalix hymenantha*** Schltr., Repert. Sp. Nov. Regni Veg. 15: 143. 1919, *nomen, et* Beih. Bot. Centralbl. 36: 419. 1918. TYPE: COSTA RICA. Curillo [?], 300 m, *C. Wercklé s.n.* (holotype, B, destroyed; lectotype, selected here, AMES 24866, drawings of type). Fig. 5.

Plant epiphytic, cespitose, erect, to about 20 cm tall. **Roots** filiform, flexuous, glabrous, about 1 mm in diameter. **Pseudobulbs** ovate, strongly compressed, bifoliate [?] at apex, 2.5 cm long, 1.5–2 cm wide. **Leaves** coriaceous, linear, acute, to 13–17 cm long, 0.5–0.7 cm wide. **Inflorescence** lateral, erect, slender, the peduncle slightly compressed, subequal to leaves in length, with laxe, condensed lateral branches, the flowers emerging from dense clusters of bracts. **Floral bracts** imbricating,

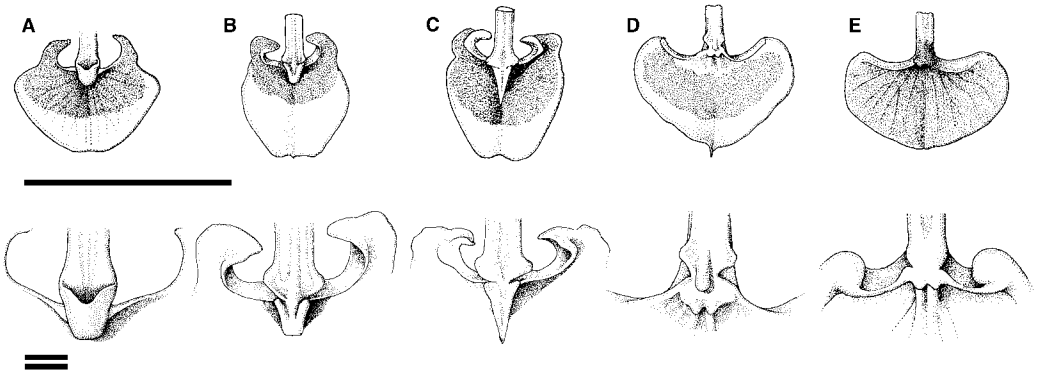

FIGURE 4. Comparison of lip and callus shape in species of *Sigmatostalix picta* group. A. *S. picta* Rchb.f., from Ecuador. B. *S. guatemalensis* Schltr. C. *S. poikilostalix* Kraenzl. D. *S. cardioglossa* Pupulin. E. *S. savegrensis* Pupulin. All drawn at the same scale. Single bar = 1 cm. Double bar = 1 mm. Based on: A, *Ibanez s.n.* (USJ-Spirit); B, *Mora-Retana s.n.* (USJ); C, *Pupulin 3845* (USJ); D, *Herrera et al. 7282* (USJ).

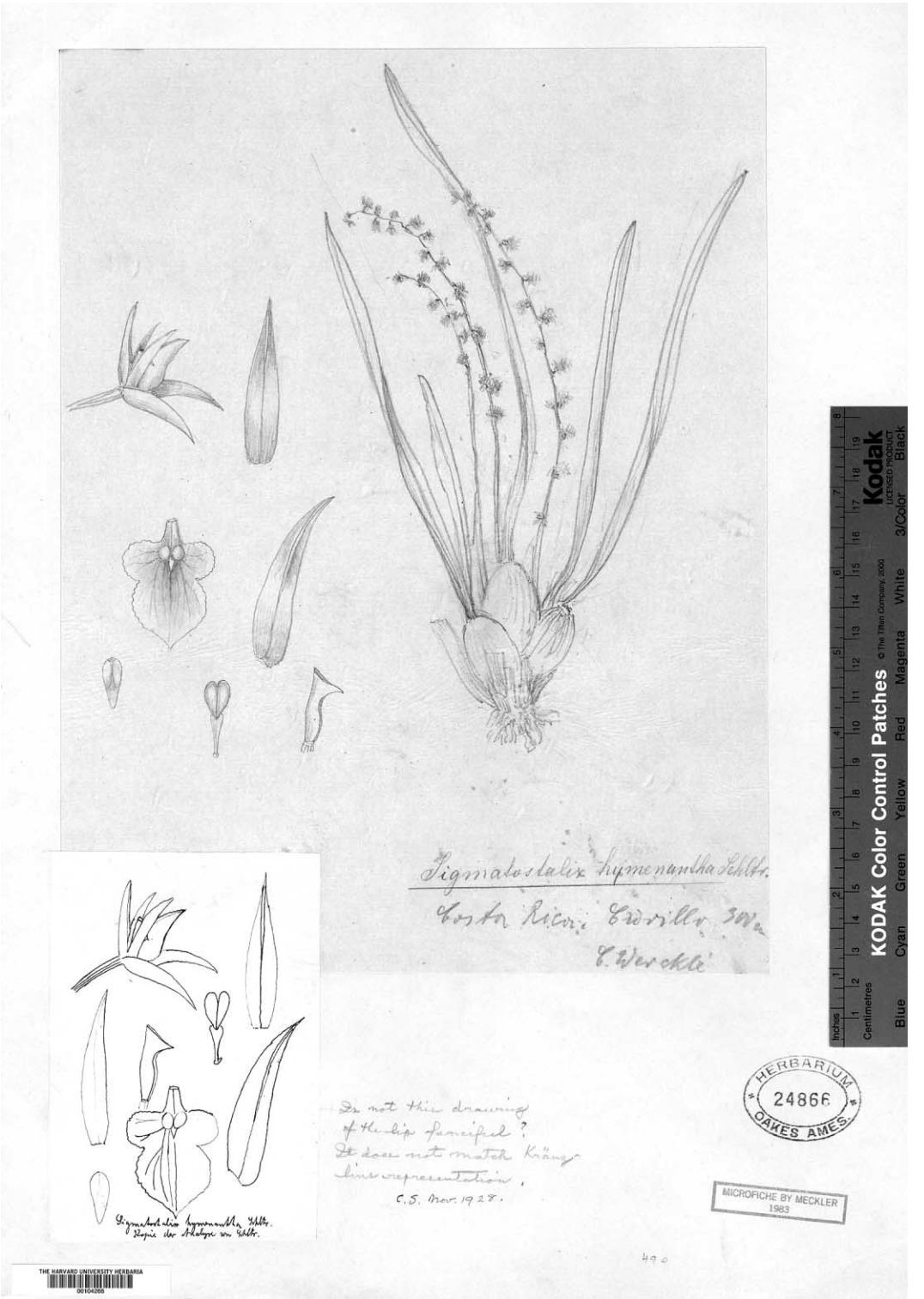

FIGURE 5. Lectotype of *Sigmatostalix hymenantha* Schltr. Reproduced with the kind permission by the Keeper, Oakes Ames Orchid Herbarium, Harvard University Herbaria.

lanceolate, acuminate, subequal to pedicel. **Ovary** slender, 5 mm long including the pedicel. **Flowers** small. **Dorsal sepal** narrowly lanceolate-ligulate, acuminate, 3 mm long, 0.6 mm wide. **Lateral sepals** free, obliquely narrowly lanceolate-ligulate, acuminate, 3 mm long, 0.7 mm wide. **Petals** linear-lanceolate, acuminate, 2.5 mm long, 0.6 mm wide. **Lip** short-unguiculate, 3-lobed, widely ovate, subcordate at the base, acuminate, 2.5 mm long, 2 mm wide; lateral lobes suborbicular, with irregularly subcrenulate margins; midlobe suborbicular, acuminate; disc with two elliptic-ovate calli. **Column** slender, terete, straight, dilated at apex into a porrect rostellum, 1.4 mm long. **Anther cap** narrowly obovate, obtuse, 2-celled. **Pollinia** 2, obliquely pyriform, on a linear, attenuate stipe; viscidium rounded, small.

Habitat and Ecology: Epiphytic in tropical wet forest, at 300 m elevation. Flowering season unknown.

Distribution: Only known from the type collection in Costa Rica.

Additional specimens examined: COSTA RICA. Curillo [?], 300 m, *C. Wercklé s.n.* (AMES, drawings).

In the absence of an actual type specimen, the interpretation of Schlechter's concept of *S. hymenantha* is somewhat difficult. The type locality given in the protologue, Curillo, is probably a misspelling and no such a toponym exists in Costa Rica nor can be tracked in older maps of the country, and apparently the species was never collected again after the collection by Wercklé. The original diagnosis, as well as the tracing of the type kept at AMES (the floral details published by Mansfeld, 1930) does not match any of the species actually known from Costa Rica. The type sheet at AMES (n. 24866, photo) includes the pencil sketch made under the supervision of Schlechter's wife after the death of Rudolph Schlechter in 1925, in which the plant habit and flower dissections are illustrated. Fearing that the drawing of the floral parts was inaccurate, Professor Ames sent a request to Berlin for a fragment of type, but a packet received from Dr. Mansfeld, said to have a flower within, was empty when reached the Botanical Museum of Harvard University (letter of Oakes Ames to Charles H. Lankester, 15 November 1928). After a comparison with the illustration of *S. hymenantha* published by Kränzlin in his treatment of the oncidioid orchids (Kränzlin 1922, fig. 27 C – a,b), which depicts a totally different flower (fig. 6), also

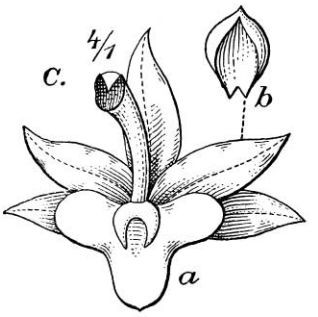

FIGURE 6. Kränzlin's interpretation of *Sigmatostalix hymenantha*. From Kränzlin 1922, fig. 27 C – a,b.

Charles H. Schweinfurth was suspicious about the accurateness of the copy of Schlechter's drawing prepared for AMES, and in 1928 he asked Mansfeld to retrace the holotype in Berlin (G.A. Romero, pers. comm.). Mansfeld's ink sketch, mounted on bottom left of the same type sheet, perfectly agrees with the pencil drawings originally prepared for Prof. Ames' files, with the omission of the plant habit.

Probably the most striking character of *S. hymenantha* is its unguiculate and clearly 3-lobed lip with suborbicular, subcrenulate lobes (Schlechter 1918, 1919). One could be tempted to consider *S. hymenantha* cospecific with *S. picturatissima*, the only other species in Costa Rica that presents a subsessile and clearly 3-lobed lip, but several inconsistencies in morphological characters between the two taxa preclude such a decision. The lip of *S. hymenantha* is shorter than sepals *versus* longer than sepals in *S. picturatissima*, the petals are lanceolate-ligulate *versus* widely elliptic-ovate, the column is shorter *versus* longer than lip. The callus of *S. hymenantha* is too vaguely sketched in the copy of type, and the concise description done by Schlechter is not precise enough to give a clear idea of its morphological structure. On the basis of the drawing at AMES, it should be interpreted as a rather small (<1/5 of lip length), 2-lobed structure provided with a central, triangular, acute projection seemingly placed below the callus plate, which has no close affinities with callus structure in other species from Costa Rica.

The name of *S. hymenantha* has been repeatedly applied to a rather different *Sigmatostalix* species from Costa Rica and Panama (Kränzlin 1922, Schweinfurth 1942, Allen 1949, Dressler 1993, Mora-Retana 1999). Likely, the origin of

this misinterpretation was Kränzlin's concept of *S. hymenantha*, which evidently was not based on Schlechter's holotype (Kränzlin 1922), but on a different specimen collected in Costa Rica by A.R. Endres (Reichenbach Herbarium 2038, W). This specimen was designated by Kränzlin in 1916 as the type of his *Sigmatostalix ramulosa*, a name never published, and the sketch of the flower prepared by Kränzlin himself and affixed to the same sheet was eventually used to illustrate *S. hymenantha* in his treatment of the genus for Engler's Pflanzenreich (Kränzlin 1922: fig. 27, C: a, b). There is no doubt that the drawing of *S. hymenantha* published by Kränzlin, as many others of Kränzlin's illustrations, is rather a personal "interpretation" of the taxon described by Schlechter. Trying to match both Endres' specimen and Schlechter's protologue, the 3-lobed lip of Schlechter diagnosis (Schlechter 1918) transformed into "*obscure trilobulum*", and the two calli at the apex of claw were reduced to a single "*callus* [...] *antice in dentes 2 triangulos exiens, medio excavatus cum gynostemio continuus*" (Kränzlin 1922). However, the species from southern Mesoamerica treated by Kränzlin and others as *S. hymenantha* has partially connate lateral sepals, a sessile, entire lip longer than sepals, and a large, cup-like callus occupying nearly half of the lamina length, all characters that do not agree with Schlechter's protologue nor with the illustration of type. Revising the genus *Sigmatostalix*, Schlechter (1919) includes his still inedit *S. hymenantha* within a group of species characterized by the long and narrow claw (*labelli ungue gracili, bene longo*), comprising *S. guatemalensis*, *S. eliae*, and *S. picta*.

5. ***Sigmatostalix integrilabris*** Pupulin, *sp. nov.* TYPE: COSTA RICA. Heredia: camino a Puerto Viejo de Sarapiquí, junto a una laguna, ca. 600 m, junio 1991, *D.E. Mora-Retana & F. Pupulin s.n.* (holotype, USJ 48464). Fig. 7.

Synonym: *Sigmatostalix ramulosa* Kraenzl., Ms. (Reichenbach Herbarium, W).

Usage synonym: *Sigmatostalix hymenantha* of authors, *non* Schltr. 1918.

Species Sigmatostalici adamsii Dodson *similis floribus omnine majoribus lamina labelli multo latiore callo cyathiformi ad dimidium inferiore laminae attingens, columna elongata alis columnae minoribus differt.*

Plant epiphytic, small, cespitose, erect, to about 18 cm tall. **Roots** filiform, glabrous, with green apex, about 1 mm in diameter. **Pseudobulbs** elliptic to ovoid, compressed, unifoliate at apex, surrounded at the base by 2–4 distichous, foliaceous sheaths, 1.5–3.3 cm long, 1.4–2 cm wide. **Leaves** green, subcoriaceous, linear-lanceolate, acute, to 17 cm long, 0.5–1.3 cm wide, narrowing toward the base into a short conduplicate petiole to 1.5 cm long. **Inflorescence** lateral, to 20 cm long, a panicle with condensed lateral branches when young, the lateral branches progressively longer in older inflorescences, 1- (apical branches) to 4 cm long (basal branches), the flowers produced in successive fascicles at each node from dense clusters of bracts. **Floral bracts** short, membranaceous, triangular-ovate, acute, 2–2.3 mm long. **Ovary** linear-clavate, 5 mm long including the pedicel. **Flowers** spreading, the sepals and petals white to pale yellow, the lip white to yellow with a reddish bar at the base of callus. **Dorsal sepal** reflexed, lanceolate, acute, concave toward apex, to 2.3 mm long, 0.6 mm wide. **Lateral sepals** shortly connate at the base, obliquely lanceolate, acute, concave toward apex, 2 mm long, 0.6 mm wide. **Petals** lanceolate to lanceolate-elliptic, acute, 2 mm long, 0.7 mm wide. **Lip** sessile, entire, ovate-subtrapezoidal, acute, concave toward apex, 2.5 mm long, 3 mm wide, the margins undulate; disc with a suborbicular, cup-shaped callus extending from the base to less than half of the length of lamina, the fleshy margins projecting into a distinct, retrorse tooth in front, the inner part of the cup with two lateral, conical, rounded projections, the basal margin provided with a linear series of elaiophores. **Column** short, terete, straight, dilated at apex, 1.4–2 mm long, with a pair of subquadrate, rounded, transverse wings; rostellum bilobed. **Anther cap** decumbent, elliptic-ovate, cucullate, glabrous, 1-celled. **Pollinia** 2, obpyriform, on a triangular stipe; viscidium elliptic.

Paratypes: COSTA RICA. Cartago: Turrialba, Pejibaye, 600 m, flowered in cultivation at Jardín Botánico Lankester, May 1998, *D.E. Mora-Retana s.n.* (USJ); near Pavones, about 15 km east of Turrialba, 600 m, May 7, 1956, *L.O. Williams 19720* (SEL); road from Turrialba to Siquirres at midpoint, 300 m, 17 February 1966, *C.H. Dodson 3541* (SEL); trees along Río Pejibaye, 83˚42'N 9˚04'W, 720 m, 5.5 km SW of Pejibaye, 22 km from Siquirres # 10 turn off, 25 March 1984, *M.W. Chase 84384* (SEL); Peralta, May 18, 1924, *C.H.*

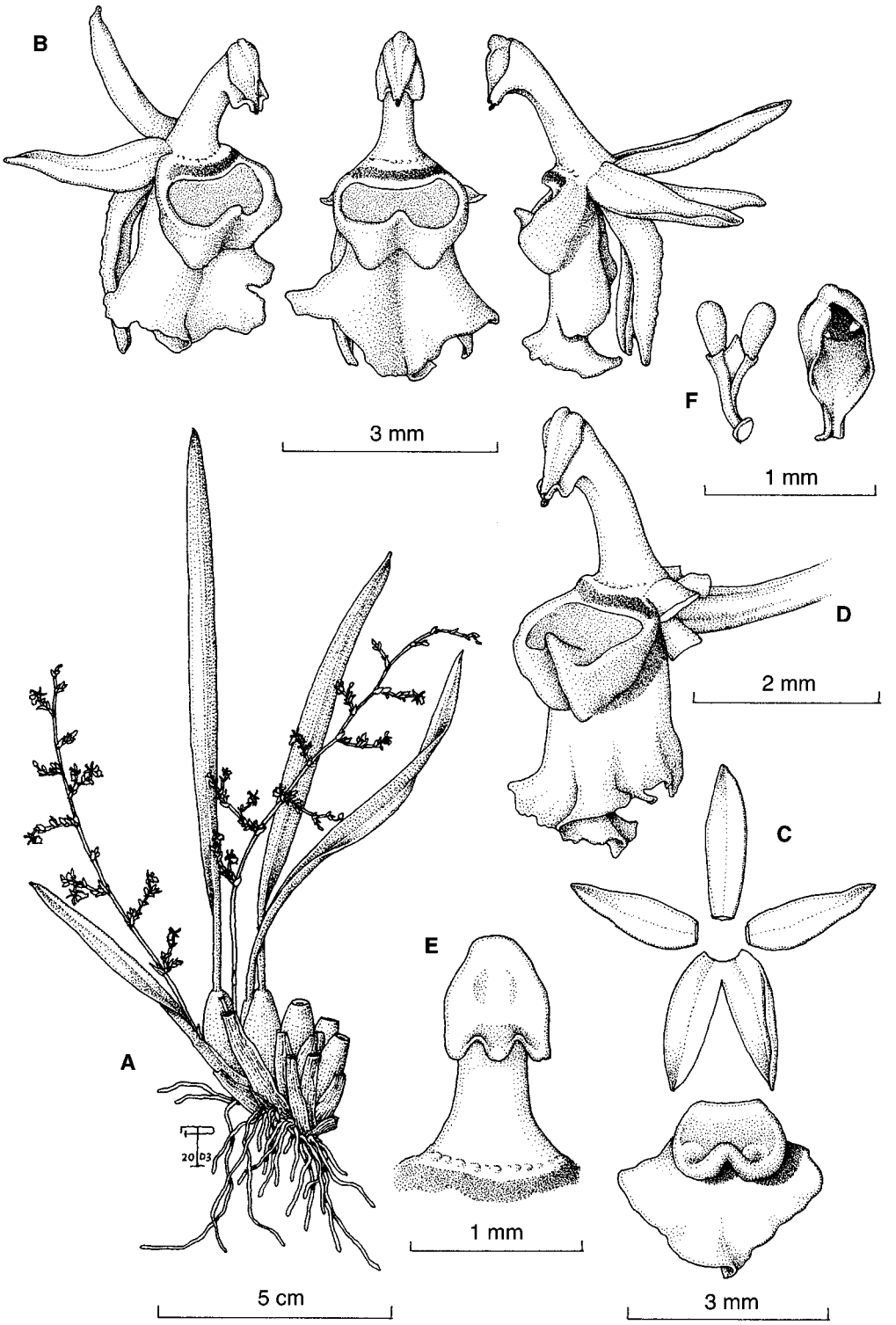

FIGURE 7. *Sigmatostalix integrilabris* Pupulin. A. Habit. B. Flower, three views. C. Dissected perianth. D. Column and lip, lateral view. E. Column, abaxial view. F. Pollinarium and anther cap. Based on *Mora-Retana & Pupulin s.n.* (USJ). Drawn from the holotype.

Lankester 851 (AMES). Callejón de Angostura, May, *A.R. Endres 535* (W). Limón: El Progreso, entre Cerro Muchilla y Cerro Avioneta, cabeceras de Río Suruy, Fila Matama, Valle de la Estrella, 9˚47'25"N 83˚06'30"W, 550 m, *G. Herrera & A. Chacón 2640* (SEL). San José: Pérez Zeledón, El Alto de San Juan, flowered in cultivation at Jardín Botánico Lankester, May 1998, *D.E. Mora-Retana s.n.* (USJ). Dota, crest of Cerro Nara, 950–1000 m, premontane wet forest, 2 March 2001, *F. Pupulin, D. Castelfranco & A. Olmi 3016* (Jard. Bot. Lankester, spirit). PANAMA. Darién: vicinity Chepigana, Cana-Cuasi trail, 2000 ft., *Terry & Terry 1437* (MO); Panama: epiphytic along the Altos de Pacoro road, 650 m, 4 March 1976, *R.L. Dressler, C. & J. Luer & P. Taylor 728* (SEL); Veraguas: NW of Santa Fé, 4.2 km from Escuela Agrícola Alto de Piedra, 25 February 1975, *S. Mori & J. Kallunki 4822* (SEL).

Habitat and Ecology: A rather common epiphyte of shaded branches and twigs in premontane moist forest at 300–1000 m elevation. Flowering mostly occurs February to May.

Distribution: Costa Rica and Panama.

Etymology: From the Latin *integri-*, entire, and *labium*, lip, in reference to the entire lip.

Sigmatostalix integrilabris has long been confused with *S. hymenantha* Schltr. (see above, under treatment of *S. hymenantha*), mainly on account of Kränzlin's interpretation, but the two species may be set apart on the basis of their different flower morphology. *Sigmatostalix hymenantha* has a clawed, distinctly 3-lobed, acute lip, the margins of the suborbicular lateral lobes crenulate, and the bilobed callus is comparatively small, less than one fifth of lip length. On the contrary, the lip of *S. integrilabris* is sessile, entire, obtuse, and the massive callus occupies more than one third of the lip lamina. *Sigmatostalix integrilabris* shows close affinities with *S. adamsii* Dodson from northern South America, and the two species (the former under the name of *S. hymenantha*) have been distinguished mainly for the shape of their inflorescence (i.e., Mora-Retana 1999). However, the relative length of lateral branches in *S. integrilabris* is quite variable. In some specimens (i.e., Pérez Zeledón, El Alto de San Juan, *Mora s.n.*, USJ 48950; San Rafael de Platanar, *Dressler & Mora s.n.*, USJ) the branches' internodes are extremely reduced, so that they appear as simple tufts of papery bracts, from which new flowers are born in succession. In other cases (i.e., Sarapiquí, Puerto Viejo, *Mora & Pupulin s.n.*, USJ; *Mora s.n.*, USJ), the branches develop longer internodes, and the inflorescence assumes the characteristic shape of a secondary panicle. Inflorescences of *S. integrilabris* (and probably also *S. adamsii*) produce flowers for many seasons, and it is likely that lateral branches grew up in length during all their life. Moreover, the lip of *S. adamsii* does not exceed 1 mm in length, the concave callus is longer than half of the lip, and the column presents two conspicuous, dolabriform wings toward the apex, whereas *S. integrilabris* has a lip 2.5 mm long, a callus shorter than half of the lip and a blunt, transversal rostellum at column apex.

6. ***Sigmatostalix macrobulbon*** Kraenzl., Pflanzenr. 80: 307. 1922. TYPE: COSTA RICA. Without precise locality, 3–4000 ft.,1867, *A.R. Endres 20* (holotype, W). Fig. 8.

Synonym: *Sigmatostalix reichenbachiana* Kraenzl., Pflanzenr. 80: 307. 1922.

Sigmatostalix endresii Rchb.f., Ms. (Reichenbach Herbarium, W).

Plant epiphytic, cespitose, erect, to about 20 cm tall. **Roots** filiform, glabrous, about 1 mm in diameter. **Pseudobulbs** oblong to elliptic-ovate, strongly compressed, unifoliate at apex, surrounded at the base by 4–6 distichous, foliaceous sheaths, 3-3.5 cm long, 1–1.5 cm wide. **Leaves** green, subcoriaceous, oblong-lanceolate to linear-lanceolate, acute, with conduplicate petioles, to 15 cm long, 0.6–1.6 cm wide. **Inflorescence** lateral, to 20 cm long, a panicle with several congested, lateral branches to 0.7 cm long, the flowers produced in succession from dense clusters of bracts. **Floral bracts** membranaceous, ovate-lanceolate, acute, 2 mm long. **Ovary** linear-clavate, 5 mm long including the pedicel. **Flowers** spreading, greenish-yellow to bright yellow, the callus orange-brown. **Dorsal sepal** ovate-lanceolate, acute, concave toward base, to 3 mm long, 1.5 mm wide. **Lateral sepals** shortly connate, reflexed, ovate-lanceolate, acute to apiculate, 3.5 mm long, 1.7 mm wide. **Petals** reflexed, elliptic-ovate, acuminate, 3.7 mm long, 2.2 mm wide, the margins undulate. **Lip** sessile, suborbicular, emarginate, strongly convex, 3 mm long, 5 mm wide, the margins undulate; disc with a rounded, fleshy, stipitate callus provided with a triangular cavity, extending from the base to lower 1/3 of the lamina. **Column** slender, terete, straight to slightly curved, dilated at apex, 4 mm long. **Anther cap** decumbent, sub-

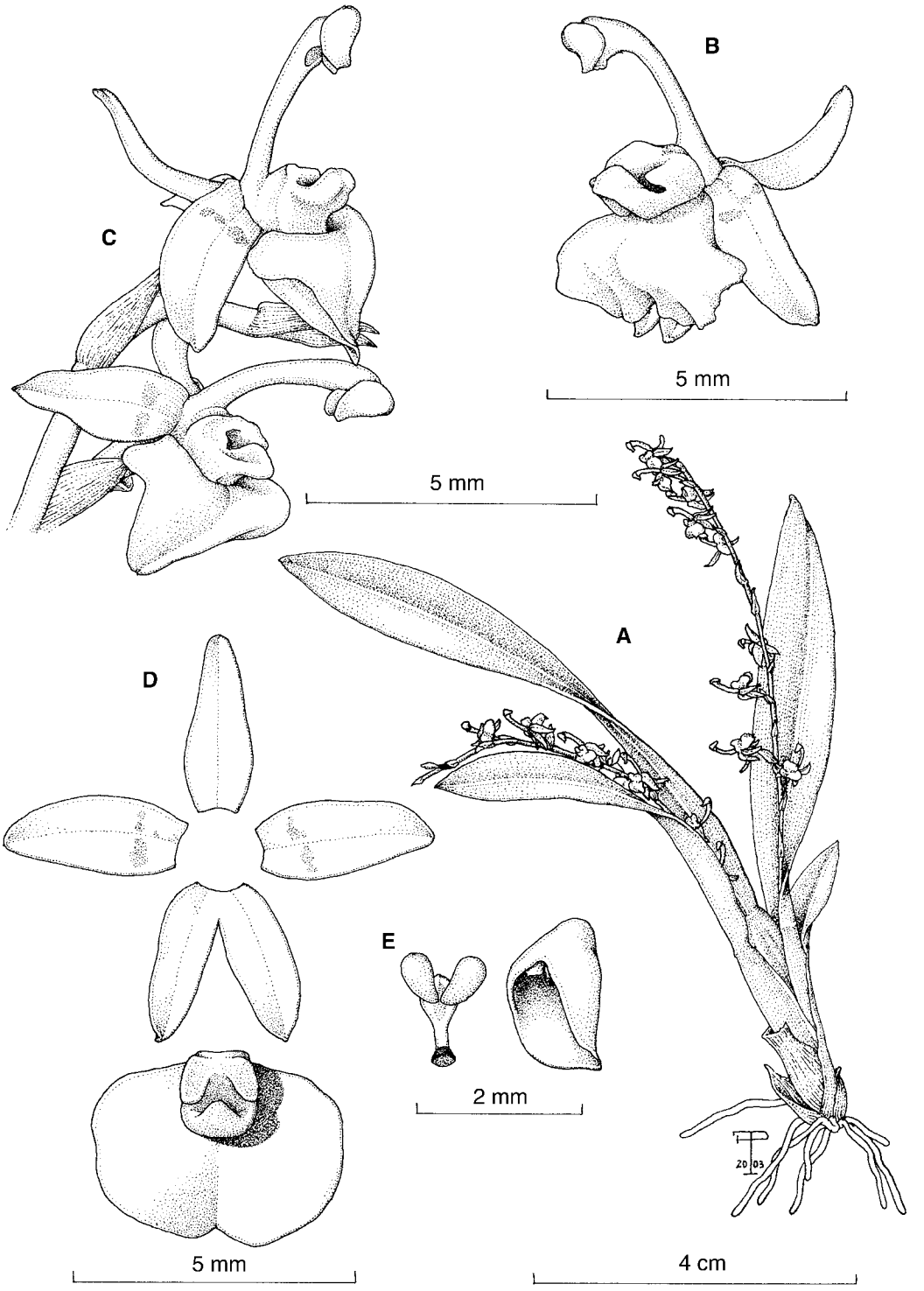

FIGURE 8. *Sigmatostalix macrobulbon* Kraenzl. A. Habit. B. Flower. C. Apex of inflorescence. D. Dissected perianth. E. Pollinarium and anther cap. Based on *Pedruzzi 61* (USJ).

quadrate, cucullate, keeled along the middle, 1-celled. **Pollinia** 2, obpyriform, on a narrowly trapezoidal stipe; viscidium rounded.

Habitat and Ecology: A common epiphyte in premontane and lower montane moist to wet forest at 700–1500 m elevation, where plants are usually found in shaded positions on branches and twigs. Flowering occurs most of the year, with a flowering peak during the months of October and November in Costa Rican populations.

Distribution: Costa Rica and Panama.

Additional specimens examined: COSTA RICA. Alajuela: Alajuela, Reserva Forestal adjacent to Parque Nacional Braulio Carrillo; SE of Cariblanco, on SW slope of Río Sarapiquí canyon, 10˚15'50"N 84˚10'20"W, 760–800 m, 19 November 1990, *S. Ingram & K. Ferrell 727* (SEL); Monteverde reserve, along Sendero Peñas Blancas just West of Refugio Alemán, 1000 m, 13 December 1989, *W. Morris 4052* (SEL); Reserva Biológica Monteverde, Río Peñas Blancas, 1 km below Refugio "The Germans", 10˚19'N 84˚44'W, 900 m, 6 April 1989, *B. Boyle 78–89* (USJ); Reserva Biológica Monteverde. Río Peñas Blancas, 3 km below Refugio "Eladio's", 10˚19'N 84˚43'W, 900 m, 7 April 1989, *B. Boyle 84–89* (USJ); Reserva Forestal de San Ramón, Zona D, August 1991, *F. Pupulin s.n.* (USJ); Reserva Forestal de San Ramón, cuenca del Río San Lorencito, 850–1000 m, August 1991, *D.E. Mora-Retana s.n.* (USJ); Reserva Forestal de San Ramón, along the Río San Lorencito, East of the Refuge, 1050 m, 21 August 1991, *D. Pedruzzi 61* (USJ). San Ramón, La Palma, 1922, *C. Wercklé 128* and *132* (B, destroyed). Cartago: Río Navarro, forest above Orosi, 5000 ft, flowered in the collection of Mr. Charles Lankester, 20 November 1940, *P.H. Allen 3635* (SEL); Taus, 11 December 1984, *R.L. Dressler & Biología 305* (USJ). Guanacaste-Alajuela: slopes of Miravalles, above Bijagua, ca. 1500 m, November 1982, *L.D. Gómez 19139* (CR, SEL). Heredia: near Cariblanco, along the Río Sarapiquí, 800 m, April 27, 1956, *L.O. Williams 19382* (SEL); Los Angeles de Sarapiquí, camino Laguna, 900 m, 16 October 1992, *J.T. Atwood, Mora-Retana & Morales 412.92* (USJ).

The pure yellow flowers, sometimes with a pair of pale brown flecks at the base of the petals, and the large, suborbicular, strongly reflexed lip provided with a massive callus, permit easy identification of this species among Costa Rican relatives. In the illustration published by Kränzlin together with the original protologue, the callus on the lip of *S. macrobulbon* is figured as a low plate, fringed along the margins (Kränzlin 1922, fig. 27 B: a–c), likely in the attempt to match the collector note about the glutinous nature of this organ. Kränzlin described *Sigmatostalix reichenbachiana* on material kept in Reichenbach's herbarium, without collecting data (and likely part of the collections sent to Hamburg by Endrés), but the diagnostic features given in the protologue (*labello omnino indiviso, basi callo minuto instructo, rostelloque vix prominulo, perbrevi)* fail to reveal any significant difference with his own concept of *S. macrobulbon*.

7. ***Sigmatostalix picturatissima*** Kraenzl., Engl. Pflanzenr. Orchid.-Monandr.-Oncid. 312. 1922, TYPE: COLOMBIA. Cauca: auf Bäumen in dichten feuchten Wäldern um Las Juntas del Dagua, am Fusse der West-Anden von Cali in 400 bis 600 m ü.d.M., *F.C. Lehmann 8075* (holotype, W; isotype, K, not seen). Fig. 9.

Synonyms: *Sigmatostalix racemifera* L.O. Williams, Ann. Missouri Bot. Gard. 27: 258. 1940. TYPE: PANAMA. Coclé: vicinity of El Valle, 600–1000 m alt., December 8, 1938, *Allen 1232* (MO, photo).

Sigmatostalix occultans Christenson & M. Lee, Orchids 71: 314. 2002. TYPE: ECUADOR. Without precise locality, *Hort. M. Lee s.n.* (holotype, K), ***syn. nov***.

Plant epiphytic, small, cespitose, erect to patent, to about 16 cm tall. **Roots** filiform, glabrous, with green apex, about 1 mm in diameter. **Pseudobulbs** elliptic to ovoid, compressed, unifoliate at apex, surrounded at the base by 4–5 distichous, foliaceous sheaths, 2.5–3 cm long, 0.9–1.8 cm wide. **Leaves** green, subcoriaceous, linear-elliptic to elliptic-oblanceolate, acute, to 14 cm long, 0.7–1 cm wide, narrowing toward the base into a short conduplicate petiole to 2 cm long. **Inflorescence** lateral, a panicle to 15 cm long with short, lateral, densely flowering branches to 1.5 cm long, the flowers produced in successive fascicles at each node from dense clusters of bracts. **Floral bracts** short, membranaceous, widely ovate, cucullate, obtuse, 1 mm long. **Ovary** linear-clavate, 4 mm long including the

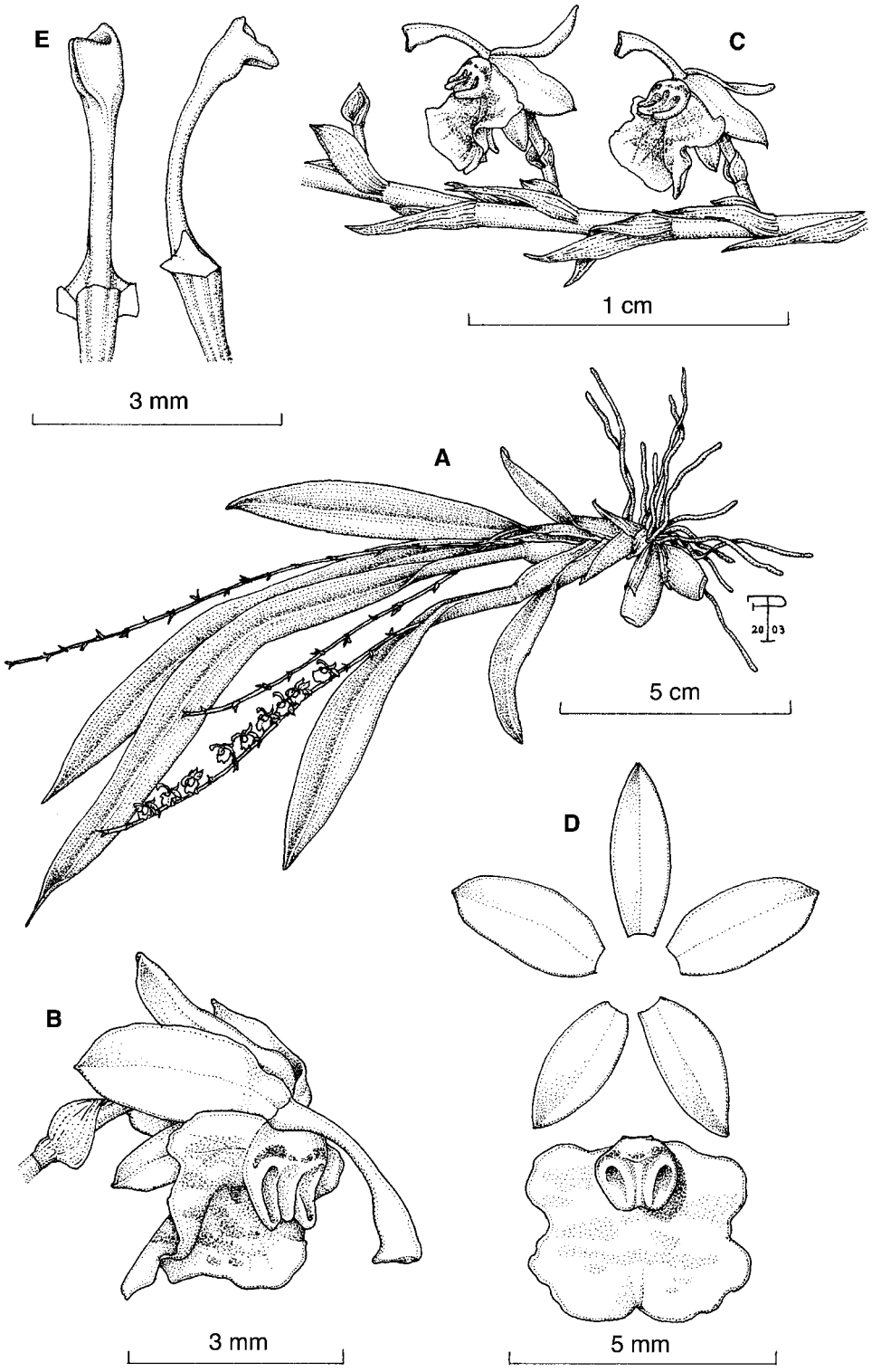

FIGURE 9. *Sigmatostalix picturatissima* Kraenzl. A. Habit. B. Flower. C. Portion of rhachis. D. Dissected perianth. E. Column, adaxial and lateral views. Based on *Pupulin 3370* (USJ).

pedicel. **Flowers** spreading, the sepals and petals pale greenish yellow, the lip white with pale orange spots. **Dorsal sepal** reflexed, lanceolate-elliptic, acute to shortly apiculate, adaxially subcarinate toward apex, to 3.2 mm long, 1.2 mm wide. **Lateral sepals** reflexed, obliquely lanceolate, acute, subcarinate, sometimes shortly connate at the base, 2.8 mm long, 1.4 mm wide. **Petals** reflexed, widely ovate-elliptic, obtuse, shortly apiculate, 3 mm long, 1.5 mm wide. **Lip** 3-lobed, with a short cuneate claw, subcordate at the base, subquadrate, pandurate, concave, 3.5 mm long, 4 mm wide, the lateral lobes rounded, with subcrenulate margins, the midlobe transversely elliptic, obtuse to retuse; disc with a subquadrate, cup-shaped callus, divided by 3 fleshy lamellae. **Column** terete, slender, curved, dilated at apex, about 3 mm long, with a pair of triangular, fleshy, acute wings. **Anther cap** decumbent, obovate, cucullate, glabrous, 1-celled. **Pollinia** 2, obpyriform, on a triangular, folded stipe; viscidium peltate.

Habitat and Ecology: Likely an uncommon epiphyte in Costa Rica, where it has been found only once. Habitat and locality data of the voucher specimen were not recorded at collecting time. Flowering occurs at least in October.

Distribution: Costa Rica, Panama, Colombia, and Ecuador.

Additional specimen examined: COSTA RICA. Without collecting data, cultivated by Nani Cañas, flowered in cultivation at the Orchid Exhibition of Alajuela, 26 October 2001, *F. Pupulin 3370* (USJ).

The clearly 3-lobed lip, emarginate in front, and the shallow callus provided with four receptacles allow quick identification of *S. picturatissima* in Costa Rica.

Apparently, F.C. Lehmann gathered under the same collecting number (his n. *8075*) two rather different *Sigmatostalix* species, one of which was used by Kränzlin to describe *S. lehmanniana* (Kränzlin 1899) and the other as the type of his *S. picturatissima*. The latter was described on scanty material, and the unique flower of the specimen seen by Kränzlin was mutilated at the time of description (Kränzlin 1922). The poor conditions of flower prevented Kränzlin from describing its morphological features with exception of shape and dimensions of sepals and gross morphology of column. However, examination of the type specimen at Kew allowed Garay (1974) to reconsider the species identity and to reduce *S. racemifera* L.O. Williams from Panama under synonymy.

Christenson and Lee (2002) claimed for the small size of the flowers and the nearly flat callus of *S. occultans* when compared with *S. picturatissima*, which has a S-shaped callus in profile. However, in Costa Rican specimen, as well as in plants from Ecuador (Dodson & Dodson 1982: 490) and Panama (*Luer et al. 1303* [SEL], *Luer et al. 9228* [SEL], *Luer & Butcher 1116* [SEL]), the shallow callus is not sigmoid, and length of the flower segments is in the range given for *S. occultans* (*Luer et al. s.n.*, from Ecuador [SEL], has a lip 3.6 mm long and 4.3 mm wide).

8. ***Sigmatostalix poikilostalix*** Kraenzl., Pflanzenr. IV. 50 (Heft 80): 310. 1922. TYPE: COSTA RICA. Without precise locality. *Endres 38, Endres 97* (syntypes: Reichenbach Herbarium, W). Fig. 10.

Usage synonym: *Sigmatostalix picta* of authors, *non* Rchb.f. 1864.

Plant epiphytic, cespitose, erect, to 18 cm tall. **Roots** filiform, flexuous, glabrous, about 1 mm in diameter. **Pseudobulbs** elliptic-ovate, compressed, unifoliate at apex, surrounded at the base by 5–7 distichous, foliaceous and non-foliaceous sheaths, 1.9–2.6 cm long, 0.8–1.5 cm wide, green flushed with purple. **Leaves** subcoriaceous, linear-ligulate, obtuse to minutely bilobulate at apex, to 11 cm long, 1.6 cm wide, the base narrowing into a short conduplicate petiole. **Inflorescence** lateral, erect, slender, apparently secund, much longer than leaves, up to 25 cm long, the successive flowers subtended by dense clusters of papyraceous bracts. **Floral bracts** lanceolate, acuminate, scarious, subequal to pedicel, about 5 mm long. **Ovary** slender, to 8 mm long including the pedicel. **Flowers** yellow blotched with reddish brown, rarely entirely yellow. **Sepals** free, narrowly lanceolate, acuminate, strongly reflexed, 7–8 mm long, 0.8–1.0 mm wide. **Petals** lanceolate-ligulate, acuminate, reflexed, 7–8 mm long, about 1.0–1.2 mm wide. **Lip** long-unguiculate, the fleshy claw linear, slightly channeled, dilated at apex into two lateral, triangular, flattened teeth, 2.5 mm long, 1 mm wide, the lamina 3-lobed, 6 mm long, 4 mm wide; basal lobules sublinear-falcate, obtuse to minutely rounded, introrse, the involute inner margins thickened; midlobe widely ovate-peltate, rounded to obtuse to emarginate; disc with a long, triangular, acuminate, suberect callus. **Column** slender, terete, arcuate, dilated at apex into a porrect, triangular,

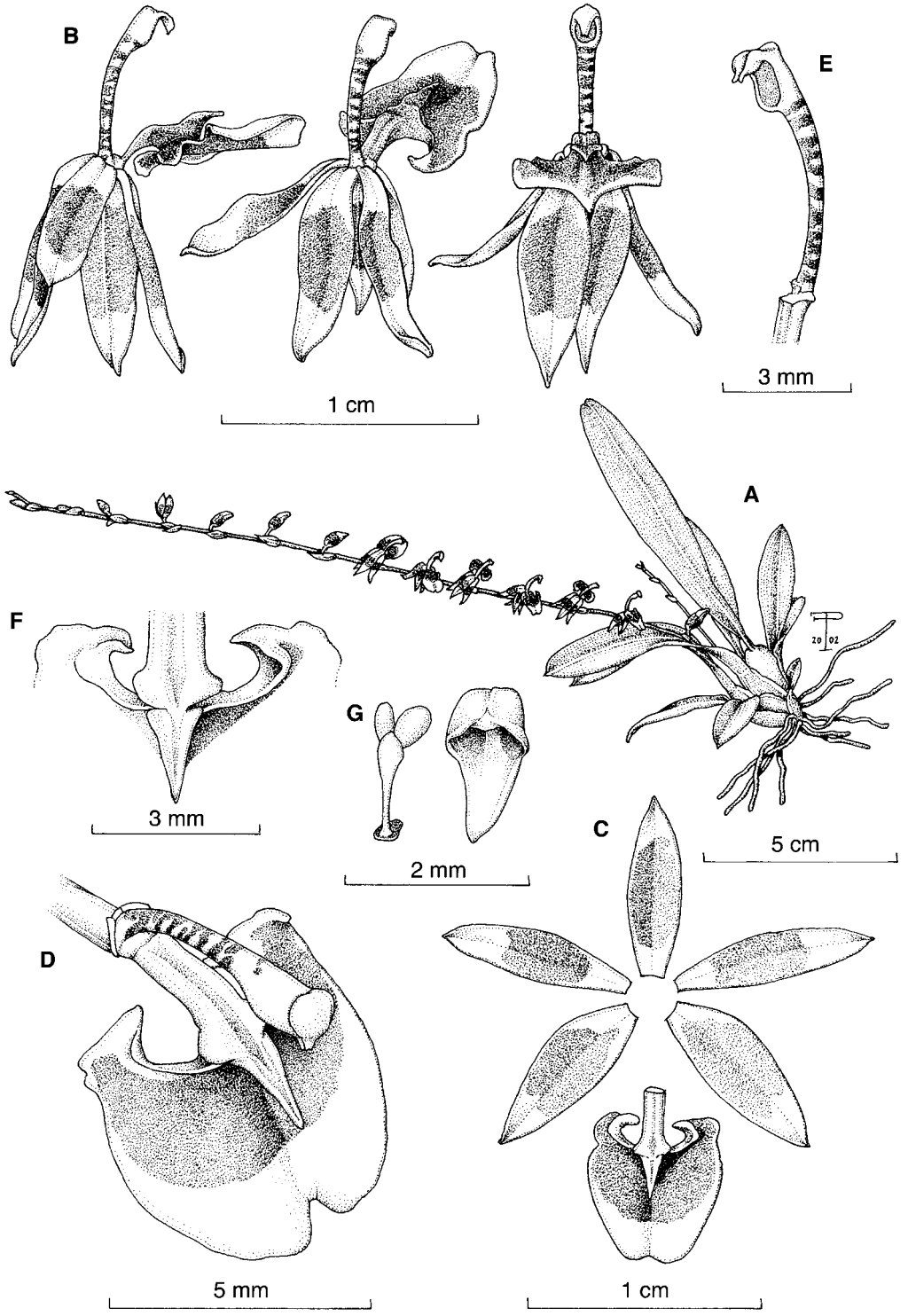

FIGURE 10. *Sigmatostalix poikilostalix* Kraenzl. A. Habit. B. Flower, three views. C. Dissected perianth. D. Column and lip, three-quarters view. E. Column, three-quarters view. F. Callus. G. Pollinarium and anther cap. Based on *Pupulin 3845* (USJ, USJ-Spirit).

shortly bifid rostellum, 5–6 mm long. **Anther cap** ovate, narrowly acute, 2-celled. **Pollinia** 2, elliptic, on a elliptic, infolded stipe; viscidium peltate.

Habitat and Ecology: An uncommon epiphyte, usually found in mature vegetation on shaded branches and twigs. Seemingly restricted to the Caribbean watershed of central Costa Rican ranges, in premontane and lower montane moist forest at 300–1400 m elevation. Flowering occurs from August to December (May), with the months of November and December as the flowering peak for the species in Costa Rica.

Distribution: Guatemala, Costa Rica.

Additional specimens examined: COSTA RICA. Alajuela: San Ramón, Los Angeles, 10˚08'N 84˚28'W, 1300–1350 m, 21 Sept. 1993, *J. Gomez-Laurito 12470* (USJ); San Ramón, 24 October 2001, *Abraham Bolaños s.n.* (flowers completely yellow, USJ-Spirit). San Ramón, 24 October 2001, *Abraham Bolaños s.n.* (flowers yellow blotched brown, USJ-Spirit); San Ramón, San Lorenzo, Reserva Valle Escondido, 300–550 m, premontane rain forest, collected by J.A. Campos, flowered in cultivation, 12 May 2002, *F. Pupulin 3845* (USJ-Spirit); *F. Pupulin 3848* (flowers yellow, USJ-Spirit); *F. Pupulin 3846* (USJ); *F. Pupulin 3847* (USJ). Cartago: ca. 2.5 km north by east-northeast of Tapantí, 1500–1600 m, 5 December 1975, *Utley & Utley 5543* (SEL). Heredia: Cinchona, Sarapiquí, 16 October 1992, *D.E. Mora-Retana s.n.* (USJ); from Pacific slopes near San Carlos, 25 August 1963, *C.H. Dodson 2520* (SEL).

Although it was considered cospecific with *S. guatemalensis* (i.e, Allen, 1949; Williams, 1951; Hamer, 1984; Espejo Serna & López-Ferrari, 1998), *S. poikilostalix* may be distinguished by its long, triangular, acute callus at the base of the lip, instead of the short, rounded callus of the former. In Costa Rican populations the callus usually lies rather flat over the surface of the lamina, whereas in Guatemalan specimens (i.e., Boca Costa de Quetzaltenango, *Pupulin 4206*, USJ-Spirit) it is often strongly upcurved toward the apex. Kränzlin's description stress the importance of callus morphology to distinguish species of the *S. picta* group in Mesoamerica, but the illustration published with the original protologue (Kränzlin 1922, fig. 27 D: a–e), completely obscures this detail. Hopefully, Endrés' accurate drawings of the holotype kept in Vienna clearly show the characteristic shape of this structure.

9. ***Sigmatostalix pseudounguiculata*** Pupulin & Dressler, Lindleyana 15: 27. 2000. TYPE: COSTA RICA. San José: Dota, San Joaquín, collected by M. Flores, 25 November 1996, flowered in cultivation at Jardín Botánico Lankester, Dulce Nombre de Cartago, 6 January 1998, *F. Pupulin 497* (holotype, USJ; isotypes, CR, SEL). Fig. 11.

Plant epiphytic, small, cespitose, to 10 cm tall. **Roots** fibrous, flexuous, glabrous. **Pseudobulbs** ovate, compressed, unifoliate at apex, supported by foliaceous sheaths with scarious margins in the basal portion, green blotched with purple, 2.0 cm long, 1.2 cm wide. **Leaves** linear-oblong, submembranaceous, the conduplicate base forming a distinct petiole, acute to subobtuse at apex, to 5.5 cm long, 0.6 cm wide. **Inflorescence** produced from the axils of the basal leaves, up to 3 simultaneously, a raceme remotely 1– to rarely 3–flowered, to 5 cm long, concealed with 2 narrowly ovate, tubular sheaths, 3.5 mm long, 1.8 mm wide. **Ovary** subclavate, to 12 mm long including the pedicel. **Flowers** membranaceous, small, with reflexed sepals and petals, pale greenish spotted with rose-purple, the lip with white lateral lobes and yellow callus. **Sepals** subsimilar, ovate-lanceolate, acuminate, slightly concave toward the apex, 3-nerved, 6.5 mm long, 2.2 mm wide. **Petals** obliquely ovate, slightly falcate, acute, 5.8 mm long, 2.3 mm wide. **Lip** long-unguiculate, the claw elongate, fleshy, narrowly subconic, the apex abruptly projecting downward, provided at the base with an open, slightly bilobed elaiophore, 5 mm long, the lamina deflexed, abruptly 3-lobed, 2.8 mm long, 10 mm wide; lateral lobes linear-falcate, obtuse to truncate, glabrous, thickened at the base into a fleshy, ovate, bilobed callus; mid-lobe narrowly triangular-pandurate, deflexed, subacute, concave. **Column** slender, arcuate, terete, ventrally keeled; gradually widening into the elliptic stigma, 5 mm long. **Anther cap** cucullate, carinate, obscurely 2-celled. **Pollinia** 2, on a short, rhombic stipe; viscidium peltate, large.

Habitat and Ecology: Uncommon along the Pacific watershed of Cordillera de Talamanca in Costa Rica, where plants are usually found as epiphytes of disturbed vegetation in premontane wet forest at *ca.* 1000 m elevation. Flowering occurs at least in January.

Distribution: Known only from Costa Rica.

Additional specimens examined: COSTA RICA. San José: Dota, San Joaquín, collected

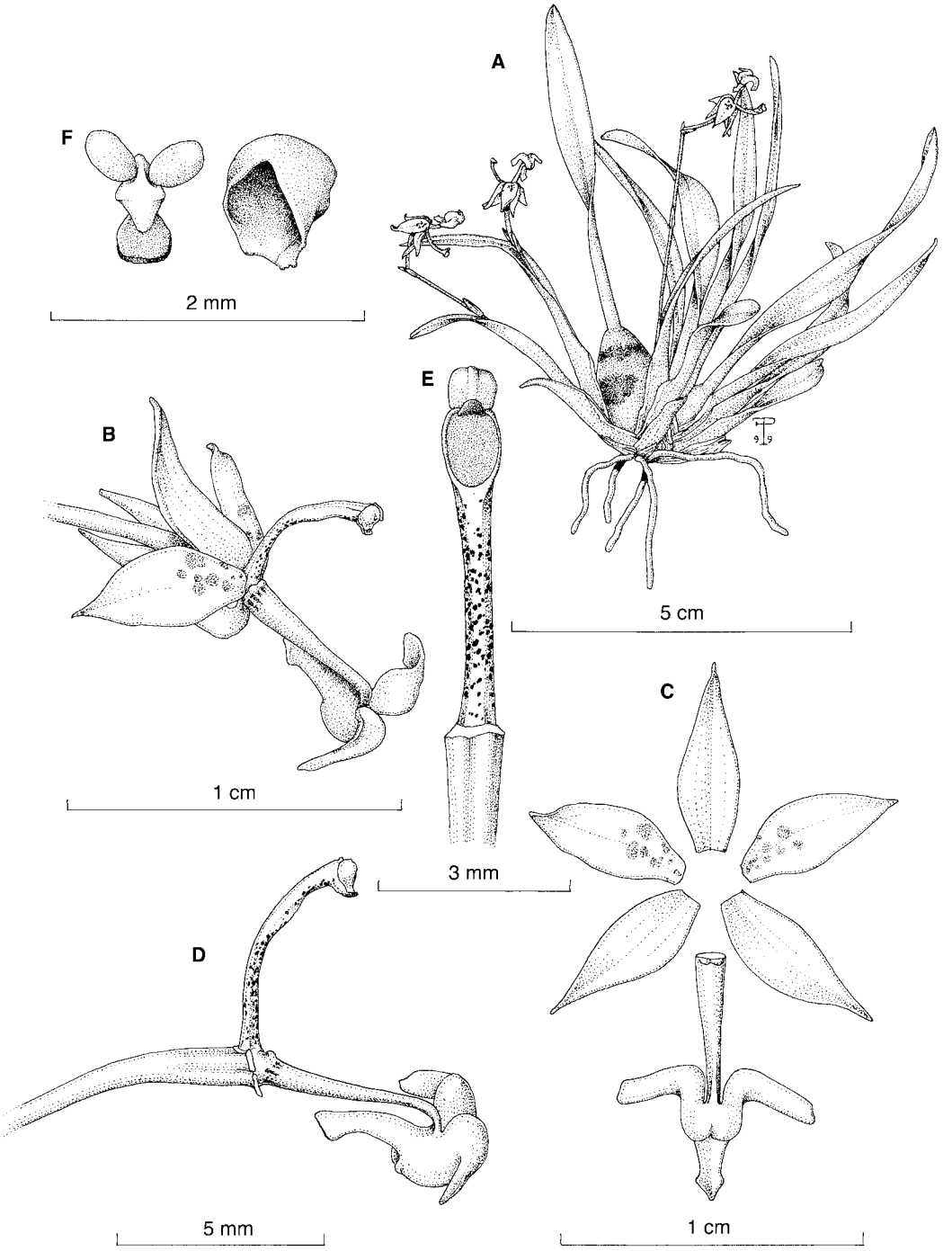

FIGURE 11. *Sigmatostalix pseudounguiculata* Pupulin & Dressler. A. Habit. B. Flower. C. Dissected perianth. D. Column and lip, lateral view. E. Column, abaxial view. F. Pollinarium and anther cap. Based on *Pupulin 497* (USJ). Drawn from the holotype.

by M. Flores, 25 November 1996, flowered in cultivation at Jardín Botánico Lankester, Dulce Nombre de Cartago, 6 January 1998, *F. Pupulin 497* (USJ).

Sigmatostalix pseudounguiculata is closely related to *S. unguiculata* L.O. Williams, but the lateral lobes of lip in *P. pseudounguiculata* are truncate, not acute, white instead of yellow, and in most of the specimens they are turned back toward the claw.

10. ***Sigmatostalix savegrensis*** Pupulin, ***sp. nov.*** TYPE: COSTA RICA. San José: Pérez Zeledón. Savegre. Peor Es Nada. Margen izquierda de Quebrada Misteriosa, 09º 31' 10" N 85º 51' 30" W, 1700 m, 4 agosto 1994, *G. Herrera, J. Sánchez & F. Durán 7282* (holotype, USJ). Fig. 12.

Species Sigmatostalici pictae Rchb.f. *similis, sepalis lateralibus usque ad medium connatis, lamina labelli intera rheniformi, callo non cyathiformi antice in lobo hemicirculari producto differt.*

Plant epiphytic, cespitose, erect, to 10 cm tall. **Roots** filiform, flexuous, glabrous, about 1 mm in diameter. **Pseudobulbs** elliptic, compressed, unifoliate at apex, surrounded at the base by 5–7 distichous, foliaceous and non-foliaceous sheaths, 2.0–2.4 cm long, ca. 1 cm wide, green flushed with purple. **Leaves** subcoriaceous, narrowly elliptic, obtuse to minutely bilobulate at apex, to 7 cm long, 1.2 cm wide, the base narrowing into a short conduplicate petiole to 0.7 cm long. **Inflorescences** 1–3, lateral, erect, slender, much longer than leaves, up to 23 cm long, the successive flowers subtended by clusters of papyraceous bracts. **Floral bracts** lanceolate, acute, scarious, shorter than pedicel, about 3 mm long. **Ovary** slender, to 6 mm long including the pedicel. **Flowers** with sepals and petals yellow, the lip reddish brown adaxially. **Dorsal sepal** narrowly lanceolate, acute, strongly reflexed, 7 mm long, 1.7 mm wide. **Lateral sepals** connate just to the middle, elliptic-lanceolate, acute, 6 mm long, 2.2 mm wide. **Petals** narrowly lanceolate-ligulate, acute, reflexed, 7 mm long, about 1.6 mm wide. **Lip** long-unguiculate, the fleshy claw linear, with 2 channels, slightly dilated at apex into two lateral, rounded, flattened projections, 1.5 mm long, 0.7 mm wide, the lamina entire, widely rheniform, rounded to shortly emarginate, 4.5 mm long, 8 mm wide, deeply cymbiform in natural position; disc with a short, semicircular, rounded, flattened callus. **Column** slender, terete, arcuate, dilated at apex into a porrect, triangular rostellum, ca. 6 mm long. **Anther cap** ovate, acute, 2-celled.

Habitat and Ecology: An uncommon epiphyte of lower montane wet forest, apparently restricted to the central Pacific watershed of Cordillera de Talamanca in Costa Rica, where it was so far collected only along the medium drainage of Savegre River at 1500–1700 m elevation. Flowering occurs in August and September.

Distribution*:* Only known from Costa Rica.

Paratypes: COSTA RICA. San José: Pérez Zeledón. Savegre. Peor es nada. Margen izquierda de Quebrada Misteriosa, 09˚31'10"N 85˚51'30"W, 1700 m, flor amarilla con guías café, 2 Ago. 1994, *G. Herrera, G. Retana V., J. Sánchez & F. Durán 7220* (USJ, CR, INB); Savegre Arriba, márgenes del Río Savegre, 1300–1600 m, bosque montano bajo húmedo, junio del 2002, colectado por E. Víquez Jiménez, floreció en cultivo, 10.12.2002, *R.A. Valverde A. 225* (USJ-Spirit).

Etymology: Named from the region of Río Savegre in central Pacific Costa Rica, where the species was discovered.

Among the species of the *S. picta* group in Costa Rica, *S. savegrensis* is easily recognizable for the connate lateral sepals, the widely rheniform lamina of the lip, strongly cup-shaped in natural position, and the semicircular callus at the base of the lip. Moreover, *S. savegrensis* has pure yellow sepals and petals, and the lip is almost entirely red, with the pigmentation restricted to the adaxial surface.

11. ***Sigmatostalix unguiculata*** C. Schweinf., Bot. Mus. Leafl. 8: 55. 1940. TYPE: COSTA RICA. San José: vicinity of El General, 975 m, December 1936, *A.F. Skutch 3020* (holotype, AMES, photo). Fig. 13.

Plant epiphytic, small, cespitose, to 15 cm tall. **Roots** fibrous, flexuous, glabrous. **Pseudobulbs** elliptic to ovate-elliptic, compressed, unifoliate at apex, supported at the base by 6–8 foliaceous and non–foliaceous heaths, green to 2 cm long, 1.2–1.8 cm wide. **Leaves** linear-oblong to elliptic, submembranaceous, the conduplicate base forming a distinct petiole, obtuse to shortly bilobed, to 7 cm long, 0.8 cm wide. **Inflorescence** produced from the axils of the basal leaves, up to 5 simultaneously, a raceme remotely 2– (rarely 1–) flowered, to 7 cm long, concealed with 2 narrowly ovate, tubular sheaths. **Ovary** subclavate, to 7 mm long including the pedicel.

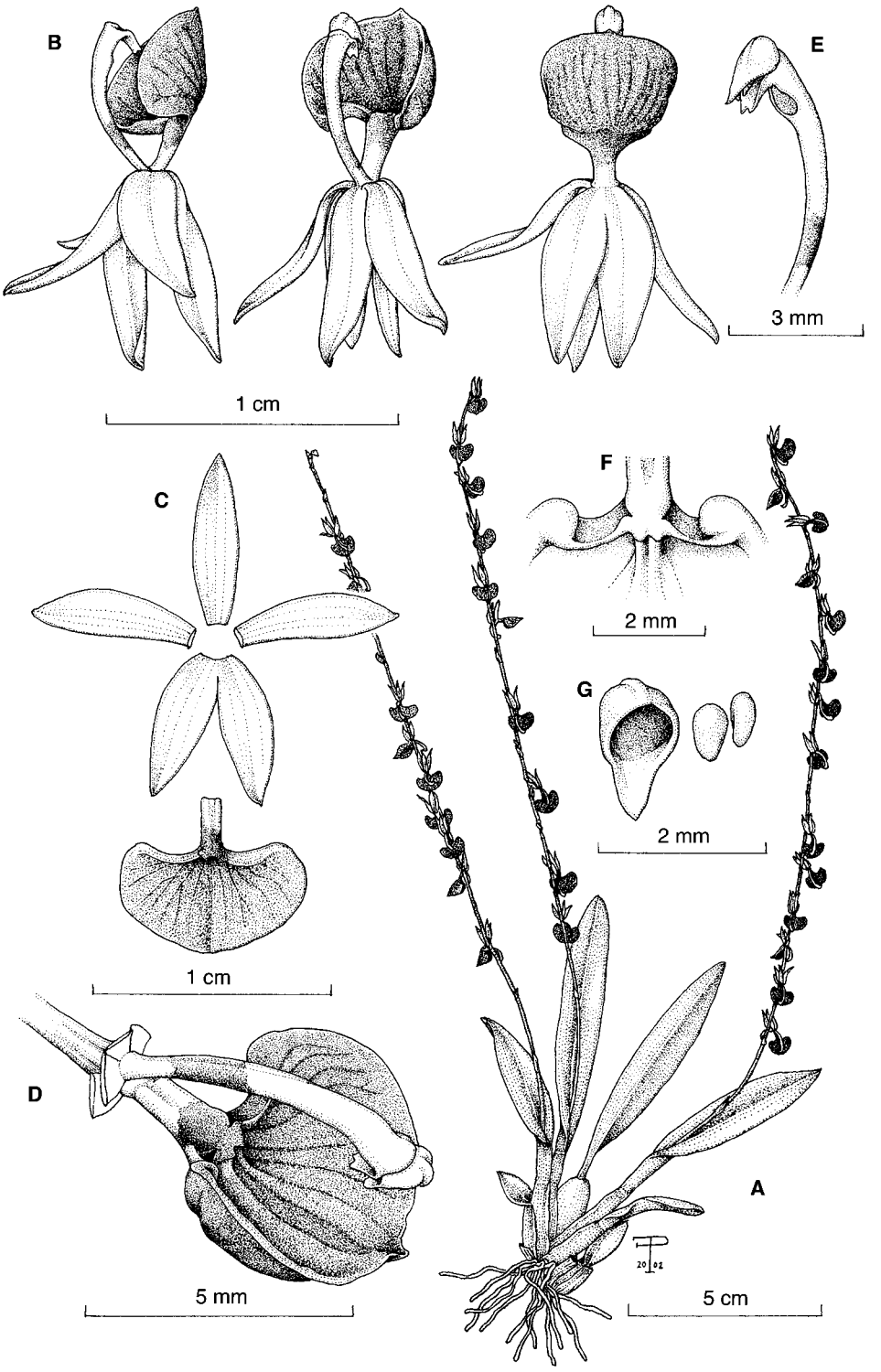

FIGURE 12. *Sigmatostalix savegrensis* Pupulin. A. Habit. B. Flower, three views. C. Dissected perianth. D. Column and lip, three-quarters view. E. Column, three-quarters view. F. Callus. G. Anther cap and pollinia. Based on A, C: *Herrera et al. 7282* (USJ); B, D–F: *Valverde A. 225* (USJ-Spirit). Drawn from the holotype and a paratype.

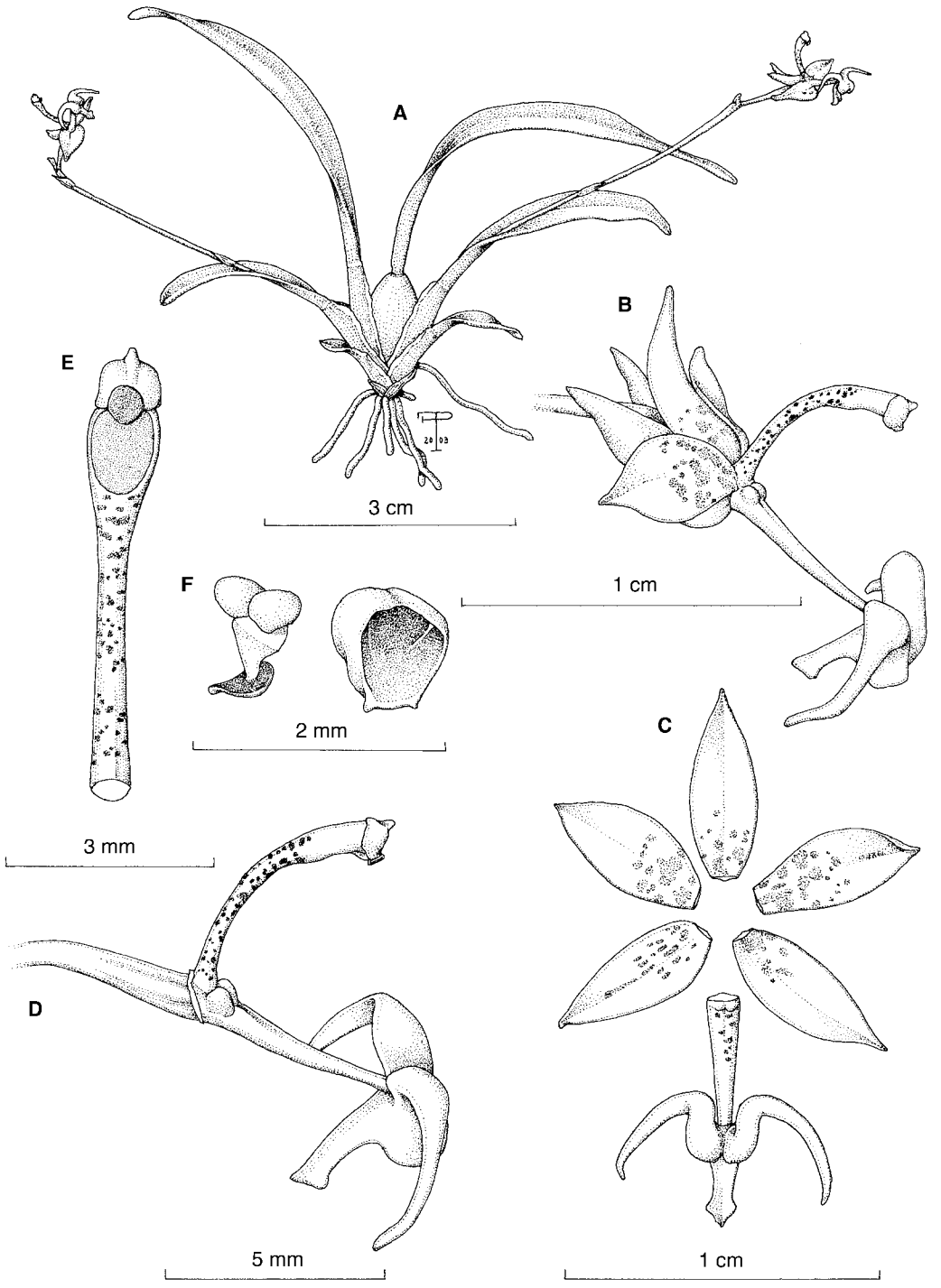

FIGURE 13. *Sigmatostalix unguiculata* C. Schweinf. A. Habit. B. Flower. C. Dissected perianth. D. Column and lip, lateral view. E. Column, abaxial view. F. Pollinarium and anther cap. Based on *Pupulin 1021* (USJ).

Flowers membranaceous, small, with reflexed sepals and petals, yellow to yellow-green, the lip with yellow lateral lobes and callus. **Sepals** subsimilar, ovate-lanceolate, acute, reflexed, 6 mm long, 2 mm wide. **Petals** obliquely ovate-lanceolate, acute, 6 mm long, 2 mm wide. **Lip** long-unguiculate, the claw elongate, fleshy, the apex abruptly projecting downward, 6 mm long, the lamina deflexed, abruptly 3-lobed, 5.3 mm long, 9 mm wide; lateral lobes linear-falcate, narrow, acute, thickened at the base into a fleshy, pubescent callus; mid-lobe obovate-pandurate, deflexed, obtuse, concave. **Column** slender, terete, arcuate, gradually widening toward the apex, 5 mm long. **Anther cap** cucullate, obscurely 2-celled. **Pollinia** 2, on a short, rhombic stipe; viscidium rounded, large.

Habitat and Ecology: A rather common epiphyte of disturbed vegetation in premontane and lower montane rain forests in southern Costa Rica, where it is apparently restricted to the Pacific watershed at 900–1400 m elevation. Flowering occurs from October to December.

Distribution: Known only from Costa Rica.

Additional specimens examined: COSTA RICA. San José: Alfombra de Pérez Zeledón, 1992, *J. Cambronero s.n.* (USJ); Alfombra de Pérez Zeledón, collected by J. Cambronero, 1994, *F. Pupulin 1021* (USJ); Pérez Zeledón, Miraflores, road to Santa Cruz, 1350 m, 2 December 2001, *F. Pupulin, D. Castelfranco & J. Cambronero 3458* (Gaia Bot. Garden); Las Nubes de Quizarrá, along the Río Quizarrá, 1080 m, 9 November 2000, *F. Pupulin, D. Castelfranco & J. Prada 2526* (Gaia Bot. Garden) and *2577* (Gaia Bot. Garden). Puntarenas: road from Dominical to San Isidro del General, about km 11, 09˚18'N 83˚46'W, 950 m, 10 November 2001, *F. Pupulin, H. Montealegre & A.C. Rodríguez 3404* (Gaia Bot. Garden). Without precise locality, cult. Fabio Fournier J., 27 November 1975, *R.L. Rodríguez C. s.n.* (USJ).

The long, slender claw of the lip, and the falcate, acute, yellow lateral lobes distinguish this species from its closest relative, *S. pseudounguiculata*, which presents linear, truncate, white lateral lobes of the lip.

Excluded Species

Sigmatostalix adamsii Dodson, Selbyana 2: 54. 1977. TYPE: ECUADOR. Pichincha, very common in orange trees in the city of Santo Domingo, 650 m, 15 June 1967, *C.H. Dodson, N. Williams & R. Adams 3705* (holotype, SEL).

Among Mesoamerican species of the genus, *S. adamsii* may be recognized for the small flowers (sepals < 2 mm long), the reduced lip (< 1 mm long), the cup-shaped callus longer than half of the total length of lip, and the long lateral branches (up to 8 cm) of the paniculate inflorescence. Mora-Retana (1999) included Costa Rica in the distribution range of *S. adamsii* on the basis of plants living in private collections, distinguished by the slender inflorescence and the numerous bracts at the base of the flowers. However, the voucher for the illustration published in *Flora Costaricensis* (Atwood & Mora-Retana 1999, fig. 46 A), from the lower drainage of Río Sarapiquí in central Costa Rica (*Mora & Pupulin s.n.*, USJ), falls within the expected range of variation shown by *S. integrilabris*. *Sigmatostalix adamsii*, which Dodson (1977) defined as the least significant member of the genus, is actually known only from Panama to Ecuador [Panama. Without precise locality data, *Maduro s.n.* (Dalström collection). Colombia. Dept. del Valle: Río Digua, Piedra de Moler, *Cuatrecasas 15042* (drawing). Ecuador. Pichincha, in orange trees in the city of Santo Domingo, 650 m, 26 October 1961, *C.H. Dodson & Thien 1128* (SEL); km 20, Quito-Santo Domingo, 900 m, 13 March 1976, *C. Luer et al. 856* (SEL)].

Köeniger (1997) reduced *S. adamsii* in synonymy under *S. lehmanniana* Kraenzl., probably accounting for the very small size of the flowers in Kränzlin's species. I was unable to locate the type of *S. lehmanniana* in Vienna (Colombia: Cali, nahe Las Juntas del Dagua, *Lehmann 8075*, the type), but the original protologue (Kränzlin 1899) does not support this interpretation. The lip of *S. lehmanniana* is described as trilobate, with the lateral lobes shorter than the linear midlobe, and the callus is cupuliform, keeled and convex. Kränzlin himself (1899) compared it with the Colombian *S. reversa* Rchb.f., and with his own *S. miranda* (Kränzlin 1922), a species with the lip provided with very narrow lobes. Schlechter (1922) followed the same interpretation when he compared *Roezliella lehmanniana* (Kraenzl.) Schltr. with *R. malleifera* (Rchb.f.) Schltr., both characterized by their deeply tripartite lip.

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