This poorly known species (*Oncidium leucomelas*) is closely related to *O. stenoglossum* (Schltr.) Dressler & N.H. Williams, differing slightly in form and markedly in coloration. Although Bockemühl and Senghas (1988) treat *O. stenoglossum* as a subspecies of *Miltonioides leucomelas,* they base the subspecific name on an unpublished herbarium name. Until the relationship between these two taxa is better understood, it may be well to treat them as distinct species.

Trichocentrum

Trichocentrum nudum (Batem. ex Lindl.) Chase and N.H. Williams subsp. **stipitatum** (Lindl.), comb. nov. *Oncidium stipitatum* Lindl., Bot. Voy. Sulphur 172. 1843.

Trichocentrum stipitatum, of the former Panama Canal area, seems very distinct from the widespread *T. nudum,* of eastern Panama and northern South America. A zone of intergradation, however, occurs in the Pearl Archipelago and for about 50 km east of Panama City. Thus, we prefer to treat *stipitatum* as a subspecies of the widespread *T. nudum.*

Psygmorchis

Undoubtedly *Oncidium crista-galli* is closely allied to *Psygmorchis* and should be placed in the same genus. Williams et al. (2001) assign it, with all other species of *Psygmorchis,* to *Erycina,* noting that *O. crista-galli* agrees well with *Erycina hyalinobulbon* in leaf texture and in pseudobulbs without a terminal leaf. Leaf texture, unless most unusual, is a difficult feature to measure or compare; and the terminal leaf may be lacking in other Oncidiinae, especially *Ionopsis.* Striking differences are found between the flower and inflorescence of *Erycina* (sensu stricto) and *Psygmorchis* (including *O. crista-galli*).

Seemingly and paradoxically, a policy of enthusiastic "lumping" may lead to the same problems as did enthusiastic "splitting" by ornithologists some decades ago. In either case, one must identify the species before being able to assign it to a genus. *Erycina* and *Psygmorchis* are clearly sister groups; but when kept as distinct genera, they are easily characterized and recognized.

Psygmorchis crista-galli (Rchb.f.) Dodson. Native Ecuadorian Orchids 4: 883. 2003 Synonyms: *Oncidium crista-galli* Rchb.f., Bot. Zeit. (Berlin) 10: 697. 1852; *Erycina crista-galli* (Rchb.f.) N.H. Williams & Chase, Lindleyana 16: 136. 2001.

Acknowledgments

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CONTRIBUTIONS TO THE UNDERSTANDING OF ANDEAN AND AMAZONIAN *AECHMEA* SUBGENUS *CHEVALIERA* (BROMELIACEAE)

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ABSTRACT. Living, dried, or liquid-preserved material from seven Amazonian and Andean species of *Aechmea* subgen. *Chevaliera* were studied along with type specimens. Illustrations, redescriptions, and identification keys are provided for the studied species, and collection sites for the specimens are plotted on a map.

Key words: Bromeliaceae, *Aechmea, Chevaliera,* morphology, redescriptions

INTRODUCTION

The genus *Aechmea* contains a large and diverse array of species with some discordant characteristics. The genus is certainly polyphyletic (Smith & Downs 1979), encompassing species of vast morphological diversity totaling 172 taxa divided in 8 subgenera. Since 1979, 55 new species of *Aechmea* have been described (Luther 2000), thus elevating to 227 the number of species in the genus. Recent taxonomic alterations involving the genus include elevation of the 8 subgenera to genus status (Smith & Kress 1989, 1990) based solely on nomenclatural considerations. That elevation was not accepted by taxonomists who specialize in the family (Leme 1992, Brown et al. 1993). In addition, *Streptocalix* was reduced to *Aechmea* (Smith & Spencer 1992), further increasing its artificial character. Although this work was criticized as a major taxonomic change unsupported by a thorough taxonomic analysis (Brown et al. 1993), the proposed nomenclatural changes were accepted (Luther 2000).

Aechmea is ambiguously defined by Smith and Downs (1979). For example, they define the scape as usually well developed; inflorescences can be compound or simple; flowers can be distichous or polystichous, sessile or stipitate; sepals can be free or connate and are usually strongly asymmetric; petals are free, usually bearing two basal appendages; stamens are included, free, or the second series adnate to the petals; pollen with two, three, four, or numerous pores; and ovules are mostly caudate. Wendt (1993) referred to the genus *Aechmea* as having most species with petal appendages, a few with naked petals; flowers pedicellate or sessile; inflorescences varying from amply and laxly compound to simple and densely strobiliform; sepals mucronulate or unarmed; and ovules varying from obtuse to long caudate.

Of the eight *Aechmea* subgenera recognized by Smith and Downs (1979), *Chevaliera* shows a more consistent set of morphological characteristics and appears to be, at least in part, monophyletic. *Chevaliera* was first defined as a genus by Charles Gaudichaud-Beaupré (1843), to honor the French botanist Francois Fulgis Chevallier. Gaudichaud circumnavigated the globe in 1836 and 1837 on board the *Bonite.* During his passage to eastern Brazil, he discovered *C. ornata* and *C. sphaerocephala,* which he defined as the type of the new genus. His publication is not considered taxonomically valid, however, since he did not publish species descriptions, only the engravings.

The genus *Chevaliera* was validly described by Beer (1856). Baker (1879) treated *Chevaliera* as a section of *Aechmea* and later (Baker 1889) as one of eleven subgenera in *Aechmea.* It was characterized by a dense, simple and strobiliform inflorescence with each flower subtended by a large, ovate, coriaceous bract and the ovary flattened on the side towards the axis. Within subg. *Chevaliera,* Baker (1889) included *A. crocophyla* Baker, *A. fernandae* (E. Morren) Baker, *A. germinyana* (Carrière) Baker, *A. gigantea* (Maury) Baker, *A. magdalenae* (André) André ex Baker, *A. schomburgkii* Baker, *A. sphaerocephala* Baker, *A. stephanophora* E. Morren ex Baker, and *A. veitchii* Baker.

Carl Mez (1896) treated a subset of *Aechmea* subg. *Chevaliera* (Baker 1889) as *Aechmea* subg. *Purpurospadix.* Diagnostic features for subg. *Purpurospadix* included a simple, spicate, strobiliform or subglobose inflorescence; coriaceous floral bracts, with serrate margins; innermost flowers withered at the tip; petals greenish with rudimentary ligules often modified into small, entire, transverse calli. Subgenus *Purpurospadix* encompassed the species *A. fernandae, A. germinyana, A. magdalenae, A. rubiginosa*

Mez, and *A. veitchii.* Carl Mez elected *A. fernandae* as the type species. In the same work, Mez treated *Chevaliera* as a genus, accepting Gaudichaud as author and including the following species: *Chevaliera sphaerocephala, C. comata, C. stephanophora* and *C. ornata.* In this study, the geographic distribution of these species is referred to as being restricted to western Brazil.

Smith and Downs (1979) accepted Baker's treatment of the subg. *Chevaliera* and defined it as having simple, strobiliform inflorescences or rarely digitate from a few spikes, often perennial; floral bracts coriaceous or ligneous; flowers in many ranks; sepals free or connate; petals with appendages reduced or lacking. Smith and Downs (1979) also included in subgenus *Chevaliera* all species from subg. *Purpurospadix* (Mez 1896), as well as newly described taxa, to bring *Aechmea* subg. *Chevaliera* to a total of 21 species (Amazonian or Andean species indicated by *). They are *Aechmea cariocae* L.B. Sm., *A. castanea* L.B. Sm., *A. conifera* L.B. Sm., *A. depressa* L.B. Sm., *A. digitata* L.B. Sm. & Read, **A. fernandae, *A. germinyana, A. hostilis* E. Pereira, **A. lateralis* L.B. Sm., *A. leucolepis* L.B. Sm., **A. magdalenae, A. multiflora* L.B. Sm., *A. muricata* (Arruda) L.B. Sm., **A. pallida* L.B. Sm., *A. perforata* L.B. Sm., **A. rodriguesiana* (L.B. Sm.) L.B. Sm., **A. rubiginosa, A. saxicola* L.B. Sm., *A. sphaerocephala, **A. strobilacea* L.B. Sm., and **A. veitchii.*

Since 1979, the following species have been described for subgenus *Chevaliera*: *Aechmea frassi* Leme & Siqueira, *A. gustavoi* Siqueira & Leme (Leme & Siqueira 2001), *A. microcephala* E. Pereira & Leme, and **A. tayoensis* Gilmartin (Gilmartin 1981). In 1994, Eric Gouda transferred *A. lateralis* L.B. Sm. to *Disteganthus* (Gouda 1994), recognizing it as *D. lateralis* (L.B. Sm.) Gouda. This change was based on the inflorescence being lateral from the base of the rosette and hidden by foliage; also sepals are symmetrical, and petals high connate and spreading recurved. Thus subgenus *Chevaliera* now encompasses 24 species, 9 of which are distributed in the Amazon or the lower Andes.

Grant and Zijlstra (1998) accepted *Chevaliera* as a genus based on Smith and Kress (1989, 1990) and Beer as author. For now, however, it is best kept at the subgenus level, since elevation to genus status requires considerable morphological and molecular work inserted in a cladistic aproach to justify the change.

Materials and Methods

Because of their great size and the extreme aggressiveness of their foliar spines and their occurrence in remote and isolated regions, few were the specimens of *Aechmea* subgenus *Chevaliera* from the Amazon and the Andes deposited in Herbaria prior to 1979. This sparsity of specimens contributed to a poor knowledge of their geographic distribution and morphology and resulted in very short and incomplete descriptions in Smith and Downs (1979).

The present study arose from the opportunity to study living specimens of subgenus *Chevaliera* from the Amazon and the Andes (with complete collection data) being cultivated at The Marie Selby Botanical Gardens. The study was based on observations and collections of plants cultivated in the Selby Gardens research greenhouses and detailed examination of recent collections of herbarium specimens, including types from the Marie Selby Botanical Gardens Herbarium (SEL), United States National Herbarium (US), and New York Botanical Gardens Herbarium (NY). All studied materials are cited in the taxonomy section, as are recent collections deposited at the Herbaria SEL, US, and NY.

Specimens were observed using a stereoscopic microscope. Floral bracts and flowers were rehydrated by immersion in boiling tap water. For the visualization of foliar trichomes, a 1 cm wide plastic Scotch tape was applied to ca. 1 cm^2 of the abaxial face of the leaf of dried specimens. This tape was glued to a glass microscopic slide and examined using a transmitted-light microscope at 100 magnification.

Life-size drawings were made of floral bracts and sepals using a representative specimen of each species. For the drawings of abaxial surfaces of floral bracts and sepals, these were opened and flattened under a clear acrylic ruler and two lead weights. In the drawings, dots represent indumentum and lines represent keels. Drawings of foliar trichomes were made using a representative specimen of each species.

Species descriptions and keys were based on the specimens observed and the available literature, and measurements represent the maximum variation observed. Morphological terminology was based upon Smith and Downs (1979) and (Kinger & Porter 2001). Abreviations of authors names followed Brummitt and Powell (1992), Lawrence and colleagues (1968), and *Botanico Periodicum Huntianum* (BPH and BPH/S).

Results and Discussion

The collection site for each studied specimen was plotted on a map of northwestern South America (Figure 1).

Aechmea germinyana, A. veitchii, A. magdalenae, A. fernandae, A. rubiginosa, A. strobilacea, and *A. tayoensis* seem to form a natural

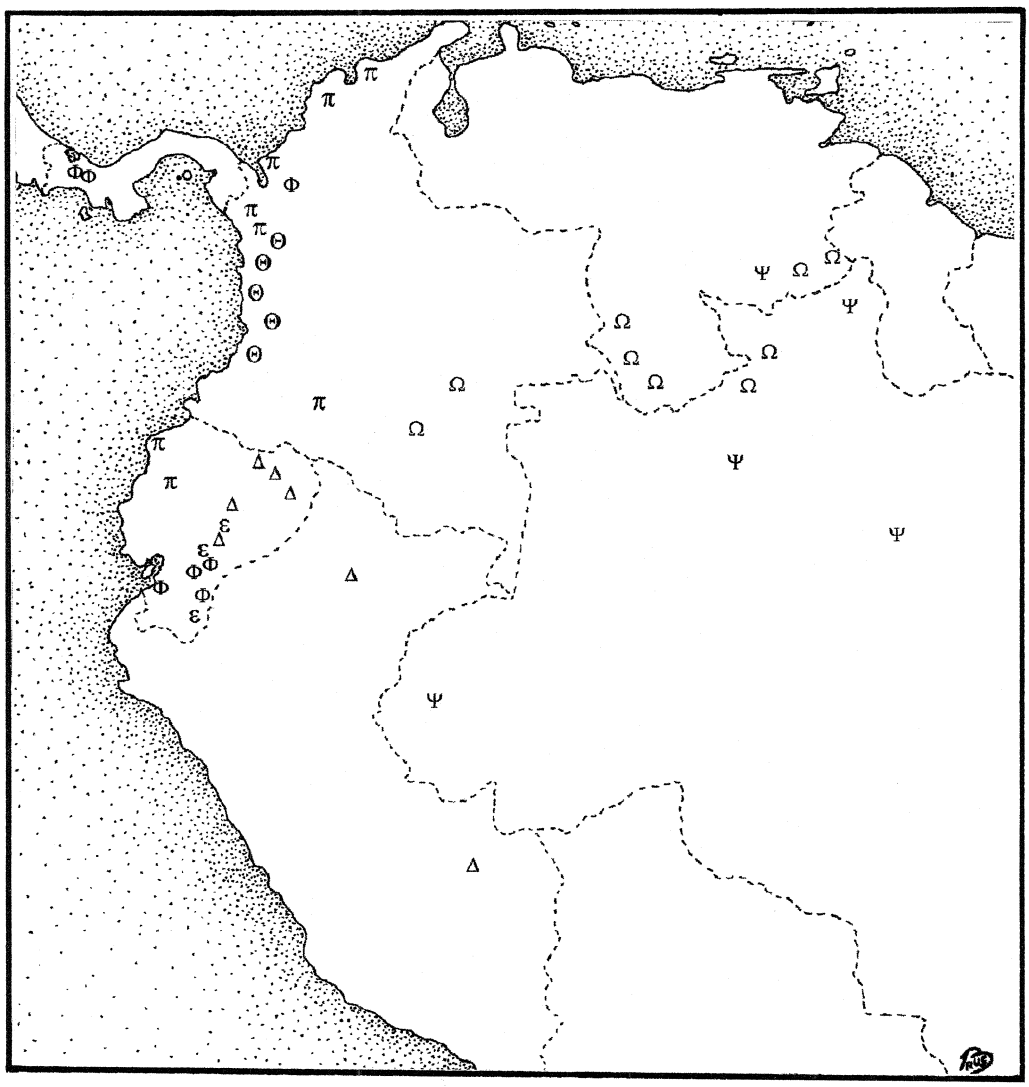

FIGURE 1. Distribution of the studied specimens of *Aechmea.* **Φ** *Aechmea veitchii.* **Θ** *A. germinyana.* **Δ** *A. strobilacea.* **Ω** *A. rubiginosa.* **Ψ** *A. fernandae.* **ε** *A. tayoensis.* **π** *A. magdalenae.*

group, being ecologically adapted to the shady and humid terrestrial habitat of the equatorial rain forest.

Aechmea pallida and *A. rodriguesiana,* although Amazonian and treated by Smith and Downs (1979) in subg. *Chevaliera,* do not appear to belong to this natural group. These plants grow in near full exposure to the sun, are relatively small obligate epiphytes, the abaxial face of the leaves have sparse, rounded trichomes as shown for *A. rodriguesiana* (FIGURE 2), the leaf sheaths are ample and somewhat inflated, the floral bracts are entire, glabrous, broadly elliptic with the apex rounded, the sepals are oblong, obtuse and unarmed.

The eastern Brazilian species of subgenus *Chevaliera* do not seem to be closely related to the Amazonian and Andean species treated in this study, and many are the morphological differences separating these two groups (TABLE 1). In terms of ecological differences, most eastern Brazilian species of *Chevaliera* are facultative epiphytes that grow in near full exposure to the sun, forming large clumps at tree bifurcations or on the ground, often more than 4 m across. *Aechmea sphaerocephala, A. saxicola,* and *A.*

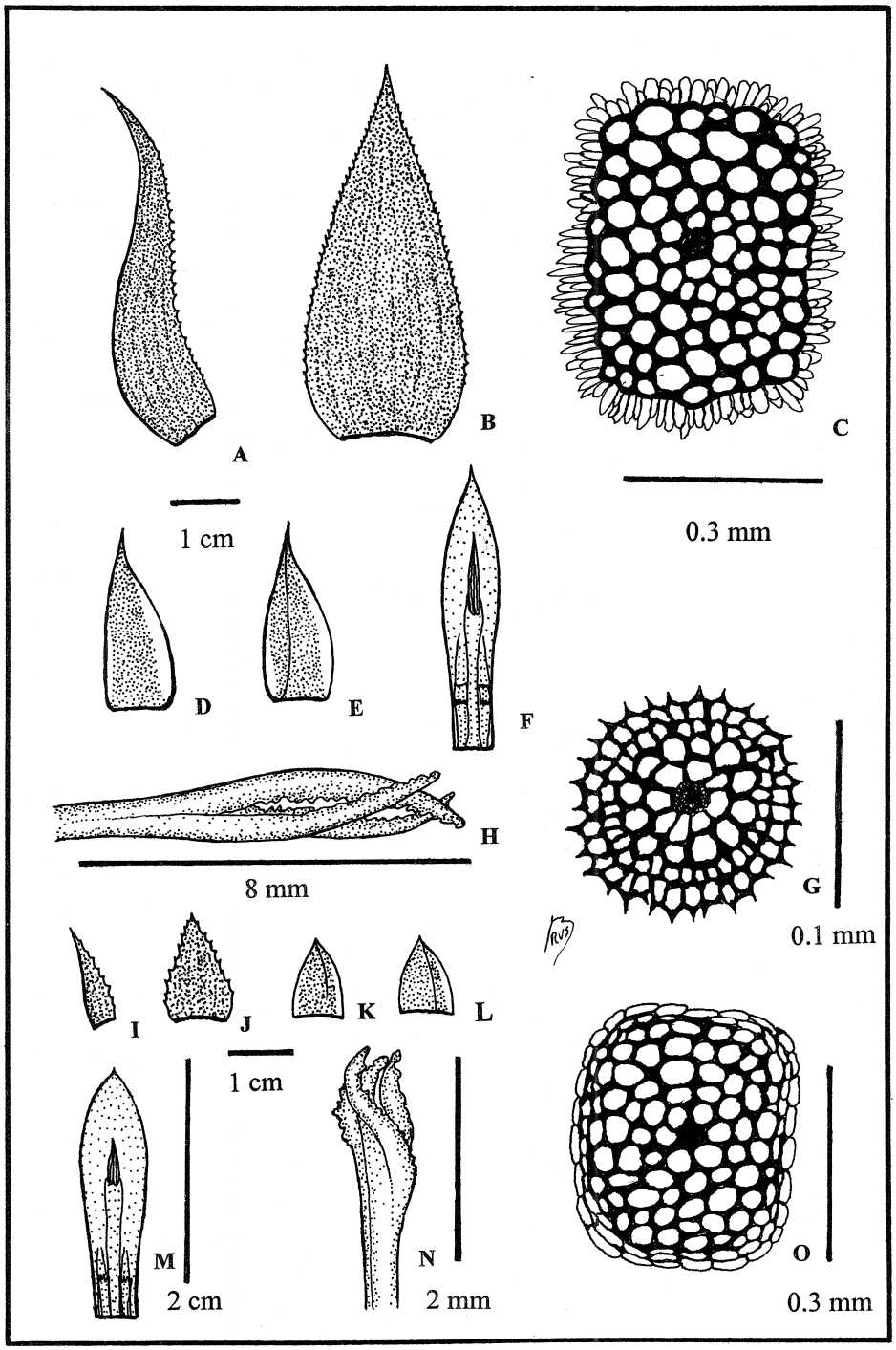

FIGURE 2. **A.–F.** & **H.** *Aechmea tayoensis.* **B.** Feuerstein legit. **G.** *A. rodriguesiana,* clonotype, M. Mee legit. **I.–O.** *Ananas comosus,* B.R. Silva 592. **A.** & **I.** Floral bract from side. **B.** & **J.** Abaxial face of floral bract. **C.**, **G.** & **O.** Trichome from abaxial face of leaf. **D.** & **K.** Ecarinate sepal. **E.** & **L.** Carinate sepal. **F.** & **M.** Petal. **H.** & **N.** Stigma.

TABLE 1. Comparison of eastern Brazilian and Amazonian *Aechmea* subgenus *Chevaliera*.

	Characteristics of *Aechmea* subgenus *Chevaliera*	
Parts of plant	Eastern Brazil	Andes and Amazon*
Rosette	Crateriform, holding large amounts of water	Spreading, holding very small amounts of water for short periods
Leaf sheaths	Elliptical to ovate	Triangular
Leaves	Ligulate, apex rounded or attenuate and acuminate, never narrowed at base	Linear-elliptical, apex attenuate to long attenuate, always narrowed at base
Scape bracts	Suberect, imbricate and acuminate, never foliaceous	Suberect, imbricate to foliaceous, spreading and recurved
Floral bracts	Ovate, apex rounded and acuminate, densely covered abaxially with rounded trichomes	Elliptical, apex triangular, completely covered abaxially with rectangular trichomes
Sepals	Conspicuously asymmetrical, apex rounded and mucronulate, glabrous to sparsely covered with rounded appressed trichomes	Inconspicuously asymmetrical, apex triangular, completely covered abaxially with coarse trichomes
Petals	Elliptical throughout, apex attenuate	Elliptical with linear base, apex attenuate and apiculate
Stigma	Conduplicate-spiral, lobes strongly twisted, with conspicuous papillae	Conduplicate-spiral, lobes only partially twisted, with inconspicuous papillae
Anthers	Apex and base obtuse	Base sagitate, apex attenuate
Ovaries	Dorsiventrally compressed, not fused	Partially to completely fused, becoming loose when dry
Ovules	Long caudate	Obtuse

* Excluding *Aechmea rodriguesiana* and *A. pallida*.

hostilis are rupicolous or saxicolous. Only *A. perforata* and *A. muricata* occur as terrestrials, but always on very exposed, dry, sandy soils.

These morphological and ecological differences are reflected in the separate treatment given by Carl Mez to the group of species here analyzed. A complete cladistic study of all species of subgenus *Chevaliera* could yield a new classification for these taxa. The genera *Ananas* (FIGURE 2) and *Pseudananas* (FIGURE 3) should also be included in this cladistic approach because of their superficial resemblance to *Aechmea* subgen. *Chevaliera,* including their densely strobiliform inflorescences. This cladistic study has begun and will include molecular and anatomical data. Perhaps the resurrection of *Aechmea* subgenus *Purpurospadix* would be a good option for this group of species since the type species of *Aechmea* subgenus *Chevaliera* is *A. sphaerocephala,* an eastern Brazilian species.

SYSTEMATIC TREATMENT

Key to the Amazonian and Andean Species of *Aechmea* subg. *Chevaliera*

1. Plants facultatively epiphytic; sheath linear elliptic; leaf blade inconspicuously narrowed at base, apex rounded or short attenuate and apiculate; leaf spines less than 1.5 mm long, spaced 2–3 mm apart; scape bracts imbricate, erect, not foliaceous, with apex attenuate and apiculate; sepals glabrous; petals white or yellow; seeds to 4 mm long.
2. Rosette loosely spreading, cyathiform at base, leaf spines dark brown; floral bracts strongly nerved, elliptic, apex recurved, slightly longer than the mature flowers; floral bract spines up to 1 mm long . . . . . *Aechmea veitchii*

2a. Rosette loosely spreading, not cyathiform at base, leaf spines light brown; floral bracts inconspicuously nerved, ovate, apex spreading, not recurved, slightly shorter than mature flowers; floral bract spines not over 0.5 mm long . . . . . *Aechmea germinyana*

1a. Plants terrestrial; sheath triangular; leaf blade not narrowed at base to pseudopetiolate, apex long attenuate; leaf spines longer than 2 mm, specially at base, spaced 5–20 mm apart; scape bracts foliaceous, spreading recurved, not imbricate; sepals covered with coarse trichomes, petals yellowish; seeds to 7 mm long.
3. Leaf pseudopetiolate; pseudopetiole channeled, margins with triangular, straight and dark brown spines, 3–5 mm long, spaced 3–8 mm apart; blade broadly elliptical, to 20 cm wide, tinged rose on midrib, spines antrorse, recurved, 1–2 mm long, spaced 2–5 mm apart; inflorescence cylindrical when mature; floral bracts 5–6 cm long, ecarinate . . . . . *Aechmea tayoensis*

3a. Leaf slightly to strongly narrowed at base, not pseudopetiolate, blade linear.
4. Leaf slightly narrowed at base for 20–40 cm,

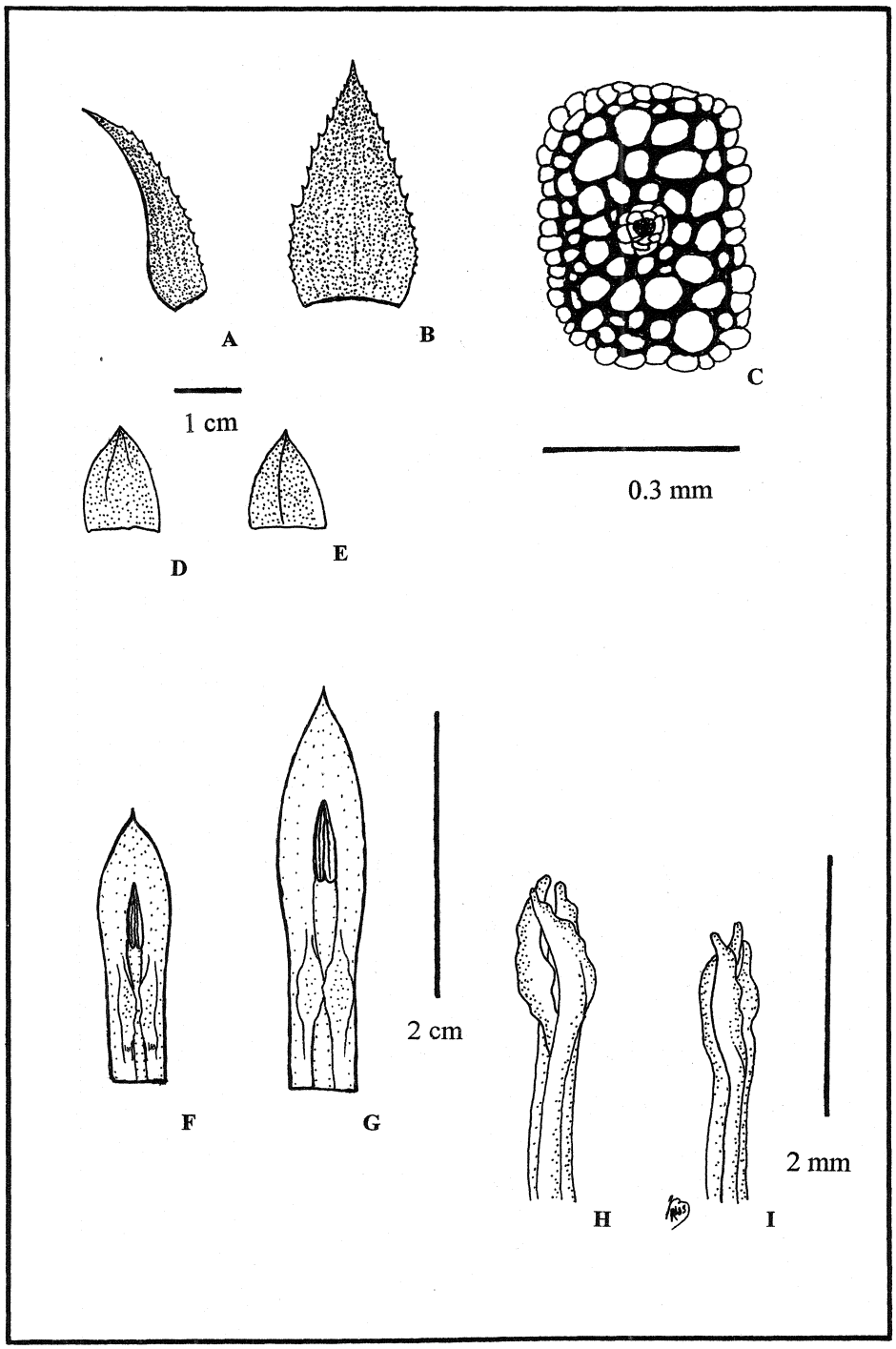

FIGURE 3. **A.–F.** & **H.** *Pseudananas sagenarius.* M.B. Foster 1066. **G.** & **I.** *Aechmea strobilacea,* Alberto Dik 1470. **A.** Floral bract from side. **B.** Abaxial face of floral bract. **C.** Trichome from abaxial face of leaf. **D.** Ecarinate sepal. **E.** Carinate sepal. **F.** & **G.** Petal. **H.** & **I.** Stigma.

blade stramineous to chartaceous in texture; inflorescence bipinnate, bearing 1–3 short basal branches, conical, occasionally simple; floral bracts linear-elliptic, 4.5–5.5 cm long, monocarinate toward apex; flowers 4.0–5.0 cm long without petals; sepals free . . . . . *Aechmea magdalenae*

4a. Inflorescence always simple.

5. Blade stramineous to subchartaceous in texture, narrowed at base for 20–40 cm; leaf spines light brown, antrorse or retrorse near the base; inflorescence spherical even in fruiting stage; floral bracts straight, not recurved, inconspicuously carinate towards apex; floral bract spines not over 0.5 mm long . . . . . *Aechmea rubiginosa*

5a. Blade chartaceous to coriaceous; spines dark brown and retrorse near the base; inflorescence cylindrical; floral bracts recurved, floral bract spines 1–1.5 mm long.

6. Leaf blade less than 1.5 m long, abruptly narrowed at base for 10–30 cm; flowers forming an angle of 45° with the main axis; floral bracts ovate, less than 5 cm long, inconspicuously carinate near apex; flowers less than 5 cm long; sepals free . . . . . *Aechmea fernandae*

6a. Leaf blade 2–3 m long, narrowed at base for 20–50 cm; floral bracts linear elliptic, 6–9 cm long, bicarinate; flowers forming an angle of 70–90° with the main axis, 5.5–6.5 cm long without the petals; sepals unequally connate for 2–3 mm . . . . . *Aechmea strobilacea*

Redescriptions of the Species

Aechmea tayoensis Gilmartin, Selbyana 5(3,4): 308–309. 1981. Type: Ecuador: Morona-Santiago, Los Tayos, 03°7′S, 78°14′W, 700 m, 12 Jul. 1976, *G. Argent & R. B. Burbidge 60* (holotype: E!). Figure 2.

Plant terrestrial, short to long stoloniferous, flowering 60–100 cm high. ***Leaves*** ca. 15 in number, arching, forming a loosely spreading rosette, not holding water, 80–150 cm in diameter. ***Sheaths*** triangular, 8–15 cm long, 5–8 cm wide, brown, drying dark brown, coriaceous, nerved, entire, completely covered with brown appressed trichomes on both surfaces. ***Blades*** pseudopetiolate at base, abruptly very broadly elliptical, apex long attenuate and pungent, 40–100 cm long, petiole channeled, 15–40 cm long, 4–5 cm wide, chartaceous to subcoriaceous, channel gradually disappearing in the elliptical portion, flat near apex, elliptical portion 25–60 cm long, 10–20 cm wide at middle, chartaceous to subcoriaceous, strongly nerved, abaxially completely covered with cinereous appressed trichomes, whitish green, tinged rose mainly on mid rib and petiole, drying opaque brown, adaxially very sparsely covered with appressed trichomes, green spotted with dark green, tinged rose mainly on petiole, drying light brown, serrate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells rounded, not radially elongated, thin walled, wing cells rounded and thick walled, bordered by small, radially elongated cells. ***Spines*** at petiole triangular, straight, a few recurved, antrorse or retrorse, dark brown, 3–5 mm long, spaced 3–8 mm apart, decreasing in size and becoming antrorse and more tightly spaced towards wide portion of blade, 1–2 mm long, spaced 2–5 mm apart, recurved, brown to dark brown, very tightly spaced near apex. ***Scape*** stout, erect, ca. 10 cm long, ca. 15 mm in diameter, completely concealed by leaf sheaths. ***Scape bracts*** exceeding the internodes, foliaceous, imbricate, ca. 7 cm long, erect, the upper ones spreading and recurved, massed below the inflorescence, serrulate, densely to completely covered with appressed trichomes on abaxial surface, sparsely covered with appressed trichomes on adaxial surface. ***Inflorescence*** simple, erect, flattened when young, cylindrical when mature, very densely strobiliform, ca. 12 cm long, 10 cm in diameter, bearing a coma of sterile bracts at apex. ***Floral bracts*** elliptic, apex triangular and pungent, recurved, pointing diagonally downwards, strongly nerved, 5–6 cm long, ca. 1.5 cm wide at base, much longer than the mature flowers, carinate, light rose, coriaceous, lepidote, serrulate. ***Flowers*** sessile, densely and polystichously arranged, spreading ca. 70° from the main axis. ***Sepals*** linear-elliptic, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, slightly asymmetrical, thick with membranous margins, 25–40 mm long, 10–12 mm wide at wing, free, subcoriaceous, red, drying light brown, wing hyaline, abaxially completely covered with coarse trichomes, adaxially sparsely to densely covered with appressed trichomes. ***Petals*** yellow to lemon-yellow, suberect, elliptical, apex attenuate and apiculate, 35–45 mm long, 6–8 mm wide, free, twisted after anthesis, with two flap-like callosities, ca. 9 mm long, ca. 1.5 mm wide, flaps turned toward ovary and fimbriate at apex. ***Filaments*** partially concealed by callosities, free, expanded towards apex, ca. 22 mm long, ca. 1.5 mm wide, whitish. ***Anthers*** dorsifixed below the middle, with the base sagitate and the apex attenuate, ca. 11 mm long, ca. 1.5 mm wide, light yellow. ***Style*** cylindrical, whitish, ca. 15 mm long, ca. 1 mm wide. ***Stigma*** conduplicate-spiraled, ellipsoid, lobes only partially twisted, ca. 5 mm long, margins undulate, papillae inconspicuous. ***Ovary*** ellipsoid, dorsiventrally flattened, free when dry, not fused to other ovaries, sepal keels continuing to the ovary, 15–25 mm long, 15–20 mm wide in fruiting stage,

sparsely covered with appressed trichomes, drying dark brown. ***Ovules*** obtuse, ca. 1 mm long. ***Seeds*** ellipsoid, 5–7 mm long, 3 mm in diameter. ***Epigynous tube*** cylindrical, 4–6 mm long.

Etymology. Named after the place where it was discovered, Los Tayos, between the rivers Coangos and Santiago, in the Province of Morona-Santiago, Ecuador.

Distribution. Ecuador.

Material examined. Ecuador: Zamora-Chinchipe, road Quime, crossing Río Zamora into the Condor/Chumbleza cutoff road from Gualaquiza/El Pangui, ca. 1000 m, Mar. 1996, *B. Feuerstein legit.,* Fl. Cult. Marie Selby Botanical Gardens, Oct. 1998, *H.E. Luther s.n.* (SEL); Zamora-Chinchipe, Cord. Del Condor, 6 Aug. 1997, *Lynn Hannon s.n.* (SEL). Zamora-Chinchipe, road Quime, crossing Río Zamora into the Condor/Chumbleza cutoff road from Gualaquiza/El Pangui, ca. 1000 m, Mar. 1996, *B. Feuerstein legit.,* Fl. Cult. Marie Selby Botanical Gardens, Mar. 2001, *B.R. Silva 574* (SEL).

Habitat. This species grows on the very shaded ground level of the pre-montane rain forests of the eastern slopes of the Ecuatorian Andes, between altitudes of 700–1000 m. The petiolate leaves with a broad blade may be an adaptation for light gathering in its shady habitat.

Aechmea veitchii Baker, Bot. Mag. 103: *pl. 6329.* 1877. TYPE: Kew Hortus s.n. HOLOTYPE: K; Photo: GH, Colombia. SYN. *Chevaliera veitchii* (Baker) E. Morren, Belg. Hortic. 28: 177, *pl. 9.* 1878. FIGURE 4.

Plant terrestrial, occasionally epiphytic, short stoloniferous, flowering 40–90 cm high. ***Leaves*** ca. 15 in number, arching, forming a loosely cyathiform rosette, not holding water, 50–150 cm in diameter. ***Sheaths*** indistinct from blade, linear-elliptic, 8–12 cm long, 3–6 cm wide, pale green, drying light brown, chartaceous, nerved, entire, completely covered with hyaline appressed trichomes on both surfaces. ***Blades*** linear elliptic, attenuate to rounded and acuminate, canaliculate at base, keeled towards apex, stramineous to subchartaceous, inconspicuously nervate, slightly narrowed at base for less than 20 cm, 3–5 cm wide at narrow portion, 4–6 cm wide near the middle, 30–90 cm long, apicule 4–9 mm long, abaxially completely covered with cinereous to brown appressed trichomes, whitish green, drying opaque brown, adaxially densely covered with inconspicuous hyaline trichomes, light green spotted with dark green, shiny, drying shiny light brown, serrulate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells radially elongated and thin walled, wing cells rounded and thick walled, bordered by dark, tangentially elongated cells. ***Spines*** antrorse, recurved, dark brown, 0.3–1 mm long, decreasing in size towards apex, spaced 3–8 mm. ***Scape*** stout, erect, 20–60 cm long, 6–9 mm in diameter, internodes greenish to purple, drying light brown, 3–6 cm long, sparsely covered with round appressed trichomes to densely lanate. ***Scape bracts*** elliptic and apiculate, apicule triangular, dark brown, 4–10 mm long, exceeding the internodes, 5–10 cm long, 2–4 cm wide, greenish, drying light brown, inconspicuously nerved, erect, imbricate and completely covering the scape, serrulate towards apex, spines very variable, 0.2–1 mm long, straight, antrorse or retrose, light brown, recurved, spaced 1–5 mm, papyraceous, completely covered with appressed cinereous trichomes on abaxial face, sparsely covered with appressed cinereous trichomes on adaxial face. ***Inflorescence*** simple, erect, conical when young, cylindrical when mature, very densely strobiliform, 10–40 cm long, 5–7 cm in diameter, bearing a coma of sterile bracts at apex. ***Floral bracts*** elliptic, apex triangular and pungent, strongly recurved, pointing downwards, 2–3.5 cm long, 1.5–2 cm wide, slightly longer than the mature flowers, ecarinate, inconspicuously nerved, red, drying light brown, chartaceous, abaxially completely covered with appressed brown and rounded trichomes, adaxially sparsely covered with hyaline trichomes, serrate, spines 0.7–1 mm long, mostly straight, some antrorse, spaced 1–3 mm apart. ***Flowers*** sessile, densely and polystichously arranged, spreading ca. 45° from the main axis, 20–25 mm long without the petals. ***Sepals*** linear-elliptic, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, slightly asymmetrical, 12–15 mm long, 5–7 mm wide at wing, free, chartaceous, greenish white with the apex rose, drying light brown, wing hyaline, glabrous. ***Petals*** white to yellow, twisted after anthesis. ***Ovary*** ellipsoid, dorsiventrally flattened, sepal keels continuing to the ovary, 6–8 mm long, 5–7 mm wide, glabrous, drying dark brown. ***Ovules*** apiculate, 0.7 mm long. ***Seeds*** ellipsoid, 4–5 mm long, 1 mm in diameter. ***Epigynous tube*** cylindrical, 1–2 mm long.

Etymology. This species was discovered by Gustave Wallis in New Granada in 1874; it was introduced into cultivation by Mr. Veitch, a famous British nurserymen of the 19th century. When Baker described the species, in 1877, he

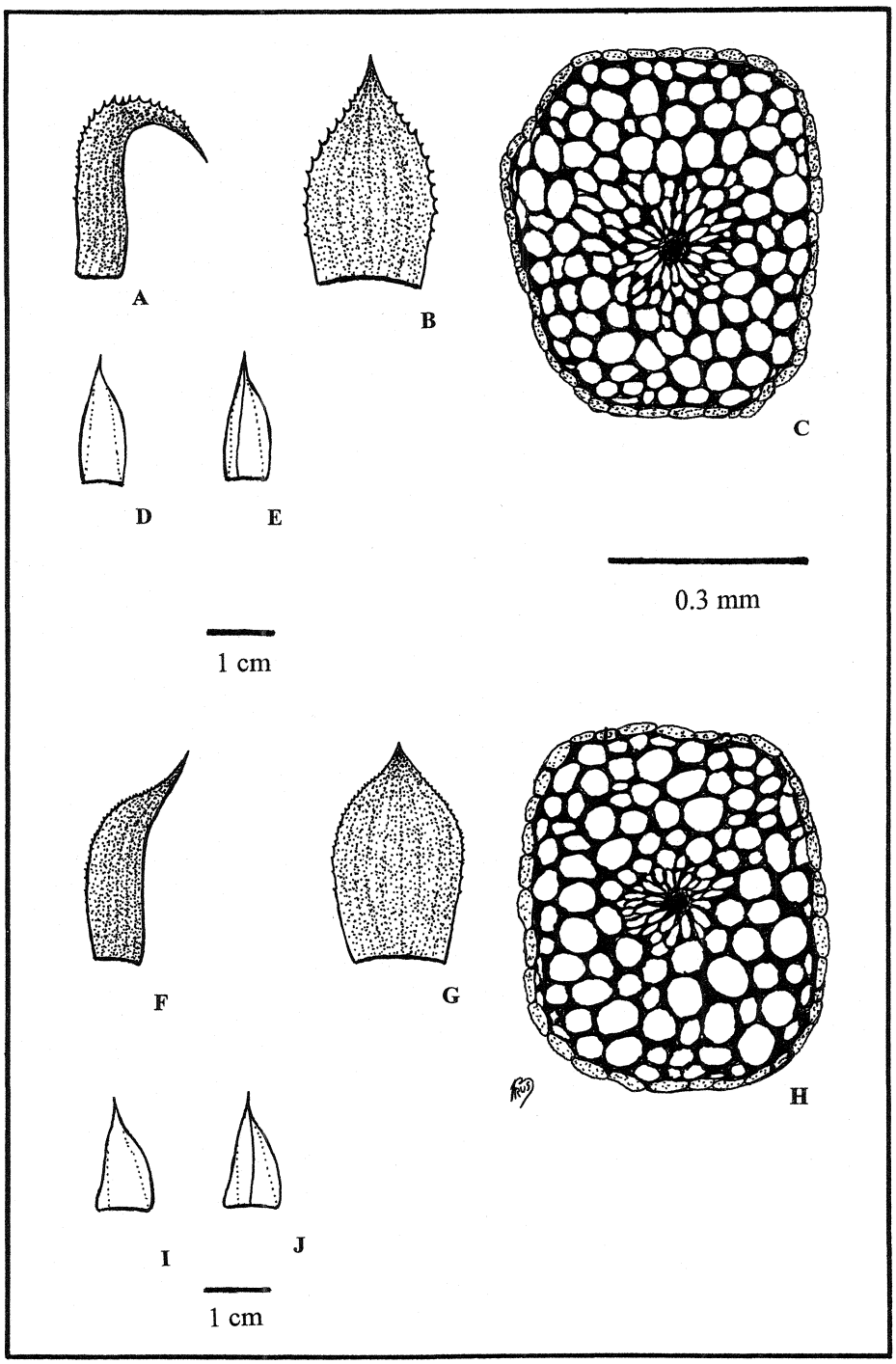

FIGURE 4. **A.–E.** *Aechmea veitchii,* Al Gentry 80261. **F.–J.** *A. germinyana,* Thomas B. Croat 70100. **A.** & **F.** Floral bract from side. **B.** & **G.** Abaxial face of floral bract. **C.** & **H.** Trichome from abaxial face of leaf. **D.** & **I.** Ecarinate sepal. **E.** & **J.** Carinate sepal.

honored Veitch, who donated the plant to be cultivated at The Royal Botanical Gardens, Kew.

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

Material examined. Colombia: Antioquia, Municipio San Francisco, Corregimiento de Aquitania, Alto del Venado (Tierra Linda), 1200–1350 m, 2 Apr. 1992, *R. Fonnegra 4008 & Curso Tax. Plan. Vasc.* (SEL). Ecuador: Zamora-Chinchipe, Cordillera del Condor, 1700 m, June 1990, *B. Girko E90-089j* (SEL); Morona-Santiago, North Gualaquiza, 1900 m, 7 Mar. 1992, *S. Dalström 1623* (SEL); Morona-Santiago, Gualaquiza Canton, Cordillera del Condor, Cuangos, 20 km east of Gualaquiza, near disputed Peru-Ecuador border, trail to stream, 03°29′S 79°14′W, 1400–1500 m, 20 Jul. 1993, *Al Gentry 80261* (SEL); Zamora-Chinchipe, along road Guisme-Condor, 1800 m, Jan. 1989, *Hoijer & Dalström 1175* (SEL). Panama: Chiriqui-Bocas, Cerro Colorado, 1600 m, 1986, *H. Luther, L. Besse, Halton, J. Kress,* Fl. Cult. Marie Selby Botanical Gardens, sel 1995-0288, 15 Feb. 2001, *B.R. Silva 480* (SEL); Chiriqui/Bocas del Toro, Cerro Colorado, 10–12 km N of the copper mine, 1500 m, 21 June 1986, *H. Luther, J. Kress, L. Besse, J. Halton 1085A* (SEL); Chiriqui-Bocas del Toro, Cerro Colorado, above the copper mine, 1600 m, June 1986, *Luther, Besse, Halton, Kress 1053* (SEL).

Habitat. This species grows as a terrestrial and occasionally as an epiphyte at the shady lower levels of the tree trunks in montane rain forests, between altitudes of 1000–2000 m.

Aechmea germinyana (Carrière) Baker, Handb. Bromel. 66. 1889. TYPE. Carrière Hortus ex Germiny Hortus s.n. (Typified by original description and illustration!) SYN. *Chevaliera germinyana* Carrière, Rev. Hortic. 53: 230, *fig. 55, pl.* 1881. *Bromelia daguensis* Carrière, Rev. Hortic. 53: 230, 1881; nomen. FIGURE 4.

Plant terrestrial, occasionally epiphytic, stoloniferous, flowering 40–100 cm high. ***Leaves*** ca. 25 in number, arching, forming a loosely spreading rosette, not holding water, 100–200 cm in diameter. ***Sheaths*** distinct from blade, linear-elliptic, 8–15 cm long, 5–8 cm wide, pale green, drying light brown, chartaceous, nerved, entire, completely covered with hyaline appressed trichomes on both surfaces. ***Blades*** linear elliptic, attenuate and acuminate, channeled at base, keeled towards apex, stramineous to subchartaceous, nervate, narrowed at base for less than 20 cm, 3–4 cm wide at narrow portion, 5–7 cm wide near the middle, 40–110 cm long, including the 4–9 mm long apicule, abaxially completely covered with cinereous to brown appressed trichomes, whitish green, drying opaque brown, adaxially densely covered with inconspicuous hyaline trichomes, sometimes fused and forming a membrane, light green spotted with dark green, shiny, drying shiny light brown, serrulate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells radially elongated and thin walled, wing cells rounded and thick walled, bordered by dark, tangentially elongated cells. ***Spines*** antrorse, recurved, light brown, 0.3–1 mm long, decreasing in size towards apex, spaced 3–8 mm. ***Scape*** stout, erect, 30–60 cm long, 6–9 mm in diameter, internodes greenish to purple, drying light brown, 3–6 cm long, sparsely covered with round appressed trichomes to densely lanate. ***Scape bracts*** elliptic and apiculate, apicule triangular, dark brown, 6–12 mm long, exceeding the internodes, 5–10 cm long, 2–4 cm wide, greenish white, drying light brown, inconspicuously nerved, erect, imbricate and completely covering the scape, serrulate towards apex, spines 0.2–0.5 mm long, straight, light brown, triangular, spaced 1–5 mm, papyraceous, completely covered with appressed cinereous trichomes on abaxial face, sparsely covered with appressed cinereous trichomes on adaxial face. ***Inflorescence*** simple, erect, conical when young, cylindrical when mature, very densely strobiliform, 10–30 cm long, 5–7 cm in diameter, bearing a coma of sterile bracts at apex. ***Floral bracts*** ovate, apex triangular and pungent, not recurved, pointing upwards, inconspicuously nerved, 2–3.5 cm long, 1.5–2 cm wide, slightly shorter than the mature flowers, ecarinate, red, drying light brown, chartaceous, abaxially completely covered with appressed brown and rounded trichomes, adaxially sparsely to densely covered with cynereous trichomes, serrulate, spines 0.3–0.5 mm long, mostly straight, some antrorse, spaced 0.1–1 mm apart. ***Flowers*** sessile, densely and polystichously arranged, spreading ca. 45° from the main axis, 20–25 mm long without the petals. ***Sepals*** linear-elliptic, wider at base, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, asymmetrical, 12–15 mm long, 6–8 mm wide at wing, free, chartaceous, white with the apex rose, drying light brown, wing hyaline, glabrous. ***Petals*** white to yellow, twisted after anthesis. ***Ovary*** ellipsoid, dorsiventrally flattened, sepal keels continuing to the ovary, 6–8 mm long, 5–7 mm wide, glabrous, drying dark brown. ***Ovules*** apiculate, 0.7 mm long. ***Seeds*** ellipsoid,

4–5 mm long, 1 mm in diameter. ***Epigynous tube*** cylindrical, 1–2 mm long.

Etymology. Named after the French Count Alfred de Germiny.

Distribution. Colombia and Panama.

Material examined. Colombia: Dept. of Valle, Bajo Calima, road to Juanchaco Palmeras, 03°55′N, 77°2′W, 100 m, 10 July 1984, *Al. Gentry, M. Monsalve & D. Wolfe 47825* (SEL); Valle, Buenaventura Department, Bajo Calima Region, along road from Buenaventura to Malaga vicinity, Pulpapel Headquarters (located at km 11), km 9, 185 m, 3 Feb. 1990, *Thomas B. Croat 70100* (SEL); Dept. Chocó, hills near highest point of Bagado-Certegui trail, 5°25′N, 76°28′W, 130–150 m, 7 Dec. 1983, *Adrian Juncosa 1543* (SEL); Sin loco, 2000, *R.G. Wilson,* Fl. Cult. Marie Selby Botanical Gardens #2000-032, 15 Feb. 2001, *B.R. Silva 481* (SEL); Dept. Valle, Bajo Calima, ca. 15 km N of Buenaventura, Carton de Colombia concession, 3°56′N, 77°8′W, 50 m, 19 Feb. 1983, *Al Gentry & Adrian Juncosa 40523* (SEL).

Habitat. This species grows as a terrestrial and occasionally as an epiphyte at the shady lower levels of the tree trunks in lowland and pre-montane rain forests, between altitudes of 100–1300 m.

Aechmea strobilacea L.B. Smith, Phytologia 6: 435, *pl. 1, figs. 13, 14.* 1959. TYPE: *Asplund 19480* (holotype, S; isotype, US!), on ground in forest, Vera Cruz, 900 m alt., Napo, Ecuador, 18 Feb. 1956. FIGURE 5.

Plant terrestrial, stoloniferous, flowering 150–200 cm high; ***Leaves*** ca. 15 in number, arching, forming a loosely spreading rosette, not holding water, 150–300 cm in diameter. ***Sheaths*** triangular, 8–20 cm long, 6–8 cm wide, brown, drying dark brown, thick coriaceous, nerved, entire, completely covered with brown appressed trichomes on both surfaces. ***Blades*** linear elliptic, apex long attenuate and pungent, channeled at base, channel gradually disappearing, flat near apex, chartaceous to subcoriaceous, strongly nerved, narrowed at base for 20–50 cm, 3–4 cm wide at narrow portion, 6–8 cm wide near the middle, 150–300 cm long, abaxially completely covered with cinereous to brown appressed trichomes, whitish green, drying opaque brown, adaxially densely covered with appressed trichomes, green spotted with dark green, drying light brown, serrate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells rounded, not radially elongated, thin walled, wing cells rounded and thick walled, bordered by dark, radially elongated cells. ***Spines*** at basal narrow portion of leaf retrorse, recurved, dark brown, 3–5 mm long, spaced 1–3 cm apart, decreasing in size and becoming antrorse and more tightly spaced towards apex of blade, 1–3 mm long, spaced 2–5 mm apart, recurved, brown to dark brown, very tightly spaced near apex. ***Scape*** stout, erect, 20–30 cm long, 25–40 mm in diameter, internodes drying light to dark brown, 3–8 cm long, sparsely to densely lanate. ***Scape bracts*** exceeding the internodes, 10–30 cm long, 2–4 cm wide near the base, greenish, drying light brown, foliaceous, spreading and recurved, not imbricate, bases completely covering the scape, elliptic and long attenuate, nerved, serrulate towards apex, spines very variable, 0.5–1.5 mm long, straight near base, antrorse towards apex, brown to dark brown, recurved, spaced 1–5 mm, chartaceous, densely to completely covered with appressed trichomes on abaxial surface, sparsely covered with appressed trichomes on adaxial surface. ***Inflorescence*** simple, erect, flattened when young, cylindrical when mature, very densely strobiliform, 15–40 cm long, 12–18 cm in diameter, bearing a coma of sterile bracts at apex. ***Floral bracts*** elliptic, apex triangular and pungent, moderately to strongly recurved, pointing downwards, occasionally incurved, strongly nerved, 6–9 cm long, 1.5–3 cm wide, much longer than the mature flowers, bicarinate, dull red, drying dark brown, coriaceous, abaxially completely covered with course brown trichomes, adaxially densely covered with appressed trichomes, serrate, spines dark brown, 0.5–1.5 mm long, straight at base, mainly antrorse but also retrorse and straight towards apex, spaced 1–3 mm apart. ***Flowers*** sessile, densely and polystichously arranged, spreading 70–90° from the main axis, 50–65 mm long without the petals. ***Sepals*** linear-elliptic, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, slightly asymmetrical, thick with membranous margins, 35–45 mm long, 10–12 mm wide at wing, unequally connate for 2–3 mm, subcoriaceous, red, drying light brown, wing hyaline, abaxially completely covered with coarse trichomes, adaxially sparsely to densely covered with appressed trichomes. ***Petals*** yellow to lemon yellow, suberect, elliptical, apex attenuate and apiculate, 35–40 mm long, ca. 5 mm wide, free, twisted after anthesis, with two flap-like callosities, ca. 9 mm long, ca. 1.5 mm wide. ***Filaments*** partially concealed by callosities, free, expanded towards apex, ca. 17 mm long, ca. 1.5 mm wide, light yellow. ***Anthers*** dorsifixed below the middle, with the base sagitate and the apex attenuate, ca. 9 mm long, ca. 1.5 mm wide,

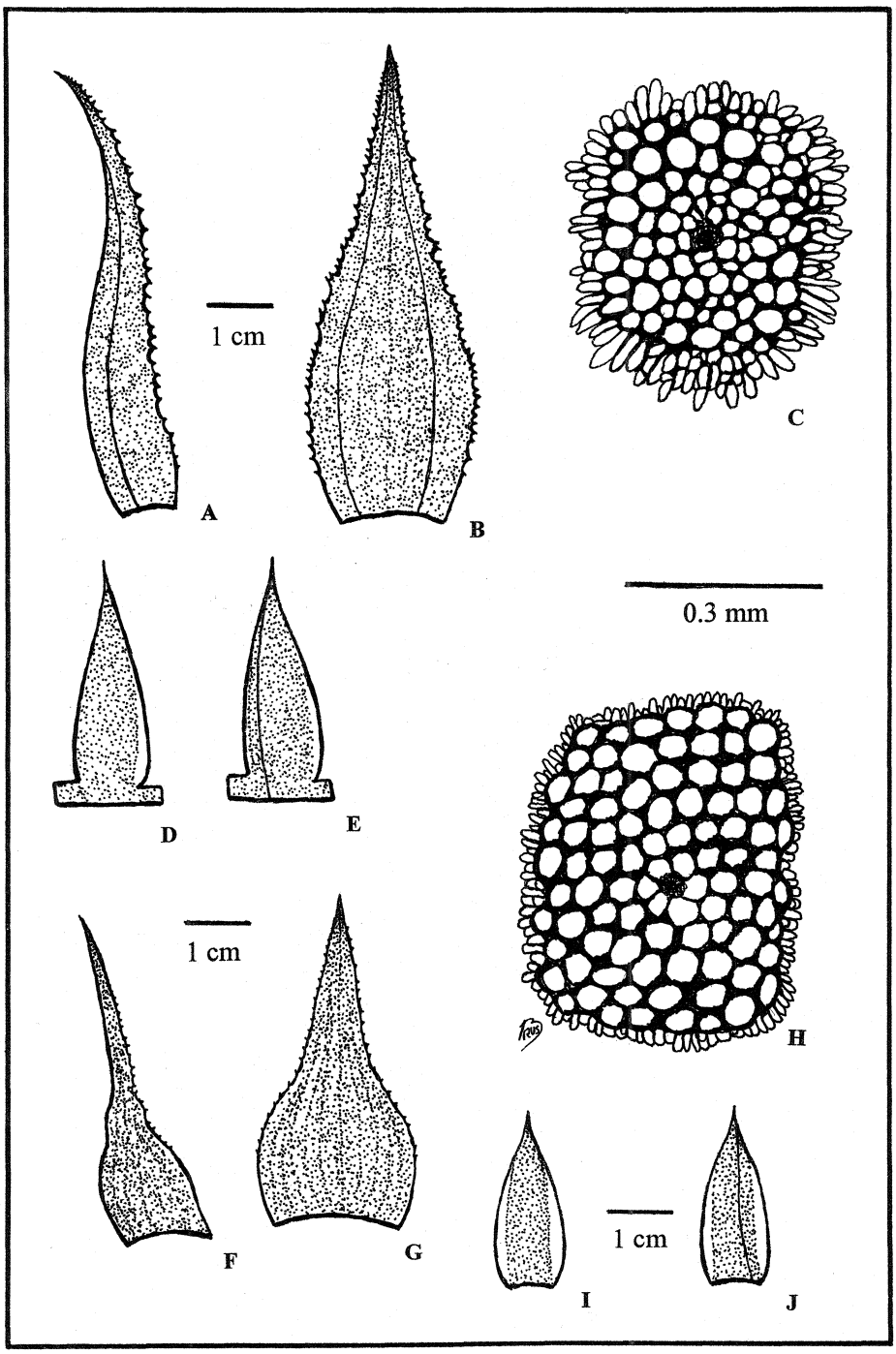

FIGURE 5. **A.–D.** *Aechmea strobilacea,* Isotype, Asplund 19480. **E.** *A. strobilacea,* R.B. Foster 11990. **F.–J.** *A. rubiginosa,* J.J. Wurdack & L.S. Adderley 43549. **A.** & **F.** Floral bract from side. **B.** & **G.** Abaxial face of floral bract. **C.** & **H.** Trichome from abaxial face of leaf. **D.** & **I.** Ecarinate sepal. **E.** & **J.** Carinate sepal.

light yellow. ***Style*** cylindrical, whitish, ca. 15 mm long, ca. 1 mm wide. ***Stigma*** conduplicate-spiraled, ellipsoid, lobes only partially twisted, margins undulate, papillae inconspicuous. ***Ovary*** ellipsoid, dorsiventrally flattened, free when dry, not fused to other ovaries, sepal keels continuing to the ovary, 15–25 mm long, 15–20 mm wide in fruiting stage, sparsely covered with appressed trichomes, drying dark brown. ***Ovules*** obtuse, ca. 1 mm long. ***Seeds*** ellipsoid, 5–7 mm long, 3 mm in diameter. ***Epigynous tube*** cylindrical, 4–6 mm long.

Etymology. This species was named after its very dense, conspicuous, and large strobiliform inflorescence.

Distribution. Ecuador and Peru.

Material examined. Ecuador: Prov. Napo, Anangu, South bank of Rio Napo, 95 km downstream from Coca, 00°32′N, 76°23′W, 300 m, 19 Jun.–4 Jul. 1985, *Henrik Balslev, A. Barfod & F. Skov 60535* (SEL); Provincia Morona-Santiago, Alredadores puente sobre el Rio Bombioza en la carretera Gualaquiza-Zamora y cerca la Paroquia de Bombioza, 800 m, 30 Oct. 1985, *Marc A. Baker 6477 & Jorge Zaruma* (US); Prov. Napo, 70 km downstream from Coca at Anangu, 260 m, 8–11 Jul. 1982, *Libby Besse, Helen Kennedy, Ray Baker 1590* (SEL). Peru: Dept. Madre de Dios, Prov. Manu: Parque Nacional Manu, Rio manu, Rio Cumerjali, 11°49′S, 71°32′W, 350–450 m, 22 Oct. 1986, *Robin B. Foster 11990 & B. d'Achile* (SEL); Dept. Loreto, Prov. Loreto, San Jose de Parinari, 04°32′S, 74°30′W, 150 m, 6 Nov. 1982, *R. Vasquez y N. Jaramillo 3379* (SEL).

Habitat. This species grows on the very shaded ground level of the lowland and premontane rain forests of the eastern slopes of the Ecuadorian and Peruvian Andes, between altitudes of 100–900 m.

Aechmea rubiginosa Mez, DC. Monogr. Phan. 9: 285. 1896. TYPE: *Spruce 3118* (holotype, P; isotype, K!), San Carlos, Rio Negro, Venezuela, Aug. 1853. FIGURE 5

Plant terrestrial, stoloniferous, flowering 50–100 cm high. ***Leaves*** ca. 15 in number, arching, forming a loosely spreading rosette, not holding water, 150–250 cm in diameter. ***Sheaths*** triangular, 8–15 cm long, 4–7 cm wide, brown, drying light brown, thick coriaceous, nerved, entire, completely covered with dark appressed trichomes on both surfaces. ***Blades*** linear elliptic, apex long attenuate and pungent, channeled at base, channel gradually disappearing, flat near apex, stramineous to subchartaceous, strongly nerved, narrowed at base for 20–40 cm, 3–4 cm wide at narrow portion, 6–9 cm wide near the middle, 70–150 cm long, abaxially completely covered with cinereous to brown appressed trichomes, whitish green, drying opaque light brown, adaxially densely covered with appressed trichomes, green spotted with dark green, drying light brown, serrate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells rounded, not radially elongated, thin walled, wing cells rounded and thick walled, bordered by small, thin walled, radially elongated cells. ***Spines*** at basal narrow portion of leaf antrorse, sometimes retrorse, recurved, light to dark brown, 3–5 mm long, spaced 1–3 cm apart, decreasing in size and becoming more tightly spaced towards apex of blade, 1–3 mm long, spaced 2–5 mm apart, recurved, antrorse, brown to light brown, very tightly spaced near apex. ***Scape*** stout, erect, 15–25 cm long, 15–25 mm in diameter, internodes drying light to dark brown, 2–6 cm long, grabrous to sparsely lanate. ***Scape bracts*** exceeding the internodes, very long and leaf-like, 20–80 cm long, 3–5 cm wide, greenish, drying light to dark brown, spreading and recurved, not imbricate, bases completely covering the scape, linear-elliptic and long attenuate, nerved, serrulate towards apex, spines very variable, 0.5–1.5 mm long, straight near base, antrorse towards apex, light to dark brown, recurved, spaced 1–5 mm, chartaceous, densely to completely covered with appressed trichomes on abaxial surface, sparsely covered with appressed trichomes on adaxial surface. ***Inflorescence*** simple, erect, flattened when young, spherical when mature, even after fruiting, very densely strobiliform, 10–15 cm long, 10–15 cm in diameter, bearing a coma of sterile bracts at apex. ***Floral bracts*** usually with a distinction more or less clear between the ovate sheath and the triangular blade, apex triangular and pungent, not recurved, pointing diagonally upwards, strongly nerved, 4.5–6 cm long, 2–3 cm wide at sheath, longer than the mature flowers, inconspicuously carinate near the apex, red, drying light to dark brown, chartaceous, abaxially completely covered with appressed to course brown trichomes, adaxially sparsely covered with appressed trichomes, serrate, spines 0.2–0.5 mm long, mostly straight, spaced 1–3 mm apart. ***Flowers*** sessile, densely and polystichously arranged, spreading ca. 45°from the main axis, 35–50 mm long without the petals. ***Sepals*** linear-elliptic, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, slightly asymmetrical, thick with membranous margins, 25–30 mm long, 10–12 mm wide at wing, free, subcoriaceous, red,

drying light brown, wing hyaline, abaxially completely covered with coarse trichomes, adaxially sparsely to densely covered with appressed trichomes. ***Petals*** yellow, twisted after anthesis. ***Ovary*** ellipsoid, dorsiventrally flattened, sepal keels continuing to the ovary, 15–20 mm long, 10–15 mm wide in fruiting stage, glabrous to sparsely covered with appressed trichomes, drying light to dark brown. ***Ovules*** obtuse, ca. 1 mm long. ***Seeds*** ellipsoid, 5–7 mm long, 3 mm in diameter. ***Epigynous tube*** cylindrical, 2–3 mm long.

Etymology. From the Latin "rubidus," meaning reddish, because of the very intense red color of the inflorescence.

Distribution. Brazil, Colombia, and Venezuela.

Material examined. Brazil: Amazonas, Slopes of Western Massif of Serra Araca, 00°50′N, 63°21′W, 500 m, 23 Jul. 1985, *G.T. Prance, I. Cordeiro, E.L.S. da Silva 29729* (US); T. Roraima, Rio Catrimani, 70 km ao Norte da Missao Catrimani, 13 Feb. 1975, *J. M. Pires* (US). Colombia: Vaupes, Casa Alvarez, Bocas Caruru, 230 m, 26 Nov. 1939, *J. Cuatrecasas 7024* (US); Amazonas-Vaupés, Rio Apaporis, Cachivera de Jirijirimo y alrededores, 250 m, 5 Jul. 1951, *Richard Evans Schultes & Isidoro Cabrera 12895* (US). Venezuela: Terr. Amazonas, at base of Piedra Arauicaua, Rio Yatua, 130 m, 15 Jul. 1959, *J.J. Wurdack & L.S. Adderley 43549* (US, RB); Estado Bolivar, 4.5 km. al suroeste de Icabaru, 04°20′N, 61°48′W, 480 m, 16 Dec. 1978, *Julian Steyermark & Victor Carreno Espinosa 117683* (US); Amazonas-Vaupes, Rio Apaporis: Cachivera de Jirijirimo y alredores, Federal Amazonas, Entre el Rio Sipapo y El Venado, 25 Nov. 1977, *Antonio Fernandez 2889* (SEL); Territorio Federal Amazonas, Sierra Parima, Vecindades de Simarawochi, Río Matacuni, 3°49′N, 64°36′W, 795–830 m, 18 Apr.–23 May. 1973, *Julian A. Steyermark s.n.* (US).

Habitat. This species grows as a terrestrial in the very shaded rain forests on the slopes of the Guiana Shield, between altitudes of 100–500 m.

Aechmea fernandae (E. Morren) Baker, Handb. Bromel. 64. 1889. TYPE: *Linden Hortus s.n.* (Clonotype, LG; Photo GH!), Sep. 1879. SYN.: *Bromelia longifolia* Richard Schomburgk, Reise 3: 903. 1848; nomen, non Rudge, 1805. *Bromelia fernandae* E. Morren, Ill. Hortic. 18: 114. *pl. 65.* 1871. *Ananas mensdorfianus* hortus ex Baker, Handb. Bromel. 64. 1889; nomen. *Chevaliera fernandae* hortus ex Baker, Handb. Bromel. 64. 1889; nomen. *Aechmea shomburgkii* Baker, Handb. Bromel. 66. 1889. Type. *Schomburgk Icon* (K). FIGURE 6.

Plant terrestrial, stoloniferous, flowering 40–80 cm high. ***Leaves*** ca. 15 in number, arching, forming a loosely spreading rosette, not holding water, 80–200 cm in diameter. ***Sheaths*** triangular, 8–15 cm long, 5–8 cm wide, brown, drying light to dark brown, thick coriaceous, nerved, entire, completely covered with brown appressed trichomes on both surfaces. ***Blades*** linear, apex long attenuate and pungent, channeled at base, channel gradually disappearing, flat near apex, chartaceous to subcoriaceous, strongly nerved, abruptly narrowed at base for 10–30 cm, 3–5 cm wide at narrow portion, 5–7 cm wide near the middle, 70–120 cm long, abaxially completely covered with cinereous to brown appressed trichomes, whitish green, sometimes reddish, drying opaque light to dark brown, adaxially completely covered with appressed hyaline trichomes, sometimes forming a fused membrane, green spotted with dark green, drying light brown, serrate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells rounded, not radially elongated, thin walled, wing cells rounded and thick walled, bordered by thin walled, radially elongated cells. ***Spines*** at basal narrow portion of leaf retrorse, recurved, light to dark brown, 3–5 mm long, spaced 0.5 cm, at the middle of blade antrorse, recurved 1–3 cm apart, decreasing in size and becoming more tightly spaced towards apex of blade, 1–3 mm long, spaced 2–5 mm apart, recurved, antrorse, brown to light brown, very tightly spaced near apex. ***Scape*** stout, erect, 10–20 cm long, 10–15 mm in diameter, internodes drying light to dark brown, 2–4 cm long, glabrous to sparsely lanate. ***Scape bracts*** exceeding the internodes, foliaceous, 15–25 cm long, 3–5 cm wide, greenish, drying light to dark brown, spreading and recurved, not imbricate, bases completely covering the scape, linear-elliptic and long attenuate, nerved, serrulate towards apex, spines very variable, 0.5–3 mm long, straight or retrorse near base, antrorse towards apex, light to dark brown, recurved, spaced 1–5 mm, chartaceous, densely to completely covered with appressed trichomes on abaxial surface, densely covered with appressed trichomes on adaxial surface. ***Inflorescence*** simple, erect, flattened to spherical when young, cylindrical when mature, very densely strobiliform, 10–15 cm long, 10–12 cm in diameter, bearing a coma of sterile bracts at apex. ***Floral bracts*** ovate, without a distinction between

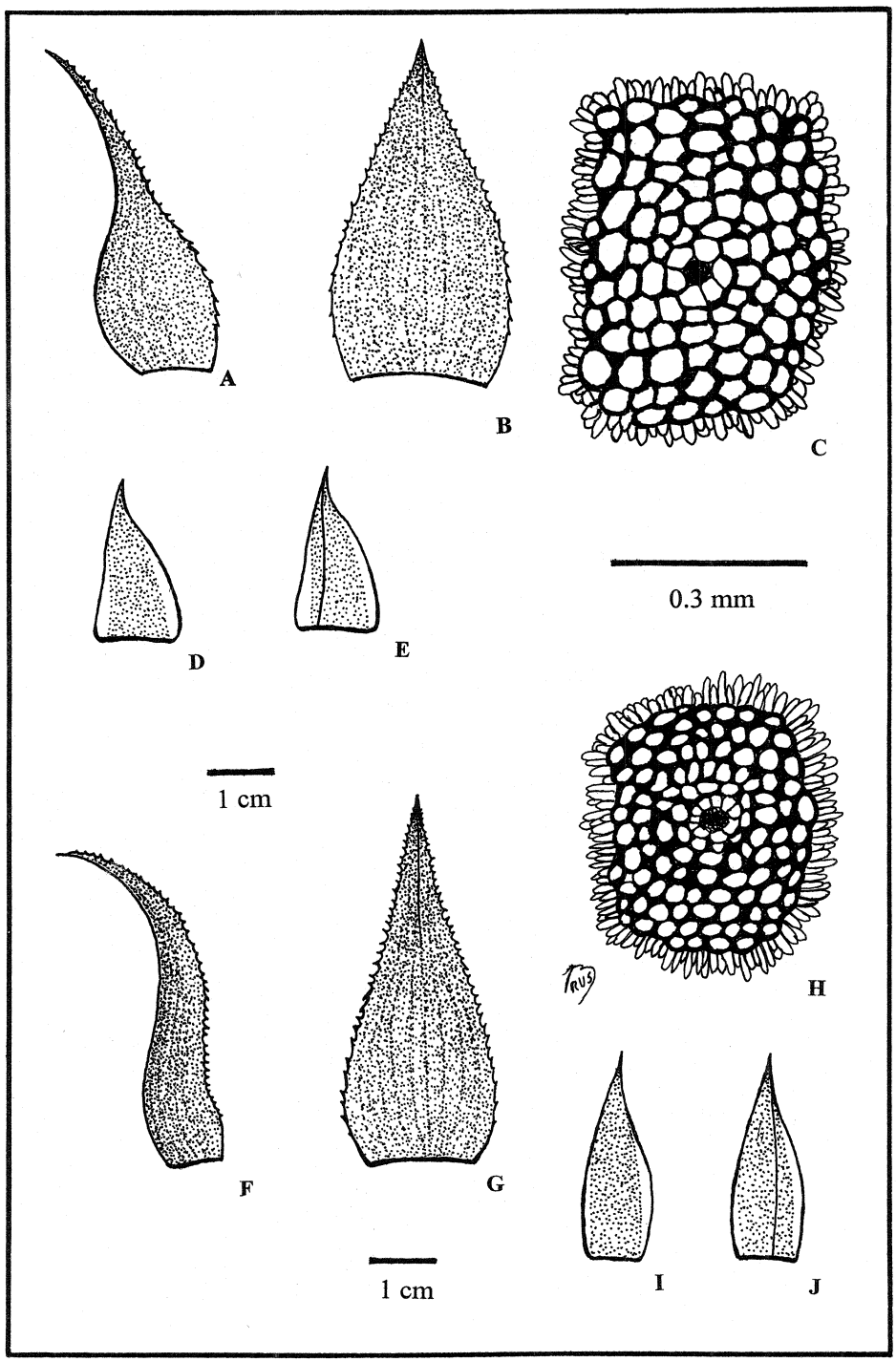

FIGURE 6. **A.–E.** *Aechmea fernandae,* W. Rodrigues & Osmarino 6755. **F.–J.** *A. magdalenae,* R.J. Seibert 1692. **A.** & **F.** Floral bract from side. **B.** & **G.** Abaxial face of floral bract. **C.** & **H.** Trichome from abaxial face of leaf. **D.** & **I.** Ecarinate sepal. **E.** & **J.** Carinate sepal.

sheath and blade, apex triangular and pungent, moderately recurved, pointing diagonally downwards, strongly nerved, 3.5–5 cm long, 2–3.5 cm wide at base, reaching or shorter than the sepals, inconspicuously carinate near the apex, red, drying light to dark brown, chartaceous, abaxially completely covered with course brown trichomes, adaxially sparsely covered with appressed trichomes, serrate, spines 0.5–1 mm long, at base recurved, mostly retrorse, some straight, near apex straight, spaced 1–3 mm apart. ***Flowers*** sessile, densely and polystichously arranged, spreading ca. 45° from the main axis, 30–45 mm long without the petals. ***Sepals*** linear-elliptic, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, asymmetrical, thick with membranous margins, 25–30 mm long, 10–12 mm wide at wing, free, subcoriaceous, red, drying light brown, wing hyaline, abaxially completely covered with coarse trichomes, adaxially sparsely to densely covered with appressed trichomes. ***Petals*** yellow, twisted after anthesis. ***Ovary*** ellipsoid, dorsiventrally flattened, sepal keels continuing to the ovary, 15–20 mm long, 15–20 mm wide in fruiting stage, glabrous to sparsely covered with appressed trichomes, drying light to dark brown. ***Ovules*** obtuse, ca. 1 mm long. ***Seeds*** ellipsoid, 4–6 mm long, 2–3 mm in diameter. ***Epigynous tube*** cylindrical, 4–5 mm long.

Etymology. Named in honor of Fernande Gloner, daughter of M. Linden born on September 4, 1870, one year before E. Morren's description of *Bromelia fernandae.*

Distribution. Brazil and Venezuela.

Material examined. Brazil: State of Amazonas, Rio Negro, near Serra Jacamin, 18 Jan. 1978, *W.C. Steward, I. Araujo, G. Rogers, J.F. Ramos & J. Ribamar 413* (NY); State of Amazonas, Manaus, Reserva Florestal Ducke, 8 Oct. 1964, *W. Rodrigues & Osmarino 6753* (US); Acre, Rio Jurua, Operacao Jurua, Ponto 81, 13 Nov. 1975, *B.S. Pena 619* (US); Territory of Roraima, Mun. Alto Alegre, Ilha de Maraca, SEMA estacao, 03°22′N, 61°22′W, 6 Jun. 1986, *M J G. Hopkins, K F. Rodrigues, E S. Silva, R. Pereira de Lima, J. Guedes de Oliveira & B. Lowy 517* (US); Amazonas, *J. G. Kulman 1706* (US); Atalaia do Norte, near the Peruvian border, Rio Javari, 17 Jan. 2001, *J. Bogner s.n.* (SEL). Venezuela: Estado Bolivar, Chimanta Massif, Vicinity of Techine-Meru, along Rio Aparuren, between mouth of Rio Aparuren and Kon-quen, 470 m, 8 Jul. 1953, *Julian A. Steyermark* (US).

Habitat. *Aechmea fernandae* inhabits the very shaded forest floors of the great Amazon Basin, average temperatures are high and rainfall is very intense all year round. It occurs below 300 m of altitude.

Aechmea magdalenae (André) André ex Baker, Handb. Bromel. 65. 1889. TYPE: *André 692* (holotype, K; photo GH), banks of Río Magdalena, between Tenerife (Magdalena) and Canaletal (Bolívar), Colombia, Dec. 1875. SYN. *Chevaliera magdalenae* André, Énum. Bromél. 3: 13 Dec 1888; Rev, Hortic. 60: 563. 16 Dec. 1888. *Bromelia longissima* Posada, Estudios Cient. 241. 1909; nomen subnudum. *Bromelia magdalenae* (André) C.H. Wright, Kew Bull. 1923: 267. 1923. *Ananas magdalenae* (André) Standley ex Standley & Calderón, Lista Prelim. Pl. S. Salvador 45. 1925. *Aechmea magdalenae* var. quadricolor M.B. Foster, Bromel. Soc. Bull. 16: 27, *fig.* (p. 25). 1966.

FIGURE 6.

Plant terrestrial, stoloniferous, flowering 80–120 cm high. ***Leaves*** ca. 15 in number, arching, forming a loosely spreading rosette, not holding water, 150–300 cm in diameter. ***Sheaths*** triangular, 8–15 cm long, 5–7 cm wide, brown, drying light to dark brown, thick coriaceous, nerved, entire, completely covered with brown appressed trichomes on both surfaces. ***Blades*** linear elliptic, apex long attenuate and pungent, channeled at base, channel gradually disappearing, flat near apex, stramineous to chartaceous, strongly nerved, slightly narrowed at base for 20–40 cm, 3–5 cm wide at narrow portion, 6–10 cm wide near the middle, 150–250 cm long, abaxially completely covered with cinereous to brown appressed trichomes, whitish green, drying opaque brown, adaxially densely covered with appressed hyaline trichomes, green spotted with dark green, drying light brown, serrate. ***Trichomes*** on abaxial face very tightly aligned on the grooves between vascular bundles, with straight margins, about 0.5 mm long, 0.3 mm wide, with a dark center, central disc cells rounded, not radially elongated, thin walled, wing cells rounded and thick walled. ***Spines*** at basal narrow portion of leaf retrorse, recurved, dark brown, 35 mm long, spaced 1–2 cm apart, decreasing in size and becoming antrorse and more tightly spaced towards apex of blade, 1–3 mm long, spaced 2–5 mm apart, recurved, brown to dark brown, very tightly spaced near apex. ***Scape*** stout, erect, 15–25 cm long, 15–25 mm in diameter, internodes drying light to dark brown, 2–5 cm long, glabrous to sparsely lanate. ***Scape bracts*** exceeding the internodes, 10–50 cm long, 2–5 cm wide near the base, greenish, drying light brown, foliaceous, spreading and recurved, the upper ones massed below the inflo-

rescence and reflexed, not imbricate, bases completely covering the scape, elliptic and long attenuate, nerved, serrulate, spines very variable, 0.5–2 mm long, retrorse near base, antrorse towards apex, light to dark brown, recurved, spaced 2–5 mm, chartaceous, densely to completely covered with appressed trichomes on abaxial surface, sparsely covered with appressed trichomes on adaxial surface. ***Inflorescence*** compound, 2–5 short sessile cylindrical spikes in a dense mass, occasionally simple, erect, conical shaped, 15–25 cm long, 15–20 cm in diameter, branches very densely strobiliform, bearing a coma of sterile bracts at apex of branches. ***Floral bracts*** elliptic, apex triangular and pungent, recurved, pointing diagonally downwards, strongly nerved, 5–6.5 cm long, 1.5–2.5 cm wide, longer than the mature flowers, carinate from middle to apex, red, drying brown to dark brown, coriaceous, abaxially completely covered with course brown trichomes, adaxially densely covered with appressed trichomes, serrate, spines 0.5–1 mm long, straight and some retrorse at base, straight and some antrorse towards apex, spaced 1–2 mm apart. ***Flowers*** sessile, densely and polystichously arranged, spreading 70–90° from the main axis, 45–55 mm long without the petals. ***Sepals*** linear-elliptic, apex triangular and pungent, the lateral ones carinate, the abaxial one ecarinate, slightly asymmetrical, thick with membranous margins, 25–35 mm long, 10–12 mm wide at wing, free, subcoriaceous, red, drying light brown, wing hyaline, abaxially densely to completely covered with coarse trichomes, adaxially sparsely covered with appressed trichomes. ***Petals*** yellow, twisted after anthesis. ***Ovary*** ellipsoid, dorsiventrally flattened, sepal keels continuing to the ovary, 15–25 mm long, 15–20 mm wide in fruiting stage, sparsely covered with appressed trichomes, drying dark brown. ***Ovules*** obtuse, ca. 1 mm long. ***Seeds*** ellipsoid, 5–7 mm long, ca. 3 mm in diameter. ***Epigynous tube*** cylindrical, 3–5 mm long.

Etymology. This species was named after its place of discovery by the botanist Édouard François André in 1875, the banks of Río Magdalena, in Colombia.

Note. *Aechmea magdalenae* var. *quadricolor* M.B. Foster is here treated as a synonym of *A. magdalenae* and should be called *A. magdalenae* cultivar Quadricolor, since it is a cultivated sport, and not a variety found in nature.

Distribution. Mexico, from Central America to Colombia, Venezuela, and Ecuador. Since local populations use it as an important source of fibers, such a vast range may have been the result of dispersal by humans.

Material examined. Colombia: Dept. Choco, Río Truando, 12 Feb. 1941, *R.J. Seibert 1692* (US); Dept. Antioquia, Turbo, 23 Jan. 1941, *R.J. Seibert 1668* (US); Santa Marta, 1898–1899, *Herbert H. Smith 2640* (US); Dept. Chocó, Tutunendo, 20 km north of Quibdó, 80 m, 19 & 20 May 1931, *W.A. Archer 2158* (US); Intendencia del Meta, Sierra de la Makeel, Cano Entrada, 550 m, 23 Jan. 1950, *W.R. Philipson, J.M. Idrobo, J.M. Jaramillo 2201* (US). Ecuador: Prov. Esmeraldas, Cerro Mutiles, 5 Sep. 1996, *X. Cornejo & C. Bonifaz 5187* (SEL); Prov. Los Rios, Rio Palenque Science Center, km 56 Quevedo-Santa Domingo, 150–220 m, 11 Aug. 1977, *CH & HC Dodson 6748* (SEL).

Habitat. This species grows terrestrially on the very shaded and often flooded forest floor where it forms dense thickets. It is more common at middle elevations, from 400–700 m. A study conducted in Barro Colorado Island, in Panama (Pfitsch & Smith 1988), demonstrated that this species has a CAM type of metabolism, carbon dioxide being absorbed from the atmosphere mainly at night. The study also demonstrated that growth rates are the same for plants exposed to full sun in forest gaps and those in the deep forest shade; water, rather than light, is the limiting factor in growth.

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SYMBIOTIC GERMINATION AND REINTRODUCTION OF *SPIRANTHES BREVILABRIS* LINDLEY, AN ENDANGERED ORCHID NATIVE TO FLORIDA

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ABSTRACT. Once distributed along the Coastal Plain from South Carolina to Texas, the short-lipped ladies'-tresses, *Spiranthes brevilabris* Lindley (Orchidaceae), appeared in 1999 to be restricted to a single population in Levy County, Florida. That population consisted of 152 plants. Ongoing efforts to locate additional populations of this terrestrial orchid have been unsuccessful. We provide 1) a technique to germinate seeds of this orchid *in vitro* using mycorrhizal fungi (symbiotic seed germination); 2) a technique to establish seedlings onto soil *ex vitro*; and 3) a description of the mycorrhizal fungi that prompted germination and establishment. Two fungal endophytes, both *Epulorhiza* spp. recovered from the roots of the epiphytic orchid *Epidendrum magnoliae* Muhl. (syn. *E. conopseum*) and *S. brevilabris,* were utilized in the inoculation of seed. Germination was rapid (<10 days), and a higher percentage of seedlings developed leaves *in vitro* when inoculated with the *S. brevilabris*-derived fungus as opposed to the *E. magnoliae*-derived fungus (25% versus 20%). Of 165+ laboratory-grown seedlings transplanted onto soil at six sites in Florida, 100% survived >1 month, and 17 initiated anthesis >6 months.

Key words: *Spiranthes,* conservation, Orchidaceae, mycorrhizae, reintroduction

RESUMEN. Hace algún tiempo se encontraba el short-lipped ladies'-tresses, *Spiranthes brevilabris* Lindley (Orchidaceae) a lo largo de la costa literal desde la Carolina del Sur a Texas, pero ahora parece que está restringido a una población que consistía en 152 plantas en 1999 en el condado de Levy en la Florida. Los esfuerzos continuos de localizar poblaciones adicionales de esta orquídea terrestre no han tenido éxito. Proveemos lo siguiente: 1) una técnica para germinar las semillas de esta orquídea in vitro, usando los hongos micorrizales (germinación simbiótica de semillas); 2) una técnica para establecer las plantas de semillero en el suelo ex vitro; y 3) una descripción de los hongos micorrizales que inducen la germinación y el establecimiento de las planta de semillero. Para inocular las semillas se utilizaron dos endófitas hongosos (*Epulorhiza* spp.) que se habían recuperado de los órganos raizosos del *Epidendrum magnoliae* Muhl. (syn. *E. conopseum*)—una orquídea epifítica—y el *S. brevilabris.* La germinación fue rápida (menos de 10 días), y un porcentaje más alto de plantas de semillero desarrollaron hojas in vitro cuando fueron inoculadas con los hongos derivados del *S. brevilabris* (25% versus 20%). De las 165 plantas de semillero cultivadas en laboratorio y trasplantadas en el suelo de seis localidades en la Florida, 100% sobrevivieron más de un mes, 17 iniciaron antesis despues de 6 meses.

Palabras claves: *Spiranthes,* conservación, Orchidaceae, mycorrhiza, reintroducción

INTRODUCTION

The short-lipped ladies'-tresses, *Spiranthes brevilabris* Lindley (Orchidaceae), is a small-flowered terrestrial orchid found primarily along roadsides and in cemeteries along the Gulf Coastal Plain from eastern Texas to Florida. Numerous collections of the orchid were recorded for more than 150 years, particularly in Florida, but only a few of the specimens are actually *S. brevilabris.* Despite 12 Florida records, only a single extant site is known for the species along a roadside in Levy County, Florida, at which 152 plants were counted in 1999 (Brown 2002). Other specimens in herbaria from Texas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, and North Carolina were examined. Most specimens labeled as *S. brevilabris* were incorrectly identified (P.M. Brown pers. obs.) and subsequently annotated with correct identifications. In Florida, the species is listed as en-

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