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Orthomitrium tuberculatum (Orthotrichaceae), a New Genus and Species from Guizhou, China

Jette Lewinsky-Haapasaari
Kuopio Museum of Natural History, Myhkyrinkatu 22, FIN-70100 Kuopio, Finland

Marshall R. Crosby
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166–0299, U.S.A.

ABSTRACT. *Orthomitrium tuberculatum* gen. et sp. nov. (Orthotrichaceae, Orthotrichoideae) is described from Guizhou, China. The diagnostic characters are: (1) terminal sporophytes on the main (primary) stems, which continue growth by lateral innovations; (2) large, mitrate, plicate calyptrae covering the entire capsules; (3) ovoid or globose, smooth capsule with strongly plicate mouth; (4) single peristome; (5) immersed stomata in upper parts of capsules; and (6) large, multicellular spores. The genus is considered most closely related to *Orthotrichum* and *Muelleriella.*

The family Orthotrichaceae includes acrocarpous mosses, i.e., those with terminal perichaetia and additional growth by lateral innovations. It is further characterized by having small, papillose upper leaf cells, undifferentiated alar cells, large, usually mitriform calyptrae, and diplolepidous peristomes with endostomial segments alternating with the exostome teeth, which have thicker outer layers than inner layers. Vitt (1982) included 14 genera in the family: *Zygodon* Hooker & Taylor, *Stenomitrium* (Mitten) Brotherus, *Orthotrichum* Hedwig, *Muelleriella* Dusén, *Pleurorthotrichum* Brotherus, *Ulota* Weber & Mohr, *Bryodixonia* Sainsbury, *Drummondia* Hooker, *Macrocoma* (C. Müller) Grout, *Macromitrium* Bridel, *Florschuetziella* Vitt, *Groutiella* Steere, *Schlotheimia* Bridel, and *Desmotheca* Lindberg. To these were later added *Amphidium* Schimper (Lewinsky, 1976; Vitt et al., 1993), *Stoneobryum* Norris & Robinson (Norris & Robinson, 1981), *Leiomitrium* Mitten and *Cardotiella* Vitt (Vitt, 1981), and *Ceuthotheca* Lewinsky-Haapasaari (Lewinsky-Haapasaari, 1994). The Orthotrichaceae are divided into four subfamilies: Zygodontoideae (Limpricht) Brotherus, Orthotrichoideae (Limpricht) Brotherus, Drummondioideae Vitt, and Macromitrioideae (Fleischer) Brotherus (Vitt, 1982). This subdivision is mainly based on stem branching pattern, sporophyte position, and calyptra shape.

More than 60 papers have been published on this family within the last 23 years, and of these 37 within the last 10 years. Thus, in view of the intense degree to which the family has been studied, it was surprising to find a moss among some recent collections from Guizhou Province, China, that clearly belongs to the Orthotrichaceae, but cannot be placed in any of the known genera. The plants have erect or erect-ascending stems with the perichaetia at the end of the primary stems, which continue growth by lateral innovations. This gives the impression of an *Orthotrichum,* an impression supported by the large, mitrate, 16-plicate calyptrae, not split at the bases, with many papillose, slender, yellowish hairs. The capsules, however, are more like those in some species of *Macromitrium.* They are ovoid or globose, smooth, with strongly plicate mouths, and a simple peristome of truncate, hyaline teeth. Unlike *Macromitrium* species, they have immersed stomata present in great numbers on the upper portion of the capsules. Immersed stomata are known within the family only in the subfamily Orthotrichoideae, from the genus *Muelleriella*, and the *Orthotrichum* subgenera *Orthotrichum*, *Pulchella* (Schimper) Vitt, and *Callistoma* (Iwatsuki & Sharp) Lewinsky. Another striking character of this Chinese moss is its multicellular spores, which usually consist of four cells. Since the younger spores are quite regularly rounded, have one or two interior walls, and outer walls with the same ornamentation as the mature spores, we do not think it is a question of spore-tetrads. Multicellular spores are known within the family in *Muelleriella*, *Drummondia*, and one species of *Orthotrichum*, *O. steerei* Lewinsky.

The moss from Guizhou is here referred to the new genus *Orthomitrium*, which is characterized by the following combination of characters: (1) sporophytes terminal on the main (primary) stems, which continue growth by lateral innovations; (2) large, mitrate, plicate calyptrae covering the entire capsules; (3) ovoid or globose, smooth capsule with strongly plicate mouth; (4) single peristome; (5) numerous immersed stomata in upper parts of capsules; and (6) large, multicellular spores (ca. 50 μm in diameter).

Orthomitrium tuberculatum Lewinsky-Haapasaari & Crosby, gen. et sp. nov. TYPE: China. Guizhou: Sui-yan Co., Kuan Kuo Shui Forest Reserve, Tai Yan Shan (Sun Summit) and vicinity, on tree, *Crosby 16040* (holotype, MO). Figures 1, 2.

Plantae parvae, nigrescentes. Caules erecti vel erecto-ascendentes. Folia sicca erecta vel erecto-flexuosa, e basibus ovatis lanceolata vel lineari-lanceolata, acute vel rotundate acuta; cellulae superiores folii breviter rectangulae, porosae, membranis crassis, quaeque 1–2(–3) papillis conicis humilibus ornata; cellulae basales folii elongate rectangulae vel rhombicae, membranis crassis, porosis, laevibus. Setae erectae, breves; capsulae laeves, ovoides vel globulares, ad ostia valde plicatae; peristomia singula; stomata immersa, in partibus superioribus capsularum sitae. Calyptrae magnae, mitratae, plicatae. Sporae magnae, circiter 50 μm diameter, multicellulares.

Plants in small tufts among other bryophytes, soft, blackish green to green above, black below. *Stems* up to 2 cm tall, erect or erect-ascending, fastigiately branched above, with a rather thick epidermis, no central strand. *Rhizoids* only present at the extreme stem bases. *Leaves* erect or erect-flexuose when dry, spreading when moist, from ovate bases lanceolate to linear-lanceolate, varying in size and shape with the largest ovate linear-lanceolate leaves near the stem apices, 2–5 × 0.4–0.8 mm, gradually acuminate, sometimes shortly decurrent, but not with distinct auricles; leaf apices acute to rounded acute: costae ending shortly below the apices, without stereids; margins plane in short leaves, slightly undulate in longer leaves, recurved to revolute at least in the central part; basal leaf cells elongate rhomboidal to rectangular, porose, with thick, brown, nodose longitudinal walls and thinner transverse walls, smooth, 40–65 × 4.5–8.0 μm; transitional leaf cells shorter, with less porose and nodose walls, occasionally with one conical papilla near the end, 14–21 × 6–13 μm; upper leaf cells short rectangular, arranged in distinct rows, with thick, nodose, porose walls and 1–2(–3) low conical papillae per cell, 9–12 × 4.5–7.0 μm. *Gemmae* not seen. *Goniautoicous. Perichaetial and perigonial leaves* not markedly differentiated. *Perichaetia* at the end of the main stems, which continue growth by lateral innovations. Setae short, 1–3 mm long, slender, straight, with an epidermis of yellow to brown cells and an inner ring of brown cells surrounding a few central hydroids. *Vaginulae* with many long, smooth, yellowish hairs. *Capsules* ovoid to globose when wet, 2.0–2.8 mm long, smooth, erect, emergent, reddish brown below, darker at the strongly plicate mouths, persistent for several seasons; exothecial cells immediately below mouth differentiated in eight stripes of thick-walled dark brown cells, usually four cells wide, alternating with eight paler stripes, usually nine cells wide; further down the cells are short rectangular to quadrate, thick-walled; stomata immersed, half to completely covered by the subsidiary cells, numerous in upper parts of capsules giving young, dry capsules a puckered appearance; annuli of two rings of small, hyaline, thin-walled, almost quadrate cells. *Peristomes* single, no prostomes; exostome of 16 truncate teeth, sometimes partly united, hyaline, but with the areas around the old cell walls yellow and prominent, with a rough ornamentation of horizontal and vertical lines and papillae, with many short, densely set papillae along the edges. *Opercula* erect-rostrate. *Spores* large, multicellular, ca. 50 μm diam., finely papillose. *Calyptrae* large, mitrate, covering the entire capsules, yellow with red-brown apices, 16-plicate, with many hairs reaching to the top; hairs yellow, slightly papillose from protruding cell ends.

Habitat. Epiphytic, mixed with *Ulota* spp.

Due to the erect to erect-ascending primary stems at the end of which the sporophytes are produced, the upper leaf cells with 1–2(–3) conical papillae, the large mitrate calyptrae, and the emergent capsules, *Orthomitrium tuberculatum* can be referred to the subfamily Orthotrichoideae as defined by Vitt (1972, 1982). Within this subfamily it

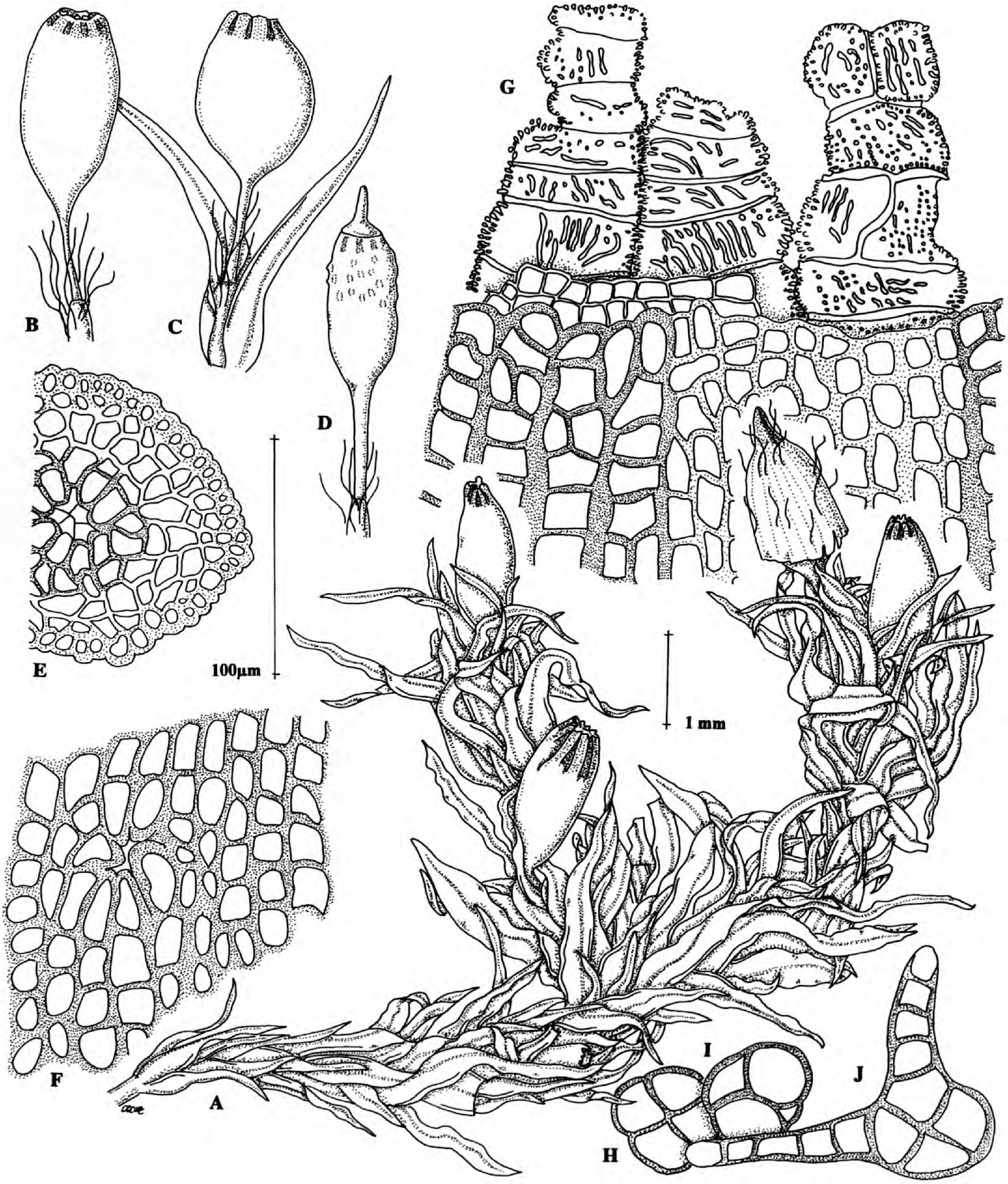

Figure 1. A–J. *Orthomitrium tuberculatum* Lewinsky-Haapasaari & Crosby (*Crosby 16040*). —A. Habit when dry. —B, C. Mature capsules, dry. —D. Young capsule, dry. —E. Cross section of seta. —F. Stoma from capsule wall. —G. Part of peristome. —H, I. Spores. —J. Germinating spore.

seems most closely related to *Orthotrichum* and *Muelleriella*, which also include species with immersed stomata. This condition is considered an apomorphous character having developed from superficial stomata. In *Orthotrichum* this event is thought to have taken place twice (cf. Lewinsky, 1993). The blackish coloration, the thick-walled exothecial cells, the smooth capsule wall, and the multicellular spores are also found within *Muelleriella*. These similarities, however, might not indicate these two genera are more closely related. They have quite different ecology, and an adaptation to xeric habitats may have evolved independently in the two genera. Likewise the emergent

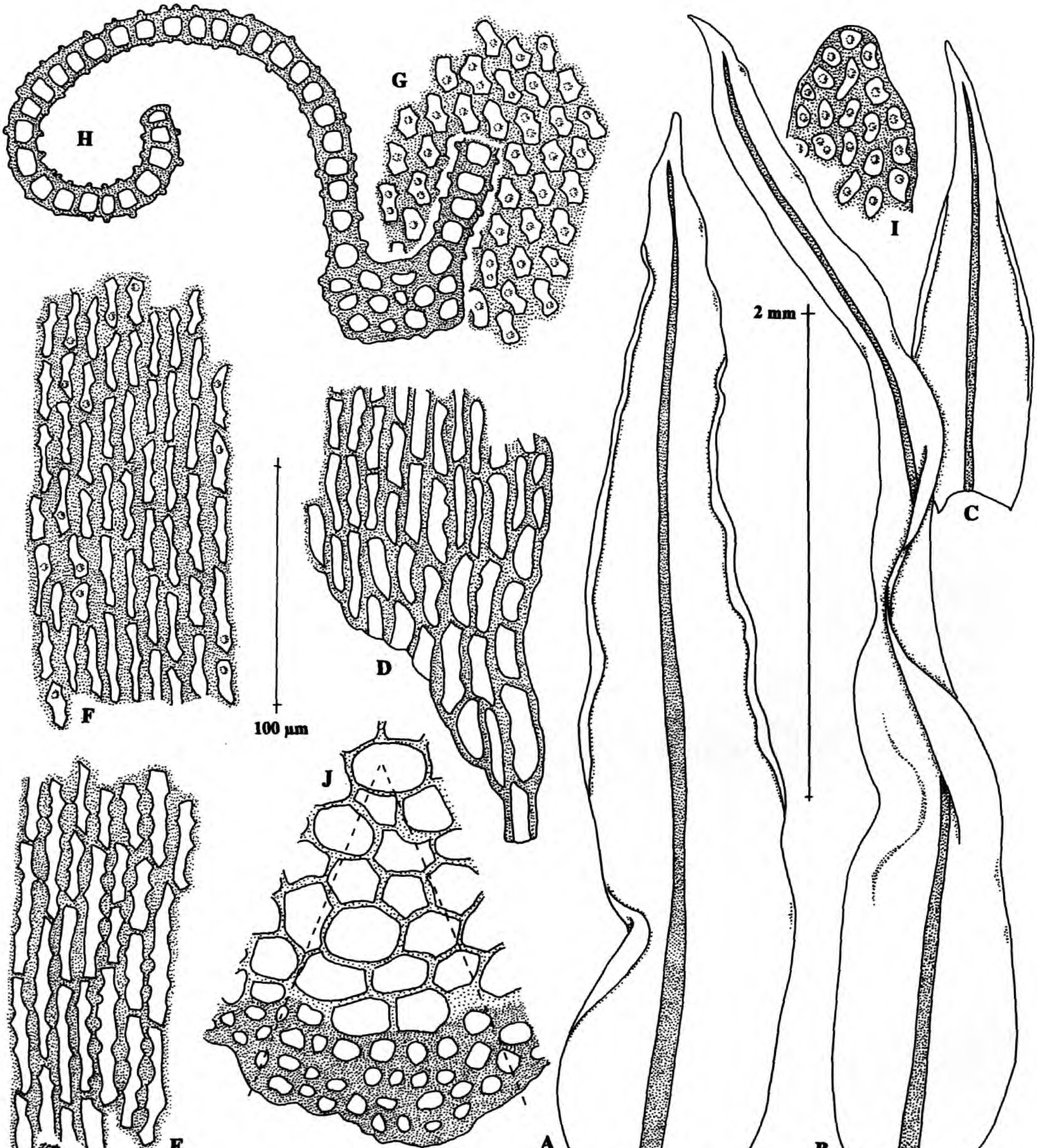

Figure 2. A–J. *Orthomitrium tuberculatum* Lewinsky-Haapasaari & Crosby (*Crosby 16040*). —A–C. Leaves. —D. Basal leaf corner. —E. Basal leaf cells. —F. Transitional leaf cells. —G. Upper leaf cells. —H. Partial cross section of leaf. —I. Leaf apex. —J. Partial cross section of stem.

capsules and reduced peristomes in *Orthomitrium*, both apomorphous character states, can be regarded as further adaptations to xerophytic habitats. The capsules of *Orthomitrium* are unlike any in the Orthotrichoideae, but resemble through their shape, strongly plicate mouths, and reduced peristomes some of those in the Macromitrioideae. The mosses in this subfamily do, however, have a different branching pattern, a character considered of great importance when dividing Orthotrichaceae into subfamilies. Further, immersed stomata and multicellular spores are not known from this subfamily.

It can be argued that of the six characters on which this new genus is based, characters 1, 2, and 5 are commonly found in *Orthotrichum*. Character 4, although uncommon, is found in at least three species of *Orthotrichum*, and character 6 is found in one species (*Orthotrichum steerei*). Therefore, if the individual characters are looked upon, the ovoid to globose capsules with plicate mouths are the only separating character. It is, however, not the individual characters that are of importance, but the combination of characters, just as in the case of *Muelleriella* (cf. Vitt, 1976). Further, if *Orthomitrium tuberculatum* had to be included in *Orthotrichum*, which species would represent the closest relatives? We cannot assign it to any of the three existing subgenera that include taxa with immersed stomata due to the capsule shape, the plicate mouth, the exostome ornamentation, and the position of the stomata in the upper parts of the capsules. There is no intermediate capsule type linking the *Orthomitrium* capsules with the types commonly found in *Orthotrichum*. It is not like in *Macromitrium*, where capsules being irregularly plicate the entire lengths are thought to have developed into capsules being 8-plicate and puckered near the mouths, capsules 4-plicate near the mouths, or not at all plicate (cf. Vitt, 1983). *Orthomitrium tuberculatum* also seems more isolated from other *Orthotrichum* species than *O. callistomum* Brotherus (only member of subg. *Callistoma*) and *O. gymnostomum* Bridel and *O. obtusifolium* Bridel (making up subg. *Orthophyllum* Delogne). This in our eyes justifies the creation of a separate genus.

Distribution. *Orthomitrium tuberculatum* is known only from a single collection from Tai Yan Shan, Guizhou, Southwest China. The locality is about 150 km north of Guiyang, the provincial capital of Guizhou, or about 550 km northeast of Kunming, Yunnan Province.

Etymology. The generic name *Orthomitrium* has been made by combining the two generic names *Orthotrichum* and *Macromitrium*. The gametophytes of *Orthomitrium* are like those of the first mentioned genus, whereas the sporophytes resemble those of the latter. The specific epithet *tuberculatum* refers to the tuberculate young capsules due to the presence of the many immersed stomata in the upper parts.

Acknowledgments. We thank Ellen Farr, Smithsonian Institution, for checking that the generic name *Orthomitrium* had not been used previously, Tyge Christensen, Botanical Institute, University of Copenhagen, for translating the description into Latin, and Lin Qi-Wei, Guiyang, for making local arrangements for fieldwork in Guizhou.

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Matelea roulinioides, uma Nova Espécie da Tribo Gonolobeae (Asclepiadaceae) do Nordeste Brasileiro

Maria de Fátima Agra
Laboratório de Tecnologia Farmacêutica, Universidade Federal de Paraiba, Cx. Postal 5009,
58.049 João Pessoa, Paraíba, Brasil

Warren Douglas Stevens
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

RESUMO. Analizando-se coletas recentes realizadas em Campina Grande, estado da Paraíba, Brasil, reconheceu-se uma nova espécie, *Matelea roulinioides*, que é aqui descrita e ilustrada.

ABSTRACT. *Matelea roulinioides*, a new species of Gonolobeae (Asclepiadaceae) from northeastern Brazil, is described and illustrated.

Matelea roulinioides M. F. Agra & W. D. Stevens, sp. nov. TIPO: Brasil. Paraíba: Campina Grande, Distrito de São José da Mata, Fazenda Pedro da Costa Agra, estrada para Soledade, 16 km Oeste do centro de Campina Grande, 7°46′S, 35°52′W, alt. 500–510 m, 27 jul. 1990, *M. F. Agra 1251* (holótipo, JPB; isótipos, MO, K). Figura 1.

Frutex volubilis. Caulis complanato-bisulcatus, indumento glandular-pubescente. Folia opposita, petiolis 40–45 mm longis, glandulari-pubescentibus; laminae virides, ovatae vel ovato-oblongae, submembranaceae, margine ciliatae, 65–85 mm longae, 33–50 mm latae, apice acuminatae, basi cordatae, supra dense pilosae, praesertim in nervis primariis et secundariis, 4–5 nectariis conicis in nervi basi praesentibus, reliqua pagina utrinque adpresso-pilosa. Inflorescentiae sessiles vel subsessiles, interpetiolares, glomerulatae, 12–18 florae; bracteae lineari-lanceolatae 2.4–2.5 mm longae, pubescentes; trichomata hyalina uniseriata simplicia. Pedicelli 4–6 mm longi, glandulis minutis numerosis trichomatibus intermixtis praediti. Calyx subcampanulatus, lobis anguste deltoideis, 1.0–1.2 mm longis, 0.9–1.0 mm latis, intus glabris, 10 nectariis conicis, ad cuiusque sepali basin lateraliter sitis, extus glabrescentibus, minute glandulosis, trichomatibus intermixtis uniseriatis hyalinis conspersis. Corolla viridescens campanulata, crassa, glabra, tubo 1.2–1.5 mm longo praedita. Laciniae adscendentes, apice reflexae, dein acumine inflexae, oblongae, fere acutae, utrinque glabrae, 4.9–5.0 mm longae, 1.5–1.8 mm latae, nervis rubro-brunneis confluentibus, exterioribus breviter truncato-ramificatis ornatae. Corona glabra, carnosa, 2.1–2.3 mm longa, 5-lobata; coronae lobi adscendentes parte centrali longe bifida, segmentis convergentibus plica longitudinali auctis, 1.1–1.2 mm gynostegium superantibus; ligula interna protrusa in sinu bifurcationis, necnon concrescentia ventrali fulcrea binis lobulis acutis amplexa. Gynostegium stipiti angustato 0.3–0.5 mm longo insidens, capitatum, pentagonale, 1.1–1.2 mm altum, 2.0–2.1 mm diam.; pars locularis antherarum scutiformis dorso leviter sulcata, pellicula membranacea antice obtecta; retinaculum oblanceolato-truncatum, rufo-brunneum, 0.2–0.25 mm longum, apice brevi exsertum, erecto-patens; caudiculae hyaline, laeviter descendentes, parte distali latiore; pollinia orbicularia, lentiformia, 0.5–0.55 mm diam. marginibus hyalinis ornata. Fructus pyriforme; maturum 64–66 mm longum, 20–22 mm diam., dehiscens.

Arbusto volúvel. Caule complanado-bissulcado com indumento glandular pubescente, formado de tricomas glandulares e tricomas simples, unisseriados, hialinos. Folhas opostas; pecíolo com 40–45 mm de comprimento, revestido por indumento semelhante ao do caule; lâmina ovada ou oval-oblonga, 65–85 mm de comprimento e 33–50 mm de largura, sub-membranácea, levemente discolor, verde escuro, brilhante, na face ventral e verde claro na face dorsal, com indumento adpresso-piloso em ambas as faces; ápice acuminado, base cordada, superiormente denso-pilosa na face ventral, principalmente nas nervuras primárias e secundárias com 4–5 nectários, cônicos, amarelados; margens inteiras, ciliadas. Inflorescências sésseis ou subsésseis, interpeciolares, glomeruladas, 12–18 flores; brácteas linear-lanceoladas 2.4–2.5 mm de comprimento com indumento pubescente de tricomas simples unisseriados, margens ciliadas. Pedicelo 4–6 mm de comprimento, revestido por indumento glandular-pubérulo, constituído de diminutos tricomas glandulares, violáceos, estipitados, unisseriados e de tricomas eglandulares, ocorrendo conjuntamente. Cálice sub-campanulado; lobos deltóides com ápices agudos, 1.0–1.2 mm de comprimento, 0.9–1.0 mm de largura, externamente glabrescentes com tricomas esparsos, semelhantes aos do pedicelo; internamente glabro com nectários laterais nas bases dos sinos. Corola campanulada, crassa, glabra, esverdeada, com tubo curto, 1.2–1.5 mm; lacínias reflexas no ⅓ superior,

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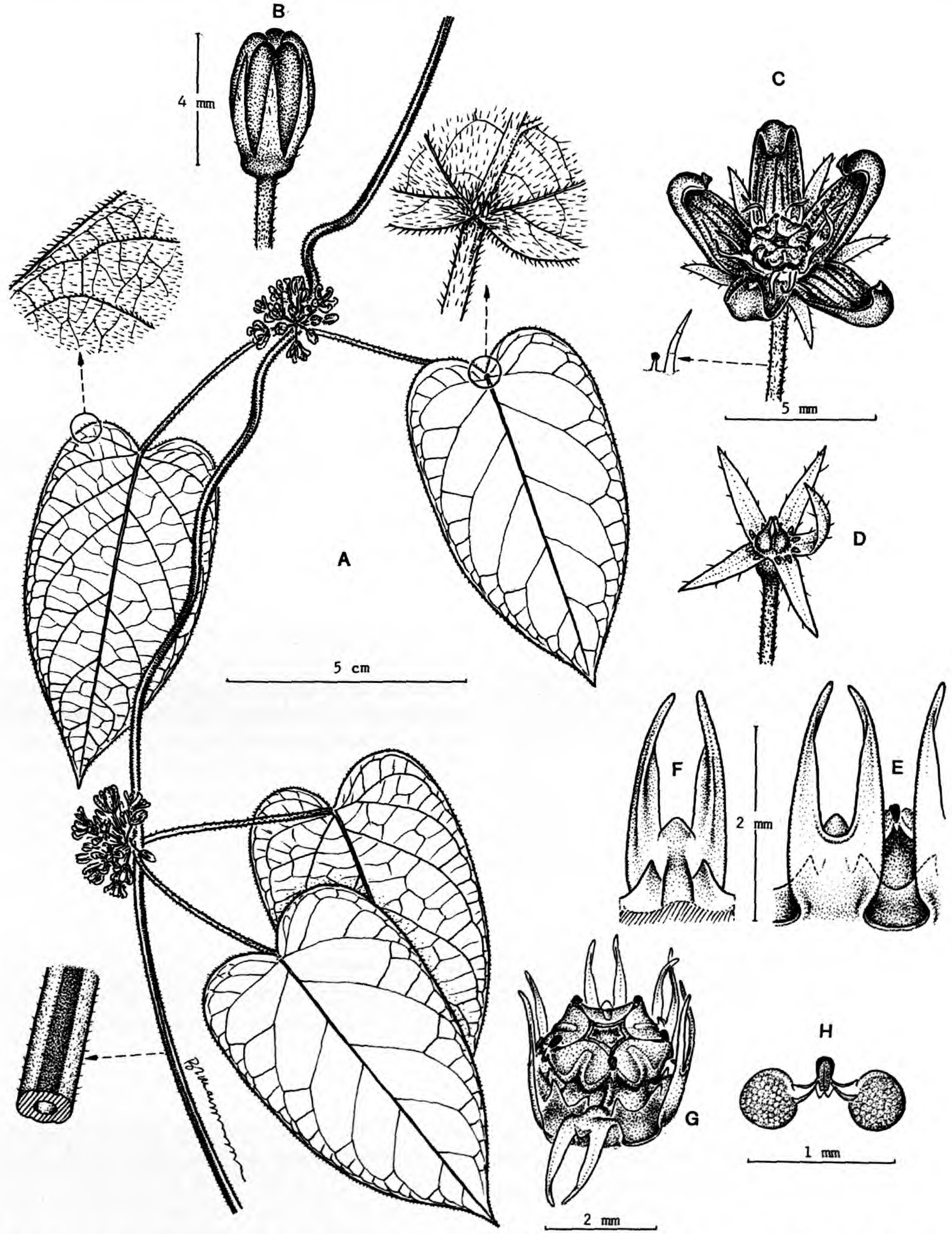

Figura 1. *Matelea roulinioides* M. F. Agra & W. D. Stevens (*Agra 1251*). —A. Hábito, detalhes do caule, folha com nectários e margem ciliada. —B. Botão floral. —C. Flor e pedicelo, tricomas eglandulares/unisseriados e glandulares. —D. Cálice isolado mostrando os nectários internos. —E. Corona, detalhe dos lobos, externamente. —F. Lobo da corona com lígula central interna. —G. Ginostégio pentagonal e corona. —H. Retináculo, caudículas e polínias.

oblongas, glabras em ambas as faces, 4.9–5.0 mm de comprimento, 1.5–1.8 mm de largura, ornamentadas com venações marrom-avermelhadas, confluentes, ramificadas, as mais externas abruptamente truncadas, ápices inflexos, levemente agudos. Corona glabra, carnosa, 2.1–2.3 mm de comprimento, 5-lobada; lobos centrais, maiores, bífidos, com segmentos, ascendentes, lateralmente plicados, com ápices convergentes, 1.1–1.2 mm acima do ginostégio, com lígula interna levemente projetada para diante, no ângulo da bifurcação um engrossamento ventral, foliáceo, ladeado por dois lóbulos agudos, basais. Ginostégio capitado, pentagonal, 1.1–1.2 mm de altura e 2.0–2.1 mm de diâm., curto-estipitado; estípite mais estreita, 0.3–0.5 mm de comprimento, 0.3–0.4 mm de largura; lóculos das anteras escutiformes, levemente sulcados no dorso, com uma película membranácea, frontal, envolvente. Retináculo oblanceolado-truncado, marrom-avermelhado, brilhante, 0.2–0.25 mm de comprimento, ápice levemente exserto, ereto-patente; caudículas não geniculadas, hialinas, levemente descendentes, soldadas ao retináculo da parte mediana até a base, distalmente ampliadas; polínias orbiculares, lentiformes, 0.5–0.55 mm de diâm. com uma margem hialina. Folículo piriforme, deiscente na maturação; 64–66 mm de comprimento, 20–22 mm de diâm.; epicarpo granuloso, com emergências tuberculares, esparsas.

Habitat e distribuição. Matelea roulinioides é conhecida de apenas duas coleçoés provenientes da "caatinga, microrregião dos Cariris Velhos," Estado da Paraíba, área quente e seca, situada a 500–510 m de altitude, com uma vegetação arbustivo-arbórea formada por espécies caducifolias e espinhosas, xerofíticas, características de grande parte do Nordeste brasileiro.

A forma e orientação das polínias claramente indicam que esta planta pertence à Gonolobeae. A ausência de um conjunto de caracteres distintivo, que poderia colocá-la em um gênero à parte, como também a ausência de caracteres de *Gonolobus,* fazem com que a deixemos, de maneira claramente artificial, no gênero *Matelea.* A mistura de tricomas do indumento é típica de muitas espécies de *Matelea,* com tricomas longos, unisseriados, e glandulares, curtos. A corona é complicada e se assemelha à de *M. oxypetaloides* (Fourn.) Morillo. A venação e o ápice inflexo da corola são especialmente distintivos e emprestam à planta uma aparência geral de *Cynanchum* subgen. *Mellichampia,* também tratado algumas vezes como *Telminostelma* ou *Roulinia.*

Parátipo. BRASIL. **Paraíba:** Campina Grande, Distrito de São José da Mata, Fazenda Pedro da Costa Agra, estrada para Soledade, 16 km Oeste do centro de Campina Grande, 7°46'S, 35°52'W, alt. 500–510 m, 12 nov. 1990, *M. F. Agra 1324* (JPB).

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Brongniartia guiengolensis (Fabaceae: Faboideae): A New Arboreal Species from the State of Oaxaca, Mexico

Oscar Dorado

Centro de Educación Ambiental e Investigación Sierra de Huautla, Universidad Autónoma del Estado de Morelos, Avenida Universidad #1001, Cuernavaca, Morelos, C.P. 62210, Mexico

Leticia Torres-Colín

Herbario Nacional, Instituto de Biología, Universidad Nacional Autónoma de México, Cd. Universitaria, México D.F., C.P. 04510, Mexico

ABSTRACT. A new arboreal species, *Brongniartia guiengolensis* (Fabaceae: Faboideae), endemic to Cerro Guiengola, a hill in the northwestern region of Tehuantepec, Oaxaca, Mexico, is described and illustrated. Its morphological affinities with *B. sousae* O. Dorado are discussed, and habitat data are given.

RESUMEN. Se describe una especie nueva arborea, *Brongniartia guiengolensis* (Fabaceae: Faboideae), endémica del Cerro Guiengola, localizado en la región noroeste de la ciudad de Tehuantepec, Oaxaca, México. Se discuten sus afinidades morfológicas con *B. sousae* O. Dorado y se proporcionan datos de su hábitat.

In the last decade, explorations in the state of Oaxaca by botanists from the National Herbarium of Mexico (MEXU) have added many new records for the state flora. One locality where recent and old discoveries have been made is Cerro Guiengola, a limestone hill near the city of Tehuantepec that supports tropical deciduous forest. During a a floristic inventory of this region by L. Torres-Colín (1989), seven new species and three new records for the state were found, among them *Brongniartia sousae* O. Dorado. The genus *Brongniartia* is nearly endemic to Mexico and has many species in the state of Oaxaca. Of the 60 species known hitherto (Dorado, 1992), only two are trees. *Brongniartia mollicula* T. S. Brandegee is commonly a shrub more than 1.5 m tall, but in more humid habitats, may be a tree up to 4.5 m tall. The second arboreal species is *B. montalvoana* Dorado & Arias (Dorado & Arias, 1992). The species described here, *B. guiengolensis,* is a dominant member of the forest of the Cerro Guiengola, where its trunk attains a diameter of 20 cm or more. This feature, combined with other morphological characters, is distinctive.

Brongniartia guiengolensis O. Dorado & L. Torres-Colín, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Tehuantepec, Cerro Guiengola, "Las Palmitas," camino al Ocotal, 16°21′ lat. N y 95°19′ long. W, 26 aug. 1986, *M. L. Torres-Colín 461, R. Torres & C. Martínez* (holotype, MEXU; isotypes, ENCB, HUMO, MO, RSA-POM). Figure 1.

Arbor ad 7 m alta; caulis plus quam 20 cm diametro, aspectu lobatus, cavis ad 10 cm longis perforatus, profunde costatus, costis in sectione transversali rotundatis, cortex laevis, cinerascens; rami juniores hirsutuli, vetustiores glabrescentes. Stipulae 1–1.6 cm longae, 4–4.2 mm latae. Folia imparipinnata vel aliquando paripinnata; foliola opposita vel aliquando alterna, elliptica vel late elliptica, interdum ovata, (1.2–)1.7–3.8 cm longa, (0.7–)1.3–2 cm lata tenuia, maturia glabra. Vexillum late ovatum, 1.3–1.4 cm longum, 1.2–1.6 cm latum, rubrum, per ca. 90° reflexum, apice rotundatum; alae spathulatae, 1.6–1.7 cm longae, 8–8.2 mm latae, rubrae; carina oblongo-falcata 1.7–1.8 cm longa, 6.5–6.8 mm lata, viridi-flava, tubus staminalis ad 2.5 cm longus, stamene vexillari libero ad 2 cm longo; ovarium 9.5 mm longum, stylus 1.6 mm longus, glaber; ovula 4–5. Fructus 5.0–6.6 cm longus, glaber subsessilis, aliquandum calyce persistenti basim cinctus.

Tree to 7 m tall, trunks more than 20 cm diam., with deep elongate holes up to 10 cm long which appear lobed in cross section, the bark smooth and grayish; branches hirsutulous when young, becoming glabrous. Stipules elliptic to lanceolate, 1–1.6 cm long, 4–4.2 mm wide, sparsely strigose, early becoming glabrous, deciduous; leaves (6.5–)8.4–16 cm long, imparipinnate or sometimes paripinnate; petiole (0.5–)0.8–15(–1.8) cm long, glabrescent; petiolules 2.8–4.3 mm long, yellowish green; leaflets elliptic or broadly elliptic, sometimes ovate, at apex rounded, obtuse, or frequently retuse, mucronate, (5–)9–29, (1.2–)1.7–3.8 cm long, (0.7–)1.3–2 cm wide, opposite or sometimes alternate, thin, glabrous at maturity, strigose when young on both surfaces, especially along the midvein, venation con-

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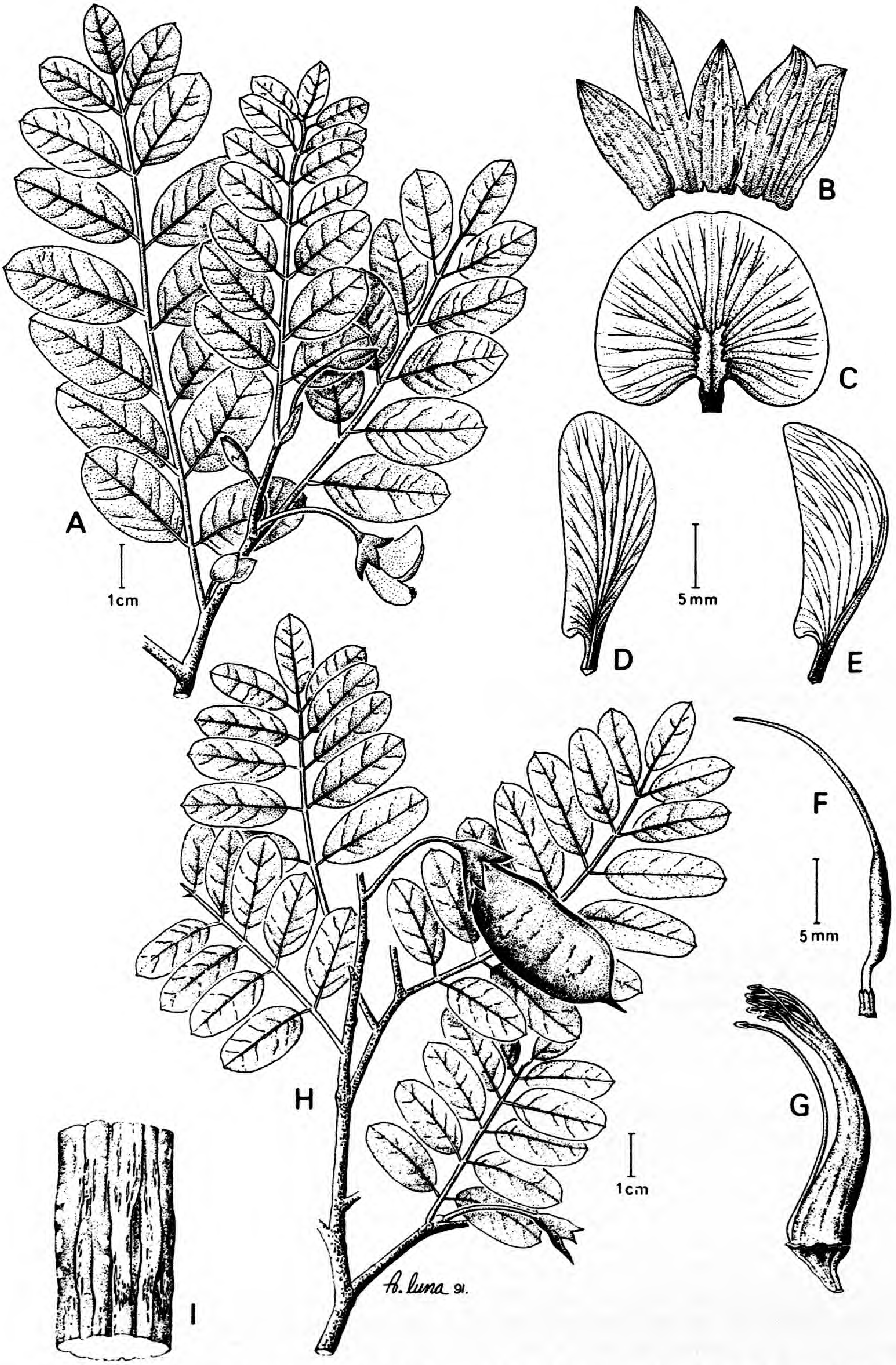

Figure. 1. *Brongniartia guiengolensis* O. Dorado & L. Torres-Colín. —A. Flowering branch. —B. Dissected calyx. —C. Standard petal. —D. Wing petal. —E. Keel petal. —F. Gynoecium. —G. Androecium. —H. Fruiting branch. —I. Trunk. Based on the holotype.

Table 1. Characteristics distinguishing *Brongniartia guiengolensis* and *B. sousae.*

Characteristics	*B. guiengolensis*	*B. sousae*
Habit	tree to 7 m tall	shrub to 3 m tall
Trunk and main branches	with deep elongate holes, appearing lobed in cross section	without deep fissures
Stipules	1–1.6 cm long, 4–4.2 mm wide	0.22–0.3(–0.4) cm long, 1.2(–3) mm wide
Bracteoles	0.8–1 cm long	0.5–0.8 cm long
Length of vexillar calyx lobes	(6–)8–10 mm long	6–8(–10) mm long
Connation of vexillar calyx lobes	$\frac{1}{10}$ to $\frac{1}{8}$ of their length	$\frac{5}{6}$ of their length

spicuous on both surfaces, base acute to rounded, mucro more than 0.5 mm long. Flowers axillary, solitary or 2–5 per node, contemporary with the leaves; peduncles 2–2.5 cm long, glabrescent; bracteoles ovate to elliptic, 0.8–1 cm long, 6.5–7 mm wide, strigose or sometimes glabrous, deciduous before anthesis; calyx campanulate, 1.4–1.6 cm long, 5–6.5 mm wide, glabrous when mature but sometimes densely strigose, glabrescent internally, tube 3.5–4 mm long; two vexillar lobes (6–)8–10 mm long, 6–7 mm wide (both lobes), connate $\frac{1}{10}$ to $\frac{1}{8}$ of their length; lateral lobes 1–11 mm long, 4.5–5 mm wide; carinal lobe (7–)9–11 mm long, (2.5–)3–4 mm wide; standard petal broadly ovate, 1.3–1.4 cm long, 1.2–1.6 cm wide, red, reflexed ca. 90°, apex rounded, claw 2 mm long; wing petals spathulate, 1.6–1.7 cm long, 8–8.2 mm wide, red, claw 2.2–2.6 mm long; keel petals oblong-falcate, 1.7–1.8 cm long, 6.5–6.8 mm wide, greenish yellow, claw 2.1–2.3 mm long; staminal tube up to 2 cm long, vexillar stamen free up to 2 cm long; ovary 9.5 mm long, style 1.6 mm long, glabrous, ovules 4–5. Fruit 5.0–6.6 cm long, subsessile, glabrous, sometimes with the calyx persistent surrounding the base of the fruit. Seeds 5 per fruit, known only immature.

Distribution. Brongniartia guiengolensis is known only from Cerro Guiengola, a hill in the northwestern region of the city of Tehuantepec. It is a dominant tree of the tropical deciduous forest, between 700 and 1000 m above sea level, associated with arboreal species such as *Ceiba parvifolia* Rose, *Lonchocarpus lanceolatus* Bentham, *Lysiloma microphyllum* Bentham, *Plumeria rubra* L., and shrubby *Mimosa torresiae* R. Grether and *Eupatorium guiengolense* L. Torres-Colín & J. L. Villaseñor. The flowering and fruiting period of *B. guiengolensis* is from August to November.

Relationships. Brongniartia guiengolensis is most similar to *B. sousae,* which also grows in the Cerro Guiengola, although the latter is found at lower elevations, below 450 m (Dorado, 1987). Extensive explorations in the area have shown that the two species are not sympatric and that altitude may be an important limiting factor in the distribution of both. While *B. guiengolensis* is a tree up to 7 m tall, *B. sousae* is a shrub shorter than 3 m. Additional morphological features are compared in Table 1. The very restricted range of *B. guiengolensis* suggests that it may be a vulnerable species. Official protection of Cerro Guiengola should be given priority due to the high number of endemic species.

Paratypes. MEXICO. **Oaxaca:** Distr. Tehuantepec, El Desmonte, donde está el mango, Cerro Guiengola, 26 nov. 1986, *M. L. Torres-Colín 572, A. García & L. Cortes* (HUMO, MEXU); subida al Cerro Guiengola por la ladera S, 26 nov. 1986, *M. L. Torres-Colín 703, R. Torres & C. Martínez* (HUMO, MEXU); "Las Palmitas," subida al Ocotal, lado este del Cerro Guiengola, 26 July 1987, *O. Dorado 1773, S. Zona & R. Torres* (HUMO, MEXU); subida a Las Palmitas ladera oriente del Cerro Guiengola, 13 nov. 1987, *M. L. Torres-Colín 972, R. Torres & C. Martínez* (HUMO, MEXU); ladera norte del Cerro Guiengola, 13 sep. 1988, *M. L. Torres-Colín 1006, R. Torres & C. Martínez* (HUMO, MEXU).

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Three New Species of *Justicia* (Acanthaceae) from Costa Rica

L. H. Durkee
Department of Biology, Grinnell College, Grinnell, Iowa 50112–0806, U.S.A.

Lucinda A. McDade
Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, U.S.A.

ABSTRACT. *Justicia arborescens, J. circulibracteata,* and *J. densibracteata* are described and illustrated. *Justicia arborescens,* of the Monteverde Cloud Forest area, is rare or unique in its arboreal habit. *Justicia circulibracteata* is recognized by its spikelike inflorescences with spreading, suborbicular bracts 3–4 mm long, each bract bearing a spikelet with 2–5 secund flowers. *Justicia densibracteata* is recognized by its spicate panicles, inflorescences with nodes with one fertile and one highly reduced sterile bract, and 4-colporate pollen.

The intensive collecting effort of the collaborative team from the Instituto de Biodiversidad (InBio), the Missouri Botanical Garden, and a number of other institutions is yielding a great deal of new information about the Costa Rican flora, including species new to science, new records, and vastly improved data on the ranges of species. Among the former are several new species of *Justica* that we have studied as part of our work to prepare the treatment of the Acanthaceae for the *Manual to the Plants of Costa Rica.*

As surveyed by Graham (1988), *Justicia* is the largest genus of the family, with at least 600 species worldwide and many no doubt yet to be described. It is also the most species-rich genus of Acanthaceae in Costa Rica with 30 species reported to date, three recently described by Gómez-Laurito and Hammel (1994).

As will be clear from this paper alone, *Justicia* as presently circumscribed is an exceedingly heterogeneous group. Earlier generations of students of Acanthaceae have recognized a number of genera as distinct from *Justicia,* but these have not withstood additional study. We suspect that, as the genus becomes better known, monophyletic lineages will be recognized within it and the group will be revised taxonomically at least at the infrageneric level. Graham's (1988) work represents a significant step in this direction. That we still have considerable work to do is apparent from the fact that none of the species described here is successfully accommodated in Graham's (1988) classification. To facilitate comparison among species, we urge all who describe new taxa in *Justicia* to provide complete information on the characters that Graham employed in her analysis of the group (i.e., inflorescence type, bracts and bracteoles, calyx, corolla, androecium, pollen, fruit, and seeds). In particular, as a result of working with these new species, we are struck by the rich diversity of inflorescence morphology in these plants. It seems likely that careful study of inflorescence development and morphology would yield a great deal of phylogenetically useful information.

Two of the species described herein are from lowland wet forest on the Caribbean slope of Costa Rica, areas that have not received a great deal of attention from collectors in the past. In particular, the foothill elevations, between the coastal plain and about 700 m elevation, have been very poorly collected and are likely to yield additional new taxa. It is more surprising that the third species is from one of the best known sites in Costa Rica, the Monteverde Cloud Forest Reserve. That a treelet with large and conspicuous, orange-red flowers would have escaped notice until recently is especially unexpected. These discoveries highlight the value of intensive collecting of the sort being undertaken for the *Manual* project.

Justicia arborescens Durkee & McDade, sp. nov. TYPE: Costa Rica. Puntarenas: Monteverde, Río San Luis Valley on Pacific slope, 1000 m, 11 Nov. 1984, *Haber 893* (holotype, MO). Figures 1, 4A.

Frutex ad 7 m altitudine. Folia elliptica ad ovato-elliptica, saepe anisophylla, 7–25 cm longa, 1.2–7.5 cm lata, apice acuminato, basi attenuata; sessiles ad subsessiles. Inflorescentiae spiciformes vel paniculatae spiciformes, terminales ad 17 cm longitudine; bracteae rubiginosae, oblongae ad oblongo-lanceolatas, 7–13 mm longitudine, 2–3 mm latae. Flores aurantiaci ad aurantiaco-rubros, cor-

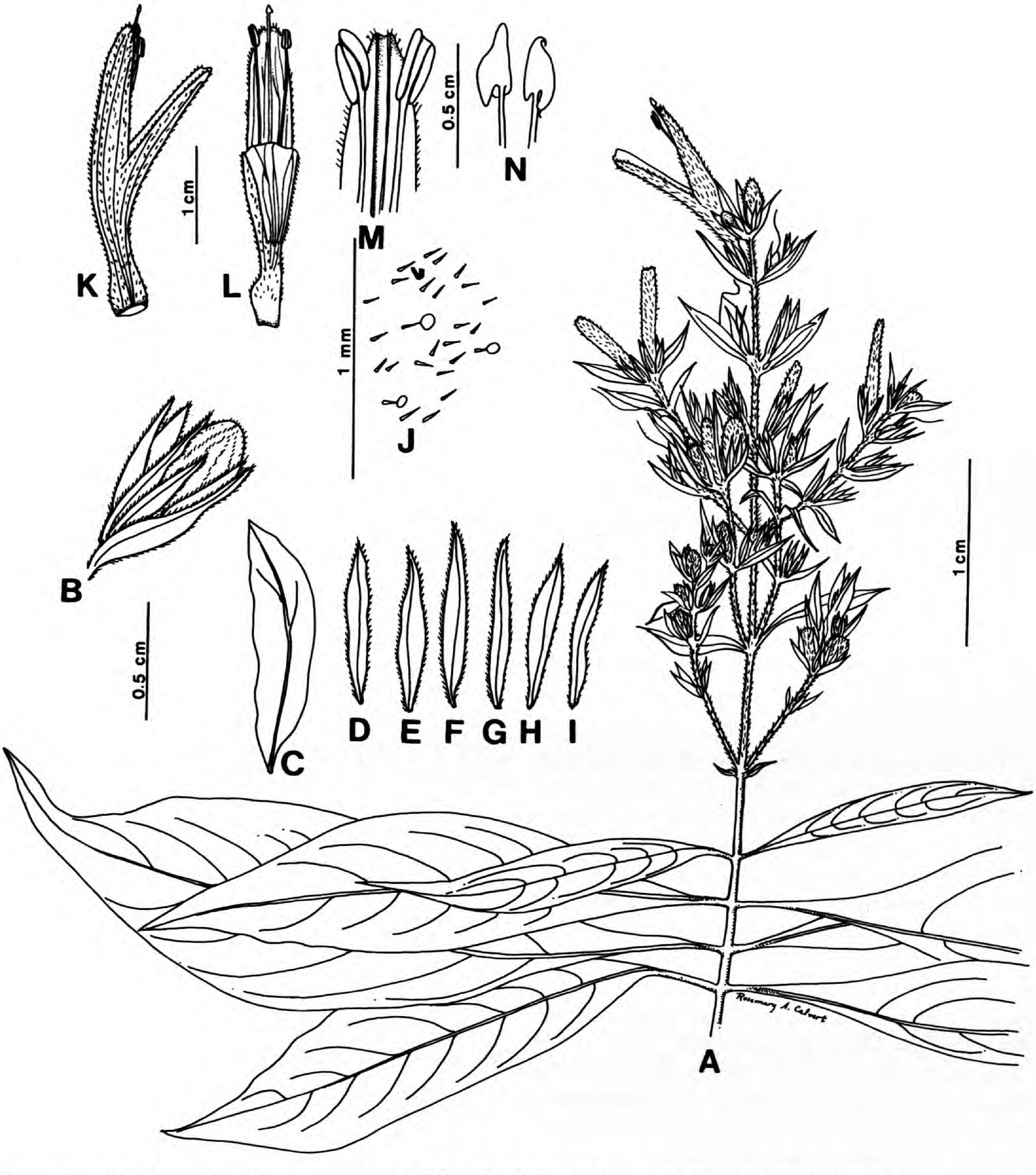

Figure 1. A–N, *Justicia arborescens* Durkee & McDade (*Haber 893*) —A. Habit. —B. Node showing bract, bractlet, calyx, and flower bud. —C. Bract. —D. Bractlet. —E–I. Calyx segments. —J. Glandular and eglandular trichomes of bracts. —K. Corolla, lateral view, with exserted style and stigma. —L. Corolla, ventral view. —M. Distal portion of corolla with style removed and anthers bent laterally to show rugula. —N. Anthers, dorsal view.

ollis 2.5–3 cm longis, staminibus exsertis. Fructus clavati, 18–21 mm longi, seminibus 4.

Understory shrub or tree to 7 m tall. Stem quadrangular, glabrous. Leaves elliptic to elliptic-ovate, often anisophyllous, 7–25 cm long, 1.2–7.5 cm broad, apically acuminate, basally long attenuate, margins entire to sparingly crenulate, glabrous, cystoliths abundant; petioles (unwinged portion) 0–3 mm long. Inflorescences in terminal spicate panicles to 17 cm long, distal portions of inflorescences unbranched, with opposite bracts each bearing a single flower, proximal portions of inflorescences with opposite branches at each node, these 4-ranked, each subtended by a single bract (lateral branches sometimes additionally branched in larger inflorescences), ultimate branches of the inflorescences spicate, with paired bracts at each node, one of these often sterile, nodes lax; floral bracts dull red, spreading, oblong to oblong-lanceolate, 7–13 mm long, 2–3 mm broad, sterile bracts similar but smaller, bracteoles similar but smaller; peduncles sparingly puberulous, rachises puberulous. Flowers one per bract; calyx 5-merous, lobes subulate, equal, 5.5–8 mm long, 0.65–0.75 mm broad, minutely puberulous; corolla bright orange to orange-red to red with yellow, 2.5–3 cm long, 2.6 mm broad at base, bilabiate, glandular-puberulous, lips 10–13 mm long, upper lip ca. 5.5 mm broad, apically minutely bilobed, lobes acute, ca. 0.3 mm long, lower lip ca. 4 mm broad, apically 3-lobed, lobes ca. 1 mm long, apically acute, lateral lobes ca. 0.8 mm broad, middle lobe ca. 1 mm broad; stamens exserted to about the tip of the upper lip, thecae attached one slightly above the other, 2.2–2.5 mm long, lower theca very slightly spurred, pollen prolate-perprolate, 42–53 × 24–27 μm, diporate with four longitudinal rows of ca. 9 insulae in each trema region, strongly flattened on porate surface, exine between the tremata reticulate; ovary 3.5–4.5 mm long, glabrous, style 17–18 mm long, glabrous, stigma linear, 0.5–0.7 mm long. Fruits a clavate capsule, 18–21 mm long, sterile stipe portion ca. 2.5–3 mm long, glabrous or essentially so, up to 4 ovules, mature seeds ca. 2.5–3 mm diam., tuberculate.

Habitat, distribution, and phenology. Justicia arborescens is a species of premontane moist forest slopes, thus far known from the Pacific slope of the Cordillera de Tilarán and the Cordillera Guanacaste, Costa Rica. It appears to occur in primary as well as secondary forest understory. Flowering collections have been made in June, August, November, December, and January, and it thus appears to flower during the wet to early dry seasons. Two fruiting collections have been made, both from Guanacaste, one in June and the other in December. Each of the fruiting collections also had flowers.

Etymology. The species epithet refers to the arboreal habit.

Using Graham's (1988) key to sections of *Justicia,* this new species keys to section *Plagiacanthus* and is consistent with most of this group's characteristics (i.e., compound inflorescences with spicate units, eglandular rachises, calyces of five equal parts, anther thecae slightly superposed). Inflorescence structure appears to conform to Graham's type H. *Justicia arborescens* has pollen type 7 (Graham, 1988), which is also common among members of section *Plagiacanthus.* The new species differs from others in this section in having bracts that are longer rather than shorter than the calyx and corollas that are bright orange rather than red. Because the new species is not completely in line with the characteristics of Graham's section *Plagiacanthus,* we feel it is best not to formally place it in that section.

Among Costa Rican *Justicia, J. arborescens* is recognized by its arboreal habit, which is rare among neotropical species of the genus, its terminal spicate panicles with narrow spreading bracts that are dull red, its bright orange corollas, and its sessile to subsessile leaves that are often anisophyllous. The tallest *Justicia* species described for Costa Rica is *J. aurea* D. F. K. Schlechtendal, a shrub that attains a height of 6 m, has larger leaves (to 30 or more cm long), and thyrsoid inflorescences with long yellow corollas to 5.5 cm long. *Justicia trichotoma* (Kuntze) Leonard also has anisophyllous leaves, but it has numerous other differences and would not likely be confused with *J. arborescens.* In inflorescence, corolla shape, and color, *J. arborescens* is more similar to *J. tinctoria* (Oersted) D. N. Gibson, but differs in its arboreal habit (vs. shrubby), nearly sessile leaves (vs. with petioles to 1.2 cm long), terminal vs. axillary inflorescences, longer bracts (8–12 mm vs. 1–2 mm), longer calyx segments (6–7 mm vs. 2.25–3 mm), and its shorter corollas (2.5–3 cm vs. 3–4 cm). *Justicia spicigera* D. F. K. Schlechtendal, which is easily confused with *J. tinctoria,* also has orange corollas and can be distinguished from *J. arborescens* by a similar suite of characters.

None of the species of *Justicia* known from Nicaragua or Panama that do not also occur in Costa Rica is likely to be confused with *J. arborescens* (Durkee, 1978, and in prep.).

Paratypes. COSTA RICA. **Guanacaste:** along Río Las Flores between Quebrada Desprendimiento and Q. Sanguijuela, Hacienda Montezuma, 10°40'N, 85°04.5'W, 450 m, 25 Jan. 1985, *Grayum et al. 4917* (GRI, INB, MO); Parque Nacional Guanacaste, Estación Cacao, 1100 m, 2 Nov. 1990, *Chavez 334* (CR, INB, MO, USJ); Parque Nacional Guanacaste, Estación Cacao, Quebrada Pedregal, streamside, 700–900 m, 6 June 1990, *Hammel 17793* (ARIZ, INB, MO); Parque Nacional Guanacaste, Estación Maritza (on Volcan Orosí), 600 m, 29 Aug. 1990, *Delgado 85* (ARIZ, CR, F, INB, MO). **Puntarenas:** Monteverde Cloud Forest Reserve, 1500 m, 10 Dec. 1985, *Haber ex Bello 3619* (CR, MO); Monteverde, Río San Luis Valley on Pacific slope, 1100 m, secondary forest understory, 1100 m, 11 Nov. 1984, *Haber 863* (ARIZ, CAS, GRI, INB, MO), *Haber 891* (ARIZ, DUKE, GRI, INB, MO, US); Monteverde, Río San Luis valley below community, premontane moist forest on Pacific slope, 10°20'N, 84°50'W, 1200 m, 30 Dec. 1985, *Haber & Bello 4038* (MO); San Luis, on Río Guacimal, 700 m, 21 Dec. 1989, *Haber &*

Zuckowski 9668 (ARIZ, CAS, CR, DUKE, F, INB, MO, US).

Justicia circulibracteata Durkee & McDade, sp. nov. TYPE: Costa Rica. Limón: just SE of Puerto Viejo de Talamanca, along trail leading from cemetery, 9°39′N, 82°45′W, 100–150 m, 1 Aug. 1984, *M. H. Grayum 3634* (holotype, MO). Figures 2, 4B.

Herbae ad 27.5 cm altitudine. Folia ovato-elliptica, 3–10 cm longa, 1.4–3.7 cm lata, apice acuminato, basi acuminata; petiolis 5–8 mm longis. Inflorescentiae terminales et axillares ad 8 cm longitudine; bracteae sub-orbiculares, 3–4 mm longae, 2.4–3 mm latae. Flores sub-rosei, corollis 6.5–7.5 mm longis, staminibus exsertis. Fructus clavati, 6–7.5 mm longi, seminibus 4.

Herb to 27.5 cm tall. Stem quadrangular, pubescence of younger stems bilineately retrorse. Leaves ovate-elliptic, 3–10 cm long, 1.4–3.7 cm broad, apically acuminate, basally acuminate, margins entire to slightly undulate, glabrous on both surfaces, cystoliths abundant on both surfaces of dried specimens; petioles 3–7 mm long, puberulous. Inflorescences in terminal and axillary compact cymose panicles (thyrses) appearing as spikes to 8 cm long, 1 cm broad, primary rachises with mainly bilineate retrorse hairs; peduncles 0.9–2.8 cm long, with bilineate retrorse hairs; bracts opposite, perpendicular to primary rachis at anthesis, suborbicular, 3–4 mm long, 2.4–3 mm broad, venation prominent, puberulous; each bract bearing what appears as a short spike with 2–5 secund flowers, the peduncle of the short spike nested in and nearly enclosed by the grooved petiole of the bract; bracteoles 2 per flower, oblanceolate, 2.5–3.5 mm long, 0.5–0.75 mm broad, puberulous-glandular. Flowers sessile, calyx 5-merous, lobes subulate, 3–4 mm long, puberulous, posterior segment smaller, 2–2.5 mm long; corolla pinkish, sparingly puberulous outside, bilabiate, 6.5–7.5 mm long, the upper lip erect, ca. 3 mm long, the lower lip ca. 2.5 mm long, obscurely 3-lobed; stamens exserted to ca. 0.5 mm from the tip of the upper lip, anther cells superposed, ca. 0.5 mm long, lower cell slightly smaller, pollen prolate, 34–37 × 23–25 μm, diporate with two rows of 5 insulae in each trema region, exine between tremata thickened, reticulate; ovary ca. 1 mm long, style ca. 11 mm long. Fruit a clavate capsule, 6–7.5 mm long, ca. 2 mm broad, ca. 1.5 mm thick, puberulous, ovules 4, seeds broadly obovate, asymmetrical at the hilar end, compressed, ca. 1.5 mm diam., muricate.

Habitat, distribution, and phenology. Justicia circulibracteata is known only from the type location on the Caribbean slope of southern Costa Rica where it was collected in the understory of disturbed forest and cacao plantations. Plants collected in August (wet season) had both flowers and fruits.

Etymology. The specific epithet refers to the unusual circular shape of the floral bracts.

Justicia circulibracteata cannot be successfully keyed to any of Graham's (1988) sections, but plants in her section IV, *Tyloglossa*, have inflorescences resembling those of *J. circulibracteata.* These superficially resemble a simple spike, but with each node bearing two very reduced spicate units instead of single flowers. However, Graham described the flowers of the spicate units as "not secund." Pollen of *J. circulibracteata* is of Graham's (1988) type 5, which occurs in plants belonging to at least five of her sections, as well as in a number of species identified by her as of uncertain position.

Among other species of *Justicia* in Costa Rica, *J. parvibracteata* Leonard shares the unusual feature of having 2–4 flowers per bract (Durkee, 1986). *Justicia circulibracteata* may be distinguished from this species by bract size (3–4 mm vs. 3–6 mm long in *J. parvibracteata*), shape (suborbicular vs. elliptic to obovate), apical shape (rounded vs. obtuse, apiculate), and orientation (spreading and lax vs. erect and imbricate); leaf size (3–10 × 1.4–3.7 cm vs. 3.5–7 × 0.7–1.2 cm) and shape (ovate-elliptic vs. elliptic-oblong).

None of the Nicaraguan or Panamanian species of *Justicia* that do not also occur in Costa Rica is likely to be confused with *J. circulibracteata.* It is interesting, however, that three species of Panamanian *Justicia* recently described by Daniel and Wasshausen (1990) share pollen type 5 (Graham, 1988) with this new species. Plants of all three species also have spicate inflorescences with relatively broad bracts and small flowers; however, the bracts are closely imbricate and bear only a single flower in the Panamanian species.

Justicia densibracteata Durkee & McDade, sp. nov. TYPE: Costa Rica. Heredia: Cantón de Sarapiquí, Rara Avis Lodge, ca. 15 km SW of Horquetas, 10°15–19′N, 84°0–04′W, 400–600 m, 8 Nov. 1989, *Vargas 297* (holotype, ARIZ; isotypes, DUKE, INB, MO). Figures 3, 4C.

Frutex ad 1.5 m altitudine. Folia ovata, 9–22 cm longa, 4.5–13.5 cm lata, apice acuminato, basi acuta ad attenuatam; petiolis 3–8 cm longis. Inflorescentiae paniculatae spiciformes, terminales ad 19 cm longitudine; bracteae virides, imbricatae, ellipticae ad spathulatas, 12–22 mm longae, 7–12 mm latae, apice apiculato. Flores albi, corollis 2.7 cm longis, staminibus exsertis. Fructus clavati, 14–16 mm longi, seminibus 4.

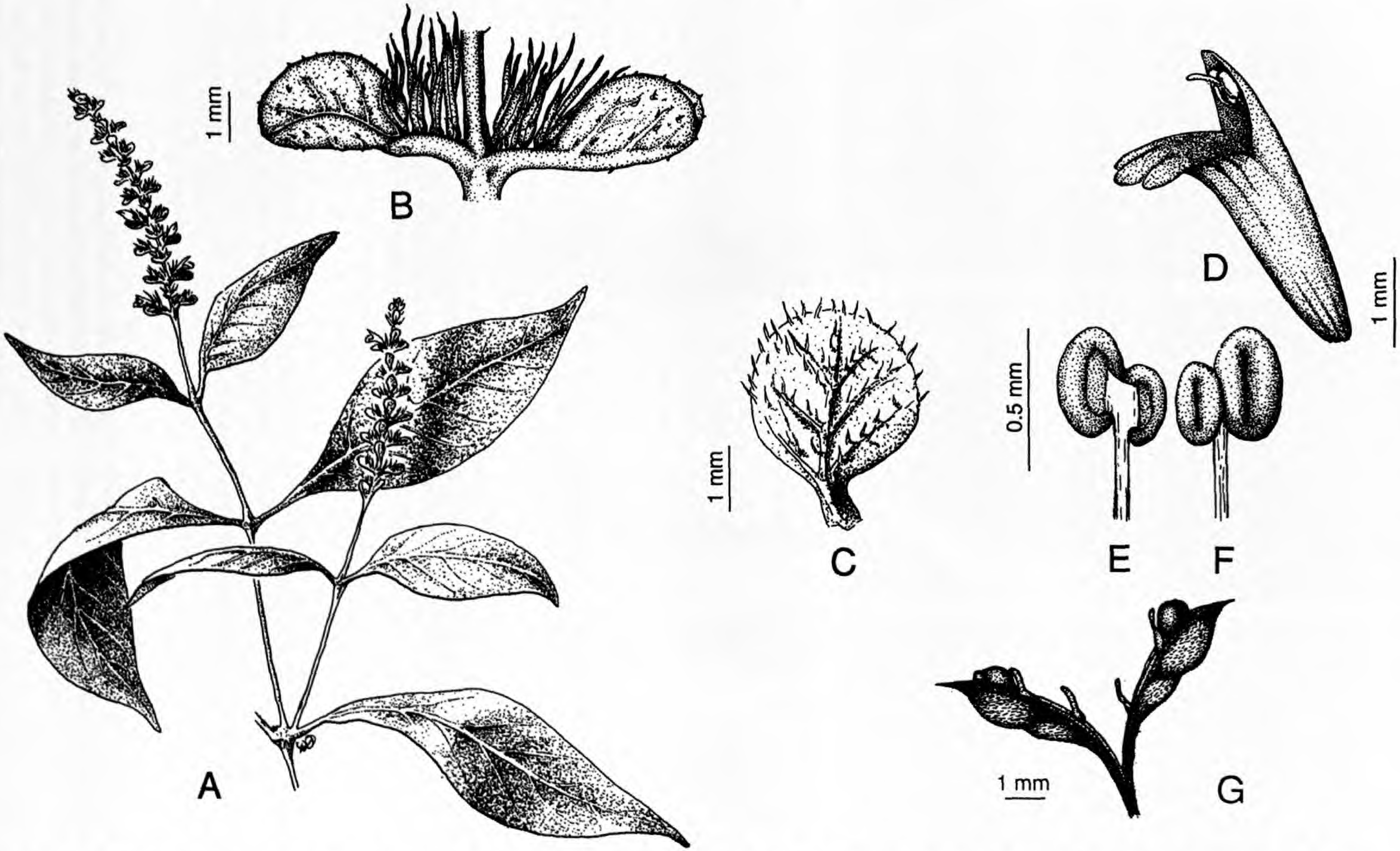

Figure 2. A–G, *Justicia circulibracteata* Durkee & McDade (*Grayum 3634*). —A. Habit. —B. Node of inflorescence showing opposite bracts each subtending short inflorescences with secund flowers. —C. Bract. —D. Corolla. —E, F. Dorsal and ventral views, respectively, of anther. —G. Dehiscent capsule.

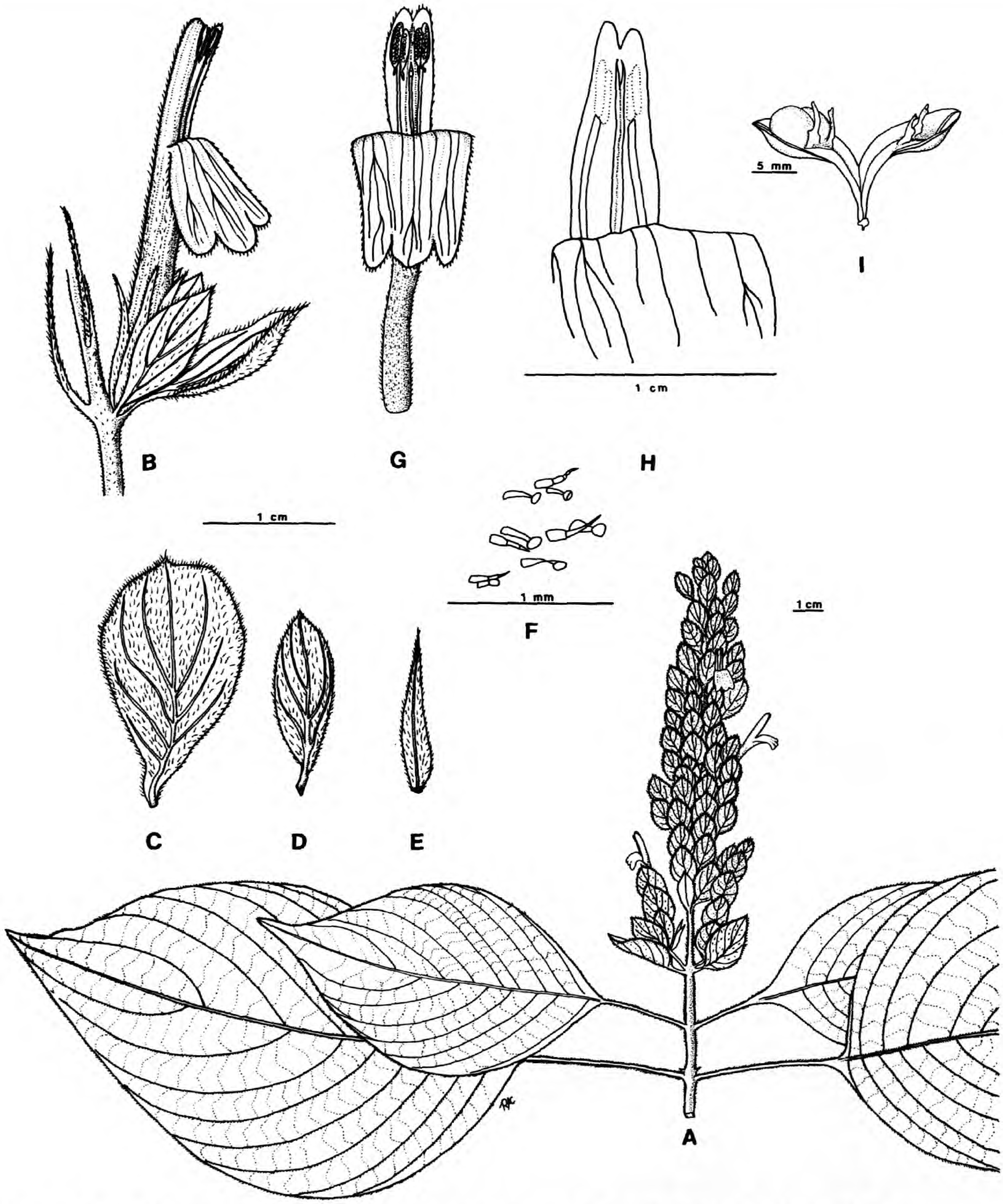

Figure 3. A–J, *Justicia densibracteata* Durkee & McDade (*Vargas 297*). —A. Habit. —B. Node of inflorescence with sterile and fertile bracts; fertile bract showing bractlets, calyx, and corolla. —C. Fertile bract. —D. Bracteole. —E. Calyx segment. —F. Glandular and multiseriate trichomes of bracts. —G. Corolla. —H. Distal portion of corolla with anthers and style removed to show rugula. —I. Dehiscent capsule. (Note that B–E and G are drawn to same scale.)

Shrub ca. 1.5 m tall. Young stem quadrangular, sparingly puberulous. Leaves ovate, 9–22 cm long, 4.5–13.5 cm broad, apically acuminate, basally obtuse to acute to slightly attenuate, margins entire, glabrous above, puberulous on costa and main veins beneath, cystoliths abundant and visible on both surfaces of dried leaves; petioles 3–8 cm long, puberulous. Inflorescences in terminal, densely and oppositely branched, spicate panicles to 19 cm long, 5 cm broad; peduncle of entire inflorescence to 2.5 cm long, puberulous; rachises more densely puberulous than peduncle; spikes (i.e., branches of

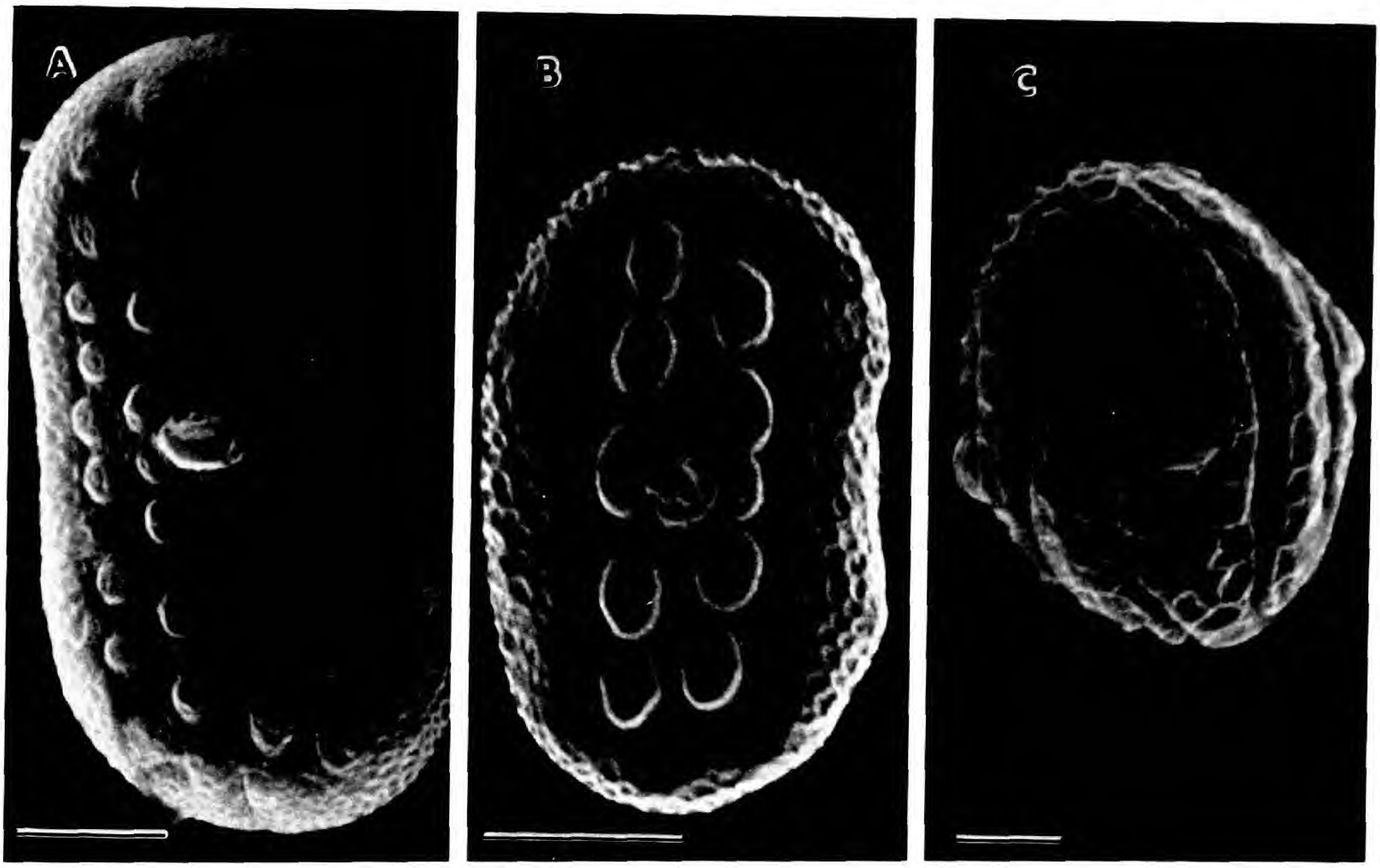

Figure 4. Scanning electron micrographs of *Justicia* pollen. —A. *J. arborescens* (*Haber 893*). —B. *J. circulibracteata* (*Grayum 3634*). —C. *J. densibracteata* (*M. Grayum et al. 7937*). Scale lines represent 10 μm.

the compound inflorescence) to 6 cm long, shorter toward apex of inflorescence, nodes bearing one fertile, externally oriented bract and one sterile, internally oriented bract, fertile bracts green, midrib often reddish, imbricate, elliptic to broadly spathulate, 12–22 mm long, 7–12 mm broad, apically apiculate, glandular-puberulous, eglandular trichomes uniseriate and multicellular, ciliate, sterile bracts subulate, ca. 10 mm long, 1.9 mm broad; bracteoles oblanceolate, 11–17 mm long, 4–7 mm broad, pubescence like bracts. Flowers one per bract; calyx 5-merous, lobes subulate, ca. 10 mm long, 2 mm broad, glandular-puberulous, ciliolate; corolla white tinged with purple externally, 2.7–2.9 cm long (including lips), the tube cylindrical, 2.5 mm broad, expanding slightly at the throat to ca. 3 mm, puberulous, lips 10 mm long, upper lip 4 mm broad, minutely bilobed, lobes ca. 1 mm long, lower lip 5–6 mm broad at base of lobes, three-lobed, the lobes ca. 3 mm long, middle lobe ca. 3 mm broad, lateral lobes ca. 2 mm broad; stamens exserted to tip of upper lip, thecae attached one slightly above the other, ca. 4 mm long, both spurred but the upper theca less so; pollen prolate, 48–55 × 39–45 μm, 4-colporate, pores operculate, paired inaperturate colpi lying between each pair of aperturate colpi, aperturate colpi extending ca. ⅔ the distance from equator to poles, adjacent inaperturate colpi joined near the poles, sculpting of intercolpate regions coarsely reticulate, sculpting of colpi essentially smooth; stigma minutely bilobed and infundibular reaching to ca. 2–3 mm from tip of upper lip, style in a dorsal rugula of corolla, filiform, hyaline, ca. 25 mm long, ovary ca. 1.5 mm long, sparsely puberulous, trichomes as on bracts, borne on a disk ca. 2 mm diam. Fruit clavate, 14–16 mm long, ca. 4 mm broad, ca. 3.5 mm thick, puberulous; seeds 4, suborbicular, compressed, surface minutely reticulate, ca. 3 mm diam.

Habitat, distribution, and phenology. *Justicia densibracteata* is found in wet primary forest between sea level and about 600 m on the Caribbean slope of Costa Rica. Collectors working at these elevations at other sites on the Caribbean slope of Costa Rica, adjacent Nicaragua, and Panama should watch for this distinctive plant. Plants collected in January had both flowers and fruits; however, many more collections will be needed before flowering and fruiting seasons can be determined with confidence.

Etymology. The specific epithet refers to the compact arrangement of the bracts in the inflorescences.

Using Graham's (1988) key to sections of *Justicia*, this new species keys to section *Plagiacanthus*, a group characterized by compound inflorescences with spicate units, glandular rachises, and calyces of five equal parts. This species, however, differs from members of this section in having elliptic to obovate bracts that exceed the calyx (vs. subulate bracts that are shorter than the calyx) and in pollen type. The pollen of *J. densibracteata* does not correspond to any of the types described by Graham (1988), differing in number and type of apertures as well as in sculpturing. However, it bears considerable resemblance both in nature of apertures and sculpture pattern to the pollen of *J. montana* (Standley & Leonard) D. N. Gibson of Guatemala (Gibson, 1972), *J. orosiensis* Durkee (Durkee, 1986), and to that of two species of *Dicliptera* from the Guianas (Wasshausen, 1991), although pollen grains of the *Dicliptera* species are 3-colporate. Clearly much work remains to be done on pollen morphology and its taxonomic significance in these plants.

Among Costa Rican species of *Justicia*, *J. densibracteata* is distinctive and may be recognized by its spicate panicles with large, green, imbricate bracts, nodes bearing one fertile and one sterile bract, narrow, white corollas, 4-colporate pollen, and rather large ovate leaves. It bears considerable resemblance to *J. peninsularis* Gómez-Laurito & Hammel (of the Osa Peninsula), which has similar inflorescences with nodes bearing one fertile and one sterile bract. The two species can be distinguished by the breadth, shape, and vestiture of their fertile bracts (5–8 mm broad, narrowly spathulate, with multiseriate eglandular trichomes and minute sessile glands in *J. peninsularis* vs. 7–12 mm broad, elliptic to broadly spathulate, with multiseriate eglandular and glandular trichomes in *J. densibracteata*), size of bracteoles (10–15 mm long, 1–2.5 mm broad in *J. peninsularis* vs. 11–17 mm long, 4–7 mm broad in *J. densibracteata*), length of calyx (8–9 mm long in *J. peninsularis* vs. ca. 10 mm long in *J. densibracteata*), and size and vestiture of capsules (9–12 mm long, glabrous in *J. peninsularis* vs. 14–16 mm long, puberulous in *J. densibracteata*). Perhaps the strongest evidence for recognizing these two species as distinct is that pollen grains are quite different: those of *J. densibracteata* lack insulae, whereas pollen grains of *J. peninsularis* have the pores flanked by rows of six or seven insulae. Gómez-Laurito and Hammel (1994: 357) have noted the similarity of these two species and refer to several additional differences. A number of these alleged differences do not appear to be the case now that additional material of both species is available. From our studies, it appears that at least some specimens of *J. peninsularis* have sparsely pubescent rather than glabrous leaves and pedicels (e.g., *Marin 293,* MO), and flowers that, like those of *J. densibracteata,* are white with purple markings rather than green. The leaves of *J. peninsularis* do appear to be larger than those of *J. densibracteata,* but there is considerable overlap. Still these two species can be distinguished readily by the differences presented above.

Justicia densibracteata also resembles *J. orosiensis* Durkee, which has similar inflorescences with nodes of branches bearing one fertile and one sterile bract, as well as 4-colporate pollen. *Justicia densibracteata* differs in its longer, glandular-puberulous bracts (12–22 mm long vs. 6–8 mm, mostly basally strigose), longer, glandular-puberulous calyx segments (ca. 10 mm long vs. 6–7 mm, glabrous), and longer, puberulous corollas (2.7 cm long vs. 1.6–1.7 cm, glabrous).

Among Panamanian species of *Justicia* that do not also occur in Costa Rica, three species recently described by Daniel and Wasshausen (1990), *J. fortunensis*, *J. veraguensis*, and *J. readii*, have spicate inflorescences and bracts that are similar in shape to those of *J. densibracteata.* However, these species have simple, unbranched spikes that are axillary as well as terminal, and corollas that are much shorter than those of *J. densibracteata* (to 19 mm in *J. readii* vs. 27 mm long).

No species of *Justicia* are known to occur in Nicaragua that are not also found in Costa Rica, thus none additional with which *J. densibracteata* might be confused (Durkee, in prep.).

Although similar to this new species palynologically (see above), the Guatemalan species *Justicia montana* (Standley & Leonard) D. N. Gibson is a decumbent plant with much smaller leaves, bracts and calyces.

Justicia chol T. F. Daniel of Mexico (Daniel, 1995) also has spikelike inflorescences with nodes bearing one fertile and one sterile bract, but its pollen is 3-aperturate. As noted in the introduction, inflorescence architecture warrants further study in these plants as a character of potential phylogenetic utility.

Paratypes. COSTA RICA. **Limón:** Zona Protectora Barbilla, 10°00.5′N, 83°28.5′W, SE of Siquirres in primary forest, 600–660 m, 11 Jan. 1987, *M. Grayum et al. 7937* (INB, MO); Parque Nacional Tortuguero, Estación Agua Fría, 3 km sur siguiendo el Sendero Real, bosque primario, 10°27′N, 83°34′W, 40 m elev., 18 Jan. 1988, *R. Robles 1524* (DUKE, INB, MO).

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Wasshausen, D. C. 1991. New species of *Dicliptera* (Acanthaceae) from the Guianas. Brittonia 43: 1–6.

Notes on Some Scrophulariaceae from China

Hong De-yuan

Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Xiangshan, Beijing 100093, China

ABSTRACT. A new species, *Veronica laxissima*, is described. Five new combinations, *Pseudolysimachion rotundum* (Nakai) Yamazaki subsp. *coreanum* (Nakai) Hong, *P. rotundum* subsp. *subintegrum* (Nakai) Hong, *P. linarifolium* (Pallas ex Link) Holub subsp. *dilatatum* (Nakai & Kitagawa) Hong, *Veronica himalensis* D. Don subsp. *yunnanensis* (Tsoong) Hong, and *Veronicastrum brunonianum* (Bentham) Hong subsp. *sutchuenense* (Franchet) Hong, are proposed. One genus, *Sinobacopa*, 12 species, and 2 infraspecific taxa are reduced to synonymy.

During a recent visit to the herbaria A, GH, MO, NY, and US to study the Chinese Scrophulariaceae, it became obvious that the nomenclature of several taxa required adjustments. These adjustments, as well as a new species, are herein proposed to make the names available for the forthcoming account of the family in volume 18 of the *Flora of China.*

Bacopa Aublet, Hist. Pl. Guiane 1: 128. 1775.

Sinobacopa Hong, Acta Phytotax. Sin. 25: 393. 1987. Syn. nov. TYPE: *Sinobacopa aquatica* Hong.

Bacopa repens (Swartz) Wettstein in A. Engler & K. Prantl, Nat. Pflanzenfam. IV, 3B: 76. 1891.

Sinobacopa aquatica Hong, Acta Phytotax. Sin. 25: 395. 1987. Syn. nov. TYPE: China. Guangdong: "Hainan Island, Lingshui," 11 Aug. 1983, *Diao Zheng-su 1715* (holotype, PE).

Authentic material and other collections of *Bacopa repens* were not available for study when the genus *Sinobacopa* and its single species, *S. aquatica,* were described.

Euphrasia matsudae Yamamoto, Trans. Nat. Hist. Soc. Taiwan 20: 107. 1930.

Euphrasia bilineata Ohwi, Acta Phytotax. Geobot. 2: 306. 1933. Syn. nov. TYPE: China. "Formosa: inter Pianan-anbu et Shikayausha in Taichushu," *J. Ohwi 2779* (holotype, KYO).

Euphrasia exilis Ohwi, Acta Phytotax. Geobot. 2: 306. 1933. Syn. nov. TYPE: China. "Formosa: in m. Daibu in Takaoshu," *J. Ohwi 1809* (holotype, KYO).

Euphrasia masamuneana Ohwi, Acta Phytotax. Geobot. 2: 307. 1933. Syn. nov. TYPE: China. "Formosa: Nokogoe in Taichushu," *J. Ohwi 3386* (holotype, KYO).

Euphrasia filicaulis Kimura, Acta Phytotax. Geobot. 13: 203. 1943. Syn. nov. TYPE: "Taiwan. Prov. Karenkō, Kita-gokanzan," 10 Sep. 1934, *M. Tagawa 843* (holotype, KYO).

In his key to the species, Ohwi (1933) separated *Euphrasia exilis* primarily based on having leaves with only one tooth on each side, *E. bilineata* by having stems biseriately pubescent, and *E. masamuneana* by having wider, ovate-orbicular leaves with more obtuse teeth. The original publication of *E. filicaulis* describes the corolla as 12 mm long and the leaves as glabrous, 2–3 times as long as wide, and with one or two teeth on each side. An examination of a large number of specimens of the taxa listed here under *E. matsudae* shows that the stems vary from erect to ascending or decumbent and from being pubescent throughout to basally pubescent and apically biseriately pubescent or biseriately pubescent throughout. Furthermore, the corolla length varies considerably (6–12 mm), and the leaves vary from orbicular to narrowly oblong, and the marginal teeth from 1 to 4 along each side. All of these characters exhibit continuous variation, and some vary even on the same individual. Therefore, it is better to treat these minor segregates as synonyms of *E. matsudae.*

Linaria thibetica Franchet, Bull. Soc. Bot. France 47: 11. 1900.

Linaria yunnanensis W. W. Smith var. *caerulea* Li, Bot. Bull. Acad. Sin. 3: 208. 1962. Syn. nov. TYPE: China. Yunnan: "Mount Peimashan, Mekong–Yangtze divide between Atungtze and Pungtzera," July 1923, *J. F. Rock 10039* (holotype, US; isotype, PH).

Pseudolysimachion incanum (L.) Holub, Folia Geobot. Phytotax. 2, 4: 424. 1967.

Veronica xilinensis Y. Z. Zhao in Y. C. Ma, H. C. Fu & S. Chen, Fl. Intramongol. 5: 412. 1980. Syn. nov. TYPE: China. Nei Mongol: Xilingolemeng, Abahanaerqi, 25 July 1979, *Liou Shu-run 942* (holotype, HIMC).

The original description and illustration of the holotype of *Veronica xilinensis* clearly show no distinct differences from plants of *Pseudolysimachion incanum.*

Pseudolysimachion kiusianum (Furumi) Holub, Folia Geobot. Phytotax. 2: 424. 1967.

Veronica glabrifolia Kitagawa, J. Jap. Bot. 17: 238. 1941. Syn. nov. TYPE: China. "Manshuria. An-Tung," 7 Aug. 1931, *M. Kitagawa s.n.* (holotype, TI).

Pseudolysimachion rotundum (Nakai) Yamazaki subsp. **coreanum** (Nakai) Hong, comb. nov. Basionym: *Veronica coreana* Nakai, Bot. Mag. (Tokyo) 32: 228. 1918. TYPE: Korea. "Montibus Chirisan," *Tamezo Mori 281* (holotype, TI).

Pseudolysimachion rotundum (Nakai) Yamazaki subsp. **subintegrum** (Nakai) Hong, comb. nov. Basionym: *Veronica spuria* L. var. *subintegra* Nakai, Bot. Mag. Tokyo, 25: 62. 1911. TYPE: Korea. "Kyöng-san, Mulgeum," *T. Uchiyama s.n.* (holotype, TI).

Pseudolysimachion linarifolium (Pallas ex Link) Holub subsp. **dilatatum** (Nakai & Kitagawa) Hong, comb. nov. Basionym: *Veronica angustifolia* Fischer var. *dilatata* Nakai & Kitagawa, Rep. First Sci. Exped. Manch. Sect. 4(1): 54. 1934. TYPE: China. "Hsing-lung-t'ang, Peiying-fang," 27 Aug. 1933, *N. H. Kitagawa s.n.* (holotype, TI).

Striga lutea Loureiro, Fl. Cochinch. 1: 22. 1790.

Striga hirsuta Bentham var. *humilis* Bentham in A. de Candolle, 10: 503. 1846. Syn. nov. TYPE: India. "In Nilghiries," *Perrott s.n.* (holotype, G).

Veronica deltigera Wallich ex Bentham, Scrophul. Ind. 45. 1835.

Veronica semiamplexicaulis Hong in Tsoong & H. P. Yang, Fl. Reipubl. Popularis Sin. 67(2): 404. 1979. Syn. nov. TYPE: China. "[Xizang: Nyalam Xian," Hou Shan, Zham, *Y. T. Chang & K. Y. Lang*] *4521* (holotype, PE).

Veronica semiamplexicaulis is conspecific with *V. deltigera,* a species distributed in eastern Nepal and southern Xizang (Tibet). The latter was confused with *V. lanosa* Royle ex Bentham, and the boundaries between the two were first clarified by Montserrat (1955).

Veronica himalensis D. Don subsp. **yunnanensis** (Tsoong) Hong, stat. nov. Basionym: *Veronica himalensis* D. Don var. *yunnanensis* Tsoong in Tsoong & H. P. Yang, Fl. Reipubl. Popularis Sin. 67(2): 402. 1979. TYPE: China. "[Yunnan: Bijiang Xian, 4000 m,]" *H. T. Tsai 58169* (holotype, PE).

Veronica laxissima Hong, sp. nov. TYPE: China. E Sichuan: Chenkou (Tchen-keou-tin), *R. P. Farges 543* (holotype, US; isotype, PE).

Veronicae sutchuenensi Franchet affinis, sed a qua imprimis differt caulibus prostratis in dimidio inferiore, foliis minoribus et glabris, petiolis brevioribus, inflorescentiis longioribus glandulosisque, pedicellis longioribus, bracteis et calycibus glabris, stylis longioribus.

Perennials. Stems very slender, creeping and rooting at least in lower half, 10–15 cm long, ca. 0.5 mm diam., villous with multicellular hairs. Leaves more than 6-paired, evenly or almost evenly distributed, ovate-orbicular to oblong, glabrous on both surfaces, base rounded, margin crenulate, apex obtuse; lower leaves with petioles 2–3 mm long, small; upper leaves sessile, larger, 10–15 × 6–9 mm. Racemes 2, lax, one in axil of an upper leaf and the other in axil of uppermost leaf, 3–12 cm long; rachises and pedicels densely multicellular glandular; peduncle 3–6.5 cm long; flowers several, distant; bracts linear or linear-elliptic, 2–4 mm long, glabrous. Pedicels straight, 6–7 mm long. Calyx glabrous; lobes 4, elliptic or linear-elliptic, 2.5–3 × 1 mm. Corolla rotate, 7–8 mm diam., tube less than 0.5 mm long, anterior lobe oblong, other 3 lobes oblong-orbicular. Ovaries and young fruits strongly compressed, ciliate, lateral angles rounded. Persistent style 5–6 mm long. Mature fruits not seen.

Although no mature fruits have been seen, other characters indicate that *Veronica laxissima* is most closely related to *V. sutchuenensis* Franchet. *Veronica laxissima* is readily distinguished from that species by having creeping stems, smaller and glabrous leaves, shorter petioles, longer and glandular inflorescences, longer pedicels, glabrous bracts and calyces, and longer styles.

Veronicastrum brunonianum (Bentham) Hong subsp. **sutchuenense** (Franchet) Hong, comb. nov. Basionym: *Calorhabdos sutchuenensis* Franchet, Bull. Soc. Bot. France 47: 18. 1990. TYPE: China. Sichuan: "circa Tchen-keoutin," *Farges s.n.* (holotype, P).

Collections of *Calorhabdos sutchuenensis* from eastern Sichuan and western Hubei show mostly winged stems and/or glabrous filaments, whereas those from the western range of the taxon have pubescent filaments and wingless stems. However, stem and filament characters are not always correlated with each other for material from eastern Sichuan and western Hubei, and some specimens are indistinguishable from those of *Veronicastrum brunonianum* subsp. *brunonianum.*

Veronicastrum villosulum (Miquel) Yamazaki, J. Fac. Sci. Univ. Tokyo 3, 7: 130. 1957.

Botryopleuron macrophyllum Li, Bot. Bull. Acad. Sin. 1: 21. 1960. Syn. nov. TYPE: China. Anhui: "Huang Shan," 550 m, 5 July 1925, *R. C. Ching 4128* (holotype, UC; isotype, NY).

An examination of the type material of *Botryopleurom macrophyllum* reveals that it is indistinguishable from plants of *Veronicastrum villosulum* var. *villosulum.*

Veronicastrum villosulum (Miquel) Yamazaki var. **parviflorum** Chin & Hong in Tsoong & H. P. Yang, Fl. Reipubl. Popularis Sin. 67(2): 401. 1979.

Veronicastrum lungtsuanense M. Cheng & Z. J. Feng, Bull. Bot. Lab. North.-East. Forest. Inst. 8: 1. 1980. Syn. nov. TYPE: China. Zhejiang: "Lungtsuan, mount. Maoshan," 950 m, Sep. 1957, *T. S. Chien 1525* (holotype, SZ).

The original description and illustration of the holotype of *Veronicastrum lungtsuanense* show no differences from material of *V. villosulum* var. *parviflorum.*

Veronicastrum formosanum (Masamune) Yamazaki, J. Fac. Sci. Univ. Tokyo 3, 7: 127. 1957.

Calorhabdos kitamurae Ohwi, Repert. Spec. Nov. Regni Veg. 36: 54. 1934. Syn. nov. TYPE: China. Taiwan. "Tarokokyo," *M. Tatewaki & S. Kitamura s.n.* (holotype, KYO).

Yamazaki (1957) transferred *Calorhabdos kitamurae* to *Veronicastrum* and distinguished it from *V. formosanum* based on its having rigid stems 30–60 cm high and lanceolate to oblong leaves 4–9 × 0.8–2.5 cm, instead of slender stems 15–30 cm high and linear-lanceolate leaves 4–9 × 0.3–0.5 cm. Li (1978) indicated that *V. formosanum* has sessile or short-petiolate leaves, simple stems, terminal inflorescences, and greenish to yellowish flowers, and that *V. kitamurae* has more distinctly petiolate leaves, branched stems, lateral inflorescences, and purplish flowers. None of the alleged differences listed by Yamazaki (1957) or Li (1978) is reliable in differentiating between the two species, and some specimens (e.g., *Ching-I Peng 7281, 5873,* both at HAST) exhibit the characters of both. Therefore, *V. kitamurae* is reduced to synonymy of *V. formosanum.*

A broader concept treating *Veronicastrum formosanum* as a subspecies of *V. caulopterum* (Hance) Yamazaki on the mainland of China is perhaps more practical because the differences separating the two are quantitative.

Acknowledgment. I thank Ihsan Al-Shehbaz for his help in the preparation of the manuscript.

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Yamazaki, T. 1957. Taxonomical and phylogenetic studies of Scrophulariaceae–Veronicae, with special reference to *Veronica* and *Veronicastrum* in eastern Asia. J. Fac. Sci. Univ. Tokyo 3, 7: 91–162.

The New Genus *Calyptranthera* (Asclepiadaceae) from Madagascar

Jens Klackenberg
Naturhistoriska riksmuseet, Sektionen för fanerogambotanik, Box 50007, S-104 05 Stockholm, Sweden

ABSTRACT. A species previously identified as *Toxocarpus caudiclavus* Choux (Asclepiadaceae, Secamoneae) is outside the morphologic and phylogenetic bounds of this genus. Instead, it is more closely related to the Malagasy endemic genus *Pervillea* Decaisne (Secamoneae), with which it shares some gynostegium characters. *Toxocarpus caudiclavus* differs from *Pervillea,* however, in several characters and is best placed in a new genus, *Calyptranthera,* which is herein described and illustrated.

During a survey of the tribe Secamoneae in Madagascar for the *Flore de Madagascar et des Comores,* I came across a taxon of *Toxocarpus, T. caudiclavus* Choux, that has been misplaced.

Toxocarpus caudiclavus was described by Choux (1914: 415), who with some hesitation placed the taxon in this genus. *Toxocarpus* Wight & Arnott is a primarily Asian genus, with a few species described from the African mainland and Madagascar. The type species, *T. kleinii* Wight & Arnott, which is distributed in India and Sri Lanka, is characterized by a two-parted dorsiventrally flattened corona lobe, a stigma head placed directly on the ovary with a thick lower part and a long thin upper part distinctly projecting above the staminal column. The likewise paleotropical *Secamone* R. Brown, the other large genus within the tribe Secamoneae, also described from Asia, differs primarily from *Toxocarpus* by having small flowers, laterally compressed corona lobes, and a short stigma head that does not project above the staminal column. Outside Asia, however, the distinction between these two genera is less marked, and several species of *Toxocarpus* might be better placed in *Secamone,* or both taxa may need to be divided into several smaller monophyletic genera (for discussion and references, see Klackenberg, 1992: 8). In Madagascar none of the diagnostic characters for the two genera holds true, and most Malagasy Secamoneae have hitherto been included in *Secamone* sensu lato. However, a handful of distinctly different Malagasy taxa with large flowers and dorsiventrally flattened corona lobes have been considered to be congeneric with the Asian *Toxocarpus.* Recent studies have shown that the Malagasy *Toxocarpus* is a paraphyletic group composed of species better placed in at least three other genera, i.e., *Secamone* s.l. (Klackenberg, 1992: 20), *Pervillea* (Klackenberg, 1995 and in prep.) and *Calyptranthera* (see below).

Toxocarpus caudiclavus fits neither in *Toxocarpus* s. str. as it is circumscribed in Asia, nor in *Secamone* s.l. as it is known in Madagascar. It differs by its long projecting connectives and by having a discoid stigma head abruptly narrowed into a style and topped by a short broad upper part. This structure is found also in, e.g., Periplocaceae and the Malagasy endemic genus *Pervillea,* but not in *Secamone/Toxocarpus* (see above). Furthermore, in *T. caudiclavus* the four pollinia are adnate to a very thin U-like folded corpusculum without caudicle. These three characters, which distinguish *Toxocarpus caudiclavus* from *Toxocarpus/Secamone,* ally it, however, to *Pervillea.*

Pervillea was described by Decaisne (1844: 613) as a monotypic genus (*P. tomentosa*), but was later included in *Toxocarpus* by Jumelle and Perrier de la Bâthie (1907: 389, 1908: 214). However, it has recently been shown that due to several distinguishing characters, particularly the long projecting connectives, this taxon must be excluded from *Toxocarpus,* and *Pervillea* has been reinstated as a separate genus (Klackenberg, 1995). Furthermore, *Pervillea* is no longer monotypic but comprises, in addition to *P. tomentosa,* two more species: *P. decaryi* (Choux) Klackenberg (= *Toxocarpus decaryi* Choux) and *P. venenata* (Baillon) Klackenberg (= *Menabea venenata* Baillon) (Klackenberg 1995 and in prep.).

Toxocarpus caudiclavus differs from *Pervillea* and *Toxocarpus/Secamone* by the fused connectives forming a calyptra at the top of the gynostegium, the club-shaped appendages on long strings at the top of the prolonged connectives, the filaments with cuplike projections below the anther wings forming the pollinium entrance, the short recurved corona lobes, and the thin hairy submarginal fold at the corolla lobes. None of these features have been observed elsewhere in the tribe Secamoneae. *Toxocarpus caudiclavus* also lacks the unique feature of distinctly curled leaf hairs with much reduced or

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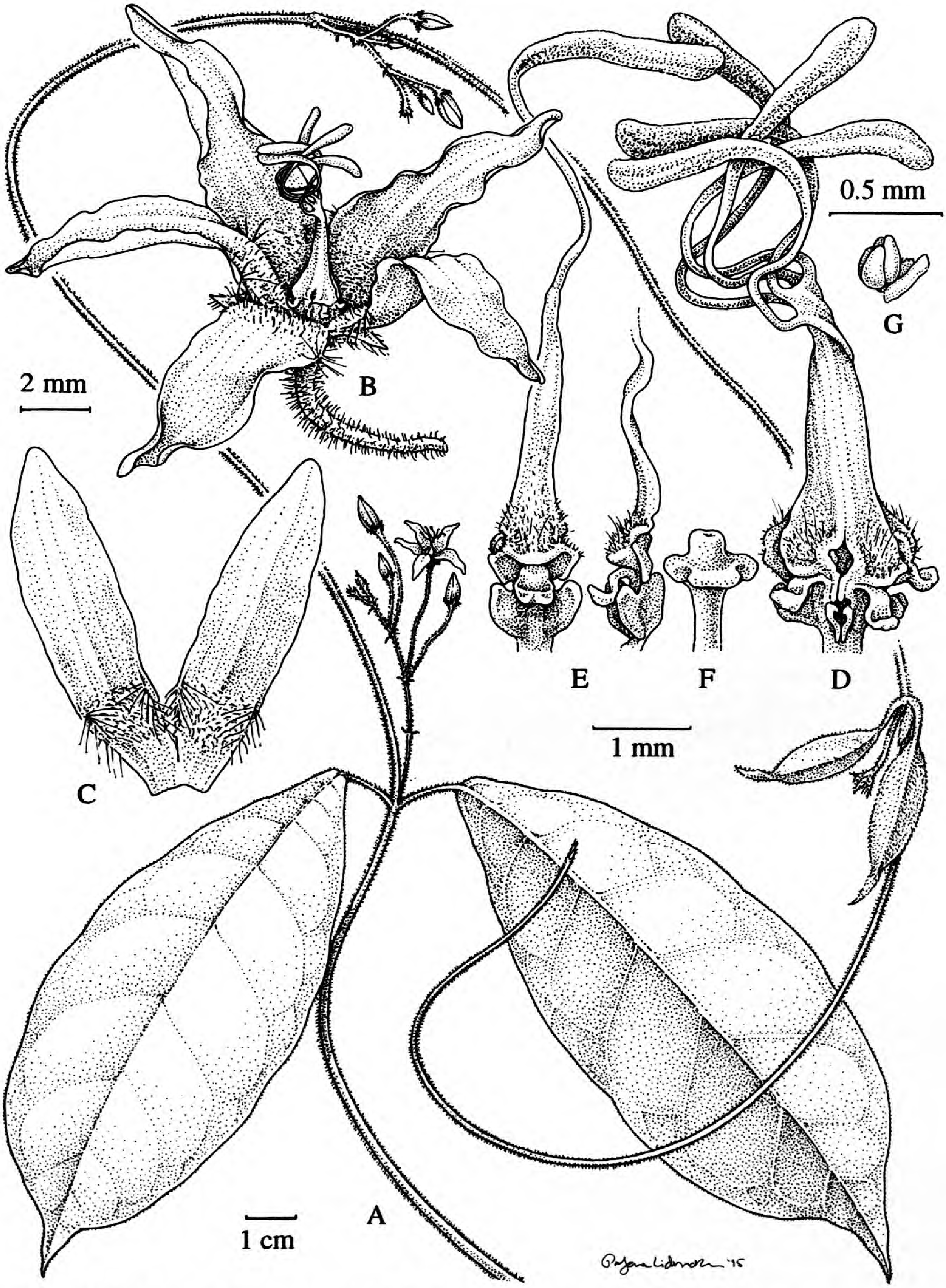

Figure 1. *Calyptranthera caudiclava* (Choux) Klackenberg. —A. Habit. —B. Flower. —C. Portion of corolla from within. —D. Gynostegium. —E. Anther seen from outside (left) and in lateral view (right). —F. Stigma head. —G. Pollinarium in lateral view. A–G, *Perrier de la Bâthie 11747* (P).

absent lumen, which are characteristic of *Pervillea.* Consequently, *T. caudiclavus* must be excluded from *Toxocarpus* and does not fit in *Pervillea.* Including *T. caudiclavus* in *Pervillea* would make this genus unnecessarily heterogeneous. Furthermore, a phylogenetic analysis (Klackenberg, in prep.) clearly demonstrates that *T. caudiclavus* is not an apomorphic ingroup (as might be suspected because of the fused connectives), but is phylogenetically separate from *Pervillea.* A new genus, *Calyptranthera,* is thus proposed for this taxon. The name alludes to the unique calyptra above the gynostegium formed by the anthers.

Calyptranthera Klackenberg, gen. nov. TYPE: *Toxocarpus caudiclavus* Choux = *Calyptranthera caudiclava* (Choux) Klackenberg.

Genus hoc *Pervilleae* connectiviis ultra loculos productis et structura pollinarii affinis vel differt connectiviis connatis et distincte appendiculatis, prominentiis cyathiformibus prope basin filamentorum, lobis coronae brevibus necnon recurvatis, et pilis non crispis. A *Toxocarpo* stigmate brevi et lato cum parte inferiori angusta (stylus) insuper distinguenda.

Calyptranthera caudiclava (Choux) Klackenberg, comb. nov. Basionym: *Toxocarpus caudiclavus* Choux, Ann. Inst. Bot.-Géol. Colon. Marseille, sér 3(2): 415. 1914. TYPE: Madagascar. Forêt orientale, Mt. Vatovavy, 300 m alt., 1911, *Perrier de la Bâthie 11747* (lectotype, selected here, P). Figure 1.

Suffrutescent twiner; younger branches with rather stiff, erect reddish hairs. Leaf blades 10–14 × 4–5.5 cm, oblong to obovate, cuneate but minutely cordate at the very base, acuminate, with even or somewhat revolute margins, reddish erect hairs with lumen beneath, glabrescent above, with usually one colleter at the base above; venation pinnate and looped, reticulate; midrib, primary and secondary veins distinctly raised below when dry; petiole distinct, ca. 1 cm long, densely hairy when young, glabrescent. Inflorescences much shorter than the adjacent leaves; cyme lax, hairy, with only a few flowers developed at the same time; pedicels in pairs, up to 2 cm long; bracts 2–3 mm long. Calyx lobes ca. 2 × 0.9 mm, longer than the tube, ovate-triangular, acute, with long straight hairs outside, glabrous inside. Corollas contorted, with the left lobe margins overlying, not twisted, the lobes fused at the base only into a short wide tube, greenish white with reddish spots; tube ca. 0.4 mm long, glabrous; lobes ca. 9 × 2.5 mm, oblong, acute but rounded at the very apex, inside glabrous below for ca. 1.5 mm then covered with rather long, ± erect white hairs for a zone of ca. 1.5 mm but glabrous above, with a few scattered longer reddish hairs outside. Staminal column in total ca. 8 mm high; filaments with projecting margins forming a cup (pollinia entrance) jutting out below the anther wings; anthers with connectives excluded ca. 1 mm long; connectives fused and projecting well above the thecae, forming a cone crowned with five elongated papillate clubs on free stalks, papillate and hairy below between the thecae. Corona lobes somewhat spathulate, truncate at the apex, bent downwards and outwards, much shorter than the connectives, glabrous. Pollinia ca. 0.2 mm long. Style abruptly broadened to a discoid stigma head ca. 1 mm broad with short upper part ca. 0.7 mm high. Fruits not seen.

Calyptranthera caudiclava, the only known species of this genus, is hitherto known only from Mt. Vatovavy on the east coast of Madagascar in rainforest at ca. 300 m altitude; flowering in October.

Acknowledgments. I thank P. O. Karis, Stockholm, for commenting on the manuscript and Pollyanna Lidmark, also at our Museum, for providing the illustration.

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New Andean Species of *Solanum* Section *Geminata* (Solanaceae)

Sandra Knapp

Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

ABSTRACT. Three new Andean species of *Solanum* sect. *Geminata* are described: *S. youngii* from Peru and Ecuador, *S. quebradense* from Venezuela, and *S. habrocaulon* from Peru. Relationships within section *Geminata* are discussed, and the species are illustrated.

Solanum is one of the largest genera of flowering plants, with approximately 2000 valid species. Section *Geminata* (G. Don) Walpers (s.l.) is one of the largest subdivisions of the nonspiny solanums, with some 145 species. Members of the section are distinguished from other nonspiny solanums by their shrubby habit, small white flowers in leaf-opposed inflorescences, and hard green fruits at maturity. Section *Geminata* itself is composed of several smaller monophyletic groupings and is probably related to the *Solanum nitidum* species group and section *Holophylla* (G. Don) Walpers (s. str.). A key distinguishing these groups can be found in Knapp (1989).

Most of the members of section *Geminata* grow in the understory of primary forest and are rare plants of limited distribution. All but one of the species of section *Geminata* are found in the Neotropics, with the highest concentration in the Andes and their foothills. These foothill areas are particularly rich in taxa of families that are primarily understory shrubs (Gentry, 1982), and species diversity of *Solanum* sect. *Geminata* is extremely high in the Andes (Knapp, 1986).

Solanum youngii S. Knapp, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Parque Nacional Podocarpus, Loja–Zamora road just E of pass, ca. 2800 m, 3°58′S, 79°07′W, 15 Mar. 1989, *Madsen 85888* (holotype, QCA; isotype, AAU). Figure 1A, B.

Frutex; caules dense pubescentes trichomatibus dendriticis; sympodia difoliata, geminata; folia elliptica vel ovata valde bullata subtus dense dendritico-pubescentia; corolla alba; bacca globosa in pedicello erecto portata; semina complanata reniformia.

Shrubs, 1.5–2 m tall; young stems and leaves densely pubescent with matted dendritic trichomes to 1.5 mm long, the trichomes drying a rich golden brown; stems thick, erect; bark of mature stems dark gray. *Sympodial units* difoliate, geminate, occasionally appearing unifoliate through loss of the minor leaf. *Leaves* elliptic to ovate, widest at or just below the middle, thick and fleshy, strongly bullate and corrugated when dry, with 5–6 pairs of primary veins, sparsely to moderately pubescent with dendritic trichomes adaxially, densely pubescent with dendritic trichomes 1–1.5 mm long abaxially, the trichomes denser along the veins, major leaves 7–17 × 4–9.5 cm, the apex acute, the base decurrent onto the petiole; petiole 1.2–2 cm long; minor leaves differing from the majors only in size, 4–8 × 2–4 cm; petiole ca. 1 cm long. *Inflorescences* opposite the leaves, simple, 0.5–7 cm long, 5–40-flowered, but bearing only a few flowers at a time, densely pubescent with dendritic trichomes like those of the stems and leaves. *Pedicel scars* closely spaced, obscured by the dense pubescence of the inflorescence axis. *Buds* globose, later elliptic, strongly exserted from the calyx tube. *Pedicels at anthesis* erect to somewhat deflexed, thick and fleshy, 0.8–1 cm long, pubescent with trichomes like the rest of the inflorescence. *Flowers* with the calyx tube broadly conical, 1–1.5 mm long, the lobes triangular and irregularly splitting, 1–4 mm long, with a tuft of dendritic trichomes at the tips, otherwise sparsely pubescent; *corolla* white, waxy, 1.7–2 cm diam., lobed ca. ⅔ of the way to the base, the lobes planar at anthesis, tips of the lobes with a tuft of dendritic trichomes ca. 0.5 mm long, the margins papillose; *anthers* 5–6 × 1–2 mm, poricidal at the tips, the pores lengthening to slits with age; free portion of the filaments ca. 0.5 mm long, the filament tube ca. 0.5 mm; ovary glabrous; style 7–9 mm long, glabrous; stigma bilobed, the surface minutely papillose. *Fruit* a globose, green berry, 1–1.2 cm diam.; *fruiting pedicels* erect and woody, ca. 2 cm long, ca. 1.5 mm diam. at the base, ca. 2.5 mm diam. at the apex, 1–2 stone cells occasionally present in the pericarp. *Seeds* dark brown, flattened reniform, 2–3 × 1.5–2 mm, the margins incrassate and paler, the surfaces minutely pitted.

Figure 1. —A. Holotype of *Solanum youngii* S. Knapp (*Madsen 85888,* QCA). —B. Isotype of *Solanum youngii* (*Madsen et al. 85888,* AAU).

Distribution. In wet montane and cloud forest, often in forest patches above timberline, in southern Ecuador and northern Peru, from 2800 to 3500 m. Figure 2.

The strongly bullate leaves and the dense dendritic pubescence make this species very distinctive. The trichomes are slender and very highly branched, and the branches themselves are very short. *Solanum youngii* is morphologically most similar to *S. nutans* Ruiz & Pavón, also of the Andean cloud forests, but differs from it in its more loosely branched pubescence, bullate leaves and difoliate geminate sympodial units. It shares with *S. nutans* dark brown, flattened reniform seeds, somewhat pointed fruits, and a high-elevation habit. The stone cells observed in the single fruiting specimen (*Young 2157*) may not be typical for the species: in other species of section *Geminata* such hardened growths are produced in response to insect attack.

This species is named for Ken Young, who has done much for the preservation and study of the montane forests of the central Andes.

Paratypes. ECUADOR. **Loja:** Parque Nacional Podocarpus, S of Loja, Centro de Información E of Nudo de Cajanuma, 2850–2950 m, 4°5′S, 79°10′W, 21–22 Feb. 1985, *Øllgaard et al. 57903* (AAU). **Zamora-Chinchipe:** Loja–Zamora road, near the pass, 2800–2900 m, 15 Mar. 1989, *Romoleroux 814* (AAU). PERU. **San Martín:** Río Abiseo National Park, Chochos, ca. 3425 m, 7°S, 77°W, 25 Nov. 1985, *Young 2157* (F, NY, USM); trail between Mirador and Puerto del Monte, 3300–3450 m, 7°S, 77°W, 27 June 1986, *Young 3833* (NY, USM).

Solanum quebradense S. Knapp, sp. nov. TYPE: Venezuela. Mérida: Mucurubá, quebrada near town, ca. 2600 m, 25 June 1930, *Gehriger 244* (holotype, NY; isotypes, F, MO). Figures 3, 4A.

Frutex vel arbor parva; caules dense pubescentes trichomatibus simplicibus uniseriatis; sympodia unifoliata; folia elliptica vel anguste elliptica supra glabra subtus plusminusve dense pubescentia trichomatibus simplicibus, praesertim in venis densa; inflorescentiae foliis oppositae simplices dense pubescentes; corolla alba; bacca globosa, in pedicello erecto portata; semina ovoideo-reniformia.

Shrubs or treelets, 1–2 m tall; young stems and leaves densely pubescent with simple, uniseriate trichomes 0.5–1 mm long, the stems erect; bark of older stems grayish brown. *Sympodial units* unifoliate. *Leaves* elliptic to narrowly elliptic, widest

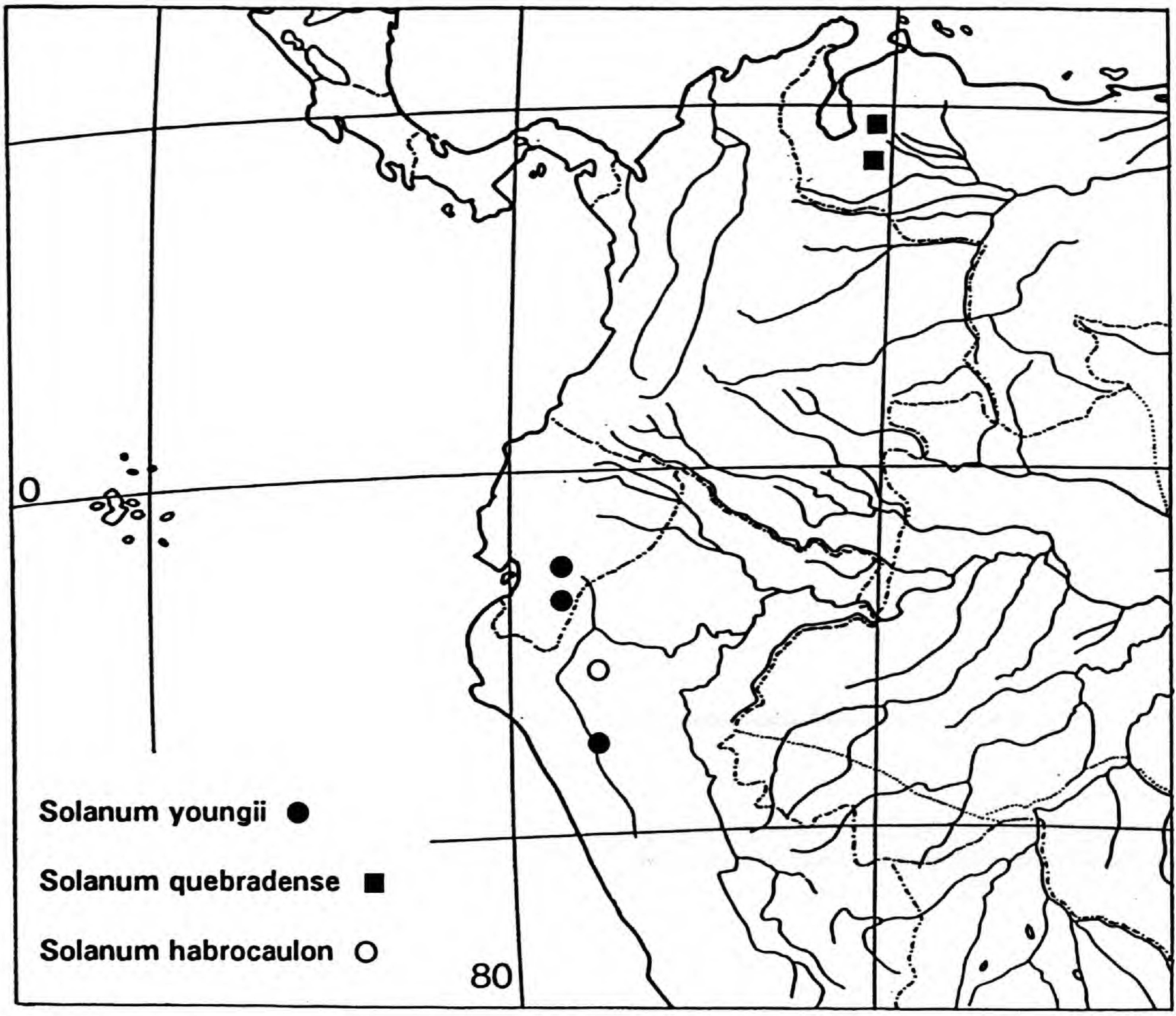

Figure 2. Distribution of *Solanum youngii*, *Solanum quebradense*, and *Solanum habrocaulon*.

at the middle, with 6–9 pairs of primary veins, thick and somewhat coriaceous, glabrous adaxially, densely to moderately pubescent abaxially with simple uniseriate trichomes 1–1.5 mm long, these denser along the veins, lamina 4–15 × 1.5–5 cm, the apex acute to acuminate, the base acute, somewhat decurrent onto the petiole; petiole 1–1.5 cm long. *Inflorescences* opposite the leaves, simple, 3–5 mm long, 5–8-flowered, densely pubescent with simple uniseriate trichomes like those of the stems and leaves. *Pedicel scars* closely spaced, overlapping. *Buds globose,* later elliptic, strongly exserted from the calyx tube just before anthesis. Pedicels at anthesis reflexed to somewhat erect(?). *Flowers* with the *calyx* tube broadly conical, 1–1.5 mm long, the lobes elongate deltate, with the tips rounded, 1–2 mm long, sparsely pubescent with simple uniseriate trichomes; *corolla* white, 1–1.2 cm diam., lobed ca. ¾ of the way to the base, the lobes planar (?) at anthesis, the tips and margins of the lobes densely pubescent with simple trichomes; *anthers* 4.5–5 × 1–1.5 mm, poricidal at the tips, the pores lengthening to slits with age; free portion of the filaments ca. 0.5 mm long, filament tube ca. 0.5 mm long; ovary glabrous; style 6–7 mm long; stigma capitate and minutely bilobed, the surface papillose. *Fruit* a globose, green berry, 1–1.2 cm diam.; *fruiting pedicels* erect, woody, 1.7–2.7 cm long, ca. 1.5 mm diam. at the base, ca. 2 mm diam. at the apex. *Seeds* dark brown, ovoid-reniform, 3–4 × 2–2.5 mm, the surface very smooth, the embryo clearly visible through the testa.

Distribution. Cloud forests in the Venezuelan Andes in the states of Mérida and Trujillo, from 2200 to 3200 m. Figure 2.

Solanum quebradense is superficially very similar and probably closely related to *S. callianthum* C.V. Morton of high-elevation Colombia. It can be dis-

Figure 3. *Solanum quebradense* S. Knapp (*Knapp & Mallet 6778*, Edo. Trujillo, Venezuela). Photo actual size.

tinguished from that species by its simple rather than dendritic pubescence, narrower leaves, glabrous ovaries, and smaller, less fleshy flowers. These two species share uniseriate, rather than arachnoid, pubescence. Fruits of *Knapp & Mallet 6778* were very pale green to nearly white in color. Only the type collection bears flowers.

This species is named for the habitat in which the type was collected, a small stream or quebrada.

Paratypes. VENEZUELA. **Mérida:** Monte Zerpa, Páramo de los Conejos, 3100–3200 m, 16 May 1964, *Bernardi 1255* (NY); San Javier valley, along Quebrada La Cueste toward Monterrey, 2500–2650 m, 10 Dec. 1983, *Weitzmann et al. 48* (NY, US). **Trujillo:** old road from Bocono to Trujillo, ca. 51 km W of Trujillo, below summit, 2200–2250 m, 9°21′N, 70°19′W, 20 Oct. 1984, *Knapp & Mallet 6778* (BH, K, MY, VEN).

Solanum habrocaulon S. Knapp, sp. nov. TYPE: Peru. Amazonas: Bongará, 4 km N of Pomacochas on road to Rioja, trail down gorge to W of road, 2150–2200 m, 5°40′S, 77°22′W, 2 June 1986, *Knapp et al. 7507* (holotype, USM; isotype, MO). Figure 4B.

Frutex; caules glabri valde alati; sympodia unifoliata; folia elliptica glabra; inflorescentiae foliis oppositae simplices filiformes; corolla ignota; bacca globosa in pedicello deflexo portata; semina ignota.

Small shrubs with arching flattened branches, ca. 1.5 m tall; young stems and leaves completely glabrous, stems strongly winged from the inflorescence not from the leaf bases, a few papillae present in the axils of the new leaves; bark of older stems dark brown. *Sympodial units* unifoliate. *Leaves* narrowly elliptic to lanceolate, widest just below the middle, with 7–8 pairs of primary veins, glabrous on both surfaces, 6–9 × 1.5–2.7 cm, the apex acuminate, the ultimate tip rounded, margins of the tips minutely ciliate, the base attenuate, decurrent onto the petiole; petiole 2–3 mm long. *Inflorescences* opposite the leaves, almost sessile, simple, 1–2 mm long, 1-2-flowered, glabrous. *Pedicel scars* closely spaced. *Buds* and *flowers* not known. *Fruit* a globose green berry, 0.7–1 cm diam. (immature); *fruiting pedicel* pendant, somewhat woody, 2–2.5 cm long, ca. 0.5 mm diam. at the base, ca. 2 mm diam. at the apex. *Seeds* not known.

Figure 4. —A. Holotype of *Solanum quebradense* S. Knapp (*Gehriger 244,* NY). —B. Isotype of *Solanum habrocaulon* S. Knapp (*Knapp et al. 7507,* MO).

Distribution. Known only from the type locality in montane northern Peru, at ca. 2200 m. Figure 2.

Solanum habrocaulon is a member of the *Solanum dolosum* species group, a small assemblage of three species distributed along the Andes from southern Colombia to Bolivia. The group is characterized by its delicate habit, unifoliate sympodia, long-acuminate leaves with ciliate margins at the tips, and very small flowers. *Solanum habrocaulon* is distinguished from the other members of the *dolosum* species group (*S. dolosum* C. V. Morton ex S. Knapp, *S. gonyrhachis* S. Knapp) by its completely glabrous foliage, strongly winged stems, and minute inflorescences. Members of this group are all apparently rare, but since they are inconspicuous plants of the forest understory it is possible that they are merely undercollected.

This species is named for its winged stems: habro (Greek)—winged, caulon (Greek)—stem.

Acknowledgments. I thank Blanca León, Emma Cerrate de Ferreyra, Ramón Ferreyra, Magda Chanco, and Oscar Tovar for help at USM and in Peru in general; Carmen Emilia Benítez de Rojas for help in Venezuela; James Mallet, Peter Alcorn, and Harriet Eeley for field assistance; the authorities in Peru and Venezuela for permission to collect plants; and the curators of AAU, F, MO, NY, and QCA for the loan of specimens.

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Miscellaneous Mistletoe Notes, 20–36

Job Kuijt
Missouri Botanical Garden, and (mailing address) Department of Biology, University of Victoria, Victoria, B.C. V8W 2Y2, Canada

Elizabeth A. Kellogg
Harvard University Herbaria, 22 Divinity Ave., Cambridge, Massachusetts 02138, U.S.A.

ABSTRACT. The following new species are described and illustrated: *Dendrophthora haberi* Kuijt, *Dendrophthora lacryma-jobi* Kellogg, *Dendrophthora oligantha* Kuijt, *Dendrophthora scopulata* Kuijt, *Phoradendron diminutivum* Kellogg, *Phoradendron kelloggii* Kuijt, *Phoradendron kingii* Kuijt, *Phoradendron roldanii* Kuijt, *Phoradendron triflorum* Kellogg, *Phoradendron websteri* Kuijt, and *Psittacanthus breedlovei* Kuijt. Recombined names include *Dendrophthora densifrons* (Ule) Kuijt, *Dendrophthora fanshawei* (Maguire) Kuijt, and *Dendrophthora intermedia* (Rizzini) Kuijt. The *Dendrophthora obliqua-fendleriana* complex is discussed, as are the recently recombined names *Dendrophthora fendleriana* (Eichler) Kuijt, *Phthirusa podoptera* (Chamisso & Schlechtendal) Kuijt, and *Phthirusa stelis* (L.) Kuijt, including an extended synonymy of the latter.

A number of new species and combinations are presented here in connection with forthcoming regional treatments of the Loranthaceae and Viscaceae of various parts of South America. Additionally, some explanations are provided for the use of certain names in these treatments, since such explanations cannot be given there. Previous installments in this series were published in *Brittonia* (32: 518–529. 1980; and 39: 447–459. 1987). The second author is responsible for species number 24, 28, and 32, the first author for remaining items, including the illustrations.

20. Dendrophthora densifrons (Ule) Kuijt, comb. nov. Basionym: *Phoradendron densifrons* Ule, Notizbl. Bot. Gart. Berlin-Dahlem 6: 292. 1915. TYPE: Venezuela/Guyana. Mt. Roraima, 1900 m, *Ule 8602* (MG not seen).

A very rare species, known from the type and the two following recent collections: Venezuela. Bolívar: Chimantá Massif, Central Section, tributary of E branch of headwaters of Río Tirica, 2185–2210 m, on *Ternstroemia, Steyermark & Wurdack 858* (F, NY); wide valley of SE part of Apakarátepui, 05°19′N, 62°12′W, 2150 m, *Huber & Cleef 13153* (LEA, MYF).

21. Dendrophthora fanshawei (Maguire) Kuijt, comb. nov. Basionym: *Phoradendron fanshawei* Maguire, Bull. Torrey Bot. Club 75: 300. 1948. TYPE: Guyana. Potaro River Gorge below Tukei, *Maguire & Fanshawe 27201* (holotype, NY; isotype, K).

This species is distinguishable from the closely related *Dendrophthora obliqua* (Presl) Wiens by its consistently obovate, rather small, symmetrical leaves, and by its yellowish flowers, which contrast with the spike axis. The collection that was checked for anther morphology is *Irwin et al. 55486A* (F), a specimen corresponding in all details to the type; the anthers are clearly unilocular, as might be expected from its evident similarity to *D. obliqua.*

22. Dendrophthora haberi Kuijt, sp. nov. TYPE: Costa Rica. Puntarenas: Cantón de Puntarenas, Monteverde, cliff edge above Quebrada Máquina, moist forest along Fonseca, Hotel de Montaña and Savage farms, 10°18′N, 84°48′W, 1100–1300 m, on *Drypetes, Haber & Daniel 9904* (holotype, MO; isotypes, CR, LEA). Figure 1.

Caules teretes, percurrentes atque propter inflorescentias terminales dichotomi. Cataphylla basalia 2–4-juga; internodia percurrentia cataphyllis intercalaribus uni- vel bijugis. Folia ad 6.5 × 2 cm, lamina lanceolata, extremitate utraque acute angustata. Planta dioecia; inflorescentia pistillata ad 3 cm longa; pedunculus compositus; internodia fertilia 3 vel 4; flores terni ad septenos pro bractea fertili, triseriati.

Much branched plants with terete stems, the lateral innovations bearing 1 or 2 pairs of foliage leaves and subtended by 2–4 pairs of basal cataphylls, the upper pair at least halfway to the next foliar node; where percurrent internodes, these with

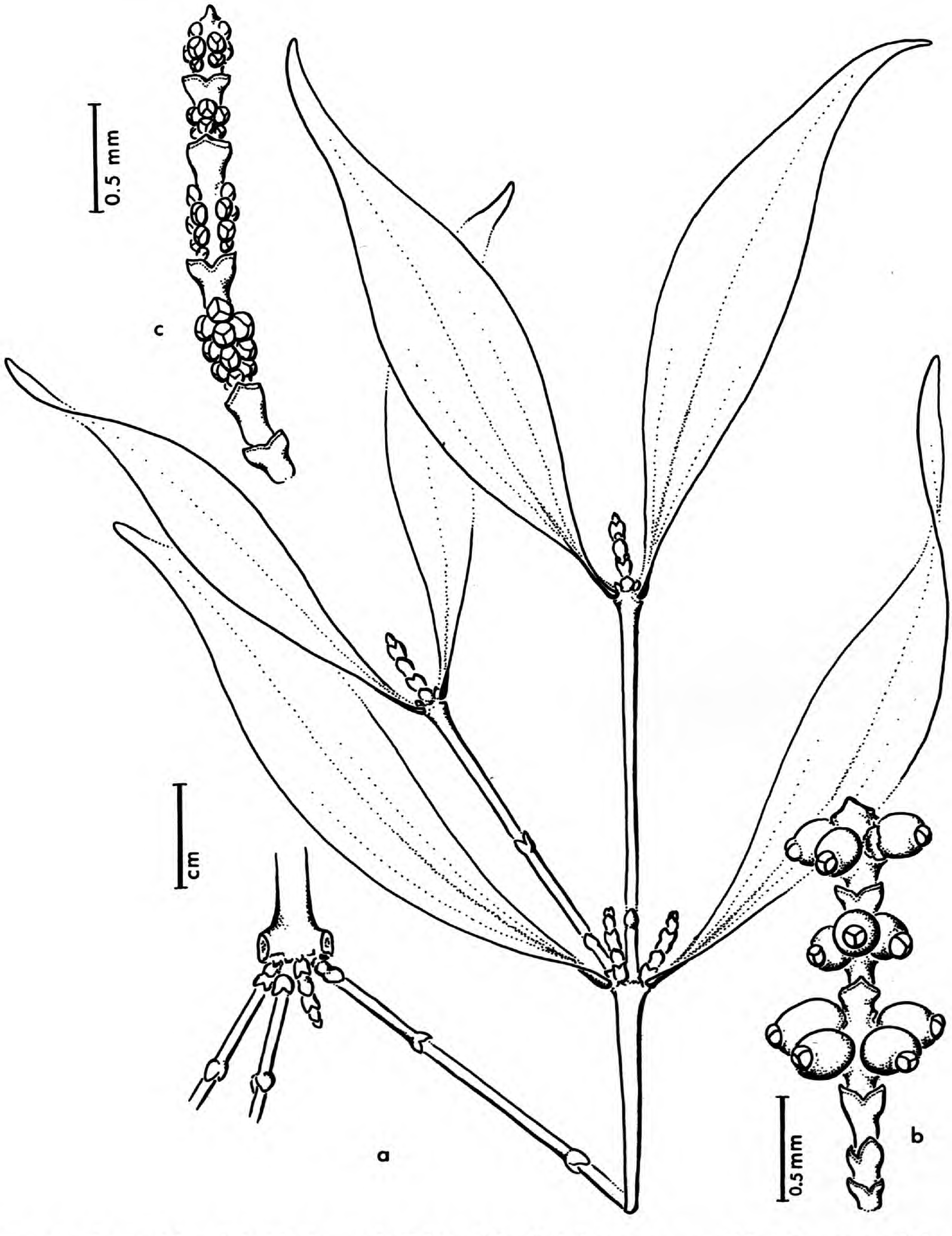

Figure 1. *Dendrophthora haberi* Kuijt. —a, b. Habit and female inflorescence. —c. Male inflorescence. (*Haber & Zuchowski 9495*, 10890, respectively, LEA.)

1(2) pair of intercalary cataphylls 5–7 mm above the foliar node. Leaves to 6.5 × 2 cm, blade narrowly lanceolate, apex and base sharply tapered, petiole indistinct, ca. 2 mm. Venation inconspicuous, midvein associated with 2 long basal veins. Dioecious. Male inflorescence ca. 2 cm long, peduncle 2 mm when simple, 4–5 mm when consisting of 2 sterile internodes; fertile internodes 4, flowers 6–11 per fertile bract, triseriate. Female inflorescence to 3 cm, peduncle compound, sterile internodes (1)2, followed by 3 or 4 fertile internodes; flowers 3–7 per fertile bract, triseriate, crowded at the tip of the internode. Fruit 2.5 × 3 mm, white, ovoid, perianth members closed.

Notwithstanding some similarity to the South American *Phoradendron laxiflorum* Ule, this species has unilocular anthers and must therefore be assigned to *Dendrophthora.* The general high altitudinal preference of continental *Dendrophthora* is once again confirmed. The species is unique in *Dendrophthora* in combining occasional apical inflorescences (leading to dichotomy) with normal percurrent growth; its overall aspect is one of repeated forking, often with several branches from the (then swollen) node. I am at a complete loss to find close relatives in the genus.

Paratypes. COSTA RICA. **Guanacaste:** Las Nubes, 1 km N of Las Nubes village, 8 km NW of Monteverde, premontane rain forest, 10°22′N, 84°51′W, 1200 m, *Haber & Zuchowski 9495* (CR, LEA, MO). **Puntarenas:** Cantón de Monteverde, cliff edge and descending ridge below Hotel de Montaña, 10°18′N, 84°48′W, 1200–1300 m, on *Ardisia compressa, Haber & Zuchowski 10890* (LEA, MO).

23. Dendrophthora intermedia (Rizzini) Kuijt, comb. nov. Basionym: *Phoradendron intermedium* Rizzini, Rodriguésia 18/19: 190. 1956. TYPE: Venezuela. Amazonas: Selvas de Yavita, Alto Orinoco, 128 m, *Ll. Williams 14067* (holotype, VEN).

Amended description: Rather large plants, glabrous, percurrent, internodes to 6 cm long, terete, basal cataphylls 1 pair 3–6 mm above axil, sometimes followed by a second pair 1.5 cm higher, rather small. Leaves to 12 × 6 cm, oblong-elliptical to obovate, apex rounded, base tapering into indistinct petiole 5–10 mm long; venation palmate or nearly so. Dioecious, this plant male. Male inflorescences apparently only lateral, with 1–4 pairs of sterile basal cataphylls, to 4 cm long, the sterile internodes together to 8 mm long, followed by 4 or 5 fertile internodes; flowers ca. 8–15 or more per fertile bract, often triseriate above, at other times entirely biseriate.

It is surprising to find a *Dendrophthora* at this low elevation, but both Elizabeth Kellogg and I have independently confirmed the unilocular nature of the anther. Only the type has come to our attention. The species looks a little like *D. tepuiana* (Steyermark) Kuijt, but it lacks the latter's yellowish cast and, more importantly, has longer and often biseriate inflorescences.

24. Dendrophthora lacryma-jobi E. Kellogg, sp. nov. TYPE: Venezuela. Bolívar: Gran Sabana, ca. 15 km WSW of Karaurín Tepui, at junction of Río Karaurín and Río Asadón (Río Sanpa), 05°19′N, 61°03′W, 900–1000 m, *Liesner 23978* (holotype, GH; isotype, MO). Figure 2.

Planta innovationibus determinatis, floribus congestis in inflorescentiis utque fructibus 3 mm brevioribus luteolis vel cremeis. A speciebus *Phoradendri* differt antheris unilocularis.

Stems flattened to very nearly terete when young; cataphylls (1–)2(–4) pairs on lateral branches only, if 1 pair then 2–7 mm above node, if 2 then the first 1–2 mm above node, the second 5–8 (17) mm above the first, broadly triangular to ovate, flaring. Many specimens with determinate innovations. Leaves with petiole 0–6 mm long; blade elliptic, obovate or oblanceolate, widest at or above the middle, 2.7–7.0 × 1.3–3.0(3.6) cm, the apex rounded, obtuse or truncate, sometimes apiculate, the base cuneate, the nerves basal or inner pair suprabasal, obscure. Inflorescences 1 to 3 per leaf axil or terminal in some innovations, to 2.3 cm long, axis 1–2 mm thick when dry; cataphylls 0–2 pairs, like the bracts fused and flaring to form a short infundibular tube; fertile internodes 3–6; flowers biseriate, 3–7 per bract, crowded, all pistillate or staminate and pistillate flowers intermixed; apical flowers with median perianth member lowermost, lower ones with median perianth member uppermost. Fruits globose, yellowish, much smaller than those of all other species (3 mm vs. 6 mm long); perianth members open, short, spreading, not stiff.

The epithet is in honor of Job Kuijt, authority on mistletoes and monographer of *Dendrophthora*; he will be the one to shed tears over the ultimate circumscription of this species.

This species is superficially similar to *Phoradendron trinervium* (Lamarck) Grisebach and *P. zuloagae* Trelease, but the yellowish fruits that are less than 3 mm long and short, crowded inflorescences mark it as distinct. It appears to grow only on species of *Qualea* (Vochysiaceae).

One specimen, *Vareschi & Foldats 4590* (NY), is unusual in that it has a few, apparently bisexual flowers. Each has only one anther, but the pistil appears to be fully formed.

Paratypes. VENEZUELA. **Bolívar:** Municipio Raul Leoni Macizo Guaiquinima, Cerro Camarón, Arbustal sobre areniscas del Grupo Roraima, 05°41′N, 64°09′W, 800 m, *Fernandez & Aymard 4765* (MO); Gran Sabana, ca. 15 km WSW of Karaurín Tepui, Quebrada Tanuan, 05°19′N, 61°04′W, 950 m, *Liesner*

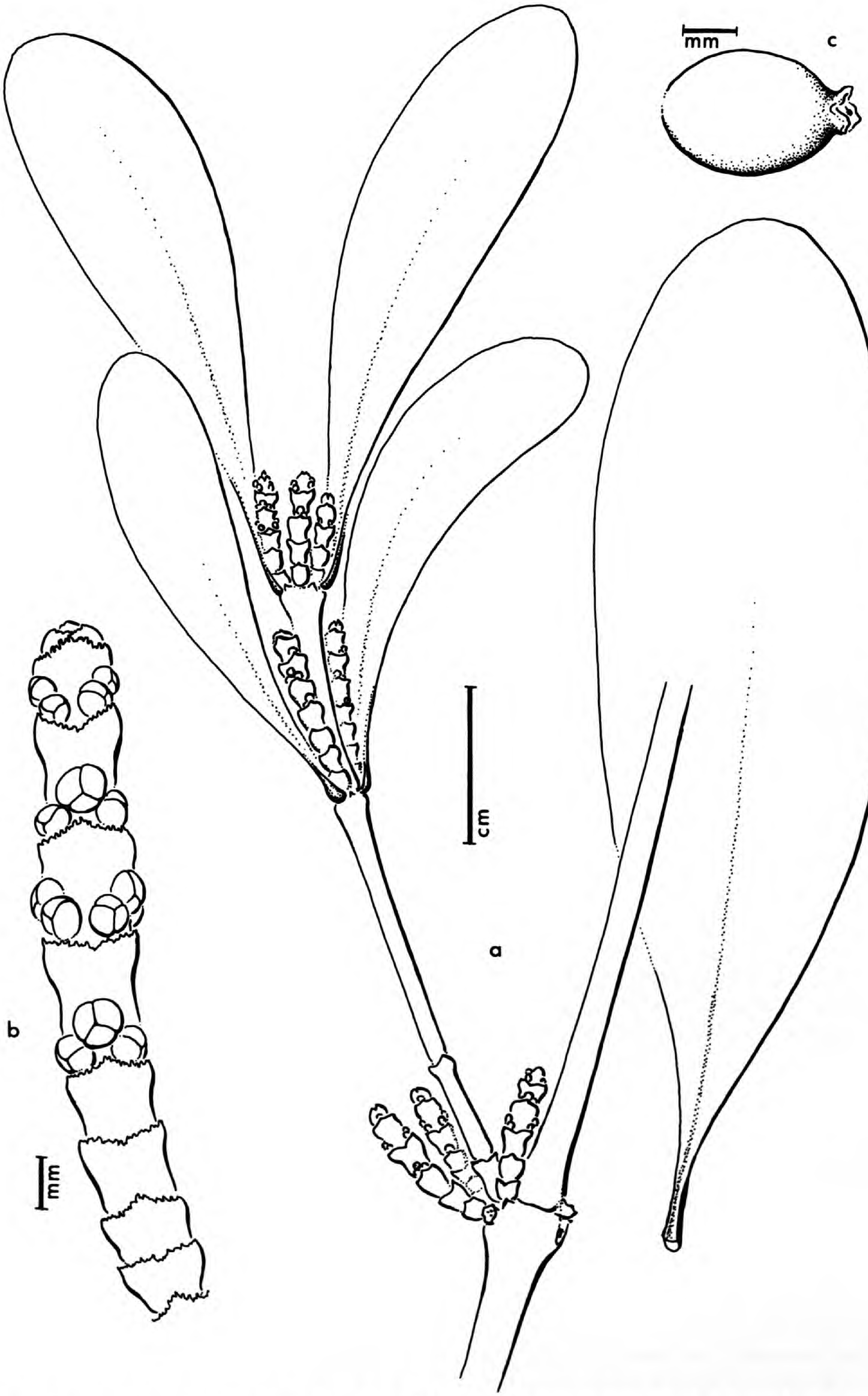

Figure 2. *Dendrophthora lacryma-jobi* Kellogg. —a. Habit. —b. Inflorescence. —c. Fruit. (*Fernandez & Aymard 4765*, MO.)

24109 (GH); Sierra Auraima, en la parte terminal norte sobre el margen oeste del río Paragua, en la zona del raudal de El Perro, 6°32′N, 63°33′W, 400 m, *Steyermark 90843* (NY); cumbre del cerro Guaiquinima, a lo largo del afluente del río Carapo, 1 km río arriba del Salto Szczerbanari, 5°44′4″N, 63°41′8″W, parte sur-oriental del cerro, 730–750 m, *Steyermark et al. 117397* (VEN); al borde de la teraza de Guayaraca, lugar rocoso, seco, 1100 m, Auyantepui, *Vareschi & Foldats 4590* (NY); slope forest Tirepón-tepui, 1200–1250 m, *Wurdack 34047* (NY). **Terr. Fed. Amazonas:** Dpto. Atures, Río Coro-Coro, W of Serrania de Yutaje, 8 km N of settlement of Yutaje, 5°41′30″N, 66°07′30″W, 650–700 m, *Holst & Liesner 3113* (GH, MO); Dpto. Atures, W side of valley of Río Coro-Coro, 8 km NNW of settlement of Yutaje, 05°41′N, 66°08′30″W, 500–1000 m, *Liesner & Holst 21436* (M); Dpto. Atures, 1 to 2 km E of Río Coro-Coro, W of Serrania de Yutaje, 9 km N of settlement of Yutaje, 05°42′N, 66°07′30″W, 500–730 m, *Liesner & Holst 21477* (GH); Río Guainia, savanna on left bank of Cano Caname (right bank of Cano San Miguel just below Limoncito), 120–140 m, *Maguire et al. 41881* (NY); San Carlos de Río Negro, 125 m, *Steyermark & Bunting 102750* (NY); Dpto. Atabapo, Cerro Marahuaca, along branch of Cano Negro, south-central portion of meseta, 3°43′N, 65°31′W, 1140 m, *Steyermark & Holst 130882* (NY).

25. The *Dendrophthora obliqua-fendleriana* question.

In the northern Andes and southern Mesoamerica, we encounter a complex of extremely stout *Dendrophthora* plants with large basal and/or intercalary cataphylls. In Peru and Ecuador, these have unusually large, asymmetrical, acute leaves. In more northerly areas, leaves are smaller and more symmetrical. In both the southern and northern extremes, it is clear that the growth habit is dichotomous in that the shoot tip aborts after an innovation forms a single pair of foliage leaves (see fig. 43 in Kuijt, 1986). However, some of the Venezuelan plants are percurrent rather than dichotomous, and it is to such a plant that the name *Phoradendron fendlerianum* Eichler is attached.

There are a number of serious difficulties in comprehending this complex of plants. The most important, practical one is their fragility; we often cannot be sure whether intercalary cataphylls are present on percurrent stems or whether these occur at all. Even if that problem did not exist, we have at present no way of knowing how variable the percurrent vs. dichotomous feature is; for example, in a related species in Mesoamerica, *Phoradendron robustissimum* Eichler, both types seem to coexist. The plants in question are by no means common, and they seem to exist in highly disjunct populations on tepuis and other mountain peaks. To confound the situation further, several additional names have been applied to elements of this complex. Their authors seem not to have been aware of the morphological complexities involved, and type specimens are not always helpful. A further problem is that a lateral stem at a dichotomy, especially where its partner fails to develop or is weak, may come to occupy a seemingly percurrent position, and very close scrutiny may be needed to understand the situation properly.

The resolution that I propose for the present is the division of most of the complex into two species, one of which is the strictly dichotomous *Dendrophthora obliqua* as described and illustrated in Kuijt (1986, fig. 43; 1978, fig. 6), the other being percurrent and presently known as *Phoradendron fendlerianum.* There are two qualifiers to this solution. First, "*Phoradendron*" *fanshawei* (see species number 21 in the present paper) is clearly a member of the complex, but is here judged to be a distinct unit. Second, I cannot exclude the possibility that the Panamanian plants may eventually have to be recognized as a separate entity. However, I feel that this should be done only after the Colombian situation is more adequately known; it may then be possible to use an existing Colombian epithet such as *guascanum* in Panama. In the meantime, I wish to include the Panamanian material in *D. obliqua.*

Every specific epithet in this complex was first assigned to *Phoradendron.* To the contrary, I am convinced that these plants are more properly placed in *Dendrophthora*; I am assuming that all have unilocular anthers. This is known as a fact for *D. obliqua* (Wiens & Barlow, 1971); for Panamanian plants (Kuijt, unpublished information); and for the type of *P. duidanum* (*Tate 737*; E. Kellogg, unpublished information). Additionally, the consistent preference for high altitude points to this conclusion, although this is not an infallible guide. In consequence, *P. fendlerianum* has recently been assigned to *Dendrophthora* (Kuijt, 1994). I have not, unfortunately, been able to clarify adequately the sex distribution of members of this complex. I speak of *D. obliqua* as being dioecious in Panama and Ecuador (Kuijt, 1978, 1986), but I am not completely certain of the facts elsewhere, especially in Colombia and Venezuela.

In conclusion, I would recognize the following two species and their synonyms:

Dendrophthora obliqua (Presl) Wiens, Taxon 20: 326. 1971. TYPE: Colombia, *Haenke s.n.* (holotype, PR).

Phoradendron guascanum Trelease, Bull. Torry Bot. Club 54: 474. 1927. TYPE: Colombia. Guasca, *Ariste-Josèph B-60* (holotype, US).

There is no indication of intercalary cataphylls in the protologue of *P. guascanum,* and Trelease compares the species to "*Phoradendron obliquum.*" The type locality seems to be well beyond the known range of *D. fendleriana.*

Dendrophthora fendleriana (Eichler) Kuijt, Taxon 43: 190. 1994. *Phoradendron fendlerianum* Eichler, Fl. Brasil. 5(2): 129. 1868. TYPE: Venezuela. Tovar, *Fendler 1102* (holotype, P; isotype, MO).

Phoradendron duidanum Trelease, Bull. Torrey Bot. Club 58: 58. 1931. Syn. nov. TYPE: Venezuela. Top of Mt. Duida, dry slopes of Savanna Hills, 4400 ft., *Tate 737* (holotype, NY; isotype, ILL).

Phoradendron duidanum Trelease var. *hymenaeifolium* Rizzini, Rodriguésia 30: 58. 1978. Syn. nov. TYPE: Venezuela. Bolívar: Chimantá Massif, Agparaman-tepui, forested middle slopes near Río Tirica, 1365 m, *Steyermark & Wurdack 1250* (holotype, VEN; isotype, F).

Phoradendron spectabile Rizzini, Rev. Brasil. Biol. 31: 200–202. 1971. Syn. nov. TYPE: Venezuela. Táchira: near Colombia–Venezuela border, below Páramo de Tama, *Steyermark et al. 98433* (holotype, RB; isotype, NY).

Phoradendron spectabile Rizzini var. *altimontanum* Rizzini, Rev. Brasil. Biol. 31: 201. 1971. Syn. nov. TYPE: Same locality as var. *spectabile,* 2750–2950 ft., *Steyermark et al. 98588* (holotype, RB).

Phoradendron tatei Trelease, Bull. Torrey Bot. Club 58: 359. 1931. Syn. nov. TYPE: Venezuela. Mt. Duida, slopes of ridge 25, 5500–6000 ft., *Tate 450* (holotype, NY).

Type material of *Phoradendron fendlerianum* has two to several pairs of conspicuous intercalary cataphylls between successive pairs of foliage leaves and is undoubtedly a *Dendrophthora,* as indicated by its clear similarity to *D. obliqua*; unfortunately, the type is female, and certainty is impossible, the generic distinction largely being one of anther morphology. A virtually identical specimen (Venezuela. Trujillo: Selva nublada virgen entre La Pena y Agua de Obispo, 22–28 km de Carache, 2400–2500 m, *Steyermark 105006,* MO, determined *P. spectabile* by Rizzini), however, is purely male; to confuse matters further, this specimen alternates normal and cataphyllar "internodes" along a percurrent branch. There may or may not be additional differences from *D. obliqua,* such as the simple peduncle of *P. fendlerianum*; my comments and illustration of the spikes of *D. obliqua* for Ecuador are incomplete in this regard, for many plants have two sterile internodes instead of one.

The type of *P. duidanum* has unilocular anthers. Trelease wrote: "scarcely forked," and "cataphylls on all joints"; the holotype clearly shows several percurrent stems with intercalary cataphylls; inflorescences have 2 or 3 sterile internodes at the base.

The type of *Phoradendron spectabile* is male and the species therefore dioecious; the inflorescence peduncle is simple, the leaves very broadly ovate, symmetrical. The protologue speaks of the 2–4 cataphylls as "ad omnia internodia obviae." A nearly identical specimen, *Luteyn et al. 8242* (Venezuela. Aragua, La Victoria–Colonia Tovar road, 11.5 km N of Pie de Cerro, 10°22′N, 67°20′W, MO), is also strictly male and bears at least some percurrent internodes without intercalary cataphylls; it thus originates from the same general area as the type of *D. fendleriana.*

The type of *Phoradendron tatei* is entirely percurrent, with 2 or 3 pairs of intercalary cataphylls; inflorescences seem to bear some sterile basal internodes; the leaves are rather small (to 6 × 3 cm).

26. Dendrophthora oligantha Kuijt, sp. nov. TYPE: Venezuela. Bolívar: Sifontes, Gran Sabana, Kavanayén, en bosquete a orilla de quebrada, cerca del aeropuerto, *Fernandez & Bracamonte 3203* (holotype, PORT; isotype, LEA). Figure 3.

Planta ramosissima, ut videtur succulenta; cataphylla basalia unijuga sub inflorescentiis surculorum brevium lateralium. Folia usque 12 × 7 mm, obovato-elliptica. Inflorescentia ad 7 mm longa, pedunculo 1 mm longo; internodia fertilia 2 vel 3, flores singuli vel terni pro bractea fertili.

Profusely branched, small-leaved species, the leaf-bearing internodes ca. 1 cm long, with minutely papillate surface, apparently succulent when fresh; basal cataphylls one pair on lateral branches, sometimes also one pair of intercalary cataphylls on the node directly below a terminal inflorescence (see drawing), to 3 mm above the base. Leaves to 12 × 7 mm, obovate-elliptical and somewhat fleshy, apex rounded, base tapering into indistinct, flat petiole ca. 1 mm long; venation obscure. Lowest leafy organs in median position. Possibly monoecious, both sexes represented on the same spike? Inflorescence to 7 mm long, peduncle 1 mm long, followed by 2 or 3 fertile internodes, flowers 1 or 3 per fertile bract, deeply sunken in axis, bi- or triseriate; inflorescence commonly in terminal positions at the tip of short branches bearing one pair of expanded leaves. Fruit and male flowers unknown.

Dendrophthora oligantha is a small species with a very distinctive morphology. The smaller innovations have 3 inflorescences at the tip, and these innovations must be shed following flowering or

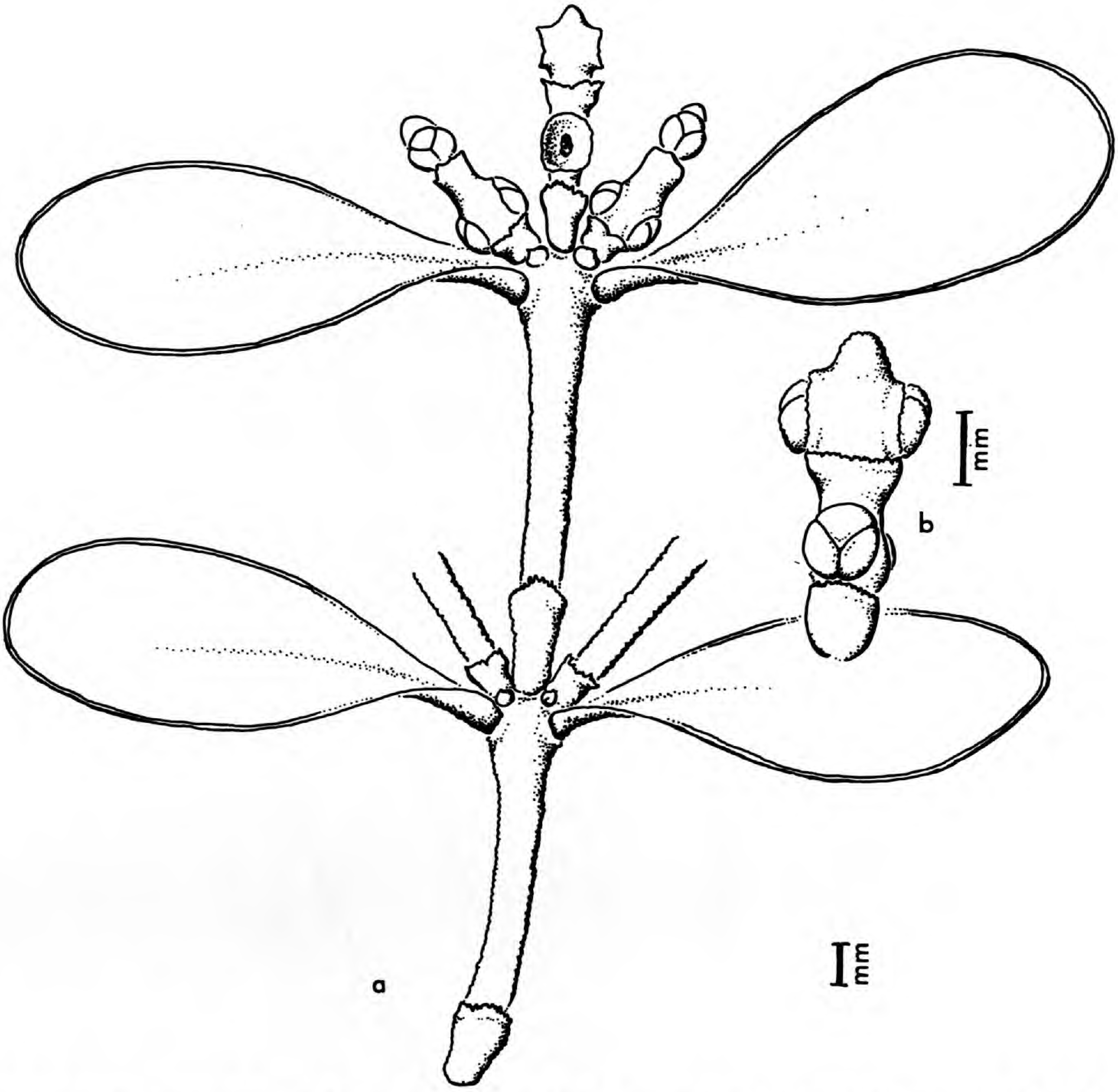

Figure 3. *Dendrophthora oligantha* Kuijt. —a. Habit. —b. Inflorescence. (*Fernandez & Bracamonte 3203,* LEA.)

fruiting. Branches that are percurrent for more than one internode also have a terminal inflorescence, but the latter tends to be flanked by young innovations rather than inflorescences, facilitating further growth of a furcate pattern.

Although no reliable generic placement is possible at this moment, the (male?) flowers seen being immature, the high elevation strongly suggests (but does not prove) the present choice. The habitat of the *Moore et al.* collection (low open woods with moss on tree- and shrub-bases and many shrubs with lichens interspersed in patches) is also very typical of *Dendrophthora.* A more mature plant is needed to ascertain secure generic placement.

Paratype. VENEZUELA. **Bolívar:** Río Tehuanén camp between Kavanayén and Ptari-tepui, 1240 m, *Moore et al. 9698* (VEN).

27. Dendrophthora scopulata Kuijt, sp. nov. TYPE: Honduras. Morazan, in cloud forest, Rancho Quemado above San Juancito, on *Podocarpus oleifolius,* 2100 m, *Williams & Williams 18517* (holotype, F; isotype, US). Figure 4.

Planta gracilis, ramosissima, squamata, monoecia; caules teretes; folia squamiformia 1–2 mm longa, acuta. Inflorescentia ad 7 cm longa, internodiis fertilibus ca. 7, floribus ca. senis pro internodio fertili, uniseriatis, superioribus pistillatis, inferioribus staminatis. Fructus diam. 3 mm, globosus.

Slender, profusely branched, erect plants, squamate. Internodes to 2.5 cm, terete, basal cataphylls none, the lowest scale leaves in median position; prophylls 1 mm, with strikingly fimbriate margin. Scale leaves 1–2 mm, acute and spreading when dry, rarely replaced by a small spatulate to obovate

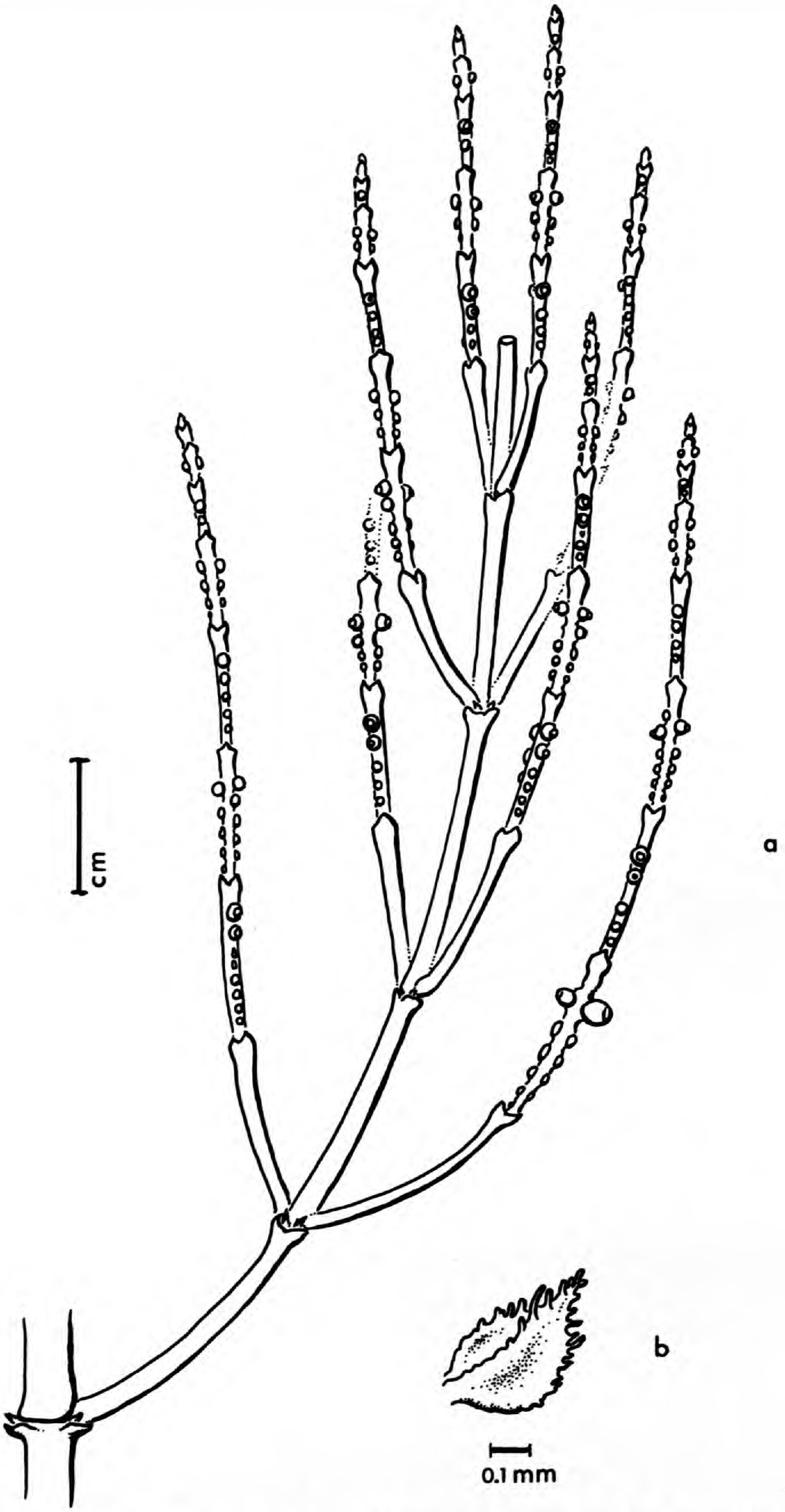

Figure 4. *Dendrophthora scopulata* Kuijt. —a. Habit. —b. Prophyll. (*Williams & Williams 18517*, F.)

leaf 10 × 4 mm. Monoecious. Inflorescence to 7 cm long, slender, peduncle 8–15 mm, followed by ca. 7 fertile internodes becoming progressively shorter upwards; flowers 4–10 per fertile internode, uniseriate, the upper 1 or 2 female, lower ones male. Mature fruit 3 × 2 mm, ovoid to globose, perianth members closed.

This species is closely related to *Dendrophthora squamigera* (Bentham) Kuntze and *D. davidsei* Kuijt, differing in being much larger and more slender, and in having a much larger number of fertile internodes; the other two species rarely have more than 1 or 2–4 fertile internodes, respectively, in Central America.

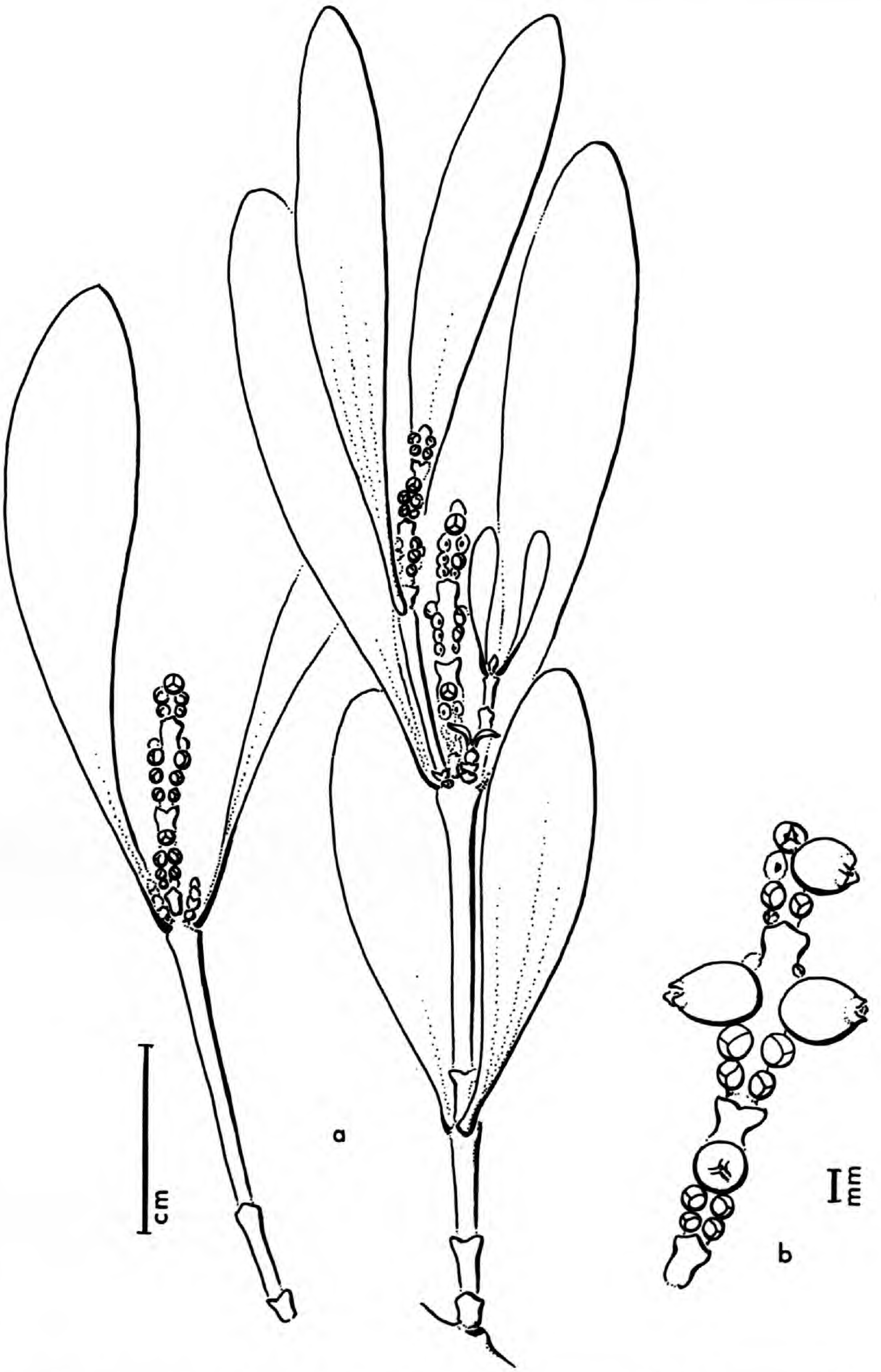

Figure 5. *Phoradendron diminutivum* Kellogg. —a. Habit. —b. Inflorescence. (*Davidse 27772*, GH.)

28. Phoradendron diminutivum E. Kellogg, sp. nov. TYPE: Venezuela. Amazonas: Dpto. Río Negro, Río Pasimoni, between its mouth and its junction with the Río Baria and the Río Yatua, inundated forest, 80 m, *Davidse 27772* (holotype, GH; isotypes, LEA, MO). Figure 5.

Planta cataphylla multo super nodos fert; innovationes determinatae. A *Phoradendro strongyloclado* internodis brevioribus et a *Ph. piperoide* foliis nervi e basi differt.

Stems terete, internodes <3 cm long; cataphylls 1 or 2 pairs on all axes, the first 1 or 2 mm above each node, the second 4–5 mm above the first, broadly triangular, fused or not. Determinate innovations common. Leaves drying yellowish, with petiole indistinct; blades oblanceolate, 2.7–4.8 × 0.9–1.3 cm, the apex obtuse, sometimes apiculate, the base cuneate, the nerves basal or inner two suprabasal, indistinct. Inflorescences 1 or 2 per leaf

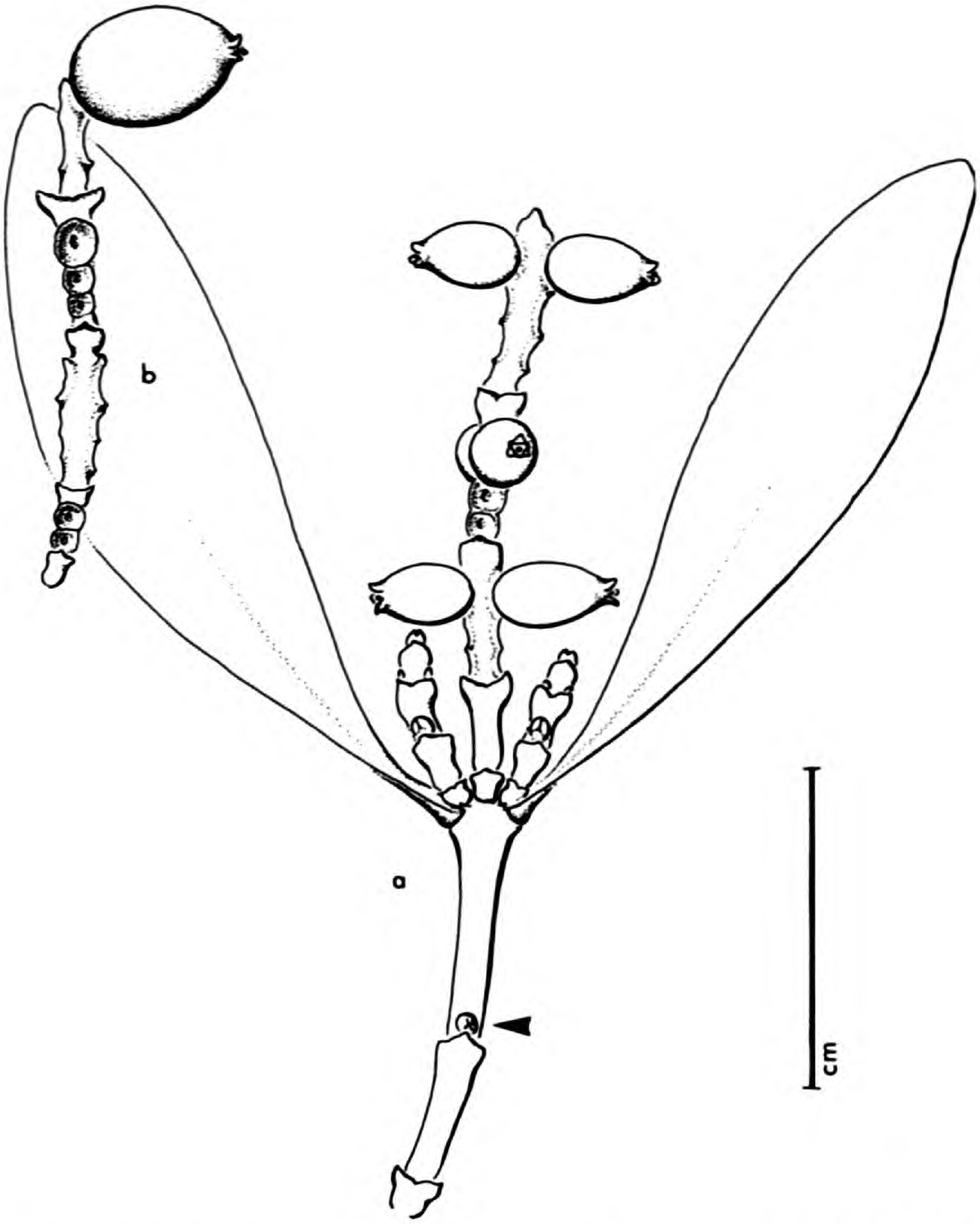

Figure 6. *Phoradendron kelloggii* Kuijt. —a. Habit. Arrow shows inflorescence bud in axil of cataphyll. —b. Inflorescence. (*Colonnello G. 726*, VEN.)

axil, to 1.5 cm long, the axis <1 mm thick when dry; cataphylls lacking, peduncle simple; bracts fused infundibular; fertile internodes 2 or 3; flowers 3 to 6 per bract, biseriate, staminate and pistillate intermixed, apical flower with median perianth member lowermost, lower flowers with median perianth member uppermost. Fruit ovoid when immature; perianth members open, spreading, not stiffly erect.

Known only from the type, this species is distinctive in having cataphylls on all internodes, generally with one pair well above the node. In this respect it is similar to *Phoradendron piperoides* (Kunth) Trelease, but the entire plant is more diminutive and the leaves are much smaller and differently shaped, with basal nerves. *Phoradendron piperoides* never has terminal inflorescences. The short internodes and spreading cataphylls well above the nodes distinguish it from *P. strongyloclados* Eichler.

29. Phoradendron kelloggii Kuijt, sp. nov. TYPE: Venezuela. Amazonas: en la Altiplanicie del Cerro Duida, arriba de la Culebra, 1250 m, *Colonello G. 726* (holotype, VEN). Figure 6.

Planta ramosissima, ad 1 m longa, succulenta, monoecia; caules teretes. Cataphylla basalia 1(–3)-juga. Folia ad

5 × 1.5 cm, lanceolata. Flores staminati aggregati ad partes inferiores internodiorum fertilium; inflorescentiae ad 2 cm longae, axillares necnon terminales ad ramulos, plerumque prope basim bracteis sterilibus unijugis; flores singuli ad ternos pro bractea fertili, uniseriati.

Much branched, glabrous plants 0.5–1 m in size, succulent, internodes 3 cm or less long, terete; basal cataphylls one pair 2–4 mm above the base, frequently followed by one or two pairs of well-spaced cataphylls the highest of which may subtend inflorescences. Leaves to 5 × 1.5 cm, lanceolate, venation obscure but probably palmate, apex and base acute, the latter long-tapering into a slender petiole to 5 mm long. Monoecious, the male flowers concentrated on the lower part of the fertile internodes. Inflorescence to 2 cm long, one per leaf axil but also terminating branchlets, usually with one very low pair of sterile bracts, the entire peduncle 2–3 mm long, followed by 2 or 3 fertile internodes, flowers 1–3 per fertile bract, uniseriate. Fruit 4.5 × 4 mm, broadly ovoid, perianth members reflexed.

This is the third known species of *Phoradendron* with uniseriate flowers. *Phoradendron uniseriale* Kuijt, an unrelated species from Colombia with this inflorescence type, was discovered recently (Kuijt, 1990). In *P. uniseriale*, only the unequivocal structural correspondence to another species of *Phoradendron*, *P. piperoides*, demonstrated its generic status, but in the present case I have been able to dissect the male flower to observe the bilocular anther. The third species with uniseriate flowers is *P. karuaianum* Steyermark, which differs from *P. kelloggii* in not having terminal inflorescences, in its much longer spikes, and in having a very different, ovate-attenuate leaf shape. *Phoradendron karuaianum* has bilocular anthers (E. Kellogg, unpublished information).

Phoradendron kelloggii consists of a succession of innovations, each bearing 2 or 3 pairs of cataphylls below followed by a single pair of expanded leaves. The second and third cataphyll pair frequently (but not always) subtend inflorescences; the innovation is normally terminated by 3 inflorescences, a terminal one, and two in the adjacent leaf axils. New innovations arise in the axils of prophylls of lateral spikes, or in the place of such spikes.

30. Phoradendron kingii Kuijt, sp. nov. TYPE: Mexico. Chiapas: pine-oak forest along route 190, 10 mi. E of Teopisca, in gymnospermous trees, *King 3027* (holotype, NY). Figure 7.

Planta glabra, rigida, sat carnosa, ut videtur monoecia. Internodia media teretia, utraque extremitate compressa; cataphylla basalia unijuga. Folia usque 4.5 × 2.5 cm, obovata, rigida, obtusa, basi angustata. Spica pistillata ca. 1–1.5 cm longa; pedunculus simplex, validissimus; internodia fertili 2 vel 3, flores terni ad internodia inferiora, pauciores ad superiora, bi- vel triseriati. Fructus 3 × 3 mm, perianthium clausum.

Glabrous, stiff, branched plants, rather fleshy, internodes to 4 cm long, often somewhat compressed at each end but terete in the middle; basal cataphylls 1 pair 3–5 mm above axil, stout. Leaves to 4.5 × 2.5 cm, obovate to spathulate, rigid, apex blunt, base tapering into thick, indistinct petiole 3 mm long. Apparently monoecious. Spike 1–1.5 cm, peduncle simple, very stout, ca. 2 mm long, fertile internodes 2 or 3, flowers 3 in lower internodes, fewer above, bi- or triseriate, the apical above each bract female, the lateral ones apparently male. Fruit 3 × 3 mm, deeply sunken in axis, somewhat tubercular, perianth members closed.

Phoradendron kingii is similar to the broad-leaved form of *P. brachystachyum* (DC.) Nuttall (Sonora to Oaxaca) and to *P. spathulatum* Kuijt (Chiapas), both of which are dioecious; basal cataphylls are lacking in the former, while in the latter they are rather inconspicuous. The fruit of *P. spathulatum* is much larger and smooth rather than tubercular as in *P. kingii.*

31. Phoradendron roldanii Kuijt, sp. nov. TYPE: Colombia. Antioquia: Municipio Frontino, Vereda la Fenia, Carretera Nutibara, km 17–32, 6°55′N, 76°18′W, 1000–1200 m, sobre *Phoradendron* sp., *Roldán et al. 861* (holotype, LEA; isotype, HUA). Figure 8.

Planta dioecia, erecta, sparsim ramosa; ramificationes percurrentes; internodia ad 10 cm longa, infra teretia, supra ad nodum maxime expansa. Cataphylla basalia 3-(4- vel 5-)juga, intercalaria unijuga. Folia ad 1.5 × 1.5 cm, sessilia, late ovata. Inflorescentiae staminatae aggregatae ad nodos, pedunculus internodiis sterilibus ad 3 (vel 5) vel nullis; flores usque ad novenos pro bractea sterili, biseriati et triseriati.

Sparsely branched, erect, percurrent, glabrous and yellowish plants, the stout internodes to 10 cm long, terete below, expanding massively above to form a clavate node to 2 cm wide, flattened in the plane of the leaves. Basal cataphylls 3 (4–5) pairs, lower pair axillary, the uppermost pair 1.5 cm above axil; intercalary cataphylls one pair, 2–4 mm above nodal constriction, inconspicuous. Leaves small, to 1.5 × 1.5 cm (–5 cm), sessile, broadly ovate to orbicular, fleshy. Dioecious, the type male. Inflorescences clustered at the internodes, with 0–3(–5) pairs of sterile cataphylls, mostly to 2.5 cm long, with 5–7 fertile internodes, flowers to 9 per fertile bract (the terminal internode with 1–3 flow-

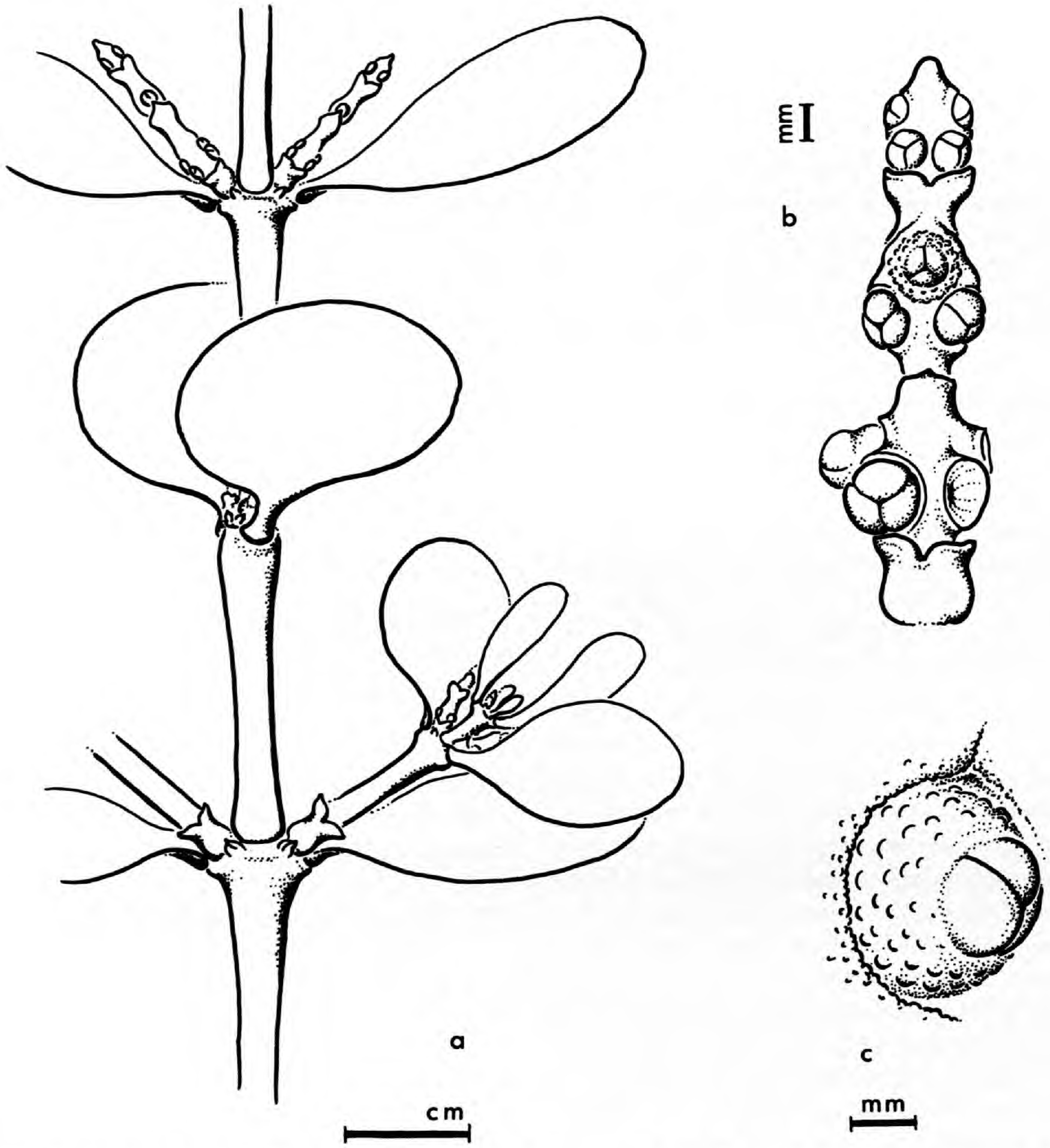

Figure 7. *Phoradendron kingii* Kuijt. —a. Habit. —b. Inflorescence. —c. Young fruit, showing tubercular surface. (*King 3027,* NY.)

ers per bract), biseriate or triseriate even on the same inflorescence. Female inflorescence and fruit not known.

An exceedingly distinctive species because of the excessively clavate internodes and small leaves, *Phoradendron roldanii* is a close relative of *P. piperoides* and *P. tardispicum* Kuijt, especially the latter.

32. Phoradendron triflorum E. Kellogg, sp. nov. TYPE: Venezuela. Bolívar: región de los ríos Icabaru, Hacha, y cordillera sin nombre, cabeceras del Río Hacha, 450–850 m, *Bernardi 2798* (holotype, NY). Figure 9.

Planta inflorescentiis fere moniliformibus internodis contractis infra superque flores, ramis bifurcis, apicibus abortivis. A *Phoradendro mucronato* (DC.) Krug & Urban et *P. tetragono* Ule internodis longioribus (ad 6 cm longis) et fructibus nontuberculatis, a *P. dichotomo* (Bertero) Krug & Urban et *P. northropiae* Urban floribus tantum tres differt.

Stems quadrangular when young, internodes becoming terete with age; branching consistently bifurcate, the apex aborting; cataphylls one pair just above each internode, annular to very broadly triangular, partially fused. Leaves with petiole ca. 5 mm long; blades ovate to oblanceolate, 2.1–4.5 × 1.4–2.8 cm, the apex rounded, obtuse or emarginate, the base cuneate, the nerves obscure but apparently pinnate. Plants monoecious; inflorescences terminal and axillary, to 2.5 cm long, the axis 1–2 mm thick when dry with golden sheen; cataphylls 1 (2) pair(s), fused to form a narrow tube, ca. 1 mm

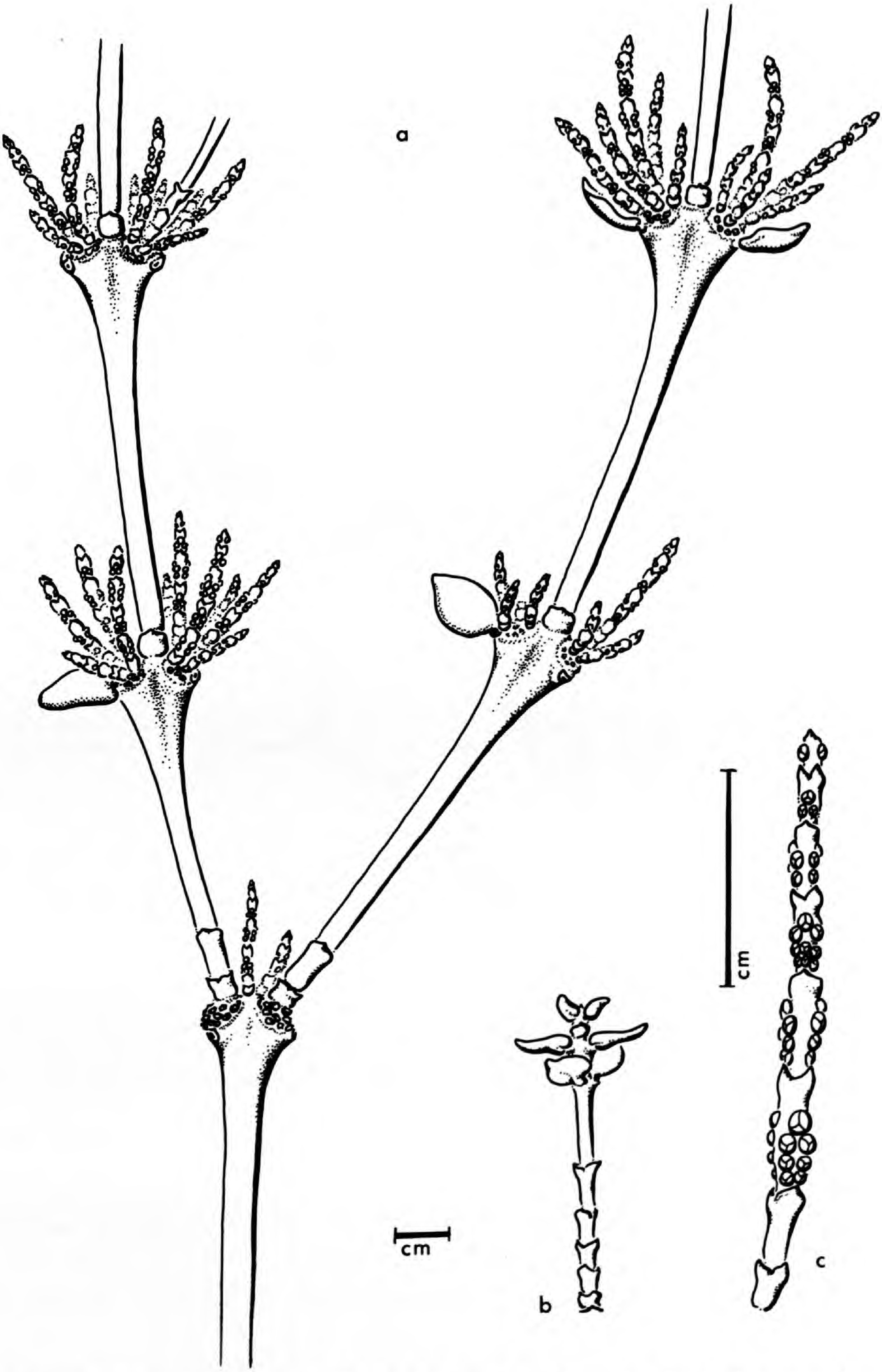

Figure 8. *Phoradendron roldanii* Kuijt. —a. Habit. —b. Young lateral innovation showing five pairs of basal cataphylls. —c. Inflorescence. (*Roldán et al. 861*, LEA.)

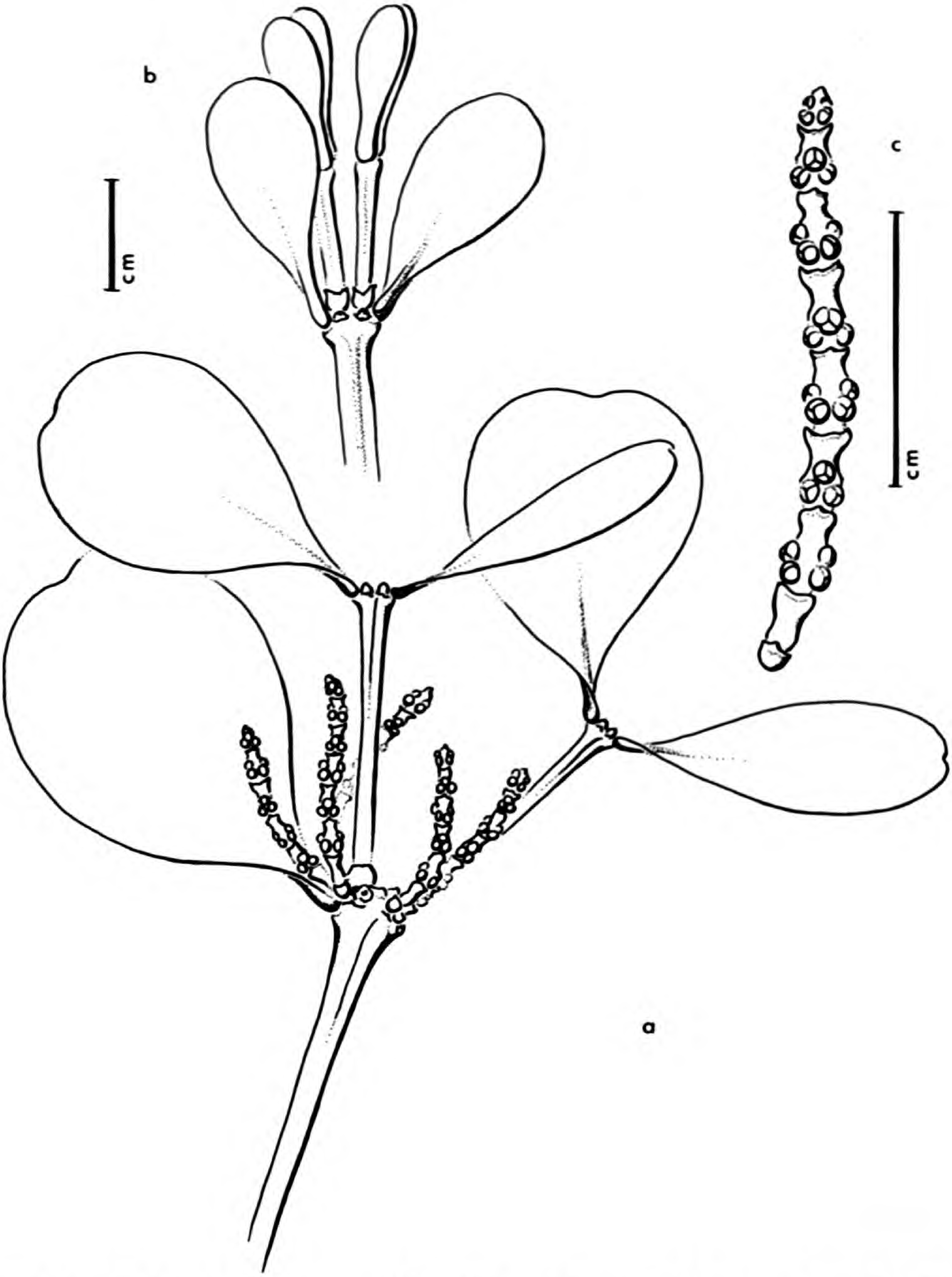

Figure 9. *Phoradendron triflorum* Kellogg. —a. Habit. —b Young dichotomy. —c. Inflorescence. (*Bernardi 2798*, NY.)

high; bracts fused and narrowly infundibular; fertile internodes 5 or 6, narrowed and elongate above and below the flower-bearing part, the latter slightly swollen so that inflorescence appears somewhat moniliform in outline; flowers consistently in triangular groups of 3 over each bract, deeply sunken in rachis, apical flower staminate, lower two pistillate, the apical flower with the median perianth member lowermost, the lower two with median perianth member uppermost. Fruits globose when immature; mature color not recorded; perianth members spreading. Rainforests and savannas, 400–900 m.

Phoradendron triflorum is a distinctive species, superficially similar to *P. tetragonum,* but without warty fruits and with consistently bifurcate branching.

Paratype. Locality the same as the type, *Bernardi 2791* (NY).

33. Phoradendron websteri Kuijt, sp. nov. TYPE: Panama. Chiriquí: Distr. Boquete, thickets along road from Alto Boquete to Bajo Volcancito, 82°26–27′W, 8°46′N, on *Conostegia xalapensis,* 1100 m, *Webster 16650* (holotype, MO). Figure 10.

Caules novelli complanato-carinati, deinde teretes. Cataphylla basalia 2–7-juga, per cm 1–2 inferiores teretes ramorum lateralium dispersa. Lamina 6 × 1.5 cm, lanceolata ad anguste ovatam, basi acuta, apice anguste rotundata. Planta dioecia; inflorescentia pistillata ad 4 cm longa, internodiis basalibus sterilibus 2–5, fertilibus ca. 7; flores (singuli vel) terni pro bractea fertili. Fructus 3 × 2 mm, ovoideus, perianthium clausum.

Young stems compressed and sharply keeled, internodes to 4 cm, eventually becoming terete; squamate basal internodes of branches terete. Basal cataphylls 2–7 pairs, spread over the lowest 1–2 cm of branches. Blades 6 × 1.5 cm, lanceolate to narrowly ovate, petiole slender, ca. 5 mm, tapering into acute base of blade; apex narrowly rounded. Dioecious, the type female. Female inflorescence to 4 cm, with 2–5 basal sterile internodes followed by about 7 fertile ones; flowers (1) 3 per fertile bract. Fruit 3 × 2 mm, ovoid, white, perianth members closed.

At first glance, *Phoradendron websteri* is remarkably similar to *P. woodsonii* Trelease. In *P. woodsonii,* however, percurrent stems have a number of intercalary cataphylls placed between successive pairs of foliage leaves, and the stems are terete throughout, features which clearly separate the two entities.

34. Phthirusa podoptera (Chamisso & Schlechtendal) Kuijt, Taxon 43: 198. 1994. Basionym: *Loranthus podopterus* Chamisso & Schlechtendal, Linnaea 3: 218. 1828. TYPE: Brazil. Prov. Alagoas: *Gardner 1330* (neotype, designated here, P; isoneotype, NY).

Loranthus pterygopus Martius, in Schultes f., Syst. Veg. 7: 155. 1829. Syn. nov. *Struthanthus pterygopus* (Martius) Martius, Flora 13: 105. 1830. TYPE: Brazil. In prov. Minarum campis Taboleiro inter fl. Rio Verde et S. Francisci, *Martius s.n.* (lectotype, designated by Kuijt (1994), M).

This unmistakable species has been known as *Struthanthus pterygopus* since the *Flora Brasiliensis* treatment in 1868, but it is clear that the Chamisso & Schlechtendal name antedates Martius's epithet and that it belongs to the same species. There is no other continental member of Loranthaceae that possesses a winged inflorescence peduncle; the only other neotropical species with this feature is the Caribbean *Dendropemon alatus* Tieghem, which is not directly related.

The anther morphology of this unique species was apparently misinterpreted in Eichler's (1868) plate 25. While the type of *Loranthus pterygopus* at M does not allow floral dissection, the species cannot be mistaken, and the identity of the material here illustrated (Fig. 11) is beyond question. Stamens are strongly dimorphic, the 4-celled lower anthers comparing closely to Eichler's representation except that the filament in Eichler's figure corresponds to a median ridge of the petal below the sessile anther. The upper anthers, however, have only 2 pollen sacs, below which deep excavations exist in what presumably is the fused filament; around the excavation are somewhat tubercular cells. In contrast to Eichler's drawings, there are no free filaments. In other words, anther morphology leaves no doubt that we are concerned with a species of *Phthirusa,* unique in either genus through its broadly flanged peduncle.

35. The *Phthirusa stelis* (L.) Kuijt problem.

Probably the most ubiquitous of all South American Loranthaceae is what has in recent years been known as *Phthirusa retroflexa* (Ruiz & Pavón) Kuijt and, before that, under a great variety of names such as *Phthirusa adunca* (Meyer) Maguire, *P. magdalenae* (Chamisso & Schlechtendal) Eichler, *P. theobromae* (Schultes f.) Eichler, etc. It is also the most troublesome species from a taxonomic point of view, because it is extremely variable. The main variables appear to be leaf size and shape, flower size, and degree of branching of the inflorescence. The leaf blade varies from broadly ovate with nearly truncate base to narrowly lanceolate with attenuate apex (Peru. Amazonas: *Woytkowski 8183,* MO). Flower size, even within one sex, is extremely diverse, ranging from 2 mm (Venezuela. Zulia: *Steyermark et al. 123214,* MO) to 7 mm (*Woytkowski 8183,* MO). Perhaps the most striking and difficult variable is the degree of branching of the inflorescence. My impression is that the tip of the shoot always bears a compound inflorescence, but herbarium specimens are often incomplete in this respect, and it is impossible to be certain.

Figure 10. *Phoradendron websteri* Kuijt, habit. (*Webster 16650,* MO.)

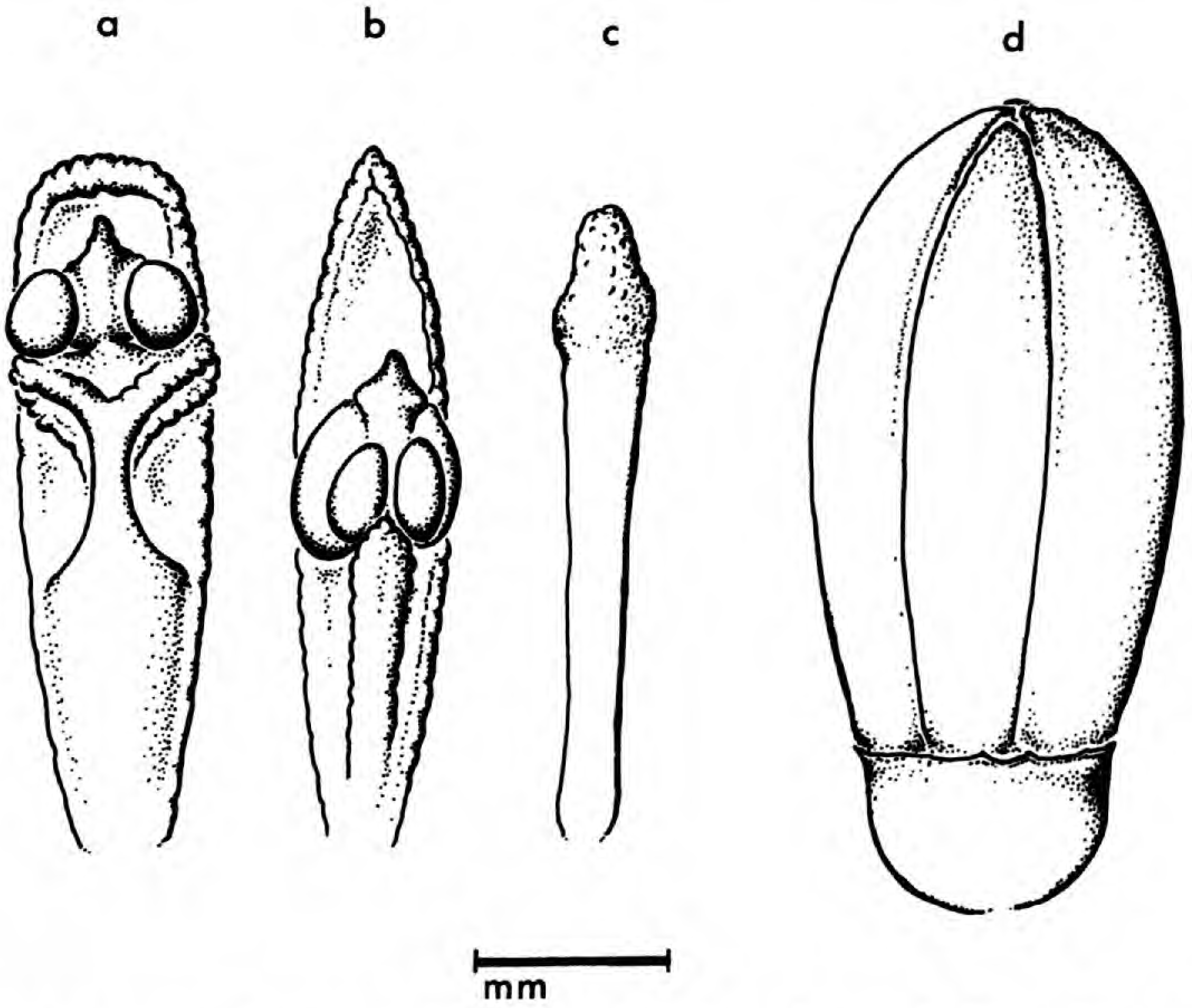

Figure 11. *Phthirusa podoptera* (Chamisso & Schlechtendal) Kuijt, male. —a, b. Dimorphic petals and stamens. —c. Style. —d. Mature bud. (*Maguire et al. 37480,* MO.)

Some specimens have axillary inflorescences that are simple throughout, others have only branched axillary ones, and many have both, the branched inflorescence being near the terminal, compound one. Occasionally, the terminal inflorescence is to 20 cm long, with 6 pairs of lateral branches, of which the lowest may again be branched (*Steyermark et al. 123109,* MO). It may well be that the vigor of the plant, perhaps through the suitability of the host, determines some of these features and that they have little taxonomic significance. Geographically, the complex ranges from Costa Rica and western Panama (where rare) throughout northern and central South America, into southern Brazil and Amazonian Bolivia; on the Pacific slopes, the plants may be encountered from southern Ecuador northward. They occur in lower and middle elevations, but occasionally grow at elevations up to 1400 m, as in the Cerro Duida region. The species seems equally at home in the crowns of undisturbed forest trees and on cultivated woody plants, where it often constitutes a serious pest.

It is not surprising that such a wide-ranging and variable complex has spawned a towering synonymy. The genus *Phthirusa* has never been monographed, and this synonymy has therefore never been sorted out.

I have, over the past 20 years, inspected the majority of specimens belonging to this complex in the major herbaria of Western Europe and the United States, including many of the types involved. The above variables, even in combination, seem not to show any morphological or geographical discontinuities; rather, they appear to show a complete continuum. I have thus reached the conclusion that the only reasonable way to treat these plants is conservatively, as a single species. I cannot exclude the possibility that more detailed future work, including extensive floral dissections, might lead to the recognition of discontinuities, but I am convinced that any subdivisions thus resulting could be assigned an infraspecific rank.

Granted that the complex can be visualized as a single though polymorphic species, the question of nomenclature arises. The oldest name by far in the complex is *Loranthus stelis* L., a name that has been virtually ignored since its appearance in 1762. Its protologue is sparse, indeed (Linnaeus, 1762):

> 5. LORANTHUS racemis trichotomis, pedunculatis trigonis, floribus aequalibus. *Loefl.it.*187. *Habitat in* Cumanae *arboribus.*

Loefling, in the *Iter Hispanicum* to which Linnaeus refers, does not use a binomial, but appears to use *Stelis* as a generic name. Since he seems to equate it with *Loranthus* and perhaps even *Scurrula,* however, it is difficult to think of *Stelis* as a valid generic name. Linnaeus, therefore, is to be regarded as the authority of *Loranthus stelis.*

A holotype or neotype does not appear to exist. Fred Barry (MO, pers. comm.) states that no American Loefling specimens are known, and none are known to have reached Linnaeus. "*Loranthus* #3" in the Linnaean *Catalogue* has no data, and it can therefore not be used as a type specimen no matter what its identity is. As far as I know, a neotype has not been previously designated.

Even though the protologue is brief, it contains one pivotal element that leaves little doubt that we are concerned with the present species: "*racemis trichotomis*." There is no other known species of any small-flowered loranthaceous genus in Venezuela in which this type of compound inflorescence occurs. The present species is also the most abundant one in that part of the country. I see no other option, therefore, but to apply this name to the complex and have recently made the requisite recombination, as cited below.

Phthirusa stelis (L.) Kuijt, Taxon 43: 193. 1994. Basionym: *Loranthus stelis* L., Sp. Plant. ed. 2, 231, 1762, non G. Forster. *Struthanthus stelis* (L.) Blume, in Schultes f., Syst. Veg. 7(2): 1731. 1830. TYPE: Panama. Panamá: seaside just W of Vera Cruz, sea level, on *Laguncularia racemosa*, *Hammel 3298* (neotype (male plant), designated here, MO; isoneotype, LEA).

Phthirusa abdita Moore, Trans. Linn. Soc. London, Ser. 2, 4: 450–451. 1895. Syn. nov. TYPE: Brazil. Mato Grosso: *Moore 594* (holotype, NY; isotype, P).

Phthirusa adenostemon Eichler, Fl. Brasil. 5(2): 58, Figure 14: 2. 1868. Syn. nov. TYPE: Brazil. Prope Panuré ad Rio Vaupes, *Spruce 2906* (holotype, BR; isotype, P).

Phthirusa adenostemon Eichler var. *huberi* Rizzini, Dusenia 3: 458. 1952. TYPE: Brazil. Pará: Arumanduba, Miritizal, *Ducke s.n.* (MG?).

Loranthus aduncus Meyer, Prim. Fl. Esseq. 149. 1818. Syn. nov. *Phthirusa adunca* (Meyer) Maguire, Bull. Torrey Bot. Club 75: 301. 1948. TYPE: not designated.

Phthirusa adunca (Meyer) Maguire fo. *magnifolia* Rizzini, Fl. Venezuela 4(2): 81. 1982. Syn. nov. TYPE: Venezuela. Miranda: Vista Linda, en las cabeceras del río Guarita, 1100 m, *Steyermark & Berry 111889* (VEN?).

Loranthus avicularius Martius in Schultes f., Syst. Veg. 7: 132. 1829. Syn. nov. TYPE: not designated.

Phthirusa caucana Eichler, Fl. Brasil. 5(2): 60. 1868. Syn. nov. TYPE: Colombia. Cauca: near La Paita, *Holton 651* (in the protologue, only *Holton s.n.* is given) (isotype, P).

[*Comments.* Eichler's name is only a provisional one, and is therefore not legitimate by itself. I here include the name, in case a later listing, not known to me, of the species exists elsewhere, which would legitimize Eichler's name; it is here not accepted or legitimized.]

Phthirusa cochliostylus Ule, Notizbl. Bot. Gart. Berlin 6: 288. 1915. Syn. nov. TYPE: Brazil. Amazonas: Rio Branco, Serra de Mairarí, 900 m, *Ule 8385* (holotype, B destroyed; Field Museum Neg. #11790).

Loranthus conduplicatus Kunth, Nov. Gen. 3: 441. 1820. Syn. nov. TYPE: Venezuela. Sucre: Cumaná, *Humboldt 199* (holotype, B-W; isotype, P).

Phthirusa cothurnata Rizzini, Ernstia 24: 16–17. 1984. Syn. nov. TYPE: Venezuela. Amazonas: Depto. Tucupita, Caño Jota-Sabuca, between Laguna del Consejo and Caño Mariusa, N of Río Grande of Río Orinoco, 50 m, *Steyermark et al. 115315* (holotype, RB?; isotypes, MO, VEN).

Phthirusa elongata Gleason, Bull. Torrey Bot. Club 58: 357, Figure 4c. 1931. Syn. nov. TYPE: Venezuela. Esmeralda: Middle Camp, 500 ft., *Tate 946* (holotype, NY).

Loranthus erythrocarpus Martius in Schultes f., Syst. Veg. 7: 138. 1829. Syn. nov. *Phthirusa erythrocarpa* (Martius) Eichler, Fl. Brasil. 5(2): 58–59. 1868. *Passowia erythrocarpa* (Martius) Tieghem, Bull. Soc. Bot. France 42: 172. 1895. TYPE: Brazil. Alto Amazonas: in sylvis montis Arara-Coaras, *Martius s.n.* (holotype, M; Field Museum Neg. #19046).

Phthirusa gonioclada A. C. Smith, Bull. Torrey Bot. Club 59: 515. 1932. Syn. nov. TYPE: Colombia. Norte de Santander: W side of Culugá Valley, N of Labateca, 1480–1550 m, *Killip & Smith 20537* (holotype, NY; isotype, GH).

Phthirusa krukovii A. C. Smith, Brittonia 2: 146. 1936. Syn. nov. TYPE: Brazil. Pará: near Bocca do Paru, *Krukoff 5938* (holotype, NY; isotypes, F, GH).

Loranthus magdalenae Chamisso & Schlechtendal, Linnaea 3: 219. 1828. Syn. nov. *Phthirusa magdalenae* (Chamisso & Schlechtendal) Eichler, Fl. Brasil. 5(2): 55. 1868. *Passowia magdalenae* (Chamisso & Schlechtendal) Tieghem, Bull. Soc. Bot. France 42: 172. 1895. TYPE: *Bertero s.n.* ("vermutlich eine Pflanze von Bertero . . .") (holotype, M).

Phthirusa maritima Rizzini, Rev. Fac. Agron. Maracay 8(3): 92. 1975. Syn. nov. TYPE: Venezuela. Falcón: Distr. Silva, coral island near Cayo Borracho & Caño Ramadita, *Steyermark & Manara 110306* (holotype, RB?).

Passowia odorata Karsten ex Klotsch in Schlechtendal, Bot. Zeits. 10: 305. 1852. Syn. nov. TYPE: not designated.

Loranthus orinocensis Sprengel, Syst. 2: 129. 1825. Syn. nov. *Phthirusa orinocensis* (Sprengel) Eichler, Fl. Brasil. 5(2): 60. 1868. *Passowia orinocensis* (Sprengel) Tieghem, Bull. Soc. Bot. France 42: 172. 1895. *Phthirusa adunca* (Meyer) Maguire var. *orinocensis* (Sprengel) Steyermark, Fieldiana, Bot. 28: 224. 1951. TYPE: not designated.

Loranthus paniculatus Kunth, Nov. Gen. 3: 442. 1820. Syn. nov. *Phthirusa paniculata* (Kunth) Macbride, Publ. Field Mus. Nat. Hist. Bot. Ser. 11: 17. 1931. TYPE: Venezuela. Sucre: Cumaná, *Humboldt 32* (holotype, P).

Phthirusa papillosa Pilger, Bot. Jahrb. Syst. 33, Beibl. 72: 15. 1903. Syn. nov. TYPE: Brazil. "Goyas": *Glaziou 22022* (lectotype, here designated, P).

Phthirusa polystachya Eichler, Fl. Brazil. 5(2): 57–58, Figure 19-3. 1868, non *Struthanthus polystachyus* (Ruiz & Pavón) Blume (a native of Peru). Syn. nov. TYPE: Brazil. Pará: Serras de Santarém, *Spruce 1018* (holotype, P; isotype, NY).

Phthirusa punctata Gleason, Bull. Torrey Bot. Club 58: 359, Figure 4. 1931. Syn. nov. TYPE: Venezuela. Savanna Hills, S bank of Caño Negro, 4400 ft., on *Archytaea multiflora* Bentham, *Tate 853* (holotype, NY).

Loranthus retroflexus Ruiz & Pavón, Fl. Peruv. Chil. 3: 49–50, t. 279b. 1802. Syn. nov. *Phthirusa retroflexa* (Ruiz & Pavón) Kuijt, Brittonia 32: 521–522. 1980. *Struthanthus retroflexus* (Ruiz & Pavón) Blume in Schultes f., Syst. Veg. 7: 1731. 1830. TYPE: Peru, *Pavón s.n.* (isotype, MO).

Phthirusa seitzii Krug & Urban, Bot. Jahrb. Syst. 24: 16. 1897. Syn. nov. TYPE: Tobago, *Eggers 5521* (holotype, P; isotypes, M, P).

Loranthus theobromae Schultes f., Syst. Veg. 7: 132. 1829. Syn. nov. *Phthirusa theobromae* (Schultes f.) Eichler, Fl. Brasil. 5(2): 56–57. 1868. *Passowia theobromae* (Schultes f.) Tieghem, Bull. Soc. Bot. France 42: 172. 1895. *Phthirusa theobromae* (Schultes f.) Eichler fo. *parvifolia* Eichler, Fl. Brasil. 5(2): 57. 1868. TYPE: Brazil. Prov. "Piauhy": *Gardner 2181a* (P).

Phthirusa tortuosa A. C. Smith, Bull. Torrey Bot, Club 59: 514–515. 1932. Syn. nov. TYPE: Colombia. Huila: Río Cabrera to Villavieja, 500–550 m, *Rusby & Pennell 377* (holotype, NY; isotype, GH).

Loranthus virgatus Martius, in Schultes f., Syst. Veg. 7: 132. 1829. Syn. nov. *Phthirusa virgata* (Martius) Eichler, Fl. Brasil. 5(2): 55–56. 1868. TYPE: Brazil. Rio Negro, *Martius s.n.* (holotype, M; Field Museum Neg. #19052).

The type of *Loranthus theobromae* possibly is #6945 at B-W (holotype ?), which is very badly fragmented but belongs to *P. stelis*; otherwise as neotype: Brazil. Prov. Rio Negro, in sylvis Yapurensibus, *Martius s.n.* (holoneotype, M).

In addition to the names listed above, and the possibility of several more later Rizzini names of which I have not seen the types (*P. anastyla* Rizzini, *P. pedicularis* Rizzini, and *P. pyramidalis* Rizzini), there are two more that might have to be added eventually. I cannot at present be certain whether they represent taxa sufficiently different to warrant continued separation, but list them here for the sake of completeness:

Phthirusa ovata (DC.) Eichler, Fl. Brasil. 5(2): 60–61. 1868. *Loranthus ovatus* DC., Prodr. 4: 315. 1830. *Passowia ovata* (DC.) Tieghem, Bull. Soc. Bot. France 42: 172. 1895. TYPE: Brazil. Prov. "Goyas": prope S. Rita ad fluvium Bagagem, *Pohl s.n.* (holotype, M; Field Museum Neg. #19050).

Phthirusa ovata (DC.) Eichler var. *nemorosa* Rizzini, Arq. Jard. Bot. Rio de Jan. 24: 26. 1980. TYPE: Brazil. D.F., Brasilia, Catetinho, *Heringer 14872* (holotype, RB; isotype, NY).

Phthirusa robusta Rusby, Bull. New York Bot. Gard. 6: 501. 1910. TYPE: Bolivia. Santa Cruz: 5000 ft., *Williams 1503* (holotype, NY).

There are two specimens at P, both undoubtedly *P. stelis*, labeled "S. Thomas," "1841" (*Finlay 77, 95*). An annotation label in both cases seems to question the locality. The island, just east of Puerto Rico, would be an exceedingly surprising station for both species, and the records may be assumed to be in error.

36. Psittacanthus breedlovei Kuijt, sp. nov. TYPE: Mexico. Chiapas: slope with tropical deciduous forest 10–15 km W of Ocozocoautla on road to El Ocote, 880 m, on *Acacia*, *Breedlove 70607* (holotype, CAS). Figure 12.

Plantae minores, glabrae; folia usque ad 5.5 × 0.7 cm, angustissime lanceolata. Inflorescentia racemosa, e triadis ca. 6 binis ad axem 1–1.5 cm longam insertis consistens, pedunculus triadae 1–1.5 cm longus, bracteis acicularibus 5–6 mm longis; pedicelli 10–12 mm longi. Alabastrum (cum ovario) 6 cm longum, rectum, aurantiacum. Stamina dimorpha; filamenta ca. 2.5 cm supra basem petali inserta; anthera 2.5–3.5 mm longa, in sulco dorsali profundo dorsifixa; ligulae carentes.

Rather small, glabrous plants, internodes short (to 2 cm); axillary buds flanked by two compressed or naviculate, yellowish prophylls 0.5 mm long. Leaves to 5.5 × 0.7 cm, extremely narrowly lanceolate, with long-attenuate apex and base, petiole indistinct, ca. 5 mm long, venation obscure. Inflorescence a raceme of ca. 6 paired triads crowded on axis 1–1.5 cm long; triad peduncle 1–1.5 cm, its bract 5–6 mm long, acicular; pedicels 10–12 mm long, beyond which a somewhat expanded cupule 4 mm wide, in the case of lateral flowers with a marginal bracteole 1 mm long. Flower bud (including ovary) 6 cm long, straight, angular, orange; ovary 2 × 2 mm, mostly hidden by cupule, crowned by flaring, irregularly dentate calyculus 2 mm long. Stamens dimorphic, filaments inserted ca. 2.5 cm above base of petal, 23 and 26 mm long, slightly sinuous below anthers; anther 2.5–3.5 mm long, dorsifixed in a deep dorsal groove; ligules absent; style nearly the length of the petals, straight, stigma capitate, small. Fruit unknown.

There is no other known species of *Psittacanthus* that shows such an extraordinary, terminally proliferating inflorescence, as *P. breedlovei* apparently does. The evidence of this growth pattern, which I consider rather compelling, does not just lie in the unusually well developed terminal bud of the inflorescence. More importantly, it revolves around the scars such as those indicated by the arrow in Figure 12a and c. These scars are much crowded together, as the triads in the present inflorescences. Furthermore, they show no evidence of the prophylls that might otherwise be expected. I know of no other member of Loranthaceae that shows such inflorescences, except occasionally *Tristerix aphyllus* (DC.) Barlow & Wiens (Kuijt, 1981, fig. 9: 1). It should be understood that this is a situation morphologically very different from that in, for example, *P. pinicola* and *P. ramiflora*, where full-fledged inflorescences develop in the axils of leaves. The triads of *P. breedlovei* do not develop in the axil of

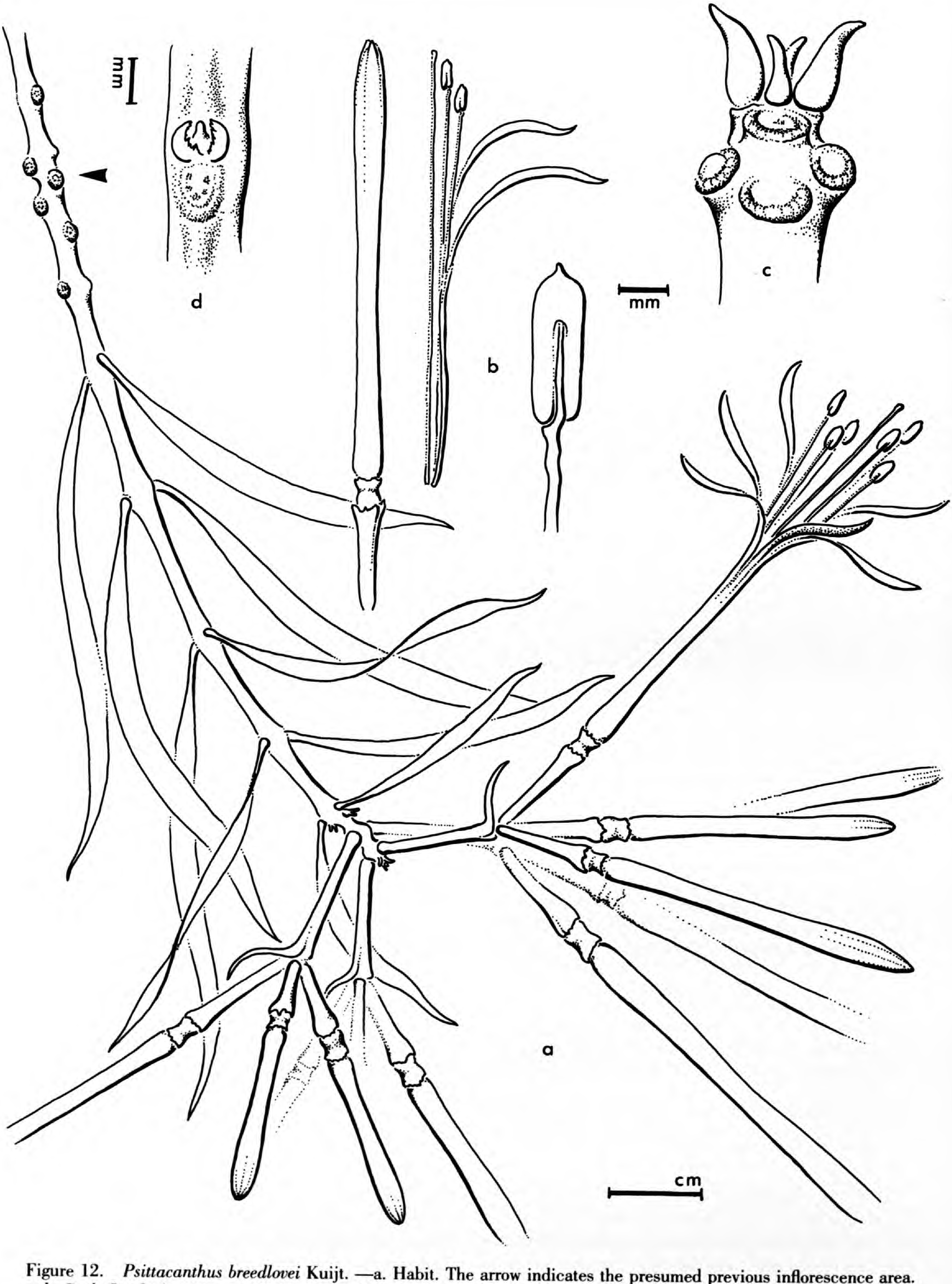

Figure 12. *Psittacanthus breedlovei* Kuijt. —a. Habit. The arrow indicates the presumed previous inflorescence area. —b. Bud, floral elements, and anther. —c. Inflorescence apex showing apical bud and triad scars, the latter lacking prophylls. —d. Leaf scars and associated pair of prophylls. (*Breedlove 70607*, CAS.)

any leafy organ; the foliar organ in that position is the primary bract, which is fused along the length of the triad peduncle and is recognizable at the latter's end.

The other morphological feature worthy of mention is the prominence of the prophylls (Fig. 12d). These structures are recognizable in the young shoots of other species also, as in *Psittacanthus schiedeanus* (Chamisso & Schlechtendal) Blume, but are rarely as prominent. In the present species they are compressed between the petiolar base and the stem, but separate widely when the axillary bud develops. Morphologically, they might be homologous with the bracteoles associated with the cupules of lateral flowers.

Acknowledgments. JK is much indebted to the late Ru Hoogland (Paris) and Fred R. Barrie (MO) for nomenclatural advice in the matter of *Phthirusa stelis.* The Latin species diagnoses for one of us (JK) were kindly prepared by the late Karel U. Kramer of Zurich. Acknowledgments are also due for the continuing financial support of the first author by the Natural Sciences and Engineering Research Council of Canada. The second author has been supported by the Arnold Arboretum and by National Science Foundation grant DEB9106581.

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Two New Species of *Ormocarpopsis* R. Viguier and a New Combination in *Ormocarpum* P. Beauvois (Leguminosae-Papilionoideae) from Madagascar

Jean-Noël Labat
Muséum national d'Histoire naturelle, Laboratoire de Phanérogamie, UMS 826 CNRS-MNHN,
16 rue Buffon 75005 Paris, France

David J. Du Puy
Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, England

ABSTRACT. Morphological characters support the description of two new species of *Ormocarpopsis* from Madagascar: *O. itremoensis* Du Puy & Labat from the Itremo Massif (Central Region) and *O. tulearensis* Du Puy & Labat from the dry region around Tulear (Toliara) in the southwest of the island. A new combination is made for *Ormocarpum bernierianum* (Baillon) Du Puy & Labat.

RÉSUMÉ. L'étude des caractères morphologiques permet la description de deux nouvelles espèces d'*Ormocarpopsis* de Madagascar: *O. itremoensis* Du Puy & Labat du Massif de l'Itremo (Région Centrale) et *O. tulearensis* Du Puy & Labat de la région sèche autour de Tulear (Toliara), dans le sud-ouest de l'île. Une nouvelle combinaison est faite pour *Ormocarpum bernierianum* (Baillon) Du Puy & Labat.

Prior to completion of an account of the subfamily Papilionoideae in Madagascar, two new species of *Ormocarpopsis* R. Viguier are described and illustrated. *Ormocarpopsis* is a genus endemic to Madagascar, in the tribe Aeschynomeneae (Bentham) Hutchinson, subtribe Ormocarpinae Rudd (Rudd, 1981). It contains six species occurring throughout the island except for the lowland eastern rainforest. *Ormocarpopsis* differs from the paleotropical genus *Ormocarpum* P. Beauvois in its pods, which are not segmented (although often containing more than 1 seed), are very swollen, and lack obvious longitudinal striations. The racemes are always short or even reduced to a single flower, but otherwise of a similar structure to those of *Ormocarpum*. A brownish to blackish midvein or blotch on the undersurface of the leaflets appears in dried specimens of most species of *Ormocarpopsis*, but not in *Ormocarpum*. *Ormocarpum* is also present in Madagascar, with two species, *Ormocarpum drakei* R. Viguier and a species described by Baillon as *Diphaca bernieriana*. The genus name *Diphaca* Loureiro (Fl. Cochinch.: 457, 1790) is a rejected name, and the new combination *Ormocarpum bernierianum* is required.

Ormocarpopsis itremoensis Du Puy & Labat, sp. nov. TYPE: Central Madagascar. Province de Fianarantsoa: 7 km au sud d'Ambatofinandrahana, Mahavanyno, lieux-dit Analalehibe, 20°37′43″S, 46°50′32″E, 1350 m, 19 Nov. 1993 (fr), *J.-N. Labat, D. J. Du Puy & J. Andriantiana 2363* (holotype, P; isotypes, K, MO, P, TAN, TEF, WAG). Figure 1.

Species habitu brachyblastis numerosis robustis; floribus subsessilibus; bracteis et bracteolis grandibus stipulas brachyblastorum simulantibus; in siccitate pagina inferiori foliolorum sine macula distinguibili fusca sed principale nervi brunescente; et leguminibus (1–)2–4-spermis distincta.

A shrub ca. 3 m tall, flowering on leafless twigs or on twigs with a few persistent leaves; flowers and leaves produced from numerous robust brachyblasts (contracted lateral shoots with many closely spaced leaf scars and stipules). Leaves with 5–13 leaflets; rachis grooved above, pubescent, not becoming dark on drying. Leaflets oblong-elliptic, ca. 9–11 × 5 mm, mucronulate, glabrous above, pubescent beneath, gray-green especially beneath, thinly coriaceous, the central vein visible beneath, becoming discolored (dark brown) on drying; pulvinules drying blackish. Flowers clustered near the ends of the brachyblasts, solitary, short-pedicellate, appearing sessile as the pedicel is hidden by the stipules and bracts on the brachyblasts when in flower (but becoming elongated and 10–17 mm long in fruit), ca. 10 mm long, yellow; pedicels pubescent; bracts, bracteoles, and stipules all similar, narrowly triangular, 4–5 mm long; bracteoles situated just below the calyx. Calyx ca. 5 mm long,

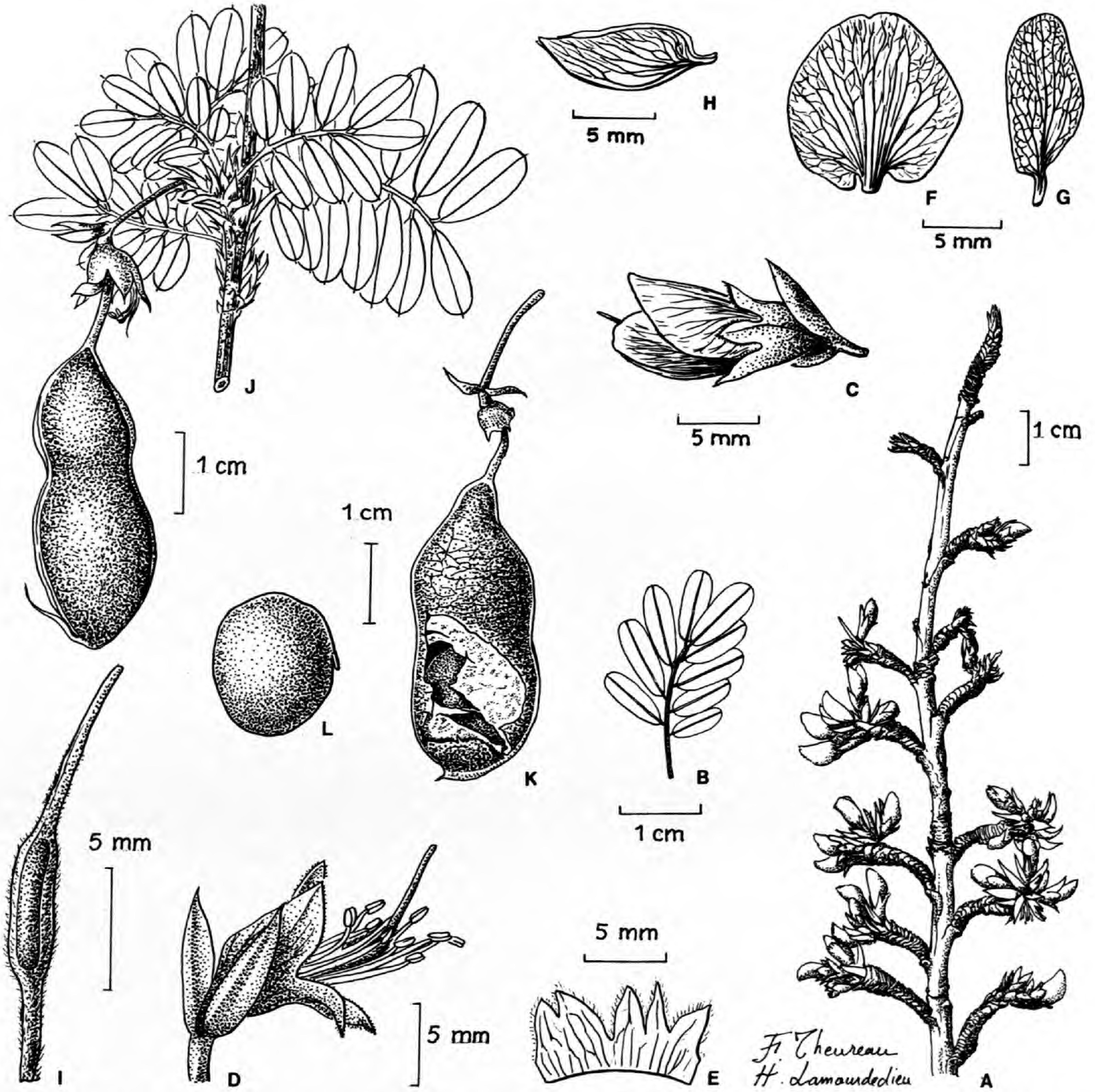

Figure 1. *Ormocarpopsis itremoensis* Du Puy & Labat. —A. Flowering habit. —B. Leaf of flowering shoot. —C. Flower. —D. Flower without corolla. —E. Calyx. —F. Standard petal. —G. Wing. —H. Keel. —I. Ovary. —J. Fruiting habit. —K. Pod. —L. Seed. (A–I from *J. Bosser 9773*; J–L from *J.-N. Labat, D. J. Du Puy & J. Andriantiana 2363*.)

glabrous, ciliate on the margins; teeth subacute, the lower tooth about as long as the others. Keel about as long as the wings. Ovary long-stipitate, glandular-pubescent on the stipe and margins. Pod long-stipitate, the stipe 8–10 mm long, more than twice as long as the calyx, oblong-ellipsoid, 20–50 × 15–17 mm, not glandular, straw-colored and with distinct reticulate venation, thin-textured (not coriaceous), indehiscent but eventually disintegrating by fragmentation of the valves, with (1–)2–4 seeds; endocarp white. Seeds large, ellipsoid, 12–20 × 13–16 × 10–11 mm, pale brown.

Ormocarpopsis itremoensis is an unusual species distinguished by its growth habit with many robust brachyblasts, its subsessile flowers, its large bracts and bracteoles resembling the stipules on the brachyblasts, the midvein of the leaflets drying dark brown beneath (but lacking a distinct brown blotch on the leaflet undersurface), and its (1–)2–4-seeded pods. The growth pattern is unusual in that it is almost completely restricted to the slow extension of the brachyblasts, which sporadically produce more extended shoots which then immediately revert to producing the contracted brachyblasts. The leaves and flowers are only produced at the brachyblast tips.

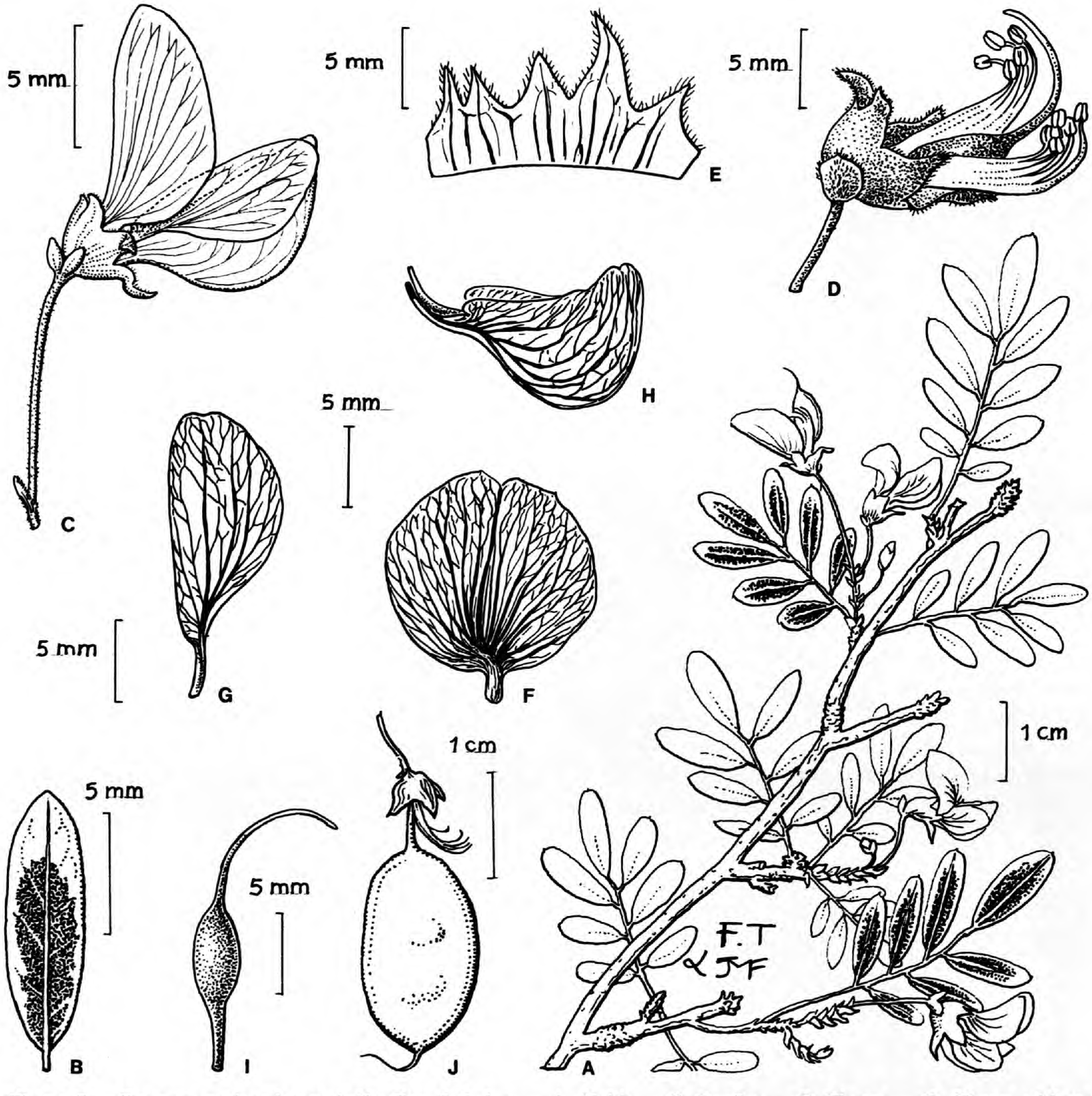

Figure 2. *Ormocarpopsis tulearensis* Du Puy & Labat. —A. Habit. —B. Leaflet. —C. Flower. —D. Flower without corolla. —E. Calyx. —F. Standard petal. —G. Wing. —H. Keel. —I. Ovary . —J. Young pod. (A–C, J from *D. J. & B. P. Du Puy & J.-N. Labat M423*; D–I from *Keraudren 1369.*)

M. Peltier recognized this species as distinct, noting the name *Ormocarpopsis* "*itremensis*" on the *Bosser 9773* specimen.

This species is only known from the type specimen, in fruit, and a flowering specimen collected in the mountains of the Itremo Massif, Central Madagascar. It occurs in woody vegetation, sometimes very open, in thin soil above marble rocks at 1300–1400 m altitude. It is recorded as flowering during September. This species is known by the vernacular name "Hazomahery," in reference to its hard wood, used in the construction of houses and carts. The branches are also used to make tool handles.

The specific epithet refers to the Itremo Massif region of western central Madagascar, where the known collections originated.

Paratype (flowering material). WEST-CENTRAL MADAGASCAR. Ambatofinandrahana, Poste Kilométrique 12, route de Fenoarivo, Sep. 1956 (fl), *Bosser 9773* (K, P, TAN).

Ormocarpopsis tulearensis Du Puy & Labat, sp. nov. TYPE: Southwestern Madagascar. Ca. 35 km N of Tulear (Toliara), 11 km N of Ifaty, near the coast, 23°04′S, 43°37′E, 10 m, 31 Jan. 1990 (fl, jfr), *D. J. & B. P. Du Puy & J.-N. Labat M423* (holotype, K; isotypes, K, MO, P, PRE, TAN, WAG). Figure 2.

Species foliolis angustis, oblongis margine perangusta, scoriasa, in siccitate pagina inferiori macula distinguibili grandi fusca saepe fere totam superficiem inferiorem obtegenti instructis; bracteolis calycem arcte approximantibus; et ovario et legumine glabro et maculato distincta.

A shrub or small, bushy tree, 2–7 m tall, flowering when young leaves are present (rarely before the leaves are produced); leaves and flowers mostly produced from short brachyblasts; young shoots often sticky. Leaves with 5–11(–14) alternate leaflets; rachis flattened, sparsely pubescent to almost glabrous, sometimes drying black. Upper leaflets narrowly oblong to oblong-obovate, 14–28 × 3–5 mm, glabrous, with a very narrow, scarious margin, bluish green, minutely punctate above, drying with a large dark brown blotch beneath, which often covers almost the entire undersurface. Flowers 1–3 on a very short peduncle up to 10 mm long, with several bracts below the flowers, 10–16 mm long, yellow and drying with distinct darker veins, the standard petal lemon yellow with a greenish base, the wings lemon yellow, the keel pale green, about as long as the wings, with a distinct beak; pedicels shorter than the flowers, finely pubescent; bracts ovate, ca. 2 mm long; pedicel up to 12 mm long; bracteoles elliptic, 2–3 mm long, situated immediately below and appressed to the calyx. Calyx 4–6 mm long (excluding the lower tooth), glabrous except for the ciliate margin; teeth obtuse, spreading, the lower tooth longer than the others. Ovary flat, subcircular to oblong, glabrous, mottled. Pod shortly stipitate, the stipe about as long as or slightly longer than the calyx, oblong-ellipsoid, ca. 22 × 12 mm, not glandular, straw-colored and distinctly reticulate-veined, thin textured (not coriaceous), indehiscent but eventually disintegrating by fragmentation of the valves, young and immature pods with 1–4 very immature seeds but the only two partially mature pods known are 1-seeded; endocarp white. Seeds ellipsoid, ca. 11 × 9 × 6 mm, brown.

Ormocarpopsis tulearensis can be recognized by its narrow, oblong leaflets with a very narrow, scarious margin and which dry with a distinctive large, brown blotch beneath that often almost entirely covers the leaflet's undersurface; its bracteoles situated just at the calyx base; and its glabrous, mottled ovary and immature pod.

This is the only species of the genus that occurs in southwestern Madagascar, being confined to a small region around Tulear (Toliara), extending north toward Manombo, east to Andranovory and Tongobory, and south to the Itambono Corridor. It occurs in xerophytic scrubland, on limestone or sand over limestone, from sea level to ca. 300 m altitude. It is recorded as flowering from November to March. It is known in the region under the vernacular name of "Sofasofa."

M. Peltier recognized this species as distinct, noting the name *Ormocarpopsis tulearensis* on the specimens.

The specific epithet refers to the town of Tulear (Toliara) in the southwest of Madagascar, because all the known collections originated from a small region around this town.

Paratypes. SOUTH MADAGASCAR. Balalana, embouchure du Fiherenana, Nov. 1956 (fl, fr), *Bosser 10611* (P, TAN); 30 km de Tulear, 1962 (fl), *Bosser 15666* (P, TAN); environs de Tulear, La Table, 14 Fév. 1961 (fl), *Chauvet 30* (P, TEF); along route n° 10 between Tongobory and Betioky, 100–300 m, 14 Fév. 1975 (bud), *Croat 31205* (TAN, MO); environs de Tulear à 40 km sur la route Tulear-Tananarive, Fév. 1962 (fl), *Keraudren 1369* (K, P); environs de Tulear, s.d. (fl, jfr), *Montagnac 49* (K, P); Province de Tulear, Itambono Corridor between Betioky and Beheloka, 18 km from Route Nationale 10, 23°52′S, 44°12′E, 250m, 30 Dec. 1987 (fl), *Phillipson 2745* (MO, P); aux environs de La Table, Tulear, Mar. 1953 (fl, jfr), *Service Forestier de Madagascar 6933-SF (Capuron)* (BR, K, MO, NY, P, TEF); Tulear, 27 Jan. 1955 (fl, jfr), *Service Forestier de Madagascar 12702-SF* (P, TEF); route Tulear–Sakaraha, vers les Postes Kilométriques 55–65, à l'ouest d'Andranovory, Déc. 1961 & Jan. 1962 (fl, jfr), *Service Forestier de Madagascar 20715-SF (Capuron)* (K, MO, P, PRE, TEF, WAG); plateau calcaire aux environs de La Table, Tulear, 12 Déc. 1962 (fl), *Service Forestier de Madagascar 22262-SF (Capuron)* (K, MO, P, TEF, WAG).

Ormocarpum bernierianum (Baillon) Du Puy & Labat, comb. nov. Basionym: *Diphaca bernieriana* Baillon, Bull. Soc. Linn. Paris 1: 416 (1884). SYNTYPES: Northern Madagascar. "Diego-Suarês" [Antsiranana], *Bernier (2ème envoie) 252* (lectotype, selected here, P; isolectotypes, P, K); *Boivin 2718* (not seen).

Ormocarpum bernierianum is closely related to *O. schliebenii* Harms, an uncommon species from Tanzania and Mozambique, differing most strikingly in its unusual white rather than yellow flowers. *Ormocarpum bernierianum* also becomes a larger shrub, and it has more numerous flowers in its longer racemes, smaller bracteoles, and more rounded calyx teeth. *Diphaca bernierianum* is the earlier name, and *O. bernierianum* would have priority over *O. schliebenii* if these two taxa were considered to be conspecific. The name *Ormocarpum hildebrandtianum* Baillon is present on a herbarium sheet in Paris but has not been published.

This species is only known from northern Madagascar and is confined to the extreme north including the Ankarana Plateau, the Analamerana Massif, Montagne des Français, Diego Suarez (Antsiranana), and Cap d'Ambre. It occurs in deciduous woodland and open vegetation over limestone, from near sea level to ca. 350 m altitude, often along watercourses.

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Two New Species and One New Combination in Leafless Malagasy *Cynanchum* (Asclepiadaceae)

Sigrid Liede
Abtlg. Spezielle Botanik, Universität Ulm, 89069 Ulm, Germany

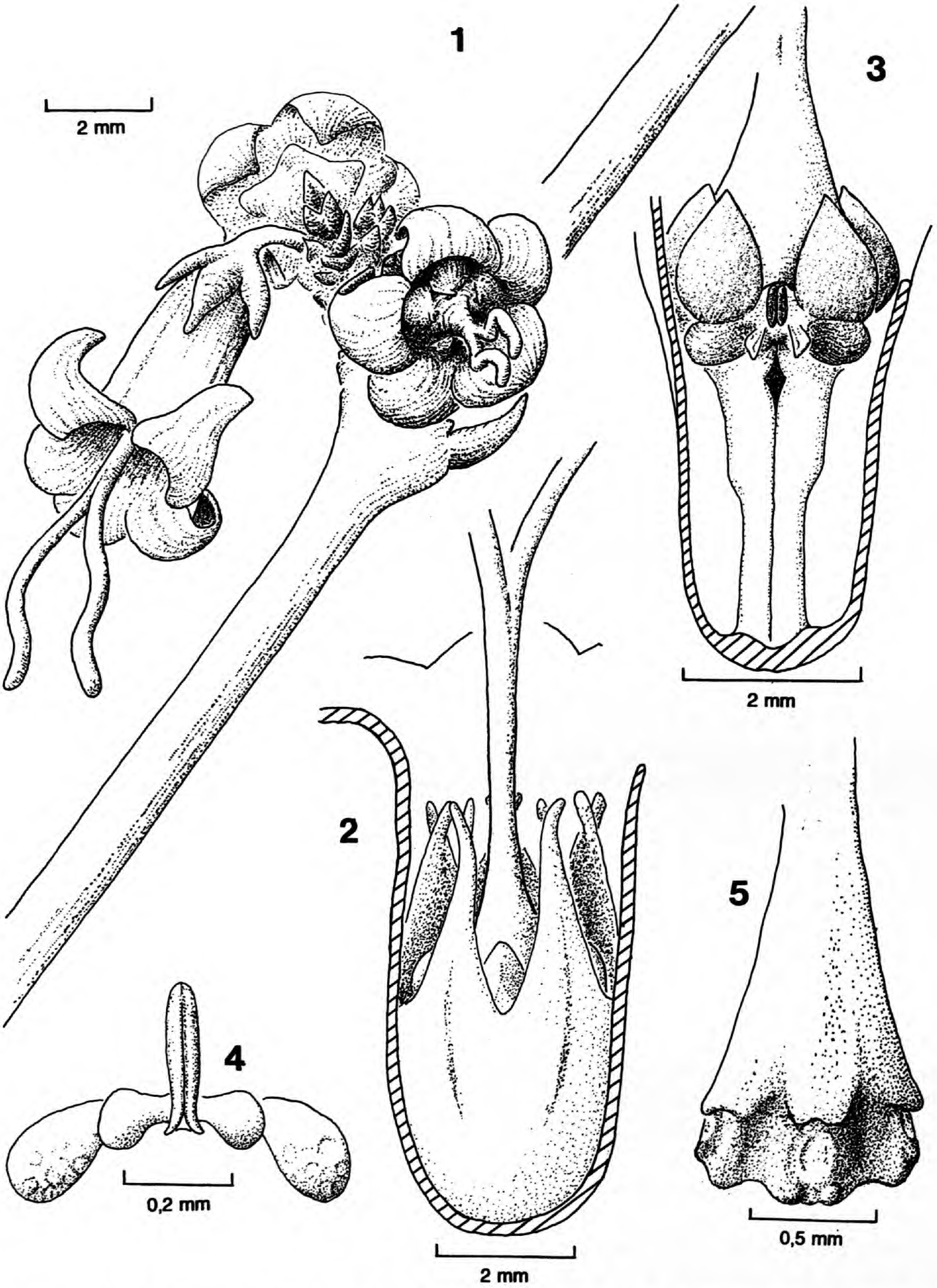
Ulrich Meve
Institut für Botanik und Botanischer Garten, Westf. Wilhelms-Universität, Schlossgarten 3, 48149 Münster, Germany

ABSTRACT. Two new leafless succulent species from Madagascar, *Cynanchum folotsioides* and *Cynanchum hardyi*, are described. Both species have been in cultivation for a considerable time. However, because of the general confusion in Malagasy *Cynanchum*, they have only now been recognized as new to science. *Folotsia aculeata* (Descoings) Descoings is transferred to *Cynanchum*.

In the course of a revision of the Malagasy Asclepiadaceae–Cynanchinae for the Flora of Madagascar project, we received two plants representing species that were not only undescribed, but of which there were no specimens in any of the collections consulted (K, MO, P). *Cynanchum folotsioides* (Fig. 2) possesses yellow latex and striped succulent shoots, a character combination shared with *C. decaisnianum* Descoings, *C. mahafalense* Jumelle & H. Perrier, and *C. messeri* Jumelle & H. Perrier. The latter two possess corolla lobes densely covered with monocellular trichomes, while those in *C. decaisnianum* and *C. folotsioides* are glabrous. In a strictly corona-based classification, *C. folotsioides* would be described as a member of the genus *Folotsia* because its more prominent corona lobes stand in interstaminal position. However, the combination of striped shoots, yellow latex, and anther wings of two ridges with upwardly directed bristles in between clearly places this species in *Cynanchum* L. The same argument holds for the atypical *Folotsia aculeata* Descoings (Fig. 1). This species, with its narrowly campanulate, highly fused corolla and its stylar head with a long appendage, also possesses the yellow latex and striped shoots associated with *Cynanchum*. However, its much reduced anther wings suggest neither genus. If the corona type of *C. decaisnianum*, with its ten lobes (five in staminal, five in interstaminal position), is considered as the ancestral type, the idea that the staminal lobes have undergone reduction, as in *C. folotsioides* and *F. aculeata*, is not any more unlikely than a reduction of the interstaminal lobes. The present authors have recognized the combination of shoot morphology, latex color, and anther wing morphology as systematically more telling than slight variations in corona morphology, a character likely subject to strong selection by pollinators. Therefore, exceedingly smooth shoots, white latex, and papillose anther wings are considered characteristic of *Folotsia*, in addition to a dominance of the interstaminal corona lobes. A cladistic analysis of all Malagasy and African *Cynanchum* and *Folotsia* species in preparation by the senior author supports this conclusion. Possibly, more species can be attributed to the distinct group of species characterized by yellow latex; however, latex color is often not recorded by collectors.

The second new species, *Cynanchum hardyi* (Fig. 3), belongs to a different alliance within the leafless Malagasy Cynanchinae. Its closest relative is the widespread and frequent *C. arenarium* Jumelle & H. Perrier, a species better known under the later name *C. nodosum* (Jumelle & H. Perrier) Descoings. The rare *C. hardyi* from the west coast of Madagascar differs from *C. arenarium* by its much more slender flower, distinctly darker corolla lobes, and an umbonate stylar head. More subtle, but equally important, distinctions are the anther wings of *C. hardyi* being much shorter than the anthers, and, especially, the unique attachment of the pollinium to the translator arm along a long, slender tail.

Cynanchum aculeatum (Descoings) Liede & Meve, comb. nov. Basionym: *Prosopostelma aculeata* Descoings, Natur. Malgache 9: 184. 1957. *Folotsia aculeata* (Descoings) Descoings, Adansonia sér. 2, 1: 313. 1961. TYPE: Madagascar. Toliara, Cap Sainte-Marie, sur la plateforme terminale, *Descoings 1013* (holotype, P; isotype, TAN). Figure 1.



igure 1. *Cynanchum aculeatum* (Descoings) Liede & Meve. —1. Stem with inflorescence. —2. Corona. —3. Gynostegium. —4. Pollinarium. —5. Stylar head, basal part. 1–5 drawn by Jim Conrad from *Descoings 1013*.

Cynanchum folotsioides Liede & Meve, sp. nov. TYPE: Madagascar. Toliara, 70 km before Ansomala, 1969, *Rauh 21847* (holotype, K; isotype, MSUN). Figure 2.

Plantae latice flavo; corona gynostegialis tubulari, partibus staminalibus interstaminalibusque late connatis, partibus staminalibus filamentis connatis, breve bifidis, partibus interstaminalibus emarginatis; gynostegio sessili.

Plants twining to erect. Shoots succulent, finely striate, sparsely glabrescent with erect, 250–300-μm-long trichomes; internodes 2–15 cm long, 5–8 mm diam. Latex yellow. *Leaf rudiments* scalelike,

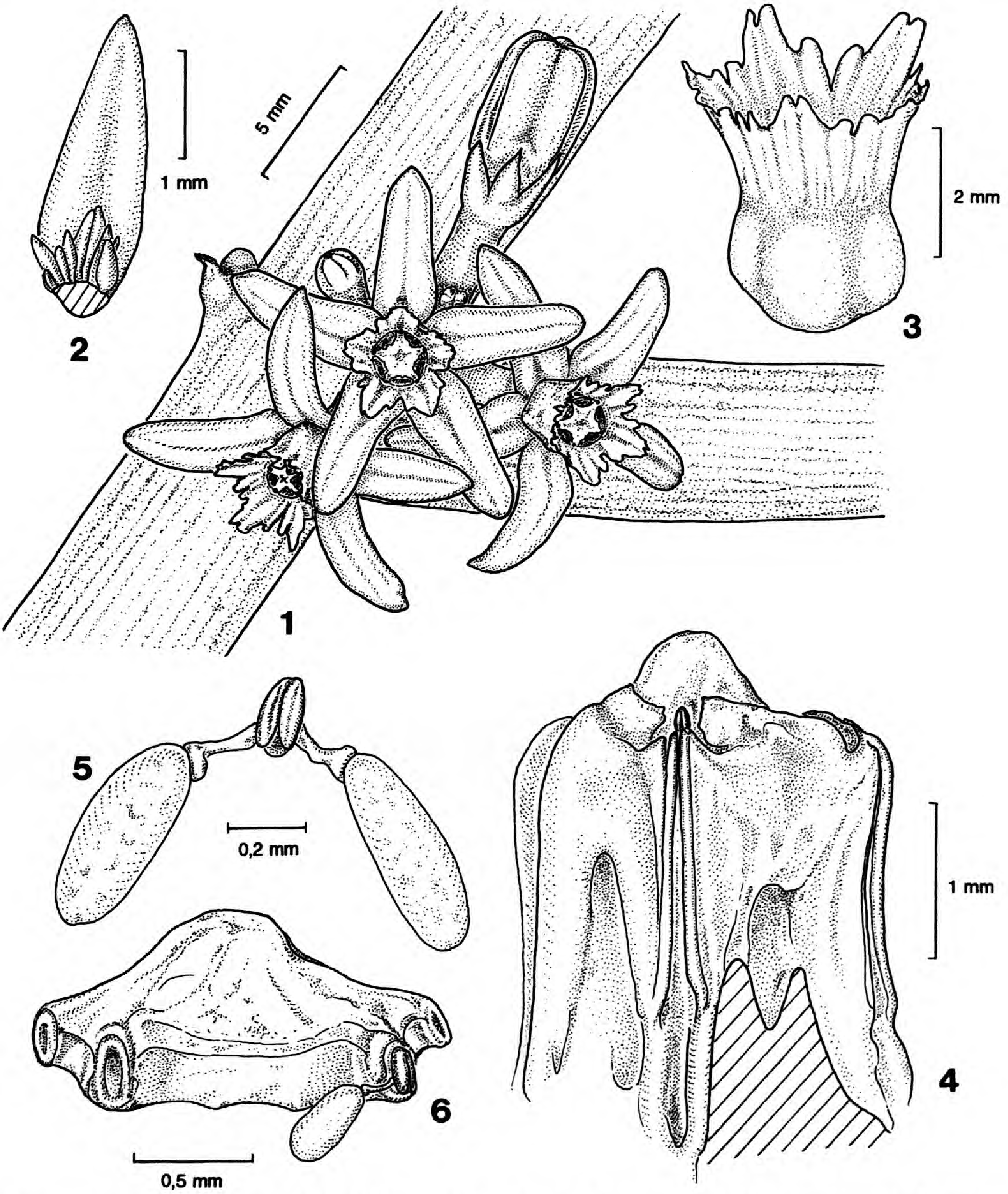


Figure 2. *Cynanchum folotsioides* Liede & Meve. —1. Node with inflorescence. —2. Leaf rudiment. —3. Corona. —4. Gynostegium. —5. Pollinarium. —6. Stylar head. 1–6 drawn by U. Meve from *Rauh 21847.*

2–2.4 mm long, 1–1.2 mm wide, ovate, apically obtuse. *Inflorescences* one per node, umbelliform, sessile. *Flowers* nectariferous, faintly and pleasantly sweet scented; floral bracts 0.7–0.9 mm long, 0.4–0.5 mm wide at the base, ovate, non-glandular, glabrous. *Pedicels* 7–9 mm long, sparsely covered with flexuous, 300–400-μm-long trichomes. *Floral buds* 4.5–5 mm long, 3 mm diam., cylindrical, with imbricate aestivation. *Calyx* basally fused (colleters visible in the sinuses of the calyx lobes), campanulate, abaxially glabrous, the lobes 1.3–1.5 mm long, 1.2–1.4 mm wide, triangular, apically acute. *Corolla* rotate; the lobes 4–4.5 mm long; abaxially and adaxially brownish, purple along the main nerves; horizontal to recurved, oblong, apically obtuse. *Gynostegial corona* white, tubular, 450–500 mm high, exceeding the gynostegium, but not obscuring it; staminal and interstaminal corona parts

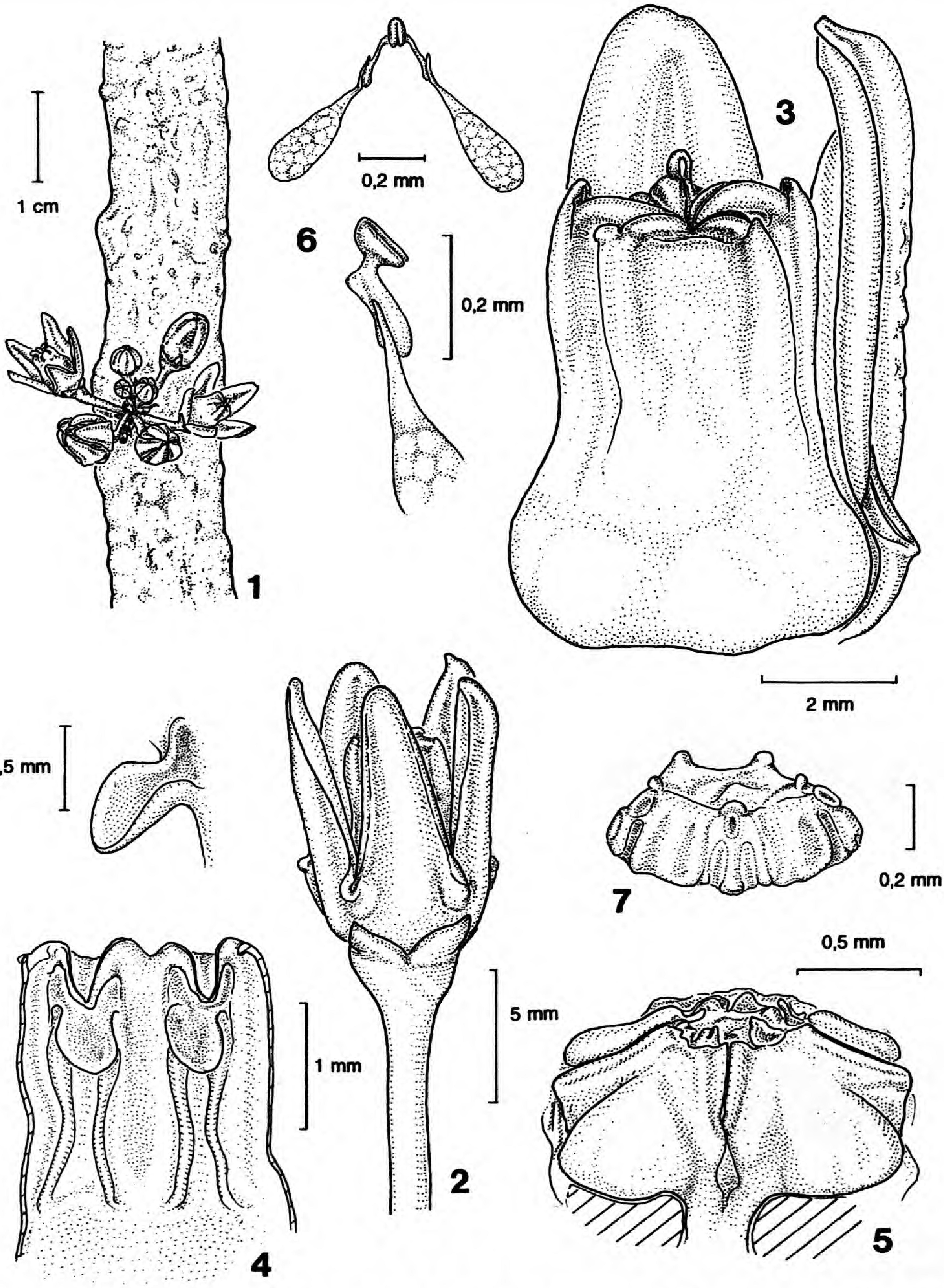


Figure 3. *Cynanchum hardyi* Liede & Meve. —1. Node with inflorescence. —2. Flower. —3. Corona. —4. Corona adaxially; top: ligule in side view; bottom: two staminal corona parts and one interstaminal corona part unfolded. —5. Gynostegium. —6. Pollinarium; top: frontally; bottom: side view. —7. Stylar head. 1–7 drawn by U. Meve from *Hardy & Jacobsen 3571.*

fused for more than ¾ of total corona length, the staminal corona parts adnate to the filament, laminar, adaxially forming two vertical ridges, with lobes ovate, apically erect, with straight, emarginate margins, the interstaminal corona parts longer and thinner than staminal parts, laminar. *Gynostegium* sessile, 2.0–2.2 mm high, 1.8–2.0 mm diam. Stamens with filament; anthers higher than broad, rectangular, abaxially planar; anther wings 1400–1600 μm long, extending basally beyond the anther proper, parallel above, divergent toward the base, in the same plane as the anther. Connective appendages 600–700 μm long, 1100–1200 μm wide, depressed ovate, equaling the stamen in width, strongly inflexed. *Pollinarium*: corpusculum 300–320 μm long, margins of the corpuscular cleft parallel; translator arms 130–150 μm long, cylindrical, s-shaped (concave-convex), thickened at the insertion of the pollinium; pollinia 300–350 μm long, 130–150 μm wide, ovate in cross section, ovoid to oblong, apically attached to the translator arm. *Stylar head* white, 1400–1500 μm diam., 850–1000 μm high; upper part 400–450 μm high, higher than the lower part, depressed-conical. *Fruit* and *seed* unknown. *Chromosome number*: $2n = 22$ (voucher: *Rauh 21847,* MSUN).

The name of the species refers to the fact that it might be mistaken for a member of the genus *Folotsia* at first sight.

Cynanchum hardyi Liede & Meve, sp. nov. TYPE: Madagascar. Toliara–Morombé, Morombé, *Hardy & Jacobsen 3571* (PRE *17127*) (holotype, K; isotypes, PRE, MSUN (in spiritu)). Figure 3.

Cynancho arenario affine, sed floribus cylindrioribus, alis antherarum brevioribus, polliniis corpusculum caudis affixis, capite stylorum non tabulari differt.

Plants decumbent, 25–35 cm high, richly branched. Shoots succulent, warty, prominently glaucous, with isolated, flexuous trichomes, 350–550 μm long, on the crests; internodes 6–8 mm diam. *Leaf rudiments* scalelike, sessile, caducous. *Inflorescences* subsessile, bostrychoid, 12–20-flowered, 6–10 flowers open at the same time; rachis 1–2 mm long, straight. *Flowers* with floral bracts 0.5–0.6 mm long, 0.6–0.7 mm wide at the base, triangular, glabrous. *Pedicels* 4–5 mm long, glabrous. *Floral buds* 4–5 mm long, 3–3.5 mm diam., ovoid, with imbricate aestivation. *Calyx* fused for a little more than ¼ of its length, campanulate; abaxially glabrous, the lobes 1.3–1.5 mm long, 1–1.1 mm wide, triangular, apically acute. *Corolla* campanulate; fused for about ¼ of its length; corolla lobes 4–4.5 mm long, 1.3–1.6 mm wide, basally yellow, abaxially brown above, forming bulges at their sinuses, patent, oblong, keeled, apically obtuse. *Gynostegial corona* white, tubular, 2.3–2.5 mm high, exceeding the gynostegium, entirely obscuring it, consisting of almost completely fused staminal and interstaminal parts. Staminal corona parts apically strongly inflexed, adaxially with solid, liguliform, inflexed appendage. Interstaminal corona parts laminar, keeled along the upper third of corona length resulting in a cucullate shape, the lobes bifid when flattened, erect, with laterally involute margins. *Gynostegium* sessile, 1.0–1.2 mm high, 1.2–1.3 mm diam. Stamens without filaments; anthers hexagonal, abaxially gibbose; anther wings 400–500 μm long, not extending along the whole length of the anther, the anther forming a "pseudostipe" 250–300 μm tall; adjacent anther wings parallel to each other, basally slightly centrifugal, with additional guiding structure formed by the anther margins along the "pseudostipe." Connective appendages 100–150 μm long, 150–170 μm wide, triangular, narrower than the stamen, strongly inflexed. *Pollinarium*: corpusculum 100–120 μm long, margins of the corpuscular cleft parallel; translator arms 130–150 μm long, flattened, convexly recurved, rectangular; pollinia 500 μm long (fertile part 300 μm), 130–150 μm wide, ovate in cross section, clavate, attached to the corpusculum along a tail of the pollinium. *Stylar head* white, 450–500 μm diam., 250–300 μm high; upper part 50–100 μm high, shorter than the lower part, umbonate. *Fruit* and *seed* unknown. *Chromosome number*: $2n = 22$ (voucher: *Hardy & Jacobsen 3571*, MSUN).

Habitat. Beach.

The species is named in honor of David S. Hardy, keen South African collector and grower of Malagasy succulents, from whom we received living material of this species.

Acknowledgments. For the supply of material, we are grateful to Werner Rauh, Heidelberg, Germany. For correction of the Latin diagnoses, we thank Peter Deitelhoff, Münster. SL thanks the Deutsche Forschungsgemeinschaft for continued financial support (grants LI 496/1-4).

A New Species of *Nototrichium* (Amaranthaceae) from Kauaʻi, Hawaiian Islands

David H. Lorence

National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawaii 96765, U.S.A.

ABSTRACT. *Nototrichium divaricatum* Lorence from the Hawaiian Island of Kauaʻi, distinguished from its congeners by its compoundly branched inflorescences with divaricate branches and shorter spikes, is described and illustrated, and its affinities within the genus are discussed.

Nototrichium (A. Gray ex Hillebrand) Hillebrand is a Hawaiian endemic genus of shrubs or occasionally small trees restricted to mesic and dry forest and shrubland communities. *Nototrichium* was originally established as a genus by Hillebrand (1888) to encompass three species: *N. sandwicense* Hillebrand (with two additional varieties), *N. humile* Hillebrand, and *N. viride* Hillebrand. Subsequently, Schinz (1931) described an additional species, *N. fulvum* Schinz. In a series of publications Sherff (1950a, b, 1951a, b, 1962) described over 20 varieties of *N. sandwicense*. St. John (1980) later described a new variety of *N. viride*. Many of these taxa were based on variable characters, such as pubescence density, leaf size, and inflorescence shape and length. In the most recent treatment of the genus, Wagner et al. (1990) recognized only two species, *N. humile* and *N. sandwicense*, with no infraspecific categories. The former species is federally listed as endangered and restricted to Oʻahu (Waiʻanae Mts.) and one locality on East Maui, whereas the latter species is much more common and widespread, occurring on all eight of the main Hawaiian Islands: Kauaʻi, Niʻihau, Oʻahu, Molokaʻi, Lanaʻi, Maui, Kahoʻolawe, and Hawaiʻi (Wagner et al., 1990).

Nototrichium belongs to subfamily Amaranthoideae based on its bithecal (tetrasporangiate) anthers and pollen of the *Amaranthus*-type (Eliasson, 1988). The following combination of characters distinguishes it from other genera of native and naturalized Amaranthaceae in Hawaiʻi: shrubby or arborescent habit, densely silky strigose pubescence, opposite leaves, flowers in terminal spikes, flowers and fruit ascending, and flowers 4-merous. *Nototrichium* is clearly related to the primarily Old World genus *Achyranthes* L., which differs by its reflexed flowers and fruit and 5-merous flowers, although certain anomalous species, such as *A. arborescens* R. Brown from Norfolk Island, have 4-merous flowers (Hillebrand, 1888; Wagner et al., 1990). Nevertheless, the pollen structure of *Nototrichium* closely resembles that of certain species of *Cyathula* Blume (Eliasson, 1988).

An unusual species of *Nototrichium* not corresponding with any of the described taxa was first collected on the Na Pali coast region of northwestern Kauaʻi by Steve Montgomery in 1985 and was relocated in 1991 by Kenneth R. Wood, staff member of the National Tropical Botanical Garden. Further exploration of this rugged area by Wood revealed a continuous band of this species comprising an estimated 1000 individuals growing on north-facing cliffs in Kalalau, Pohakuao, and Honopu valleys between ca. 600 and 1100 m elevation. Critical study of the specimens leaves no doubt that they represent a new species of *Nototrichium*.

Nototrichium divaricatum Lorence, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kauaʻi: Hanalei District, Kalalau rim, 320° NW-facing cliffs below and E of first Kalalau lookout, diverse montane precipitous slopes with small pockets of forest and vertical cliffs, 1000–1100 m, 15 Sep. 1991, *K. R. Wood, M. Query & D. Boynton 1227* (holotype, PTBG; isotypes, BISH, F, MO, NY, US). Figure 1.

Species inflorescentia pluriramosa, ramulis divaricatis, ramulis primariis paribus 1(–2), interdum ramulis secondariis instructis, spicis brevioribus 5–20(–35) mm longis, (4–)8–30(–66) floribus a congeneribus bene distincta.

Densely branching shrubs 0.3–2 m tall, most parts densely sericeous with straight, silvery-white, appressed, simple hairs 0.2–0.6 mm long; twigs densely white-sericeous, terete or slightly quadrangular, 1.5–2.5 mm diam., the internodes (0.5–)1–6.5 cm long; leaves opposite, petiolate, equal; petioles 3–12 × 0.8–1.5 mm, adaxially flattened or concave, narrowly winged distally, densely sericeous; lamina elliptic, narrowly elliptic, lanceolate, rarely rhombic-elliptic or obovate-elliptic, (2–)3–7.5 × (0.6–)1–4.6 cm, chartaceous, adaxially

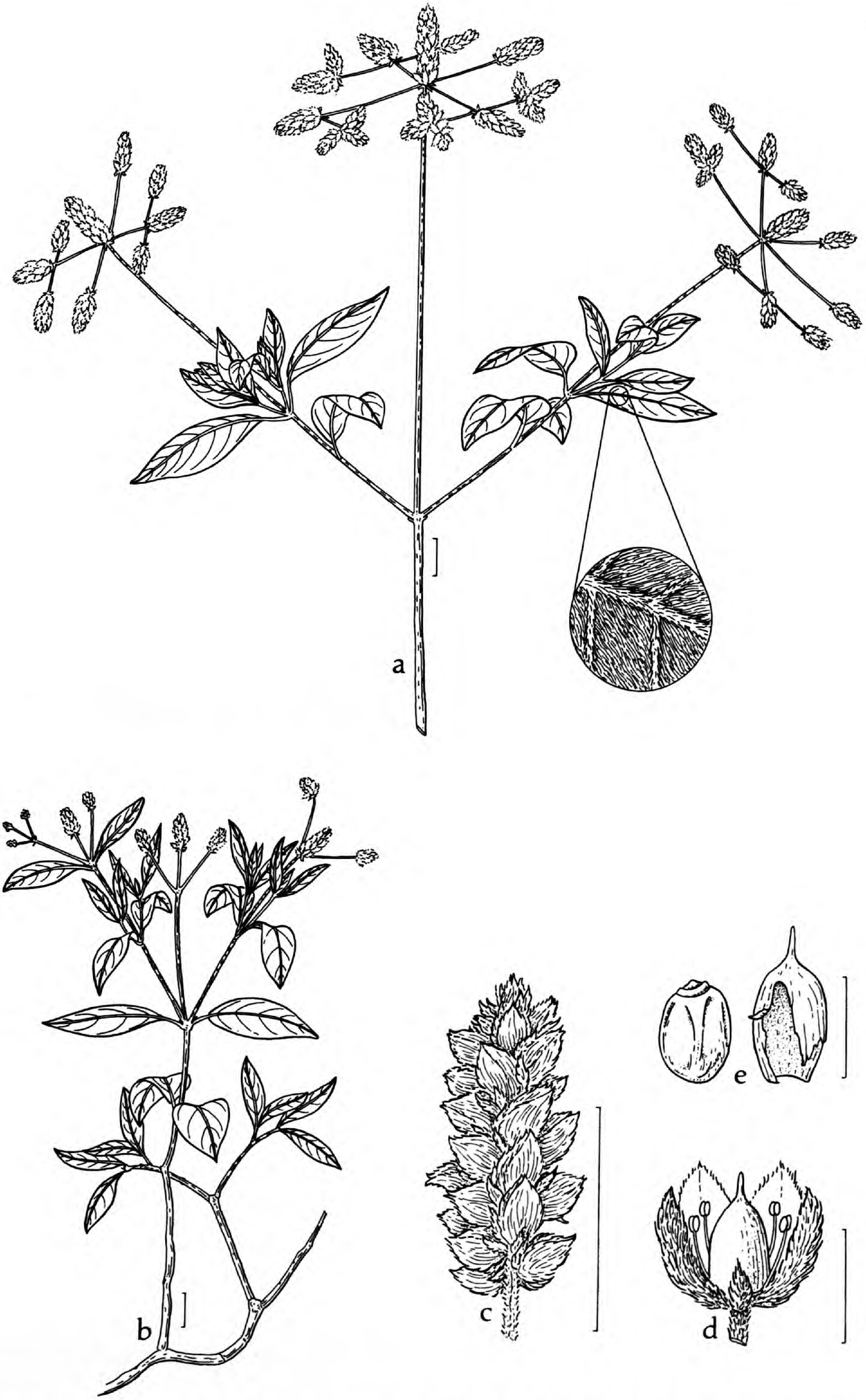


Figure 1. *Nototrichium divaricatum* Lorence. —a. Habit of plant with highly branched inflorescence. —b. Habit of plant with sparsely branched inflorescence. —c. Spike of flowers. —d. Flower, sepals opened. —e. Seed and ruptured fruit wall. a, c, *Wood et al. 1227*; b, *Wood 1155*, d, *Wood et al. 1771*, e, *Wood 1156*. Bars = 1 cm in a, b, 1.8 cm in c, 3 mm in d, 1.6 mm in e.

sparsely to densely sericeous with appressed hairs, often white-punctate, the hairs often denser along the costa, abaxially densely white-sericeous, the apex acute or acuminate, the base narrowly cuneate to attenuate, the lateral veins 7–10 on a side, ascending straight then arching near margin. Inflorescence terminal and usually solitary, rarely 2 or 3 together, (3–)4–18 × (2–)3–19 cm, a compoundly branched dichasium of spikes, the branches divaricate, the peduncle 2–8(–11) cm long, terminated by a sessile or shortly pedunculate spike, the primary branches 2–4(–5), radiate, 1.5–5.5 cm long, often unequal, each terminated by a sessile or shortly pedunculate spike, this often subtended by a pair of secondary branches 0.3–2 cm long, each terminated by 1 or 3 sessile spikes; spikes (4–)8–30(–66)-flowered, 5–20(–35) mm long, 5–7 mm diam.; flowers weakly ascending, ovoid to narrowly ovoid, 0.5–3 × 1.8–2 mm, each subtended by an externally sericeous, scarious, ovate bract 1.5–2 × 0.8–1 mm, persistent on the rachis, and 2 externally sericeous, scarious, narrowly ovate bracteoles 1.2–1.8 × 0.8–1 mm long, deciduous with the calyx and fruit; sepals 4, ovate, 2.3–3 × 1–2 mm, concave, externally uniformly white-sericeous, internally glabrous, the apex usually mucronulate; stamens 4, included, the anthers ellipsoid, 0.5 mm long, bilobed at apex and base, the filaments 0.7–0.9 mm long, pilose, connate at base; ovary subglobose-depressed, 0.6–0.8 mm long, white-pilosulous, the persistent style 0.5–0.6 mm long, stigma capitate. Fruit enclosed by the persistent calyx, ellipsoid or obovoid, 2 × 1.4 mm, pilosulous distally, the wall thin, tardily transversely dehiscent; seed broadly ellipsoid, 1.5–1.6 × 1.1–1.2 mm, the testa shiny brown.

Distribution. Known only from the Na Pali coast region in the Na Pali-Kona Forest Reserve of northwestern Kaua'i, where it has been collected in Kalalau, Honopu, and Pohakuao valleys at ca. 600–1100 m elevation.

Habitat. *Nototrichium divaricatum* occurs on north-facing cliffs and ridges in remnants of diverse lowland and montane mesic forest dominated by *Metrosideros polymorpha* Gaudichaud, *Diospyros sandwicensis* (A. DC.) Fosberg, and *Dicranopteris linearis* (N. L. Burman) Underwood. Other mesic forest associates include: *Acacia koa* A. Gray, *Boehmeria grandis* (Hooker & Arnott) A. Heller, *Coprosma* spp., *Dodonaea viscosa* Jacquin, *Dubautia* spp., *Exocarpus luteolus* C. Forbes, *Fleuggea neowawraea* W. Hayden, *Kokia kauaiensis* (Rock) O. Degener & Duvel, *Lysimachia glutinosa* Rock, *Melicope pallida* (Hillebrand) T. Hartley & B. Stone, *Peucedanum sandwicense* Hillebrand, and *Pritchardia minor* Beccari. This new species also occurs in diverse dry to mesic shrubby cliff vegetation with *Artemesia australis* Lessing, *Bidens sandvicensis* Lessing, *Chamaesyce* sp. nov., *Eragrostis variabilis* (Gaudichaud) Steudel, *Hedyotis* sp. nov., *Lepidium serra* H. Mann, *Lipochaeta connata* (Gaudichaud) Candolle var. *acris* (Sherff) R. C. Gardner, *Lobelia niihauensis* H. St. John, *Panicum lineale* H. St. John, *Poa mannii* Munro ex Hillebrand, *Stenogyne campanulata* Weller & A. Sakai, *Vaccinium dentatum* Smith, and *Wilkesia gymnoxiphium* A. Gray.

Nototrichium divaricatum is restricted to steep slopes and cliffs where remnants of native lowland and montane mesic forest and diverse cliff vegetation have escaped the ravages of feral goats. Large feral goat populations are the major threat to this new species and many other rare and localized endemic species in Kalalau, Pohakuao, and Honopu valleys. Herbivory and habitat destruction caused by the goats will likely result in the extinction of these rare plant species unless measures are taken to control these animals (Wood & Perlman, Rare & Endangered Flora of Kalalau & Pohakuao Valleys. Unpublished report prepared for Sierra Club Legal Defense Fund (1 June 1993); Lorence & Wagner, 1995). Additional threats to this new species are landslides, falling rocks, feral pigs in some areas, and choking invasion by alien plant species, particularly *Erigeron karvinskianus* DC., but also including *Rubus rosifolius* Smith, *Kalanchoë pinnata* (Lamarck) Persoon, *Lantana camara* L., *Melinis minutiflora* Palisot de Beauvois, *Psidium guajava* L., *Setaria gracilis* Kunth, and *Verbena littoralis* Kunth.

Affinities. *Nototrichium divaricatum* differs from other members of the genus by its compoundly branched inflorescences with divaricate branches and shorter spikes 5–20(–35) mm long with (4–)8–30(–66) flowers per spike. This new species is most closely related to *N. sandwicensis*, a dry forest species that further differs by its bracts subtending the flowers tipped by a spine 2 mm long and sepals with long, spreading hairs and a large tuft of hairs at the base. Field observations on Kaua'i have revealed that *N. divaricatum* and *N. sandwicensis* are habitat-differentiated and do not grow sympatrically except at a single locality, the Kalahu portion of Kalalau Valley, where the latter species occurs in mesic forest adjacent to cliffs harboring the former species (K. R. Wood, pers. comm., 1994). *Nototrichium humile*, restricted to O'ahu and East Maui, differs from both *N. divaricatum* and *N. sandwicensis* by its longer, more slender spikes 3–14 cm long and 4 mm or less in diameter (see Wagner et al., 1990: 195 for illustrations).

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Hanalei District, Kalalau Valley, Kalalau rim, Kalahu side below and W of first Kalalau lookout, 900–1000 m, 20 Aug. 1991, *Wood 1154* (PTBG), *Wood 1155* (AD, BISH, MU, P, PTBG, SING, US), *Wood 1156* (BISH, MO, PTBG, US); Kalalau rim, N of Kahuama'a Flat, 800 m, 4 July 1991, *Wood & Query 1003* (F, PTBG, US), 1000 m, 28 July 1992, *Wood 2039* (MO, PTBG); Kalalau rim, N below Pu'u o Kila, 950–1150 m, 7 July 1991, *Wood 1044* (AD, BISH, PTBG); Kalalau Valley, base camp in back of valley, 730 m, 10 June 1992, *Wood et al. 1960* (BISH, PTBG, US), 640 m, 10 June 1992, *Perlman et al. 12807* (PTBG, US); Kalalau Valley, helicopter drop on isolated ridge below and W of first lookout, 579–640 m (1900–2100 ft.), 27 Feb. 1994, *Wood & Perlman 3018* (PTBG), *Wood & Perlman 3024* (BISH, MO, NY, PTBG, US); Kalalau Valley, slopes of Kalahu, 300 m E of navy plane crash, 762 m (2500 ft.), 2 Aug. 1994, *Wood & Perlman 3385* (BISH, F, MO, NY, PTBG, US); Kalalau Valley, between lookouts, 1158–1219 m (3800–4000 ft.), 11 July 1985, *Montgomery s.n.* (BISH); Hanalei District, Pohakuao, hanging valley between Kalalau and Hanakoa, below Pu'u Ki, NW aspect, 600 m, 2 Apr. 1992, *Wood et al. 1771* (PTBG); Hanalei District, Honopu rim, 914 m (3000 ft.), 6 Nov. 1993, *Wood 2826* (NY, PTBG, US), 853 m (2800 ft.), *Wood 2835* (PTBG).

Acknowledgments. I thank Kenneth R. Wood for bringing this new species to my attention and for his invaluable field observations, and Anna Asquith for providing the excellent illustration. Warren L. Wagner, Tim Flynn, and Uno Eliasson provided helpful comments and suggestions on the manuscript.

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A New Species of *Chamaesyce* Section *Sclerophyllae* (Euphorbiaceae) from Kaua'i

David H. Lorence
National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawaii 96765, U.S.A.

Warren L. Wagner
Department of Botany, Smithsonian Institution, MRC-166, National Museum of Natural History, Washington, D.C. 20560, U.S.A.

ABSTRACT. The new species *Chamaesyce eleanoriae* is described and illustrated, and its affinities are discussed. It is restricted to the steep slopes and cliffs of northern Kaua'i, the oldest of the main Hawaiian Islands. *Chamaesyce eleanoriae* is closely related to the Kaua'i endemic *C. sparsiflora,* from which it differs by its consistently present white, glandular cyathial appendages.

Chamaesyce eleanoriae Lorence & W. L. Wagner, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Hanalei District, Pohakuao, hanging valley between Kalalau and Hanakoa, *Metrosideros-Diospyros* lowland mesic forest, 400–600 m, collected below Pu'u Ki and Ka'a'alahina Ridge, 1 Apr. 1992, *K. R. Wood, S. Perlman & J. Lau 1763* (holotype, PTBG; isotypes, BISH, F, MO, P, US). Figure 1.

Haec species *Chamaesyci sparsiflorae* (A. Heller) Koutnik affinis, sed ab ea folii petiolo breviore 0.5–1.5 mm longo, lamina elliptica, late obovato-elliptica vel subcirculari, (5–)10–20 mm longa, basi subcordata vel raro truncata vel rotundata, etiam cyathii glandibus appendices candidas 0.7–1.5 × 1.5–2.6 mm ferentibus differt.

Small shrubs (12–)20–40 cm tall, glabrous, densely branched, the branches erect-ascending, brittle, the basal stems with dark gray, longitudinally fissured bark, the leafy branches 0.6–1 mm diam., longitudinally furrowed, green or red-tinted, the internodes 6–30 mm long; stipules broadly triangular or obtuse and rounded, 0.5–1 × 1–2 mm, externally glabrous, internally villosulous, occasionally bifid, the margin brown, erose, with scattered dark colleters; leaves decussate or the pairs sometimes spirally arranged, short-petiolate or subsessile, the petioles 0.5–1.5 × 0.5 mm, glabrous, the blades elliptic, broadly elliptic, broadly ovate-elliptic, broadly ovate, or rarely suborbicular, (5–)10–20 × (4–)6–14 mm, glabrous, drying dull, pale green, slightly discolorous, adaxially faintly white-punctate, often with reddish tint marginally, abaxially grayish green, subcoriaceous or coriaceous, the base subcordate, less commonly truncate or rounded, the apex rounded or retuse, often mucronulate, the lateral veins 5–7 pairs, with 3–4 pairs arising subpalmately from the base, the venation obscure or secondary (rarely tertiary) veins visible on both surfaces, the margin entire, usually slighty involute. Cyathia solitary and terminal at branch tips, the peduncles 1–1.5 mm long, glabrous, the involucre campanulate, 2–3 mm long, 2–2.5 mm diam., internally densely villous, externally glabrous, green or dark purple, the glands (4–)5, glabrous, purple, each with a broadly obovate to subcircular, obtuse, petaloid white appendage 0.7–1.5 mm long, 1.5–2.6 mm wide, entire or irregularly sinuate or lacerate; ovary initially erect, glabrous or rarely tomentellous, styles bifid for ⅓ of their length, dark purple, thickened; stamens 0.6–0.7 mm long, the anthers dark purple, bilobed; capsule 3-angled, 2.5–2.8 mm long, 2.3–3 mm diam., broadly ovoid, glabrous, green with margins and apex purple-red, recurved on a glabrous gynophore to 2 mm long, the styles 0.5–0.7 mm long; seeds 2.2–2.3 mm long, 1.3–1.5 mm diam., testa brownish white, smooth.

Distribution, habitat, and ecology. Known only from the Na Pali coast of northern Kaua'i, Hawaiian Islands, *Chamaesyce eleanoriae* ranges in elevation from 270 to 1100 m. The new species occurs most commonly on north-facing, steep, narrow ridge crests and outcrops, less commonly on steep rocky slopes and the upper portions of basalt cliffs. It is generally restricted to windswept areas where it occurs in small populations of 50 or more plants in relictual native lowland or montane diverse mesic forest and shrubland. Dominant tree species include *Metrosideros polymorpha* Gaudichaud-Beaupré, *Acacia koa* A. Gray, and *Diospyros sandwicensis* (A. DC.) Fosberg, associated with herbaceous taxa including *Eragrostis* spp., *Poa mannii* W.

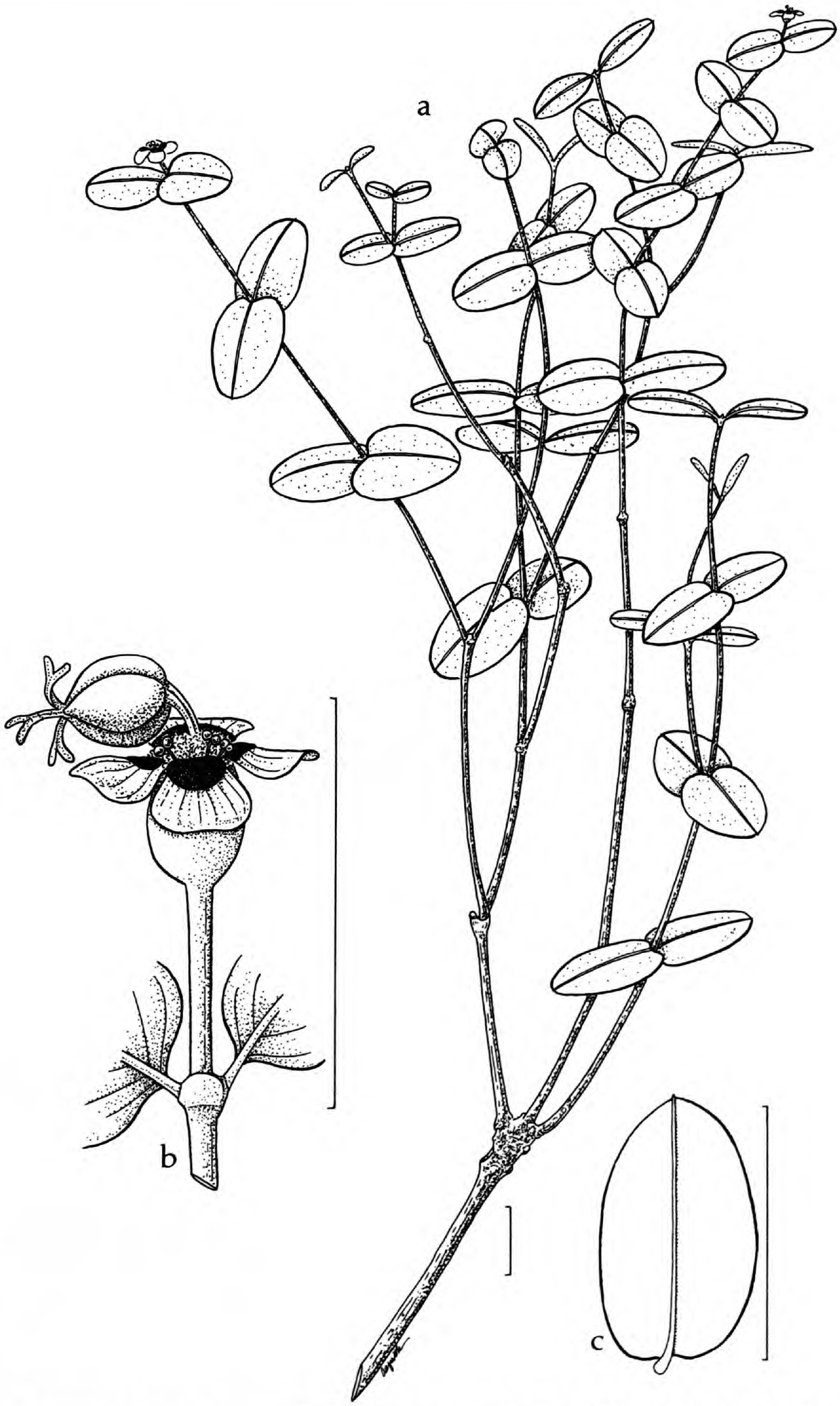

Figure 1. *Chamaesyce eleanoriae* Lorence & W. L. Wagner. —a. Habit. —b. Detail of cyathium with capsule and white petaloid appendages on the glands. —c. Detail of leaf. Scale: bar equals 1 cm. (Based on *Wood et al. 1763.*)

Munro ex Hillebrand, *Stenogyne campanulata* S. Weller & A. Sakai, and shrubby taxa including *Coprosma* sp., *Dubautia* sp., *Lepidium serra* H. Mann, *Lobelia niihauensis* H. St. John, *Lysimachia glutinosa* Rock, *Nototrichium divaricatum* Lorence, *Hibiscus kokio* Hillebrand ex Wawra subsp. *saintjohnianus* (M. J. Roe) D. M. Bates, *Styphelia tameiameiae* (Chamisso & Schlechtendal) F. v. Mueller, *Chamaesyce celastroides* (Boissier) Croizat & O. Degener var. *hanapepensis* (Sherff) O. Degener & I. Degener, *Bidens sandvicensis* Lessing subsp. *sandvicensis, Hedyotis* sp. nov., and *Vaccinium* spp. (K. R. Wood, pers. obs., 1995).

The major threats to *Chamaesyce eleanoriae* are browsing and the resulting erosion, habitat degradation, and landslides provoked by the large feral goat populations in Kalalau Valley and adjacent areas on the Na Pali coast. In addition, invasion by alien plant species, primarily *Erigeron karvinskianus* DC., *Kalanchöe pinnata* (Lamarck) Persoon, and *Lantana camara* L., also threatens this species.

Affinities. The endemic Hawaiian species of *Chamaesyce* are members of section *Sclerophyllae* (Boissier) Hurusawa (Webster, 1967; Koutnik, 1987), a pantropical group of about 30 insular or maritime species. This section is characterized by subshrubby or woody habit, articulate stems, subcoriaceous entire to occasionally serrate leaves, and glandular cyathial appendages that are reduced or absent (Webster, 1967; Lin et al., 1991). All but the Hawaiian species have been placed in subsection *Sclerophyllae,* which comprises about 16 distichous-leaved species, usually with glandular cyathial appendages. The Hawaiian species have been segregated in the endemic subsection *Gymnadeniae* (Boissier) Koutnik, based primarily on the absence of glandular cyathial appendages (Boissier, 1862; Koutnik, 1987). Koutnik stated that there is little to consistently separate these two subsections, and that detailed revision of the entire section is needed. Despite this, Koutnik made the combination bringing this subsection into the genus *Chamaesyce* from *Euphorbia* L. He noted that glandular appendages occasionally occur in several Hawaiian species, including *C. atrococca* (A. Heller) Croizat & O. Degener, *C. sparsiflora,* and *C. herbstii* W. L. Wagner, thus blurring the distinction between the subsections (Koutnik, 1987). To complicate the situation, study of collections at BISH, PTBG, and US of the Pacific island *C. atoto* (G. Forster) Croizat complex, a member of subsection *Sclerophyllae* and likely to be the closest sister species to the Hawaiian lineage, has shown that the occurrence of cyathial appendages is also variable in this group. The presence of appendages may vary in populations of the same species from different islands within an archipelago or even the same island (e.g., on Viti Levu, Fiji). Moreover, a new, as-yet-unpublished species from the Marquesas Islands related to *C. atoto* does not have appendages at all (J. Florence, pers. comm., 1994). Although this character is nearly fixed within the Hawaiian lineage (except in *C. eleanoriae* and the occurrences reported by Koutnik, 1987), we think it is too variable to use as the primary basis for division of section *Sclerophyllae* into two subsections. We therefore recognize all Pacific island species as members of one section without further subdivision. This is a more natural classification because segregation of the Hawaiian species obscures their relationship to *C. atoto* and creates a paraphyletic group, subsection *Sclerophyllae.*

Because of its large, petaloid white cyathial appendages *Chamaesyce eleanoriae* is distinct from all other Hawaiian *Chamaesyce.* It closely resembles *C. sparsiflora* and somewhat resembles *C. atrococca* in having dull, decussate leaves or the pairs occasionally spirally arranged, and inflorescences with cyathia solitary or in cymes of 1–3. Using the key of Koutnik and Huft (1990), *C. eleanoriae* keys out to *C. sparsiflora* by merit of its small leaves and low, shrubby habit. However, *C. sparsiflora* is a narrowly endemic bog species restricted to the Wahiawa Drainage on southern Kaua'i that differs by its shortly petiolate leaves with a narrower, elliptic to obovate, oblanceolate or rarely spathulate lamina and purple cyathial glands usually without appendages. *Chamaesyce atrococca* differs conspicuously in being a small tree 1–3 m tall with larger elliptic, oblanceolate, or obovate petiolate leaves, more highly branched inflorescences with (1–)3–9 cyathia, green to purple cyathial glands usually without appendages, and frequently tomentellous capsules. This latter species is widespread in western Kaua'i, where it occurs in mesic forests dominated by *Acacia koa* and *Metrosideros polymorpha.* Although *C. atrococca* is usually restricted to mesic forests, at one Kalalau Valley site it was observed growing sympatrically with *C. eleanoriae* in cliff vegetation (K. Wood, pers. comm., 1995). *Chamaesyce eleanoriae* commonly grows sympatrically with *C. celastroides* (Boissier) Croizat & O. Degener var. *hanapepensis* (Sherff) O. Degener & I. Degener, a dominant component of cliff vegetation in Kalalau Valley (K. Wood, pers. comm., 1995).

All material seen of *Chamaesyce eleanoriae* has the relatively conspicuous white cyathial appendages representing retention of a plesiomorphic character within the Hawaiian species based on outgroup comparisons to other sections of the genus and to *C. atoto.* Its decussate leaves (or the pairs sometimes spirally arranged), however, appear to represent a derived character shared with several other Hawaiian species. Wagner (1988) pointed out that there are several lines of diversification within the Hawaiian lineage. One of the more distinctive is the decussate-leaved group, which according to Koutnik (1987) includes *C. atrococca, C. halemanui* (Sherff) Croizat & O. Degener, *C. remyi* (A. Gray ex Boissier) Croizat & O. Degener, and *C. sparsiflora.* Wagner (1988), in his evaluation of what had been commonly known as the *C. clusiifolia* complex for three O'ahu species, pointed out that *C. clusiifolia* (Hooker & Arnott) Arthur can have the leaf pairs decussate or spirally arranged. The leaf arrangement is apparently more variable than stated by Wagner in that it can also be distichous, as shown by Koutnik (1987). Thus, it is equivocal if *C. clusiifolia* is also a member of this group or has acquired this phyllotaxy independently. Based on recent study of cultivated plants at the National Tropical Botanical Garden (from *Perlman 14087,* PTBG), this also appears to be the case for *C. kuwaleana* (O. Degener & Sherff) O. Degener & I. Degener, also from O'ahu (D. Lorence, pers. obs., 1995). The discovery of *C. eleanoriae* possibly adds one more species to the decussate-leaved group. Determination whether this group represents a monophyletic lineage, and if so resolution of the relationships among the species within it, awaits further studies. Based on present information, *C. eleanoriae* appears to be most closely related to the Wahiawa Bog endemic, *C. sparsiflora.*

Etymology. We are pleased to name this new species for NTBG trustee Eleanor Crum, steadfast supporter of our research program, dedicated volunteer, and plant enthusiast.

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Hanalei District, Kalalau [Valley] rim, N of Kahuama'a Flat, steep diverse lowland mesic forest, in cliff area collected with ropes, 990–1020 m, 3 Mar. 1991, *Wood et al. 635* (AD, PTBG), 800 m, 4 July 1991, *Wood & Query 1019* (PTBG); Kalalau Rim, N–S running ridge below and E of first Kalalau lookout, 960–1100 m, 18 Sep. 1991, *Wood 1244* (PTBG, US); Kalalau Rim, NE below Pu'u-o-Kila, and down to Peach Tree Ridge, 1100–1200 m, 9 May 1991, *Wood et al. 795* (PTBG), 3000–2800 ft. (914–853 m), 5 Oct. 1994, *Wood & Perlman 3613* (BISH, MO, NY, PTBG); Kalalau Valley, below Alealau, on cliffs, 3100 ft. (945 m), 17 Feb. 1993, *Perlman & Wood 13348* (BISH, F, K, P, PTBG, US), 790–900 m, 17 Feb. 1993, *Wood & Perlman 2392* (HAST, PTBG, UC, US); Na Pali Kona Forest Reserve, steep, rocky slopes below S rim of Kalalau Valley, N of Kahuama'a Flat and Highway 550, narrow rocky ridge, 900 m, 6 Mar. 1991, *Lorence et al. 6717* (PTBG); Kalalau Valley, below Puu-o-kila lookout, 3400 ft. (1036 m), 23 Sep. 1989, *Montgomery s.n.* (BISH); ridge between Kalalau and Honopu valleys, 2000 ft. (607 m), 11 July 1985, *Montgomery s.n.* (BISH); Pohakuao [Valley], diverse lowland mesic forest, 270 m, 8 June 1990, *Wood & Perlman 364* (BISH, PTBG, US).

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Change in Name and Status of a Pampas Grass (*Cortaderia*, Poaceae: Arundinoideae) from Bolivia

Mark Lyle
Forschungsinstitut Senckenberg, Senckenberganlage 25, 60325 Frankfurt am Main, Germany

ABSTRACT. Based on distinct morphological and anatomical characteristics, *Cortaderia bifida* var. *grandiflora* Henrard, currently considered a synonym of *C. bifida* Pilger, is raised to specific status as *Cortaderia boliviensis*. Known only from the Bolivian Andes, its distribution, ecology, and phenology are briefly discussed.

RESUMEN. En base a sus características morfológicas y anatómicas distinctas, *Cortaderia bifida* var. *grandiflora* Henrard, considerada actualmente como un sinónimo de *C. bifida* Pilger, es elevada al rango de especie como *Cortaderia boliviensis*. Se discute brevemente la distribución, ecología y fenología de esta especie conocida solamente de los Andes bolivianos.

The genus *Cortaderia* Stapf includes 17 species distributed throughout South America and five species found in New Zealand. *Cortaderia selloana* (Schultes) Ascherson & Graebner, the type species, is a well-known ornamental grass. Four sections are described by Conert (1961). Two of these sections occur in Bolivia: the species of section *Cortaderia* have long, awnless, linear lemmas; those of section *Bifida* have lemmas awned between two lateral lobes. Fieldwork in the Murillo and Yungas provinces of Bolivia provided material clearly showing that *Cortaderia bifida* var. *grandiflora* of section *Bifida*, previously considered a synonym of *C. bifida* (Conert, 1961; Connor & Edgar, 1974; Connor, 1983), should be given specific status.

Cortaderia boliviensis Lyle, nom. et stat. nov. Based on: *Cortaderia bifida* Pilger var. *grandiflora* Henrard, Meded. Rijks Herb. 40: 67. 1921. TYPE: Bolivia. Departamento Cochabamba: "Charaktergras der Andenwiesen über Tablas, feuchte Stellen, 3400 m, Mai 1911," *Herzog 2194* (holotype, L; isotypes, L, S, US, W). Figures 1, 2.

Caespitose, perennial grass forming large, dense tussocks. Basal leaves; blades coarse, erect to lax; senescent sheaths and basal cm of leaves curling tightly at tussock base, persistent. Culms 30–150 cm tall, slightly erect to spreading, unbranched, stiff, hirsute, with several attenuate, glabrous nodes. Sheaths of culms longer than internodes; lower sheaths tightly enclosing culm, glabrous, light brown to light straw-colored with purple hue, margins whitish; uppermost culm sheath light straw-colored, usually ± widely open at base of panicle and loosely appressed to it. Ligule a very dense, often three-pointed rim of ± 2 mm long, white hairs, some running a few mm down edges of blade. Leaf blades slender-linear, tapering off to fine point, light green to yellowish, edges and midrib of upper half with prickle hairs, longitudinally twisted to reveal abaxial leaf surface upward. Basal leaves (20–)60–90(–130) cm long, culm leaves to 30 cm long, 2.5–6 mm wide. Panicle 10–25(–35) cm long, 5–10 cm wide, terminal, richly branched, oblong, lax, leaning to one side, seldom ± erect, light brown, glossy. Main axis round, shortly scabrous, light brown. Panicle branches spreading ± erectly from main axis in distichously arranged bunches, shortly scabrous, light brown, lowest to 15 cm long. Spikelet branches 2–8 mm long, light brown, angular, shortly scabrous.

Female plants. Spikelets 2–3(–4)-flowered, with one reduced floret above, 10–11 mm long without awn, laterally compressed, light golden-brown to straw-colored, glossy, opening at anthesis, disarticulating above persistent glumes and between florets at maturity. Glumes ± equal or lower slightly shorter, 7–11 mm long, 1–1.2 mm wide, 1(–3)-nerved, linear-lanceolate, acute, light golden-brown, occasionally base with purple hue, hyaline, glossy. Callus slender, narrow-rounded, 1.3–1.5 mm long, very densely covered with up to 2 mm long, white hairs. Rachilla internodes ± 1 mm in length, thin, glabrous. Lemma 3(–5)-nerved, 3–4 mm long to attachment point of awn, 1.5–2 mm wide with continuous central nerve and lateral nerves terminating in lemma or lateral lemma lobes, linear-lanceolate, membranous, light brown to whitish with purple hue, hirsute, shortly ciliate along apex and margins, basal 2 mm of dorsal side densely covered with 4–5 mm long, spreading, glossy, white hairs, awned between two (0.5–)1.5–

3(–5) mm long, setiform, scabrously ciliate lateral lobes, seldom a further 0.5–1 mm long, ciliate lobe on outer rim of lateral lobes. Awn 8–11 mm long, light brown, shortly scabrous, basal part flattened and joined to inner margins of lobes, loosely twisted. Palea bicarinate, 5 mm long, 0.8–1 mm wide, lanceolate, apex truncate to biacutus, membranous, hirsute, densely ciliate on keels and margins, sparsely hairy on flanks. Lodicules 0.5–1 mm long with several 0.5–1 mm long hairs along upper edge. Staminodes 0.2–0.3 mm long, roundish, reduced and non-functional. Ovary ± 1.2–1.7 mm long, oblong-elliptic, apex biacutus. Caryopsis 2–3 mm long.

Transverse leaf section. Leaf blade W-shaped, with prominent midrib and symmetrical halves. Midrib always a single median vascular bundle, conspicuously displaced from blade halves through wide abaxial and deep adaxial furrows, lying deeper than adjoining vascular bundles that usually are also displaced through furrows. Ribs above all vascular bundles rectangular, flattened. Adaxial and abaxial rib of median vascular bundle often pointed roof-like. Furrows narrow, ⅓–½ height of leaf transect. Abaxial surface smooth, only midrib and 1(–2) neighboring vascular bundles with shallow intercostal furrows. Costal epidermal cells of adaxial surface small with ± thickened outer wall, many elongated as mushroom-shaped papillae. In intercostal region single stomata and small, oval, bulliform cells in chain-like groups, only near midrib are bulliform cells enlarged, forming conspicuous, fan-shaped groups. Abaxial epidermal cells in costal and intercostal regions uniform, outer wall thickened. Vascular bundle sequence of each lamina determined by 5–12 primary and secondary vascular bundles alternating with tertiary vascular bundles. Primary vascular bundles elliptical to wide-oval. Inner bundle-sheath complete, its cells elliptic, walls extremely thickened, lumina small. Outer bundle-sheath interrupted abaxially by many collenchyma cells with large lumina, its cells ± uniform, elliptic to round, thin-walled, larger than mesophyll cells, chloroplasts absent. Sclerenchyma girders distinctly developed above all vascular bundles. Abaxial sclerenchyma a 1(–2) layer hypodermal band, interrupted only by 2–4(–6) abaxial furrows. Abaxial epidermis and overlying band of sclerenchyma are strictly separated from vascular bundles and chlorenchyma by 2–3(–4) layers of very large, collenchymatically thickened, colorless parenchyma cells. Chlorenchyma fills entire transect, forming V-shaped group between all vascular bundles and H-shaped group near midrib vascular bundle. Cells predominately hexagonal, regularly arranged, without intercellular spaces.

Adaxial epidermis. Epidermal cells of adaxial surface elongated in costal region, each drawn out in a large, round papilla. Long-cells 4–6× longer than wide, widest at middle, pointed toward ends or truncated. From margins to center of intercostal region lie rows of epidermal cells with papillae and long-cells without papillae, between long-cells lie 2–3 rows of stomata, microhairs and bulliform cells. Long-cells 3–4× longer than wide with thickened, sinuous walls. Stomata wide-elliptic to almost circular between short or long, star-shaped cells. Microhairs common, with very long, slender basal cell and short, slender apical cell.

Abaxial epidermis. Epidermal cells of abaxial surface uniform, long-cells usually 6–8× longer than wide. Between these many short cells with thickened, undulated walls, usually ½ longer than wide. Single large prickle hairs along leaf margins. Short cells paired with transverse-elliptic silica-cells in single rows.

Distribution, ecology, and phenology. Cortaderia boliviensis occurs between 2400 and 4300 m on the perhumid northeastern slopes of the Bolivian Andes (Fig. 3). Above the treeline (± 3700 m in the Murillo and Yungas provinces, where the fieldwork took place) the species is locally common in perhumid grasslands (puna), growing in extremely wet, acidic, humic soils of meadows, marshes, slope-bogs and bogs, along streams and on permanently wet rock outcrops, cliffs, and waterfalls. Below the treeline the species is restricted to naturally treeless, permanently wet rock outcrops and cliffs. Most specimens have been collected in the perhumid puna of the Unduavi and Quime valleys. Only the type and an additional specimen were collected near Cochabamba, and one specimen (*Renvoize & Cope 3833*) was collected from a semihumid puna in southeastern Bolivia. The species does not inhabit open or disturbed soils. Adult plants are susceptible to repeated burnings and grazing by cattle after fire damage has occurred. Large, abundantly flowering tussocks are found only in rocky sites, free from both. Flowering apparently occurs during the drier months from March to August. Dispersal happens only through seeds that germinate among mosses and in rock cracks. No vegetative dispersal was observed.

Note. Only (apomictic) female plants with abundant seed-set were found above 3500 m. Most specimens below 3500 m had already flowered before the fieldwork period. Below 3500 m, pollen-sterile plants with staminodes longer than 2 mm

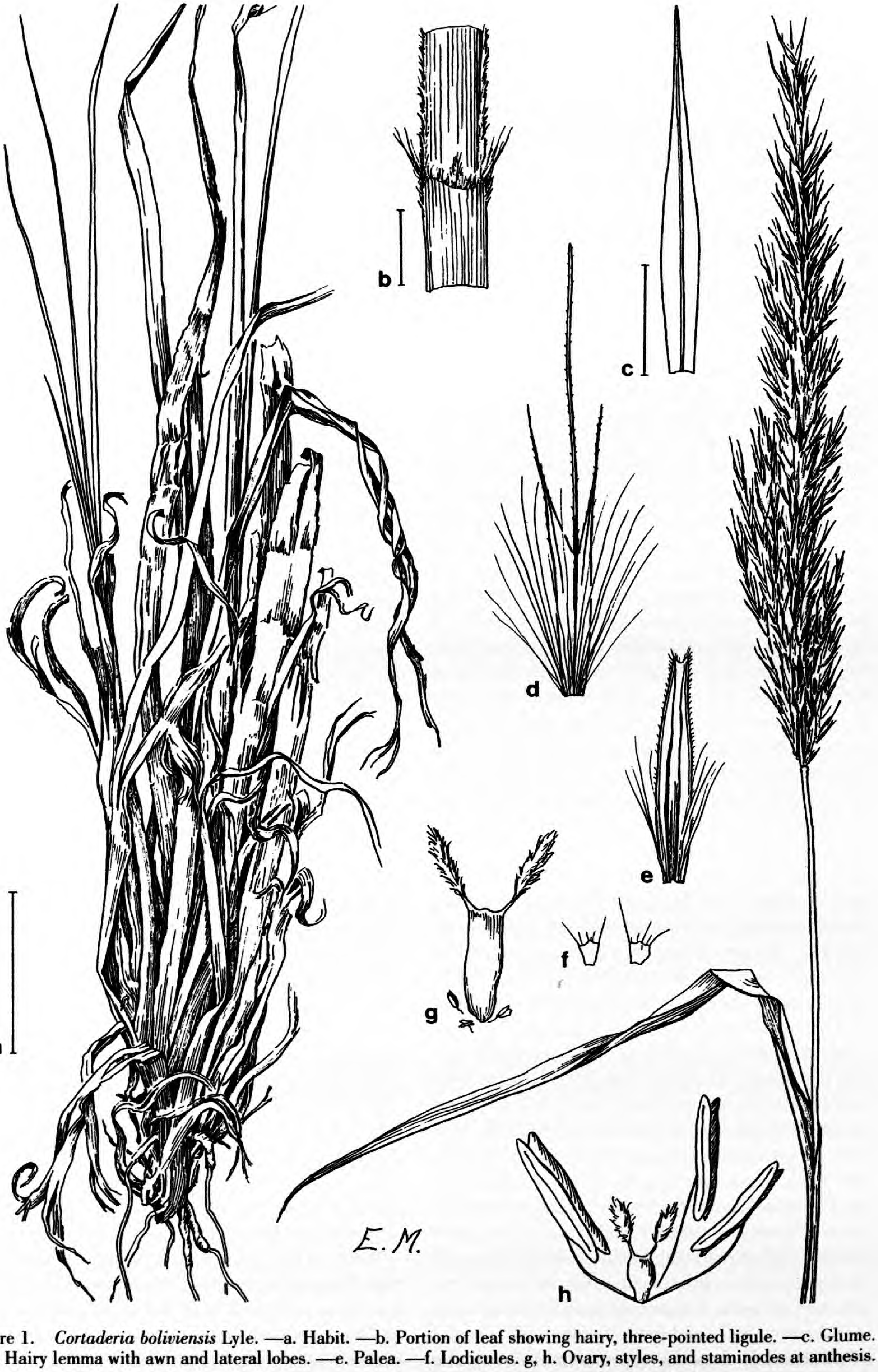

Figure 1. *Cortaderia boliviensis* Lyle. —a. Habit. —b. Portion of leaf showing hairy, three-pointed ligule. —c. Glume. —d. Hairy lemma with awn and lateral lobes. —e. Palea. —f. Lodicules. g, h. Ovary, styles, and staminodes at anthesis.

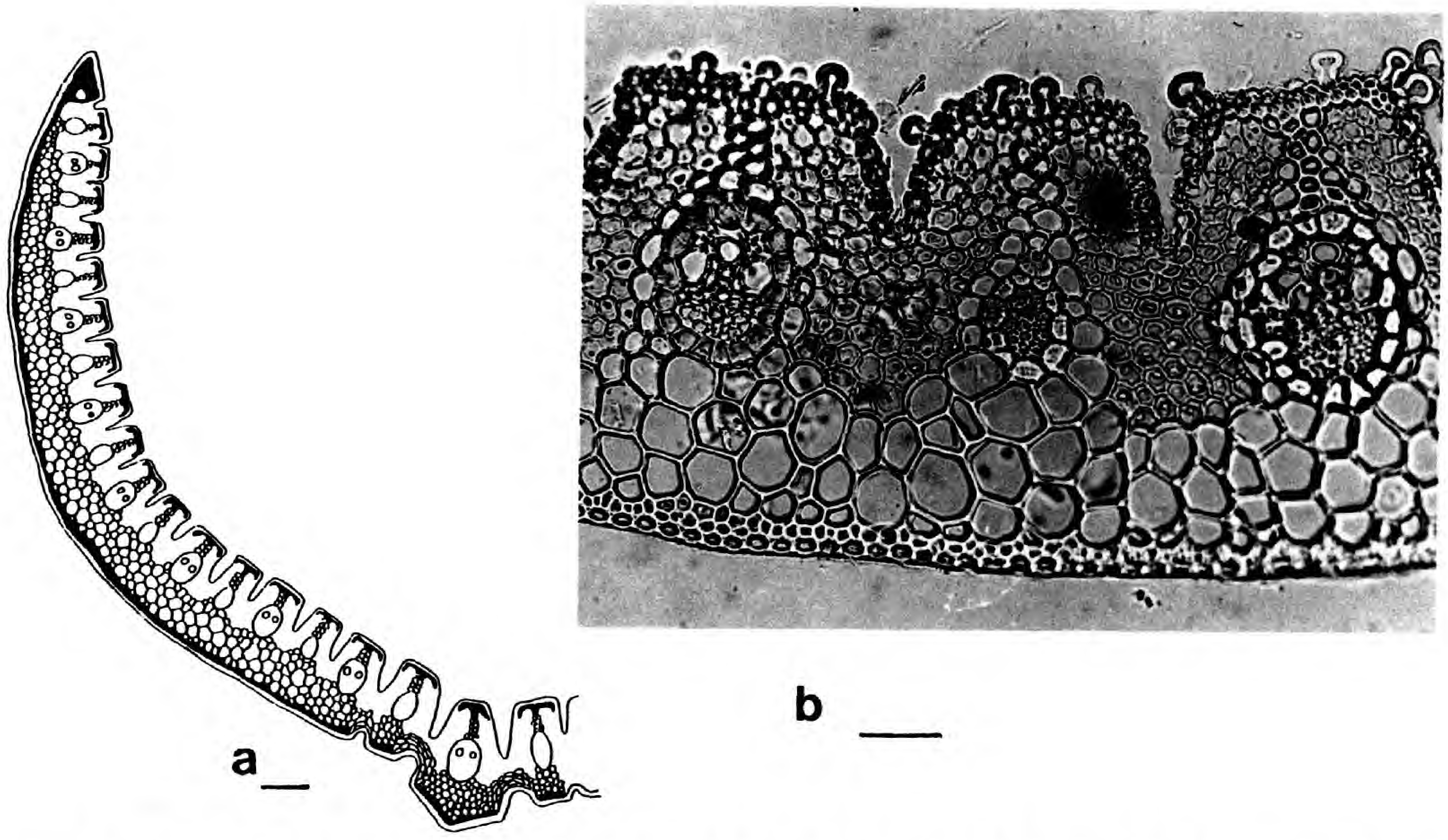

Figure 2. Transverse leaf section of *Cortaderia boliviensis* Lyle. —a. Overview. —b. Detail. Scale bars: a = 0.2 mm; b = 0.05 mm. (Based on *Lyle 14* (FR).) (Drawn by M. Lyle.)

occur irregularly and make up less than 15% of all collected specimens. Pollen-fertile hermaphrodite plants can be expected, but have not yet been verified.

Because of its long lateral lemma lobes, *C. boliviensis* was originally described by Henrard (1921) as a variety of *C. bifida* and has long been mistakenly considered a synonym of the same (Hitchcock, 1927; Conert, 1961; Connor & Edgar, 1974). Both species have long lateral lobes but these differ morphologically: those of *C. bifida* run together almost to a single point at the lemma apex, where they usually separate again as awns; those of *C. boliviensis* run parallel to one another and remain separated from the awn as distinctly developed lobes. The florets of *C. bifida* are silvery white, the staminodes are large (1–1.5 mm), and the stigmas are often dark red or purple. The florets of *C. boliviensis* are golden brown or straw-colored, the staminodes are minute (0.2–0.3 mm), and the stigmas are usually yellow. The senescent sheaths of both species curl tightly at the tussock base; however, those of *C. bifida* break at the ligule whereas those of *C. boliviensis* remain attached to the plant. The leaf anatomy of both species differs as well. The 2–4 layers of colorless parenchyma cells separating the abaxial epidermis and overlying band of sclerenchyma from the vascular bundles and chlorenchyma of *C. boliviensis* are not found in *C. bifida*, nor do the costal epidermal cells of *C. bifida* or any other *Cortaderia* species have the conspicuous mushroom-shaped papillae characteristic for *C. boliviensis*. Its distinctly different morphology and leaf anatomy clearly define it as a separate species within the genus.

Although both species grow in the same perhumid Andean environment, they differ ecologically. *Cortaderia bifida*, which is distributed in the Andes from Venezuela to Bolivia, is an aggressive weed that quickly inhabits disturbed soils. When crowded by shrubs or trees, it produces stolons of up to 7 m length, that often cascade over rock outcrops along roadsides. *Cortaderia boliviensis* is apparently endemic to Bolivia, and although it is also a pioneer on rock outcrops, it is not found on open or disturbed soils and it does not produce stolons.

Additional specimens examined. BOLIVIA. **La Paz:** Prope La Paz, circa alt. 3600 m, 1906, *Hauthal 338 (♀)* (GOET); Prov. Murillo, bajando la cumbre 13 km hacia Unduavi, 3850–3950 m, Ladura escarpada de gramineas

←

—g. Female specimen. —h. Pollen-sterile, morphologically non-female sex-form. Scale bars: a = 5 cm; b = 0.5 cm; c, d, e, f, g, and h = 2 mm. (a–g based on *Lyle 365* (FR); h based on *Killeen 2653* (FR).) (Drawn by E. Michels.)

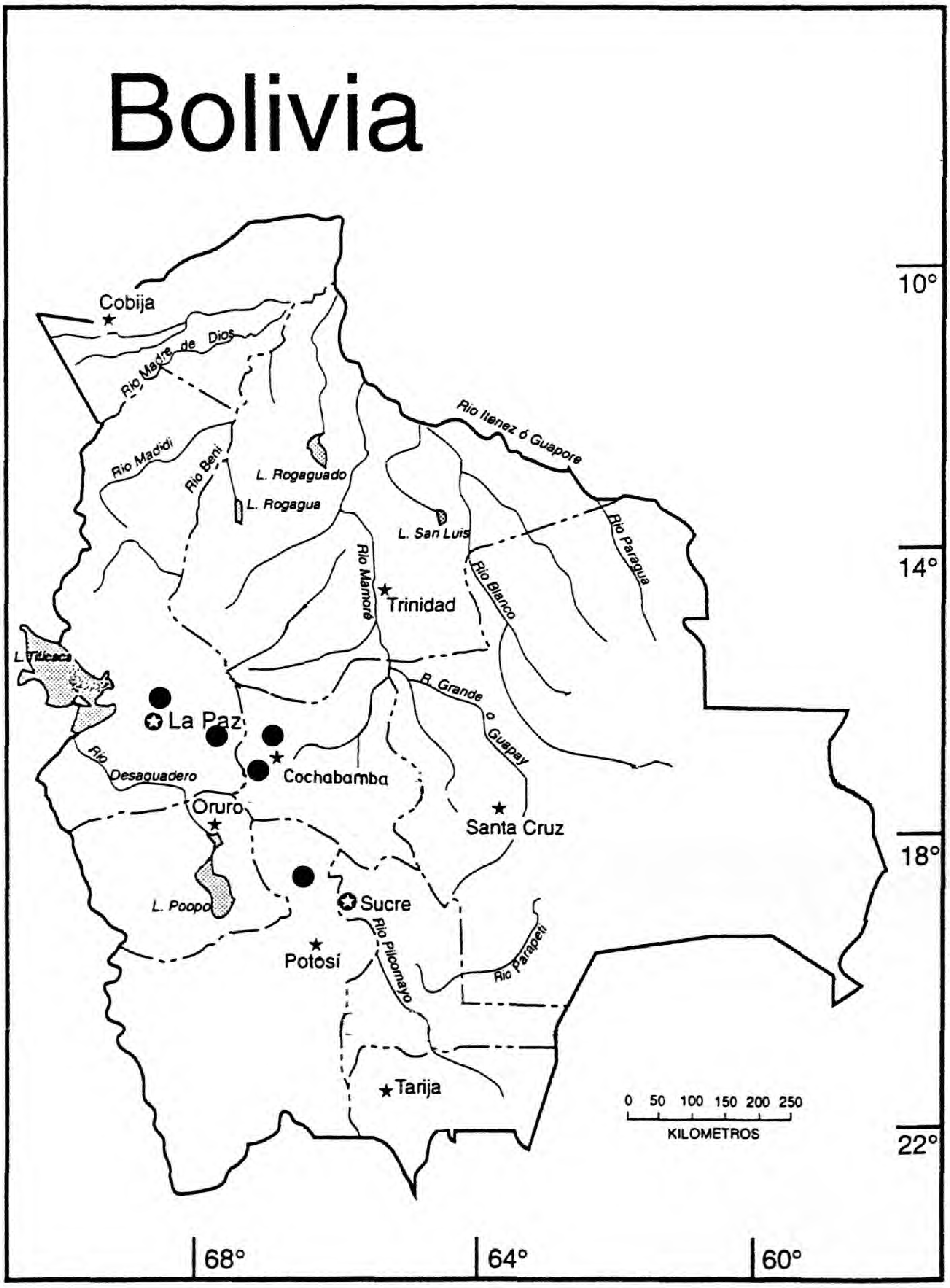

Figure 3. Distribution of *Cortaderia boliviensis* Lyle. (Map taken from Killeen et al., 1993. Used with permission.)

con aflormiento rocoso. 16 jun. 1985, *Beck 11273 (♀)* (K, US); Pongo, 6 km above Unduavi, E slope of small valley S of piscicola, water-saturated slate, 3900 m, 12 Oct. 1990, *Lyle 10 (♀), 11 (♀), 12 (♀), 14 (♀)* (FR, LPB); Pongo, 6 km above Unduavi, near Rio Choquetanga 50 m NW of road, water-saturated slate, 3700–3800 m, 03 Nov. 1990, *Lyle 142 (♀), 147 (♀), 146 a (♀), 146 b (♀), 197 (♀), 198 (♀), 199 (♀), 209 (♀), 211 (♀), 212 (♀), 214 (♀), 215 (♀), 216 (♀), 219 (♀), 220 (♀), 221 (♀), 222 (♀), 223 (♀), 224 (♀), 225 (♀), 226 (♀), 228 (♀), 229 (♀), 230 (♀), 231 (♀), 232 (♀), 233 (♀)* (FR, LPB); Pongo, 6 km above Unduavi, E of Rio Choquetanga NW of road, water-saturated slate, 3700–4050 m, 15 Nov. 1990, *Lyle 305 (♀), 309 (♀), 310 (♀), 311 (♀), 314 (♀), 365 (♀)* (FR, LPB); Pongo, 6 km above Unduavi, along Rio Choquetanga above waterfall NW of road, water-saturated slate, 3700–3900 m, 17 Nov. 1990, *Lyle 420 (♀)* (FR); Pongo, 6 km above Unduavi, near Rio Choquetango, 3600–4100 m, 24 Dec. 1990, *Lyle 624 (♀), 625 (♀), 627 (♀)* (FR, LPB); Prov. Nor Yungas, ± 3 km above Unduavi, camino ingeniero a Mina San Luis, treeline, 3400–3500 m, 06 Jan. 1991, *Lyle 637 (♀), 638 (non-♀), Lyle 645 (aberrant ♂), 648 (non-♀), 649 (sterile), 650 (sterile), 660 (sterile), 662 (non-♀), 663 (sterile), 671 (non-♀), 673 (non-♀), 674 (♀), 681 (♀), 682 (♀), 689 (♀), 705 (sterile), 711 (♀, staminodes 0.9 mm)* (FR, LPB); roadside between Unduavi and Chuspi Pata, cloud forest, ± 2900–3200 m, 23 Jan. 1991, *Lyle 784 (sterile)* (FR); rocky roadside embankments below Chuspi Pata on road leading to Yolosa and Coroico, 2900–2600 m, 23 Jan. 1991, *Lyle 792 (sterile), 805 (♀), 806 (non-♀), 814 (sterile)* (FR, LPB); Sendero al Río Coscapa (ca. 3 km al este Unduavi por el camino nuevo) 5.6 km al oeste de Cotapata, bosque nuboso con *Miconia, Weinmannia, Clethra,* 16°17′S 67°53′W, 3300–3500 m, 5 mayo 1990, *Solomon et al. 18932 (♀)* (MO); Prov. Sud Yungas, 1.4 km W of Unduavi, on new road between Chuspi Pata and La Paz, low cloud forest at the upper limit of forest vegetation, 16°18′S, 67°55′W, 3400 m, 2 July, 1986, *Solomon 15382 (♀)* (K, LPB, MO); Prov. Inquisivi, Laguna Huichincana and Mina Don Vincente 9 km NW of Quime, 16°57′S, 67°17′W, 4150 m, páramo, along fast stream below waterfall, 12 Aug. 1987, *Killeen 2653 (non-♀)* (F, FR, MO, US); 4 km NE of Huayñacota, steep slopes with low bushes and herbs, 3800 m, 23 Apr. 1992, *Renvoize 5342 (♀)* (FR, K); **Cochabamba:** Prov. Tapacari, Com Rodeo, bosque de *Polylepis,* cabecera de valle, bosque montano, 3600 m, 26 Feb. 1991, *Hensen 1146 (♀)* (US). **Potosí:** Province Chayanta, 7 km south of Ocuri, cliff face above road, 3950 m, 06 Mar. 1981, *Renvoize & Cope 3833 (♀)* (K, MO, U).

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Jaltomata chihuahuensis (Solanaceae): A New Combination and Observations on Ecology and Ethnobotany

Thomas Mione
Department of Biological Sciences, Central Connecticut State University, New Britain, Connecticut 06050–4010, U.S.A.

Robert Bye
Jardín Botánico, Instituto de Biología, Universidad Nacional Autónoma de México, Apdo. Post. 70–614, 04510 México, D.F., Mexico

ABSTRACT. The new combination *Jaltomata chihuahuensis* (Bitter) Mione & Bye is based on *Saracha chihuahuensis* Bitter. This species is distributed in Mexico at the northern end of the Sierra Madre Occidental in the states of Chihuahua, Durango, and Sonora. Morphological characters, artificial hybridizations, and distinct names applied by the Tarahumara, all indicate that *J. chihuahuensis* is distinct from the more widely distributed but sympatric *J. procumbens.* Fruits of *J. chihuahuensis* are consumed raw by the Tarahumara people and are either purple or green at maturity. Chromosome number: $n = 12$.

Jaltomata is a diverse genus of about 30 species of herbs and small shrubs that are distributed from Arizona, U.S.A., to southern Bolivia, on the Galápagos Islands, and in the Greater Antilles. This paper is part of ongoing series of studies of the taxonomy, phylogeny, breeding biology, and ethnobotany of this genus (D'Arcy et al., 1992; Davis, 1986; Davis & Bye, 1982; Knapp et al., 1991; Mione, 1992; Mione & Coe, 1992; Mione et al., 1993; Mione et al., 1994).

Ethnoecology. There are two races of *Jaltomata chihuahuensis,* one with purple fruits and the other with green fruits. Without mature fruits the two races appear to be morphologically indistinguishable. Based on greenhouse and garden studies of three accessions, we are certain that plants do not produce both types of fruits, nor do the mature green fruits become purple with age or exposure to sunlight. Information obtained (by R. B.) from the Tarahumara during ethnoecological studies in Chihuahua, Mexico, agrees with these observations. Based on greenhouse studies, fruits of the purple race are typically green when they drop and then become purple within a few days.

The two races may occupy different niches. Preliminary observations (by R. B.) are that the green-fruited race tends to occur among white volcanic rocks in soil with higher apparent organic matter. The purple-fruited race, however, is not found among white volcanic rocks nor in soil with high organic matter. The rootstock ("camote") of the purple-fruited race is eaten by the Tarahumara (Davis & Bye, 1982: 232). Further study is needed to explore the possibility of niche specificity of the two races.

Jaltomata procumbens (Cavanilles) J. L. Gentry, a widespread species that is common within the smaller range of *J. chihuahuensis,* is generally called "rurusí," "ŕurusí," "ŕuruši," or "turusí" by the Tarahumara (e.g., *Bye 9875, 9889,* COLO; *Davis 1124, 1127,* MO; Brambila, 1976; Pennington, 1963). *Jaltomata chihuahuensis,* on the other hand, is often referred to as "metárusi" or "me'táresi" (which is a "jaltomate rastrero" or creeping jaltomate, Brambila, 1976); these names are probably derived from the Tarahumara verb "me'tárema" ("to be creeping"). Some Tarahumara believe "metárusi" to be a class of "rurusí" (Bye, unpublished). Thus the Tarahumara recognize the distinction between *J. procumbens* and *J. chihuahuensis.*

In most *Jaltomata* species, at maturity fruits remain attached to the parent plant for at least a few days, and the accrescent calyx darkens when the fruit ripens. The color of the calyx (purple to brown) stands in contrast with the foliage and presumably serves, along with the brightly colored fruit, as a beacon to diurnal fruit consumers/dispersers. However, the fruits of *J. chihuahuensis* fall at maturity and the calyx remains green. Unlike most species of *Jaltomata,* which exhibit articulation at the base of the pedicel, articulation is at the attachment of the fruit; the calyx-pedicel unit remains attached to the plant for at least several days after the fruit drops. Human selection may result in a change from fruits falling free of the parent plant in wild species to fruits remaining attached to the parent plant at maturity (e.g., the nonshattering rachis of domesticated cereals, Heiser, 1990). The consumption of fruits by the indigenous people, perhaps subjecting the plants to human selection, has not had this effect on *J. chihuahuensis.*

Fruits falling free at maturity is among the features of the syndrome of saurochory (reptile dispersal) (van der Pijl, 1969), and saurochory is thus a possibility for *J. chihuahuensis,* if not now then possibly prior to extensive utilization by humans. Alternatively, fruits falling free at maturity may indicate no adaptation for dispersal, and may merely have become fixed by genetic drift at some time when population size was small. In any case, fruits falling free at maturity suggests that this species is not regularly bird dispersed, although it is possible that birds feed on the fruits that have fallen to the ground. The Tarahumara Indians consume the fruits that fall to the ground, and it is likely that seeds survive the human digestive tract and so become dispersed by humans (Davis & Bye, 1982; Davis, 1986).

Humans have selected for light color in diverse domesticates (e.g., white lupines, quinua, sheep, and camels) (Heiser, pers. comm.; Zeuner, 1963). It is thus possible that green-fruited mutant(s) within *J. chihuahuensis* were selected by humans, giving rise to the green-fruited race. Evidence that may be considered as strengthening this scenario is that to humans green fruits are sweeter than purple fruits (Bye, unpublished). Alternatively, humans may have had nothing to do with the establishment of the green-fruited race but may merely have begun to regularly consume the fruits.

Phylogenetic placement. Based on chloroplast DNA restriction sites there are two principal, sister phylogenetic groups within *Jaltomata* (Mione et al., 1994). The "Mesoamerican" group, having its center of diversity in Mexico, is widely distributed from the southwestern United States to Bolivia. The "South American" group is distributed in Andean South America, the Greater Antilles, and the Galápagos Islands. Within the Mesoamerican clade the rarest and most morphologically distinct species, *J. grandiflora* (Robinson & Greenmann) D'Arcy, Davis & Mione, forms the most basal branch, and *J. chihuahuensis* forms the second to most basal branch (Mione et al., 1994).

Artificial hybridizations. Crosses were made in a pollinator-free greenhouse (by T. M.). Flowers used as pollen recipients were emasculated prior to anther dehiscence. No fruits were set from 18 crosses of *J. procumbens* with *J. chihuahuensis* (pollen source), nor from 12 of the reciprocal crosses. Two accessions of *J. chihuahuensis* were used (*Bye 14243* green fruits, *Davis 1180* purple fruits). Six accessions of *J. procumbens* from Mexico were used (*Davis 1189A, 1191, 1124,* MO; *Bye 9889, 10033, 10084,* COLO), the latter four from Chihuahua. The following observations may be considered controls for the above crosses. Both *J. chihuahuensis* and *J. procumbens* abundantly self-set fruit in a pollinator-free greenhouse. Within *J. chihuahuensis* an uncounted number of interaccession crosses have been successful (for study of the genetic control of fruit color), and within *J. procumbens* intraccession and interaccession crosses virtually always result in fruit set.

Taxonomy. *Jaltomata chihuahuensis* has been considered to be a synonym of *J. procumbens* (Morton, 1938; Davis, 1986, discussed as the prostrate morph/form of *J. procumbens*; Nee, 1986). Our decision to recognize this species and make the following new combination was based on morphological characters of both living plants (in the greenhouse and garden as well as in the field) and herbarium specimens, artificial hybridizations, and chloroplast DNA (Mione et al., 1994). Chromosome counts of $n = 12$ were obtained for both *J. chihuahuensis* (*Davis 1180*) and *J. procumbens* (*Bye 10033*). Meiocytes were stained by crushing immature anthers with a fine dissecting needle in a drop of filtered acetic carmine.

On pressed specimens of *Jaltomata chihuahuensis* the fruit is usually partially hidden by the calyx, because on living plants fruits are pendent and the calyx (an upside-down, five-lobed funnel) hides the fruit from side view (Fig. 1). On pressed specimens of *J. procumbens,* however, the calyx is more likely to lie flat against the sheet because on living plants the fruiting calyx is rotate (Fig. 1). Table 1 compares selected morphological characters of *J. chihuahuensis* and *J. procumbens.* Based on hundreds of measurements made on plants grown during several years, these two species cannot be distinguished (due to overlapping ranges) with any one of the following characters: number of flowers per inflorescence, peduncle length, pedicel length, calyx diameter, corolla diameter, stamen length, anther length, style width at midlength, fruit length or width, or seed length.

Jaltomata chihuahuensis (Bitter) Mione & Bye, comb. nov. Basionym: *Saracha chihuahuensis* Bitter, Repert. Spec. Nov. Regni Veg. 18: 108. 1922. TYPE: Mexico. Chihuahua, [Mpio. Casas Grandes]: "bei Colonia Garcia in der Sierra Madre, 2400 m," 18 July 1899, *C. H. T. Townsend & C. M. Barber 91* (lectotype, selected here, MO; isotypes, K, NY, P; holotype designated by Bitter *l.c.* as "hb. Berol." presumed destroyed).

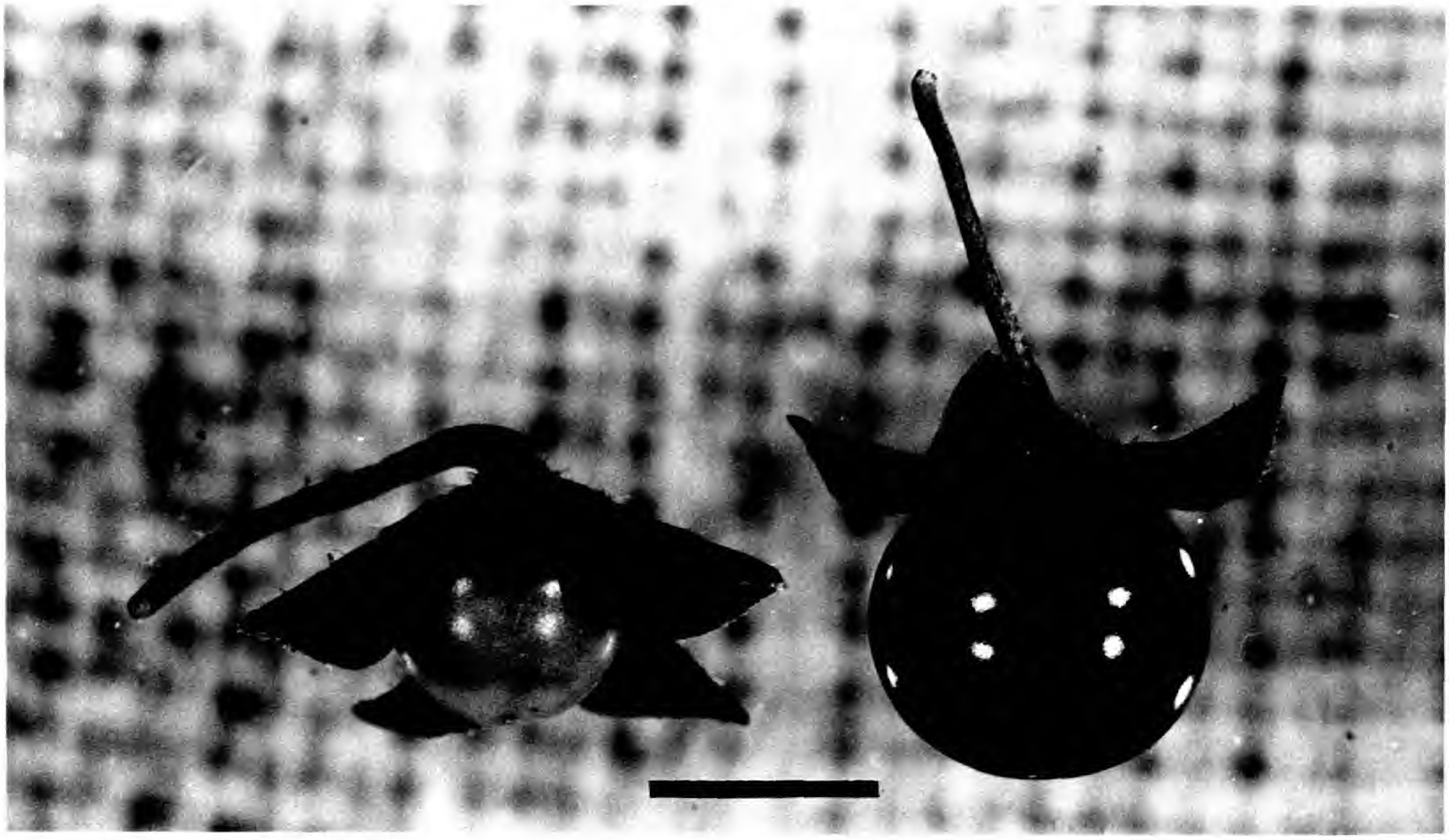

Figure 1. Mature fruits of *Jaltomata chihuahuensis* (left, *R. Bye 18329*) and *J. procumbens* (right, *R. Bye 10084*). Photos taken in Connecticut from plants grown from seed collected in Chihuahua, Mexico. Bar = 1 cm.

Other specimens examined. MEXICO. **Chihuahua:** Mpio. Bocoyna, Bocoyna valley, between Bocoyna and Creel, 2200 m, 13 July 1973, *R. A. Bye 4201B* (ECON); Creel, railroad crossing, 20 July 1973, *R. A. Bye 4295* (COLO); Creel and Río Oteros, along the mesa ridge, 19 Sep. 1973, *R. A. Bye 5253* (COLO); Creel and San Ignacio, 7300′, 15 Sep. 1973, *R. A. Bye 5069* (COLO, ECON, MEXU); Creel, 7200′, 29 June 1977, *T. Davis 700* (MO); Creel, rd. from Creel to Cusárare, 19 Aug. 1984, *T. Davis 1182* (MO); Gonogochic, 7400′, 23 May 1973, *R. A. Bye 3832* (ECON); Gonogochic, 7400′, 19 July 1973, *R. A. Bye 4286* (ECON); Gonogochic region E of Creel, 7400′, 21 July 1973, *R. A. Bye 4309* (COLO, ECON); Gonogochic, 7400′, 7 Sep. 1973, *R. A. Bye 4910* (ECON); Gonogochic, E of Creel, 2250 m, 13 Oct. 1980, *R. A. Bye 9863* (COLO); Gonogochic school, 12 July 1974, *R. A. Bye 6286* (COLO); Gonogochic, 2280 m, 12 Aug. 1977, *R. A. Bye 7931* (COLO, MEXU); Gonogochic, ejido San Ignacio Arareco, 2250 m, 17 Oct. 1980, *R. A. Bye 10007* (COLO, MO); Gonogochic, ejido San Ignacio Arareco, 2250 m, 23 Oct. 1980, *R. A. Bye 10094* (COLO, MO); Río Oteros, 2194 m, 29 June 1977, *T. Davis 705* (MO); San Ignacio Arareco, near Creel airstrip, 7300′, 9 Aug. 1972, *R. A. Bye 2699* (COLO, MEXU); San Ignacio, 17 Oct. 1977, *R.*

Table 1. Comparison of some characters of *Jaltomata chihuahuensis* and *J. procumbens* in northern Mexico.[1]

Character	*J. chihuahuensis*	*J. procumbens*
Habit	prostrate	erect
Vesture	hirsute stems, leaves and buds	variable
Calyx (fruiting) color	green	green and purple
Calyx (fruiting) lobe shape	obtuse or obtuse-acuminate	triangular to broadly triangular
Corolla lobing	5 lobes	5 lobes alternating with 5 lobules
Position of corolla lobes during hermaphroditic phase[2]	often retrorse	rotate
Outward angle of filaments relative to style, during day of anther dehiscence[2]	0° to 15°	45°
Mature fruit color	purple or green	black/dark purple
Time of fruit drop	at or just before fruit maturity	at least several days after fruit maturity

[1] Specimens studied for this table were all collected in Chihuahua, Mexico.

[2] Flowers are pistillate with very short filaments and undehisced anthers during their first day open. During the next day filaments elongate and anthers then dehisce, the flower becoming functionally hermaphroditic.

A. Bye & W. A. Weber 8290 (COLO, MEXU); San Ignacio Arareco, NW of Gonogochic, 21 Aug. 1978, *R. A. Bye 8722* (COLO, NY); San Ignacio Arareco, cerca de la cueva de Sebastian Gloria, 2330 m, 9 Sep. 1987, *R. A. Bye & T. P. Ramamoorthy 15691* (MEXU); San Ignacio Arareco, cerca limite con Creel, SE de Cueva de Sebastian Gloria, 2360 m, 11 Oct. 1991, *R. A. Bye et al. 18329* (MEXU); San Juanito, near km 17 on San Juanito-Basaseachi Rd., 13 Oct. 1980, *R. A. Bye 9858* (COLO, MO); San Juanito, between San Juanito and Basaseachi, near km 48, 12 Oct. 1980, *R. A. Bye 9859* (COLO, MO); Mpio. Guachochi, Arroyo Colorado, S of Creel, 2225 m, 1 July 1977, *T. Davis 711* (MO); Barranca de Cobre, 1828 m, 1 July 1977, *T. Davis 713* (MO); Cabañas del Cobre, 2343 m, 23 June 1982, *T. Davis et al. 1101* (MO); Cumbre de Hualayua, 29 Sep. 1894, *C. Lumholtz s.n.* (GH, US); Cusárare, S of Creel, ravine near the new SSA water tank, 11 Sep. 1973, *R. A. Bye 5013* (COLO); Cusárare, along path to falls, 29 June 1977, *T. Davis 709* (MO); Cusárare, corn field next to church, 23 June 1982, *T. Davis 1107* (MO); La Bufa-Guachochi junction, 19 Aug. 1984, *T. Davis 1179, 1180* (source of *J. chihuahuensis* DNA in Mione et al., 1994), and *1181* (MO); Norogachi, along arroyo, 2033 m, 31 May 1984, *T. Davis et al. 1129* (MO); Bridge over río Urique, along Creel-Guachochic Road, 22 Oct. 1980, *R. A. Bye 10087* (COLO); Río Urique, al lado S de Barranca del Cobre, ca. km 61 de camino Creel–Guachochi, 1740 m, 7 Oct. 1985, *R. A. Bye & E. Linares 14243* (source of *J. chihuahuensis* DNA in Mione et al., 1994) (COLO, MO); Samachique, 6890′, 22 July 1971, *R. A. Bye 1608* (COLO, GH); Samachique, along Creel–La Bufa Rd., ca. 0.2 rd. mi. from Samachique road junction, 19 Oct. 1980, *R. A. Bye 10034* (COLO, MO); Mpio. Guerrero, W of La Junta on Mexico 16, near Campo Miñaca, above arroyo, 12 Oct. 1980, *R. A. Bye 9835* (COLO); Mpio. Madera, Chuhuichupa, Aug.–Sep. 1936, *Harde LeSueur 890* (F, US); Chuhuichupa, 29 Sep. 1939, *C. H. Muller 3569* (GH); Mpio. Ocampo, Cascada de Basaseachi, 13 Oct. 1980, *R. A. Bye 9837* (COLO); Cascada de Basaseachic, 3 km al SE de Basaseachic, 1960 m, 26 Sep. 1983, *R. Torres C. & P. Tenorio L. 3765* (MEXU, MO, NY). **Durango:** Mpio. El Salto, 17 mi. W of El Salto, 12 Aug. 1956, *U. T. Waterfall 12701* (F); El Salto, hwy. 40, 2500 m, 29 July 1991, *Mayfield et al. 1075* (MEXU); Mil Diez, 2 km N de El Salto, 2200 m, 27 June 1982, *R. Hernández M. & P. Tenorio 7424*; Mpio. Santiago Papasquiaro, Laguna la Chaparra, 18 July 1982, *P. Tenorio L. & C. Romero de T. 1075* (MEXU); Paraje Bajío de Vacas, ejido de Haciendítas, 2700 m, 27 July 1990, *A. Benítez 1570* (MEXU); Mpio. Tepehuanes, Buenos Aires-Mesa de Navar, 2570 m, 19 Dec. 1989, *A. Benítez 618* (MEXU); Buenos Aires, 36 km al W de Tepehuanes, 22 July 1982, *P. Tenorio L. & C. Romero de T. 1173* (MEXU, MO). **Sonora:** Mpio. Bavispe, Las Tierritas de El Temblor, Sierra de El Tigre, Aug. 1940, *S. S. White 3432* (GH).

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A New Species of *Cayaponia* Manso (Cucurbitaceae: Cucurbiteae) from Mesoamerica

A. K. Monro

Department of Botany, Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

ABSTRACT. A new species, *Cayaponia longiloba*, is described from Mesoamerica. It is illustrated, and its affinities are discussed.

While preparing an account of *Cayaponia* for *Flora Mesoamericana* the following new species was identified. It is morphologically most similar to *Cayaponia attenuata* (Hooker & Arnott) Cogniaux, which occurs from Mexico to Mesoamerica. Differences between the species are detailed in the discussion.

Cayaponia is a genus of over 60 species and, as such, is probably the largest genus in the Cucurbitaceae. It is distributed throughout tropical and subtropical America; a single species occurs in the southeastern United States and one species occurs in Africa. The genus was last reviewed by Cogniaux (1881).

Cayaponia longiloba A. K. Monro, sp. nov. TYPE: Mexico. Oaxaca: between San Juan Bautista and San Sebastian, 15 m, 31 July 1889, *Rovirosa 548* (holotype, NY). Figure 1.

Species *Cayaponiae attenuatae* (Hooker & Arnott) Cogniaux similis, sed seminibus angustimarginatis, petiolo folii tertiam partem laminae longitudinis aequante, floribus fructibusque majoribus, bene differt.

Vine. *Stem* 1.5–4.0 mm diam., glabrous or pilose. *Leaves* 5.5–15.5 × 2.5–15.0 cm, entire to 3–5-lobate, entire leaves ovate, membranous to chartaceous, base obtuse to subtruncate, apex acuminate, occasionally acute; margin denticulate to crenate denticulate; upper surface strigose (the trichomes with very broad multicellular bases) to pustulate, primary and secondary veins hirsute; lower surface hirsute to densely so, primary veins glabrous, secondary veins frequently so; petiole 15–85 × 1.5–3.0 mm, pilose or hirsute, occasionally glabrous. *Tendrils* to ca. 15 cm, simple or bifid, pilose. *Staminate flowers* 1–4, solitary or borne in a fascicle or racemes up to 5 cm long; bracts 2–15 mm long, spiniform to ovate, occasionally forked, pilose; hypanthium 4–6 × 3–4 mm, campanulate, pilose; calyx lobes 1–2 mm long, glabrous or strigose (the trichomes with very broad multicellular bases), verrucose, spreading; corolla (7–)10–14 × 5 mm; lobes oblong, fused for lower ½ of their length, greenish white, outer surface densely tomentose, inner surface densely short pilose; stamens 10–11 mm long; filaments 7–8 mm × 0.5 mm; anthers ca. 3 × 2 mm; pedicel 3–5 × 0.8–1.2 mm, glabrous to occasionally pilose. *Pistillate flowers* disposed as staminate flowers; hypanthium 2–3 × 3 mm, broadly campanulate, constricted above the ovary to ca. 1 mm diam. for 1–2 mm; calyx lobes ca. 1 mm long; corolla 6–7 × 5–8 mm, spreading; style ca. 6 mm long, filiform; stigmas 2–3 mm long, fused for lower ⅙ of their length, glabrous; ovary ca. 3 × ca. 2.5 mm, subglobose, pilose or glabrous. *Fruiting peduncle* 4–11 × 1 mm, glabrous to sparsely strigose (with very broad multicellular bases). *Fruits* solitary, 12–16 mm, globose, glabrous, greenish yellow to black; apical scar 1–1.4 mm diam., circular, with an occasional central spot; grooved. *Seeds* 3–7 per fruit, 8–9 × 5–6 × 2 mm, ellipsoid, apically compressed, base rounded, apex subtruncate, surface smooth, brown.

Distribution. Moist forest, along riverbanks and in secondary regrowth, from southern Mexico (Oaxaca and Chiapas) to Costa Rica, from 0 to 1000 m (Fig. 2).

Cayaponia longiloba, the name derived from the relatively long corolla, is most closely related to *C. attenuata* (Hooker & Arnott) Cogniaux in terms of the combination of indumentum types, the presence of a bracteate inflorescence, and in having seeds that are apically compressed. It differs, however, in a number of respects. The petioles are generally twice as long in *C. longiloba* as in *C. attenuata*, while there is no corresponding difference in leaf length. The perianth, anthers, and fruit of *C. longiloba* are also significantly larger (twice the size of those of *C. attenuata*). In addition, the seeds of *C. longiloba* are narrowly marginate, while those of *C. attenuata* are emarginate.

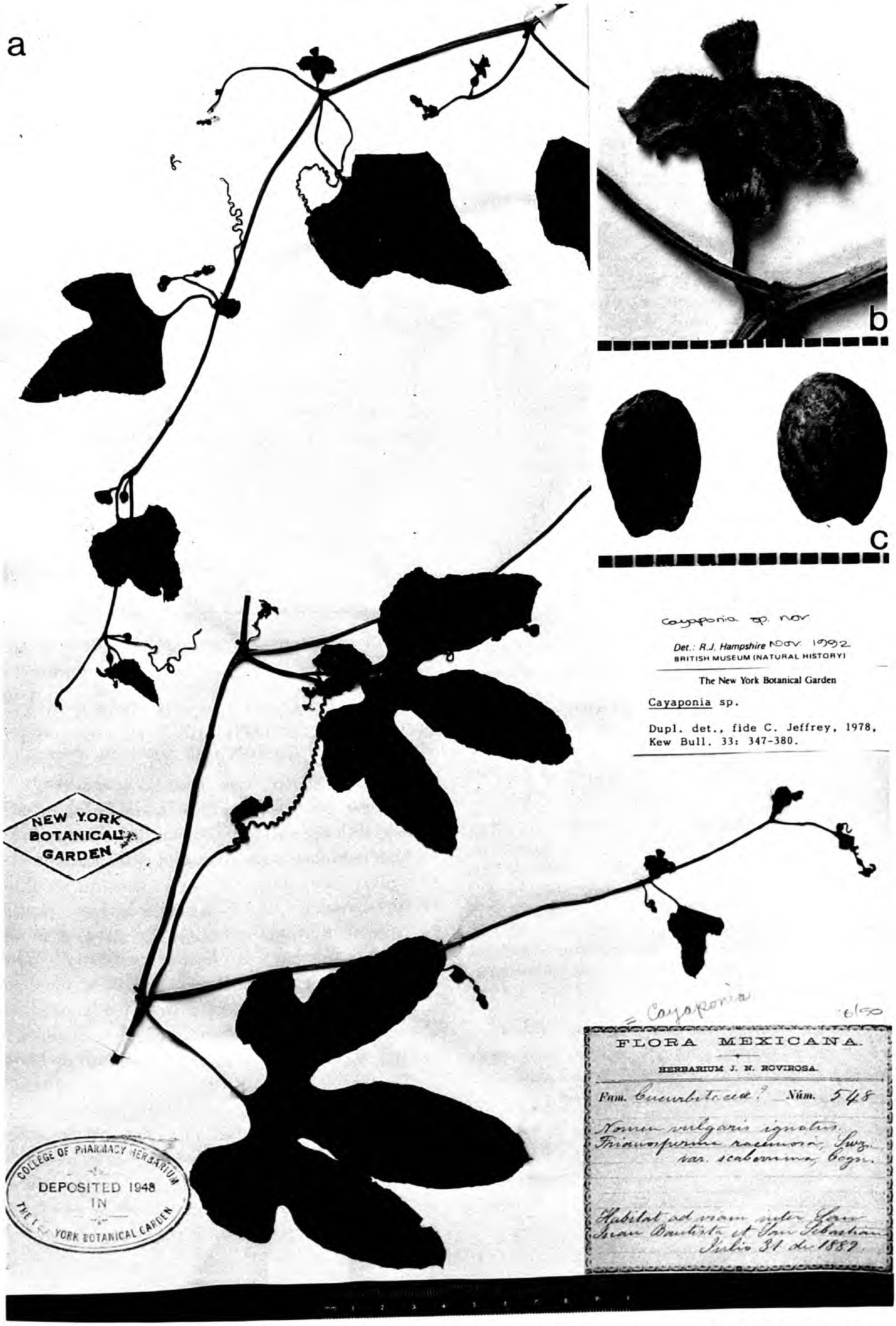

Figure 1. Photograph of the type specimen of *Cayaponia longiloba* A. K. Monro (*Rovirosa 548*, NY). —a. Habit. —b. Staminate flower. —c. Seed. All scale bars in mm.

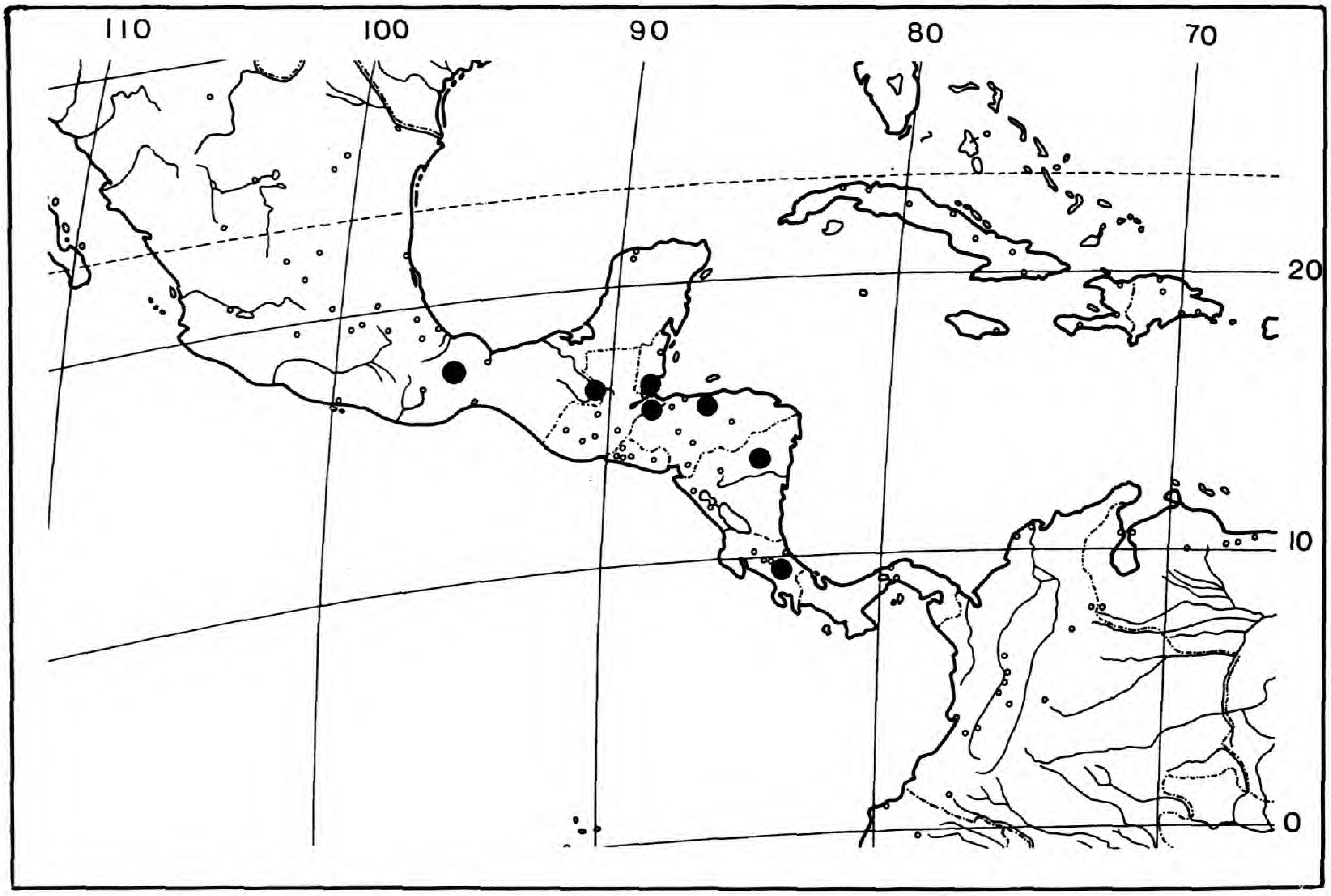

Figure 2. Distribution of *Cayaponia longiloba* A. K. Monro.

Paratypes. MEXICO. **Chiapas:** Esperenza, Escuintla, 150 m, 7 Dec. 1949, *Matuda 18710* (F, K). GUATEMALA. **Izabal:** Río Juyamá, SE of Cheyenne, about 15 mi. SW of Bananera, 50–100 m, 8 Apr. 1940, *Steyermark 39170* (F, NY). BELIZE. Jacinto Creek, 15 m, 20 July 1933, *Schipp 1195* (BM, F, NY); Stann Creek Railway, 15 m, 26 Sep. 1929, *Schipp 393* (BM, F, NY); Stann Creek, Silk Grass Creek Reserve, 13 Nov. 1939, *Gentle 3091* (NY). HONDURAS. **Cortés:** Aldea de Corinto y alrededores frontera con Guatemala, 55 km al O de Puerto Cortés, 9–11 Aug. 1975, *Nelson et al. 2855* (MO). **Atlántida:** Lancetilla Valley, near Tela, 20–600 m, 6 Dec. 1927 to 20 Mar. 1928, *Standley 52833* (F). NICARAGUA. **Zelaya:** Guamil o breñas sobre áreas pantanosas a lo largo del Río Grande, 0–15 m, 21 Apr. 1949, *Molina 2290.* COSTA RICA. **Cartago:** railway track below Turrialba, 1000 m, 6 Sep. 1928, *Stork 2487* (F).

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Novelties of the Genera *Parajubaea* and *Syagrus* (Palmae) from Interandean Valleys of Bolivia

Mónica Moraes R.
Herbario Nacional de Bolivia, Casilla 10077—Correo Central, La Paz, Bolivia

ABSTRACT. Two new species from the interandean valleys of Bolivia, *Parajubaea sunkha* and *Syagrus yungasensis* (Palmae), and a new variety, *Parajubaea torallyi* var. *microcarpa* (Palmae), are described and illustrated.

RESUMEN. Se describen e ilustran dos nuevas especies de Palmae de los valles interandinos de Bolivia, *Parajubaea sunkha* y *Syagrus yungasensis*; también se describe la variedad *Parajubaea torallyi* var. *microcarpa*.

Recent intensive fieldwork, new palm collections, and the preparation of a Bolivian palm flora have increased information about the richness and distribution of Bolivian palms. The descriptions of two new species and one variety are included in treatments of the Bolivian palm flora by Moraes (in prep.).

PARAJUBAEA BURRET

Parajubaea is a small genus occurring in the interandean valleys of southern Colombia, central Ecuador, and central to southern Bolivia. All species are treelike, with pinnate leaves, and branched interfoliar inflorescences. The genus was studied by Moraes and Henderson (1990), and two species were recognized: *P. cocoides*, growing in cultivated stands of Colombia and Ecuador, and *P. torallyi*, endemic to Bolivia. The latter species was not well understood nor looked for in other areas of Bolivia. The genus *Parajubaea* now includes a third species and two varieties, which are treated in the present contribution.

Parajubaea torallyi has been recorded from the northeastern area of the Chuquisaca department, in southern Bolivia. Moraes and Henderson (1990) added another collection for this species from the southwest of the department of Santa Cruz, but this is treated here under a distinct species, *P. sunkha*.

KEY TO THE SPECIES OF *PARAJUBAEA*

1. Rachillae with short side branches; staminodial ring with three fingerlike projections; endocarp with three inconspicuous ridges; cultivated; Colombia and Ecuador, between 2500 and 3000 m . . . . *P. cocoides*
1. Rachillae unbranched; staminodial ring not digitated; endocarp with three prominent or inconspicuous ridges; wild populations; Bolivia, between 1700 and 3400 m.
    2. Pinnae irregularly arranged; sheath fibers well developed; stem 4–10 m tall, 25–35 cm diam., densely covered by sheaths; in protected ravines, between 1700 and 2200 m . . . . *P. sunkha*
    2. Pinnae regularly arranged; scarce fibers on sheath; stem 20–26 m tall, 25–50 cm diam., smooth; on steep slopes, between 2700 and 3400 m . . . . *P. torallyi*

Some similarities are found between *Parajubaea cocoides* and *P. torallyi*, such as in habit (e.g., smooth and tall stems, long petioles, and regularly arranged pinnae). The single seed-fruit and less obvious endocarpic ridges are characteristics of both *P. sunkha* and *P. cocoides*.

Parajubaea sunkha Moraes, sp. nov. TYPE: Bolivia. Santa Cruz: Vallegrande, El Palmar, 26 km on road from Vallegrande to Postrer Valle, 2400 m, 22 Aug. 1994, *M. Moraes & I. Vargas 1805* (holotype, LPB; isotypes, AAU, NY, QCA, UCZ, US). Figure 1.

Caudex solitarius 4–10(–14) m, cum reliquiis foliaris basis. Petioli valde fibrosi, 33–100 cm longi; pinnae utroque latere 66–92, irregulariter dispositae vel 2–5 inter se obscure aggregatae. Flores masculini staminibus 13–15; flores feminei 4–5(–8) ad rhachillae basim. Fructus ovoideus 3–5 cm longus; putamine 1(–2).

Stem 4–10(–14) m tall, 25–50 cm diam., covered to the base with old sheaths. Leaves 18–26, 2–3 m long, erect and arching in distal third portion; sheath 35–120 cm long, with a dense tough brown fiber 1–1.35 m long, 40–70 cm wide; petiole 33–100 cm long; rachis 2–2.5 m long, triangular in cross section at apex; pinnae 66–92 per side, lanceolate, irregularly inserted in groups of 2–5, 3–4 cm apart, in one plane, plicate at base, green and lustrous adaxially, glaucous abaxially; basal pinnae 45–80 × 0.4–1.1 cm; middle pinnae 62–70 × 2.5–3 cm; apical pinnae 40–52 × 0.3–0.8 cm. Inflorescences up to six per plant, 1.8–2.5 m long, buds erect becoming pendulous at anthesis; prophyll ca.

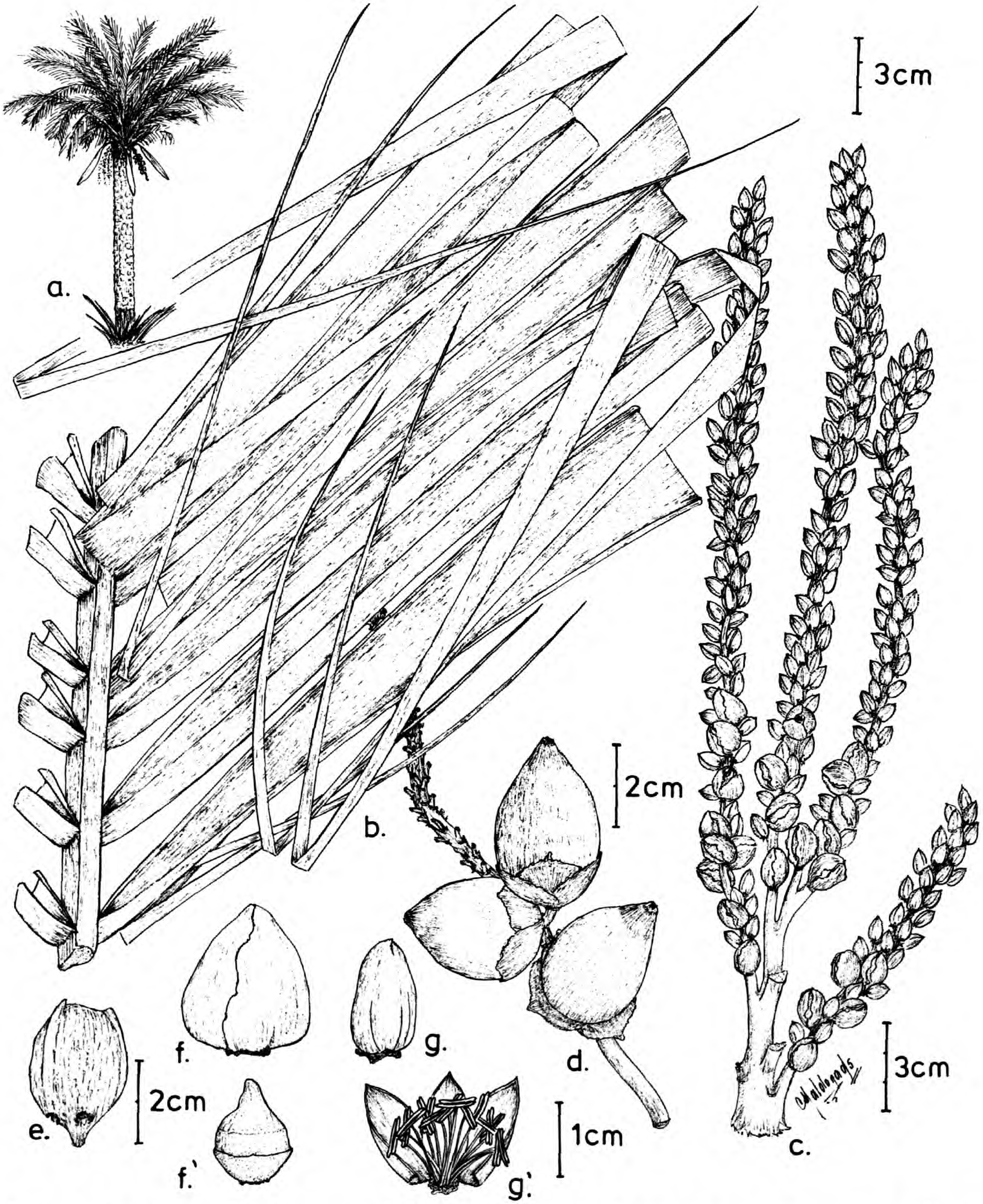

Figure 1. *Parajubaea sunkha* Moraes. —a. Habit with persistent sheaths. —b. Shape and arrangement of leaves, grouped pinnae. —c. Inflorescence, apical portion. —d. Infructescence with mature fruits. —e. Endocarp. —f. Pistillate flower. —f'. Ovary with staminodial ring. —g. Staminate flower. —g'. Open perianth showing stamens. (a based on photographs taken in El Palmar and Mataralcito, Santa Cruz; b–g on *Moraes & Vargas 1805*.)

1.4 m long and 13 cm diam. at base; peduncular bract 0.85–1.75 m long, apiculate, inflated above, woody, sulcate, brown externally, glabrous and white-cream internally; peduncle 60–80 cm long, glabrous; rachis 38–50 cm long, glabrous; rachillae 33–50 spirally arranged, spreading at anthesis, the basal ones 18–32 cm long, the middle ones 28 cm long, the apical ones 21–25 cm long; staminate flowers pedicellate, pedicel 2–6 mm, yellow-orangish; sepals free, briefly connate basally; petals broadly triangular, 10 × 6 mm, valvate; stamens 13–15, 6 mm long; filaments 2 mm long; anthers 4 mm long, medifixed, slightly sagittate; pistillode trifid; pistillate flowers 4–5(–8) per rachilla, basally inserted, 8.5 × 10 mm; sepals and petals broadly triangular, 10 × 13 mm, petals slightly smaller than sepals; staminodial ring to 2 mm tall, with 6 short teeth; ovary brownish beige tomentose; stigmas to 1 mm long; ovule basal. Fruit ovoid, 3–5 cm long, 2.5–3 cm diam.; epicarp light green, orange at apex; mesocarp very fibrous; endocarp stonish, brown with 3 inconspicuous ridges; seeds 1(–2), 2–2.5 cm long; endosperm homogeneous with central cavity; eophyll bifid.

Etymology. The vernacular Aymaran name of *sunkha,* which refers to the density of fibers, has been adopted for the species epithet.

Common names. "Sunkha," "palma sunkha," "corozo."

Uses. This palm is exploited locally: fibers are collected for ropes, mattresses, and pads; leaves and leaflets for fans and baskets; fruits for human consumption; palmheart and young leaves for forage (Moraes & Henderson, 1990; Vargas, 1994).

Distribution. Endemic to Bolivia. Restricted to narrow valleys with low semideciduous forests in the lower parts and with *Podocarpus parlatorei* Pilger, *Alnus acuminata* HBK, and *Berberis* sp. in the upper parts, partially transformed to grassy or shrubby slopes and ridges, in the Department of Santa Cruz, Province of Vallegrande (63°26′–64°10′W, 18°10′–18°30′S). Populations occur between 1700 and 2200 m elevation in interandean dry valleys. It is locally abundant in protected ravines, but most of the population is being reduced by the cultivation of maize. This palm is much less common today than 50 years ago. Several local people referred to a formerly larger area of the sunkha palm that extended to the south of Vallegrande.

Conservation status. Due to the restricted distribution of *Parajubaea sunkha,* and the harvesting of fiber and leaves, this species is endangered.

Paratypes. BOLIVIA. **Santa Cruz:** Prov. Vallegrande, Mataralcito, 2 hours E of Santa Rosita on road to Postrer Valle, 18°32′S, 64°00′W, 1900 m, 11 May 1988, *Henderson, Moraes & Saldias 760* (LPB, NY), 10 May 1988, *Moraes et al. 1048* (LPB, NY); 15 km E from Santa Rosita, 23 July 1989, *Vargas 230* (LPB, UCZ); 10 km E of Guadalupe, valley of río Piraymiri, 1 km upstream from Chorillos, 18°33′S, 63°59′W, 1800 m, 5 Feb. 1988, *Nee et al. 36179* (LPB, NY, UCZ); in Barrio Nuevo, 18°29′S, 64°06′W, 2000 m, 5 Feb. 1988, *Nee et al. 36245* (LPB, NY, UCZ).

Much material previously cited was misidentified as *Parajubaea torallyi* (Moraes & Henderson, 1990), to which the new species *P. sunkha* is undoubtedly closely related, and with which it is wholly allopatric.

Parajubaea torallyi is a tree 20–26 m tall, with a smooth and slender stem, and pinnae regularly arranged. It grows on steep western slopes of sandstone mountains ranging from 2000 to 3400 m. There are two populations, which differ in fruit size, shape of endocarp, and number of stamens. They are treated as two varieties of *P. torallyi.*

KEY TO THE VARIETIES OF *PARAJUBAEA TORALLYI*

1. Fruits 6–7.5 cm long with 2–3 seeds; endocarp with 3 prominent ridges; rachillae straight; stamens 17. . . . . *P. torallyi* var. *torallyi*
1. Fruits 4–5 cm long with 1(–2) seeds; endocarp with 3 inconspicuous ridges; rachillae zig-zag and twisted; stamens 13–15 . . *P. torallyi* var. *microcarpa*

The zig-zag and twisted rachillae shape of *P. torallyi* var. *microcarpa* is reminiscent of *P. cocoides.*

Parajubaea torallyi (C. Martius) Burret var. **microcarpa** Moraes, var. nov. TYPE: Bolivia. Chuquisaca: Jatun Palmar, Palmar Grande, 10 km E of Soroma, ravines of río Pilcomayo, 2047 m, 26 May 1995, *M. Moraes, E. Oviedo & O. Murguía 2209* (holotype, LPB; isotype, NY). Figure 2.

Flores masculini staminibus 13–15; flores feminei 1(–2) ad rhachillae basim. Fructus ovoideus 3.5–4.5 cm longus; putamine 1(–2).

Stem 10–20 m tall, 25–50 cm diam., smooth. Leaves 15–18, 4.5–5 m long, erect; sheath to 110 cm long, with few fibers to 15 cm long; petiole 70–90 cm long; rachis 2.7–3.2 m long, triangular in cross section at apex; pinnae 80–89 per side, lanceolate, regularly inserted and spreading in the same plane, plicate at base, green and lustrous adaxially, glaucous abaxially; basal pinnae 56–75 × 0.6–1 cm; middle pinnae 60–65 × 1.2–1.5 cm; apical pinnae 68–72 × 0.8–1 cm. Inflorescences up to five per plant, 1.8–2.5 m long; buds erect, becoming pendulous at anthesis; prophyll ca. 1 m long; peduncular bract 1.1–1.3 m long, apiculate, inflated above, membranous, sulcate, brown externally, glabrous and light brown internally; peduncle 60–64 cm long, glabrous; rachis 40–46 cm long with a zig-zag and twisted shape, glabrous; rachillae 13–16 spirally arranged, spreading at anthesis, the basal ones 13–15 cm long, the apical ones 17–19 cm long; staminate flowers pedicellate, 6–9 mm long; pedicel 1–4 mm long; sepals free, briefly connate basally; petals broadly triangular, valvate; stamens 13–15, 5 mm long; filaments 3 mm long; an-

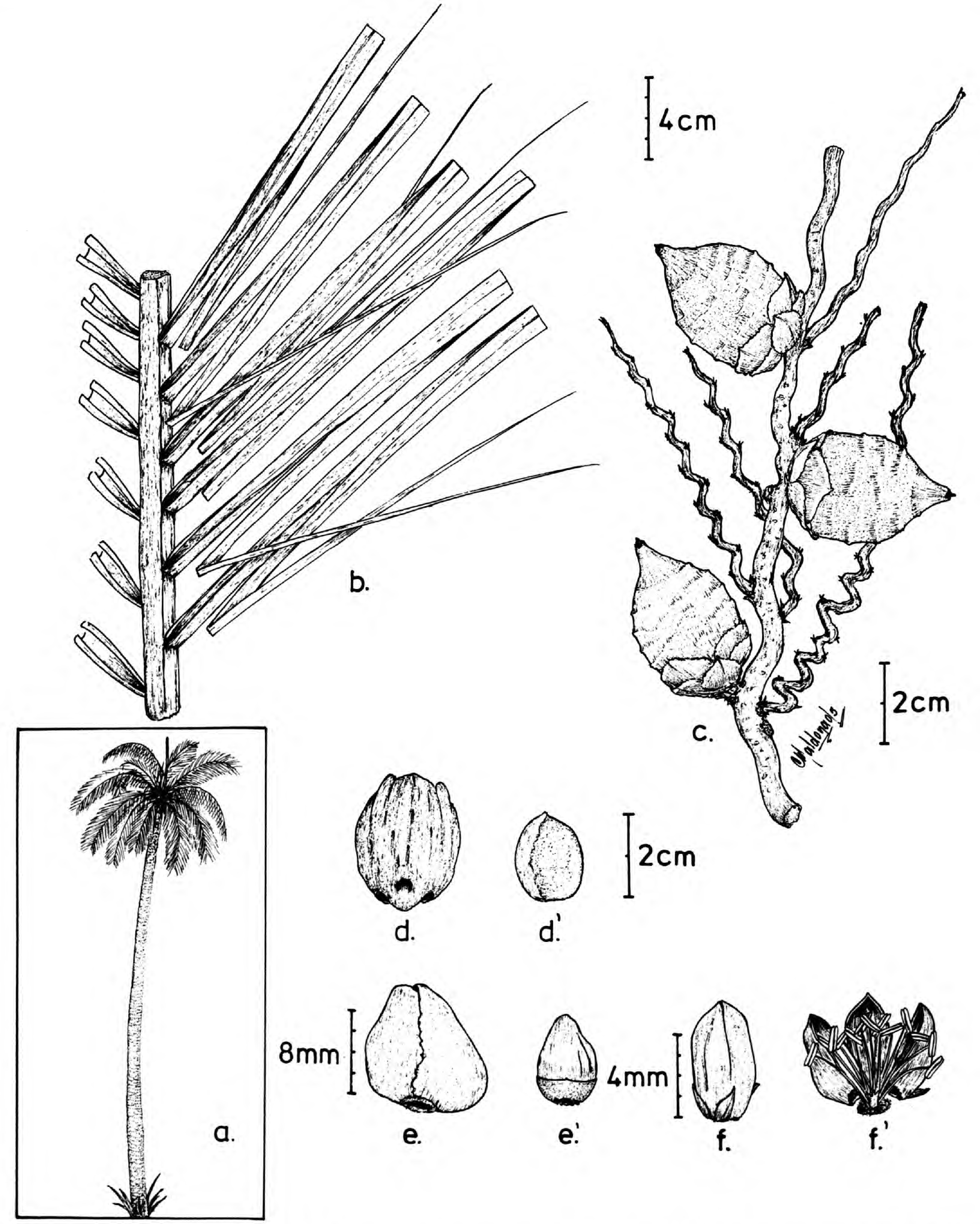

Figure 2. *Parajubaea torallyi* (C. Martius) Burret var. *microcarpa* Moraes. —a. Habit with smooth and slender stem. —b. Shape and arrangement of middle section of leaves. —c. Infructescence with mature fruits; note zig-zag shape of rachillae. —d. Endocarp. —d'. Seed. —e. Pistillate flower. —e'. Ovary with staminodial ring. —f. Staminate flower. —f'. Stamens. (a based on photographs taken in Jatun Palmar, Potosí; b–f on *Moraes et al. 2209*.)

thers 2 mm long, medifixed, slightly sagittate; pistillode trifid; pistillate flowers 1(–2) per rachillae, basally inserted, 8–12 mm long; sepals and petals broadly triangular to 9 mm long, petals slightly smaller than sepals; staminodial ring to 2 mm tall, with 3 short teeth; ovary brownish beige tomentose; stigmas to 1 mm long; ovule basal. Fruit ovoid 3–5 cm long, 2.5–3 cm diam.; epicarp light green, orange at apex; mesocarp very fibrous; endocarp with 3 inconspicuous ridges; seeds 1(–2), 2.1 cm long.

Etymology. The epithet refers to the small size of fruit, compared with *P. torallyi* var. *torallyi*.

Common names. "Janchi coco," "palma de fruto chico."

Uses. According to local people, this palm is utilized for its fruits. Formerly, the stems were split in two and then cut into pieces 1 m long, in order to extract and grind the internal fibers with an ax, and finally to weave ropes from the fibers. Occasionally, baskets and fans are made from the leaves.

Distribution. Endemic to Bolivia. Restricted to steep interandean valleys with xeric, often spiny vegetation (*Prosopis, Aspidosperma,* bromeliads), in the departments of Chuquisaca (Zudañez) and Potosí (Province Linares): (64°11'–64°55'W, 19°33'–19°50'S). Monotypic stands are found between 2700 and 3400 m elevation.

Conservation status. This species is not threatened because it regenerates prolifically and because there are few roads and human settlements.

Paratypes. BOLIVIA. **Potosí:** Prov. Linares, Jatun Palmar, 167 km E from the city of Potosí on road to Turuchipa, 19°50'S, 64°55'W, 2750–3300 m, 5 Apr. 1993, *Torrico & Peca 337* (BOLV, LPB).

Parajubaea torallyi (C. Martius) Burret var. **torallyi**, Notizbl. Bot. Gart. Berlin-Dahlem 11: 50. 1930. *Diplothemium torallyi* C. Martius in d'Orbigny, Voy. Amér. mér. 7(3). Palmiers 105, t. 15, fig. 3. 1842. *Jubaea torallyi* (C. Martius) H. A. Wendland in Kerch., Palmiers 247. 1878. *Polyandrococos torallyi* (C. Martius) Barbosa Rodrigues, Contr. Jard. Bot. Rio de Janeiro 1: 8. 1901. TYPE: Bolivia. Chuquisaca: Oropeza, Garcilaso, near town, *A. d'Orbigny 51* (holotype, P).

The type collection consists only of endocarps that are smaller than those from Pasopaya stands. Alcides d'Orbigny gathered them from cultivated trees grown in Garcilaso, which lies in the north of the city of Sucre. These five trees still are alive and were estimated to be more than 300 years old.

When Cárdenas (1970) described the palm forests of the Bolivian high Andes, he noted two different fruit sizes of the Bolivian endemic species of *Parajubaea*, *P. torallyi*. Moraes and Henderson (1990) reviewed the genus *Parajubaea* and concluded that different fruit sizes were probably due to variation within the wild species. Further fieldwork and new measurements were undertaken in Bolivia to determine if these were two species of *Parajubaea* or merely a variability within a single species. Moraes and Vargas (1994) preferred the two species hypothesis, with a distinct pattern of distribution for each. Finally, there are three distinct populations, each related to different valleys and ecosystems; they belong to three hydrographic systems that are separated by several mountain ranges and are influenced by distinctive climatic conditions.

SYAGRUS C. MARTIUS

Syagrus is most diverse in central Brazil and is usually found in dry habitats. Its 32 species range from Venezuela and Colombia to Argentina with a further species in the Antilles (Glassman, 1987). An ongoing revision of the genus will report more species (L. Noblick, pers. comm.). This genus is characterized by a wide variety of life forms and habits; its species occupy both the understory and the canopy. It has an aboveground stem or may be acaulescent, the inflorescence is branched or spicate and interfoliar, the pinnate leaves are regularly or irregularly spaced, and all the species have six stamens.

The following species, *Syagrus yungasensis* is described as new to science. None of the species reported by Glassman (1987) have the combination of branched inflorescences, irregularly inserted pinnae, numerous rachillae, and treelike habit. The size of the pistillate flowers and the ornamentation of a three-ridged endocarp are reminiscent of another Bolivian species, *S. cardenasii*, but many other characters differ as follows:

KEY TO *SYAGRUS CARDENASII* GLASSMAN AND *S. YUNGASENSIS*

1. Endocarp 3 mm thick, smooth and glabrous, slightly beaked apically; endocarp apex terminates in a 3-lobed little apical point; rachillae 9–11, spreading; stem to 3 cm diam., covered with sheaths or acaulescent; ovary tomentose . . . . *S. cardenasii*

1. Endocarp 5 mm thick, rough and covered with coarse fibers, beaked basally; endocarp apex terminates in three prominent ridges that stop short of apex; rachillae 32–46, appressed to rachis; stem 7–9 cm diam., smooth; ovary glabrous . . . . *S. yungasensis*

Syagrus yungasensis Moraes, sp. nov. TYPE: Bolivia. La Paz: Sud Yungas, 30 km on the road from Chulumani to La Asunta, 900 m, 9 Dec. 1994, *M. Moraes 1874* (holotype, LPB; isotypes, FTG, NY). Figure 3.

Caudex solitarius 4–5 m. Pinnae utroque latere 98–120, irregulariter dispositae vel 4–10 aggregatae ad me-

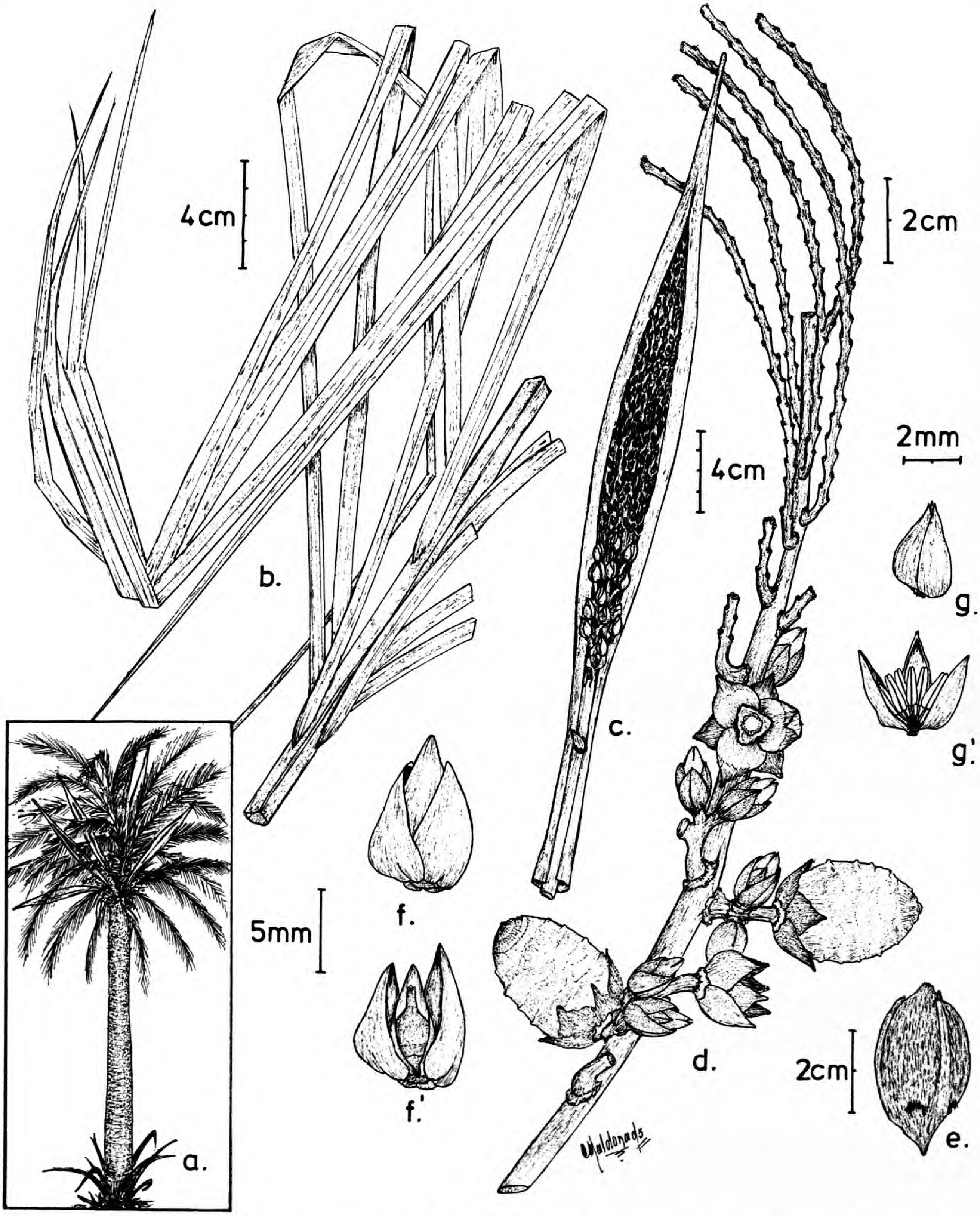

Figure 3. *Syagrus yungasensis* Moraes. —a. Habit with several erect inflorescences. —b. Shape and arrangement of middle section of leaves. —c. Inflorescence; note pistillate flowers in proximal rachillae. —d. Infructescence with mature fruits. —e. Endocarp. —f. Pistillate flower. —f′. Open perianth showing ovary and staminodial ring. —g. Staminate flower. —g′. Open flower showing stamens. (a based on photographs taken on the road from Chulumani to La Asunta, La Paz; b–g on *Moraes 1874*.)

dium usque foliato. Rhachilla 32–46 appressus ad rhachim, flores feminei congesti ad rhachillae basim.

Stem solitary 4–5 m tall, 7–9 cm diam., smooth surface with overlapping internodes without foliar bases. Leaves 13–18, ca. 2.2 m long; sheath 12–25 cm long, fibrous; pseudopetiole 80–100 cm long, fibrous, channeled with slightly raised midridge, margins with fibers 6–8 cm long; rachis 1.2–1.4 m long, triangular in cross section at apex; pinnae 98–120 per side, lanceolate, irregularly inserted in groups of 4–10, 4–6 cm apart, open, nearly perpendicular to rachis, plicate at base, green and lustrous adaxially, glabrous with ramenta on central nerve abaxially, in each group the apical pinnae erect to apex; basal pinnae 39–68 × 0.4–0.5 cm; middle pinnae 45–63 × 1–1.2 cm; apical pinnae 4–15 × 0.1–0.2 cm. Inflorescences up to 8 per plant, 40–95 cm long; prophyll 16 cm long, fibrous; peduncular bract 80–92 cm long, apiculate, inflated above, woody, sulcate, brown externally, glabrous and dark brown internally; peduncle 56 cm long, glabrous; rachis 10–13 cm long, glabrous; rachillae 32–46, appressed to rachis, 11–15 bearing 2–4 pistillate flowers, the remaining rachillae with only staminate flowers, basal ca. 8–26 cm long and apical 2.5–10 cm long; sometimes one single rachilla inserted 40 cm from the base of peduncle, with 5–6 pistillate flowers. Staminate flowers sessile, to 6 mm long; sepals and petals apiculate; stamens 6, 2–3 mm long; filaments to 1 mm long; anthers to 2 mm long. Pistillate flowers 9–10 mm; sepals and petals apiculate; ovary glabrous with trifid stigmas; staminodial ring to 2 mm high, undulate. Fruit 3.5–4 × 2.5–3 cm; epicarp smooth, green with brown scales at apex; mesocarp fibrous; endocarp 5 mm thick covered with persistent coarse fibers, rough surface, beaked at the base and with lightly prominent ridges that stop short of apex; seed 1, endosperm homogenous.

Etymology. The specific epithet refers to the geographical region known locally as the Yungas, an area that comprises much of the east slope of the Andes in northern and central Bolivia.

Common names and uses. None recorded.

Distribution. Restricted to narrow dry valleys and steep rocky slopes in the semideciduous forests of the eastern slope of the Andes, between 700 and 1000 m elevation.

Conservation status. This species is only known from narrow valleys. Due to an increasing number of vehicles and road construction in the area its population could be endangered. However, most populations are found on inaccessible, steep slopes and are not thought to be in any immediate danger.

Paratype. BOLIVIA. **La Paz:** Sud Yungas, 82 km from Chulumani on road to La Asunta, 700 m, 30 May 1986, *Beck 12636* (LPB).

Syagrus yungasensis was found on the stretch of road between Chulumani and La Asunta growing on rocky soils and cliff faces in steep ravines. These dry interandean valleys are very different from the humid forests found in much of the *Yungas,* and are a result of orographic conditions. The linear distance from the collection sites to peaks of ca. 6500 m in elevation in the *Cordillera* is ca. 55 kilometers. The population is found within rainshadowed valleys, and the vegetation is characterized by the presence of semideciduous and xerophytic species that withstand extended periods without rain.

Small species of *Syagrus* often turn out to be local endemics, such as in the northeast of Brazil (Larry Noblick, pers. comm.). Some acaulescent endemic species were reported from Brazil: *S. duartei* Glassman, *S. harleyi* Glassman, *S. mendanhensis* Glassman, *S. microphylla* Burret, and *S. werdermannii* Burret (Glassman, 1987). This new small species may have evolved in recent geologic periods; it has survived in a restricted habitat that is biogeographically related to the Chaqueñan flora further south, but separated by the more humid forests of the Yungas and Chapare.

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Taxonomic Notes on *Cimicifuga purpurea*, Stat. Nov. (Ranunculaceae)

Chong-Wook Park and Hyun-Woo Lee
Department of Biology, College of Natural Sciences, Seoul National University,
Seoul 151-742, Korea

ABSTRACT. Examination of type specimens and other collections of *Cimicifuga acerina* f. *purpurea* and forma *strigulosa* revealed that they are not separable from one another but are very distinct from *C. acerina* and other related species of the genus in many morphological characters, including sepal color, stamen number, anther structure, and presence of cauline leaves. Therefore, these two formae are combined and recognized here as a distinct species, *C. purpurea.*

The genus *Cimicifuga* L. (Ranunculaceae) consists of ca. 18 species (Tamura, 1966, 1990) that usually occupy shady, moist habitats in rich mountain woods. The species of *Cimicifuga* are distributed in temperate to cold temperate regions of the Northern Hemisphere including Europe, Asia, and North America, with the center of diversity in eastern Asia. They are readily distinguished by their large ternately compound leaves that are long-petioled, racemose or paniculate inflorescences bearing many small flowers, and follicular fruits with 4 to 15 seeds (Ramsey, 1965; Tamura, 1966, 1990).

Hsiao (in Wang & Hsiao, 1965) described four formae of *C. acerina* (Siebold & Zuccarini) Tanaka from China on the basis of differences in leaf pubescence and sepal color; these include f. *acerina,* f. *hispidula,* f. *purpurea,* and f. *strigulosa.* During a comprehensive systematic study of the genus *Cimicifuga,* we examined the type specimens and other collections of forma *purpurea* and forma *strigulosa* and found that they are very distinct from *C. acerina* (= *C. japonica* (Thunberg) Sprengel; see Hara (1985)) in having purple sepals, five to eight stamens with dorsifixed and introrsely dehiscent anthers (Fig. 1A–C), somewhat elongated styles with narrowly capitate stigmas (Fig. 1D), and cauline leaves. Furthermore, the stamen number of forma *purpurea* and forma *strigulosa* is significantly lower than that of all other species in the genus, which usually have 20 to 70 stamens. In addition, anthers are usually basifixed and latrorsely dehiscent in other species of the genus.

Although Hsiao (in Wang & Hsiao, 1965) stated that forma *strigulosa* differs from forma *purpurea* in having strigulose leaves, it does not seem to be consistently distinguishable by any characters other than leaf pubescence, which shows variation and some degree of overlap. Therefore, it can hardly be considered as distinct from forma *purpurea,* and we believe that they should be united.

Based on the above observations, it is concluded that the appropriate taxonomic treatment regarding forma *purpurea* and forma *strigulosa* is to combine them and to raise the combined taxon to species rank. Since these names were published simultaneously by Hsiao (in Wang & Hsiao, 1965) and since their synonymy has not been previously recognized, we have selected the name forma *purpurea* (Article 11.5 of ICBN (Greuter et al., 1994)) as a basionym for this species, as the distinguishing characters mentioned above seem to be correlated with purple sepals. The necessary nomenclatural change, along with an expanded description, is provided here in advance of our monograph of the genus to make it available for use in the forthcoming paper on pollen morphology of the genus *Cimicifuga.*

Cimicifuga purpurea (Hsiao) Park & Lee, stat. nov. Basionym: *Cimicifuga acerina* (Siebold & Zuccarini) Tanaka f. *purpurea* Hsiao in Wang & Hsiao, Acta Phytotax. Sin. 12 (Addit. 1): 54. 1965. TYPE: China. "Shan-si, Yuan-chü," 28 Aug. 1959, *S. Y. Pao 681* (holotype, PE).

Cimicifuga acerina (Siebold & Zuccarini) Tanaka f. *strigulosa* Hsiao in Wang & Hsiao, Acta Phytotax. Sin. 12 (Addit. 1): 55. 1965. Syn. nov. TYPE: China. "Shen-si, Shan-yang, Tien-chu-shan," alt. 1400 m, 5 Sep. 1952, *T. P. Wang 16488* (holotype, PE).

Erect rhizomatous perennial herb, 0.5–1.1 m tall; rhizomes thick, knotted, ca. 5 cm long, bearing numerous fibrous roots. Stem unbranched, thick, glabrous or sparsely pubescent with simple filiform unicellular hairs. Leaves basal and cauline, ternately compound with 3 relatively large leaflets, long-petioled. Basal leaves 1 or 2; terminal leaflet orbicular, 13.3–20.0 cm long, 9.5–21.4 cm wide,

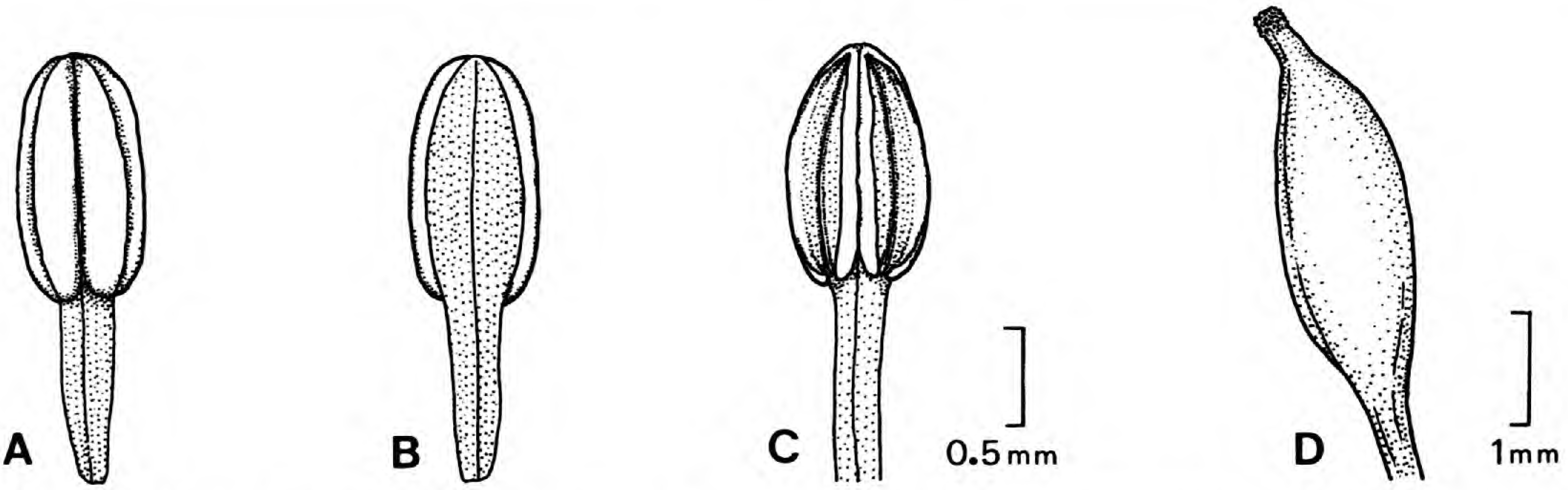

Figure 1. Stamen (A–C) and pistil (D) of *Cimicifuga purpurea* (Hsiao) Park & Lee. —A. Ventral view. —B. Dorsal view. —C. After anthesis (ventral view). —D. Pistil with an elongated style and narrowly capitate stigma. (A, B drawn from *Liou 3509* (PE); C, D from the holotype specimen, *Pao 681* (PE)).

palmately 5- to 9-lobed, lobe tip acuminate to weakly cuspidate, base weakly to deeply cordate, margin irregularly double serrate; teeth acute, gland-tipped; upper surfaces green, with a narrow zone of somewhat appressed short simple filiform unicellular hairs to 0.5 mm long along margin; rest of upper surface usually glabrous, but rarely sparsely to moderately pubescent with simple filiform unicellular hairs; lower surfaces light green, sparsely to densely pubescent with simple filiform unicellular hairs along major veins; major veins 5–9, equal to number of lobes, prominent, joining at base of leaflet; petiolules 9–15 cm long, grooved, glabrous or sparsely pubescent with simple filiform unicellular hairs ca. 0.5 mm long; lateral leaflets 2, similar to terminal one, but often slightly smaller and inequilateral. Petioles of basal leaves 11–23 cm long, grooved, glabrous or sparsely pubescent with simple filiform unicellular hairs ca. 0.5 mm long. Cauline leaves usually 1, similar to basal ones in shape, but smaller. Inflorescence a terminal, spikelike raceme with many small flowers, often bearing 1–6 branches near base, indeterminate, densely pubescent with simple saccate unicellular hairs to 0.3 mm long; terminal raceme 10–21 cm long; pedicels very short, ca. 0.5 mm long, bearing bracteoles at base; bracteoles 3, triangular, acute, middle one 1.0–1.5 mm long, 1.0 mm wide, 2 lateral ones similar in shape but smaller. Flowers bisexual, small, actinomorphic; sepals 5, petaloid, purple, broadly elliptic, concave, 3.2–4.5 mm long, 2.0–2.6 mm wide, glabrous, caducous, apex obtuse; petal 1, broadly elliptic to ovate, dark brown when dry, 2.5–3.5 mm long, 2.0–2.4 mm wide, apex obtuse, base short- stipitate, glabrous, bearing a nectariferous area near base; stamens 5–8; filaments filiform, somewhat flattened, glabrous, 1.0–4.0 mm long, dark brown when dry, elongate considerably and exserted after anthesis; anthers bilocular, narrowly elliptic to oblong, 1.1–1.6 mm long, 0.6–1.0 mm wide, dorsifixed, longitudinally and introrsely dehiscent; pistils 1 or 2, elliptic, glabrous, 2.0–3.1 mm long, 0.8–1.4 mm wide; style 1, somewhat elongated, ca. 0.2 mm long; stigma 1, narrowly capitate, 0.2–0.3 mm wide; stipe 1.0–1.2 mm long, elongate after fertilization. Mature follicles and seeds not seen.

Distribution. North central China, including Hebei, Hubei, Shaanxi, Shanxi, and Sichuan provinces.

Additional specimens examined. CHINA. "Prov. Hupeh & Szechwan," without specific locality, in 1885–1888, *Henry 6083* (BH (photo), BM, E, GH (2 sheets), MO, NY, P, US (2 sheets)). **Hebei:** Fuping-hsien, alt. 1275 m, 30 Aug. 1934, *Liou 3509* (PE). **Hubei:** Shennongjia Forest District, along the trail between Hongriwan Construction Camp and Qiujiaping, alt. 1200–1400 m, roadside slope in forest; 2 Sep. 1980, *Bartholomew et al. 586* (A); Shennongjia Forest District, vicinity of Qiujiaping, alt. 1440–1650 m, in mature, mixed deciduous-broad leaved evergreen-coniferous forest, on steep slope, 3 Sep. 1980, *Bartholomew et al. 622* (A); Zan-lan-scian, Oct. 1913, *Silvestri 3724* (A); "western Hupeh," without specific locality, Sep. 1901, *Wilson 2239* (NY). **Shaanxi:** Chungnan-shan, at base of steep cliff, alt. 1500 m, 2 Sep. 1933, *Wang 2067* (PE). **Shanxi:** N central China, Mt. Lean-san, in 1898, *Hugh s.n.* (BM); Hsiatschuan (1500 m) ad mtem. Yaoschan, 19 Aug. 1935, *Licent 12588* (GH); Yuan-chu, alt. 1900 m, 26 June 1959, *Pao & Yen 331* (PE); Yang-cheng, 28 July 1959, *Pao & Yen 2147* (PE). **Sichuan:** District de Tchen-Keou-Tin, bois à Heou-Pin, alt. 1600 m, 6 Sep. 1893, *Farges 1260* (NY, P).

Acknowledgments. We are grateful to the directors and staff members of A, BH, BM, E, GH, MO, NY, P, PE, and US, who made generous loans of their collections. This study was supported by a grant from KOSEF (grant number 921-0400-011-2) to the first author.

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Compositae of the Guayana Highland—X. Reduction of *Pollalesta* to *Piptocoma* (Vernonieae: Piptocarphinae) and Consequent Nomenclatural Adjustments

John F. Pruski
United States National Herbarium, Department of Botany, MRC-166, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. Central and South American *Pollalesta* is reduced to synonymy of West Indian *Piptocoma.* Fourteen new species combinations and three new sectional combinations are made, and *Piptocoma acevedoi* from Puerto Rico is described as new, raising the number of species in *Piptocoma* from 3 to 18. A key to the four sections of *Piptocoma* is also provided.

While preparing accounts of the Compositae (Asteraceae) for the Guayana Highland in northeastern South America and for the *Flora of St. John, U.S.V.I.*, I came to the conclusion that West Indian *Piptocoma* Cassini and Central and northern South American *Pollalesta* HBK (Vernonieae subtribe Piptocarphinae, sensu Robinson et al., 1980, and Pruski, 1992) are congeneric. Schultz-Bipontinus (1863) also treated neotropical *Piptocoma* and *Pollalesta* as congeneric more than a century ago, but treated them as synonyms of paleotropical *Oliganthes. Piptocoma* tends to have smaller leaves and larger heads than those of *Pollalesta,* but the differences are not generically useful. *Piptocoma* was treated as distinct from *Oliganthes* (then including *Pollalesta*) by Bentham (1873) and from *Pollalesta* by Stutts and Muir (1981) because of striate (not 10-costate) cypselas (achenes); however, I cannot discern a difference and do not accept recognition of two neotropical genera. The purposes of this paper are to reduce *Pollalesta* to the synonymy of *Piptocoma,* to describe a new species from Puerto Rico, and to provide the necessary transfers from *Pollalesta* to *Piptocoma.*

Pollalesta was considered by Bentham (1873) to be a synonym of *Oliganthes* Cassini, which is typified by material from Madagascar and now contains nine species, all endemic to that island. However, the neotropical species of *Oliganthes* sensu Bentham were noted by Aristeguieta (1963) to have a double pappus (vs. a uniseriate pappus in *Oliganthes* s. str.) and were treated by him in the newly resurrected *Pollalesta,* in which 24 species were recognized. In a more recent treatment of *Pollalesta,* Stutts (1981) recognized only 16 species. In my treatment of the four species of the group from Guayana (all endemic) for the *Compositae of the Guayana Highland* and *Flora of the Venezuelan Guayana,* I follow the species circumscriptions of Stutts (1981), except that I place *P. faustiana* into the synonymy of *P. schomburgkii* and *P. rarissima* into the synonymy of *P. niceforoi.*

Oliganthes has a uniseriate pappus as reported by Aristeguieta (1963), or when double has a rigid and persistent outer or shorter pappus that is formed from a cartilaginous annulus on the apex of the cypsela. The annulus is thick and is often of nearly the same color as the cypsela. Moreover, *Oliganthes* has a corolla throat that is about as long as the lobes, anthers partly included within the throat, and short-triangular anther appendages. In contrast, the pappus of the New World taxa (*Piptocoma* and *Pollalesta*) is generally deciduous and consistently white to cream-colored, it and the cypselas thus strongly discolorous. Additionally, the species from the Neotropics have a very short corolla throat that is much shorter than the lobes, anthers mostly exserted from the throat, and long-triangular anther appendages.

The Old and New World genera can thus be readily distinguished, but the two neotropical genera cannot. The general aspect, gross morphology, and floral microcharacters (the type A pollen, anthers with similar long-triangular apical appendages and spurred bases, styles with a glabrous, nonenlarged base, and a generally biseriate pappus with an inner series of spiral scales) of the neotropical species show continuous variation, making impossible the distinction of two neotropical genera. Therefore, *Pollalesta* is merged with the earlier *Piptocoma.*

Piptocoma Cassini, Bull. Soc. Philom. Paris 1817: 10. 1817. TYPE: *Piptocoma rufescens* Cassini.

Odontoloma HBK, Nov. Gen. Sp. (folio ed.) 4: 34. 1818. Syn. nov. TYPE: *Odontoloma acuminatum* HBK, "*acuminata.*" [= *Piptocoma acuminata* (HBK) Pruski.]

NOVON 6: 96–102. 1996.

Dialesta HBK, Nov. Gen. Sp. (folio ed.) 4: 35. 1818. Syn. nov. TYPE: *Dialesta discolor* HBK [≡ *Piptocoma discolor* (HBK) Pruski].

Pollalesta HBK, Nov. Gen. Sp. (folio ed.) 4: 36. 1818. Syn. nov. TYPE: *Pollalesta vernonioides* HBK [≡ *Piptocoma vernonioides* (HBK) Pruski].

Adenocyclus Lessing, Linnaea 4: 337. 1829. Syn. nov. TYPE: *Adenocyclus condensatus* Lessing [= *Piptocoma acuminata* (HBK) Pruski].

Erect subshrubs, scandent to vining shrubs, or trees; stems tomentose when young, irregularly angled. *Leaves* simple, alternate, petiolate; *blade* narrowly lanceolate to ovate or cordiform, pinnately veined, the upper surface becoming glabrous, sometimes gland-dotted, the lower surface commonly stellate-tomentose. *Capitulescence* terminal, corymbiform or glomerate, of several to many short-pedunculate capitula. *Capitula* discoid, 1–12-flowered; involucre cylindrical to narrowly campanulate, the phyllaries imbricate, graduated; receptacle weakly convex to flat, naked, plane or ridged, rarely obviously 1- or 2-awned. *Florets* bisexual; *corollas* actinomorphic, funnelform, 5(–6)-lobed, white to purple, the anthers spurred, the style base glabrous, non-enlarged, the style shaft upwardly hispidulous, the style branches ascending, slender, hispidulous, the stigmatic surface continuous. *Cypselas* obconical to less commonly plump and pyriform, often 3–5-angled and ca. 10-ribbed, brown, glabrous, glandular, or puberulent; *pappus* generally biseriate, white to cream-colored, pappus and cypsela strongly discolorous, the outer series deciduous as a ring, deciduous individually, or less commonly persistent though fragile, of ca. 10 short squamellae, these free to connate at very base (pseudocoroniform), rarely absent, the inner series deciduous, of 0–14 elongate, spiral scales reaching to about the base of the corolla lobes. *Pollen* type A. Chromosome number unknown.

The following 18 species, including one previously undescribed and 14 newly transferred from *Pollalesta,* are recognized in *Piptocoma,* which as redefined ranges from the West Indies to Central America and northern South America. Among the genera of Vernonieae in the Neotropics, *Piptocoma* is recognized by its woody habit with well-defined internodes, by its commonly stellate-tomentose lower leaf surfaces, by its few-flowered heads, and by its inner pappus of few strap-shaped, flattened, spiral, deciduous scales (not coroniform or of bristles, fimbriae, awns, or setae). The species concepts used here are largely those of Stutts (1981) and Stutts and Muir (1981), where heterotypic synonyms, keys to species, and distributions of the species are given. The infrageneric groups that Aristeguieta (1963) and Stutts (1981) recognized in *Pollalesta* are maintained, but subgenera are reduced to the sectional level. It is noted that Aristeguieta (1963) and Stutts (1981) used some of the subgenera of *Oliganthes* in Schultz-Bipontinus (1847, 1859–1860, 1863) in their views of *Pollalesta,* but they made no subgeneric combinations in *Pollalesta.*

KEY TO THE SECTIONS OF *PIPTOCOMA*

1a. Phyllaries distichous; cypselas plump and pyriform at maturity (Costa Rica south to Peru and Brazil) . . . . 1. *P.* sect. *Dialesta*
1b. Phyllaries spirally arranged; cypselas obconical.
  2a. Outer pappus series persistent though fragile; heads 4–12-flowered (Hispaniola, Puerto Rico, and the Virgin Islands) . . . . 3. *P.* sect. *Piptocoma*
  2b. Outer pappus series eventually deciduous, either individually or as a ring; heads 1–6-flowered.
    3a. Heads 1–2(–3)-flowered; involucres narrowly cylindrical; inner pappus of 0–4(–6) scales (South America) . . . . 2. *P.* sect. *Odontoloma*
    3b. Heads 2–5(–6)-flowered; involucres cylindrical or broadly so; inner pappus of (4–)6–14 scales (South America) . . . . 4. *P.* sect. *Pollalesta*

1. Piptocoma sect. **Dialesta** (HBK) Pruski, stat. nov. Based on: *Dialesta* HBK, Nov. Gen. Sp. (folio ed.) 4: 35. 1818. TYPE: *Dialesta discolor* HBK [≡ *Piptocoma discolor* (HBK) Pruski].

Oliganthes subg. *Dialesta* (HBK) Schultz-Bipontinus, Linnaea 20: 502. 1847.

Piptocoma discolor (HBK) Pruski, comb. nov. Basionym: *Dialesta discolor* HBK, Nov. Gen. Sp. (folio ed.) 4: 35, tab. 320. 1818. [*Eupatorium cuspidatum* Willdenow ex Lessing, pro syn., Linnaea 4: 315. 1829.] *Oliganthes discolor* (HBK) Schultz-Bipontinus, Linnaea 20: 502. 1847. *Pollalesta discolor* (HBK) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 275. 1963. TYPE: Colombia. Honda, 366 m, July 1801, *Humboldt & Bonpland s.n.* (holotype, P not seen [IDC microfiche 6209. 92.II.3]; isotypes, B-W 15156 not seen [photo, US; IDC microfiche 7440. 1091.I.3], P not seen [photo, US]).

Distribution. Costa Rica south to Peru and Brazil. This is the only species of *Pollalesta* sensu Stutts (1981) not found in Venezuela.

2. Piptocoma sect. **Odontoloma** (HBK) Pruski, stat. nov. Based on: *Odontoloma* HBK, Nov. Gen. Sp. (folio ed.) 4: 34. 1818. TYPE: *Odontoloma acuminatum* HBK, "*acuminata.*" [≡ *Piptocoma acuminata* (HBK) Pruski.]

Oliganthes subg. *Adenocyclus* (Lessing) Schultz-Bipontinus, Linnaea 20: 501. 1847.
Oliganthes subg. *Odontoloma* (HBK) Schultz-Bipontinus, Linnaea 20: 502. 1847.

Piptocoma acuminata (HBK) Pruski, comb. nov. Basionym: *Odontoloma acuminatum* HBK, Nov. Gen. Sp. (folio ed.) 4: 34, tab. 319. 1818, "*acuminata.*" [*Eupatorium cornifolium* Willdenow ex Lessing, pro syn., Linnaea 4: 337. 1829.] *Oliganthes acuminata* (HBK) Schultz-Bipontinus, Linnaea 20: 502. 1847. *Pollalesta acuminata* (HBK) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 282. 1963. TYPE: Venezuela. Silla de Caracas, 823 m, Jan. 1800, *Humboldt & Bonpland s.n.* (holotype, P not seen [IDC microfiche 6209. 92.II.2]; isotype, B-W 15106 not seen [IDC microfiche 7440. 1087.III.8]).

Distribution. Colombia, Trinidad, and Venezuela.

Piptocoma barinensis (Aristeguieta) Pruski, comb. nov. Basionym: *Pollalesta barinensis* Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 282. 1963. TYPE: Venezuela. Barinas: near Barinas, 500 m, Aug. 1958, *Aristeguieta 3256* (holotype, VEN; isotypes, NY, US).

Distribution. Venezuela.

Piptocoma hypochlora (S. F. Blake) Pruski, comb. nov. Basionym: *Oliganthes hypochlora* S. F. Blake, Contr. U.S. Natl. Herb. 20: 533. 1924. *Pollalesta hypochlora* (S. F. Blake) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 280. 1963. TYPE: Venezuela. Carabobo: vicinity of Las Trincheras, near Valencia, 200–400 m, 15 Oct. 1918, *Pittier 8185* (holotype, US).

Distribution. Trinidad and Venezuela.

Piptocoma trujillensis (Aristeguieta) Pruski, comb. nov. Basionym: *Pollalesta trujillensis* Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 281. 1963. TYPE: Venezuela. Trujillo: Loma de Morón, near Valera, 18 Nov. 1922, *Pittier 10732* (holotype, VEN; isotypes, NY, US).

Distribution. Venezuela.

3. **Piptocoma** sect. **Piptocoma**

Piptocoma acevedoi Pruski, sp. nov. TYPE: Puerto Rico. Isabela: Guajataca Forest, along Juan Pérez trail, 100–200 m from trail #4, [ca. 200–250 m], 28 Aug. 1992, *Acevedo-Rdgz. & Chinea 5217* (holotype, US; isotypes, K not seen, NY, SJ not seen, UPR not seen, UPRRP not seen). Figure 1.

Piptocomae samanensi similis et affinis sed foliis laevibus integris magnis, ramulo capitulescentiam subtendenti 6–14 cm longo, involucro cylindrico, necnon capitulo 6–10-floro diversa.

Scandent, scrambling, or vining shrub; stems 3–7 m long, tomentose, subterete below, irregularly angled distally, finely striate, tips arching or drooping. *Leaves* simple, alternate, petiolate; *blade* chartaceous, elliptic to obovate, 2–9.5 × 1–4.3 cm, the base acute to attenuate, the apex acute to obtuse or rounded, the margins entire, venation pinnate, not obviously reticulate, the upper surface dark green, smooth, gland-dotted, thinly puberulent, the lower surface often gray or rust-colored, stellate-tomentose; *petiole* 2–8 mm long. *Capitulescence* glomerate, held well above uppermost leaves on tomentose 1-bracted (otherwise naked) branches 6–14 cm long; individual *glomerules* with 4–9 capitula, to 2 cm broad. *Capitula* discoid, 6–10-flowered, 7–10 mm tall, sessile or less commonly subsessile, glomerule or individual capitula often subtended by herbaceous bracts, bracts narrowly elliptic to lanceolate, to 6.5 mm long, commonly longer than the outermost phyllaries; *involucre* cylindrical or often becoming campanulate in fruit, 5–6.5 × (2–)3–4 mm, 3–4-seriate; *phyllaries* 20–23, imbricate, graduated, outer 1 or 2 herbaceous, pubescent, the outer series deltoid to elliptic, 1.5–2.5 × 0.7–1.2 mm, apically acute to rounded, the inner ones elliptic-lanceolate, 4–5.5 × 1.2–1.5 mm, apically obtuse to rounded, scarious, proximally glabrous, pubescent and gland-dotted toward apex; *receptacle* flat, 0.5–1.5 mm diam., glabrous, naked or less commonly awned (paleate), pitted or with 2 ridges bordering pits to ca. 0.2 mm tall, one or both ridges sometimes elongating into awns 1–4 mm long. *Corollas* actinomorphic, deeply 5(–6)-lobed, (4–)5–6.3 mm long, lavender, funnelform, the limb exserted from involucre, the tube and especially the lobe apex glandular; tube narrow, 2.5–3 mm long; throat broadened, ca. 0.5–0.8 mm; lobes ascending, linear, 2–2.8 mm long; *anthers* exserted from throat, cream-colored, 1.8–2.2 mm long, long-triangular at apex, basally spurred, the filaments very short, ca. 0.8 mm long; *style* to 6.8 mm long, without basal node, hispidulous in upper half, the branches ascending to gently recurved, slender, 1.2–2.3 mm long, the stigmatic surface continuous. *Cypselas* obconical, ca. 10-ribbed, 2.5–4 mm long, light brown, glabrous or sometimes weakly puberulent at top; *pappus* biseriate, cream-colored, outer series of ca. 10, reduced, persistent scales, these free or pseudocoroniform, 0.4–1(–1.4) mm long, inner series of 9–12 elongate, erect, twisting, deciduous scales, ca. 3–4.7 mm long. *Pollen* type A.

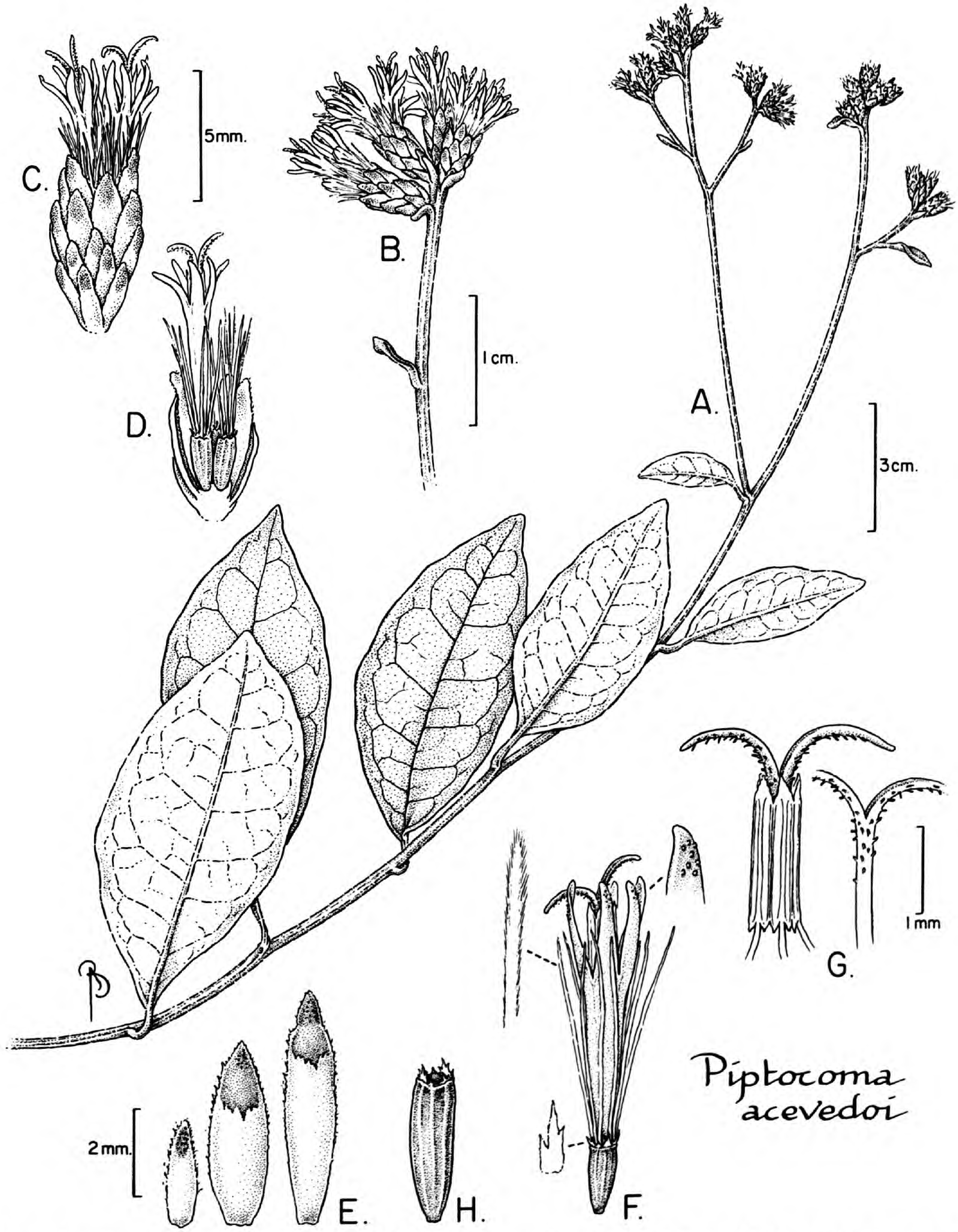

Figure 1. *Piptocoma acevedoi* Pruski. —A. Habit. —B. Glomerule. —C. Capitulum. —D. Longitudinal section of capitulum. —E. Phyllaries. —F. Floret with close-ups of outer pappus, inner pappus, and corolla lobe apex. —G. Anthers and styles. —H. Mature cypsela. (Drawn from the holotype, *Acevedo-Rdgz. & Chinea 5217*, US.)

I am happy to name this species after its discoverer, my friend and colleague Pedro Acevedo-Rodríguez. Pedro is the author of *Los Bejucos de Puerto Rico* (Acevedo-Rodríguez, 1985).

Distribution and ecology. This species is uncommon on limestone or serpentine in moist disturbed or riverine forests in western and northern Puerto Rico. It has been collected from 200 to 545 m elevation and is known to flower from August to January. With the description of this new species, the floras of Puerto Rico and Hispaniola each have two species of *Piptocoma,* one with a glomerate capitulescence and another with a corymbiform capitulescence.

By its persistent outer pappus, *P. acevedoi* belongs to *Piptocoma* sect. *Piptocoma.* Because of its glomerate capitulescence it is most closely related to *P. samanensis* Alain of Hispaniola. The two other species of section *Piptocoma, P. rufescens* Cassini from Hispaniola and *P. antillana* Urban from Puerto Rico, have a corymbiform capitulescence and are not as closely related. *Piptocoma acevedoi* differs from *P. samanensis* by entire (vs. aculeate or less commonly denticulate), smooth (vs. rugose) leaves that are often twice as long as those of *P. samanensis,* by glomerules held high above the upper stem leaves on 1-bracted (vs. 1-leaved) branches that are 6–14 (vs. 3–8) cm long, and by cylindrical (vs. broadly cylindrical to turbinate), 6–10 (vs. 8–12)-flowered heads. Moreover, the receptacle in *P. acevedoi* is occasionally awned with elongations to 4 mm long, a "paleate" condition not found in *P. samanensis,* and seen rarely elsewhere in the tribe Vernonieae.

Paratypes. PUERTO RICO. Bosque de Guajataca, Vereda #4, [ca. 200–250 m], 16 Jan. 1992, *Acevedo-Rdgz. et al. 4784* (F not seen, MO not seen, US); Maricao, Bo. Maricao Afuera, along Maricao River, between 0.5 & 1 km upriver from entrance to fish hatchery, 18°10.191′N, 66°59.163′W, 485–545 m, 10 Jan. 1995, *Acevedo-Rdgz. & Cedeño 7148* (HAC, UPR not seen, US); Maricao, Bo. Maricao Afuera, Río Maricao margins, on shaded river banks, serpentinitic soil, 18°10′05″N, 66°59′16″W, 470 m, 9 Oct. 1993, *Cedeño 196* (MARP not seen, US); Maricao, Bo. Maricao Afuera, Río Maricao margins, on shaded river banks, serpentinitic soil, 18°09′43″N, 66°59′15″W, 500 m, 10 Jan. 1995, *Cedeño & Acevedo 379* (MARP not seen, US).

Piptocoma antillana Urban, Ark. Bot. 23A(11): 50. 1931. TYPE: U.S. Virgin Islands. Water Island near St. Thomas, July 1881, *Eggers edit. Toepffer 475* (holotype, B destroyed; isotype, GH not seen [photo, US]).

Distribution. Puerto Rico and the Virgin Islands.

Piptocoma rufescens Cassini, Bull. Soc. Philom. Paris 1818: 58. 1818. *Oliganthes rufescens* (Cassini) Schultz-Bipontinus, Jahresber. Pollichia 20–21: 338. 1863. TYPE: Hispaniola. "Saint-Domingue," *Desportes s.n.* (holotype, P-JU 8439 not seen [IDC microfiche 6206. 621.II.2]).

Distribution. Hispaniola.

Piptocoma samanensis Alain, Brittonia 20: 153. 1968. TYPE: Dominican Republic. Samaná: Península de Samaná, Pan de Azúcar, 5 Aug. 1930, *Ekman 15847* (holotype, NY; isotype, US).

Distribution. Hispaniola.

4. Piptocoma sect. **Pollalesta** (HBK) Pruski, stat. nov. Based on: *Pollalesta* HBK, Nov. Gen. Sp. (folio ed.) 4: 36. 1818. TYPE: *Pollalesta vernonioides* HBK [≡ *Piptocoma vernonioides* (HBK) Pruski].

Oliganthes subg. *Pollalesta* (HBK) Schultz-Bipontinus, Jahresber. Pollichia 20–21: 337. 1863.

Piptocoma areolata (Wurdack) Pruski, comb. nov. Basionym: *Oliganthes areolata* Wurdack, Mem. New York Bot. Gard. 8: 144. 1953. *Pollalesta areolata* (Wurdack) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 270. 1963. TYPE: Venezuela. Amazonas: Cerro Sipapo (Paraque), along water course, central east drainage, 1800 m, 14 Jan. 1949, *Maguire & Politi 28366* (holotype, NY; isotype, US).

Distribution. Guayana region of Venezuela.

Piptocoma macrophylla (Schultz-Bipontinus) Pruski, comb. nov. Basionym: *Oliganthes macrophylla* Schultz-Bipontinus, Linnaea 20: 503. 1847. *Pollalesta macrophylla* (Schultz-Bipontinus) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 266. 1963. TYPE: Venezuela. Distrito Federal: Galipán, Sep. [no year given], *Moritz 1358* (holotype, B destroyed [photo, US]).

Distribution. Colombia and Venezuela.

Piptocoma milleri (J. R. Johnston) Pruski, comb. nov. Basionym: *Vernonia milleri* J. R. Johnston, Proc. Amer. Acad. Arts 40: 698. 1905. *Oliganthes milleri* (J. R. Johnston) Gleason, Bull. Torrey Bot. Club 46: 251. 1919. *Pollalesta milleri* (J. R. Johnston) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 268. 1963. TYPE: Venezuela. Nueva Esparta: Isla de Margarita, El Valle, summit of South hill, 300 m, 31 July 1901, *Miller & Johnston 254* (holotype, GH not seen; isotypes, NY, US).

Distribution. Trinidad and Venezuela.

Piptocoma neglecta (Stutts) Pruski, comb. nov. Basionym: *Pollalesta neglecta* Stutts, Rhodora 83: 412. 1981. TYPE: Venezuela. Sucre: Península de Paria, between Cumaná and Carupano, 5 m, 14 Aug. 1966, *Steyermark & Rabe 96443* (holotype, NY; isotype, US).

Distribution. Venezuela.

Piptocoma niceforoi (Cuatrecasas) Pruski, comb. nov. Basionym: *Oliganthes niceforoi* Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 9: 243. 1954. *Pollalesta niceforoi* (Cuatrecasas) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 267. 1963. TYPE: Colombia. Norte de Santander: Río Zulia, 4 Jan. 1949, *Nicéforo 35* (holotype, F not seen [photo, NY]).

Pollalesta rarissima Stutts, Rhodora 83: 412. 1981. Syn. nov. TYPE: Venezuela. Táchira: between La Muleta and Independencia, 1300 m, 15 Feb. 1939, *Alston 7070* (holotype, MO; isotypes, NY, US, VEN).

Distribution. Colombia and Venezuela.

Piptocoma roraimensis (Steyermark) Pruski, comb. nov. Basionym: *Oliganthes roraimensis* Steyermark, Fieldiana, Bot. 28: 662. 1953. *Pollalesta roraimensis* (Steyermark) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 271. 1963. TYPE: Venezuela. Bolívar: Mount Roraima, SW-facing quebrada near Rondón Camp, 2040 m, 25 Sep. 1944, *Steyermark 58678* (holotype, F not seen; isotype, NY).

Distribution. Guayana region of Guyana and Venezuela; expected from adjacent Brazil.

Piptocoma schomburgkii (Schultz-Bipontinus) Pruski, comb. nov. Basionym: *Oliganthes schomburgkii* Schultz-Bipontinus, Linnaea 20: 504. 1847. *Pollalesta schomburgkii* (Schultz-Bipontinus) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 269. 1963. TYPE: Venezuela. Near Roraima, Nov. 1842, *Rich. Schomburgk 921* [cited in the Schomburgk determination lists (ms. in K, copy in NY) as 626(921)] (holotype, B destroyed [photo, US]).

Pollalesta faustiana Stutts, Rhodora 83: 414. 1981. Syn. nov. TYPE: Venezuela. Bolívar: Río Suapure, along river between Raudal Budare and Raudal Pta. Brava (70–80 river km from mouth), 110–120 m, 17 Jan. 1956, *Wurdack & Monachino 41267* (holotype, K not seen; isotypes, NY, US).

Distribution. Guayana region of Brazil, Colombia, French Guiana, Guyana, Surinam, and Venezuela.

Piptocoma spruceana (Bentham) Pruski, comb. nov. Basionym: *Oliganthes spruceana* Bentham in Bentham & Hooker f., Gen. Pl. 2: 233. 1873. *Pollalesta spruceana* (Bentham) Aristeguieta, Bol. Soc. Venez. Ci. Nat. 23: 270. 1963. TYPE: Venezuela. Amazonas: Río Atabapo, June(–Aug.?) 1854, *Spruce 3705* (holotype, K not seen; isotype, P not seen [photo, US, frag., F not seen]).

Distribution. Guayana region of Venezuela; expected in adjacent Colombia.

Piptocoma vernonioides (HBK) Pruski, comb. nov. Basionym: *Pollalesta vernonioides* HBK, Nov. Gen. Sp. (folio ed.) 4: 37, tab. 321. 1818. [*Vernonia dichocarpha* Sprengel, Syst. Veg. 3: 437. 1826, nom. superfl.] [*Eupatorium cydoniaefolium* Willdenow ex Lessing, pro syn., Linnaea 4: 269. 1829.] *Oliganthes vernonioides* (HBK) Mattfeld, Notizbl. Bot. Gart. Berlin-Dahlem 12: 687. 1935. TYPE: Venezuela. Sucre: near Caripe and El Purgatorio, Sep. 1799, *Humboldt & Bonpland 239* (holotype, P not seen [IDC microfiche 6209. 92.II.4; frag., F not seen]; isotypes, B-W 15134 not seen [IDC microfiche 7440. 1089.III.7], P not seen [photo, US]).

Distribution. Venezuela.

EXCLUDED SPECIES

Piptocoma lychnophoroides Lessing, Linnaea 4: 316. 1829, nom. illeg. ≡ *Lychnophora trichocarpha* (Sprengel) Sprengel ex Schultz-Bipontinus.

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New Species of *Siparuna* (Monimiaceae) II. Seven New Species from Ecuador and Colombia

Susanne S. Renner and Gerlinde Hausner
Institute of Systematic Botany, University of Mainz, Bentzel-Weg 2, D-55099 Mainz, Germany

ABSTRACT. *Siparuna campii, S. guajalitensis,* and *S. pubancura* from central Ecuador, *S. multiflora* and *S. conica* from northwestern Ecuador and western Colombia, *S. verticillata* from Amazonian Ecuador, and *S. cascada* from southeastern Ecuador are described, illustrated, and discussed as to their relationships with morphologically similar species. Macrophotographs of male and female flowers illustrate the unusual details of *Siparuna* floral structure.

Siparuna, with about 200 named species, is the largest genus in the Monimiaceae. Recently we described four new species from Ecuador and Colombia (Renner & Hausner, 1995) as a result of treating *Siparuna* for the *Flora of Ecuador* (Renner & Hausner, submitted). Recent visits to herbaria in Quito (QCA, QCNE, acronyms following Holmgren et al., 1990) and material received in the course of ongoing monographic work on the genus have resulted in additional new species, which we describe here.

As a point of reference for the descriptions that follow we first give a brief overview of the morphology of the flowers, which is highly unusual in the angiosperms. Flowers of *Siparuna* have an obconical, cup-shaped, or slightly urceolate floral cup in which the carpels or stamens are more or less completely enclosed (Figs. 8, 9). A feature characteristic of the genus is that the bases of the tepals form a roof, or velum, which completely covers the young stamens and carpels (Fig. 9B, C, F). At anthesis, this roof opens via a central pore through which the upper parts of the styles or stamens protrude (Figs. 8B, D, 9A, D). In the female flowers the floral roof is usually differentiated into a more or less prominent cylindrical bulge and a central tube sheathing the styles (Figs. 8D, right-hand flower; 9A). In dried condition, both structures may be separated by a distinct groove. In the male flowers the pore through which the tips of the stamens protrude may be quite narrow, as in the seven species described here, or the stamens may be completely exposed on a cup-shaped receptacle as in *S. muricata.*

Siparuna campii Renner & Hausner, sp. nov. TYPE: Ecuador. Chimborazo: Río Chanchán, 5 km N of Huigra, 2000 m alt., female, 19–28 May 1945 (fl), *W. H. Camp E-3253* (holotype, NY; isotypes, AAU, BM, GH, K, MO, S, US). Figures 1, 8C, D.

A *Siparuna muricata* (Ruiz & Pavón) A. DC. foliis duplo longioribus (28–44 cm vs. 10–26 cm), staminibus paucioribus (20–30 vs. 50–72) stylibusque duplo plus (7–12 vs. (2–)3–5(–6)) differt.

Dioecious treelet, 4–10 m tall, the young branchlets quadrangular and often deeply sulcate, yellowish tomentose with minute stellate hairs to glabrescent. Leaves in whorls of 3, the petioles 2–9 cm long, the lamina drying brownish, papery and brittle, lanceolate, 28–44 × 9–15 cm, the base obtuse or acute, the apex acute, upper surface with few minute stellate hairs, lower surface with somewhat longer hairs of the same type, with 16–22 pairs of secondary veins, the veins flat above, distinctly raised below, the margin crenate-dentate. Cymes umbell-shaped, 3–5 cm long, with 15–20 flowers, densely pubescent like the young branchlets. Male floral cup at anthesis 2.5–4 mm diam. and 2–3.5 mm high, obconical, with stellate hairs and short wartlike outgrowths, about 0.2 mm long, the 4–6 tepals broadly triangular, 2–3 mm long, with few minute hairs on the upper tepal tips, the floral roof distinctly raised, glabrous, when fresh yellowish green, drying black; stamens 20(–30). Female floral cup at anthesis of the same size but with longer outgrowths, up to 2 mm long, the floral roof differentiated into a cylindrical bulge separated by a distinct groove from a central acutely conical tube sheathing the styles; the styles 7–12. Fruit pear-shaped, subglabrous, 1.5–2 cm long, with thick conspicuous outgrowths and crowned by the persistent tepals, when fresh and mature reddish and with a strong pungent scent; fruitlets 5–10.

Distribution, habitat, and phenology. Endemic in the Chimborazo province in central Ecuador; growing in moist forested valleys in the afternoon fog-belt at elevations of 1500–2000 m; collected flowering and fruiting in May.

Figure 1. *Siparuna campii* Renner & Hausner (*Camp E-3492*, NY). Fruiting specimen.

Siparuna campii resembles *S. muricata* (Ruiz & Pavón) A. DC., which is very widespread in the Andes, in having umbell-shaped inflorescences and fruits with tuberculate outgrowths. It differs from *S. muricata* in its smaller male flowers, typically less numerous stamens, and more numerous styles.

Topotypical paratypes. *Camp E-3398* (AAU, K, MO, NY, S, US), *Camp E-3412* (AAU, K, MO, NY, S, US), *Camp E-3492* (AAU, F, K, MO, NY, S, US).

Siparuna guajalitensis Renner & Hausner, sp. nov. TYPE: Ecuador. Pichincha: Estación Río Guajalito, 1800 m alt., male, 10 June 1990 (fl), *B. Øllgaard 98013* (holotype, QCA; isotypes, AAU, MO, QCNE). Figures 2, 9E, F.

Siparuna echinata (HBK) A. DC. affinis sed differt foliis oblanceolatis duplo longioribus (30–65 cm vs. 13–32 cm).

Dioecious shrub or sparsely branched treelet, 3–10 m tall, young branchlets usually quadrangular and strongly sulcate, densely covered with hispid-stellate yellowish brown hairs. Leaves opposite, the petioles 1.5–5.5 cm long, the lamina drying brown or green, chartaceous and sometimes slightly bullate above, oblanceolate, 30–65 × 13–25 cm, the base acute or obtuse, the apex acuminate to cuspidate, the tip 1.5–3 cm long, upper surface with single or few-branched stellate hairs, lower surface stellate-tomentose, especially on the veins, with 18–32 pairs of secondary veins, the veins ± inconspicuous above, slightly raised below, the margin irregularly dentate. Cymes 5–8 cm long, with 40–60 flowers, pubescent like the young branchlets. Male floral cup at anthesis 4–5 mm diam. and 3–4 mm high, subglobose, with hispid-stellate hairs and small equally pubescent outgrowths, 0.5–0.8 mm long, tepals 4–5, triangular, 2.5–4.5 mm long, the floral roof slightly raised, glabrous, when fresh pale yellow, drying black; stamens 5–6, scarcely exserted at anthesis. Female floral cup at anthesis slightly larger than in the males and with longer stellate-pubescent outgrowths (up to 2 mm long), the floral roof differentiated into a low cylindrical bulge and a central narrow tube sheathing the styles; the styles 5–6. Fruit globose and with spine-like outgrowths, 1.5–2 cm diam., when fresh and mature pink or green suffused with red, strongly lemon-scented; fruitlets 5–6.

Distribution, habitat, and phenology. Known only from the Pichincha region in central Ecuador where it grows in wet montane forest at elevations of 1500–2050 m; collected flowering and fruiting year-round. The species appears to be relatively abundant near the Río Guajalito scientific station, where its flowers and fruits are occasionally used to prepare a lemon-flavored tea (*Jaramillo & Zak 8043*).

The suggested relative, *S. echinata*, has shorter, elliptic or ovate rather than oblanceolate leaves and narrower flowers. Both species have been collected numerous times at the Río Guajalito station.

Paratypes. ECUADOR. **Pichincha:** Saloya, *Acosta-Solís 5839* (F); km 56–59 on old rd. from Quito to Santo Domingo, Estación Río Guajalito, *Feil 91348* (AAU, QCA, Z); *Øllgaard 90413* (AAU, QCNE), *Grijalva 617* (MO, QCA), *Jaramillo 7826* (MO, QCA), *Jaramillo & Zak 7870* (MO, QCA), *7885* (MO, PTBG), *7892* (MO, QCA), *8043* (MO, QCA), *8073* (AAU, QCA), km 69 on old rd. Quito–San Juan–Chiriboga–Empalme, *Zak 1201* (AAU, MO, QCA); Quito–Nono–Mindo rd., 5 km N of Mindo, *Neill et al. 8944* (AAU, MO, QCNE), *Luteyn & Borchsenius 13341* (AAU, F, MJG, NY, QCA, QCNE).

Siparuna pubancura Renner & Hausner, sp. nov. TYPE: Ecuador. Pichincha: SE of Santo Domingo along rd. to Puerto Limón, 500 m alt., male, 11 Dec. 1983 (fl), *L. P. Kvist & A. Barfod 49088* (holotype, QCA; isotype, AAU). Figures 3, 8A, B.

Species ramulis et foliis subglabris et tepalis redactis a congeneribus in parte regionis Ecuadoriensis occidentali diversa.

Dioecious shrub, 2.5–5 m tall, young branchlets terete, with few minute stellate hairs to glabrescent. Leaves opposite, the petioles 1.5–4.5 cm long, the lamina drying dark brown or olive green, papery and brittle, oblanceolate, 13–23 × 5.5–9 cm, the base acute, the apex apiculate to acuminate, the tip to 1.5 cm long, both surfaces with few minute appressed stellate hairs, with 7–8(–10) pairs of secondary veins, the veins inconspicuous on both surfaces, the margin subentire or denticulate. Cymes to 1 cm long, with 5–10 flowers. Male floral cup at anthesis 1.5–2.5 mm diam. and 3–3.5 mm high, obconical, the tepals fused, the floral roof glabrous and forming a thin-walled central tube, when fresh green, drying black; stamens mostly 5. Female floral cup at anthesis similar in size, the tepals fused to a narrow, somewhat undulate rim, the floral roof differentiated into a ± prominent cylindrical bulge separated by a groove from a central tube sheathing the styles; the styles 5–8. Fruits globose, 1–1.5 cm diam., drying black and glabrous and with the 5–8 fruitlets distinctly protruding, when fresh and mature pink or purple and with a strong lemon smell.

Distribution, habitat, and phenology. Occurring in northwestern Ecuador where it has been collected in patches of forest surrounded by farmland and in mature rainforest; from 500 to 2000 m ele-

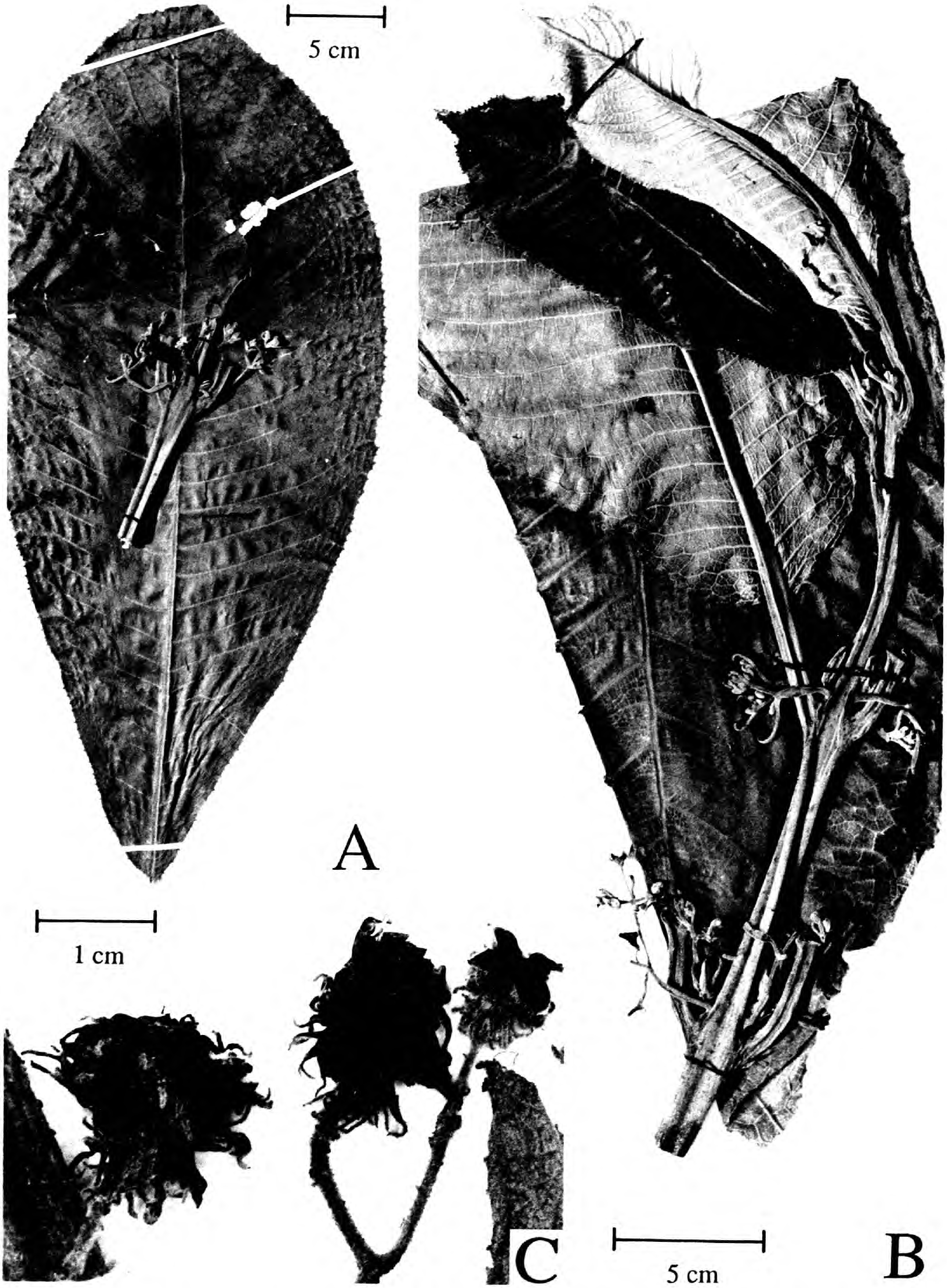

Figure 2. *Siparuna guajalitensis* Renner & Hausner (A, *Feil 91348*, AAU; B, *Øllgaard 98013*, AAU isotype; C, *Jaramillo & Zak 8073*, QCA). —A, B. Leaves and male inflorescences. —C. Flower and fruits.

Figure 3. *Siparuna pubancura* Renner & Hausner (A, *Jaramillo 6539*, QCA; B, *Harling & Andersson 23342*, GB). —A. Fruiting specimen. —B. Female flowers.

vation. Flowering and fruiting at least from December to June.

Siparuna pubancura is easily recognized among western Ecuadorean species by being almost entirely glabrous. It is called "puban cura," "bu wann cura," or "guayusa" by the Colorado Indians, who use an extract of the leaves in hot water as a drink or bath against colds, fever, stomach, kidney, and bladder problems.

Paratypes. ECUADOR. **Carchi:** from Prima Vera hike about six hrs. up Río Gualchan drainage to shelter built by Nilo Ortiz, *Bradford et al. 32* (MJG, MO, QCNE); Canton Mira, Norte del Carmen, Camino a Chical, *Palacios et al. 9748* (MJG, MO, QCNE). **Pichincha:** Reserva ENDESA, ca. 6 km WNW of Pedro Vicente Maldonado, *Harling & Andersson 23342* (AAU, GB, QCA), *Jaramillo 6305* (AAU, GB, MO, QCA), *6434* (AAU, QCA), *7545* (AAU, GB, QCA), *7563* (NY, QCA), *7609* (AAU, GB, MO, QCA), *Luteyn & Borchsenius 13356* (AAU, MJG, NY, QCA, QCNE); Río Toachi near Santo Domingo de los Colorados, *Játiva & Epling 538* (UC, US); km 23 of Santo Domingo–Puerto Limón rd., *Kvist & Holm-Nielsen 40216* (AAU), *Kvist 40693* (AAU).

Siparuna multiflora Renner & Hausner, sp. nov. TYPE: Ecuador. Carchi: Canton Tulcán, Parroquia Tobar Donoso, Reserva Indígena Awá, 500 m alt., male, 19 June 1992 (fl), *G. Tipaz 1337* (holotype, QCNE; isotypes, MJG, MO). Figures 4, 9C, D.

A *Siparuna eggersii* Hieronymus differt inflorescentiis duplo longioribus (4–8 vs. 2–4 cm) et floribus minoribus (1.3–1.7 vs. 2–4 mm diam.).

Dioecious shrub or treelet, 2–12 m tall and reaching a DBH of 10 cm, young branchlets terete and with minute appressed stellate hairs. Leaves opposite, the petioles 2.5–7 cm long, the lamina drying brown, olive-brown, or grayish brown above and olive-brown below, papery and brittle, obovate to oblanceolate, 15–29 × 7–14 cm, the base acute to obtuse, sometimes with small domatia to 0.5 cm long, the apex cuspidate, the tip 0.5–1.5 cm long, both surfaces with minute appressed stellate hairs sometimes mixed with a few stellate-lepidote hairs on the midrib, with 9–13 pairs of secondary veins, veins flat above, slightly raised below, the margin finely dentate or subentire. Cymes ample, 4–8 cm long, with 40–60 flowers. Male floral cup at anthesis 1.3–1.7 mm diam. and 1.1–1.2 mm high, subglobose or urceolate, with few minute appressed stellate hairs, tepals fused to a narrow upright rim, the floral roof slightly raised, glabrous, when fresh pale yellow or cream, drying dark brown; stamens 8–10. Female floral cup at anthesis of the same shape as in the male but slightly larger (1.5–1.8 mm diam.), the floral roof usually domed and with only a short central tube sheathing the styles; the styles 5–8. Fruits globose, 0.8–1 cm diam., the narrow tepal rim persistent in fruit, drying glabrous and black and with the ca. 8 fruitlets distinctly protruding, when immature green with white spots, when mature yellow and purple, with a strong lemon smell.

Distribution, habitat, and phenology. Restricted to undisturbed wet forest in northwestern Ecuador; from 80 to 1500 m elevation; collected flowering and fruiting almost year-round. Known by the Spanish name "palo de monte" and the Quichua names "ingal teu" or "engal teiug"; used to make animal traps (*Aulestia et al. 51*; *Tipaz 1337*).

Siparuna multiflora resembles *S. eggersii,* also from western Ecuador, in having terete branchlets and obovate to oblanceolate leaves with minute appressed stellate hairs, but the latter species has mature flowers twice the size, a broader tepal rim, shorter inflorescences, and more numerous stamens and styles. *Siparuna eggersii* and *S. multiflora* cooccur at the Río Palenque Science Center, where they have been confused in the past.

Paratypes. ECUADOR. **Esmeraldas:** 10 km N of Lita, *Acevedo & Daly 1681* (QCA, NY), *1689* (QCA, NY); Reserva Etnica Awá, *Aulestia et al. 51* (QCNE), *121* (QCNE), *411* (QCNE), *623* (QCNE), *Rubio et al. 973* (AAU, MO, QCNE); creek pouring into Río Palaví across from Awá camp, *Hoover et al. 3087* (QCA); Reserva Ecológica Cotacachi-Cayapas, *Tirado et al. 474* (QCNE). **Carchi:** above San Marcos de los Coaiqueres, *Øllgaard et al. 57226* (AAU, QCA), *57382* (AAU, QCA), *57531* (AAU, QCA); about 30 km past Lita on rd. to Alto Tambo, *van der Werff et al. 12114* (AAU, QCNE). **Pichincha:** Santo Domingo de los Colorados, 1000 m, *Croat* 72995 (MO). **Los Rios:** Río Palenque, *Dodson & Gentry 5508* (F, GB, MO, QCA, SEL, US), *Dodson 6653* (MO, SEL), *Dodson & Gentry 12841* (MO, SEL).

Siparuna conica Renner & Hausner, sp. nov. TYPE: Ecuador. Carchi: Reserva Etnica Awá, Comunidad de Gualpi Medio, 900 m alt., female, 21 May 1992 (fl), *C. Quelal 685* (holotype, QCNE; isotypes, MJG, MO). Figure 5.

A *Siparuna aspera* (Ruiz & Pavón) A. DC. differt foliis tenuioribusque, nervis lateralibus paucioribus (9–13 vs. (12–)16–20(–26)) et floribus angustioribus.

Dioecious shrub or treelet, sometimes semi-scandent over other trees, 3–7(–15) m tall, the young branchlets terete or subquadrangular, with brownish stellate hairs. Leaves opposite, those of a pair slightly unequal in size, the petioles (2.5–)3–5(–6.5) cm long, the lamina drying khaki to burnt umber, chartaceous, smooth, obovate, 20–30 × 12–14.5(–17) cm, the base truncate, cordate or more rarely obtuse, the apex acuminate, the tip 0.5–1(–

Figure 4. *Siparuna multiflora* Renner & Hausner (A, *Aulestia et al. 121*, QCNE; B, *Øllgaard et al. 57531*). —A. Flowering male specimen. —B. Young fruits.

Figure 5. *Siparuna conica* Renner & Hausner (*Cazalet & Pennington 5242*, B). Fruiting specimen.

1.5) cm long, upper surface with few stellate hairs on the veins, lower surface moderately covered with stellate hairs, with 9–13 pairs of secondary veins, the veins slightly raised on both surfaces, the margin finely dentate or crenate. Cymes often on leafless nodes, 2–7 cm long in the males, 1–3 cm long in the females, with 15–25 flowers, densely covered with golden-brown or grayish stellate hairs. Male floral cup at anthesis 2.5–3 mm diam. and 4–7 mm high, narrowly obconical, pubescent like the cymes, tepals 4–6, triangular, 2–3 mm long, with a few stellate hairs on the upper tepal tips or glabrous, the floral roof glabrous and centrally raised to a thin-walled tube surrounding the pore, when fresh greenish yellow or yellow, drying black; stamens 4–6, the outer ones distinctly exserted at anthesis and often with their tips bent backwards. Female floral cup at anthesis more densely pubescent, the tepals 4–5 mm long, the floral roof conspicuously acute-conical; the styles 10–14. Fruits globose, 1.5–2 cm diam., with stellate hairs and crowned by the persistent tepals, when fresh and mature dull red with white spots and with an astringent odor; fruitlets 8–14.

Distribution, habitat, and phenology. Known from northwestern Ecuador (provinces of Los Rios, Pichincha, Esmeraldas, and Carchi) and western Colombia (provinces of Nariño, Cauca, Valle, Chocó, and Antioquia); lowland tropical wet forest and secondary forest; from 10 to 1800 m. Collected flowering and fruiting year-round.

Local names for *Siparuna conica* are "limón de monte," "rama de hediondo" (Spanish), and "ne chin buca" (Cayapa), but no uses have been reported.

Poor collections of *S. conica* may be confused with the widespread and variable *S. aspera*, from which it differs in having thinner leaves with usually fewer lateral veins, more narrowly obconical male floral cups, an acutely raised floral roof in the female flowers, and globose rather than pear-shaped fruits. In the florula of the Río Palenque Science Center (Dodson & Gentry, 1978) *S. conica* is described and illustrated under the name *S. gesnerioides* (HBK) A. DC.

Paratypes. COLOMBIA. **Antioquia:** Municipio de Mutatá, *Zarucchi et al. 5099* (COL, MO); Mpio. San Carlos, along creeks leading into ISA hydroelectric dam reservoir, *McPherson et al. 13323* (MJG, MO, WIS); Mutatá, Fincas Puentiadero-La Palma, left-hand margin of Río Mutatá, *Fonnegra et al. 2213* (MO), *2257* (MO). **Chocó:** Municipio Quibdó, *Arias 052* (COL); Río San Juan, near Palestina, *Cuatrecasas 16928* (F, US); Río Calima, Quebrada La Brea, *Cuatrecasas 21277* (F, US); Municipio de Pizarro, km 30–33 of rd. Pié de Pepé-Puerto Meluk, *Espina 1857* (MO); Quibdó–Guayabal rd., *Forero et al. 1289* (COL, MO, NY), *1290* (COL, MO, NY); Quibdó, *Forero & Jaramillo 2607* (COL, MO, NY); Quibdó–Itsmina rd., km 36, *Forero & Jaramillo 2656* (MO); Quibdó–Tutunendo rd., 15 km from Quibdó, *Forero & Jaramillo 2632* (COL, MO); hoya del Río San Juan, Río Bicordó, Noanamá, *Forero et al. 4755* (COL, MO); Río San Juan between Tadó and El Tapón, *Gentry & Fallen 17749* (COL, F, MO); 12 km E Quibdó, *Gentry & Renteria A. 23882* (AAU, COL, MO); 14 km E Quibdó, *Gentry & Renteria A. 24121* (MO); area of Baudó, *Fuchs & Zanella 21899* (G, MO, NY, US); rd. Bolívar–Quibdó, near km 210, *Juncosa 1145* (MO, PTBG). **Valle:** Río Naya, upriver from Puerto Merizalde, *Gentry & Juncosa 40681* (COL, MO). **Cauca:** Bajo Calima, Buenaventura, *Monsalve B. 577* (MO). **Nariño:** above Barbacoas, *Ewan 16852* (BM, S, US). ECUADOR. **Carchi:** Parroquia Maldonado, Reserva Etnica Awá, *Aulestia et al. 683* (QCNE), *Grijalva et al. 582* (QCNE), *Quelal et al. 541* (MO, QCNE), *Rubio et al. 1042* (AAU, QCNE). **Esmeraldas:** Río San Miguel, *Harling 4668* (S); Eloy Alfaro, Reserva Ecológica Cotacachi-Cayapas, *Tirado et al. 696* (QCNE). **Los Rios:** Río Palenque Biological Station, *Dodson & Dodson 6788* (AAU, MO, QCA, SEL), *Dodson et al. 7570* (F, MO, QCNE, SEL). **Pichincha:** Santo Domingo de los Colorados, *Cazalet & Pennington 5242* (B, FHO, K, NY, UC, US); km 41 of rd. Santo Domingo–Quinindé, *Zak et al. 5509* (MO, QCA, QCNE).

Siparuna verticillata Renner & Hausner, sp. nov. TYPE: Ecuador. Napo: Estación Biológica Jatun Sacha, 450 m alt., male, 17–24 Feb. 1988 (fl), *C. E. Cerón 3591* (holotype, QCNE; isotypes, AAU, MO). Figures 6, 9A, B.

A *Siparuna gilgiana* Perkins foliorum pilis simplis (non stellatis) et staminibus 5 (vs. 2) differt.

Dioecious shrub or treelet, 3–6 m tall, occasionally scandent, the young branchlets terete, with few short thick simple hairs. Leaves in whorls of 3, rarely opposite, the petioles 1–2 cm long, the lamina drying grayish brown or brown, chartaceous, oblong or elliptic, 8–17 × 3–6 cm, the base acute to obtuse, the apex acuminate to cuspidate, the tip 0.5–1 cm long, both surfaces with short simple or bifid hairs, with 6–8(–10) pairs of secondary veins, the veins smooth above, slightly raised below, the margin subentire or serrulate. Cymes 1–2.5 cm long, with 10–20 flowers. Male floral cup at anthesis 1.5–2 mm diam. and 1.8–2 mm high, obconical, the tepals fused to a narrow undulating rim about 0.8 mm broad, the floral roof moderately raised, glabrous, when fresh pale yellow or cream, drying black; stamens mostly 5. Female floral cup at anthesis obconical, the floral roof differentiated into a prominent cylindrical bulge separated by a deep groove from a hardly raised central tube sheathing the styles; styles 8–12. Fruit globose, 1–1.5 cm diam., glabrescent and with the 6–12 fruitlets distinctly protruding in dried condition, when fresh and mature yellowish red or purple with pale brown or green spots and a strong lemon smell.

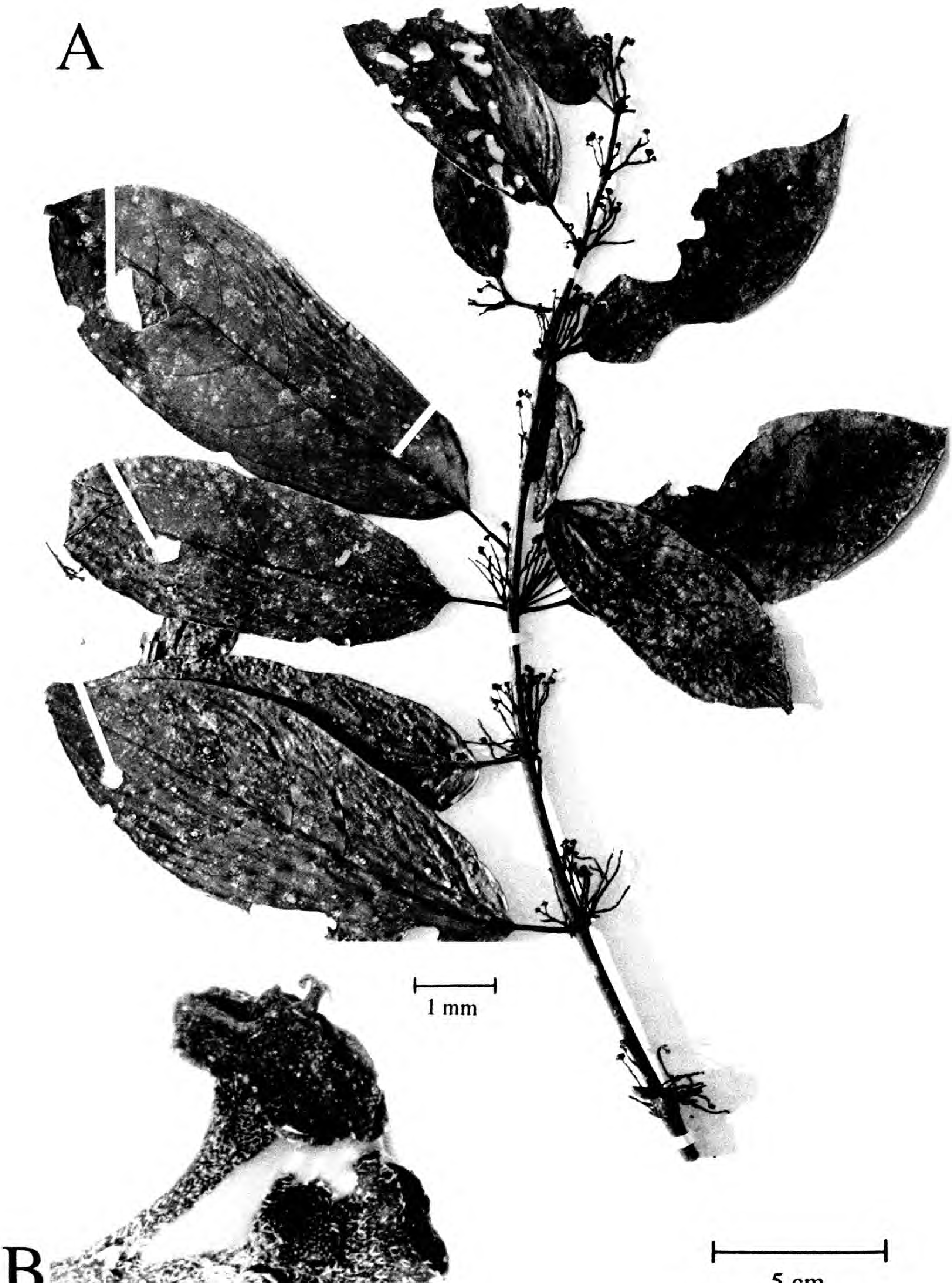

Figure 6. *Siparuna verticillata* Renner & Hausner (A, *Cerón 3591*, AAU isotype; B, *Neill et al. 6342*, QCNE). —A. Flowering male specimen. —B. Female flower.

Figure 7. *Siparuna cascada* Renner & Hausner (*Jaramillo & Winnerskjold 5651*, MO). Flowering female specimen.

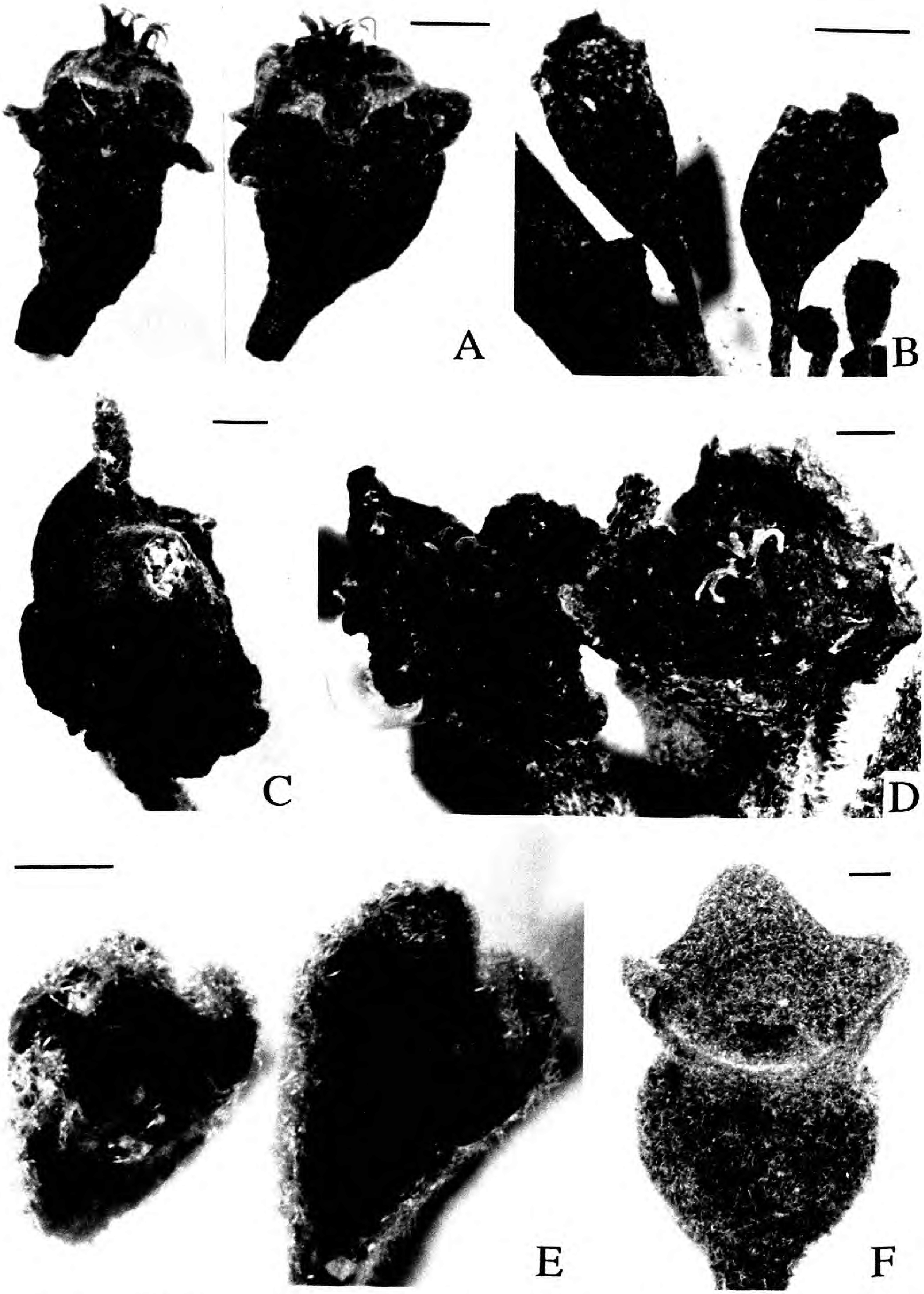

Figure 8. Male and female flowers of three new species of *Siparuna*; bars equal 1 mm. —A. *S. pubancura*, female flowers (*Jaramillo 6305*, QCNE). —B. *S. pubancura*, male flowers from the type (*Kvist & Barfod 49088*, AAU). —C. *S. campii*, male flower (*Camp E-3398*, US). —D. *S. campii*, female flowers from the holotype (*Camp E-349*, NY). —E. *S. cascada*, section through a young male flower showing arrangement of stamens (*Feil 91326*, AAU). —F. *S. cascada*, young fruit, one tepal removed (*Jaramillo & Winnerskjold 5653*, AAU).

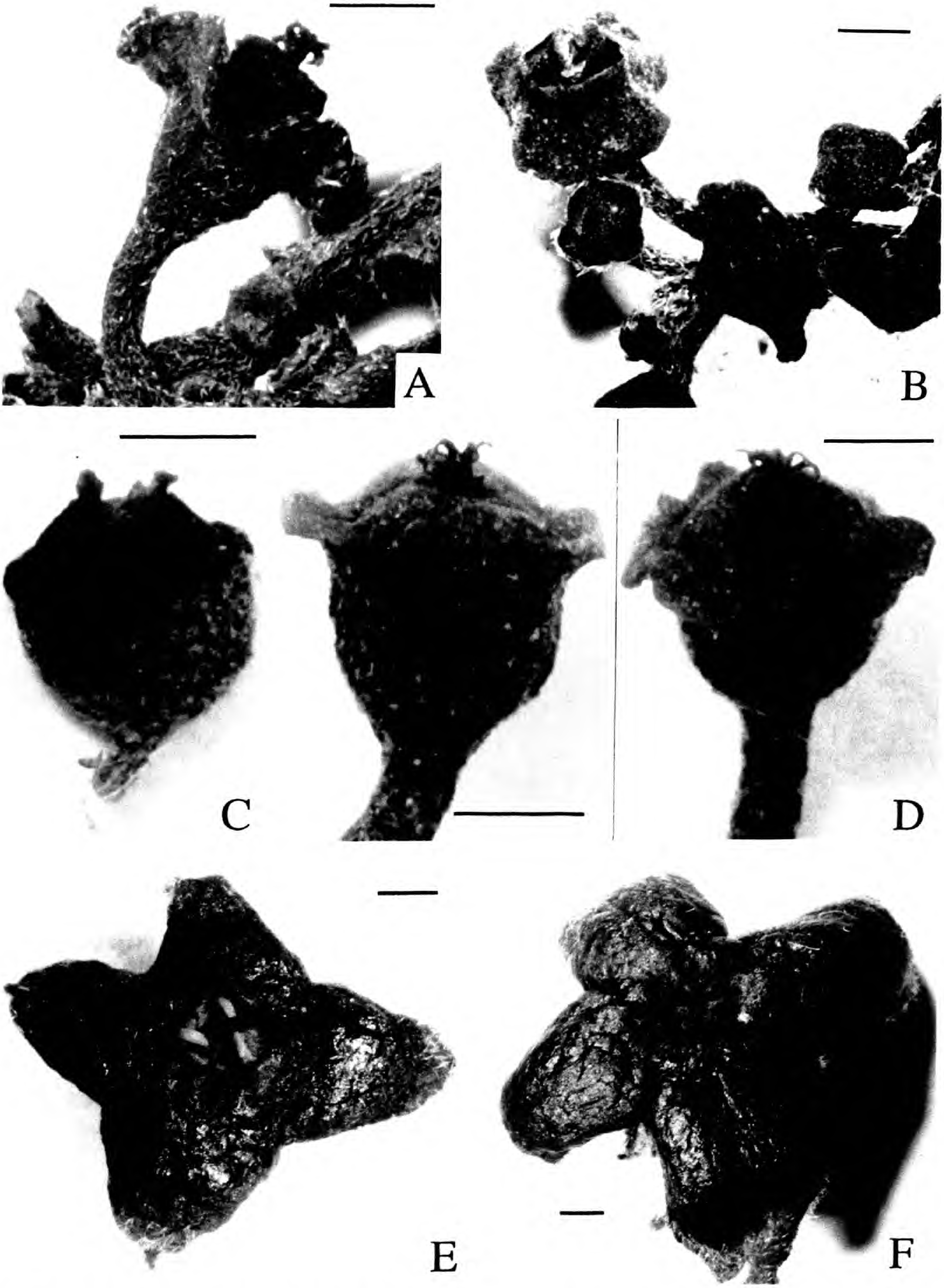

Figure 9. Male and female flowers of three new species of *Siparuna*; bars equal 1 mm. —A. *S. verticillata*, female flower (*Huttel 693*, QCA). —B. *S. verticillata*, male flowers from the holotype (*Cerón 3591*, QCNE). —C. *S. multiflora*, male flower (*Aulestia et al. 121*, QCNE). —D. *S. multiflora*, female flowers (*Øllgaard et al. 57531*, AAU). —E. *S. guajalitensis*, male flower (*Jaramillo & Zak 7885*, PTBG). —F. *S. guajalitensis*, female flower (*Jaramillo & Zak 8073*, AAU).

Distribution, habitat, and phenology. Endemic in Amazonian Ecuador; growing in primary forest on lateritic soils at elevations of 200–450 m; flowering and fruiting year-round. Vernacular name: "veñañabo" (Waorani).

Siparuna verticillata is similar in habit to *S. gilgiana* from Amazonian Peru, but that species has stellate, rather than simple, hairs on the leaf blades and floral cups and always seems to have two stamens.

Paratypes. ECUADOR. **Napo:** 45 km N of Coca, rd. Coca–Lago Agrio, Río Palanda Yacu, *Bohlin & Bohlin 324* (GB); San José de Payamino, *Irvine 507* (QCNE); Parque Nacional Yasuní, Pozo Petrolero Daimi 2, *Cerón & Hurtado 4197* (AAU, QCNE); Jatun Sacha, *Cerón & Iguago 5486* (AAU, QCNE), *Cerón 6344* (AAU, MO, QCNE), *Palacios et al. 4913* (AAU, MO, QCNE); Hacienda Cotapino (Concepción), *Harling et al. 6979* (AAU, GB); Finca del Sr. Bercelino, 8.5 km S of Coca, *Huttel 693* (QCA); 15 km W Coca, *Neill et al. 6342* (AAU, MO, QCNE); Reserva Etnica Huaorani, Maxus petroleum pipeline rd. under construction km 75–76, 250 m, *Aulestia & Gonti 1799* (QCNE).

Siparuna cascada Renner & Hausner, sp. nov. TYPE: Ecuador. Azuay: Paute–Guarumales rd., sector Amaluisa, Parroquia Palmas, Canton Paute, ca. 1800 m alt., female, 9 Aug. 1983 (fl), *J. Jaramillo & V. Winnerskjold 5653* (holotype, QCA; isotypes, AAU, MJG). Figures 7, 8E, F.

A *Siparuna tomentosa* (Ruiz & Pavón) A. DC. tepalis conspicuis (3–5 mm) differt.

Dioecious shrub or treelet, 3–7 m tall, young branchlets terete and densely covered with reddish brown hispid-stellate hairs. Leaves opposite, the petioles 1–2.5 cm long, the lamina drying greenish brown, chartaceous, lanceolate, 8–20 × 3.5–7.5 cm, the base acute to obtuse, the apex acuminate, the tip about 1 cm long, upper surface with hispid-stellate hairs, lower surface more densely pubescent with softer hairs of the same type, with 8–12 pairs of secondary veins, the veins almost flat above, slightly raised below, the margin finely dentate. Cymes 3.5–4 cm long, with 5–12 flowers, densely covered with brownish stellate hairs. Male floral cup obconical, with brownish stellate hairs, tepals 4, triangular, 3–4 mm long, on both sides pubescent like the floral cup; stamens 10–15(–20), when fresh red. Female floral cup about 5 mm diam. and 3.2 mm high, the tepals fused to a 3-mm-broad collar, their free apical lobes 0.8–2 mm long, the floral roof differentiated into a cylindrical bulge separated by a distinct groove from a central tube sheathing the styles; the styles 6–12, barely exserted from the pore, when fresh reddish. Fruits globose, 1–1.5 cm diam. and crowned by the persistent tepals, in dried fruits the 6–11 fruitlets somewhat protruding, when fresh and mature purple with white spots and a strong pungent smell.

Distribution, habitat, and phenology. Siparuna cascada grows in montane forest in southeastern Ecuador (Azuay, Morona–Santiago, Zamora–Chinchipe) at 1500–2000 m elevation.

Siparuna cascada resembles the Peruvian species *S. tomentosa* (Ruiz & Pavón) A. DC., *S. weberbaueri* Perkins, and *S. saurauiifolia* Perkins in having reddish brown densely pubescent leaves; the Peruvian species usually have three leaves per whorl (vs. leaves opposite in *S. cascada*).

Observations on the pollination and floral longevity of *S. cascada* were made by J. P. Feil (Feil, 1992, sub *S. saurauiifolia*) who found that the species differs from other Ecuadorean species of the genus in having red stamens and stigmas. He studied it near a waterfall to which the epithet cascada refers.

Paratypes. ECUADOR. **Azuay:** Guarumales trail, *Jaramillo & Winnerskjold 5651* (MO). **Morona–Santiago:** Guarumales, *Larsen & Eriksen 45296* (QCA, QCNE). **Zamora–Chinchipe:** 15 km on new rd. from Loja to Zamora, *Feil 91313* (AAU, QCA), *91326* (AAU, QCA); Cantón Nangaritza, sector Pachicutza, *Jaramillo & Grijalva 13371* (QCA).

Acknowledgments. We thank A. Horn for help with the photographs, R. Valencia for help in Quito, D. Lorence and P. M. Jørgensen for their careful reviews, and QCA, QCNE, MO, and other herbaria for extensive loans and gifts of critical specimens. Dan Nicolson checked the Latin diagnoses, for which we are grateful.

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New Combinations in *Carex* Section *Acrocystis* (Cyperaceae)

J. H. Rettig
Biology Department, College of the Ozarks, Pt. Lookout, Missouri 65726, U.S.A.

William J. Crins
Ontario Ministry of Natural Resources, P.O. Box 9000, Huntsville, Ontario P1H 2A3, Canada

ABSTRACT. *Carex communis* and *C. amplisquama* can be distinguished based on achene micromorphology. However, similarity in macromorphology and flavonoid chemistry suggest they are best treated as two varieties of *Carex communis. Carex rugosperma* and *C. tonsa* are morphologically closely related and are best treated as two varieties of a single species. For reasons of nomenclatural priority, the new combination *C. tonsa* var. *rugosperma* is required. *Carex tonsa* also is lectotypified.

Carex communis L. Bailey is a wide-ranging taxon of eastern North America, whereas *C. amplisquama* F. J. Hermann is restricted to northern Georgia and extreme western South Carolina. The most striking feature of *C. amplisquama* is the large pistillate scales. The two taxa are very difficult to distinguish, and some specimens assignable to *C. communis* based on other macromorphological characters have pistillate scales that approach the length of those in *C. amplisquama.*

Principal component (PC) and cluster analyses of macromorphological characters revealed overlap between the two taxa; however, study of a discriminant function analysis resulted in complete separation (Rettig, 1988). Pistillate scales of *Carex amplisquama* are significantly longer than those of *C. communis* ($p < 0.001$), although there is some overlap (Rettig, 1988). *Carex amplisquama* also is always densely caespitose with culms erect and arching over at the tip, whereas *C. communis* is usually loosely caespitose with prostrate culms. This field character ("lost" in pressing) is especially useful in separating taxa when combined with pistillate scale length.

Ranges of 10 achene micromorphological characters examined in the multivariate study overlapped; therefore no characters could be considered diagnostic, although five characters were significantly different (Rettig, 1988). PC and cluster analyses show complete separation of the two taxa without any overlap: all individuals of *Carex amplisquama* clustered together before clustering with individuals of *C. communis.*

Some plants of *Carex communis* produce Luteolin 7-Methyl ether 4′-diglucoside, a Luteolin 5-substituted glycoside and a 5-substituted flavone glycoside not found in *C. amplisquama* (Rettig, 1988). Multivariate analyses did not separate the two varieties into groups that correspond to morphological delimitations; however, *C. amplisquama* specimens were grouped together.

Achene micromorphology provides the strongest evidence for two distinct taxa. However, similarity in macromorphology and overall flavonoid chemistry suggest that they are best treated as two varieties.

Carex communis L. Bailey var. **amplisquama** (F. J. Hermann) J. Rettig, comb. nov. Basionym: *Carex amplisquama* F. J. Hermann, Rhodora 57: 158. 1955. TYPE: U.S.A. Georgia: Gilmer Co., *J. H. Pyron & Rogers McVaugh 2951* (holotype, US; isotypes, GA, MICH not seen).

KEY TO THE VARIETIES OF *CAREX COMMUNIS*

1a. Pistillate scale shorter than perigynium or extending beyond the perigynium no more than 0.8 mm; plants usually loosely caespitose with lax culms . . . . *C. communis* var. *communis*
1b. Pistillate scale extending beyond the perigynium more than 0.8 mm; plants usually densely caespitose with culms erect to arching . . . . *C. communis* var. *amplisquama*

North American caricologists acknowledge *Carex rugosperma* Mackenzie and *C. tonsa* (Fernald) Bicknell to be very close relatives. The taxa differ qualitatively in leaf texture, color, and indument, and in the degree of pubescence of the perigynia, with *C. tonsa* having coriaceous, light green, smooth leaves and perigynia that are virtually glabrous. Fernald (1902) was the first to combine these taxa at varietal rank, although at the time the typification of *C. umbellata* Schkuhr ex Willdenow had not yet been resolved (*C. umbellata* is now known to be a related but distinct species with short perig-

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ynium beaks). Voss (1966) also recognized the close relationship between *C. rugosperma* and *C. tonsa* and treated the latter as a variety of *C. rugosperma.*

We concur with the view that these taxa are closest relatives. However, the epithet "*tonsa*" predates "*rugosperma*" at the rank of species, and therefore a combination of *C. rugosperma* within *C. tonsa* is required.

Carex tonsa (Fernald) Bicknell, Bull. Torrey Bot. Club 35: 492. 1908. Basionym: *Carex umbellata* Schkuhr ex Willdenow var. *tonsa* Fernald, Proc. Amer. Acad. 37: 507. 1902. TYPE: U.S.A. Connecticut: *C. B. Graves s.n.* (lectotype, selected here, GH; isolectotype, GH).

Carex tonsa (Fernald) Bicknell var. **rugosperma** (Mackenzie) Crins, comb. nov. Basionym: *Carex rugosperma* Mackenzie, Bull. Torrey Bot. Club 42: 621. 1915. TYPE: U.S.A. New Jersey: Tuckerton, May 1911, *K. K. Mackenzie 9871* (holotype, NY).

The epithet *Carex tonsa* requires lectotypification. One of three sheets collected by C. B. Graves in Connecticut is here designated as the lectotype. It is one of the syntypes cited by Fernald (1902) and contains ample material with characteristic thick, relatively smooth foliage, and typical long-beaked, nearly glabrous, mature perigynia. The plant at the bottom left corner of the sheet is selected as the type.

Acknowledgments. We thank A. A. Reznicek, Peter Ball, John McNeill, and Ed Voss for helpful comments on this manuscript, and the curators of several herbaria for facilitating loans of critical material.

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Chaetocalyx longiloba (Fabaceae, Papilionoideae), a New Species from Peru

Velva E. Rudd
Department of Biology, California State University, Northridge, California 91330, U.S.A.

ABSTRACT. A new species, *Chaetocalyx longiloba* Rudd, from the Department of Amazonas, Peru, is proposed. Similarities to *C. weberbaueri* Harms and *C. latisiliqua* (Poiret) Bentham ex Hemsley, as well as distinguishing characters of *C. longiloba*, are described.

Two collections of *Chaetocalyx* from the Department of Amazonas, Peru, are distinct from previously known species of the genus (Rudd, 1958, 1972; Vanni, 1981) and are here presented as *Chaetocalyx longiloba* Rudd. Superficially, the new material resembles that of *C. weberbaueri* Harms, from Piura, Peru, and *C. latisiliqua* (Poiret) Bentham ex Hemsley, originally attributed to Peru but actually from Ecuador northward to Costa Rica. All three species are twining vines with 5-foliolate leaves; the flowers are 15–25 mm long; the fruits of *C. longiloba* and *C. latisiliqua* are linear-oblong, compressed, articulate, 6–10 mm wide; mature fruit of *C. weberbaueri* has not been seen but is expected to be similar. The principal differences are in the details of the flowers, as indicated in the following key. There also are some altitudinal differences: *C. longiloba* was found at 2450–2550 m, *C. weberbaueri* at 1000–1500 m, and *C. latisiliqua* at 40–1200 m.

1a. Flowers with vexillar petal pubescent on the outer face, 20–22 mm long; calyx 10–12 mm long including linear lobes 5–6 mm long, the tube slightly gibbous, narrowed at the base, longitudinally striate . . . . *C. longiloba* Rudd
1b. Flowers with vexillar petal glabrous on the outer face or with only a few hairs near the base; calyx lobes 1–5 mm long, the tube essentially symmetrical, not striate.
  2a. Calyx 7–10 mm long including linear, attenuate lobes; flowers 22–25 mm long . . *C. weberbaueri* Harms
  2b. Calyx 5–6 mm long including acute, deltoid lobes 1–2.5 mm long; flowers 15–25 mm long . . . . *C. latisiliqua* (Poiret) Bentham

Chaetocalyx longiloba Rudd, sp. nov. TYPE: Peru. Depto. Amazonas: Prov. Luya, Camporredondo, Fundo Cedro, 2450–2550 m, 25 May 1989, *C. Díaz, J. Campos & L. Campos 3530* (holotype, MO; isotype, SFV).

Planta volubilis lomentis planis lineari-oblongis *C. weberbaueri* Harms et *C. latisiliquae* (Poiret) Bentham ex Hemsley similis; ab eis floribus petalo vexillari pubescenti, calyce gibboso, striato, lobis 5–6 mm longis praedito differt.

Twining vines; stems puberulent, about 2 mm diam. Leaves 5-foliolate, the axis 2–5 cm long, puberulent to tomentulose. Stipules lanceolate, attenuate, 5–10 mm long, 1 mm wide at the base, puberulent. Leaflets elliptic, 1.5–5 cm long, 0.8–2 cm wide, obtuse, apiculate at the apex, rounded at the base, glabrous above, glabrous or subglabrous beneath except pubescent along the midvein. Inflorescences axillary, fasciculate, few-flowered, the pedicels 1–1.5 mm long. Flowers 20–22 mm long; calyx about 10–12 mm long, puberulent, the tube 5–6 mm long, 3.5–4 mm diam., slightly gibbous, longitudinally striate, narrowed at the base, the lobes linear, 5–6 mm long; petals yellow, the vexillum pubescent on the outer face, the wings and keel glabrous. Fruit lomentaceous, compressed, about 8–10-articulate, the articles quadrate, 7–9 mm long, 6–7 mm wide, the stipe about 5 mm long.

Paratypes. PERU. **Depto. Amazonas:** Prov. Luya, Camporredondo, Fundo Cedro, 2450–2550 m, 24 May 1989, *C. Díaz, J. Campos & L. Campos 3518* (MO, SFV).

Acknowledgment. My thanks to Joy Nishida for coaching me at the computer.

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Three Previously Undescribed Central American Species of *Sloanea* (Elaeocarpaceae)

Damon A. Smith
445 W. Center St., Whitewater, Wisconsin 53190, U.S.A.

ABSTRACT. *Sloanea geniculata* Damon A. Smith, *S. laevigata* Damon A. Smith, and *S. rugosa* Damon A. Smith are described from Nicaragua and Costa Rica based primarily on stamen, foliage, and stipule characters. They are differentiated from the most closely related *S. faginea* Standley, *S. schomburgkii* Bentham, and *S. meianthera* Donnell Smith, respectively, and Latin diagnoses, specimen lists, and summaries of distinguishing features are provided. Illustrations are also provided for *S. geniculata* and *S. rugosa*.

Although Costa Rica has the highest collection density of any Central American country (Gentry, 1978), new species are continually being discovered there, particularly among hard to collect arborescent groups. *Sloanea* is a case in point, with eleven species new to science and eight range extensions recorded in Costa Rica in the forty years since C. E. Smith's (1954) monograph of the New World species (D. A. Smith, in prep.). Three of the new species occur along the eastern edge of the Caribbean piedmont. Although they are at present known only from small areas in Costa Rica and Nicaragua, the true range of each may well be larger. They are presented here to accommodate publication of the *Flora of Nicaragua*. The information presented here is in large part a product of research conducted at Duke University, Durham, North Carolina (D. A. Smith, 1985).

In the following descriptions, "growth increment" indicates that portion of a twig produced during a flush of growth.

1. Sloanea geniculata Damon A. Smith, sp. nov. TYPE: Costa Rica. Heredia: Finca La Selva, on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, about 100 m elev., banks of the Quebrada El Salto along the South Boundary Trail, 10 May 1984 (fl, fr), *Wilbur & Jacobs 34183* (holotype, DUKE; isotypes, CR, F, MO, US). Figure 1.

Arbor parva vel mediocris. Rami 4–7 mm crassi, dense tomentosi; stipulae (1.2–)2.0–4.0(–6.3) cm longae, (0.4–) 0.6–1.0(–1.4) cm latae, lanceolatae, adaxialiter valde concavae, persistentes. Folia alterna; laminae (7.0–)19.0–33.0(–48.2) cm longae, (4.1–)7.0–15.0(–19.0) cm latae, plerumque serratae, in apice acuminatae. Inflorescentia (2–)4–16-floribus, axe plerumque 2–7 cm longo; bracteis (0.2–)0.4–1.0 cm longis, 2–8 mm latis, valde concavis, plerumque tridentatis. Flores rosei, antheris luteolis; sepala (3.0–)4.0–6.0(–8.25) mm longa, 1.0–3.0(–4.5) mm lata; stamina (3.3–)4.4–7.4 mm longa, antheris (0.8–)1.0–1.6(–2.2) mm longis ad basim dehiscentibus, aristis (0.9–) 1.1–2.1 mm longis, subulatis, plerumque bigeniculatis. Capsulae 2.0–2.5 cm longae, 1.3–2.0 cm latae, ellipsoidae vel cylindricae, spinis heteromorphis usque 5–11 mm longis.

Tree to 25 m tall, to 60 cm DBH; buttresses small, trunk usually fluted; bark reddish, with prominent lenticels. *Twigs* 4–7 mm diam., densely tomentose to long-tomentose; apical buds conical, with stipules and leaves tightly adpressed, loosely enclosed by stipules from upper nodes. *Leaves* alternate; *stipules* persistent on youngest 1–3 growth increments, (1.2–)2.0–4.0(–6.3) cm long, (0.4–)0.6–1.0(–1.4) cm wide, lanceolate, canoe-shaped, entire, tip attenuate, base asymmetric and truncate to slightly cordate; midrib ridged, margins with obscure net venation; midrib abaxially densely strigose, lamina sparsely so; *petiole* (1.0–)3.0–7.5(–10.6) cm long, (1.0–)1.5–3.0 mm diam., usually densely tomentose, occasionally also strigose, tomentum more pronounced adaxially; upper pulvinus prominent on mature leaves, lower rarely so; *lamina* (7.0–)19.0–33.0(–48.2) cm long, (4.1–)7.0–15.0(–19.0) cm wide, with 17–25 secondary vein-pairs, mostly obovate to narrowly oblanceolate, occasionally elliptic; tip narrowly acuminate, blunt; base rounded to truncate or slightly cordate, rarely acute-cuneate; margin apically crenate to blunt-serrate about ½ to ⅓ of length; primary vein densely tomentose and secondary veins sparsely short-tomentose to puberulent adaxially; primary vein tomentose to long-tomentose abaxially, occasionally densely so, all other veins short-tomentose to puberulent, indument reduced on smaller veins or occasionally lacking on veins of tertiary and higher order; primary to occasionally tertiary veins depressed adaxially, all others flush or slightly raised; all veins raised abaxially; *venation* eucamptodromous basally, usually becoming semicraspedodromous, or less often craspedodromous or

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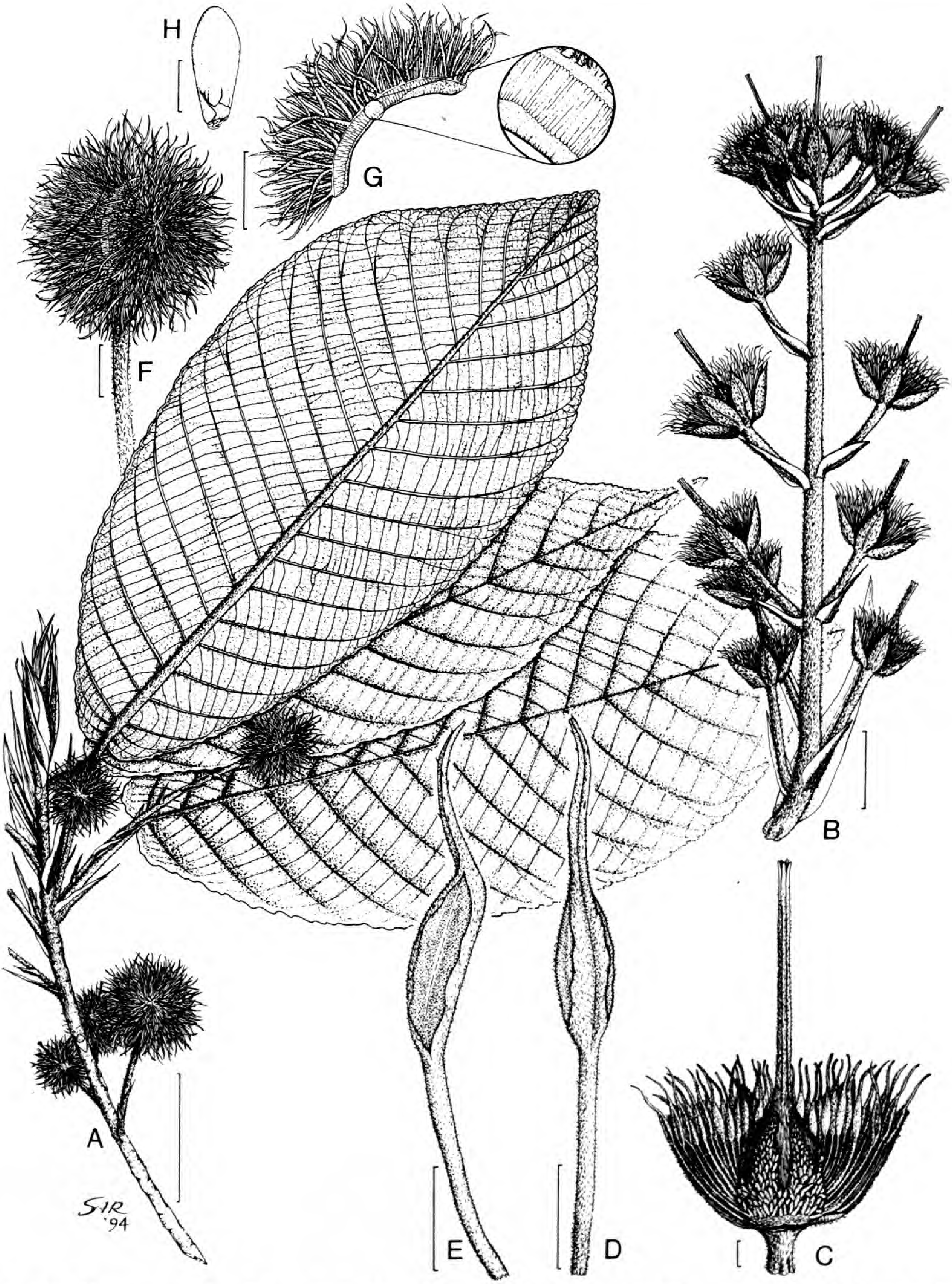

Figure 1. *Sloanea geniculata* Damon A. Smith. —A. Branch with fruits. —B. Inflorescence. —C. Old flower with capsular spines starting to develop. —D. Stamen from old flower, dorsal view. —E. Stamen from old flower, lateral view. —F. Unopened capsule. —G. Capsular valve with detail of wall layers apparent at the suture. —H. Seed with aril, chalazal end up. (A–E from the holotype sheet of *Wilbur & Jacobs 34183*; F–H from *D. Smith et al. 1216*. Scale bars represent 5 cm for A, 1 cm for B, F, G, and H, and 1 mm for C, D, and E.)

brochidodromous, above widest point; tertiaries straight or rarely forked; intersecondaries absent. *Inflorescences* (2–)4–16-flowered racemes or thyrses borne on leafy or leafless nodes on the youngest to third youngest growth increment, densely tomentose; bracts and bracteoles (0.2–)0.4–1.0 cm long, 2–8 mm wide, lanceolate to strongly cupped, enclosing very young buds, entire to apically tridentate, rarely three bracts at a node shaped like miniature leaves and stipules, densely strigose to short-strigose, indument reduced adaxially and marginally; primary axis (0.3–)2.0–7.0(–9.0) cm long, 2–3 mm diam. basally, tapered to the apex; pedicels 0.2–2.6(–4.0) cm long, 0.8–2.0 mm diam., flared apically and usually tapered to base. *Flowers*: sepals light green abaxially, yellow or reddish adaxially, (6–)7–12(–14) per flower, (3.0–)4.0–6.0(–8.25) mm long, 1.0–3.0(–4.5) mm wide, triangular to ovate, strap-shaped on old flowers, sparsely short-tomentose or strigose abaxially, densely short-tomentose adaxially; stamens ca. 40–120, yellow or yellow with orange awns, outer occasionally reddish, (3.3–)4.4–7.4 mm long; filaments 1.4–3.3 mm long, 0.2–0.3 mm diam., widening gradually to anther, often flattened dorsiventrally, short-tomentose; anthers (0.8–)1.0–1.6(–2.2) mm long, (0.3–)0.4–0.6(–0.7) mm wide, 0.32–0.44(–0.52) mm thick, lanceolate, with 2 abaxial ridges, connective ± flush, mostly short-tomentose but anther-sacs often nearly glabrous and connective often abaxially puberulent, anther-sacs opening widely along entire length; awns (0.9–)1.1–2.1 mm long, 0.15–0.30 mm diam., uniformly tapered, mostly flattened, angled, or grooved, basally sparsely tomentose and usually apically glabrous, at anthesis mostly bent sharply at the base away from the floral axis with some also recurved at the very tip, awns on older stamens often less sharply bent or merely gently curved; pistil 5–11 mm long (probably 5–7 mm at anthesis), densely tomentose to strigose except for stigmas, pubescence decreasing apically; ovary 1–3 mm long, 1.6–2.75 mm diam., ovoid, generally wider than long; style 3.7–7.3 mm long, the upper ½ to ⅙ or less 3–5(–6)-parted, often irregularly so. *Infructescences* 1–2-fruited, on youngest to third youngest growth increment; peduncles 0.0–9.2 cm long, 2–3 mm diam., tapered to apex; pedicels 1.2–3.0 cm long, 1–2 mm diam. *Capsules* red at maturity, red within, 2.0–2.5 cm long, 1.3–2.0 cm diam., elliptical to ± cylindrical; valves 4–5 per fruit, 2–3 mm thick, opening to about 90°, flat to slightly reflexed, outer wall layer barely evident at base; spines dimorphic, densely covering capsule, longer spines to 5–11 mm long, 0.27–0.9 mm diam. at the base, flaring or straight at the base, tapered to a sharp point, short-strigose, usually hooked, occasionally with short basal branches; shorter spines to 3–5 mm long, 0.04–0.08 mm diam. at point of attachment, 0.08–0.15 mm diam. just above, to 0.15–0.25 mm diam. distally, cylindric or clavate, straight, constricted basally, short-strigose, easily detached; seeds 1–4 per fruit, about 1.3–1.6 cm long and 0.9 cm wide when fresh, ellipsoid and somewhat flattened, completely covered by the fleshy orange aril which is fused to the chalazal ⅓ of the seed.

Habitat and phenology. Stream banks and recent alluvial soils on the Caribbean slope of northern Costa Rica, from near sea level to about 200 m elevation; flowering April–May (occasionally June), fruiting mostly July–August (one fruiting collection each from March and September).

Discussion. *Sloanea geniculata* is distinguished by its medium-sized elongate serrate leaves, relatively large adaxially concave lanceolate persistent stipules, dimorphic densely packed capsular spines, and long staminal awns which are often bent sharply at the base and frequently also near the apex. The floral and capsular morphology place it in C. E. Smith's subgenus *Sloanea*, section *Sloanea*. Specimens of *S. geniculata* have been consistently misidentified as *S. faginea* Standley, which has much smaller wing-shaped stipules that never persist beyond the youngest growth increment, smaller leaves broader in proportion to their length, somewhat smaller ovoid fruits, short straight staminal awns, and essentially flat inflorescence bracts. The foliage of some specimens of *S. geniculata* closely resembles that of *S. tuerckheimii* Donnell Smith, which can always be distinguished by the relatively small narrowly triangular caducous stipules, monomorphic slender capsular spines, or short staminal awn. *Sloanea geniculata* is part of a species complex that includes *S. faginea* and *S. guapilensis* Standley, as well as several species as yet undescribed. This species is locally common around and to about 200 m elevation above the confluence of the Río Puerto Viejo and the Río Sarapiquí, and has so far been found only at one other location about 45 km to the east. It is well known in spite of its limited distribution due in large part to a long-standing collecting program and flora project at the La Selva biological station.

The specific epithet was chosen to describe the kneelike bend in the staminal awn.

Paratypes. COSTA RICA. **Heredia**: Parque Nacional Braulio Carrillo, estación Magsasay, Sarapiquí, 10° 24′10″N, 84°03′30″W, elev. 150 m, 5 July 1990 (fr), *Aguilar 142* (INB); near Puerto Viejo, elev. under 100 m, 20 Sep. [probably 1965] (fr), *Hern 7* (US); bank of the Río Puerto Viejo, about 4–6 km SE of Puerto Viejo, 30 Aug.

1984 (fr), *D. Smith et al. 1216* (CR, DUKE, F, MO); Finca La Selva, on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, about 100 m elev., along Camino Central, southern half, cpDNA voucher, 23 Sep. 1988 (veg), *Alverson 2178* (WIS); on small trail exiting behind "old new lab" built around 1983, cpDNA voucher, 12 May 1990 (veg), *Alverson 2211* (WIS); en el Arboretum, 18 May 1983 (fl), *Chacón 801* (CAS, DUKE, F, GH, MICH, NY); cacao overstory, primary forest, 25 June 1969 (fl, fr), *Frankie 192a* (MO); along trail from Pejebaje to Arboretum, near junction with El Surá trail, 27 May 1978 (fl), *Grayum 1339* (DUKE, LL, MO, NY, US); along trail from Pejebaje grove to Arboretum, 6 Apr. 1980 (imm. fl), *Hammel 8473* (DUKE, GH, NY, US); at south boundary along Q. El Salto, 7 Apr. 1982 (fl), *Hammel 11604* (CR, DUKE, MICH, MO, TX); on ridge in Plot 3, 4 May 1982 (fl), *Hammel 12014* (DUKE, F); in forest on ridge in SW quarter of new property, 7 June 1982 (imm. fr), *Hammel & Trainer 12912* (DUKE, F); Plot 1, tag 0890, 7 Mar. 1970 (fr), *Hartshorn 829* (MO); trail to Area 1, between river road and Río Puerto Viejo, 13 Apr. 1973 (fl), *Hartshorn 1148* (DUKE, MO); Holdridge Arboretum tag #35, 31 Aug. 1973 (fr), *Hartshorn 1290* (F); Lindero Sur at Quebrada Salto, 15 June 1984 (old fl), *Jacobs 2348* (DUKE); El Salto at the south boundary, 16 May 1985 (old fl), *Jacobs 3052* (DUKE); West River Road, 23 May 1985 (old fl), *Jacobs 3132* (CR, DUKE, MO, WIS); Lindero el Peje, 25 May 1985 (fl), *Jacobs 3134* (CR, DUKE, F, MO, US); Holdridge trail, at a small stream crossing, 26 May 1985 (old fl), *Jacobs 3159* (CAS, CR, DUKE, F, LL, MO, NY, US); "no-name" trail from the Pejebaje grove to the arboretum, 2 Sep. 1984 (veg), *D. Smith 1220* (DUKE, NY); by Q. Salto at South Boundary trail, 27 July 1979 (imm. fr), *Sperry 1084* (CAS, DUKE, MO); in the vicinity of the arboretum along Q. Arboreta, 22 May 1985 (imm. fr), *Wilbur 37250* (CR, DUKE). **Limón:** Pueblo Nuevo, 17 km NE of Cariari, on the farm of Bernardo Herrera M., 10°20′N, 83°36′W, 100 m elev., 9 Sep. 1994 (veg), *Thomsen 1143* (CR, K, USJ, WIS).

2. **Sloanea laevigata** Damon A. Smith, sp. nov. TYPE: Costa Rica. Heredia: Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, about 100 m elev., far research loop trail, 360 m from its beginning on the West River Road, trail tree #260, 10 Apr. 1982 (old fl), *Hammel 11654* (holotype, DUKE; isotypes, CAS, CR, F, GH, MO, NY, US).

Arbor ad 35 m alta. Rami (3–)4–8 mm crassi, strigosi vel glabrati; stipulae 4–6 mm longae, 2–4 mm latae, triangulatae, plerumque caducae. Folia alterna; laminae (9.3–)15–26(–39.6) cm longae, (3.9–)7–13(–15.5) cm latae, integrae, in apice acutae vel breve acuminatae. Inflorescentia 3–5-floribus, axe 1–3 cm longo. Flores viridibus, antheris luteolis; sepala 1.0–1.6 cm longa, 4–7 mm lata, stamina 7–9 mm longa, antheris (2.2–)2.6–6.4 mm longis ex apice ⅕–⅓ dehiscentibus, aristis 1.0–2.4 mm longis, teretibus, rectis vel ad basim abaxialiter flexis. Capsulae 3.1–3.8 cm longae, 1.9–2.6 cm latae, inermis.

Tree to 35 m tall, to 1.5 m diam. above the buttresses; buttresses to 3 m tall and 4 m wide or larger, about 10 cm thick; bark smooth, light gray. *Twigs* (3–)4–8 mm diam., narrowing only slightly at the apex, terete; strigose to sparsely strigose, rapidly becoming glabrous, hairs tightly appressed; apical buds mostly short-conical, with leaves and stipules tightly adpressed. *Leaves* alternate, present only on youngest growth increment, often decreasing in size toward apex; *stipules* ± caducous (see discussion below), 4–6 mm long in bud, mostly about 6 mm long at maturity, 2–4 mm wide; triangular to narrowly triangular with thickened midrib and thickened, often calluslike base, outer half of lamina often wider than inner; entire; long to short strigose, particularly on midrib; *petiole* (1.4–)3–7(–10.8) cm long, (1.0–)2.0–2.5 mm diam.; ± terete, often with an adaxial ridge and three grooves descending from upper pulvinus; glabrous to basally tightly appressed-strigose; both pulvini prominent and darker than rest of petiole, upper often greatly enlarged; *lamina* (9.3–)15–26(–39.6) cm long, (3.9–)7–13(–15.5) cm wide, with 9–13 secondary vein-pairs, elliptic to obovate or oblanceolate; tip acute to broadly short-acuminate; base cuneate to concave, acute to obtuse; margin entire to broadly shallowly crenate; glabrous; primary and secondary veins raised and others slightly raised on both surfaces, veins usually lighter than rest of lamina; *venation* eucamptodromous basally, mostly brochidodromous above widest point, loop-forming branches often irregular; tertiaries straight or forked; intersecondaries mostly absent, occasionally present as irregular or indistinct composite segments. *Inflorescences* 3–5-flowered simple to once-compound dichasia on most recent growth increment, sparsely to densely short twisted-tomentose; bracts and bracteoles not seen, but simple bract and bracteole scars present; primary axis 1–3 cm long, 2.5–3.0 mm diam., secondary peduncles 1.0–1.3 cm long, about 2.0 mm diam., pedicels 1.5–2.6 cm long, 1.5–2.5 mm diam. basally, tapering to base. *Flowers*: sepals light green, 4 per flower, 1.0–1.6 cm long, 4–7 mm wide, ± triangular, acute, fleshy, deciduous, reflexed at anthesis, strigose to densely long-strigose adaxially, densely minutely lanate abaxially; receptacle much broader than pedicel apex at sepal attachment; stamens approx. 200–300, yellowish, 7–9 mm long; filaments 0–6 mm long, about 0.1 mm diam., shortest at center of flower, terete, abruptly joined to anther, densely short twisted-tomentose; anthers (2.2–)2.6–6.4 mm long, 0.5–0.7 mm wide, about 0.4 mm thick, reduced toward periphery of flower, ± straight, linear-lanceolate becoming oblanceolate with dehiscence, abruptly joined to filament, connective depressed on both surfaces, nearly glabrous to sparsely short-tomentose, anther-sacs opening by terminal pores about ⅕–⅓ of length; awns 1.0–2.4 mm long, 0.1–0.2 mm diam., longest toward periphery of flower, straight or bent away from floral axis, terete except for adaxial groove, glabrous; pistils 1.0–1.3 cm long, densely minutely twisted tomentose to base of style; ovary 5–7 mm long, about 4 mm diam., roughly cylindric to ovoid; style 5–6 mm long, 3–4-parted near the apex. *Infructescences* 1(probably to 3)-fruited, on youngest growth increment, peduncles about 1.7 cm long, about 2 mm diam., pedicels on fallen fruits 1.2–2.3 cm long, 3–5 mm diam., about twice as thick apically as basally. *Capsules* dark brown overall (fide Herrera), unarmed, ellipsoid, 3.1–3.8 cm long (estimated from open capsules), 1.9–2.6 cm diam., with an enlarged angular receptacle at the base; valves 3–5, 4–6 mm thick, recurved or flat when dry, outer layer thicker than inner nearly to apex; seed solitary, about 1.8 cm long, about 1.2 cm diam., nearly globose, exposed seed coat black (fide Herrera); aril aromatic, white (fide Herrera), partly covering seed.

Habitat and phenology. Wet evergreen forests from around sea level to 700 m elevation on the Caribbean slope of Costa Rica; flowering collections from April and June, fruiting June–November.

Discussion. *Sloanea laevigata* is distinguished by the medium-sized nearly glabrous leaves, caducous stipules, large flowers with abaxially wooly, green, fleshy sepals, stamens with elongate anthers that are longer toward the center of the flower and that open by a relatively small apical pore, terete filaments that are shorter toward the center of the flower, long filiform staminal awns, and unarmed capsules with valves recurved to flat when dry. The floral morphology and inflorescence form place it in C. E. Smith's subgenus *Quadrisepala,* section *Paniculi.* Though the stipules are usually caducous, they may occasionally persist at several upper nodes on mature shoots and at the leafy nodes of juvenile shoots. Those on juvenile shoots are often asymmetric and tightly appressed to the stems. The variation in stamen morphology within the flowers, though distinctive in Central America, is shared by the South American species *S. durissima* Spruce ex Bentham, *S. nitida* G. Don, *S. schomburgkii* Bentham, and *S. synandra* Spruce ex Bentham. *Sloanea laevigata* is most similar to *S. schomburgkii,* which may be distinguished by the somewhat longer inflorescences (peduncles 1.8–7.0 cm long), obtuse pink or pale cream sepals, and possibly by the shorter staminal awns and thinner capsule walls. *Sloanea laevigata* has long been known as *S. latifolia* (Richard) K. Schumann, but bears only superficial resemblance to that species. *Sloanea latifolia* differs in having more slender twigs, smaller flowers, and a short staminal awn (about 0.2–0.4 mm long, based on illustrations in Castaneda (1981), and Martius (1886, tab. 35, fig. 1)). It is known only from Amazonia, and is poorly represented in U.S. herbaria.

The majority of the specimens of *S. laevigata* have come from the OTS field station "La Selva," where it occurs mainly on old alluvial soils and is sparsely distributed. The specific epithet was chosen to describe the glabrous leaves without prominent secondary and higher order veins.

Paratypes. COSTA RICA. **Alajuela:** near Florencia, 20 Nov. 1965 (fr), *Hern 51* (CR, US); Upala, Bijagua, El Pilón, camino a Río Chimurria, 10°43′30″N, 84°59′W, elev. 600 m, 21 July 1988 (fr), *Herrera 2140* (F, MO); cantón Upala, finca Los Tigres, en las Flores de Bijagua, 600–650 m elev., Dec. 1992 (veg), *I. Salas s.n.* (USJ). **Heredia:** Parque Nac. Braulio Carrillo, estación Magsasay, Sarapiquí, 10°24′10″N, 84°03′30″W, 200 m elev., 17 Sep. 1990 (fr), *Aguilar 75* (INB); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, about 100 m elev., far loop trail, June 1982 (fr), *Fetcher s.n.* (DUKE); 1984 (fr), *Fetcher s.n.* (DUKE); 14 July 1973 (veg), *Poveda et al. s.n.* (USJ); on the Near Research Loop, about 10 m S of the trail on the slope of a small rise, 26 June 1984 (old fl), *D. A. Smith & Jacobs 1225* (CR, DUKE, F, NY, US). **Limón:** Cantón de Limón, El Progresso, entre Cerro Muchilla y Cerro Avioneta, siguiendo las filas que llevan a las cabeceras del Río Suruy, fila Matama, Valle de la Estrella, 9°47′18″N, 83°8′45″W, elev. 675 m, 18 Apr. 1989 (fr), *Herrera & Chacon 2650* (USJ, WIS).

3. **Sloanea rugosa** Damon A. Smith, sp. nov. TYPE: Costa Rica. Heredia: along Río Puerto Viejo, about 3–5 km SE of Puerto Viejo de Sarapiquí on the road to Río Frío, 30 Aug. 1984 (fr), *D. Smith et al. 1215* (holotype, DUKE; isotypes, CR, F, MO, US). Figure 2.

Arbor parva vel mediocris. Rami plerumque 1.5–3.0 mm crassi, dense tomentosi; stipulae (0.6–)1.0–2.7 mm longae, 0.15–0.60 mm latae, lineares, caducae. Folia opposita; laminae (2.1–)5.0–17.0(–22.0) cm longae, (1.3–)2.0–8.0(–11.5) cm latae, subtus plerumque dense tomentosae, repandae vel raro integrae. Inflorescentiae parvae, in ramulos veteres portatae. Flores parvi, luteoli; sepala (1.0–)1.5–3.6 mm longa, (0.4–)1.0–1.5(–3.0) mm lata, stamina (1.9–)2.5–4.0(–4.2) mm longa, filamentis tomentosis teretibus (1.0–)1.5–3.1 mm longis, antheris (0.6–)0.8–1.1 mm longis ad basim dehiscentibus aristis obtusis plerumque 0.10–0.25 mm longis. Capsulae (1.1–)1.5–2.0(–2.5) cm longae, (0.7–)0.8–1.2 cm latae, ellipticae, valvis (1.3–)2.0–3.0 mm crassis; spinis monomorphis, linearis, usque 5–9 mm longis.

Tree to 20 m tall, to 80 cm DBH, buttresses small, narrow; bark reddish, with prominent lenticels. *Twigs* (1.2–)1.5–3.0(–4.0) mm diam., densely tomentose to short-tomentose; apical buds mostly

Figure 2. *Sloanea rugosa* Damon A. Smith. —A. Branch with fruits. —B. Inflorescence. —C. Flower; composite of old flower and detached stamens. —D. Stamen, dorsal view. —E. Stamen, lateral view, before dehiscence. —F. Capsule (split in drying, but valves not separated). —G. Capsular valve with detail of wall layers apparent at the suture. —H. Seed, aril missing, chalazal end down. (A, F, G, and H from holotype sheet of *D. Smith et al. 1215*; B–E from *Jacobs & Grayum 3227*. Scale bars represent 5 cm for A, 1 cm for B, F, G, and H, and 1 mm for C, D, and E.)

conic to lanceolate, densely strigose. Leaves opposite to occasionally subopposite, persisting on youngest 1–2 growth increments; *stipules* caducous, (0.6–)1.0–2.7 mm long, 0.15–0.6 mm wide, linear, entire, densely strigose; *petiole* (0.2–)0.5–2.5(–3.6) cm long, (0.6–)0.8–1.4(–2.0) mm diam., flat to canaliculate adaxially toward apex, densely tomentose to short-tomentose; upper pulvinus prominent, lower inconspicuous except on fresh material; *lamina* (2.1–)5.0–17.0(–22.0) cm long, (1.3–)2.0–8.0(–11.5) cm wide, with (5–)6–9(–11) secondary vein-pairs, elliptic or lanceolate to obovate or oblanceolate; apex acute to acuminate; base usually cuneate-acute, often narrowly truncate, occasionally rounded or slightly cordate; margin entire to shallowly crenate, rarely shallowly blunt-serrate apically; primary to secondary or tertiary veins depressed and tomentose to densely tomentose adaxially, all veins raised and densely to sparsely tomentose abaxially, with primary and secondary to tertiary veins prominent; venation eucamptodromous basally, usually becoming brochidodromous at or above widest point, rarely craspedodromous apically; tertiaries mostly straight; interrupted composite intersecondaries occasionally present. *Inflorescences* (1–)3–7-flowered racemes borne mostly on second to third youngest growth increments. *Flowers*: sepals (1.0–)1.5–3.6 mm long, (0.4–)1.0–1.5(–3.0) mm wide, triangular to lanceolate or ovate, entire to laciniate, tomentose, with indument reduced adaxially; stamens yellow (fide Herrera), ca. 30–60, (1.9–)2.5–4.0(–4.2) mm long, tomentose with indument reduced on anther and awn; filaments (1.0–)1.5–3.1 mm long, (0.06–)0.10–0.15 mm diam., terete to strongly flattened, tomentose to sparsely so; anthers (0.6–)0.8–1.1 mm long, 0.15–0.30 mm wide, 0.2–0.5 mm thick, tomentose to glabrous, opening broadly the entire length; awn 0.10–0.25 mm long, 0.10–0.15 mm wide, terete to somewhat flattened, puberulent to glabrous, straight or abaxially bent, blunt; pistil about 5–7 mm long, densely strigose to the basal ⅓ of style, ovary about 1.7–1.8 mm long, 1.2–1.3 mm diam., style about 3–5 mm long, with 3–4 lobes about 0.25–1.0 mm long apically (appearing entire in fruit). *Infructescences* 1–3-fruited, on leafless nodes 2–4+ growth increments from the stem-tip, densely tomentose; peduncles 2–15 mm long, 1.2–2.5 mm diam.; pedicels 2–6 mm long, 0.9–1.5 mm diam. *Capsules* green to reddish overall at maturity, (1.1–)1.5–2.0(–2.5) cm long, (0.7–)0.8–1.2 cm diam., ellipsoid; valves 3–4 per fruit, (1.3–)2.0–3.0 mm thick, spreading flat; spines monomorphic, not densely packed, 5–9 mm long, 0.1–0.5 mm diam., stiff, brittle, straight, tapered from base to somewhat clavate, briefly tapered to a sharp tip, strigose; seeds 1.1–1.4 cm long, about 7 mm diam., 1 or rarely 2 per capsule, ellipsoid and somewhat flattened, completely covered by the fleshy orange aril firmly attached to chalazal ⅓.

Habitat and phenology. Wet evergreen forest from near sea level to about 700 m elevation on the Caribbean slopes of Nicaragua and Costa Rica and on the Osa peninsula, possibly also in Panama; one flowering collection from April, range most likely April–June, fruiting June–September.

Discussion. *Sloanea rugosa* is distinguished by the small, opposite, mostly obovate or oblanceolate, abaxially tomentose leaves, densely tomentose stems, small, linear, caducous stipules, small flowers borne on short inflorescences from relatively old nodes, short anthers with awns about as long as anthers are wide, and small, relatively thick-walled capsules with short, monomorphic, linear spines which are not densely packed. The floral and capsular spine morphology place it in C. E. Smith's subgenus *Sloanea*, section *Brevispicae*. *Sloanea rugosa* is most closely related to *S. brenesii* Standley, *S. guianensis* (Aublet) Bentham, and *S. meianthera* Donnell Smith, and vegetative or juvenile material may be difficult to distinguish from the latter two species. *Sloanea meianthera* may be distinguished from *S. rugosa* by the smaller, nearly glabrous leaves and stems, shorter stipules (< 1 mm long), essentially awnless anthers, smaller and thinner-walled capsules borne on younger twigs, and shorter, densely packed capsular spines. *Sloanea brenesii* may be distinguished by the smaller, less acute leaves with much shorter petioles and with apical secondary veins that usually extend to the margin (craspedodromous), and generally smaller capsules with shorter spines. *Sloanea guianensis* differs in the nearly glabrous petioles and leaf veins, and thinner capsule walls. *Sloanea rugosa* is represented in herbaria by scattered collections from the Caribbean piedmont of Costa Rica and southeastern Nicaragua, and one collection from the Osa peninsula. Two vegetative specimens from the Panama Canal Zone (*Gentry 3227* (MO) and *3283* (MO)) may also belong to this species. It appears to have roughly the same range in Costa Rica as *S. guianensis*; *S. brenesii* and *S. meianthera* occur at higher elevations (ca. 800–1600 m and ca. 300–1100 m, respectively).

Material showing flowers with stamens (*Moraga 350*) was not seen until after the illustrations had been prepared, but agrees well with Figure 2 (B, C), which was extrapolated from detached stamens and very young fruits.

The specific epithet describes the typical leaf texture.

Paratypes. COSTA RICA. **Alajuela**: Upala, Colonia Libertad, 2 km al noreste de la escuela, 300–400 m elev., 2 May 1988 (imm. fr), *Herrera 1932* (MO); Upala, Bijagua, El Pilón, alrededores de la intersección del camino de Argüello con Río Chimurria margen izquierda, 10°43'30"N, 85°00'30"W, 600–700 m elev., 19 July 1988 (fr), *Herrera 2128* (MO); San Carlos, rumbo a La Marina, 23 Aug. 1973 (imm. fr), *Poveda 592* (CR); San Carlos, San Joaquín de Cutris, 12 Aug. 1983 (veg), *Poveda et al. 3629* (CR); San Carlos, San Joaquín de Cutris, 12 Aug. 1983 (fr), *Poveda et al. 3639* (CR); San Carlos, San Luis de Cutris, finca de Oldenar Perozo, 20 July 1985 (fr), *Zamora & Poveda 1023* (MO). **Heredia**: Parque Nacional Braulio Carrillo, estación Magsasay, Sarapiquí, 10°24'18"N, 84°03'30"W, elev. 200 m, 5 July 1990 (imm. fr), *Acevedo et al. 142* (CR); Parque Nacional Braulio Carrillo, estación Magsasay, 10°24'04"N, 85°03'03"W, elev. 200 m, 5 July 1990 (imm. fr), *Carballo 159* (CR); along Río Puerto Viejo, ca. 3 km N of Las Horquetas on road to Puerto Viejo de Sarapiquí, elev. ca. 60 m, 10°23'N, 83°58'W, 19 July 1984 (imm. fr), *Grayum et al. 3569* (DUKE, MO); road between Puerto Viejo and Horquetas, along the Río Puerto Viejo, 2 June 1985 (imm. fr), *Jacobs & Grayum 3227* (DUKE). **Guanacaste**: Estación Pitilla, La Cruz, Parque Nacional Guanacaste, 10°59'26"N, 85°25'40"W, elev. 700–1000 m, 1 Apr. 1991 (old fl), *Moraga 350* (MO). **Puntarenas**: Osa peninsula, Reserva Forestal Golfo Dulce, Rancho Quemado, ca. 15 km W of Rincón, along Quebrada Quebradón and ridge above it, 8°40'N, 83°34'W, elev. 200 m, 4 June 1988 (imm. fr), *Hammel el al. 17023* (MO). NICARAGUA. **Zelaya**: Río Barbarena a 5 km de Nueva Guinea, 11°47'N, 84°29'30"W, elev. 160 m, 27 Aug. 1982 (fr), *Araquistain 3154* (MO); municipio de Nueva Guinea, Río El Zapote, elev. 250 m, 3 Sep. 1982 (fr), *Laguna 58* (MO).

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A New Species of *Hedyotis* (Rubiaceae) from Jalisco, Mexico

Edward E. Terrell

Department of Plant Biology, University of Maryland, College Park, Maryland 20742, U.S.A.

ABSTRACT. *Hedyotis macvaughii,* a new species from Jalisco, Mexico, is described and compared with related taxa. It is a small wiry-stemmed perennial herb with filiform leaves, small funnelform flowers, and non-crateriform seeds.

Among specimens lent by MICH was a previously unnamed species collected by Rogers McVaugh in Jalisco, Mexico. It is here described as a new species of *Hedyotis.*

Hedyotis macvaughii Terrell, sp. nov. TYPE: Mexico. Jalisco: steep mountain sides 3–10 km generally E on the road to Mina del Cuale from the junction 5 km NW of El Tuito, Mpio. de Cabo Corrientes, elev. 850–1150 m, 16–19 Feb. 1975, *R. McVaugh 26426* (holotype, MICH). Figures 1, 2.

Herba perennis rhizomata. Caules 15–20 cm alti erecti. Folia filiformia. Inflorescentia diffusissima. Corolla alba infundibuliformis 3.0–4.5 mm longa. Capsulae subglobosae 1–2 mm longae. Semina 0.3–0.5 mm longa compressa ellipsoidea hilo punctiformi in crista ventrali.

Perennial herbs with slender rhizomes. Stems 15–20 cm tall, subterete, erect, very slender, wiry, glabrous, widely and diffusely branched, internodes numbering ca. 5–6. Leaves 6–20 mm long, 0.3–0.7 mm wide, filiform, with 2 inconspicuous grooves beneath, obtuse, glabrous above and beneath. Stipules to 1 mm long and wide, inconspicuous, entire or few-toothed. Inflorescences widely spreading, diffuse, to ca. 15 cm wide, with many filiform branches, flowers heterostylous, in many 2–5-flowered cymes, pedicels filiform, to ca. 15 mm long. Calyces glabrous; lobes 4, 0.4–0.8 mm long, 0.2–0.5 mm wide, broadly lanceolate, obtuse. Corollas 4-lobed, 3.0–4.5 mm long, funnelform, white; tubes 2.0–2.7 mm long, 0.5–0.6 mm wide at base; lobes 1–2 mm long, 0.5–1.5 mm wide, ovate. Anthers 4, ca. 0.5–0.8 mm long. Pollen colporate type A. Stigmas 2-branched, ca. 0.5 mm long, linear. Pin flowers with stigmas slightly exserted at corolla throat, anthers located at ⅓–½ point of corolla tube. Thrum flowers with anthers slightly exserted at corolla throat, stigma not seen. Capsules 1–2 mm long and wide, subglobose, thin-walled, straw-colored, ¾–⅞ inferior, apices rounded or truncate, dehiscence loculicidal. Seeds several per capsule, 0.3–0.5 mm long, 0.2–0.35 mm wide, brown, dorsiventrally moderately compressed, in outline broadly elliptic, oblong, or ovoid, sometimes irregularly angulate, non-crateriform, dorsal side almost smooth or obscurely reticulate, convex, ventral side finely reticulate, hilum punctiform on acentric hilar ridge, ridge obtuse or acutish, low to rather high, testa with areoles single or double walled. Chromosome number unknown.

Hedyotis macvaughii (spelling in accordance with Greuter et al., 1994: Rec. 60 C.4.(a)) is somewhat geographically isolated from related species that occur to the eastward in Mexico, as there are no records of *Hedyotis* or *Houstonia* species occurring in Jalisco, Colima, Michoacán, or Nayarit (Standley, 1918; Terrell, 1991).

The new species is distinct in its morphology. It is a small wiry-stemmed perennial herb with filiform leaves and small funnelform flowers (Fig. 1). The seeds (Fig. 2) lack any kind of ventral depression or cavity, hence are non-crateriform. They are moderately dorsiventrally compressed and have a punctiform hilum on a low to rather high hilar ridge. These seed characters ally the new species with *Hedyotis* rather than *Houstonia,* which has crateriform seeds, or *Oldenlandia,* which has distinctive 3-angled (trigonal) or conic seeds (Terrell, 1991).

Lewis (Terrell et al., 1986) recognized three types of pollen aperture structure, based on the extent of thinning of the nexine in the equatorial region. Two of these types, colpororate and colporate type B, occur in *Houstonia,* whereas *Hedyotis* and *Oldenlandia* have predominantly colporate type A. For *Hedyotis macvaughii,* Lewis (pers. comm., May 1995) reported the occurrence of colporate type A pollen.

There are three species that superficially resemble or might be confused with *Hedyotis macvaughii: Hedyotis asperuloides* Bentham, *Houstonia palmeri* A. Gray, and *Houstonia longifolia* Gaertner. *Hedyotis asperuloides* of Baja California, Mexico, is a small annual with corollas 3–11 mm long, anthers 1.0–1.3 mm long, stigma branches 1.0–1.4 mm long, capsules 1.3–5.0 mm long that are turbinate,

Figure 1. Holotype (MICH) of *Hedyotis macvaughii* Terrell, with inflorescence enlarged (top).

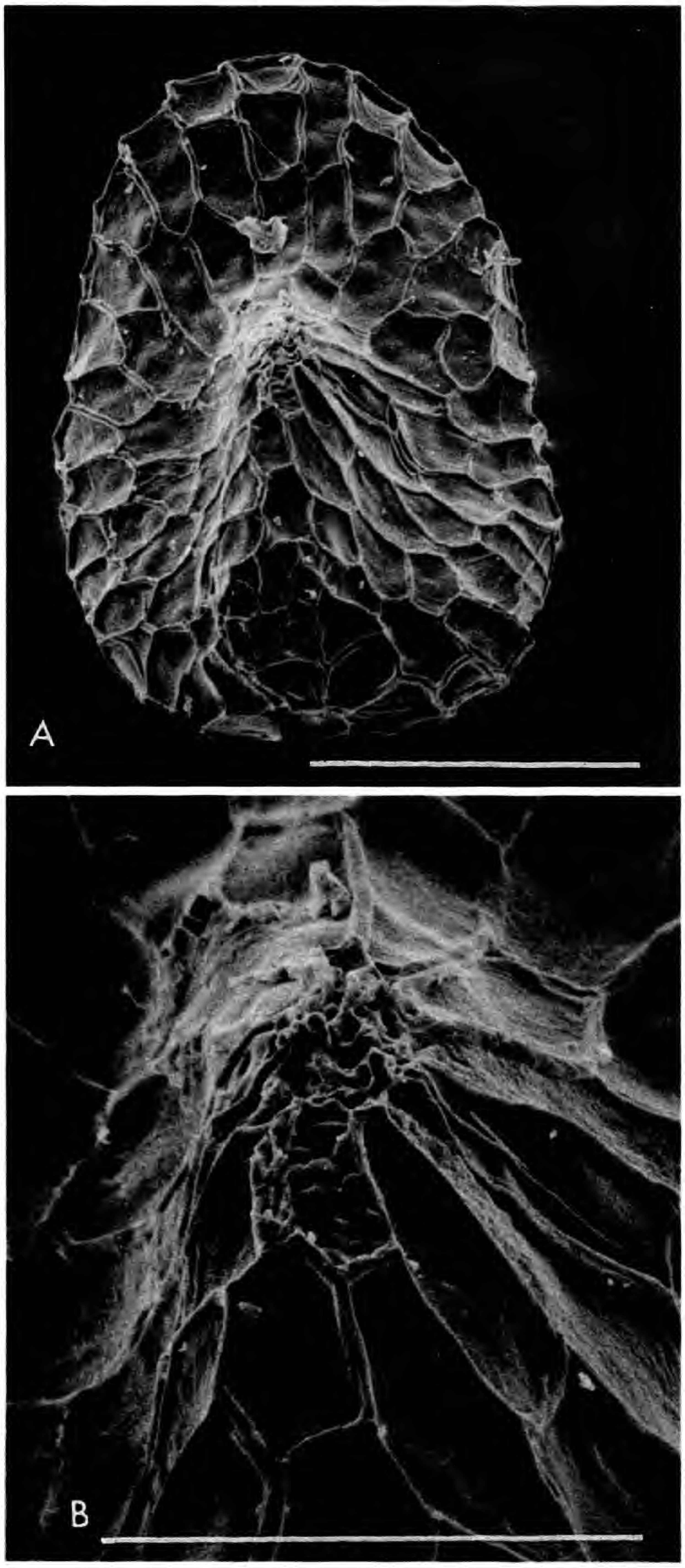

Figure 2. Scanning electron micrographs of *Hedyotis macvaughii* seeds (from holotype). —A. Ventral view showing punctiform hilum on hilar ridge, ×150, bar = 200 μm. —B. Enlarged view of hilum and testa areoles (cells), ×500, bar = 100 μm.

oblong, or elliptic, and seeds with a larger rounded hilar ridge. *Hedyotis macvaughii* also somewhat resembles *Houstonia palmeri* (including *H. longipes* S. Watson) of northern Mexico and *Houstonia longifolia* Gaertner of the U.S. and Canada (including *H. tenuifolia* Nuttall of the southeastern U.S.). These *Houstonia* species differ from *Hedyotis macvaughii* in several characters, including their longer corollas (usually 4–10 mm or in *H. palmeri* to 15 mm long) and crateriform seeds with a linear hilar ridge centered in a ventral depression (cup-shaped in *H. palmeri*).

The main body of *Hedyotis* species are Asian, being most numerous in India and China, and are related to *H. fruticosa* L., the type species (Jarvis et al., 1993). Terrell (1991) recognized about 20 species of *Hedyotis* in North America, of which 19 occur only in the southwestern U.S. or Mexico. The 20 species are diverse in morphology and differ variously from the Asian species. They remain in *Hedyotis* pending further study.

This new species is named for its collector, Rogers McVaugh, who has contributed much to our understanding of the Mexican flora.

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A New Species of *Mutisia* (Compositae–Mutisieae) from Ecuador

Carmen Ulloa Ulloa and Peter Møller Jørgensen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Mutisia magnifica* C. Ulloa & P. M. Jørgensen is described and illustrated. This species is distinguished by its large inflorescence heads, essentially glabrous phyllaries, ray florets with broadly elliptic, revolute ligulas, long inner lip segments, and long style. It is only known from the Cerro Uritusinga in the province of Loja, Ecuador.

RESUMEN. Se describe e ilustra *Mutisia magnifica* C. Ulloa & P. M. Jørgensen. Las características más notables son los grandes capítulos, las filarias prácticamente glabras, las lígulas elípticas, anchas y revolutas y, los segmentos del labio interior de las flores radiadas y el estilo largos. Esta especie sólo se conoce del Cerro Uritusinga en la provincia de Loja, Ecuador.

The South American genus *Mutisia* L. f. comprises some 60 species distributed in two well-defined areas: along the Andes from northern Colombia to southern Chile and Patagonia, and in southern Brazil and adjacent regions of Paraguay, Uruguay, and northern Argentina. The genus was revised by Cabrera (1965[1966]), and more recently Harling (1991) treated it for the Flora of Ecuador, Díaz-Piedrahita and Vélez-Nauer (1993) for Colombia, and Ferreyra (1995) for Peru. Harling recognized 11 species in Ecuador and expected one Colombian species to occur in the country.

During a recent collecting trip to the province of Loja, Ecuador, we collected a beautiful vine of the genus *Mutisia* that was climbing on the vegetation in the upper montane forest, southwest of the town of Loja. The specimens turned out to be a new species belonging to section *Mutisia* as treated by Cabrera (1965[1966]); it is here described, illustrated, and compared with other species.

Mutisia magnifica C. Ulloa & P. M. Jørgensen, sp. nov. TYPE: Ecuador. Loja: Cerro Uritusinga, Loja-La Palma Km 18.4, 4°5′24″S, 79°13′39″W, 3000 m, 28 Nov. 1994, *P. M. Jørgensen, C. Ulloa, S. León, H. Vargas & P. Lozano 1010* (holotype, MO; isotypes, LOJA, QCA, QCNE). Figure 1.

A *Mutisia grandiflora* Humboldt & Bonpland phyllariis glabriusculis, laciniis labii interioris florum radii longis, ligula ample elliptica, lobis florum disci glabriusculis differt.

Suffruticose vine climbing to ca. 10 m; branches striate, with a caducous ochraceous arachnoid indumentum. Leaves alternate, pinnate, 3–5-paired, rachis densely arachnoid to glabrescent, ending in a long trifid tendril; basal folioles stipuliform, sessile, ovate, mucronate at apex, cordate at base, 0.6–1.5 cm long, 0.4–1.3 cm wide; the others alternate or subopposite, petiolulate, petiolule to 2 mm long, densely arachnoid, folioles elliptic to ovate, acute-obtuse and mucronate at apex, rounded and commonly unequal at base, (1.5–)2.4–5.6 cm long, (0.8–)1.2–2.5 cm wide, finely reticulate, loosely arachnoid particularly on the main nerve to glabrescent above, paler and densely ochraceous arachnoid below. Inflorescence heads solitary, pendulous; peduncle striate, 5.8–13.5 cm long, glabrous or slightly arachnoid. Involucre narrowly cylindric, 8.5–9.6 cm long, 2.2–3 cm wide, phyllaries 25–30, in 6–7 series, entire, glabrous but minutely puberulous at tip, coriaceous, green turning black with age; outer ones broadly ovate, obtuse, mucronate, 0.5–1.5 cm long, 0.4–1.8 cm wide; median ones broadly oblong to oblong-obovate, obtuse to subacute, mucronate, 4.1–5 cm long, 1.8–2.2 cm wide; inner ones narrowly oblong, acute, 8.4–9 cm long, 0.6–1.4 cm wide. Ray florets pistillate, 8–9, ligulate; tube yellow, 7.5–8.8 cm long; ligula broadly elliptic, tridentate, recurved to revolute, bright orange-red, 5–6.4 cm long, 1.8–3 cm wide; interior lip of 2 laciniate segments, yellow, 2.5–4.3 cm long; rudimentary stamens exserted 4–6 mm; style 11.5–16.7 cm long. Disc florets perfect, 35–40, yellow; corolla 9.6–12.5 cm long, glabrous, but with scattered hairs with age; tube conspicuously wrinkled below the middle, not conspicuously bilabiated at apex, lobes ca. 0.5 mm long; anthers exserted 3–4.5 cm; style 12.1–16.5 cm long. Achenes 1.1–1.9 cm long; pappus off-white, plumose, 2.2–2.4 cm long.

Distribution, habitat, and phenology. Ecuador, Loja Province, Cerro Uritusinga toward hacienda La Palma, in upper montane forest, 3000 m, flowering and fruiting in November. This species was found in a relatively undisturbed forest patch,

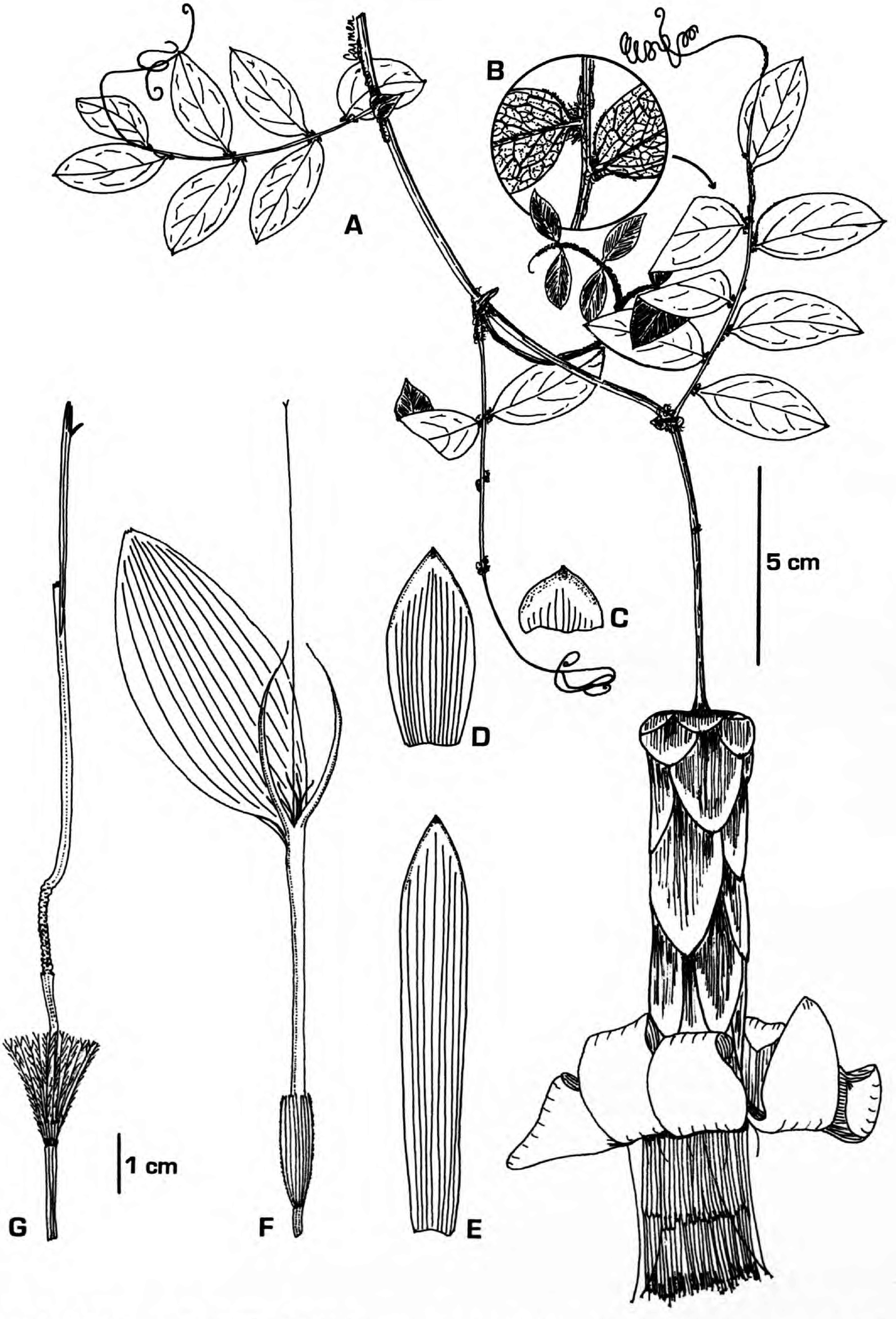

Figure 1. *Mutisia magnifica* C. Ulloa & P. M. Jørgensen, illustrated by C. Ulloa from herbarium specimens and photos of the type collection. —A. Branch with inflorescence. —B. Detail of leaflet venation above. —C, D, E. Outer, median, and inner phyllaries. —F. Ray floret. —G. Disc floret fully developed. The following parts share the same scale: B, C, D, E, F, and G.

which is severely threatened by the extraction of wood for charcoal production.

Mutisia magnifica is recognizable by its large inflorescence heads with narrowly cylindric involucre to 9.6 cm long, coriaceous, mostly glabrous phyllaries, and ray florets with reflexed to revolute, broadly elliptic ligulas, interior lip divided into two long segments, and extremely long style exceeding the ligula. In Harling's (1991) key to the species of *Mutisia* of Ecuador, *M. magnifica* would key out close to *M. grandiflora* Humboldt & Bonpland. Harling treated *M. intermedia* Hieronymus as a synomym of *M. grandiflora.* However, Díaz-Piedrahita and Vélez-Nauer (1993) considered *M. grandiflora* an endemic of Colombia's Cordillera Central and *M. intermedia* a species distributed from southern Colombia to central Ecuador. Furthermore, they suggested that all the Ecuadorian material cited by Harling might belong to *M. intermedia.* With only a few specimens in hand we cannot conclude whether these two names should be maintained as separate species, nor which is the correct name for all the Ecuadorian collections seen by Harling. It seems, however, that these species, together with *M. microcephala* Sodiro ex Cabrera, an endemic from Ecuador, constitute a complex that needs further study. This species complex has the branches covered with loosely arachnoid hairs and the lower surface of the leaflets with a dense indumentum very similar to *M. magnifica*; it differs, however, by the smaller involucre to 7.4 cm long, outer phyllaries with scattered to dense arachnoid indumentum, inner lip of the ray florets absent, lobes of disc corollas pubescent to villous apically, and disc florets fewer in number (25 to 30).

The long and well-developed inner lip of the ray florets in *M. magnifica* is a feature only found in *M. lanata* Ruiz & Pavón and *M. wurdackii* Cabrera within section *Mutisia.* These two species differ from *M. magnifica* by the broadly campanulate involucre, the tomentose recurved involucral bracts, and the pappus of the ray florets about as long as the tube.

This magnificent new species is only known from the type collection. The other species of the genus known from the province of Loja is *M. alata* Hieronymus of section *Guariruma.*

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New Taxa of *Fuchsia* from Central America and Mexico

Paul E. Berry
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Dennis E. Breedlove
Department of Botany, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, U.S.A. Current address: P.O. Box 564, Bolinas, California 94924, U.S.A.

ABSTRACT. This paper describes and illustrates three new taxa of *Fuchsia* from Central America and Mexico. *Fuchsia paniculata* subsp. *mixensis* P. E. Berry & Breedlove is newly described in section *Schufia*; it is from a small area in central Oaxaca, Mexico, that is a geographical transition area between *F. arborescens* and *F. paniculata*. The new subspecies is distinguished by its large pubescent leaves and flowers. Because it has both hermaphrodite and female individuals, it is placed with the gynodioecious *F. paniculata* rather than the exclusively hermaphrodite *F. arborescens*. In section *Encliandra, Fuchsia encliandra* subsp. *microphylloides* P. E. Berry & Breedlove is newly described from material that was previously included in *F. encliandra* subsp. *encliandra*, but differs in its more divaricating branching pattern and more serrulate leaves. *Fuchsia microphylla* subsp. *chiapensis* (Brandegee) P. E. Berry & Breedlove, stat. nov., is created to recognize populations that were most recently treated as part of *F. microphylla* subsp. *aprica*. This taxon differs from subspecies *aprica* in its larger leaves, more pubescent stems and leaves, and lower elevational range.

Since the latest treatments of the Mexican and Central American species of *Fuchsia* (Breedlove, 1969; Breedlove et al., 1982), additional field and herbarium studies have led us to recognize one new taxon in section *Schufia* and two additional taxa in section *Encliandra*, all of which are described and illustrated below. Both of these sections have members that exhibit sexual dimorphism, a trait which has evolved probably independently in several other sections of the genus. We follow the precedent of Breedlove (1969) in recognizing the new taxa at the subspecific level, implying that they have sufficient morphological, ecological, and/or geographical differences to distinguish them from other populations of the same species.

Fuchsia paniculata Lindley subsp. **mixensis** P. E. Berry & Breedlove, subsp. nov. TYPE: Mexico. Oaxaca: 35 km N of Ayutla along road from Mitla to Choapam, N slope of Cerro Zempoaltepetl, 2470 m, 17 Apr. 1988, (hermaphrodite), *Breedlove & Bartholomew 66841* (holotype, CAS). Figure 1.

A *Fuchsia paniculata* Lindley subsp. *paniculata* foliis ramulisque pubescentibus, nervis secundariis 14–18-jugatis, tubo florali sepalisque roseis differt; florum hermaphroditorum magnitudine formaeque *F. arborescenti* Sims similis.

Erect shrub 2.5–4 m tall, gynodioecious; branchlets ascending, 5–30 cm long, finely pubescent with hairs 0.2–0.4 mm long. Leaves opposite, membranous, the blade elliptic, 11–25 cm long, 4–10 cm wide, puberulent on the lower surface along the veins, becoming glabrescent on the upper surface but short hairs often present along the veins, secondary veins 14–18 on either side of the midvein, apex acute to subacuminate, base acute to attenuate, margin gland-denticulate; petiole 10–25 mm long, puberulent; stipules narrowly triangular, dark

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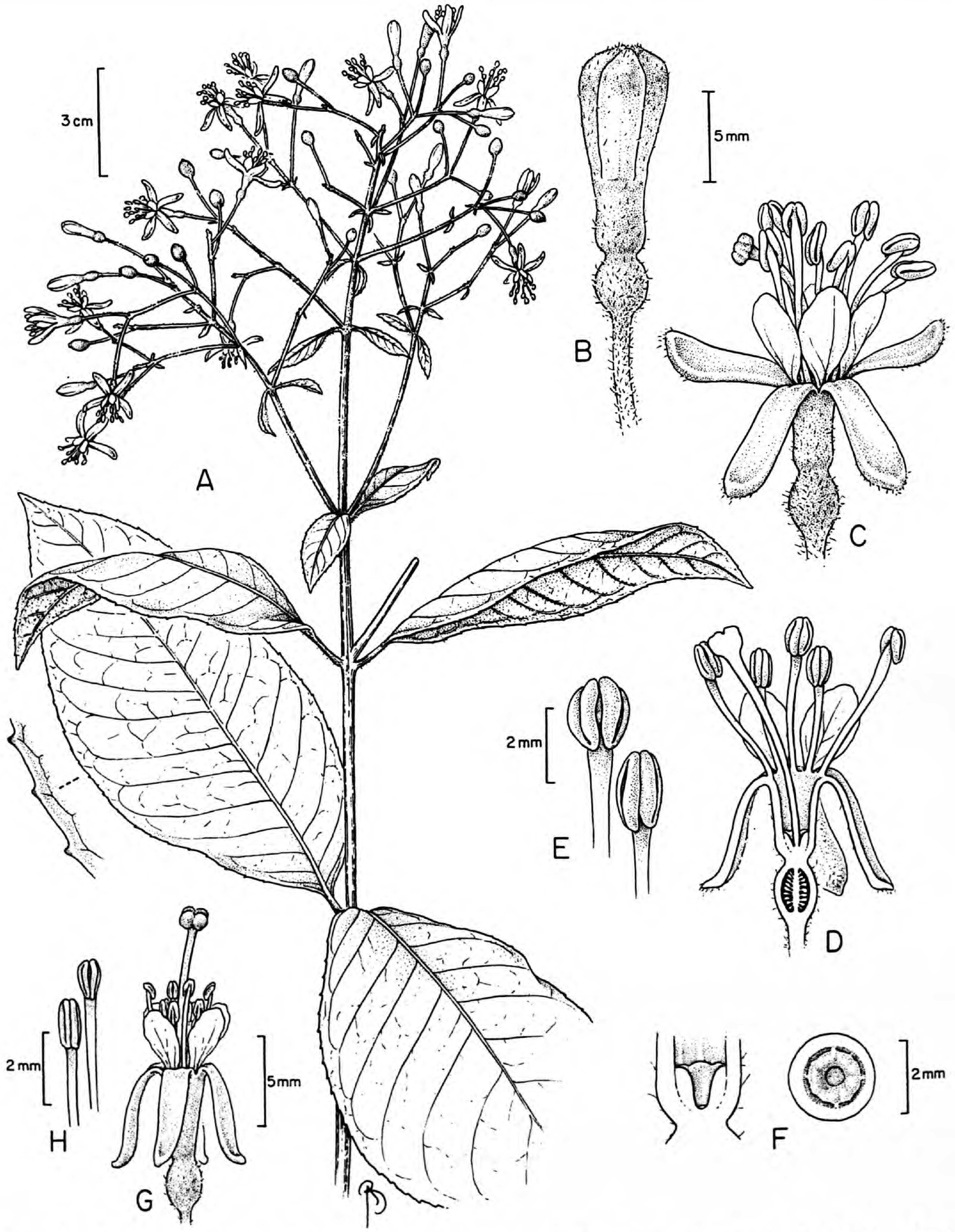

Figure 1. *Fuchsia paniculata* Lindley subsp. *mixensis* P. E. Berry & Breedlove. —A. Flowering branch, from *Martin 411* (MO). B–F. Details of bisexual flower, from individual cultivated at Strybing Arboretum. —B. Flower in bud. —C. Flower at anthesis. —D. Longitudinal section. —E. Details of fertile anthers. —F. Longitudinal section through the nectary at the base of the floral tube (left), and nectary as seen from above after the floral tube was cut off transversely. G, H. Details of female flower, from *Breedlove & Almeda 64697* (MO). —G. Flower at anthesis. —H. Details of sterile anthers.

brown, 0.3–0.7 mm wide, 1.0–1.5 mm long, crassate, soon deciduous. Flowers erect and numerous in terminal di- to trichotomously branched panicles, 10–20 cm long × 10–15 cm wide; narrowly leaflike, quickly deciduous bracteoles 1–3 mm long present at branching points of the panicle. *Perfect flowers*: Pedicels slender, 15–20 mm long, finely pubescent; ovary oblong, puberulent, 2–3 mm long; buds noticeably wider at the tip than below, 4–5 mm wide at the apex before opening; floral tube cylindric-conical, reddish pink to magenta, sparsely puberulent to subglabrous externally, 4–5 mm long at anthesis, 2–2.5 mm wide at the rim, 1–1.5 mm wide at the base; sepals narrowly oblong, 8–10 mm long, 1.5–2.5 mm wide, soon becoming reflexed back against the floral tube, the apex acute; petals obovate, pink-lavender, 4–6 mm long, 2–4.5 mm wide; nectary 1.2–1.5 mm high, slightly lobed, adnate to the bottom of the floral tube; filaments lavender, 7–11 mm long; anthers oblong, ca. 2 × 1 mm; style 14–18 mm long, exserted 10–13 mm beyond the rim of the tube; stigma capitate, ± 4-angled, 1.5–2 mm wide; fruit subglobose, 5–7 mm diam.; mature seeds not seen. *Female flowers*: Similar to the perfect ones except in the following characters: pedicels 9–14 mm long; floral tube cylindrical, 3.5–4.5 mm long, ca. 2 mm wide at the rim, 1–1.5 mm wide at the base; sepals 6–7 mm long, ca. 1.5 mm wide at the base; petals 3.5–4.5 mm long, 2–2.5 mm wide; filaments 3–4 mm long, sterile anthers oblong, ca. 1 mm long, nectary ca. 1.5 mm high; style 13–14 mm long; stigma square-capitate, with 4 noticeable lobes, 2–2.5 mm wide, exserted 8–9 mm beyond the rim of the tube.

Ecology and distribution. Known only from central Oaxaca, Mexico, in Distrito Mixe and Distrito de Ixtlán, in dense montane rainforest and mixed oak-conifer forest between 1700 and 2500 m elevation.

This subspecies is named after Mixe, the name of one of the districts of Oaxaca state where this taxon occurs, as well as the name of an indigenous group inhabiting the same area.

Reyes 1165 (MO) from ca. 1900 m elevation at Totontepec in Distrito Mixe, Oaxaca, is a particularly pubescent specimen that agrees with the denticulate margins and pubescent leaves of this subspecies. Although there are only flower buds and no fully developed flowers present, it appears to be a female individual, thus supporting its placement in *Fuchsia paniculata*. Another specimen cited from the same locality, *Reyes 868* (MO), is a fairly typical individual of *F. arborescens* (except that most of the leaves are alternate or subopposite), indicating that the two species are apparently sympatric. Whether or not *F. paniculata* subsp. *paniculata* occurs together in the same area is unknown, but it should be searched for.

Fuchsia arborescens reaches its southernmost limit in Oaxaca, but occurs there mainly along the Pacific slopes of the Sierra Madre. A few collections are known further inland, however, such as *Pringle 6242* from the Sierra de San Felipe and *Reyes 868* mentioned above. This species is entirely hermaphroditic and has glabrous, entire leaves. The shape and the size of the perfect flowers of *F. paniculata* subsp. *mixensis* are close to those of *F. arborescens*, whereas flowers of *F. paniculata* subsp. *paniculata* are smaller, narrower, and more violet in color throughout. However, the presence of female individuals in subspecies *mixensis* and the toothed leaves place it in *F. paniculata* rather than in *F. arborescens*. The fine pubescence of subspecies *mixensis* is quite unique from the other taxa in section *Schufia*, although Breedlove et al. (1982) cited several unusual pubescent individuals referable to either *F. arborescens* or *F. paniculata*, all from Oaxaca. Additional field studies in central Oaxaca should enable us to gain a better understanding of this transitional area between the two species that comprise *Fuchsia* sect. *Schufia* and whether interspecific hybridization is contributing to the presence of novel traits in populations such as those described here.

Paratypes. MEXICO. **Oaxaca:** Distrito de Ixtlán, Municipio de Yolox, along road between Yolox and Comaltepec at the river crossing closest to Yolox, 1700 m, 11 Mar. 1981, hermaphrodite, *Martin 411* (CAS, MO); 6.5 km E of the Mitla to Choapam road along road to Zacatepec, N slope of Cerro Zempoaltepetl, 2285 m, 26 Sep. 1986, male, *Breedlove & Almeda 64697* (CAS).

Fuchsia microphylla HBK subsp. **chiapensis** (Brandegee) P. E. Berry & Breedlove, stat. nov. *Fuchsia chiapensis* Brandegee, Univ. Calif. Publ. Bot. 6: 59. 1914. TYPE: Mexico. Chiapas: Cerro de Boquerón, Sep. 1913, *Purpus 6707* (holotype, UC; isotypes, BM, F, GH, MO, NY, US). Figure 2.

Fuchsia heterotricha Lundell, Contr. Mich. Herb. 4: 19. 1940. TYPE: Mexico. Chiapas: Volcán de Tacaná, Aug. 1938, *E. Matuda 2457* (holotype, MICH; isotypes, LL, MEXU, US).

Shrub 1–2 m tall, gynodioecious; branchlets 5–15 cm long, lightly to densely strigose with tan to white hairs. Leaves opposite, membranous, the blade elliptic-ovate, 15–40(–50) mm long, 8–23 (–30) mm wide, with scattered hairs on the lower surface along the veins, secondary veins 4–6 on

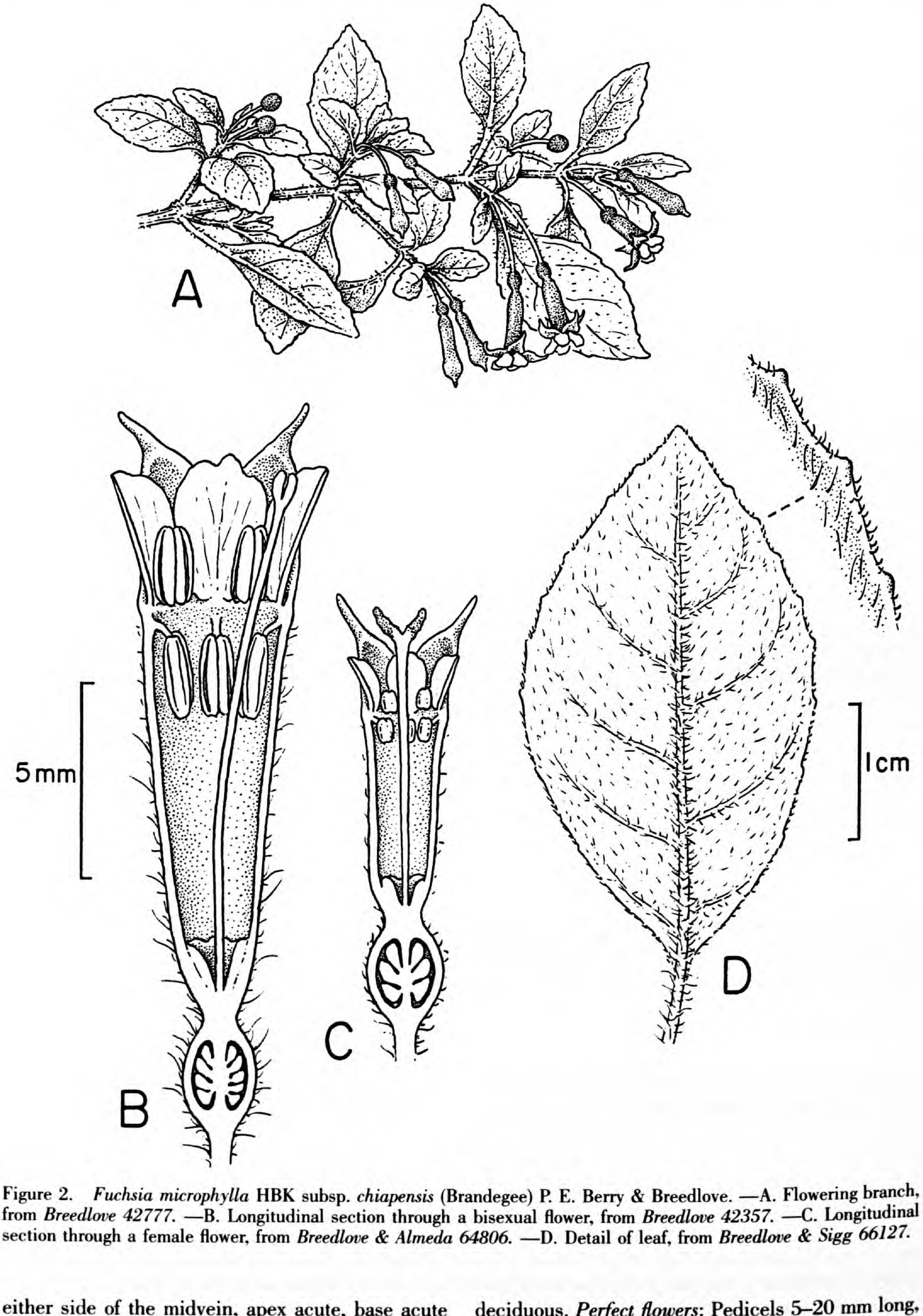

Figure 2. *Fuchsia microphylla* HBK subsp. *chiapensis* (Brandegee) P. E. Berry & Breedlove. —A. Flowering branch, from *Breedlove 42777*. —B. Longitudinal section through a bisexual flower, from *Breedlove 42357*. —C. Longitudinal section through a female flower, from *Breedlove & Almeda 64806*. —D. Detail of leaf, from *Breedlove & Sigg 66127*.

either side of the midvein, apex acute, base acute to cuneate, margin subentire to dentate; petiole 8–23 mm long; stipules narrowly lanceolate, dark brown, ca. 0.5 mm wide, 0.5–1 mm long, crassate, deciduous. *Perfect flowers*: Pedicels 5–20 mm long, strigose; ovary rounded, pubescent, 1–2 mm long; floral tube cylindrical, pubescent externally, red, 5–11 mm long, 2–4.5 mm wide at the rim, 1.5–2.5

mm wide at the base; sepals 2.5–4 mm long, 1.5–2.5 mm wide at the base, spreading, the apex subacuminate; petals red, 2–3 mm long, 2–4 mm wide, ± 3-lobed at the apex; nectary 0.7–1.2 mm high, entire; style 8–12 mm long, the stigma capitate, exserted 3–6 mm beyond the rim of the tube; antesepalous stamens exserted above the rim of the tube, antepetalous ones included inside the floral tube; filaments 0.5–1.5 mm long; anthers 1.4–2.0 mm long, 0.7–1.0 mm thick; fruit subglobose, 5–7 mm diam., with 12–20 seeds; seeds 1.9–2.4 mm long, 1.0–1.3 mm thick. *Female flowers*: Pedicels 6–20 mm long; floral tube cylindric-obconic, 4–6 mm long, 2–2.5 mm wide at the rim, ca. 1 mm wide at the base; sepals narrowly triangular, 3–5 mm long, 1.5–2 mm wide at the base; petals 0.7–2 mm long, 0.7–1.7 mm wide; sterile anthers oblong, 0.5–1 mm long, filaments 0.3–0.8 mm long; nectary 0.5–0.8 mm high; style 7–8 mm long, the stigma exserted 1.5–2.5 mm beyond the rim of the tube, its lobes ca. 1 mm long.

Ecology and distribution. In Mexico in the mountains of southwestern Chiapas (Sierra de Soconusco) and in scattered localities along the Pacific slope of Guatemala and El Salvador. This subspecies occurs in montane rainforest, evergreen cloud forest, and wet pine-oak forest at elevations between 1800 and 2400 m.

Fuchsia microphylla subsp. *chiapensis* was previously treated by Breedlove (1969) under *F. microphylla* subsp. *aprica,* which he considered a particularly variable taxon, but several morphological and ecological criteria support the separation of subspecies *chiapensis.* Subspecies *aprica* is a higher elevation group of populations occurring mostly between 2700 and 3400 m. The size and shape of the leaf blades also distinguishes the two taxa: ovate in subspecies *chiapensis* and mostly 3–4 cm long × 1.5–2 cm wide vs. elliptic-oblanceolate and mostly 1.5–2.5 cm long × 0.5–1(–1.5) cm wide in subspecies *aprica.* Perhaps most characteristic of the leaves of subspecies *aprica* is the gradually attenuate base contrasting to the mostly acute apex and the firm texture of the blade, with crenate-serrate margins. In subspecies *chiapensis,* the base is more cuneate and not so markedly different from the apex, the blade is membranous, and the margins vary from subentire to toothed. Subspecies *aprica* is usually glabrous on the flowers and leaves, whereas subspecies *chiapensis* characteristically has a pubescent floral tube externally and noticeably pubescent young stems and leaves. Fresh flowers of subspecies *aprica* are magenta, whereas those of subspecies *chiapensis* are red. Both subspecies intergrade freely at intermediate elevations, and subspecies *aprica* replaces *chiapensis* at higher elevations on the same slopes.

Representative specimens cited. MEXICO. **Chiapas:** 21.5 mi. NW of Motozintla on road to Siltepec, 1.3 mi. E of El Porvenir, 1770 m, 11 Feb. 1979, *Croat 47317* (MO); path from Talquian to Volcán Tacaná, 1800 m, 20 Oct. 1985, *Martínez et al. 14162* (MEXU, MO); Cerro del Boquerón, June 1914, *Purpus 7168* (MO); above El Rosario, 8 mi. S of Motozintla, 1800 m, 10 July 1977, *Croat 40742* (MO); near Niquivil at junction with a small side ridge to Cerro Boquerón, 16 Dec. 1976, *Breedlove 42777* (DS, MO); SW side of Cerro Mozotal, 2100 m, 23 Nov. 1981, *Breedlove & Bartholomew 55729* (CAS, MO); ridge NE of Cerro Boquerón on road from El Rosario to Niquivil, 2255 m, 7 Nov. 1986, *Breedlove 65736* (CAS), 29 Nov. 1986, *Breedlove & Sigg 66128* (CAS), *66129* (CAS), *66136* (CAS); 45–50 km NE of Huixtla along road to Motozintla, 1900 m, 17 Nov. 1971, *Breedlove & Smith 22608* (DS); NW slope of Volcán Zunil, 6–8 km S of Zunil along road to Fuentes Georgina, 2375 m, 2 Oct. 1986, *Breedlove & Almeda 64796* (CAS), *64805* (CAS), *64806* (CAS). GUATEMALA. **Chimaltenango:** 15 km W of Patizicia on highway from Patzún, 2300 m, 14 July 1977, *Croat 41081* (MO); highway CA1 24 km NNW of turnoff to Patzún, 2480 m, 13 Feb. 1987, *Croat & Hannon 64751* (MO). EL SALVADOR. **Santa Ana:** Cantón La Joya, 13°52′N, 89°52′W, 1750 m, 8 Nov. 1989, *Villacorta & Calderón* (LAGU, MO). **Sonsonate:** near top of Cerro Verde, 2030 m, 30 July 1977, *Croat 42202* (MO); Laguna de las Ninfas, 13°35′N, 89°47′W, 1830 m, 3 Apr. 1991, *Villacorta & Cortez 737* (LAGU, MO).

Fuchsia encliandra Steudel subsp. **microphylloides** P. E. Berry & Breedlove, subsp. nov. TYPE: Mexico. Oaxaca: crest of ridge just N of Chicahauxtla, 2470 m, 5 Nov. 1983, (male plant), *Breedlove & Almeda 59742* (holotype, CAS; isotype, MO). Figure 3.

A *Fuchsia encliandra* Steudel subsp. *encliandra* ramulis valde divaricatis, statura majore, foliis lanceolato-ellipticis marginibus serrulatis, floribus magenteis differt.

Shrub 1–2 m tall, dioecious; branchlets 4–18 cm long, emerging at a ± 90° angle from the main stem, subglabrous to finely appressed-pubescent with tan hairs 0.2–0.4 mm long. Leaves opposite, firmly membranous, the blade lance-elliptic, 15–40(–50) mm long, 7–15 mm wide, glabrous on both sides or sometimes with fine appressed hairs along veins or margins on lower surface, secondary veins 4–6 on either side of the midvein or sometimes inconspicuous, apex acute, base attenuate, margin subentire to serrulate, sometimes ± revolute; petiole 4–10 mm long; stipules narrowly lanceolate, dark brown, ca. 0.3 mm wide, 0.5–0.7 mm long, deciduous. *Male flowers*: Pedicels 5–22 mm long; floral tube cylindrical, glabrous, magenta, 9–11 mm long, 2–4 mm wide at the rim, 1.5–2 mm wide at the base; sepals triangular, 3–4 mm long, 2–2.5 mm

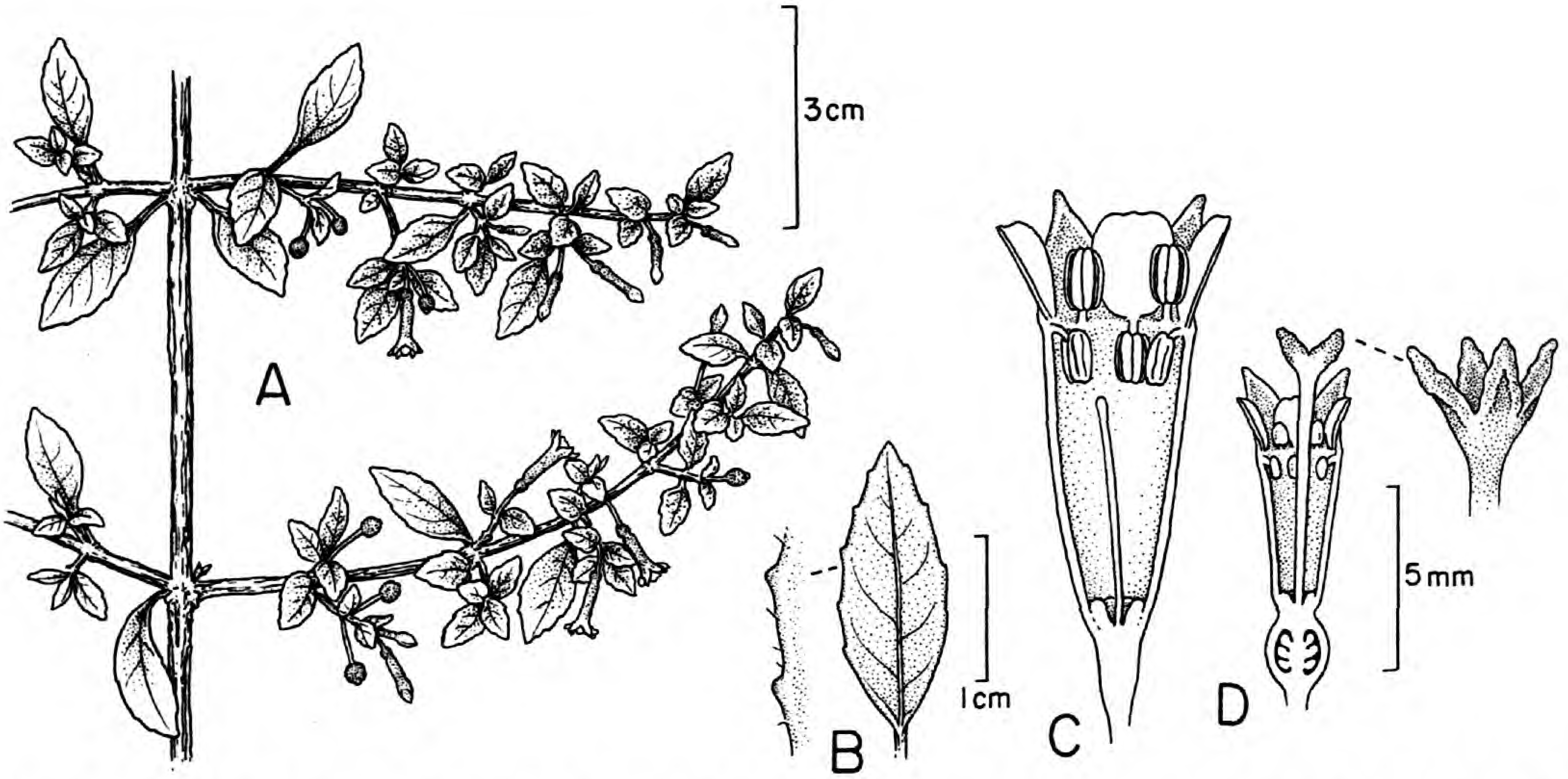

Figure 3. *Fuchsia encliandra* Steudel subsp. *microphylloides* P. E. Berry & Breedlove. —A. Flowering branch showing divaricate branchlets, from *Breedlove 65077.* —B. Detail of leaf, from *Breedlove 59742.* —C. Longitudinal section through a male flower, from *Breedlove 59742.* —D. Longitudinal section through a female flower, with detail of the stigma, from *Breedlove 59743.*

wide at the base, spreading, the apex shortly acuminate; petals magenta, subrotund, 2–3 mm long, 2–3 mm wide, slightly 3-lobed at the apex; nectary 0.9–11 mm high, entire; style 6–10 mm long, included within the floral tube, the stigma inconspicuous, aborted; antesepalous stamens exserted above the rim of the tube, antepetalous ones included inside the floral tube; filaments 1.0–1.5 mm long; anthers oblong 1.6–2.0 mm long, 0.7–1.0 mm thick. *Female flowers*: Pedicels 4–7 mm long; ovary spherical, ca. 2 mm diam.; floral tube narrowly cylindric, 5–7 mm long, 2–2.5 mm wide at the rim, ca. 1 mm wide at the base; sepals triangular, 2.5 mm long, 1.5–2 mm wide at the base; petals 1.3–2 mm long, 1.0–1.3 mm wide; sterile anthers oblong, 0.5–0.8 mm long, filaments 0.2–0.6 mm long; nectary 0.5–0.8 mm high; style 7–9 mm long, the stigma exserted 1.5–2.5 mm beyond the rim of the tube, its lobes ca. 1 mm long; fruit subglobose, 4–5.5 mm diam., with 12–18 seeds; seeds 1.5–2.0 mm long, 0.9–1.1 mm thick.

Ecology and distribution. An abundant shrub in wet pine-oak forests and in cloud forests along the crest of the Sierra Madre of Guerrero, Michoacán, and Oaxaca, in Mexico. It occurs mainly above 2000 m elevation, usually between 2200 and 2500 m, but occasionally up to 3000 m.

This subspecies is named for its strongly divaricate branching pattern, which resembles that of *Fuchsia microphylla* but is not found in the other two subspecies of *F. encliandra.* Specimens of subspecies *microphylloides* were previously included by Breedlove (1969) under *F. encliandra* subsp. *encliandra.* However, that subspecies can be distinguished geographically, ecologically, and morphologically from subspecies *microphylloides.* Subspecies *encliandra* is locally abundant and is usually restricted to mesic sites in drier pine-oak or only pine or oak forests on the interior slopes of the Sierra Madre and in many other interior mountain ranges from Hidalgo to Oaxaca. It is a smaller shrub that rarely exceeds 1 m in height and is usually found below 2000 m elevation. In subspecies *encliandra,* the floral tube is red and the petals pink, white, or red, whereas the floral tube of subspecies *microphylloides* is magenta, as are the petals. Also, the leaves of subspecies *encliandra* are typically ovate-elliptic and entire, while those of subspecies *microphylloides* are lance-elliptic and usually serrulate.

Paratypes. MEXICO. **Guerrero:** W of Puerto El Gallo along road to Toro Muerto, 2530 m, 9 Oct. 1986, *Breedlove & Almeda 65041* (CAS), *65077* (CAS); Asoleadero, ca. 15 km W of Camotla, 45 km W of Chilpancingo, 2650 m, 2 Dec. 1963, *Feddema 2849* (MO), *2855* (MO); Sierra Madre del Sur, 15 km SW of Filo de Caballo along Milpillas-Atoyac road, ca. 3000 m, 21 May 1987, *Miller & Campos 2845* (MO), 16 Oct. 1975, *Reveal et al. 4209* (MO). **Michoacán:** 32 km SE of Puerto las Cruces, N of Coalcoman along road to Dos Aguas, Sierra de Coalcoman, 2195 m, 17 Sep. 1986, *Breedlove & Anderson 64379* (CAS), *64380* (CAS). **Oaxaca:** crest of ridge just N of Chicahauxtla, 2470 m, 5 Nov. 1982, (female plant), *Breedlove & Almeda 59743* (CAS, MO); highway 175 between Oaxaca and Pochutla, 5 km S of Suchixtepec, 2300 m, 19 Jan. 1979, *Croat 45992* (MO); ca. 32 km N of Pochutla on highway 175, 19 Aug. 1970, *Norris & Taranto 16033* (MO), *16034* (MO).

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Two New Combinations in *Kengyilia* (Poaceae)

Cai Lian-bing
Northwest Plateau Institute of Biology, Academia Sinica, Xining, Qinghai 810001, People's Republic of China

ABSTRACT. Two new combinations are provided for Chinese species of Poaceae: *Kengyilia leiantha* (Keng) L. B. Cai and *Kengyilia kaschgarica* (D. F. Cui) L. B. Cai.

Kengyilia Yen & J. L. Yang (1990) was originally published as a new genus of the tribe Triticeae (Poaceae). Initially, the genus included only *K. gobicola* Yen & J. L. Yang. Subsequently, Baum et al. (1991), Yang and Yen (1992), and Yang et al. (1992, 1993) not only added new species to the genus, but also transferred some species of *Roegneria* and *Agropyron* because the P genome in *Kengyilia* agrees with the P genome of the species of these genera, and in appearance these taxa possess similar morphological characters. The work of Yen and Yang (1990) and Yen et al. (1992, 1993) was accepted by most taxonomists. Chen et al. (1991) published an academic thesis in which they discussed the systematic position of the genus and the relationships among related genera, based on the micromorphology of the leaf epidermis, and concluded that the genus *Kengyilia* is a new branch derived from the primitive *Roegneria.*

Thus far, 19 species of *Kengyilia* have been reported. Most of the species are endemic to China, and they are mainly distributed on the Qinghai–Xizang Plateau and the contiguous zone north of the plateau. In external morphology, the genus *Kengyilia* has erect or slightly curved spikes often with dense spikelets, ovate-lanceolate or oblong glumes, and lemmas covered with hairs. The diagnostic characteristics of *Kengyilia* and its nearest related genera have been documented recently by Baum et al. (1995). Their key indicates that *Kengyilia* is distinguished from *Agropyron* by the glumes symmetric, not keeled, but midrib prominent, and from *Roegneria* and *Elymus* by the spikes crowded, with rachis internodes short, spikelets densely imbricated, and lemma awns up to 5 mm long. (If the spikes, spikelets, and lemma awns lack the aforementioned characters, then the genus differs from *Roegneria* by the glumes with prominent to slightly keeled midrib, and from *Elymus* by the palea shorter than the lemma, or if equal to the lemma then with an obtuse or retuse tip.) According to these external characters, however, there still are two species that remain in *Roegneria* and *Elymus,* namely *R. leiantha* Keng and *E. kaschgaricus* D. F. Cui, that have close relationships to *Kengyilia,* and are remote to the original genus whether in the morphology of the spike or in the arrangement and constitution of the spikelet. The presence of these species in *Roegneria* and *Elymus* causes both overlap of characters and confusion of taxa. Therefore, in order to safeguard the uniformity of generic characteristics and the clarity of the demarcation between the genera, the two species should be assigned to the genus *Kengyilia.* The following are the two new combinations.

Kengyilia leiantha (Keng) L. B. Cai, comb. nov. Basionym: *Roegneria leiantha* Keng, Acta Nanjing Univ. (Biol.) 3: 42. 1963. TYPE: China. Qinghai: Datongxian, Xiangshan, on the edge of a pool, alt. 2380 m, 3 July 1945, *Hejing 758* (holotype, NJU).

Kengyilia kaschgarica (D. F. Cui) L. B. Cai, comb. nov. Basionym: *Elymus kaschgaricus* D. F. Cui, Bull. Bot. Research 10: 27. 1990. TYPE: China. "Xinjiang: Tashikurgan et Aheqi Xian, ad pratum alpinum frigidum crescens, alt. 2800–3800 m; 4 XII 1978, Exped., Xinjiang Northwest Inst. Bot. 922" (holotype, XJBI).

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A Second Species of the Malagasy Genus *Secamonopsis* (Asclepiadaceae)

Laure Civeyrel
Laboratoire de Palynologie & Paleoenvironnements, ISEM-EPHE, Université Montpellier II
34095, Montpellier cedex 05, France

Jens Klackenberg
Naturhistoriska riksmuseet, Sektionen för fanerogambotanik, S-104 05 Stockholm, Sweden

ABSTRACT. *Secamonopsis microphylla* sp. nov., from dry southern Madagascar, is described, illustrated, and compared to *S. madagascariensis* Jumelle, the only other known species of this genus.

While preparing a treatment of the tribe Secamoneae (Asclepiadaceae) for the *Flore de Madagascar et des Comores,* and during the course of a survey of the pollen structure within this tribe, a new species, *Secamonopsis microphylla,* was encountered. This adds a second species to the hitherto monotypic Malagasy genus *Secamonopsis* Jumelle.

Secamonopsis microphylla Civeyrel & Klackenberg, sp. nov. TYPE: Madagascar. Toliara Prov.: 17 km E of Toliara on Road No. 7, E of "Montagne de la Table," alt. 110 m, 20 Nov. 1994, *Civeyrel 1242* (holotype, P; isotypes, K, S, TAN). Figure 1.

Species haec a *Secamonopsi madagascariensi* habitu fruticoso, brachyblastis foliiferis, inflorescentiis 1–3 floribus et foliis minoribus differt.

Shrub, prostrate or erect, up to 1.5 m tall, with young branches ± densely covered by short appressed hairs, glabrescent. Leaves mostly on opposite brachyblasts, grayish green with reddish margin; blade 5–10 × 2–3 mm, oblong to narrowly obovate, tapering at base into a distinct petiole, usually rounded but sometimes acute or truncate at the apex, with sparse to rather dense short appressed hairs on both sides, sparser above, with even margin; venation with only midrib visible; epidermal cells of lower leaf surface tuberculate-papillate; petiole 1–2 mm long, with appressed hairs. Flowers pentamerous, actinomorphic, usually solitary but sometimes 2–3 on the brachyblasts; pedicels 1–2 mm long; bracts 2 or 3, 1–3 mm long. Calyx lobes free, 1.8–2.4 × 1.5–2.0 mm, concave, longer than the corolla tube, obovate to ± circular, rounded at the apex, hairy outside and along the margin, glabrous inside, without colleters. Corolla imbricate, with lobes fused for ca. ⅖ of their length into a tube, yellow; tube 0.9–1.2 mm long, with long white retrorse hairs in upside down Vs with 5 bunches of erecto-patent hairs at the top below the lobe sinuses; lobes 1.5–1.7 × 1.2–1.4 mm, oblong, rounded at the apex, thick, glabrous. Stamens inserted at base of corolla tube; staminal column 0.6–0.8 mm long; filaments with horny margins distinctly projecting at base; thecae papillately hairy at the top. Coronal lobes inserted along lower half of anthers, 0.3–0.5 mm long, dorsiventrally compressed, ± as broad as long, rounded at the apex, straight, much shorter than the staminal column, glabrous. Pollinia seemingly 2 per corpusculum but in fact 4 glued together in pairs, ca. 0.1 mm long, ± ascending, lens-shaped to ellipsoid, attached to 2 narrow distinct caudicles on an ellipsoid soft corpusculum. Stigma head slightly projecting above the staminal column; narrower upper part ca. 0.4 mm long, slightly bifid at the apex. Follicles usually paired, ca. 4 × 0.5 cm, narrowly ovoid, glabrous, horizontal. Seeds ca. 5 mm long; hairs 7–15 mm long.

Secamonopsis microphylla is sympatric with the hitherto only known species of *Secamonopsis, S. madagascariensis* Jumelle (1908: 6), but seems to be restricted to calcareous soil with rather sparse shrub vegetation while *S. madagascariensis* is usually found in gneissic areas. It is distributed in the dry southwestern part of Madagascar and has not been found outside the Southern Domain phytogeographical area (after Humbert, 1955). Flowering November to March.

Secamonopsis microphylla clearly belongs to the genus *Secamonopsis,* although it differs considerably in habit from *S. madagascariensis.* It has the same structure of the gynostegium and the characteristic pollinaria as in *S. madagascariensis.* The

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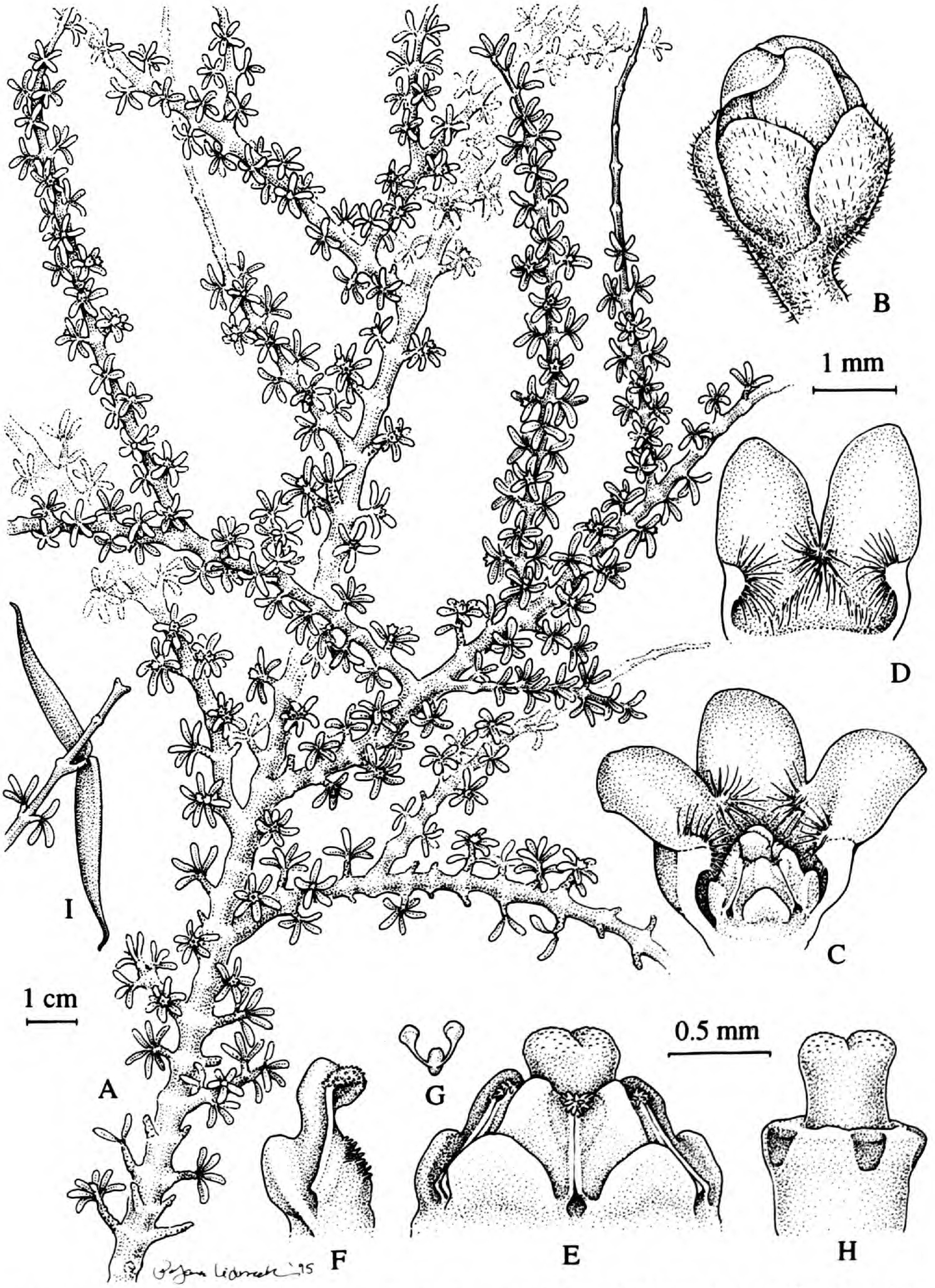

Figure 1. *Secamonopsis microphylla* Civeyrel & Klackenberg. —A. Habit. —B. Flower in bud. —C. Gynostegium and portion of corolla. —D. Portion of corolla from within. —E. Gynostegium. —F. Anther in lateral view. —G. Pollinarium. —H. Stigma head. —I. Follicles. A. *Phillipson 3000.* B–H. *Civeyrel 1242.* I. *Civeyrel 1239.*

pollinarium consists of a soft ellipsoidal to rounded corpusculum furnished with a long slit facing outward, a structure also found in other genera of tribe Secamoneae, but differs by its unique pair of long, curved, resilient caudicles each carrying two pollinia glued together. While *S. madagascariensis* is usually a slender, rather few-branched twining herb, *S. microphylla* is a much-branched, low hardwooded shrub with the leaves on brachyblasts. *Secamonopsis microphylla* is furthermore distinguished by its short 1–3-flowered inflorescences and small leaves up to 1 cm long, compared to the large many-flowered inflorescences and the usually narrow leaves 1.5–10 cm long characteristic of *S. madagascariensis.* Characteristic for both species are the lower leaf epidermis, which is tuberculate-papillate, and the thecae furnished with papillae or small hairs at the top. In *S. madagascariensis,* however, these papillae are larger and form two distinct marginal crests at each anther, becoming dark when dry. Furthermore, dark spots on the outer face of the corolla lobes, when dry, due to resin deposits, are present in *S. microphylla,* but lacking in *S. madagascariensis.* The corolla has imbricate aestivation, a rare condition in Asclepiadaceae but not uncommon in Malagasy *Secamone,* where both valvate and imbricate, as well as sinistrosely and dextrorsely contorted flowers are found (Klackenberg, 1992).

Paratypes. MADAGASCAR. **Toliara:** de Ranopiso à Amboasary, 100–150 m, 1967, *Bernardi 11560* (P); env. de Tuléar-Table, 1961, *Chauvet 39* (P); route de Sarodrano, *Chauvet 195* (P); 15 km E of Toliara on Road No. 7, "Montagne de la Table" hill, alt. 110 m, 1994, *Civeyrel 1206* (K, P, S, TAN); 20–25 km E of Toliara in direction of river Onilahy, first road on the right of the Road No. 7 after "Montagne de la Table" before the first village, 50–60 m, 1994, *Civeyrel 1239* (K, P, S, TAN); La Table en bas, *Dequaire 27491, 27492* (P); colline de la Table près de Tuléar, 100–140 m, 1934, *Humbert 14388* (P); Cap Sainte-Marie et ses abords, 1–150 m, 1955, *Humbert & Capuron 29296* (P); Ampanihy to Androka, 36 km SW of Ampanihy, 150 m alt., 1990, *Liede et al. 2679* (MO, P); La Table de Tuléar, alt 20 m, 1971, *Mabberley 944* (K); Cap Sainte Marie Reserve, SW of Tsiombe, 200 m alt., 1988, *Phillipson 3000* (K, MO, P); SE of Tuléar on Route Nationale 7, 15 km from town near la Table, 75 m alt., 1988, *Phillipson 3037* (K, MO, P).

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Sciaphyllum amoenum (Acanthaceae) is a Peruvian *Streblacanthus*

Thomas F. Daniel

Department of Botany, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, U.S.A.

ABSTRACT. *Sciaphyllum amoenum* has been known solely from cultivated plants of unknown origin. This species exhibits all of the diagnostic characteristics of *Streblacanthus* but is not conspecific with any previously described species of that genus. The cultivated specimens, including the type, of *S. amoenum* correspond to an undescribed series of collections from Peru. Thus the species is transferred to *Streblacanthus,* and its place of origin can be established. *Streblacanthus amoenus* is compared with the other species of this genus of American plants. *Streblacanthus boliviensis* is considered to be a synonym of *S. dubiosus.*

Bremekamp (1940) described a plant known to him only from cultivated material as a new genus and species, *Sciaphyllum amoenum* Bremekamp. Plants were reported to have been cultivated in Europe (the Netherlands and England) and Asia (Java), but their origin was not known. Bremekamp (1940) concluded that *S. amoenum* would be included in his Odontonemeae, and he discussed its probable relatives in that tribe. He noted that *S. amoenum* had pollen similar to *Streblacanthus* Kuntze, but he did not pursue other similarities to or differences from this genus. Bremekamp's description and figure both suggested to me a likely relationship with *Streblacanthus,* and examination of type material confirms that *Sciaphyllum amoenum* belongs in that genus.

Streblacanthus is a small American genus of Odontonemeae characterized by corollas with a long, narrow tube and a bilabiate limb; an androecium of two stamens and no staminodes; tricolporate pollen with six pseudocolpi; and capsules with flattened, subcircular heads. Eight names have been utilized in the genus; however, many of these have been synonymized or shown to refer to species in other genera. For example, Daniel (1990) transferred *Streblacanthus parviflorus* Leonard to *Schaueria* Nees; Daniel (1993) included *Streblacanthus chirripensis* Lindau in the synonymy of *Justicia chamaeranthemodes* (Kuntze) T. F. Daniel; and Durkee (1986) included both *Streblacanthus macrophyllus* Lindau and *Streblacanthus longiflorus* Cufodontis within *Streblacanthus monospermus* Kuntze.

Sciaphyllum amoenum has all of the diagnostic characteristics of *Streblacanthus* but is not conspecific with any of the remaining species in that genus. However, there are numerous unidentified Peruvian collections of *Streblacanthus* at US that correspond to Bremekamp's (1940) description and illustration, the type specimen at U, and other specimens from cultivated plants. *Sciaphyllum amoenum* is therefore transferred to *Streblacanthus,* and the provenance of this cultivated plant can be established as Peru. The unispecific genus *Sciaphyllum* Bremekamp becomes a synonym of *Streblacanthus.* A comprehensive description of the species is provided based on cultivated and field-collected specimens.

Streblacanthus Kuntze, Rev. Gen. Pl. 1: 497. 1891. TYPE SPECIES: *Streblacanthus monospermus* Kuntze.

Sciaphyllum Bremekamp, Recueil Trav. Bot. Néerl. 37: 298. 1940. Syn. nov. TYPE SPECIES: *Sciaphyllum amoenum* Bremekamp.

Streblacanthus amoenus (Bremekamp) T. F. Daniel, comb. nov. Basionym: *Sciaphyllum amoenum* Bremekamp, Recueil Trav. Bot. Néerl. 37: 298. 1940. TYPE: Indonesia. West Java: Buitenzorg (= Bogor) suburb of Kotta Paris, 4 July 1922, *R. C. Bakhuizen van den Brink, Jr. 1402* (holotype, U; see discussion).

Erect perennial herb or shrub to 2.5 m tall; young stems subterete to subquadrate, evenly pubescent with straight eglandular trichomes and inconspicuous sessile or stipitate glands up to 0.05 (–0.1) mm long. Leaves petiolate; petioles to 135 mm long; blades deltate to broadly ovate to ovate-elliptic, 65–270 mm long, 52–180 mm wide, 1.1–1.7 times longer than wide, acute to subacuminate at apex, rounded to truncate to subcordate at base, surfaces green adaxially, purplish abaxially, pubescent (especially along major veins) with cauline type trichomes; a pair of reduced, sessile leaves often subtends inflorescence. Inflorescence of ax-

Figure 1. Map of Peru showing the natural distribution of *Streblacanthus amoenus.*

illary and terminal pedunculate spicate thyrses to 4.5 dm long (including peduncle and excluding flowers), these sometimes branched proximally; peduncles (to first branch or dichasium) to 110 mm long, rachis pubescent with straight to flexuose eglandular (and ± inconspicuous glandular) trichomes to 0.5 mm long (see discussion); dichasia opposite (to subopposite to alternate) at nodes, sessile; flowers 1–7 per dichasium, subsessile or borne on pedicels to 3.5 mm long. Bracts sessile, triangular to ovate to lanceolate, 1.5–5 mm long, 0.7–2.5 mm wide, pubescent like rachis. Bractlets and secondary bractlets triangular to ovate to lanceolate, 1–3 mm long, 0.5–1 mm wide, pubescent like rachis. Calyx 5-lobed, 5–8.5 mm long; lobes lance-subulate, 4.5–8 mm long, externally pubescent with glandular (sometimes inconspicuous or represented by sessile glands only) and eglandular trichomes to 0.2 mm long. Corolla purplish or pinkish, 24–36 (–40) mm long, externally pubescent with flexuose eglandular trichomes to 0.5(–1) mm long; tube gradually ampliate distally from near midpoint or more abruptly ampliate distally into a throat (4–) 10–16 mm long, 2.5–5 mm diam.; upper lip ± triangular, 4–8 mm long, apically emarginate; lower lip 4–10 mm long with elliptic (to subcircular) lobes 4–8 mm long, 2.5–6 mm wide. Stamens exserted from corolla tube; thecae parallel, 2–2.2 mm long. Style 19–35 mm long, glabrous (or sparsely pubescent proximally); stigma subcapitate, 0.2 mm long. Capsule 11.5–17 mm long, pubescent with straight to flexuose eglandular trichomes 0.05–0.5 mm long. Seeds 4, flat, subcordate, 4–4.7 mm long, 3.5–4.5 mm wide, surface and margin papillose.

Phenology. Flowering: May–December; fruiting: June–December.

Distribution. Native to Peru (Fig. 1; Ayacucho, Huánuco, Junín, Loreto, and San Martín); plants occur in tropical moist forests at elevations from 250 to 800 m. Cultivated in Europe, Asia, North America, South America, and the West Indies.

Additional specimens examined. NETHERLANDS. **Utrecht:** Baarn, *Cantonspark 3404* (U). U.S.A. **California:** San Francisco Co., Strybing Arboretum, Golden Gate Park, San Francisco, *E. McClintock s.n.* (CAS). **Florida:** Hillsborough Co., U.S.F. Botanical Garden, *D. Burch 4154* (CAS, MO); Lee Co., Alva, cultivated at River Haven Nursery from seed from Andromeda Gardens, Barbados, *T. Plowman 13284* (US). PERU. **Ayacucho:** Estrella, between Huanta and Río Apurimac, *E. Killip & A. Smith 23089* (US). **Huánuco:** Puente Tulumayo entre T. M. y Divisoria, *R. Ferreyra 4331* (US); Pachitea, Sungaro, W of Puerta Inca, along hwy. 10 km S of Sungaro River crossing, 9°22'S, 75°00'W, *R. Foster 8787* (US); prov. Leoncio Prado, distr. Rupa Rupa, Cueva de las Lechuzas, Tingo María, *J. Schunke V. 3100* (US); prov. Leoncio Prado, distr. Rupa Rupa, Calpar Bella, cueva de los Hauriños, *J. Schunke V. 9478* (US); prov. Leoncio Prado, distr. Rupa Rupa, along Río Monzon, trail to Cueva de las Lechuzas, *D. Wasshausen & O. Tovar 1256* (US). **Junín:** prov. Chanchamayo, San Ramón, cultivated, *M. Antonieta V. & R. Fernández 89* (US); between Azupizu and Santa Rosa, Pichis Trail, *E. Killip & A. Smith 26135* (US); Río Negro, *F. Woytkowski 5798* (US). **Loreto:** Balsapuerto (lower Río Huallaga basin), *E. Killip & A. Smith 28694* (US). **San Martín:** prov. Mariscal Cáceres, distr. Tocache Nuevo, Quebrada de Huaquisha (márgen derecha del Río Huallaga), *J. Schunke V. 8649* (US); prov. Mariscal Cáceres, distr. Tocache Nuevo, Quebrada Cachiyacu de Huaquisha, *J. Schunke V. 12487* (US).

In the protologue, Bremekamp (1940) did not specifically designate a type of *Sciaphyllum amoenum.* The only herbarium specimen to which he directly referred, that cited as the holotype above, bears his determination in ink to which was added "Typus" in pencil. Because this specimen lacks capsules and seeds whereas Bremekamp's (1940) description and illustration included these, he undoubtedly utilized materials cultivated at the University Botanical Garden in Utrecht, to which he referred, in devising his protologue. In fact, it is clear from the protologue that such material formed the basis for most of the descriptive data. The only herbarium specimen of *S. amoenum* at U based on a cultivated plant (that cited above from Baarn) was not collected until 1951. Collector's information on the type specimen from the island of Java indicates that it was probably cultivated there. The circumstances surrounding the introduction of this species into cultivation around the world remain unknown.

The species shows considerable variation in corolla form (especially length of the throat, which, however, is always longer than in *S. dubiosus* (Lindau) V. M. Baum) and rachis pubescence. Rachis pubescence varies from glandular puberulent with mostly sessile glandular and eglandular trichomes up to 0.05 mm long (e.g., *Killip & Smith 23089*) to glandular puberulent and with a dense and even overstory of straight to flexuose eglandular trichomes 0.2–0.4 mm long (e.g., *Killip & Smith 28694*) to glandular puberulent and with a dense and even overstory of straight glandular trichomes 0.1–0.2 mm long (e.g., *Antonieta V. & Fernández 89*).

Streblacanthus amoenus can be distinguished from *S. monospermus* of Costa Rica and Panama by its evenly pubescent young stems with trichomes to 0.1 mm long (vs. bifariously pubescent with trichomes greater than 0.3 mm long), rounded to truncate to subcordate leaf bases (vs. acute to attenuate bases), bracts and bractlets shorter than the calyx (vs. longer than the calyx), and 5-lobed calyces (vs. 4-lobed calyces). *Streblacanthus amoenus* differs from *S. cordatus* Lindau (including *S. cordifolius* T. F. Daniel) of Costa Rica, Panama, Colombia, and Ecuador by its shorter calyces (5–8.5 mm long vs. 10–25 mm long) and larger corolla throats (4–16 mm long and 2.5–5 mm diam. vs. 1.5–2.5 mm long and 2–2.5 mm diam.). *Streblacanthus amoenus* most closely resembles the southern South American species *S. dubiosus*. These species can be distinguished by the following couplet:

Young stems inconspicuously puberulent with straight eglandular trichomes and sessile glands to 0.05(–0.1) mm long; corolla tube ampliate for (4–)10–16 mm forming a gradually funnelform throat, the throat 2.5–5 mm diam.; trichomes on capsule to 0.5 mm long; Peru . . . . *S. amoenus*

Young stems densely pubescent with an understory of straight eglandular trichomes 0.1–0.2 mm long and an overstory of flexuose to antrorse eglandular trichomes to 1 mm long; corolla tube abruptly ampliate near apex for 1–2 mm forming a short throat, the throat 2–2.5 mm diam.; trichomes on capsule 0.2–1.3 mm long (at least some always > 0.5 mm long); Peru, Bolivia, Paraguay, Argentina, and Brazil . . . . *S. dubiosus*

Based on my preliminary studies of a large series of specimens and type photographs, *Streblacanthus boliviensis* Lindau is here included in *S. dubiosus*. The resulting species forms a morphologically variable complex with both glandular and eglandular individuals. This species and the recently expanded and variable Central American *S. monospermus* (Durkee, 1986) are deserving of further studies.

Acknowledgments. I thank the curators at CAS, MO, U, and US for loans or permitting access to their collections. Herbarium travel expenses were funded by the In-House Research Fund of the California Academy of Sciences.

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Two New Species of *Neurolepis* (Poaceae: Bambuseae) from Colombia

Gerrit Davidse
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Lynn G. Clark
Department of Botany, 353 Bessey Hall, Iowa State University, Ames, Iowa 50011, U.S.A.

ABSTRACT. Two narrowly endemic bamboos from Colombia are described, illustrated, and compared to their putative relatives. *Neurolepis silverstonei* Davidse & L. G. Clark is described from collections made on Cerro del Torrá, Chocó. It is related to *N. aperta* but differs in its smaller stature, leaves, ligules, and inflorescences, and in its longer spikelets and lower sterile lemma. *Neurolepis petiolata* Davidse & L. G. Clark is described from Antioquia. It is unique in the genus in possessing a pilose callus and is unusual in its long and highly differentiated pseudopetioles. It is probably closely related to *N. aperta*, but additionally differs from that species by longer spikelets, and characters of the sterile lemmas and the palea.

Neurolepis Meissner is a genus of woody bamboos atypical in its unbranched culms, relatively large, long and narrow, persistent leaves, pseudopetioles that are often not well differentiated from the blade, and a lack of well-developed, elongated, vegetative culm internodes. However, *N. aristata* (Munro) Hitchcock and several related species are exceptional in having elongated vegetative culm internodes, and the newly described *N. petiolata* and *N. aperta* (Munro) Pilger differ in having elongated, well-differentiated pseudopetioles. The leaf blades of species such as *N. aperta*, *N. pittieri* McClure, and *N. nobilis* (Munro) Pilger are the largest in the grass family (Soderstrom, 1969), reaching 3 m or more in length. The genus is distributed primarily along the main cordillera from southern Costa Rica to Andean Bolivia, with outlying populations in the coastal cordillera of Venezuela (including the Paria Peninsula of Venezuela), Trinidad, and the Guayana Highland of Venezuela and Brazil (Soderstrom, 1969; McClure, 1973; Soderstrom & Ellis, 1987).

Soderstrom (1969) revised the genus and recognized nine species. Recent collections from Colombia could not be identified with any currently recognized species and are described here as two new species in the *N. aperta* species complex.

Neurolepis silverstonei Davidse & L. G. Clark, sp. nov. TYPE: Colombia. Chocó: Municipio de San José del Palmar, Cerro del Torrá, filo de cumbre, vegetación abierta herbácea y arbustiva, ca. 2730 m, hierba hasta 200 cm altura, brácteas e inflorescencia rojo-violetas, 15 ago. 1988, *F. A. Silverstone-Sopkin, N. Paz, R. T. González, A. Henao, J. E. Ramos & L. H. Ramos 4409* (holotype, CUVC; isotypes, ISC, MO). Figures 1, 2.

Culmi 1–2 m alti, erecti, simplices. Vaginae foliorum glabrae, apex prolongatus in quoque late, glabrus, adnatus ad ligulam interioram; ligula interiora cum apice vaginorum prolongato 16–25 mm longa, bicarinata, carinae parum alatae ad basim fimbrias 8–12 mm longas gerentes; pseudopetiolus 3–5 cm longus, adaxialiter sulcatus; laminae 30–44 cm longae, 12–22 mm latae, lineari-oblanceolatae, asymmetricae. Inflorescentia 25–55 cm longa, paniculata, solitaria, aperta; rhachis glabra; rami primarii usque ad 35 cm longi, patentes. Spiculae 9.0–10.4 mm longae, paucae; glumae 2, inaequales, obtusae, enervis; gluma inferiora 0.9–1.6 mm longa; gluma superiora 1.7–2.5 mm longa; lemmata sterilia 2, acuminata, adaxialiter glabra; lemma sterile inferiore 6.1–8.1 mm longum; lemma sterile superiore 7.6–9.8 mm longum; lemma fertile 8.0–10.0 mm longum, acuminatum; palea 1.0–1.4 mm brevior quam lemma fertile.

Caespitose, clump-forming perennial 1–2 m tall. Culms ca. 4 mm diam., erect, unbranched, herbaceous; internodes not elongated, completely covered by the leaf sheaths; nodes not visible. Leaves not differentiated into culm and foliage leaves, basal; sheaths open, glabrous, the summit prolonged on each side, glabrous, adnate to the inner ligule; ligular unit 16–25 mm long, 2-keeled, the keels slightly winged toward the base and bearing readily disintegrating fimbriae 8–12 mm long; outer ligule not differentiated; pseudopetiole 3–5 cm long, sulcate adaxially, not well differentiated from the blade, eventually obliquely disarticulating at the junction with sheath; blades 30–44 cm long, 12–22 mm wide, linear-oblanceolate, glabrous except for a few hispid hairs along the margin near the base, asymmetrical, abruptly acute apically, long-

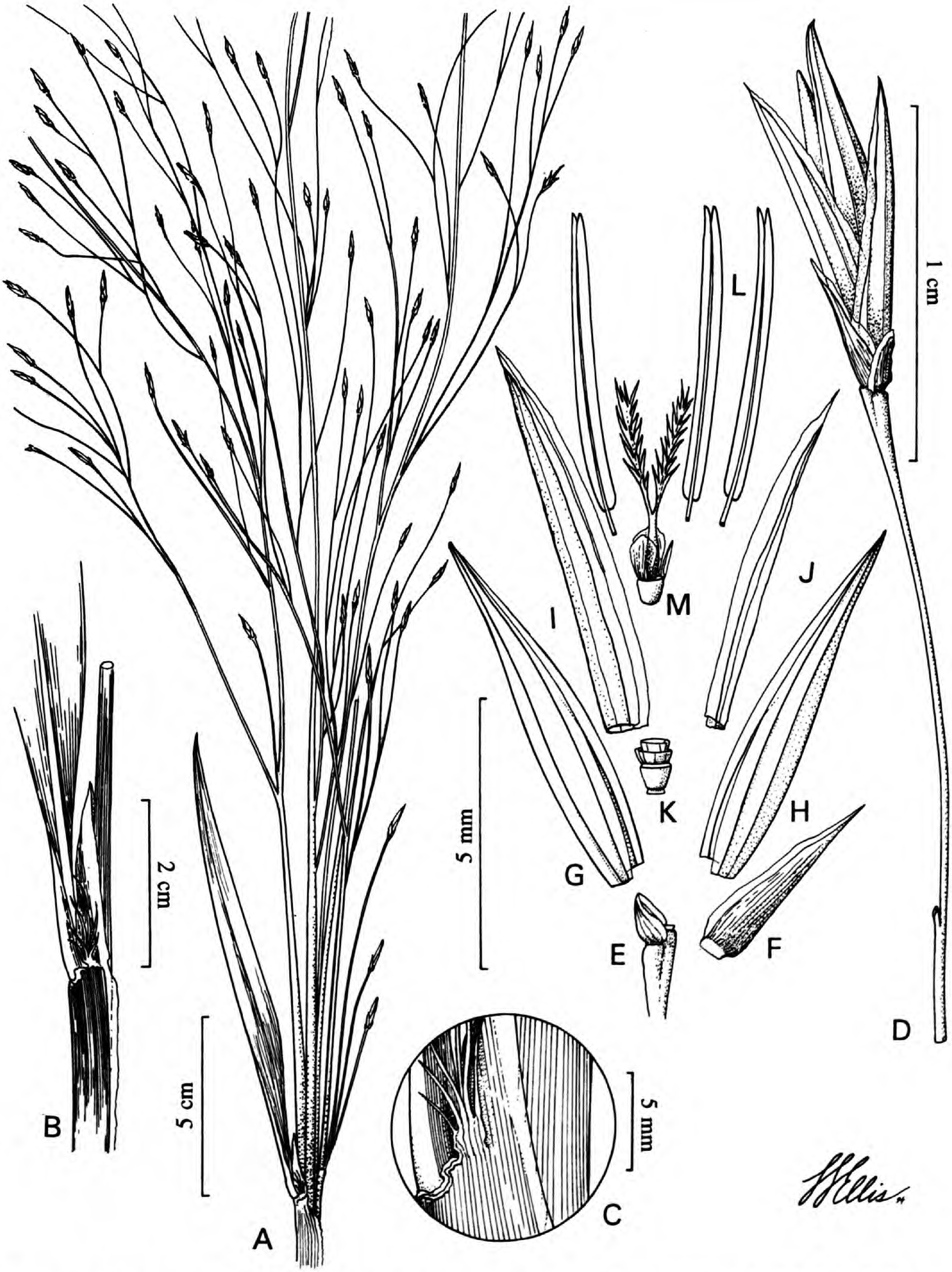

Figure 1. *Neurolepis silverstonei* Davidse & L. G. Clark. —A. Inflorescence and uppermost leaf blade. —B. Portion of the leaf in the ligular area. —C. Close-up of the ligular area showing fimbriae. —D. Long-pedicelled spikelet. E–M. Dissected spikelet. —E. Lower glume. —F. Upper glume. —G. Lower sterile lemma. —H. Upper sterile lemma. —I. Fertile lemma. —J. Palea. —K. Lower portion of the rachilla showing the prominent glumar internode. —L. Stamens. —M. Gynoecium with three lodicules. A–C based on *Silverstone-Sopkin et al. 4399* (MO); D–M based on *Silverstone-Sopkin et al. 4409* (MO).

Figure 2. Close-up of inflorescence of *N. silverstonei* at the type locality. A cloud bank obscures the background.

attenuate basally, the midrib projected abaxially, shallowly sulcate at the base adaxially. Inflorescence 25–55 cm long, paniculate, solitary, open, spreading, usually terminal, rarely axillary from the base of the plant; rachis shallowly sulcate to flattened on the side of the branches, glabrous; primary branches to 35 cm long, widely spreading at maturity, basally prominently pulvinate with glabrous pulvinii, solitary, sparingly rebranched; pedicels much longer than the spikelets, slender. Spikelets 9.0–10.4 mm long, few, 3-flowered, disarticulating between the upper glume and lowest sterile floret; glumes 2, unequal, obtuse, nerveless, stramineous; lower glume 0.9–1.6 mm long; upper glume 1.7–2.5 mm long; sterile florets 2, each consisting only of a lemma, purplish, acuminate, glabrous abaxially, scaberulous adaxially toward the tip; lower sterile lemma 6.1–8.1 mm long, 3–4-nerved; upper sterile lemma 7.6–9.8 mm long, 3–5-nerved; upper floret with a bisexual flower; fertile lemma 8.0–10.0 mm long, 3–5-nerved, acuminately boat-shaped, glabrous abaxially, scaberulous adaxially at the tip; palea 1.0–1.4 mm shorter than the fertile lemma, 2–3-nerved, convex on the back in the lower ½, 1-keeled and boat-shaped at the apex, glabrous; lodicules 3, flattened, irregularly obtuse, eciliate, 1.2–1.4 mm long, the 2 anterior ones 4–6-nerved, the posterior much narrower, 1-nerved; stamens 3, the anthers 3.5–5.0 mm long; ovary glabrous; styles 2; stigmas plumose. Caryopsis not seen.

As Soderstrom (1969) noted, *Neurolepis aperta* is the most distinctive species in the genus by virtue of its short, obtuse glumes, long, delicate pedicels much longer than the spikelet, and an easily visible elongated internode between the glumes and first sterile lemma. Except for the relatively longer, less obtuse upper glume, these characteristics are also shared with *N. silverstonei.* In addition, *N. aperta* and *N. silverstonei* share a nonsulcate palea and an inner ligule that is much elongated and adnate to the sheath summit prolongations, with the entire unit winged or fimbriate on the keels.

However, *N. silverstonei* is much shorter and has smaller blades, ligules, and inflorescences than *N. aperta.* In addition, the lower sterile lemma and spikelets are longer and much more slender. This species is only known from five gatherings at the type locality where flowering plants were collected by P. A. Silverstone-Sopkin (after whom the plant is named) and collaborators in August 1982, January 1984, and August 1988. Flowering plants were collected on each visit, but it was not noted whether all members of the population were in flower. Because flowering plants were collected over a 6-year period, it is unlikely that *N. silverstonei* flowers gregariously and synchronously over a short period of time (1–2 years) followed by many years of vegetative growth, as reported for *N. pittieri* McClure (Davidse & Huber, 1979). Instead, a continuous type of flowering (Clark et al., 1989) in which some clumps in a population flower every year seems more probable.

The Cerro del Torrá is the largest and most northerly of a chain of four peaks, the Cordillera of San Miguel, located approximately at 04°46′N, 76°29′W, and separated from the Cordillera Occidental of the Andes by a valley of about 600 m elevation. Because of its remote location, botanical collections have been made on this mountain only three times, all expeditions by the Universidad del Valle (Cali, Colombia). Although official published maps show various elevations up to 4670 m (Mapa Físico Político, escala 1:1,500,000, Ministerio de Hacienda y Crédito Público, Instituto Geográfico de Colombia "Agustín Codazzi," 1979), the true elevation is about 2770–2800 m.

Collections were made only on the eastern slope of the Cerro del Torrá up to the summit and on the

Figure 3. Open, ridge-top shrub vegetation, the habitat at the type locality of *Neurolepis silverstonei*, Cerro del Torrá, Chocó, Colombia.

summit of the adjacent peak, Cerro Panamá. Vegetation of this zone consists of primary cloud forest up to about 2500 m, where shrubby vegetation occurs; above this, nearly to the summit, is dense dwarf forest. The vegetation of the summit ridge is open, dominated by shrubs, herbs, and ferns. The soil is moist and covered in places by mats of *Sphagnum* and lichens. A small number of dwarf (to about 4 m), widely separated trees and palms are present. The summit ridge is usually covered with mist, and rainfall is heavy (probably over 6000 mm annually, although no yearly measurements have been made).

Neurolepis silverstonei occurs only in the very humid open community on the summit ridge (Fig. 3), not in the forest below the ridge. It may be endemic to the summits of the Cordillera de San Miguel, although the flora of much of the Cordillera Occidental is not well known. In support of the hypothesis of endemism and indicative of the phytogeographic importance of the Cerro de Torrá is the discovery there in 1984 of *Alzatea verticillata* Ruiz & Pavón (Alzateaceae), the only Colombian record of this monotypic family (Silverstone-Sopkin & Graham, 1986).

Paratypes. COLOMBIA. **Chocó:** Municipio San José del Palmar, Cerro del Torrá, cumbre del Torrá Grande, vegetación abierto con *Blechnum, Paepalanthus*, ciclantáceas, gramíneas y arbustos pequeños, pocos árboles, musgos forman alfombra espesa mojada, 2730 m, hierba terrestre, inflorescencia rojo-violeta oscura, 13 ene. 1984, *F. A. Silverstone-Sopkin, N. Paz, A. Duque & H. Bayona 1823* (CUVC, MO, RSA); Cerro del Torrá, cumbre, rastrojo primario bajo abierto, dominado por *Blechnum, Paepalanthus*, una gramínea, y arbusticos, muy pocos árboles, aunque se encuentran plántulas de *Clusia*, 2730–2770 m, 8 ago. 1982, *F. A. Silverstone-Sopkin & A. Henao 1265* (CUVC—4 sheets, MO—3 sheets, ISC, TULV, US—2 sheets), 18 ago. 1982, *F. A. Silverstone-Sopkin, A. Henao & R. Gómez 1378* (CUVC); Cerro del Torrá, filo de Cumbre, vegetación abierta herbácea y arbustiva, ca. 2730 m, hierba 103 cm altura, tallos e inflorescencia rojo-violetas, 14 ago. 1988, *F. A. Silverstone-Sopkin, N. Paz, R. T. González, A. Henao, J. E. Ramos & L. H. Ramos 4399* (CUVC, MO).

Neurolepis petiolata Davidse & L. G. Clark, sp. nov. TYPE: Colombia. Antioquia: Municipio de La Unión, Km 32.5 of road Sonsón–La Unión (23.5 km from La Unión), montane vegetation on slopes near stream, 05°52′N, 75°18′W, 2300 m, large clump-forming grass with culms to 4 m tall, above stream at forest margin, 4 Oct. 1987, *J. L. Zarucchi, A. E. Brant & F. J. Roldán 6265* (holotype, HUA; isotypes, COL not seen, ISC, MO). Figure 4.

Culmi 1–2 m alti, ca. 4 m alti cum inflorescentiis, erecti, simplices. Vaginae foliorum glabrae, apex valde prolongatus in quoque latae, glabrus vel puberulentus, adnatus ad ligulam interioram; ligula interiora cum apice vaginorum prolongato 4–12 cm longa, bicarinata, carinae alatae; pseudopetiolus 21–46 cm longus, ⅓–½ laminam attingens, glabrus, adaxialiter valde sulcatus; laminae 67–93 cm longae, 7–11 cm latae, oblanceolatae, glabrae, asymmetricae, costa parum excentrica. Inflorescentia 80–

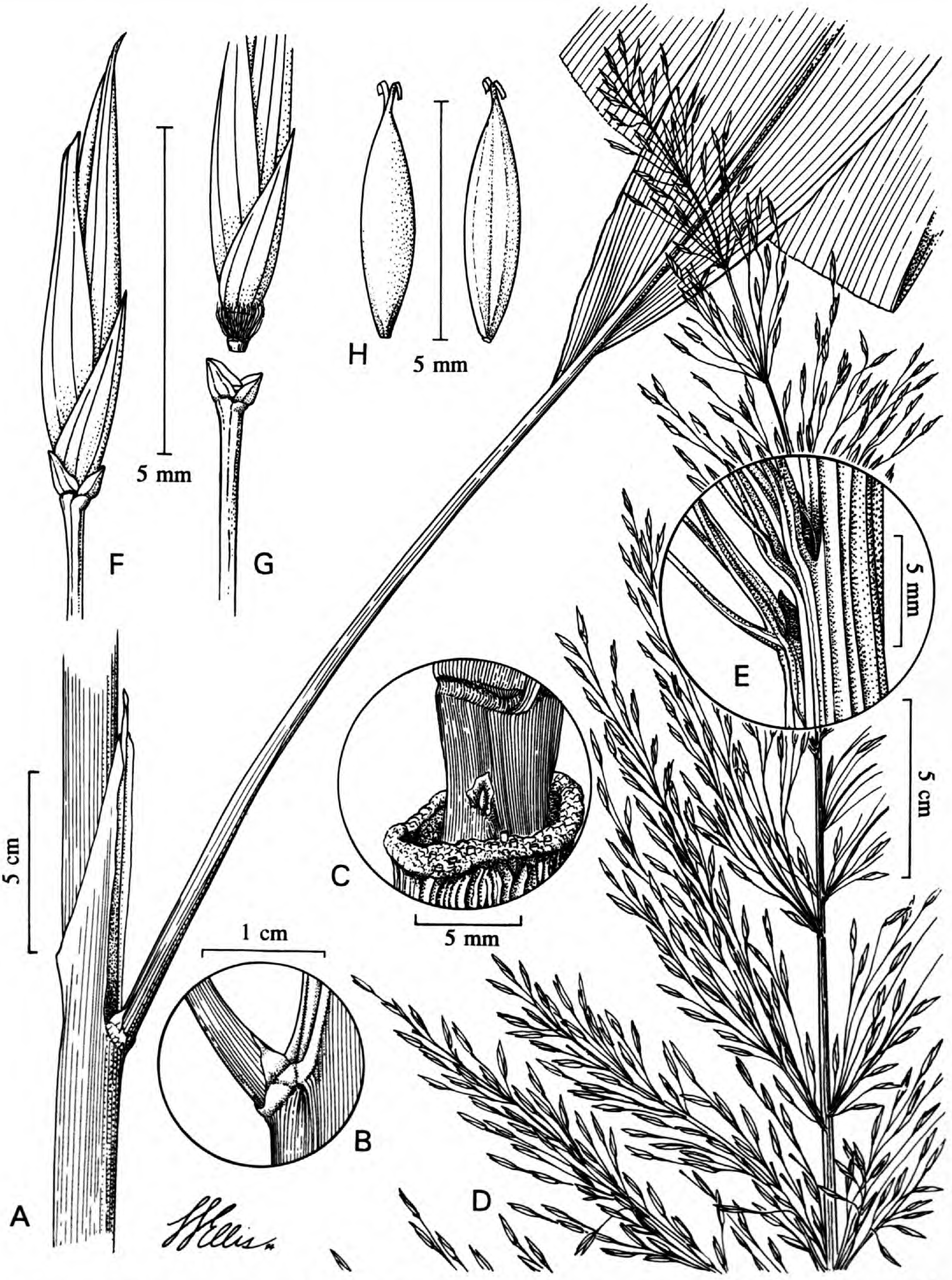

Figure 4. *Neurolepis petiolata* Davidse & L. G. Clark. —A. Portion of a fully developed leaf showing the apex of the sheath, ligular area, pseudopetiole, and base of the blade. —B. Close-up of base of pseudopetiole. —C. Portion of a culm with a solitary axillary bud. —D. Portion of the inflorescence. —E. Close-up of the base of some inflorescence branches showing the swollen pulvinii. —F. Spikelet. —G. Disarticulated spikelet showing the small glumes and the hairy callus of the lower sterile lemma. —H. Nearly mature caryopsis showing the embryo side (left) and the hilum side (right). Based on *Zarucchi et al. 6265* (MO).

160 cm longa, paniculata, solitaria, aperta; rhachis glabra; rami primarii usque ad 36 cm longi. Spiculae 8.0–9.8 mm longae, numerosae; glumae 2, inaequales; gluma inferiora 0.3–0.6(–1.6) mm longa, obtusa; gluma superiora 0.9–1.7 mm longa, obtusa vel emarginata vel irregulariter sinuata; lemmata sterilia 2, abaxialiter glabra, scariosa vel membranacea ad apicem; lemma sterile inferiore 4–6 mm longum, acutum, callus pilosus; lemma sterile superiore 6–7 mm longum, 5-nerve; lemma fertile 7–9 mm longum, acuminatum, abaxialiter glabrum; palea 0.3–1.0 mm brevior quam lemma fertile.

Clump-forming perennial 1–2 m tall, ca. 4 m tall with inflorescences, with a few aerial or prop roots from the lowest culm nodes. Rhizome sympodial, short, thin, compact. Culms 1–1.5 cm diam., erect, unbranched except for innovations produced at the base, herbaceous to woody; nodes glabrous; internodes mostly not elongated except for several ones in flowering culms, glabrous, solid or the pith breaking down. Leaves primarily basal but basal and cauline in flowering culms, not differentiated into culm and foliage leaves but with a few bladeless cataphylls at the base; sheaths open, glabrous, the summit conspicuously prolonged on each side, adnate to the inner ligule; ligular unit 4–12 cm long, prominently 2-keeled, each keel distinctly winged, its margins (formed from the sheath summit prolongations) glabrous or appressed puberulent toward the apex, its back (formed from the ligule) appressed puberulent; outer ligule 2–4 mm long, membranous, ciliolate, appressed puberulent or glabrescent; pseudopetiole 21–46 cm long, ⅓–½ as long as the blade, glabrous, prominently sulcate adaxially, pulvinate in the axil with the ligule, articulated with the sheath and eventually breaking off; blades 67–93 cm long, 7–11 cm wide, oblanceolate, glabrous, asymmetrical, especially basally, acute apically, the midrib slightly eccentric, projected abaxially, shallowly sulcate adaxially. Inflorescence 80–160 cm long, paniculate, solitary, terminal, open, spreading; rachis ridged, glabrous; primary branches to 36 cm long, widely spreading at maturity, basally prominently pulvinate with glabrous pulvinii, solitary but repeatedly rebranched near the base; pedicels usually as long as or much longer than the spikelet. Spikelets 8.0–9.8 mm long, numerous, 3-flowered, disarticulating between the upper glume and lowest sterile floret; glumes 2, unequal, nerveless, stramineous; lower glume 0.3–0.6(–1.6) mm long, obtuse; upper glume 0.9–1.7 mm long, obtuse to emarginate or irregularly wavy; sterile florets 2, each consisting of only a lemma, purplish, glabrous abaxially, scaberulous adaxially toward the tip; lower sterile lemma 4–6 mm long, 3–5-nerved, acute, membranous toward the apex, otherwise chartaceous, appressed pilose basally with callus hairs 0.5–1 mm long; upper sterile lemma 6–7 mm long, 5-nerved, apically slightly boat-shaped, membranous toward the apex, otherwise chartaceous, basally glabrous; fertile floret with a bisexual flower; fertile lemma 7–9 mm long, 5–7-nerved, acuminate with an awn tip to 0.6 mm long, glabrous abaxially, scaberulous adaxially in the upper ⅓; palea 6–7 mm long, 0.3–1.0 mm shorter than the upper lemma, 4-nerved, convex on the back, glabrous abaxially, scaberulous adaxially toward the tip; lodicules 3, multinerved, flattened, eciliate, the 2 anterior ones 1.4–1.5 mm long, the posterior 1 narrower than the anterior ones; stamens 3, the anthers 5.1–5.2 mm long; ovary glabrous; styles 2. Caryopsis 5.2–5.5 mm long, nearly flat on the hilum side, convex on the embryo side; hilum linear, as long as the caryopsis; embryo ca. ⅕ as long as the caryopsis.

In May 1988, J. L. Zarucchi (pers. comm.) revisited the locality where the type collection (*Zarucchi et al. 6265*) had been collected about six months earlier and observed that all plants had completely died. No evidence of seedlings was found, although it could not be positively ruled out that the species failed to reproduce itself, because we do not know anything about its germination requirements. Plants with mature inflorescences at anthesis were found in the same area in February 1988 by X. Londoño and L. G. Clark (*Londoño & Clark 403*). A visit to this site in 1994 revealed that it is now a potato field, but further upstream, juvenile plants and relatively young seedlings were found (*Londoño & Clark 901*). Inaccessible, but apparently mature clumps of what appeared to be this species were also observed by Londoño and Clark in 1994 at 2060 m elevation along a river gorge 4.5 km below Concepción, northeast of Medellín, about 55–60 km north of the type locality. Some of these plants appeared to be in the early stages of flowering, with immature inflorescences just emerging.

The synchronous flowering and death of all individuals in this population indicates that it probably has a similar life history to that described for *Neurolepis pittieri* McClure, the only other species in the genus for which a periodic, synchronous flowering life history has been established (Davidse & Huber, 1979) with some certainty. Although it can only be hypothesized for *N. petiolata*, it seems likely that the intervals between flowering last for a number of years, as is typical of the majority of species of the Bambuseae (Soderstrom & Ellis, 1987). If the population observed near Concepción is indeed this species, it may represent a divergence in synchrony of flowering due to isolation.

Neurolepis petiolata is closely related to *N. aperta* (Munro) Pilger and more distantly to *N. silverstonei,* as indicated by the nonsulcate palea, long-pedicelled spikelets, well-developed internode between the upper glume and lower sterile floret, and much elongated inner ligule adnate to the sheath summit prolongations, with the entire ligular unit winged or fimbriate on the keels.

Neurolepis petiolata differs from *N. aperta* in the much longer (21–46 cm vs. (1–2)7–22 cm), more slender pseudopetiole that is abruptly differentiated from the blade versus the blade gradually and long-attenuate into the pseudopetiole, its pilose versus glabrous base of the lower sterile lemma, its longer spikelets (8.0–9.8 mm vs. 5.0–7.2(–8.0) mm), the adaxial puberulence of the sterile lemmas restricted toward the tips versus most of the adaxial surface, the membranous texture of the sterile lemmas toward their apices versus chartaceous throughout, the 5-nerved versus 3-nerved upper sterile lemma, and the 4-nerved versus 2-nerved palea. The difference in development of the pseudopetiole is also very obvious if taken as a proportion of the blade length: in *N. petiolata,* the pseudopetiole reaches ⅓ to ½ the blade length, even in the leaves of juvenile plants, whereas it reaches no more than $\frac{1}{10}$ the blade length in even the best developed leaves of *N. aperta. Neurolepis petiolata* typically grows along riverbanks in montane forest at elevations of 2060 to 2400 m, whereas *N. aperta* usually occurs from 2800 to 3600 m in upper montane and cloud forests and páramo vegetation.

Callus hairs are unique among the described species of *Neurolepis.* Hairs such as these are common in grasses in general and typically function in positioning seeds into more favorable germinating conditions.

Paratypes. COLOMBIA. **Antioquia:** La Unión, Corr. Mesopotamia, Río El Cardal, 0.5 km below La Frontera, 2400 m, 28 Feb. 1988 (fl), *X. Londoño & L. G. Clark 403* (COL, HUA, ISC, TULV, US); Mun. La Unión, Corr. Mesopotamia, a mano izquierda del puente sobre el Río Cardal, arriba de la truchera, 2330 m, 18 June 1994, *X. Londoño & L. G. Clark 901* (COL, HUA, ISC, TULV).

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Phaseolus costaricensis, a New Wild Bean Species (Phaseolinae, Leguminosae) from Costa Rica and Panama, Central America

George F. Freytag
National Seed Storage Laboratory, USDA/ARS, 1111 South Mason Street, Fort Collins, Colorado 80521-4500, U.S.A.

Daniel G. Debouck
Genetic Resources Unit, Centro Internacional de Agricultura Tropical, Apartado Aéreo 6713, Cali, Colombia

ABSTRACT. During a review of *Phaseolus* undertaken by the senior author to clarify the variability of the *P. coccineus* L. species complex, a few herbarium specimens of what appeared to be a new species from Costa Rica and Panama were encountered. Subsequent field collecting by the junior author confirmed this opinion, and the new taxon is hereby named and described. Its probable relationships and the part it may have played in the early evolution of the economically important pulses such as the common bean, scarlet runner bean, and "polyanthus" bean are discussed.

As a result of an in-depth review of the genus *Phaseolus*, originally begun by the senior author to clarify the variability of the *P. coccineus* L. species complex, and the fieldwork subsequently carried out by the junior author (Debouck et al., 1989), a large vining wild bean growing in the montane forests of Costa Rica appears to be new to science. As described and discussed below, it shares many morphological traits with wild *P. vulgaris* L. and wild *P. dumosus* Macfadyen (= *P. polyanthus* Greenman; see Schmit & Debouck, 1991, for discussion) and will therefore be grouped with these two species to form the section *Phaseolus* in a monograph currently in preparation.

Phaseolus costaricensis Freytag & Debouck, sp. nov. TYPE: Costa Rica. Provincia de San José: San Isidro El General, 3 km SE de Copey, orillas del Río Pedregosa, 9°37′N, 83°55′W, 1800–2080 m, 14 Jan. 1987, *Debouck, Araya Villalobos, Ocampo Sánchez & González Ugalde 2135* (holotype, US; isotypes, BR, CR, UC). Figures 1–4.

Species *P. dumoso* maxime similis, sed bracteolis saepe ovatis, floribus puniceis alis amplectibus et legumine adulto recto 10 cm longo helvo-alutaceo tomentoso differt. Occurrit in sylvis udis pinetis nebulosisque Costa Ricae et Panamae.

Seedling large from epigeal germination, the hypocotyl 1.7 cm long, the epicotyl 2.2 cm long, the stipules united; next internode very long to 12 cm or more; primary leaves opposite, simple, the petiole 3 cm long, stipels present, the blade broadly rounded-ovate, 8 cm long, 7.5 cm wide near the base, the base auriculate, the tip acuminate and not apiculate, membranous, nearly glabrous. *Root* fibrous, extensive, not penetrating deeply into soil. *Plant* a perennial, woody, large, shrubby vine; stems stout, terete, striate-angled, 3–4 mm diam., corky and knobby on basal portions, reflexed pubescent with short and long, fine, strigose, hispid and uncinate, whitish hairs, younger stems densely short white reflexed strigose; internodes 12–16 cm long; stipules triangular-lanceolate, 6 mm long, 3 mm wide, 5- to 7-nerved, acute, thin, sparsely brownish strigose. *Leaves* medium to large, trifoliolate, including the first true leaf on main stem; petioles stout, rounded canaliculate, 2.5–8–16 (smallest–mode–largest) cm long, tawny-villous to hirtellous; rachises 5.5 cm long; stipels 6 mm long, 2.5 mm wide, the lower triangular-ovate, 8- to 10-nerved, acute, the upper oblong-linear, slightly falcate, 5 mm long, 1–1.5 mm wide; pulvini 5–6 mm long, densely yellowish to tawny brown and long strigose; terminal leaflets broadly ovate to oblong-ovate, 4–7–11 cm long, 4.5–12 cm wide at about ⅓ from base, nearly obtuse to short acute, apiculate, the main veins prominently whitish below, secondary veins inconspicuous, upper surface sparsely pubescent, below sparsely to densely yellow strigose to nearly tomentose; lateral leaflets similar and slightly inequilateral. *Inflorescence* a very long raceme, 10–38–87 cm long, much ex-

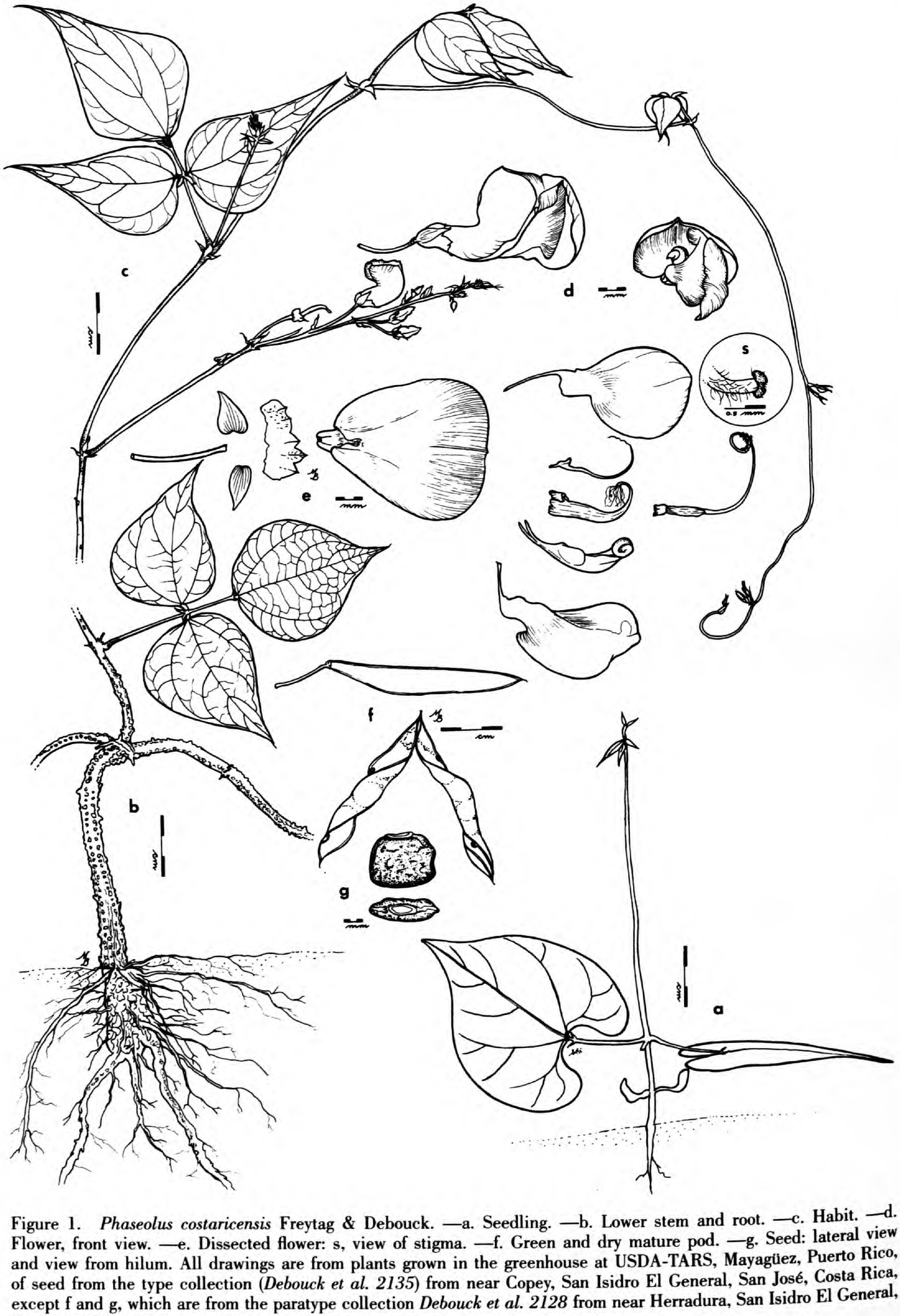
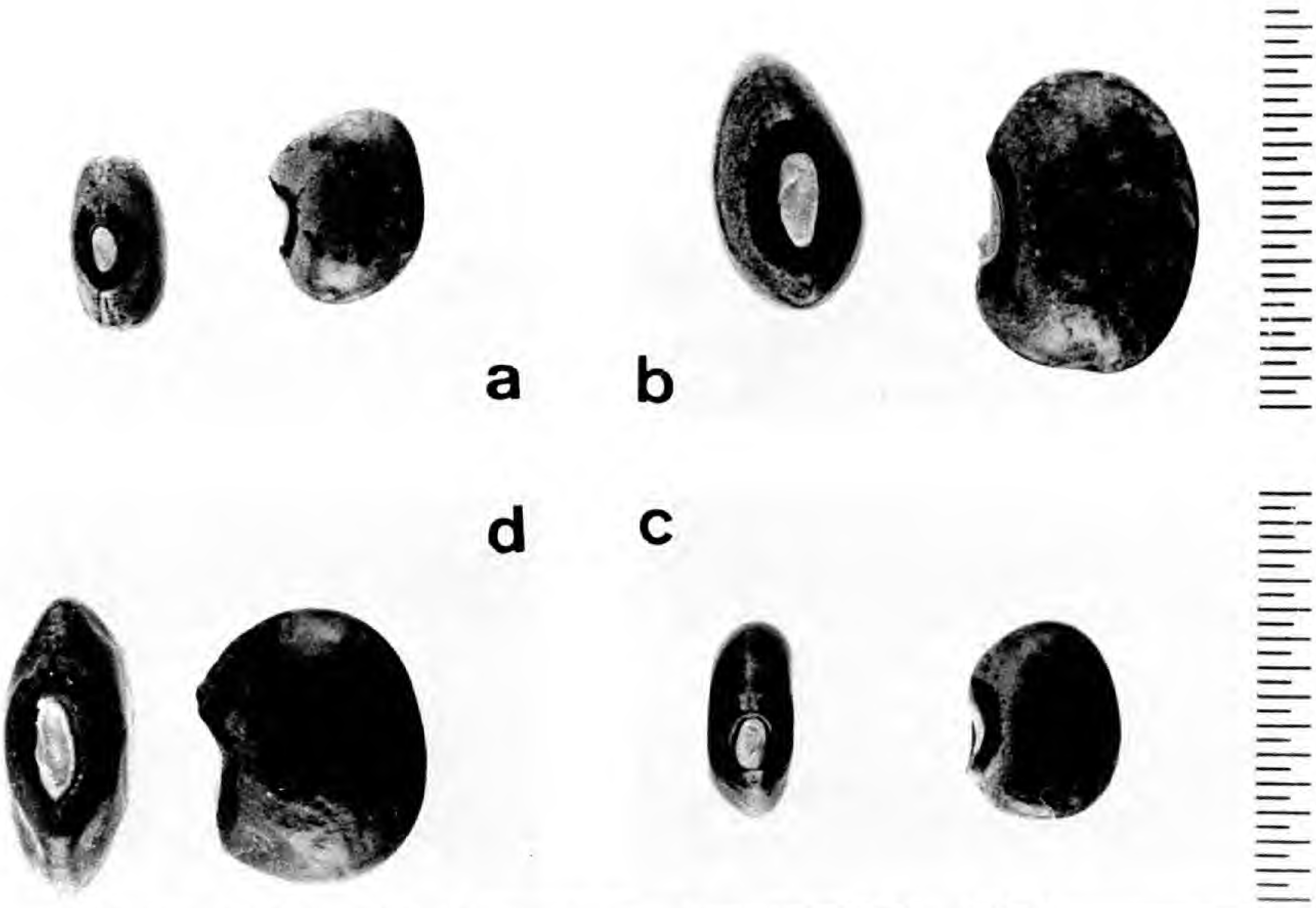


Figure 1. *Phaseolus costaricensis* Freytag & Debouck. —a. Seedling. —b. Lower stem and root. —c. Habit. —d. Flower, front view. —e. Dissected flower: s, view of stigma. —f. Green and dry mature pod. —g. Seed: lateral view and view from hilum. All drawings are from plants grown in the greenhouse at USDA-TARS, Mayagüez, Puerto Rico, of seed from the type collection (*Debouck et al. 2135*) from near Copey, San Isidro El General, San José, Costa Rica, except f and g, which are from the paratype collection *Debouck et al. 2128* from near Herradura, San Isidro El General, San José, Costa Rica.



Figures 2, 3. —2 (top). Close-ups of seeds in lateral views and views from hilum of: —a. *P. costaricensis* (*Debouck et al. 2132*) from Providencia, San Isidro El General, San José, Costa Rica. —b. *P. vulgaris* (*Debouck et al. 2097*), from Tabarca, San José, Costa Rica. —c. *P. dumosus* (*Debouck & Soto 1631*) from Panajachel, Sololá, Guatemala. —d. *P. coccineus* (*Debouck & Vásquez 2437*) from Miramundo, Jalapa, Guatemala. Scale given in millimeters. —3 (bottom). *Phaseolus costaricensis* in its natural habitat: *Debouck & Araya Villalobos 2093*, found close to the Cuesta Chinchilla, Cot, Cartago, Costa Rica. Arrows mark the showy deep fuchsia blossoms and pods.

ceeding leaves; peduncle 11–18–41 cm long; rachis stout, 3–15–46 cm long, hirtellous with tawny hairs, glabrate below with many flowering nodes to 30 or more spaced 2–5–30 mm apart on axis; primary bracts broadly rounded to ovate-lanceolate, 5–12 mm long, 1.5–8 mm wide, 3- to 12-nerved, acute, thin to hyaline, heavily white strigose below, glabrous within, somewhat persistent; pedicel stout, 6–7 mm long, becoming 16–18 mm long at mature pod, sparsely minute white uncinate. *Bracteoles* of-

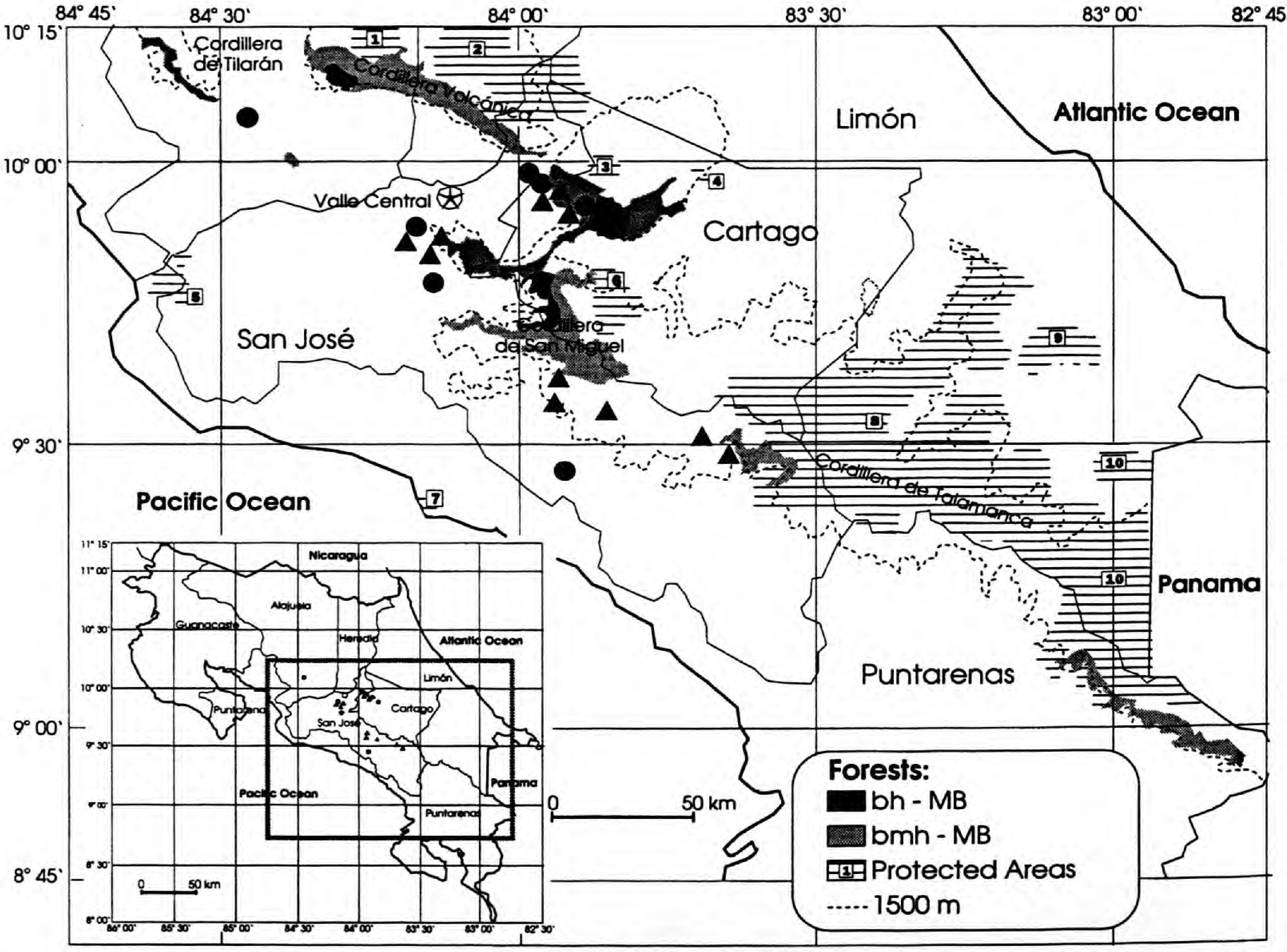


Figure 4. Distribution map for *Phaseolus costaricensis* in Costa Rica. Round spots correspond to herbarium voucher specimens, while triangles correspond to germ plasm collections (including herbarium specimens). The star refers to the capital city of San José. Dark shaded areas correspond to remnants of vegetation type "Bosque húmedo" (bh-MB), while light shaded areas correspond to the wetter variant "Bosque muy húmedo" (bmh-MB), both in the Montano Bajo domain (after the map by Tosi, 1969). Horizontally lined areas refer to protected areas, as follows: —1. Parque Nacional Volcán Poás. —2. Parque Nacional Braulio Carrillo. —3. Parque Nacional Volcán Irazú. —4. Monumento Nacional Guayabo. —5. Reserva Biológica Carara. —6. Refugio Nacional de Fauna Silvestre Tapantí. —7. Parque Nacional Manuel Antonio. —8. Parque Nacional Chirripó. —9. Reserva Biológica Hitoy Cereré. —10. Parque Nacional La Amistad. (After map published by Editorial Heliconia, Anonymous, 1987.)

ten rounded ovate to elongate-acuminate to linear, 5–8–9 mm long, 2.5–4–8 mm wide, acuminate, sparsely white hirsute to strigose on outside, glabrous within, purplish. *Flower* large, dark pink or lilac to purple, very numerous, in racemes of 2–5; calyx campanulate, 5–6 mm long, with a small knob at base, pubescent, the two upper lobes united into one emarginate scarcely developed, 1 mm long, 6 mm wide, the 3 lower lobes subequal, dentate-acute, 2 mm long, 2.5 mm wide, the center one slightly longer, sparsely weak, white, short strigose, the mouth of the calyx oblique; standard dark pink or lilac to purple, broadly rounded-obovate, cupped, 18 mm long, 14–15 mm wide, emarginate, reflexed, 8 mm to bend, somewhat thickened at flexure, lateral edges recurved with a spur at lower edge 1 mm long, claw poorly developed, 0.5 mm long, auricles 3 mm long, 2 mm wide and nectariferous, inserted 3–4 mm from base; wings lilac to purple, broadly rounded, cupped and clasping, unequal, spreading laterally, 23 mm long, claw 6–8 mm long, 0.5 mm wide, blade 13–16 mm long, 10–11 mm wide, spur well developed, nearly round, 1.5–2.5 mm long; keel tubular, straight, claws divided 4 mm, 5 mm more to flexure and 6 mm more to terminal 1¾ tight coils of 3.5 mm diam.; vexillary stamen claw 1.5 mm long to geniculate knob developed into a thin sheath 2 mm long, 1.5 mm wide, the thickened portion 7 mm long to filament; stamen tube straight, ridges not developed; basal collar 1.5–2 mm long, denticulate; ovary straight, 10 mm long covered by fine white pubescence, 6 or fewer ovules; style 10–12 mm long with a terminal thickened coil 3 mm diam.; stigma terminal, capitate, 0.75 mm long. *Pod* when young, straight, flat, broad, about 3 times longer than broad, yellow-brown tomentose, becoming sparsely strigose; the mature pods straight, 10 cm long, 13 mm wide, 7–

10 mm thick; beak strong, 7 mm long, recurved; 4–6 seeds. *Seeds* squarish ovate, rounded and flattened, 10–11.6 mm long, 8.3–9.4 mm wide, 3.8–5.1 mm thick, brown and black speckled and streaked on brown and tan, a black ring around hilum; hilum oblong oval, 4.2 mm long, 1.8 mm wide; lens medium raised.

Geographic distribution. This species seems to be restricted to remnants of the humid (bh-MB) and rain (bmh-MB) montane forests in the mountainous ranges of the Cordillera de San Miguel and Cordillera de Talamanca of Costa Rica (Provinces of Alajuela, Cartago, and San José), and extending into the slopes of volcanoes Chiriquí and Barú in the Macizo Volcánico de Chiriquí in the provinces of Boquete and Chiriquí of western Panama (see Fig. 4).

Ecology. The large vines of up to 3–6 m long are often climbing and sprawling over shrubs (*Dahlia*, Compositae, Solanaceae) and trees, and are found in sunny openings in humid montane forest (*Alnus*, *Erythrina*) and montane rainforest with bamboo and numerous epiphytes (ferns, orchids, aralias, and bromeliads) (see Fig. 3). These habitats correspond to "Vegetación de las tierras frías," according to Gómez Pignataro (1986), and to "Bosque muy húmedo premontano" and "Bosque húmedo montano bajo," according to Bolaños and Watson (1993), with a dry season of about 2–4 months.

Phaseolus costaricensis is rarely found with *P. dumosus* (*Debouck et al. 2121*), *P. xanthotrichus* Piper (*Debouck & Villalobos 2101*), and *P. tuerckheimii* Donnell-Smith (*Debouck et al. 2125, Debouck et al. 2129*). It is most frequent and abundant in relatively undisturbed habitats and inaccessible areas, at 1400–2100 m, the majority being found at 1600–1800 m, often abundant on steep slopes, and rarely found in disturbed cut-over or burnt-over areas, coffee plantations, or pastures. It is found growing on dark brown soils derived from lavas, volcanic ash, or metamorphic schists, with high organic content and rocky, very moist soils often near streams or riversides. We have found damage by angular leaf spot, anthracnose, lacebugs, thrips, and weevils.

Although some populations might be included in the protected areas "Parque Nacional Chirripó" and "Parque Nacional La Amistad" (see Fig. 4), most will not, since the ecology of *P. costaricensis* matches with zones of most human settlements in Costa Rica with pastures, coffee, and flowers for export, where most deforestation has occurred (Boucher et al., 1983; Sader & Joyce, 1988).

Ethnobotany and common names. Phaseolus costaricensis apparently is not eaten, but is known by rural inhabitants under the names "frijol de montaña" (around Cot, Provincia de Cartago, Costa Rica) and "cubá de venado" (south of Alajuelita). It is to be noted that the name "cubá" is generally used in Costa Rica for cultivated varieties of both *P. coccineus* L. (D. G. Debouck, pers. obs., 1987; P. C. Standley, 1937) and *P. dumosus* Macfadyen (G. F. Freytag, pers. obs., 1969).

Discussion. This species is named in honor of Costa Rica, the country in which it is most widely distributed.

Because of its strong climbing, perennial habit, gross morphology, allogamy, and its very showy inflorescences, *Phaseolus costaricensis* has often been confused with *P. coccineus*, namely in the *Flora of Panama* (Lackey & D'Arcy, 1980) and in the last taxonomic treatment of that group (under *P. coccineus* subsp. *formosus* (Kunth) Maréchal, Mascherpa & Stainier (in Delgado Salinas, 1988)), from which it differs by the dark pink or fuchsia flower color, the large and long primary bracts, the ovate bracteoles, the epigeal germination and fibrous roots, and by a basic difference in inflorescence type. The inflorescence type of most *Phaseolus* species is that of a reduced raceme (pseudoraceme)—similar to most Phaseoleae as pointed out by Lackey (1981) and Debouck (1983) and as is the case with *P. dumosus* and *P. coccineus*. However, *P. costaricensis* often seems to produce a raceme or panicle with several to many lower lateral branches, especially on the larger inflorescences, similar to some populations of *P. lunatus* L., *P. maculatus* Scheele, *P. polystachyus* (L.) Britton, Sterns & Pogg, and other related, more or less woody *Phaseolus* species. Many of these traits may be difficult to evaluate on herbarium specimens of incomplete vegetative and flowering material. *Phaseolus costaricensis* has also been confused with *P. tuerckheimii* Donnell-Smith, an identification given on some herbarium specimens, from which it differs by having much less tawny pubescence; large, long and broad bracts and bracteoles; differences in details of flower structure, especially the considerably larger standard and wings; and in having longer and wider pods with 4–6 seeds.

Results from cpDNA analysis confirm the placement of *Phaseolus costaricensis* close to *P. vulgaris* and *P. dumosus*, perhaps in the same section as the latter two taxa, since *P. costaricensis* shares several cpDNA polymorphisms with them (Schmit et al., 1993). In this study, *P. costaricensis* was located in the same group as a wild common bean of Chiquimula, Guatemala, and two weedy forms of *P. dumosus* of Cauca, Colombia; the wild ancestral form of *P. dumosus* fell in another close group, together with a wild common bean population of Chimborazo, Ecuador. It has been shown recently (Kami et al., 1995) that the wild common bean populations of southern Ecuador and northern Peru are close to the ancestral lineage of *P. vulgaris* prior to its separation into the two major gene pools (Gepts, 1988; Khairallah et al., 1992).

Phaseolus costaricensis crosses naturally with *P. dumosus* in the field (D. G. Debouck, pers. obs., 1987), though very rarely, since *P. dumosus* is an introduced plant in Costa Rica and can also be crossed with *P. vulgaris* (H. Bannerot, pers. comm., 1989), in both cases as pollen parent. It may be that flower structure, similar in *P. dumosus* and *P. costaricensis* except for the spreading wings of the former and the nearly vertical, clasping wings of the latter (similar to those of *P. coccineus*), and the highly nectariferous standards (also found in *P. coccineus* and *P. striatus* Brandegee) are responsible in large part for the attraction of pollinators. Field observations show *P. costaricensis* is visited by hummingbirds and carpenter bees.

The following specimen was determined by the collectors to be an obvious hybrid, probably with *P. dumosus*, found at the same location: COSTA RICA. **San José:** al pie de la Piedra de Aserrí, 1.5 km E de Aserrí, 9°52'N, 84°7'W, 1560 m, 11 Jan. 1987, *Debouck et al. 2114* (US).

Evidence has been presented elsewhere (Llaca et al., 1994; Schmit et al., 1993) about a proposed origin for *Phaseolus dumosus* that would have a cpDNA genome similar to the one of *P. vulgaris*, and a nuclear genome similar to the one of *P. coccineus*. Although different, the mtDNA genome of *P. dumosus* would be closer to that of *P. vulgaris* than that of *P. coccineus* (Hervieu et al., 1994). It is still premature to conclude that *P. costaricensis* is the cytoplasm donor parent to *P. dumosus*, but there is little doubt that the present novel species should be included in any further phylogenetic study including the three bean cultigens *P. vulgaris*, *P. coccineus*, and *P. dumosus*.

Paratypes. COSTA RICA. **Alajuela:** Tres Ríos and Ochomogo, vicinity of San Ramón, Dec. 1912, *Brenes 18* (GH). **Cartago:** Cot, Cuesta Chinchilla, 1.2 km SW de Cot (también en barranco del Río Páez cerca de Cot), 9°54'N, 83°53'W, 1650 m, 7 Jan. 1987, *Debouck et al. 2093* (BR, CR, US); Tres Ríos, Cerro de la Carpintera, 2 km S de San Vicente, 3 km SE de Tres Ríos, 9°53'N, 83°58'W, 1600 m, 11 Jan. 1987, *Debouck et al. 2118* (CR, US); Tres Ríos, cerca de la planta eléctrica María del Rosario, 3 km NE de Dulce Nombre, 9°57'N, 83°57'W, 1750 m, 11 Jan. 1987, *Debouck et al. 2119* (BR, CR, MICH, US); N of Cartago, Río Reventado, 1950 m, 11 Dec. 1984, *Khan et al. 957* (CR); Cartago, San Ramón de Tres Ríos, 20 Feb. 1959, *Rodríguez 595* (CR). **San José:** San Isidro de Coronado, 1400–1600 m, 1 Dec. 1937–1 Jan. 1938, *Allen 555* (F, GH, MO); Río Herradura, tributary of Río Chirripó del Pacífico, NW of Canaán, General Valley, 9°29'N, 83°37'W, 1600 m, 29 Dec. 1969, *Burger & Liesner 7097* (F, MO); Aserrí, 2 km SW de Aserrí, 0.2 km después de Km 13 de Ruta 4, 9°51'N, 84°6'W, 1470 m, 8 Jan. 1987, *Debouck et al. 2095* (BR, CR, UC, US); Alajuelita, potreros arriba de San Antonio, al pie del cerro San Miguel, 9°52'N, 84°7'W, 1620 m, 8 Jan. 1987, *Debouck et al. 2102* (BR, CR, US); Aserrí, 1.5 km E de Aserrí, al pie de la Piedra, 9°52'N, 84°7'W, 1590 m, 11 Jan. 1987, *Debouck et al. 2116* (BR, CR, COL, US); Santa María, 1.8 km E de Sta. María a Copey, frente Quebrada Salta, orilla del Río Pirris, 9°40'N, 83°57'W, 1660 m, 12 Jan. 1987, *Debouck et al. 2122* (BR, CR, COL, MICH, US); San Isidro El General, 0.8 km S de Pueblo Nuevo, orillas del Río Buenavista, near San Isidro El General, 9°26'N, 83°40'W, 1550 m, 13 Jan. 1987, *Debouck et al. 2126* (CR, US); San Isidro El General, al pie de la Fila Villarevia, orillas del Río Blanco, 2 km N de Herradura, 9°30'N, 83°37'W, 1690 m, 13 Jan. 1987, *Debouck et al. 2128* (BR, CR, MICH, SI, US, WIS); San Isidro El General, 1 km N de Providencia, orillas del Río Brujo, 9°34'N, 83°51'W, 1990 m, 14 Jan. 1987, *Debouck et al. 2132* (BR, CR, US); barranco entre Aserrí y Tarbaca, 1150 m, 25 Nov. 1964, *Jiménez 2581* (F); below Cerro Pico Blanco, 4 km S of Escazú, 9°52'N, 84°8'W, 1900 m, 12 Dec. 1976, *Lent 3966* (F); vicinity of El General, 1560 m, Dec. 1936, *Skutch 2990* (GH, MO); La Cruz de Alajuelita, 1810 m, 22 Dec. 1935, *Solis 392* (F, MO); between Aserrí and Tarbaca, 1200–1700 m, 6 Dec. 1925, *Standley 41362* (F). PANAMA. **Boquete:** Bajo Mono, 1400 m, 3 Apr. 1938, *Davidson 496* (F, GH, MO). **Chiriquí:** valley of the Río Chiriquí Viejo, near New Switzerland, 1800–2000 m, 6–14 Jan. 1939, *Allen 1397* (EAP, MO); Methodist Camp near Nueva Suissa, 19 Feb. 1971, *Croat 13508* (F, MO); Río Chiquero, 22 Mar. 1977, *D'Arcy 11005* (MEXU, MO); N of Volcán City, valley of R. Chiriquí Viejo, 1600–1700 m, 9 Dec. 1966, *Duke 9019* (MO); Nueva Suissa near Audubon Society Cabin, 1750 m, 12 Sep. 1972, *Gentry 5986* (F, MO); Finca Lérida to Peña Blanca, 1750–2000 m, 9 July 1940, *Woodson et al. 313* (MO, US); Casita Alta, Volcán de Chiriquí, 1500–2000 m, 28 June–2 July 1938, *Woodson et al. 918* (GH, MO, NA, US).

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Trillium channellii, sp. nov. (Trilliaceae), in Japan, and *T. camschatcense* Ker Gawler, Correct Name for the Asiatic Diploid *Trillium*

Ichiro Fukuda
Biology Department, Tokyo Woman's Christian University, Suginami, Tokyo 167, Japan

John D. Freeman
Department of Botany and Microbiology, Auburn University, Alabama 36849-5407, U.S.A.

Masakazu Itou
Environmental Div., Kushiro City Government, Kushiro 085, Japan

ABSTRACT. *Trillium channellii* (Trilliaceae), a new tetraploid species from eastern Hokkaido (northern Japan), is described. Evidence concerning its relationships with other *Trillium* taxa in Asia is presented and discussed, and hypotheses about its origin are considered. The name *T. camschatcense* Ker Gawler is presented as the correct name for the only diploid *Trillium* species in Asia, a taxon most commonly treated as *T. camtschaticum* Pallas ex Pursh; the latter name was not only published invalidly but also at a later date than the former.

Trillium channellii I. Fukuda, J. D. Freeman & M. Itou, sp. nov. TYPE: Japan. Hokkaido: Kushiro Dist., Kawakami Co., Kawayu area, NW of Teshikaga, 2 km due W of Mt. Yuo, elev. ca. 260 m, rich deciduous forest of *Acer, Betula* and *Alnus* on plains near lakeside of Kussharo Lake, 21 May 1994, *Fukuda & Itou s.n.* (holotype, MAK; isotypes, GH, KYO, MO, NY, SAPS, TI, TNS, US, VDB). Figure 1.

A *T. camschatcensi* et *T. tschonoskii* ambobus, quibus facie generali proxime accedit, foliis latioribus, sepalis latioribus et petalis latioribus differt; et a *T. hagae,* cui primo aspectu simillimum est, numero chromosomatum tetraploideorum bene distinctum.

Rhizomatous herb. Aerial stems erect, 30–50 cm tall, glabrous. Leaves 9–12 cm long, 7–14 cm wide, sessile, broadly elliptic, short acuminate at apex, very widely obtuse at base. Pedicels 1.8–2.2 cm long, straight, erect above the leaves. Flowers relatively small, ringent, ± perpendicular to the pedicel or slightly angled upward. Sepals lanceolate, 19–44 mm long, 9–18 mm wide, green. Petals ovate, 22–44 mm long, 11–27 mm wide, white. Stamens erect, the anthers 8–10 mm long, the filaments 4–5 mm long. Pistil 10–20 mm long, 7–19 mm wide, the ovary conical, white below and dark purple at apex below bases of purplish stigmatic branches, the stigmas three, spreading, yellowish above. Fruits ovoid to globose, green, with stigmas persistent. Ovules about 226 per pistil. Pollen globose, about 18.6 μm diam. Chromosome number: $2n$ ($4x$) = 20. See Table 1.

The genus *Trillium* is abundantly represented in Hokkaido, the northernmost main island in Japan. One diploid species and two other tetraploid species besides *T. channellii* occur there as well as hybrids among these taxa at certain locations. Two hexaploid taxa that undergo meiosis and reproduce sexually are assumed to have arisen, either in the distant past or more recently, by somatic doubling of sterile triploid hybrids. The nomenclature of one of the putative parents of the new species named and described herein is clarified later in this article.

The epithet *channellii* was chosen to honor Robert B. (Ben) Channell, Emeritus Professor of Botany, Vanderbilt University, Nashville, Tennessee, U.S.A. His interest in *Trillium* and support of research on taxonomy, cytogenetics, chemistry, and ecology of this genus during the early 1960s account (directly or indirectly) for much new information published about these plants since that time by us as well as many others. He challenged and encouraged those with whom he worked, often without receiving due credit for original ideas. His role in promoting the study of *Trillium* and related genera was acknowledged by Samejima and Samejima (1987), and we add our appreciation to theirs in naming *T. channellii.*

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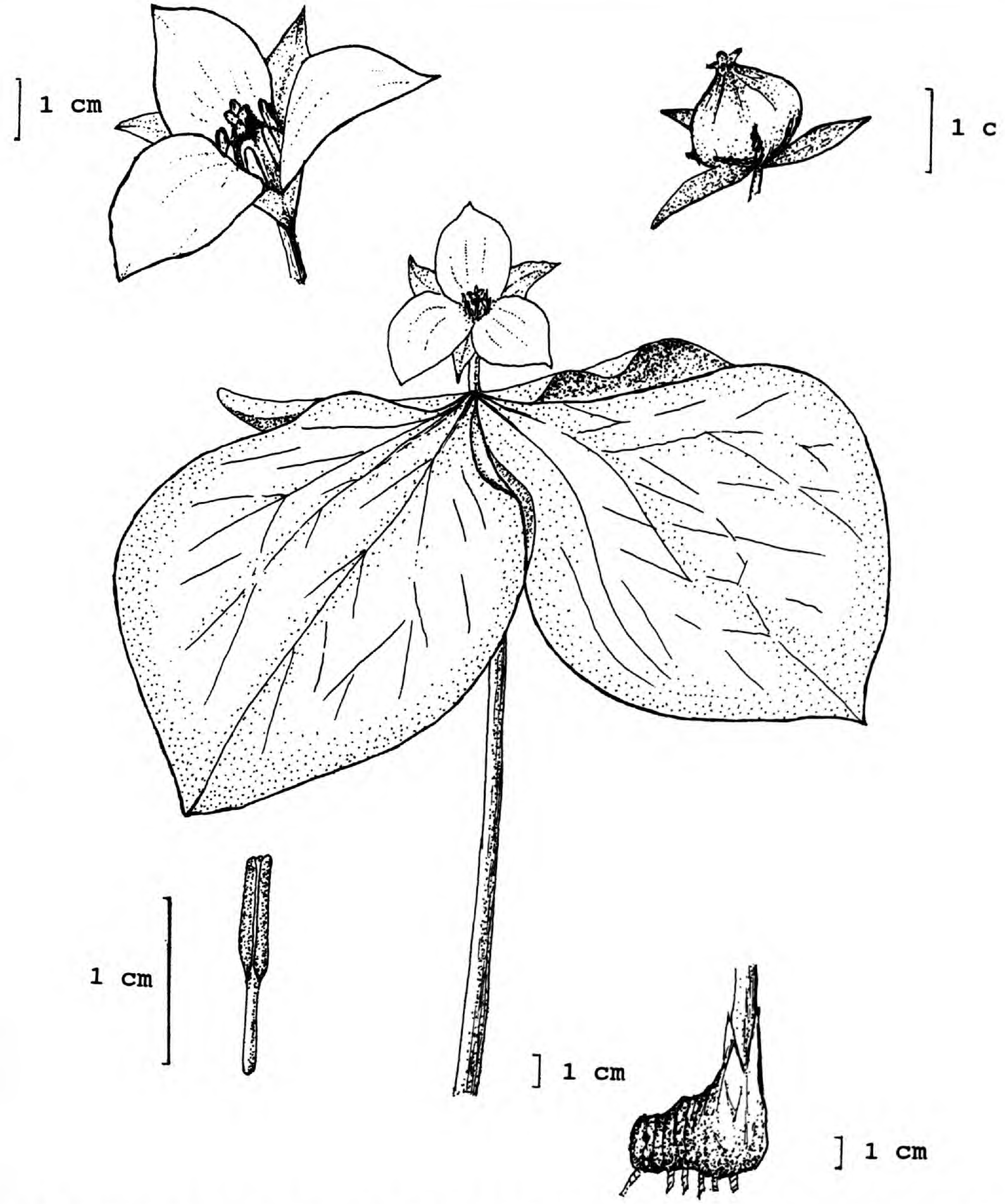

Figure 1. Habit sketch of *Trillium channellii* I. Fukuda, J. D. Freeman & M. Itou, sp. nov. (composite drawing based on the 10 pressed specimens of the type collection, *Fukuda & Itou s.n.*, habit and close-up photographs of plants and flowers taken on 21 May 1994, and photos of fruits taken on 25 July 1994).

THE CORRECT NAME FOR *TRILLIUM CAMSCHATCENSE*

Characters of *Trillium channellii* are compared with those of *T. camschatcense* and *T. tschonoskii* Maximowicz, with which it normally occurs, and *T. hagae* Miyabe & Tatewaki, the only other white-flowered species of *Trillium* in Japan, in Table 1. Before relationships among these taxa can be discussed in detail, a matter concerning the nomenclature of the only diploid species within the group, a taxon that is closely similar to (if not itself) the contributor of at least one genome in three of the Asiatic polyploids, must be rectified.

The earliest validly published name for the only known diploid *Trillium* species in Asia appears to

Table 1. Comparison of the white-flowered species of Japanese *Trillium.*

Character	*T. camschatcense*[1]	*T. channellii*[1]	*T. tschonoskii*[1]	*T. hagae*[2] 3x; 6x
Rhizomes	short, stout	same	same	same
Plant height	30–50 cm	30–50 cm	30–50 cm	22–49; 21–46 cm
Leaf	ovate	broadly elliptic	ovate-elliptic	rhombic-elliptic
apex	acute	short acuminate	long acuminate	subacute; cuspidate
basal sides	rounded/convex	obtuse/concave	obtuse/straight	obtuse/straight concave
length	10–17 cm	9–12 cm	10–15 cm	9–18; 12–19 cm
width	7–14 cm	7–14 cm	7–17 cm	9–24; 12–19 cm
length : width ratio	1.19	1.04	1.17	—
Sepal length	26–40 mm	19–44 mm	18–27 mm	23–45; 24–40 mm
width	8–12 mm	9–18 mm	8–12 mm	8–19; 9–16 mm
length : width ratio	3.11	2.48	2.74	—
Petal length	22–47 mm	22–44 mm	22–28 mm	27–49; 27–48 mm
width	9–22 mm	11–27 mm	9–13 mm	16–32; 16–27 mm
length : width ratio	2.15	1.58	2.08	—
Stamen length	17.3 mm	12.8 mm	8.9 mm	12–17; 11–15 mm
Pistil length	14.3 mm	13.9 mm	11.2 mm	12–20; 11–17 mm
Stamen length : Pistil length ratio	1.21	0.92	0.79	—
Ovules/pistil				
1986 (N = 30)	242.1	273.6	137.6	—
1988 (N = 30)	266.7	225.8	168.8	—
1995 (N = 25)	224.0	170.5	116.9	—
ave. (N = 85)	245.5	226.4	142.9	—
Pollen diam.	14.2 μm	18.6 μm	16.3 μm	—
Somatic chromosome number	10	20	20	15; 30

[1] Character states, ranges, and averages based upon 30 plants of each species from the Kawayu area unless otherwise noted.

[2] Data derived from Samejima and Samejima (1962, 1987).

be *T. camschatcense* of Ker Gawler (1805) rather than *T. camtschaticum* Pallas ex Pursh (1814). The orthographic variant "*T. kamtschaticum*" has been the name most used for this species by recent authors. The binomial *T. camtschaticum* was cited by Pursh (1814) as a synonym of *T. obovatum,* a new species he proposed on the basis of specimens from Montreal, Canada. The Pallas specimens in the Lambert Herbarium (Pursh, 1814; Miller, 1970), which Pursh no doubt noted in 1811 (Stafleu & Cowan, 1983) as being labeled *T. camtschaticum* and collected in Kamtschatka, were not described by either Pallas or Pursh as a distinct taxon. Pursh clearly did not accept Pallas's epithet for *T. obovatum,* and the specimens were not treated as something distinct. Rather, he stated, "The specimens in the herbarium of A.B. Lambert, Esq. agree in every respect with those from Canada." We believe that this taxonomic opinion was incorrect and that *T. obovatum* is a taxonomic synonym of *T. grandiflorum* (Michaux) Salisbury, the accepted name for a species only distantly allied with Asiatic taxa of *Trillium.* The name *T. camtschaticum* Pallas ex Pursh itself is simply a nomen nudum published pro syn., and Pursh's primary intent apparently was to cite a collection he believed to represent the same species as his *T. obovatum.* As a nomen nudum *T. camtschaticum* lacks nomenclatural standing under both present and prior Codes, besides also being later than *T. camschatcense.*

We are indeed fortunate that the type collection of *T. camschatcense* mentioned by Ker Gawler (1805) as being in the Banksian Herbarium (now at BM) still exists; it comprises three sheets of specimens that bear a total of five stems, including three with good flowers. The holotype (labeled "TYPE SPECIMEN of *T. camschatcense* Ker-Gawl."), the only stem that is not attached to a rhizome, is labeled "Kamtschatka ex herb. Dr. Pallas." The other two sheets (isotypes) are labeled "TYPE COLLECTION of *T. camschatcense* Ker-Gawl.": one isotype has two leaf-bearing stems from the same rhizome (with floral remnants only on one stem) and bears the handwritten label "*Trillium*

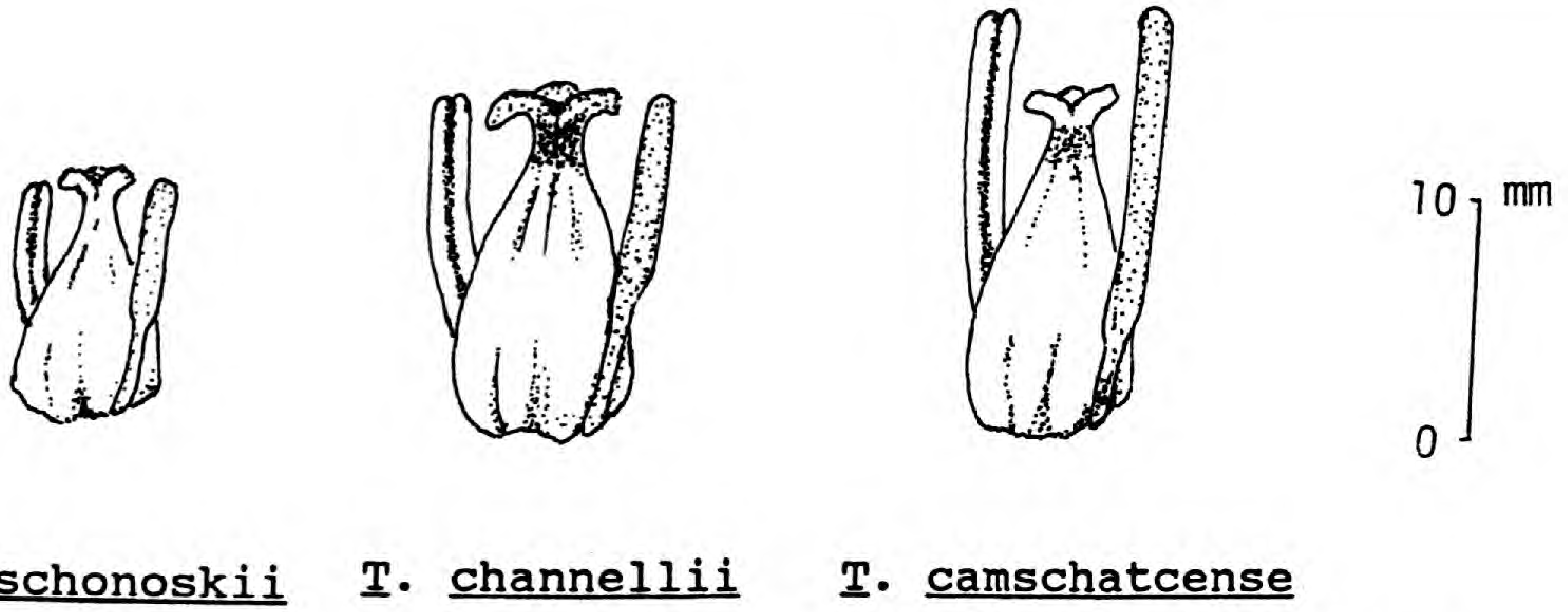

Figure 2. Comparisons of pistils and stamens among *Trillium tschonoskii, T. channellii,* and *T. camschatcense.*

camtschaticum" at the top but no data concerning collector or locality; two flowering plants from separate rhizomes are mounted on the other (third) sheet, at the top of which are borne two "*T. camtschaticum*" labels in the same handwriting as the other isotype plus one that states "Herb. Pallas." Various erroneous determinations provided via annotations to these specimens by later taxonomists (both unknown and well known) do not bear upon typification of *T. camschatcense.* This binomial is clearly based upon a collection by Pallas from Kamtschatka; any later species epithet based upon Pallas's same collection (including the duplicate in Lambert's herbarium cited by Pursh) must be treated as nomenclaturally synonymous even if other publication criteria were acceptable.

Early descriptions of *Trillium* species were so general as to fit almost any species, so the fact that *T. camtschaticum* came to be used for *Trillium* plants known to occur in eastern Russia (Kamtschatka) as well as Japan is not surprising. Publications on the Asian flora during the 19th Century (e.g., Ledebour, 1852; Miyabe, 1890) and early 20th Century (Makino, 1913) accepted *T. camtschaticum* or *T. obovatum* (more often as "*T. kamtschaticum*") for any white-flowered *Trillium* or else called it *T. erectum* var. *japonicum* A. Gray (1858). Very few authors except Hultén (1927) have treated *T. camtschaticum* as invalid, but her publication of the new name *T. pallasii* failed to account for the earlier name by Ker Gawler also based upon Pallas's collection. Now that four sexually fertile white-flowered species, including one diploid and three polyploids, are known for Japan alone, universal acceptance of *T. camschatcense* for the diploid is long overdue.

DISTINGUISHING CHARACTERISTICS OF *TRILLIUM CHANNELLII*

Some of the characteristics of *Trillium channellii* (Fig. 1) are intermediate between *T. camschatcense* and *T. tschonoskii* as shown in Table 1. It expresses one morphological extreme in certain traits or more closely resembles one or the other of them in others. Leaf shape in *T. channellii* is more broadly elliptic than in either of the other two but is closer to *T. tschonoskii.* However, sepal and petal shapes and length : width ratios for these organs in *T. channellii* are much closer to *T. camschatcense.*

Other morphological features that distinguish these three species are those of the stamens and pistil. Comparative sketches of these floral parts are shown in Figure 2. In *Trillium camschatcense,* with long stamens, the ratio of stamen length to pistil length is ca. 1.2; in *T. tschonoskii,* with short stamens, this ratio is ca. 0.8; and in *T. channellii,* with stamens and pistils almost equal in length, the ratio is ca. 0.9. Both *T. channellii* and *T. camschatcense* show similar dark purple marks near the ovary apex, but these marks are lacking in *T. tschonoskii.* Ovules per pistil average about 245 for *T. camschatcense* and 226 for *T. channellii,* but in *T. tschonoskii* the average is much lower, only about 143.

Pollen fertility was determined for all three species in the Kawayu area to be higher than 94 percent, and pollen grains in *T. channellii* were found to be much larger than those of the other two species (Table 1). Since first observed in 1986, *T. channellii* has been the earliest of the three species to flower each year. Somatic chromosome number was determined from root tip squashes by the method of Darlington and LaCour (1938) to be $2n$ $(2x)$ $= 10$ in *T. camschatcense* and $2n$ $(4x) = 20$ in both *T. channellii* (Fig. 3) and *T. tschonoskii* within the area of sympatry. From *T. hagae,* for which data are also shown in Table 1, *T. channellii* differs mainly by its tetraploid chromosome number and high degree of fertility. As a taxon present in both sterile triploid and fertile hexaploid forms in Japan, *T. ha-*

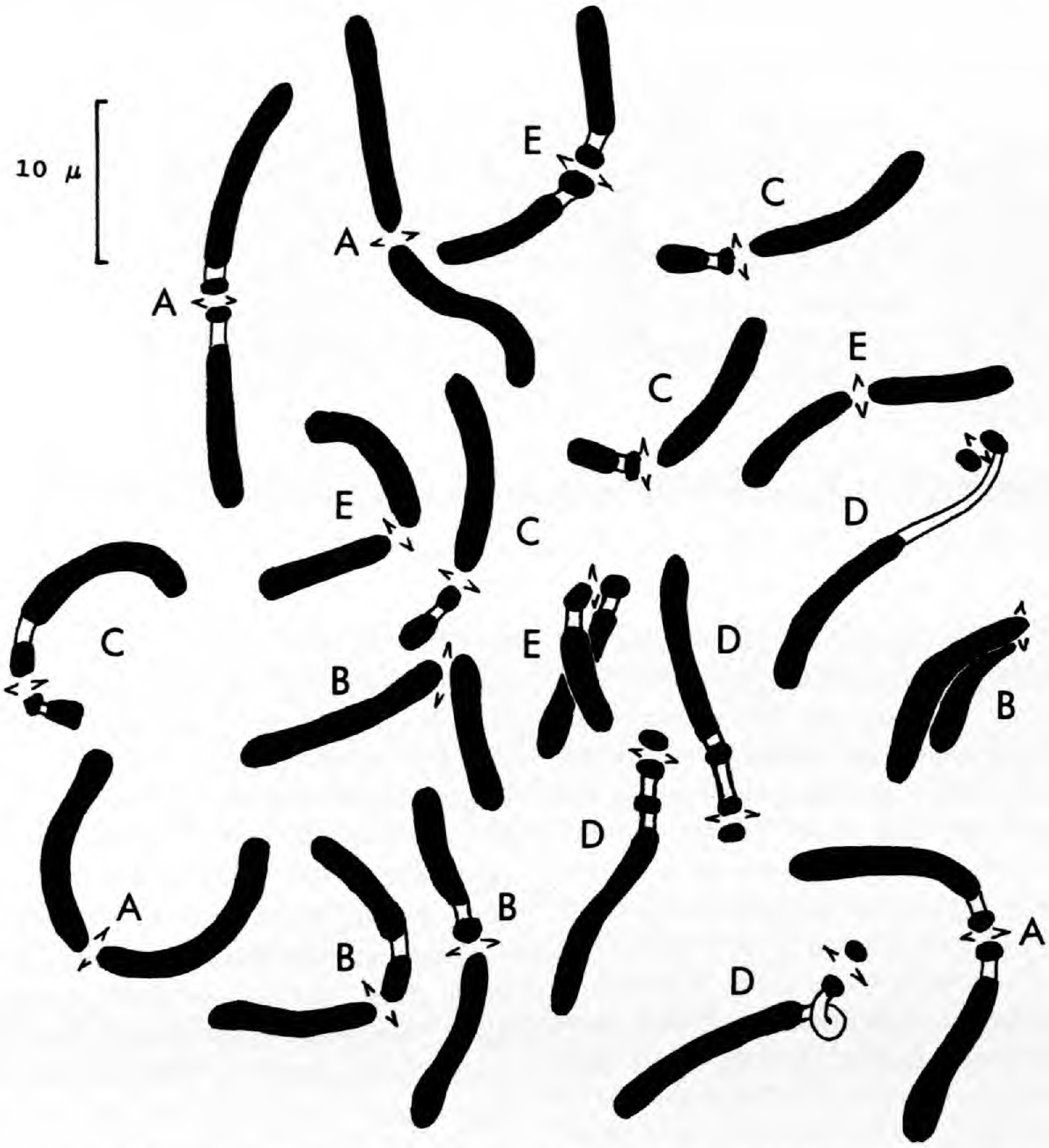

Figure 3. Chromosomes of *Trillium channellii* at mitotic metaphase showing differential staining patterns.

gae is intermediate between the parental taxa *T. camschatcense* and *T. tschonoskii* in most of its morphological features.

THE DISTRIBUTION AND HABITAT OF *TRILLIUM CHANNELLII*

The distribution of *Trillium channellii* (Fig. 4) is on the volcanic plain at the base of Mt. Yuo, especially in the Kawayu area along Kussharo Lake, Kawakami Co., Kushiro Dist., Hokkaido, Japan, where both *T. camschatcense* and *T. tschonoskii* also occur. Populations occur from near lakeside (254 m elev.) up to about 300 m elevation. Flowering specimens that were surveyed in a quadrat only 3 m × 10 m at the type locality (Fig. 5) were determined as follows: *T. channellii*, 51; *T. tschonoskii*, 14; and *T. camschatcense*, 10. In this area the first *Trillium* to reach anthesis (in late May) is *T. channellii*; several days later *T. tschonoskii* begins to flower; and *T. camschatcense* is last to flower after a few days more. When *T. camschatcense* and *T. tschonoskii* occur together to the south (Kushiro Dist.), north (Abashiri Dist.), and east (Nemuro Dist.), the former species begins to flower several days to one week earlier than the latter. The reversal of the order that these species come into flower within the range of *T. channellii* could be linked to its origin in some way and may also reflect long-term local ecological effects of Mt. Yuo, now an active volcano, on nearby plant populations. We cannot prove this speculation on the basis of data now available, but we acknowledge such a possibility.

THE ORIGIN OF *TRILLIUM CHANNELLII*

At present we can offer two hypotheses concerning the origin of *Trillium channellii*, and each of them is supported by some (but not all) of the data available. Because both *T. camschatcense* and *T. tschonoskii* occur throughout the range of the new species and since all three share similar morphology, it was felt initially that *T. channellii* might be a hybrid between the two taxa with larger geographical ranges. As shown in Table 1, several of its

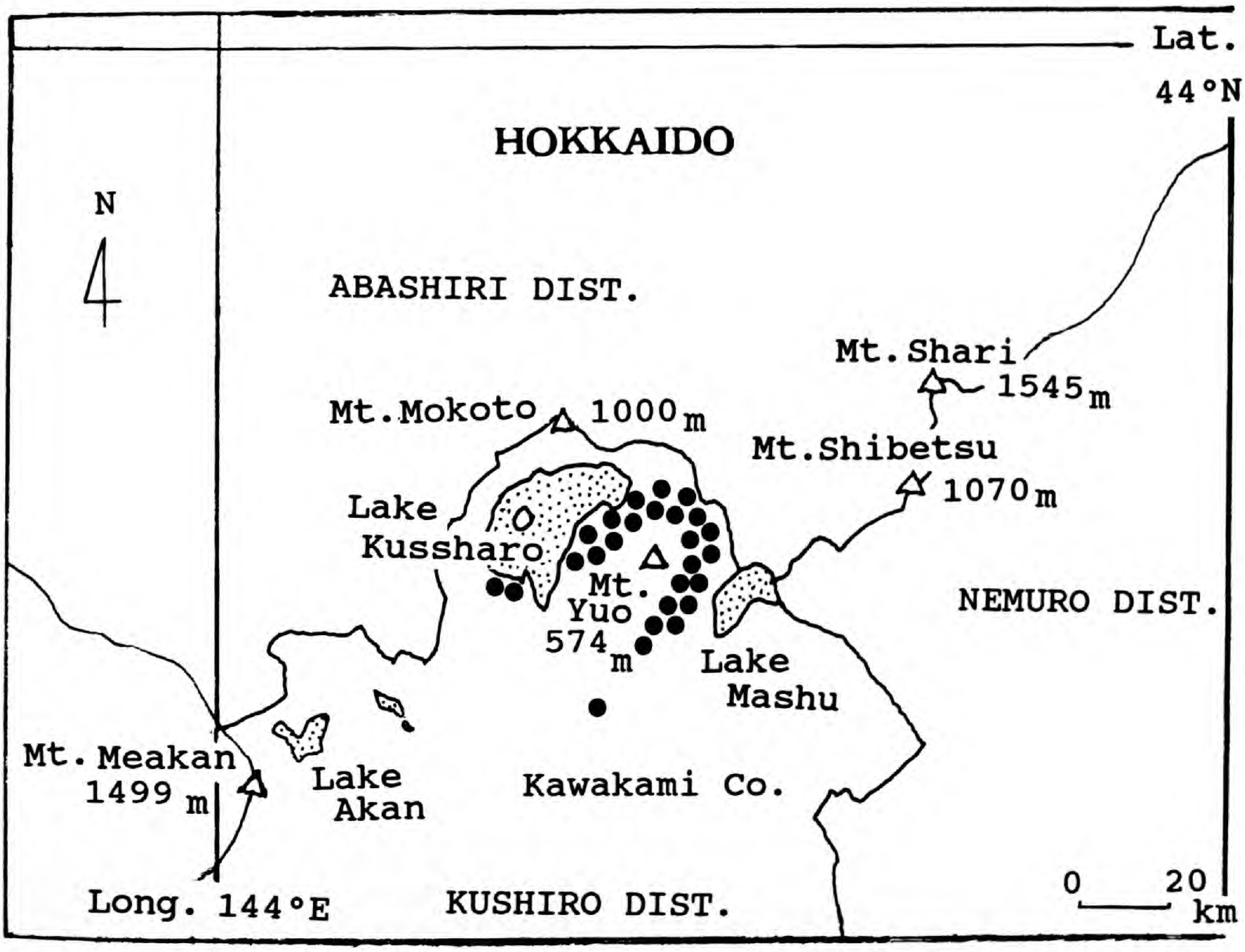

Figure 4. Distribution of *Trillium channellii* in eastern Hokkaido, Japan.

features are intermediate, and this at first led us to believe that these plants were *T.* ×*hagae*.

Since *Trillium camschatcense* is diploid ($2n = 10$) and *T. tschonoskii* tetraploid ($2n = 20$), *T. channellii* could have originated from these putative parents only if the diploid contributed an unreduced gamete and *T. tschonoskii* a normal one. Combination of reduced and unreduced gametes is the most tenable explanation of triploid individuals occasionally found in North American *Trillium* taxa, all of which are diploid. Such an origin would give *T. channellii* the genomic constitution $k_1k_1k_2t$ according-

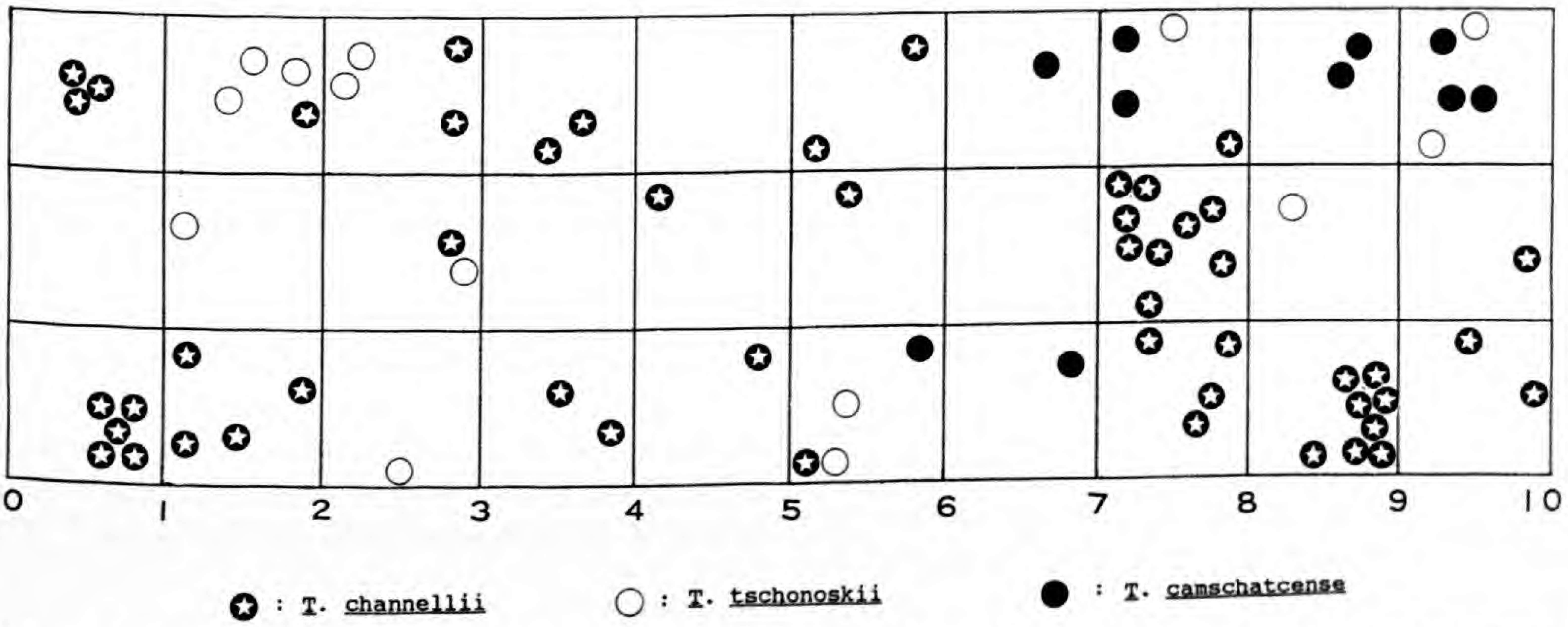

Figure 5. Quadrat (3 m × 10 m) showing locations of flowering plants of *Trillium channellii* and sympatric species at the type locality on 21 May 1994.

ing to the system of genome designations developed for *Trillium* taxa in Japan (Haga & Kurabayashi, 1953). One would expect numerous irregularities including both univalents (from the k_2 and t genomes) and trivalents (from homeologous associations among all three of the basic genomes) at Meiosis I in plants with this chromosomal constitution. Kurabayashi (1958) reported that bivalents between k_2 and k_1 are rather common in triploid plants of *T. hagae,* but trivalent and univalent frequencies are high (12 and 86 percent, respectively), and the pollen is highly sterile. By contrast, hexaploid *T. hagae* regularly shows 15 bivalents, suggesting strictly homologous associations of chromosomes, and very high pollen stainability. Furthermore, triploid plants (i.e., typical *T.* ×*hagae*) are yet to be discovered in the same area where *T. channellii* is found. Such hybrids, products of the union of normal gametes, would likely form at much higher rates than would plants from the chance union of an unreduced gamete from a diploid and a reduced gamete from a tetraploid. Since *T. channellii* flowers the earliest, and since pollen fertility is at least as high in the new species as in either putative parent, the unreduced diploid gamete hypothesis cannot be accepted without equivocation.

A thorough search of the extensive literature concerning karyotypes of the Asiatic species of *Trillium* turned up no report of tetraploid plants that resemble *T. channellii* and *T. hagae* at sites where both *T. camschatcense* and hexaploid *T. hagae* are sympatric and form gametes with reduced chromosome numbers. If indeed the latter two species can hybridize, that hybrid would be a tetraploid with exactly the same genomes (i.e., $k_1k_1k_2t$) as one formed by union of an unreduced gamete from *T. camschatcense* and a reduced gamete from *T. tschonoskii. Trillium channellii* is so unlikely to have begun as a hybrid between hexaploid and diploid taxa, especially when *T. hagae* does not grow in the vicinity, that this possibility was not seriously considered. The same meiotic irregularities would be expected in such a tetraploid as in one derived from gametes from the two species that grow with *T. channellii.* As stated earlier, pollen fertility is high in the latter species, and this means that meiosis is very regular.

In addition to high pollen stainability in *Trillium channellii,* several other factors suggest an origin for *T. channellii* other than directly from the other two allied species with which it now occurs. An alternative hypothesis is that the new tetraploid may have originated by means of somatic doubling in a hybrid between *T. camschatcense* and a diploid taxon that is either now extinct or may exist only as one of the two genomes in *T. tschonoskii.* All other polyploids among the Asiatic taxa of Trilliaceae (including *Trillium, Paris, Daiswa,* and *Kinugasa*) are generally accepted to have originated by this means of polyploidization. Differential staining patterns illustrated in Figure 3 (a karyotype typical of *T. channellii* plants) are identical for nine out of ten chromosome pairs. Having perfectly matched pairs of homologues for one whole diploid complement indicates far greater correspondence between basic genomes than that suggested for k_2 and t genomes in *T. hagae* in previous studies (Haga, 1937; Haga & Kurabayashi, 1953). If these ten chromosomes are attributed to an unreduced (i.e., diploid) gamete from *T. camschatcense,* the remaining pairs still match exactly except for the C chromosome. Such strong similarity implies that one of the homologues in each of the basic sets of five may have originated from the other as a sister chromatid rather than from a reduced gamete from *T. tschonoskii.* Sexual reproduction coupled with sufficient time since its origin to permit chromosomal differentiation could well account for the staining pattern differences seen in just one pair of chromosomes in the *T. channellii* genome.

The most obvious problem with this hypothesis for an amphidiploid origin of *Trillium channellii* is the "missing" diploid parent. This stands as a real problem only if one maintains that the new species is of recent origin, and available data do not resolve that question. The geological period during which the k_2k_2 and tt genomes in *T. tschonoskii* vanished from Japan (as diploids) is not known and may even have been the post-Pleistocene. Therefore, we suggest that *T. channellii* could be an allotetraploid of the genomic constitution k_1k_1tt or $k_1k_1k_2k_2$. The former genome combination appears more likely than the latter because high pollen stainability in *T. channellii* shows it to be well diploidized, and this points to well differentiated ancestral genomes involved in its origin. Further studies, possibly using molecular markers, should be made to clarify the origin of *T. channellii,* but recognition of this new fertile tetraploid as a species distinct from other autonomous species and their hybrids in Japan is warranted at the present time.

Acknowledgments. We are grateful to Charlie Jarvis at BM for examining the type collection of *T. camschatcense* in the herbarium of Joseph Banks and for providing us with excellent photocopy images of sheets described earlier in this paper.

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Two New Edaphic Endemic Species and Taxonomic Changes in *Gladiolus* (Iridaceae) of Southern Africa, and Notes on Iridaceae Restricted to Unusual Substrates

Peter Goldblatt

B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

John C. Manning

National Botanical Institute, P. Bag X7, Claremont 7735, South Africa

ABSTRACT. Two new species of the African and Eurasian genus *Gladiolus* occurring on unusual substrates are described from southern Africa. *Gladiolus serpenticola* is restricted to serpentine soils in the Barberton District, Mpumalanga Province, South Africa, and adjacent Swaziland and *G. pavonia* occurs on dolomite in Mpumalanga. *Gladiolus serpenticola,* unusually tall for the genus, stands 75–150 cm high, has small, dry floral bracts, and short-tubed, pale pink flowers. It appears to be most closely related to another Mpumalanga endemic, *G. hollandii,* and both belong to an alliance of eastern southern African species centered around the widespread *G. crassifolius. Gladiolus pavonia* has pale pink flowers and is most likely related to a complex of eastern southern African species, mostly of rocky habitats in montane grasslands. Three additional species of *Gladiolus* from Western Cape Province, South Africa, are recognized here: *G. miniatus, G. caeruleus,* and *G. variegatus.* The first is reinstated at species rank after having been reduced to a subspecies of *G. floribundus. Gladiolus caeruleus* and *G. variegatus* are raised from infraspecific rank in which they were treated as *G. gracilis* var. *latifolius* and *G. debilis* var. *variegatus,* respectively. All three of these species are restricted to limestone outcrops. *Gladiolus miniatus* and *G. variegatus* occur in the southern part of Western Cape Province, and *G. caeruleus* is restricted to a small area of the west coast of the Province. These five species join the small number of taxa of African Iridaceae listed here, now totaling 15, known to be endemic or largely restricted to unusual soil types.

Botanists have long recognized the striking effects of such azonal substrates as limestone, dolomite, gypsum, serpentine, and heavy metal soils (Kruckeberg & Rabinowitz, 1985; Kruckeberg, 1986). These substrates often harbor unusual plant associations and endemic species, and the new species recognized here fall into this category. As far as is known, relatively few of the estimated 1750 species of the family Iridaceae are narrow edaphic endemics of these unusual substrates, and none were mentioned by Wild (1978) in his survey of edaphic endemism in southern Africa. Just a handful of African Iridaceae fall into this category (Table 1), most of which belong in the genus *Gladiolus* L. To this short list we add five more species, two new to science and three raised from infraspecific rank. The new species are *G. serpenticola,* restricted to serpentine outcrops in the Barberton District, Mpumalanga Province, South Africa, and adjacent Swaziland, and *G. pavonia,* an apparently narrow endemic of dry dolomite slopes near Abel Erasmus Pass in the Drakensberg Mountains of Mpumalanga.

Three more species, *Gladiolus caeruleus, G. miniatus,* and *G. variegatus,* are recognized here, each currently regarded as local subspecies or varieties of more widespread taxa (Lewis et al., 1972). All are restricted to Tertiary limestone outcrops and calcium-enriched coastal sands of Western Cape Province. *Gladiolus miniatus* Ecklon is reinstated as a species, having been treated by Obermeyer in Lewis et al. (1972) as a subspecies of the widespread *G. floribundus.* It is unusual in being the only species of the *G. carneus–G. floribundus* alliance that is adapted for pollination by sunbirds. *Gladiolus caeruleus* is a new name at species level for *G. gracilis* var. *latifolius,* and *G. variegatus* is a new combination and rank for *G. debilis* var. *variegatus.* The nomenclatural changes and a discussion of their relationships are provided for each of the species raised from infraspecific rank, but full descriptions are not included here. Descriptions will be published in a systematic revision of *Gladiolus* in southern Africa, currently in preparation.

NOVON 6: 172–180. 1996.

From the data available on substrate preferences in Iridaceae (Table 1), we conclude that the occurrence of endemic species on such soils is unusual and is restricted mainly to larger genera with 25 or more species, the exception being *Freesia* with just 15 species. The edaphic endemics appear in all cases to be neoendemics fairly closely related to extant species that occur on more normal soil types in the immediate vicinity. *Gladiolus,* with approximately 250 species, is possibly the most speciose genus of Iridaceae and the largest genus in subfamily Ixioideae; it also harbors the largest number of edaphic endemics.

SYSTEMATICS

1. **Gladiolus serpenticola** Goldblatt & Manning, sp. nov. TYPE: South Africa. Mpumalanga: Kaap Valley on Nelspruit–Barberton road near Noordkaap River bridge, serpentine outcrops, 9 Feb. 1994, *Goldblatt & Manning 9844* (holotype, NBG; isotypes, E, K, MO, PRE, WAG). Figure 1.

Plantae 75–150 cm altae, cormo 3–5 cm in diametro, foliis 8–10 inferioribus 4–5 basalibus longioribusque anguste lanceolatis vel sublinearibus laminibus 7–10 mm latis, caule usitate ramoso, spica 18–30 florum, bracteis siccis brunneis attenuatis exteriore 12–16 mm longis, floribus pallide roseis vel subalbis tepalis lateralibus inferioribus flavis purpureisque notatis, tubo perianthii infundibuliforme 10–12 mm longo, tepalis inaequalibus dorsale 23 × 14 mm superioribus lateralibus 23 × 12 mm inferioribus 13–18 × 5.5–8 mm, filamentis 14 mm longis, antheris ca. 6 mm longis, capsulis globoso-ovatis apicibus trilobatis 5–8 mm longis, seminibus alis ca. 1.5 mm longis.

Plants 75–150 cm high. *Corms* depressed-globose, 3–5 cm diam., the tunics initially coriaceous and unbroken, fragmenting irregularly, becoming coarsely fibrous. *Cataphylls* coriaceous and pale, the uppermost reaching 8–12 cm above the ground and then green or flushed with purple. *Leaves* 8–10, the lower 4–5 ± basal and longest, reaching to about the base of the spike, gray-green, the blades narrowly lanceolate to linear, 7–10 mm wide, the remaining leaves cauline, progressively smaller above, imbricate and sheathing the stem to about the base of the spike. *Stem* erect, usually with 1–2 branches, occasionally more, 2–2.5 mm diam. below the base of the spike. *Spike* slightly inclined, ± straight, 18- to 30-flowered, the secondary axes with fewer flowers; *bracts* pale green in bud, dry and light brown above by anthesis, narrowly lanceolate, the apices attenuate, dry and twisted, 12–16 mm long, the inner bracts similar, ca. two-thirds as long as the outer. *Flowers* pale pink to nearly white, the lower lateral tepals each with a central yellow streak surrounded by a light purple blotch, the yellow fading to purple with age, unscented; *perianth tube* obliquely funnel-shaped, 10–12 mm long; *tepals* broadly ovate, the dorsal inclined to hooded over the stamens, 23 × 14 mm, upper laterals directed forward, weakly curving upward in the distal third, 23 × 12 mm, lower 3 tepals united for ca. 2 mm, the lower laterals shortly clawed gradually expanded into the limbs, 13–14 × 5.5–6 mm, the lower median 16–18 × ca. 8 mm, arching downward, much exceeding the lower laterals. *Filaments* 14 mm long, exserted ca. 8 mm from the upper part of the tube; *anthers* ca. 6 mm long, purple, the pollen cream. *Ovary* ovoid, ca. 2.5 mm long; *style* arching over the stamens, dividing opposite the lower to upper third of the anthers, the branches ca. 2 mm long, not reaching the anther apices. *Capsules* ovoid, three-lobed apically, 5–8 mm long; *seeds* ovate, ca. 5–6 × 2.5–3 mm, the wing ca. 1.5 mm long, unevenly developed, sometimes lacking on one side or across the middle.

Flowering early February to late March, rarely in late January.

Etymology. A combination of serpentine, the substrate on which the species grows, and the Latin, "*icola,*" living on, thus *serpenticola.*

Distribution and habitat. Gladiolus serpenticola is endemic to the Barberton District of Mpumalanga Province, South Africa. Plants occur widely across the low-lying Kaap Valley, the floor and lower edges of which have extensive outcrops of verdite, a dark green form of serpentine. Soils derived from this substrate are relatively inhospitable to plants (Morrey et al., 1989) because they have high concentrations of toxic minerals, including unusually high magnesium/calcium ratios and potentially toxic concentrations of chromium and nickel, and because they are often associated with high levels of iron and cobalt,

Diagnosis and relationships. The distinguishing features of *Gladiolus serpenticola* are the tall stature, 75–150 cm high, narrow glaucous leaves, 7–10 mm wide, and small dry brittle floral bracts only 12–16 mm long. The relatively small, pale pink flowers with pale mauve markings on the lower lateral tepals and the short perianth tubes, 10–12 mm long, are unremarkable in the genus and closely resemble those of related species such as *G. densiflorus* and *G. crassifolius.* Like the majority of eastern southern African species of *Gladiolus* with small flowers, *G. serpenticola* has short, ovoid to oblong capsules with broadly trilobed apices and small seeds with narrow, poorly developed wings.

Table 1. Edaphic endemic species of African Iridaceae. Total number of species per genus is indicated in parentheses after the genus name. D = dolomite, L = limestone, S = serpentine, H = heavy metal enriched.

Species	Substrate	Distribution range
Gladiolus (ca. 250 spp.)		
G. actinomorphanthus Duvigneaud & van Bokstal	H	Shaba Province, Zaire
G. calcicola Goldblatt	L	southern Ethiopia
G. caeruleus Goldblatt & J. Manning	L	W. Cape coast, South Africa
G. dolomiticus Obermeyer	D	Northern Province, South Africa
G. ledoctei Duvigneaud & van Bokstal	H	Shaba Province, Zaire
G. miniatus Ecklon	L	S. Cape coast, South Africa
G. pavonia Goldblatt & J. Manning	D	Mpumalanga Province, South Africa
G. robiliartianus Duvigneaud & van Bokstal	H	Shaba Province, Zaire
G. tshombeanus Duvigneaud & van Bokstal	H	Shaba Province, Zaire
G. vaginatus G. Lewis	L	S. Cape coast, South Africa
G. variegatus (G. Lewis) Goldblatt & Manning	L	W. Cape coast, South Africa
Freesia (15 spp.)		
F. elimensis L. Bolus	L	S. Cape, South Africa
Hesperantha (ca. 60 spp.)		
H. juncifolia Goldblatt	L	S. Cape coast, South Africa
Ixia (45 spp.)		
I. acaulis Goldblatt & Manning	L	Namaqualand, South Africa
Moraea (125 spp.)		
M. calcicola Goldblatt	L	W. Cape coast, South Africa
M. loubseri Goldblatt[1]	L	W. Cape coast, South Africa
Tritonia (ca. 30 spp.)		
T. squalida Aiton	L	S. Cape coast, South Africa
Watsonia (52 spp.)		
W. fergusoniae L. Bolus	L	S. Cape, South Africa

[1] Although thought to be restricted to soils derived from granite, the habitat of *Moraea loubseri* has been found to have a limestone deposit overlaying the granite basement, and it seems likely that the species is restricted to a limestone substrate (unpublished obs.).

The capsules of *G. serpenticola* are particularly small, only 5–8 mm long. Its relationships appear to lie most closely with a second eastern southern African species, *G. hollandii.* Also unusually tall and with relatively soft-textured leaves, *G. hollandii* has flowers with a perianth tube ca. 25 mm long, longer floral bracts 20–30 mm long, and larger capsules 10–20 mm long. It occurs on quartzitic and granitic soils from Pilgrim's Rest to Barberton in Mpumalanga southward to Goba in Mozambique and Hlatikulu in Swaziland.

Until now the few available collections of *Gladiolus serpenticola* have been confused with either *G. crassifolius* or *G. densiflorus*, both short-tubed species with similarly proportioned flowers that broadly resemble those of *G. serpenticola. Gladiolus crassifolius* can immediately be distinguished by its coarsely ribbed leaves with thickened and hyaline midribs, secondary veins, and margins, a sturdy stem, sharply inclined spike, and broader floral bracts. *Gladiolus densiflorus* also has distinctive leaves with the midrib and margins slightly thickened and the remaining veins fine and closely set.

Paratypes. SOUTH AFRICA. **Mpumalanga**: 2530 (Lydenburg) 1 km from the Noordkaap River bridge on the road to Barberton (DB), 14 Apr. 1994 (fruit), *Manning 2108* (NBG); 2531 (Barberton) 14 km to Noordkaap from Nelspruit–Barberton road (CA), 10 Mar. 1983, *Reid 721* (PRE). SWAZILAND. 2631 (Mbabane) Hlatikulu [?District], Mar. 1911, *Stewart s.n.* (K, PRE).

2. **Gladiolus pavonia** Goldblatt & Manning, sp. nov. TYPE: South Africa. Mpumalanga: dolomite hill slopes between the top of Abel Erasmus Pass and Strydom Tunnel, 6 Dec. 1994, *Goldblatt & Manning 10131* (holotype, NBG; isotypes, K, MO, PRE). Figure 2.

Plantae 45–80 cm altae, cormo 8–13 mm in diametro stolonifero, foliis 6 vel 7 inferioribus basalibus laminis planis, caule eramoso, spica erecta (2–)4–7 florum, brac-

Figure 1. *Gladiolus serpenticola,* habit and detail of flowers ×0.5 (from *Goldblatt & Manning 9844*).

teis pallide viridibus post anthesin supra siccis (15–)23–30 mm longis, floribus pallide carneis tepalis inferioribus atrolineatis tubo perianthii ca. 16 mm longo, tepalis subaequalibus, filamentis ca. 16 mm longis, antheris ca. 8 mm longis.

Plants 45–80 cm high. *Corm* ovoid, 8–13 mm diam., with stolons produced from the base, these ultimately producing new plants some distance from the parent, the tunics of ± papery layers, with

Figure 2. *Gladiolus pavonia,* habit and detail of flowers ×0.5 (from *Goldblatt & Manning 10131*).

age becoming irregularly broken and somewhat fibrous. *Cataphylls* pale and membranous, the uppermost reaching 2–3 cm above the ground and then brownish or purple. *Leaves* six or seven, the lower three or four ± basal and largest, reaching at least to the base of the spike or sometimes slightly exceeding it, the blades narrowly lanceolate, 8–14 mm wide, usually slightly twisted in the upper halves, the remaining two to three leaves cauline and much smaller than the basal, the uppermost largely or entirely sheathing, the margins open to the base. *Stem* erect, sometimes flexed outward above the sheaths of the two upper leaves, but remaining erect, unbranched, 2.0–2.3 mm diam. at the base of the spike. *Spike* erect, occasionally 2-, usually 4- to 7-flowered, the flowers in two ranks ca. 50° apart; *bracts* pale green, relatively soft-textured, shortly after anthesis the apices becoming dry and light brown, the outer (15–)23–30 mm long, the inner bracts slightly shorter to about as long as the outer, apiculate or minutely forked apically. *Flowers* pale pink, the upper tepals shading to dark red toward the bases, the dorsal half of the upper part of the tube dark red inside and out, the lower margins of the dorsal tepals with a wide transparent band, the lower lateral tepals lightly streaked with pink longitudinal lines in the lower half, the lower median tepals whitish in the lower half lined with purple longitudinal streaks, the lower tepals also with a white zone with a central red spot just below the tepal sutures, unscented; *perianth tube* obliquely funnel-shaped, ca. 16 mm long, the lower cylindrical part ca. 8 mm long; *tepals* nearly equal and widely spreading, the dorsal slightly larger than the others, ca. 25 × 16 mm, curving outward below, erect above, the upper laterals patent in the upper half, 24–26 × 15 mm, the lower three tepals slightly inclined below, recurved in the upper half, 21–24 × 12 mm. *Filaments* ca. 16 mm long, reddish in the lower half, exserted for ca. 8 mm; *anthers* ca. 8 mm long, tilting below the horizontal, dark purple, the pollen cream. *Ovary* oblong, ca. 6 mm long; *style* arching over the stamens, dividing between the base and middle of the anthers, the branches 5–6 mm long, expanded and bilobed at the apices. *Capsules* obovoid, 21–24 mm long, three-lobed above and retuse; *seeds* evidently oval, ca. 7 mm long, the wing apparently well developed, light brown (fully mature seeds not seen).

Flowering late November and December, occasionally until late January.

Etymology. Pavonia, peacock in Latin, alluding to the dark eye on the center of the flower as in a peacock feather.

Distribution and habitat. A rare, narrow endemic, *Gladiolus pavonia* is recorded from the mountains south of the Strydom Tunnel on the slopes of the Abel Erasmus Pass in Mpumalanga Province, South Africa. Plants grow on semiarid stony dolomite hills in light woodland, and seem to favor shaded or open, exposed sites equally. They produce several stolons from the corm bases and form small clones, several juvenile plants surrounding the larger parent plants. Our observations suggest that *G. pavonia* favors steeper slopes that receive slightly more precipitation than the surrounding hills. Although known from only two sites in the area, we suspect that it is more widespread in the dolomite belt that extends to the north and south along the Drakensberg Range interior to the escarpment edge (Matthews et al., 1993). The early summer of 1994 when we collected the plants for the illustrations reproduced here was exceptionally dry and very few individuals produced flowering spikes. In years of higher rainfall we suspect that the species produces a fine display of flowers. *Gladiolus pavonia* appears to be a prime plant for cultivation in the small garden, especially in dry areas of the summer rainfall area.

Diagnosis and relationships. Gladiolus pavonia can be distinguished by its pale pink flower with a tube 33 mm long, nearly equal tepals 21–25 mm long, and circle of dark red color at the mouth of the perianth tube. The leaves are also unusually softly textured, somewhat surprising for a plant of a dry habitat. Also unusual are the pale, fairly thick stolons produced from the corm bases, each terminating in a small cormlet. The relationships of *G. pavonia* lie with the eastern southern African members of section *Blandi,* which include the Drakensberg species, *G. microcarpus, G. cataractarum* from near Dullstroom in Mpumulunga Province, and *G. brachyphyllus* from the Mpumulunga Lowveld and adjacent parts of Swaziland and Mozambique. Of these, *G. brachyphyllus* most closely resembles *G. pavonia* in its comparatively short perianth tube and general flower structure, but it differs notably in having dark pink flowers with a white median streak on each of the lower tepals, and the leaves of flowering plants have very short or vestigial blades.

Paratypes. SOUTH AFRICA. **Mpumalanga**: 2430 (Pilgrim's Rest) Lydenburg District, Farm Nooitgedacht, dolomite ridges in *Kirkia wilmsii* woodland, 1260 m (DA), 30 Nov. 1987, *Raal & Raal 1781* (J), 21 Dec. 1989, *Boyd 66* (E, J, MO, NBG).

NEW COMBINATIONS AND CHANGES IN RANK

1. **Gladiolus miniatus** Ecklon, Topogr. Verz. 40. 1827. *Gladiolus floribundus* subsp. *miniatus* (Ecklon) Obermeyer in Lewis et al., J. S. African Bot., Suppl. 10: 103. 1972. TYPE: South Africa. Western Cape: without precise locality but probably from near Cape Agulhas, 25 Nov., *Ecklon 323* (lectotype, designated by Lewis et al. (1972: 103), S not seen; K, photo).

Recognized as early as 1827 by the Danish botanist C. F. Ecklon, *Gladiolus miniatus* was most likely based on his collections from near Cape Agulhas (Lewis et al., 1972). The species was overlooked by Baker (1896) in his treatment of *Gladiolus* for *Flora Capensis*, and it was subsequently regarded as one of five subspecies of *G. floribundus* by Obermeyer in Lewis et al. (1972). They did not regard its salmon-orange perianth and long, cylindrical upper perianth tube to be different enough to merit its being treated as a separate species. We believe that Lewis et al.'s (1972) circumscription of *G. floribundus* is too broad and inclusive. The two short-tubed subspecies, subsp. *milleri* (Ker Gawler) Obermeyer and subsp. *rudis* (Lichtenstein ex Roemer & Schultes) Obermeyer should be treated as a single species separate from *G. floribundus*, and the long-tubed and red-flowered subspecies *miniatus* should be recognized at species rank. Thus the members of the *G. floribundus* alliance sensu Lewis et al. (1972) are probably best treated as three separate species. These are *G. floribundus*, including subspecies *fasciatus*, with greenish to cream or pale pink flowers and a moderately long and narrowly funnel-shaped perianth tube; *G. milleri* Ker Gawler, with white to pink flowers with a short perianth tube; and *G. miniatus*, with orange-red flowers and an extended perianth tube, the upper part of which is tubular.

Each of the three species favors a different habitat. *Gladiolus floribundus* most often occurs in fairly dry sites on rocky, sandstone-derived soils or occasionally on limestone in sandy ground. *Gladiolus milleri* usually grows on clay- and shale-derived substrates but occasionally in sandy soils in areas of high rainfall. *Gladiolus miniatus* has the most restricted range and specialized habitat. It is restricted to limestone outcrops along the southern coast of Western Cape Province extending from Hawston near Hermanus in the west to Riversdale in the east. Plants always occur just a short distance from the sea and in association with limestone outcrops. The immediately related *G. floribundus* may also grow close to the coast and sometimes in limestone outcrops, but it maintains its typical morphology and has either pink or greenish flowers and shows no tendency to intergrade with *G. miniatus*. Both *G. floribundus* and *G. milleri* have wider ranges than *G. miniatus*, extending from the western Cape mountains to the Port Elizabeth District in Eastern Cape Province.

The morphological differences in perianth tube length and the associated perianth color and markings presumably reflect adaptations for different pollination strategies. Our observations (unpublished) indicate that *G. milleri*, which has a relatively short perianth tube, is pollinated by long-tongued anthophorid bees, *Anthophora diversipes* being the most important. The floral morphology of *G. floribundus*, including the long perianth tube and longitudinal streaks on the lower tepals, is consistent with pollination by long-tongued flies, either *Philoliche* (Tabanidae) or *Prosoeca* (Nemestrinidae) (Vogel, 1954; Goldblatt et al., 1995; Manning & Goldblatt, 1996). *Gladiolus miniatus*, with its orange-red flowers with a long tube with an elongated and tubular upper portion, is most likely pollinated by sunbirds (*Nectarinia* spp.). Both flower color and tube shape and length are consistent with the assumption of bird pollination in other species of *Gladiolus*, e.g., *G. watsonius* Thunberg (Rebelo, 1987). Several species of other genera of Iridaceae, including *Chasmanthe*, *Tritoniopsis*, and *Watsonia*, which have similarly shaped and colored flowers, are pollinated by sunbirds (Goldblatt, 1989; Rebelo, 1987; Goldblatt & Manning, unpublished).

Additional specimens examined. SOUTH AFRICA. **Western Cape**: 3419 (Caledon) 3 km (2 mi.) E of Hawston (AC), 31 Oct. 1953, *Cloete s.n.* (SAM); Onrust River, surface limestone on sand hills, 22 Nov. 1934, *F. Esterhuysen s.n.* (BOL); 3420 (Bredasdorp) inland from Struys Bay (CC), *Leipoldt 3589* (BOL); near Arniston, limestone coastal fynbos, 32 m, 13 Oct. 1969, *Acocks 24255* (K); near Zoetendals Vlei, Oct. 1940, *Esterhuysen 3559* (BOL).

2. Gladiolus variegatus (G. Lewis) Goldblatt & Manning, comb. et stat. nov. Basionym: *Gladiolus debilis* var. *variegatus* G. Lewis in Lewis et al., J. S. African Bot., Suppl. 10: 188 (1972). TYPE: South Africa. Western Cape: Bredasdorp District, Brandfontein, 14 Oct. 1951, *Esterhuysen 19087* (holotype, BOL; isotypes, NBG, PRE).

Restricted to the southern Cape coast between Stanford and Cape Agulhas, thus only on the western side of the Agulhas Peninsula, Western Cape Province, South Africa, *Gladiolus variegatus* grows only short distances from the sea coast in cracks in limestone outcrops or in stony calciferous sands. The species can immediately be recognized by its white or pale pink flowers with unusual nectar guides consisting of unevenly sized, dark red spots distributed across the lower two-thirds of the lower tepals and the lower part of the throat. The markings differ on each tepal and on every flower, a condition that is unusual in *Gladiolus* where tepal markings are normally symmetrical and consistent for an individual.

Gladiolus variegatus resembles most closely the southwestern Cape mountain species *G. debilis* Ker

Gawler, and it was treated as a variety of that species by Lewis et al. (1972). As these authors pointed out, the two taxa differ in several respects, including the nectar guides, which are variously shaped in *G. debilis* but most often consist of diamond-, spade-, or chevron-shaped markings on the lower tepals. In *G. debilis* the floral bracts are 15–25 mm long and have a ridged surface, whereas the bracts are (25–)30–45 mm long and smooth in *G. variegatus.* Perhaps most significantly, leaf shape and number also differ between the two species. *Gladiolus variegatus* typically has three leaves (occasional robust individuals may have four), the blades are 1.5–2 mm wide and plane with lightly raised midribs, and the margins are unthickened. *Gladiolus debilis,* however, normally has four leaves, the lower two with blades 1–1.5 mm wide, with moderately to strongly thickened midribs and margins. In addition, the flowers of *G. variegatus* appear to be somewhat larger than those of *G. debilis* and have the dorsal tepal 20–28 × 13–22 mm, the lower tepals 18–24 mm long, the filaments 12–15 mm long, and the anthers 8–10 mm long. Flowers of *G. debilis* have the dorsal tepal 17–27 × 10–22 mm, the lower tepals 15–24 mm long, the filaments 4–10 mm long, and the anthers 5–9 mm long. The combined qualitative and quantitative differences between *G. variegatus* and *G. debilis* make it easy to distinguish the two and are of sufficient magnitude that they be regarded as separate species. We assume that they are an immediately related species pair, one adapted to stony sandstone-derived soils of the southwestern Cape mountains, and the other to coastal limestone soils of the nearby coast. They share the following synapomorphies: a white to pale pink flower with red nectar guides, a relatively long perianth tube, and similar hard-textured corm tunics consisting of thick parallel vertical fibers.

Gladiolus variegatus and *G. miniatus* join a small number of limestone endemics known from the southern Cape coastal belt (Heydenrich et al., 1994), including in the Iridaceae *Hesperantha juncifolia* and *Watsonia fergusoniae.* This area has a flora distinct enough that it was treated by Weimarck (1941) as one of several centers of endemism in the Cape Floristic Region.

Additional specimens examined. SOUTH AFRICA. **Western Cape**: 3419 (Caledon) Grootbos, off the Stanford–Gansbaai road (CB), 19 Sep. 1966, *Chater s.n.* (NBG); Ratelrivier, S of Viljoenshof, limestone outcrops (DA), 27 Sep. 1968, *Goldblatt 333* (BOL); 3420 (Bredasdorp) near Cape Agulhas (CC), 18 Sep. 1962, *Nordenstam 1455* (NBG).

3. Gladiolus caeruleus Goldblatt & Manning, nom. nov. pro *Gladiolus gracilis* var. *latifolius* G. Lewis in Lewis et al., J. S. African Bot., Suppl. 10: 228. 1972, not *Gladiolus latifolius* Lamarck (1791) (= *Babiana villosa* (Aiton) Ker Gawler). TYPE: South Africa. Western Cape: road to Donkergat N of Churchhaven, 15 Aug. 1966, *Barker 10395* (holotype, NBG; isotype, K).

Although it was treated by Lewis et al. (1972) as variety *latifolius* of the widespread *Gladiolus gracilis* Jacquin, we regard the two taxa as separate species. Both share pale blue flowers and an apomorphic leaf type in which the leaf margins are raised into wings, rendering the blade H-shaped in transverse section. No doubt the two are closely related, sharing at least the synapomorphic H-shaped leaf, but they differ in several notable features. *Gladiolus caeruleus* has spikes of (4–)8–14 flowers, and the floral bracts are 25–40 mm long and without the extended twisted apices characteristic of *G. gracilis,* which normally has spikes of 3–5 flowers. In addition, the flowers of *G. caeruleus* are fairly large, and the lower tepals are subequal and obtuse to subacute. The leaf blades are relatively broad, 4–7 mm wide with the marginal wings extended ± at right angles to the blade surface. In contrast, *G. gracilis* usually has smaller flowers, floral bracts 33–37 mm long, the lower tepals acute to subacute and unequal, the lowermost being notably longer than the lower laterals, and the leaf blades comparatively narrow, 1.5–2 mm wide, with the marginal wings curved downward toward the blade surface.

Gladiolus caeruleus is a local endemic of the southwestern coast of Western Cape Province where it occurs from Yzerfontein in the south to the hills above Cape Columbine north of Saldanha Bay. Plants are only known from a few sites, always growing in sandy soils in limestone outcrops or on calcareous sands close to the coast. Despite occurring relatively close to Cape Town, and in areas that have been relatively well botanized, records of *G. caeruleus* are scanty. The first collection seems to have been that made by Frances Leighton in 1946.

The existence of the name *Gladiolus latifolius* Lamarck (1791), a later synonym of *Babiana villosa* (Aiton) Ker Gawler, makes it necessary to rename this plant when recognized at species rank in *Gladiolus.*

Additional specimens examined. SOUTH AFRICA. **Western Cape:** 3218 (Clanwilliam) Langebaanweg, rocky flats near Airforce Base (CC), 16 Aug. 1994, *Goldblatt & Manning 9928* (MO); 3317 (Saldanha) Donkergat road N of Churchhaven (BB), 15 Aug. 1966, *Barker 10395* (NBG); Danger Bay, 13 Aug. 1946, *Leighton 1721* (BOL, NBG); 3318 (Cape Town) N of Darling-Yzerfontein intersection on R27, sandy limestone hills (AA), 8 Aug. 1995, *Goldblatt & Manning 10232* (MO, NBG).

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Notes on Costa Rican Aquifoliaceae

William James Hahn
Laboratory of Molecular Systematics, Smithsonian Institution, MRC 534, Washington, D.C. 20560, U.S.A.

ABSTRACT. Work toward a revision of the Costa Rican Aquifoliaceae has revealed several nomenclatural problems and undescribed species. In this paper, *Ilex skutchii* Edwin ex Dudley & W. J. Hahn is validly published, *Euonymus haberi* Lundell is transferred to *Ilex,* and *Ilex hemiepiphytica* W. J. Hahn is newly described.

1. *ILEX SKUTCHII*

A large and locally abundant species of *Ilex* has long been known to biologists at the Organization for Tropical Studies (OTS) research station at La Selva, Heredia Province, Costa Rica. Until recently, however, this species was represented in herbaria by only a few depauperate collections. This taxon is found throughout the lowlands of northern Atlantic slope Costa Rica and adjacent Nicaragua and has generally been referred to as *Ilex skutchii,* a name first set in print by Gabriel Edwin (1964) in his unpublished doctoral dissertation. The late Theodore Dudley, formerly of the US National Herbarium, had intended to validate this name along with several infrageneric categories discussed by Edwin, but was unable to do so before his unfortunate demise. As a further complication, another unpublished name, *Ilex locuples* L. O. Williams & Standley, is found on herbarium specimens of the same taxon collected in nearby Taus, Cartago Province, Costa Rica. Floristic projects for La Selva, Costa Rica, and Nicaragua have produced many new specimens of this taxon, giving a better understanding of its delimitation and relationships as well as allowing for the following formal description.

Ilex skutchii Edwin ex T. R. Dudley & W. J. Hahn, sp. nov. TYPE: Costa Rica. San Jose: vicinity of El General, 670 m, Jan. 1939, *A. F. Skutch 4086* (holotype, US; isotype, K).

Ex affinitate *I. tectonica* ab utroque praecipue natura foliorum, laminis chartaceis, bicoloribus, apicibus apiculatis, venationibus viridis, pedunculis et pedicellis gracilis, etiam fructibus ovoideis.

Shrub to very large tree, 1.5–40 m tall, trunk to 1 m DBH; sparingly to moderately branched. Stems angulate becoming less so with age, minutely gray-puberulent becoming glabrous with age, drying brown or dark brown; lenticels scattered on older growth, circular to elliptic, 0.1–0.2 mm long; bark yellowish, in age turning gray to dark gray, relatively smooth. Leaves chartaceous, glabrous, occasionally with small amounts of brown pubescence on the abaxial midrib, green, sometimes glaucous, drying olive-green to dark green or brown adaxially, abaxially tan or pale brown, epunctate or essentially so, symmetrical to slightly asymmetrically elliptic or narrowly elliptic, sometimes obovate, 4.0–6.0 cm long, 2.0–3.0 cm wide, apex acute to acuminate, sometimes obtuse to rounded, base cuneate to slightly attenuate, margins essentially entire, sometimes irregular; venation brochidodromous, veins apparent, same color as the blade; petioles 0.5–1.5 cm long, usually thickened, frequently drying dark, puberulent becoming glabrous with age; stipules triangular, thickened, similar to the bark, 0.5 mm long. Staminate inflorescences of densely fasciculate, compound dichasia, clustered on a reduced stem resembling a panicle, stem elongating after anthesis and the infructescences solitary; dichasia branched to 2 or 3 orders with 3–7 flowers per dichasium; bracts acute triangular-ovate, 0.4–0.7 mm long, 0.7–0.9 mm wide, coriaceous; peduncles 3.0–9.0 mm long, 0.4–0.8 mm wide, flattened in cross section, very thin and usually curled; peduncular bracts thin-triangular, 0.1–0.4 mm long, ca. 0.2 mm wide, membranous; rachis, when present, 1.0–3.0 mm long, 0.3–0.6 mm wide; bracteoles, when present, thin-triangular, 0.1–0.2 mm long; pedicels 1.0–3.0 mm long, 0.2–0.5 mm wide; floral bracteoles sometimes present, oppositely paired midway along the pedicels. Pistillate inflorescences of reduced dichasia clustered on a much reduced stem resembling a cyme, stem later elongating and the fruiting dichasia then lateral or axillary; dichasia unbranched, one flower per dichasium; bracts broadly triangular-ovate, 0.7–1.8 mm long, 0.9–1.5 mm wide, coriaceous; peduncles 0.3–1.5 cm long, 0.4–0.8 mm wide, flattened in cross section; peduncular bracts empty, slightly offset at the first furcation, triangular, 0.1–

0.4 mm long, membranaceous; pedicel 2.0–4.0 mm long, 0.3–0.6 mm wide; floral bracteoles obscure or absent. Staminate flowers 4(rarely 5)-merous; calyx open cupuliform, sepals essentially glabrous, deltoid, acute, 0.8–1.0 mm long, 0.8–1.0 mm wide, margins entire or slightly irregular; corolla rotate, petals white, glabrous or with a few scattered hairs, widely ovate at the base, rounded-acute at the apex, 1.5–2.5 mm long, 1.0–2.0 mm wide, margins entire to ciliate; filaments 1.5–2.5 mm long, filiform, anthers yellow, oblong, 1.0–1.5 mm long; pistillodium pulvinate, 0.5 mm diam., stigma rudimentary and small. Pistillate flowers 4(5)-merous; calyx open cupuliform, the sepals glabrous, deltoid, acute, 1.0–2.0 mm long, 0.7–1.5 mm wide, margins entire; corolla rotate, petals white, glabrous or with a few scattered hairs, widely ovate at the base, apices acute, 1.5–2.5 mm long, 0.8–1.8 mm wide, margins entire; filaments 1.0–1.5 mm long, filiform, aborted anthers 1.0 mm long, irregular in form; ovary subglobose, 1.5–2.0 mm long, stigma 2.0–4.0 mm long, lobed-capitate. Fruit spherical to subglobose, 2.5–3.5 mm long, 3.0–4.0 mm diam.; pericarp slightly leathery, 0.5 mm thick, purple, stigma spreading, 1.0–2.0 mm diam.; mesocarp fleshy to juicy; pyrenes 4(5), trigonal, 2.0–3.0 mm long, 1.5–2.5 mm wide, adaxially smooth, endocarp ligneous.

Common name. Campana.

Frequent to common in moist to wet forest at mid to low elevations in the northern Atlantic slope of Costa Rica and southeastern Nicaragua. This species is one of the most common trees at the La Selva OTS research station. The specific epithet honors Alexander Skutch (1904–), noted Costa Rican naturalist and collector of the type specimen.

Additional specimens examined. COSTA RICA. **Alajuela:** Parque Nacional Rincon de la Vieja, Colonia Blanca, Quebrada Leira, 4 km aquas arriba del limite este del Parque, 10°47′39″N, 85°16′36″W, 1000–1200 m, 4/14/1991, *G. Rivera & C. Schramm 1266* (CR, MO, US). **Cartago:** Taus, 750 m, 03/11/51, *J. Leon 3164* (F). **Guanacaste:** Estacion Pitilla, La Cruz, Parque Nacional Guanacaste, 10°59′26″N, 85°25′40″W, 700–1000 m, 10/10/1990, *C. Moraga 129* (CR, MO, US). **Heredia:** Finca La Selva, the OTS Field Station on the Rio Puerto Viejo just E of its junction with the Rio Sarapiqui, 470 m, 06/09/83, *I. A. Chacon G. 904* (DUKE, MO, US); Finca La Selva, near confluence of Rio Sarapiqui with Rio Puerto Viejo, 84°02′W, 10°25′N, 125 m, 07/04/85, *B. Hammel & M. Grayum 14124* (MO); Finca La Selva, near SE corner of property, 84°01′W, 10°26′N, 07/20/70, *G. S. Hartshorn 919* (F); Successional Plots, Sendero Sabalo Esquinia, 100 m, 06/07/84, *B. Jacobs 2750* (MO); Finca La Selva, Southern boundary trail, about 400 m, 05/16/85, *R. L. Wilbur 36896* (DUKE, MO). **San Jose:** vicinity of San Sebastian, S of San Jose, 1160 m, 2/23/1926, *P. C. Standley 49325* (US). NICARAGUA. **Chontales:** 4 km al NW de Santo Domingo, *Aranda et al. 83* (MO).

The species belongs to the *Ilex guianensis* (Aublet) O. Kuntze species complex as discussed by Hahn (1988, 1993). Originally, the one known collection of *I. skutchii* from Nicaragua (*Aranda et al. 83*) was placed in *I. tectonica* W. J. Hahn due to an incomplete delimitation of that taxon. The presence of discolorous, chartaceous leaves, slightly apiculate at the apex, greenish veins, thin recurved peduncles and pedicels, and ellipsoid fruits distinguish *I. skutchii* from *I. tectonica*, which has a more northerly distribution. Given the potential for misidentification, a revised key to the Central American members of the *Ilex guianensis* species complex is presented below.

KEY TO THE *ILEX GUIANENSIS* COMPLEX IN CENTRAL AMERICA

1. Leaves variable but usually spathulate, coriaceous to leathery, frequently shiny above, glaucous, glabrous, apex usually obtuse or retuse, sometimes slightly acute, margins usually revolute; venation usually obscure; new stems drying gray or green; coastal scrub inland savannas, occasionally moist forests and disturbed upland clearings; Atlantic coast of Central America and northern South America, Greater Antilles, and the Gulf of Panama; not known from Costa Rica . . . . *Ilex guianensis* (Aublet) O. Kuntze

1′. Leaves elliptic to ovate or obovate, chartaceous, opaque above, glabrous to lightly pubescent, apex usually acute to apiculate, margins flat, venation apparent to distinct; new stems drying green to dark brown or black 2

2. Young stems drying brown with white lenticels; secondary leaf venation distinct, reticulate, veins yellow, peduncles and pedicels rigid, erect, ca. 1.0–1.8 mm diam.; stigmatic residue spreading, not prominent in profile above the pericarp; Honduras, Belize, and Nicaragua . . . . *Ilex tectonica* W. J. Hahn

2′. Leaf venation apparent but not distinct, veins the same color as the leaves, peduncles and pedicels erect or recurved; stigmatic residue prominent. . . 3

3. Young stems drying green or light brown; peduncles and pedicels usually recurved, ca. 0.5 mm diam.; fruits spherical to globose; southeastern Nicaragua and northeastern Costa Rica . . . . *Ilex skutchii* (Edwin) T. R. Dudley & W. J. Hahn

3′. Young stems drying black, peduncles and pedicels generally erect, ca. 1.0–1.5 mm diam.; fruits spherical; limestone forests of Yucatán, Mexico, to Honduras along the Atlantic coast . . . . *Ilex belizensis* Lundell

2. *ILEX HABERI*

Intensive collecting in the Monteverde Cloud Forest Reserve and vicinity by William Haber and collaborators has produced many new specimens, including material of an inconspicuous mid-elevation tree, which has been described as *Euonymus haberi* Lundell (1981). A close examination of the type material has shown this to be a member of the genus *Ilex,* as indicated by the lack of a staminal disc, the distinctly alternate leaves, a typical sigmoid venation pattern, and dioecious plants. Additional collections including fruiting material now permit a more complete description.

Ilex haberi (Lundell) W. J. Hahn, comb. nov. Basionym: *Euonymus haberi* Lundell, Phytologia 48: 131. 1981. TYPE: Costa Rica. Prov. Puntarenas: Monteverde, lower community, elev. 1300 m, 16 Apr. 1979, *W. Haber 313* (holotype, LL; isotype, MO).

Tree 10–35 m tall. Stems ridged to terete, mostly glabrous, drying gray green or brown; lenticels scattered to numerous, white, round or oval, ca. 1.0 mm long; bark smooth to somewhat ridged, medium to dark gray. Leaves chartaceous, often conduplicate, drying dark green adaxially, pale green abaxially, epunctate, glabrous, elliptic to ovate, 3.0–8.0 cm long, 1.8–3.5 cm wide, acute to apiculate, attenuate, margins irregular; venation brochidodromous, secondary veins indistinct, tertiary veins diffuse-reticulate, inconspicuous; petioles 0.5–1.5 cm long, 1.0–2.0 mm diam.; stipules paired at the base of the petiole, deciduous, thin-triangular, ca. 0.5 mm long. Staminate inflorescence of solitary, axillary dichasia on recently expanded branches, dichasia usually branched to 2 orders, 3–7(–10) flowers per dichasium; bracts ca. 0.1 mm long and wide; peduncles 3.0–9.0 mm long, ca. 0.5 mm diam., flattened in cross section, peduncular bracts minute or obsolete; pedicels 3.0–4.0 mm long, 0.2–0.3 mm diam., slightly flattened in cross section; floral bracteoles minute. Pistillate inflorescence of solitary, axillary dichasia on recently expanded braches, dichasia reduced, unbranched, one flower per dichasium; bracts ovate, ca. 1.0 mm long and wide; peduncles 2.0–5.0 mm long, flattened in cross section; peduncular bracts empty, oppositely paired, triangular, ca. 1.0 mm long; pedicels continuous with the peduncle, 0.2–1.0 cm long, 0.6–1.5 mm diam., flattened in cross section; floral bracteoles absent or obsolete. Staminate flowers 4-merous, open cupular; sepals glabrous or with a few white hairs, deltoid, apices acute, 1.0 mm long, 1.0–1.5 mm wide, margins irregular; corolla rotate, petals white, glabrous or with a few white hairs, oblong-elliptic, 2.0–2.5 mm long, 1.5–2.0 mm wide, margins irregularly ciliate; filaments 2.0–4.0 mm long, inflexed, anthers ovoid, 1.5 mm long, 1.0 mm wide; pistillodium very small and pulvinate, stigmas rudimentary. Pistillate flowers 4-merous; calyx open cupuliform, sepals glabrous or essentially so, broadly ovoid, 1.0–2.0 mm long, 2.0–3.0 mm wide, margins entire or slightly irregular; corolla rotate, petals white, glabrous or with a few small white hairs, rhomboid-ovoid, 2.5–3.5 mm long, 3.0–3.5 mm wide, margins irregularly ciliate; staminodia irregular, filaments 1.0–1.2 mm long, strap-shaped, anthers irregularly ovoid, 0.5 mm long; gynoecium conical-ovoid, lightly beset with short white hairs, stigma capitate. Fruit unknown.

Common name. Campana.

The affinities of *Ilex haberi* are not certain. Superficially, the plant resembles *I. skutchii* but the production of flowers on new wood would instead group this species with two other Costa Rican taxa: *Ilex pallida* Standley and *Ilex costaricensis* G. D. Smith. This inflorescence type is the equivalent of the "solitary flowering unit composed of secondary dichasia" as described by Loizeau and Spichiger (1992).

Additional specimens examined. COSTA RICA. **Guanacaste:** Canton de Tilaran, San Rafael to El Dos de Tilaran, *W. Haber et al. 11058* (CR, MO, US). **Puntarenas:** Canton de Puntarenas, Santa Elena de Monteverde, *W. Haber et al. 11047* (CR, MO, US).

3. *ILEX HEMIEPIPHYTICA*

The Paltoria group of *Ilex* is one of the most clearly defined species groups in the genus although the component species exhibit some of the most complicated patterns of variation. Many intergradations between described species are known, and considerable clinal or geographic variation has been noted. A relatively well collected hemiepiphytic taxon is known from the upland of central Costa Rica and differs from previously described members of this species group by a number of characters.

Ilex hemiepiphytica W. J. Hahn, sp. nov. TYPE: Costa Rica. Heredia: vicinity of Vara Blanca, N slope of Central Cordillera, between Poas and Barba volcanoes, 1430 m, 3/1938, *A. F. Skutch 3729* (holotype, MO).

Ab *I. yurumanguini* et *I. chiriquensi* habitu epiphytico vel hemiepiphytico, etiam foliis tenuioribus, laminis ellipticis pro rata angustioribus, etiam pedunculis et pedicellis gracilioribus differt.

Tree to 18 m tall, sometimes epiphytic, laxly ramified, branches arching or pendulous, leaves present only toward apices of stems. Stems slightly angulate, glabrous; lenticels scattered on new stems, oval, 1.0 mm long, 0.5 mm wide, whitish; bark fissured, yellowish brown turning gray in age. Leaves coriaceous, drying dark green adaxially, pale olive or yellowish green abaxially, pubescent with scattered white or gray hairs, becoming glabrous with age, punctate abaxially, punctations poorly developed and scattered, elliptic-obcordate to obovate, 9.0–13 cm long, 4.0–7.5 cm wide, apiculate to obtuse-caudate, attenuate, cuneate, margins crenulate to subentire with a minute spine at the tip of each crenation, slightly revolute to flat; venation brochidodromous with 6–8 pairs of distinct secondary veins per side, tertiary veins distinct, reticulate; petioles 0.5–1.0 cm long, 1.5–3.5 mm diam., glabrous; stipules thick, triangular, ca. 1.0 mm long, sometimes with a spinulose apex, scarcely differentiated from the bark. Staminate inflorescences of compound dichasia borne on a much reduced stem, appearing as an axillary panicle or umbel; dichasia branched to 2 or 3 orders, 3–7 flowers per dichasium; bracts chartaceous, narrow triangular, ca. 1.0 mm long, 0.5 mm wide; peduncles filiform, 0.5–1.5 cm long, 0.1–0.3 mm wide, slightly flattened or angled in cross section; peduncular bracts thin-triangular, 0.1–0.2 mm long, opposite or offset; pedicels 1.0–6.0 mm long, 0.1–2.0 mm wide; floral bracteoles obsolete. Pistillate inflorescences of reduced dichasia borne on a much reduced stem appearing as an axillary cyme or umbel; dichasia unbranched, 1 flower per dichasium; bracts thin-triangular, ca. 1.0 mm long, 0.5 mm wide, thin coriaceous; peduncles 0.2–0.7 cm long, 0.2–0.4 mm wide, slightly angled in cross section; peduncular bracts thin triangular, 0.1–0.2 mm long, opposite or decidedly offset; pedicel 1.0–8.0 mm long, 0.2 mm wide; floral bracteoles not evident. Staminate flowers 4-merous; calyx cupuliform, sepals yellowish white, glabrous, triangular, somewhat involute, 0.8–1.0 mm long, 1.0 mm wide, margins entire to irregularly divided; corolla rotate, petals white, glabrous, elliptic-oblong, somewhat spatulate, apiculate to short acuminate, 2.0–3.0 mm long, 3.0 mm wide, margin entire; filaments filiform, 1.5–2.0 mm long, anthers yellow, ovate-oblong, 0.8–1.2 mm long, 0.2–0.4 mm wide; pistillodium conical-ovoid, 1.0 mm long, 0.6 mm diam., stigmas conical. Pistillate flowers 4-merous; calyx cupuliform, sepals glabrous, obtuse, 0.3 mm long, 0.3 mm wide, induplicately folded, margins entire; corolla rotate, petals white, glabrous, 1.2–1.8 mm long, 0.4–0.8 mm wide, margins entire; filaments 0.5–0.8 mm long, 0.1 mm wide, anthers irregular, ca. 0.5 mm long; gynoecium ovate-conical, stigma flattened-capitate. Fruit globose, 4.0 mm long, 4.0 mm diam.; pericarp thin, crustaceous, bright red to purple at maturity, stigma spreading, indistinct in fruit; mesocarp thin; immature pyrenes 4, trigonal, ca. 2.5–3.0 mm long, 1.0 mm wide, abaxially smooth, the endocarp ligneous.

Ilex hemiepiphytica is a member of the Paltoria group, as evidenced by the punctate, coriaceous leaves and inflorescences and infructescences on abbreviated shoots. *Ilex hemiepiphytica* is distinguished from *I. yurumanguinis* Cuatrecasas by its epiphytic or hemiepiphytic habit, its thin coriaceous, narrowly elliptic and generally smaller leaves with the margins only slightly revolute or flat and not as distinctly crenulate, thinner peduncles and pedicels, and occurrence at higher elevations, usually above 1000 m. *Ilex chiriquensis* Standley of Panama differs in its more orbicular, thicker leaves with distinctly revolute and crenulate margins, and shorter, stouter pedicels and peduncles.

Flowering of *I. hemiepiphytica* occurs in October to December with fruiting in May to July.

Additional specimens examined. COSTA RICA. **Cartago:** San Gerardo, 5 km NW of crater of Irazu, 2000 m, 02/01/83, *L. D. Gomez 19916* (CR, MO). **Heredia:** vicinity of water filled crater (indicated as dry on map) NE of summit of Volcan Barva and SE of Laguna Danta, 84°06′W, 10°08′N, 2500 m, 04/26/86, *M. H. Grayum et al. 7403* (MO); NW slope of Volcan Barva between Laguna del Barva and base of Cerros Las Marias, 84°07′W, 10°08′N, 2600 m, 04/28/86, *M. H. Grayum 7473* (MO). **Puntarenas:** Monteverde, 10°20′N, 84°50′W, 1400 m, 29 Nov. 85, *W. Haber & E. Bello 3607* (CR, MO, US); Monteverde, 10°20′N, 84°50′W, 9 June 86, *W. Haber & E. Bello 5047* (CR, MO, US); Monteverde Cloud Forest Reserve, 10°20′N, 84°50′W, 13 Oct. 86, *W. Haber & E. Bello 5939* (CR, MO, US); Reserva Biologica Monteverde, Oja e Agua, Finca Alvarado, 10°15′N, 84°46′W, 17 Nov. 87, *W. Haber & E. Bello 7773* (CR, MO, US); Monteverde Reserve, 2 km SW of Station, 10°28′N, 84°48′W, 1500–1550 m, *S. Ingram & K. Ferrell-Ingram 1713* (SEL, US).

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New Taxa from the A'nyêmaqên Shan Region of Eastern Qinghai Province, China

Ting-nong Ho
Northwest Plateau Institute of Biology, Chinese Academy of Sciences, Xining, Qinghai 810001, People's Republic of China

Bruce Bartholomew
Botany Department, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, U.S.A.

Michael G. Gilbert
Flora of China Project, Missouri Botanical Garden, c/o Department of Botany, Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

ABSTRACT. Five new species and two varieties from Qinghai Province, China, are described, discussed, and compared with their closest presumed relatives. *Cremanthodium microglossum* (Asteraceae), *Oxytropis qinghaiensis* (Fabaceae), *Comastoma jigzhiense* (Gentianaceae), *Gentiana clarkei* var. *lutescens* (Gentianaceae), *Parnassia qinghaiensis* (Saxifragaceae), *Pedicularis armata* var. *trimaculata* (Scrophulariaceae), and *Peristylus humidicolus* (Orchidaceae). Two of the species are illustrated.

From late July through August 1993, the authors explored the A'nyêmaqên mountain range of eastern Qinghai Province, China. This region is situated between latitude 32°32′–35°31′N and longitude 99°30′–101°30′E. The average altitude of the region is over 4000 m. The highest peak, Maqên Gangri, reaches 6282 m. The climate is cold, moist, and windy, and the vegetation is characterized by alpine species of genera such as *Astragalus, Carex, Cremanthodium, Gentiana, Kobresia, Oxytropis, Pedicularis, Saussurea,* and *Saxifraga.* The common woody plants in this area are low *Potentilla* and *Salix* shrubs, which are found at all but the highest elevations. At lower elevations there are scattered *Juniperus przewalskii* Maximowicz, although most of our collections were made above timberline. During the one month of fieldwork 1554 numbers and about 11,800 specimens were collected. The main sets of specimens so far have been distributed to A, BM, CAS, E, HNWP, and MO. Further sets remain to be distributed from HNWP. During routine determinations of all collections from this region we discovered the following five new species and two new varieties, which are additions to the published volumes of *Flora Reipublicae Popularis Sinicae* (Ho, 1988; Liu, 1989; Tsoong, 1968). Names of contributors are fully spelled in the acknowledgment section.

ASTERACEAE

Cremanthodium microglossum S. W. Liu, sp. nov. TYPE: China. Qinghai: Madoi Xian, Qingshui Xiang, Huoluoguogai, between Darlag and Huashixia, 34°49′22″N, 99°02′34″E, elev. 4600–4730 m, 17 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 1372* (holotype, HNWP; isotype, CAS). Figure 1.

Haec species *Cremanthodio nano* (Decaisne) W. W. Smith similis, sed ab eo calathio discoideo, corolla flosculi foeminei graciliter tubulosa limbo truncato vel ligula lineari praedito ac bracteis involucralibus ad medium rectangulo-patulis recedit.

Perennial herbs 4–15 cm tall. Roots 4–20, stout, 1.5–3 mm diam., fleshy. Stem solitary, dark purple, glabrous below, white and black villous above (especially near capitulum). Radicle leaves with purple-brown glabrous petioles, 4–14 cm; leaf blade ovate to broadly ovate, 1–3 × 0.7–2.4 cm, both surfaces white and black villous, base rounded to truncate, margin entire, veins 3–5 and abaxially prominent. Stem leaves shortly petiolate or sessile; leaf blade ovate to oblong-ovate, 1.5–4 × 1–2 cm, both surfaces or only abaxially white and black villous, base ± amplexicaul, apex obtuse. Capitulum solitary, erect; involucre hemispherical, 1.5–2 × 2.5–3 cm; involucral bracts 9–12, in one row, oblong to narrowly lanceolate, 3–7 mm, rectangular-

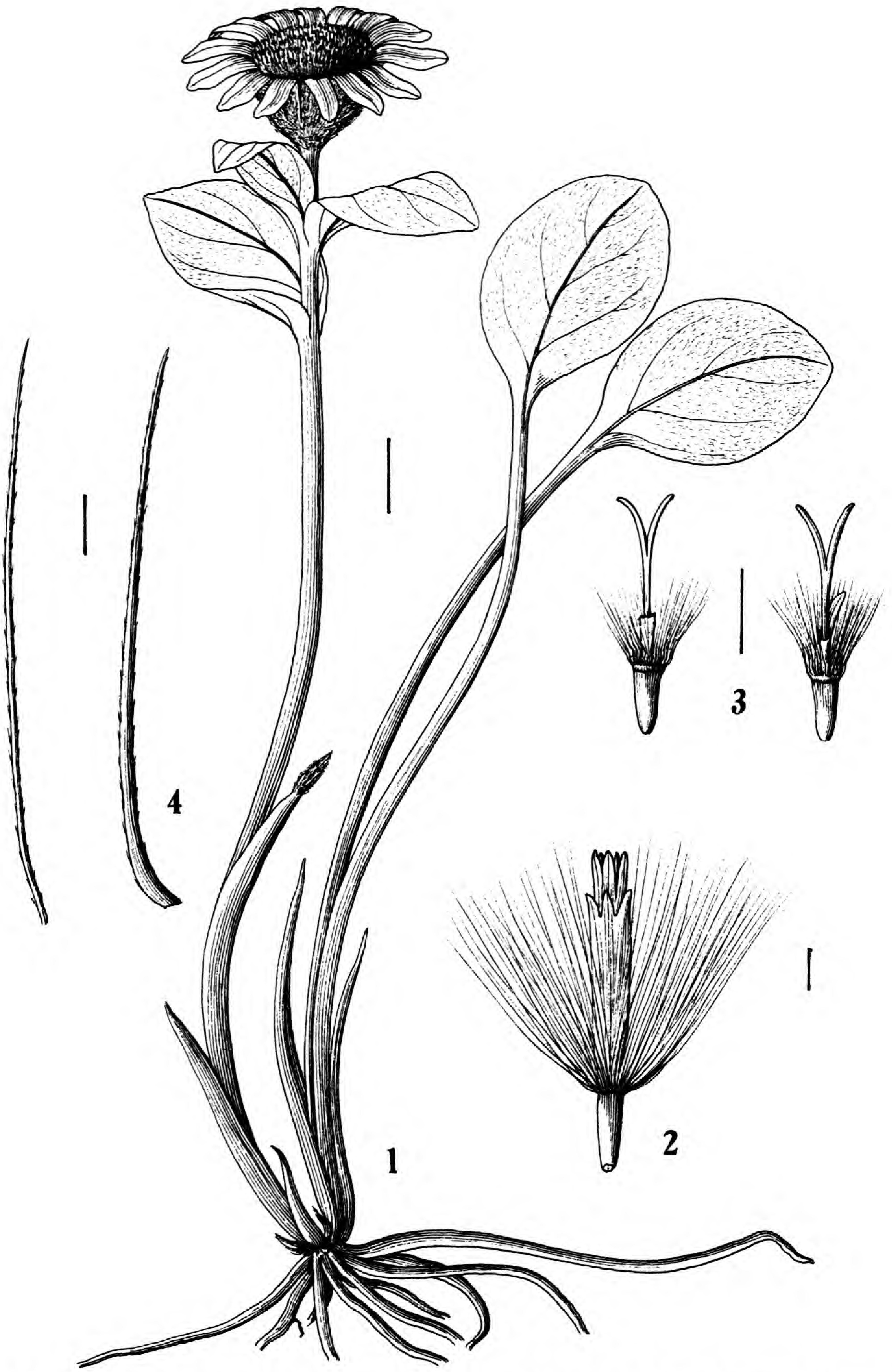

Figure 1. *Cremanthodium microglossum* S. W. Liu. —1. Plant. —2. Disk floret. —3. Ray floret. —4. Pappus. Scales: 1 = 1 cm; 2–4 = 1 mm. (Drawn by Ling Ru-lian.)

spreading from middle, abaxially densely white and black villous, margin entire, apex obtuse to acute. Radial florets female, white; corolla narrowly tubular, 3–6 mm, slender, limb truncate or with poorly linear ligules; style 6.5–11 mm, 2- or 3-branched. Disk florets hermaphroditic, orange, ± as high as involucre; corolla tubular, limb 5-lobed. Achenes cylindric, 4–5 mm, striate; pappus white, 1–1.2 cm, in 2 series, scabrous.

Cremanthodium microglossum is allied to *C. nanun* (Decaisne) W. W. Smith but is easily distinguished by having involucral bracts rectangular-spreading from the middle, capitulum nearly discoid, corollas of the radial female florets slender, narrowly tubular, and limbs truncate or sometimes with poorly linear ligules.

Habitat. Grassy slopes in alpine periglacial zone, alpine meadows, and swamp meadows. Altitude from 4000 to 5400 m.

Paratypes. CHINA. **Gansu:** Xigu, elev. 4100 m, 22 Sep. 1951, *T. P. Wang 14531* (PE). **Qinghai:** Qilian Xian, elev. 4000 m, 24 July 1962, *K. Ren & J. Y. Ding 2030* (HNWP); Nangqên Xian, elev. 5000 m, 21 July 1965, *Y. C. Young 1244* (HNWP); Qumarlêb Xian, elev. 5400 m, 28 June 1966, *R. F. Huang 37* (HNWP); Zhidoi Xian, elev. 4900 m, 13 Aug. 1966, *L. H. Chou 307* (HNWP); Henan Monggolzu Zizhixian, elev. 4200 m, 6 July 1967, *Y. C. Young 1663* (HNWP); Henan Monggolzu Zizhixian, elev. 4500 m, 6–19 July 1972, *P. C. Kuo 9960, 9877* (both HNWP); Chindu Xian, elev. 4500–4700 m, 19 July 1977, *S. W. Liu 2359* (HNWP); Chindu Xian, elev. 4600–4800 m, 11 Aug. 1977, *S. W. Liu 2484* (HNWP); Chindu Xian, elev. 5085 m, 2 July 1985, *W. Y. Wang 637* (HNWP). **Yunnan:** Dêqên Xian, elev. 4200 m, 30 July 1937, *T. T. Yü 9320* (KUN, PE).

FABACEAE

Oxytropis qinghaiensis Y. H. Wu, sp. nov. TYPE: China. Qinghai: Gadê Xian, Shanggongma Xiang, along the Danqu near its confluence with the Huang He, 33°50′33″N, 99°40′33″E, elev. 4020 m, 9 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 969* (holotype, HNWP; isotypes, A, BM, CAS, E, LE, MO, NY).

Haec species *Oxytropi kansuensi* Bunge et *O. melanocalyci* Bunge similis, sed ab ambabus planta dense albohispida cinerascente differt; a prima corolla purpurea vel azureo-purpurea ac legumine majore 12–16 × 5–7 mm, a secunda planta 15–40 cm alta ac foliolis 6–14-jugis utrinque dense albo-hispidis differt.

Herbs, perennial, 15–40 cm tall. Stems tufted, densely white hispid, much branched from base. Stipules triangular-lanceolate, white hispid, connate below middle. Leaves imparipinnate, 5–12 cm; leaflets 6–14-jugate, mostly opposite or subopposite, subsessile, ovate to ovate-lanceolate, 3–12 × 2–7 mm, both surfaces densely white hispid, base rounded, margin entire, apex acuminate to obtuse. Inflorescences terminal capitate racemes; peduncle 6–16 cm, white hispid below, black hispid above; bracts lanceolate, 4–7 mm long, hispid. Pedicel ca. 1 mm. Calyx 6–8 mm, densely black and white hispid, teeth less than or equal to tube length. Corolla purple to blue-purple, turning bluish with age; vexillum broadly obovate, ca. 1.2 cm, with a slightly concave tip; wing ca. 1 cm, with a complanate sac; keel ca. 9 mm, with a mucro less than 1 mm. Legumes oblong, 12–16 × 5–7 mm, densely white and black hispid, stipe ca. 2 mm, apex hooklike. Seeds 8–12.

Habitat. River terraces in alpine meadows. Elevation 3200–4400 m.

Paratypes. CHINA. **Qinghai:** Nangqên Xian, elev. 4100 m, 30 June 1965, *Y. C. Yang 1088* (HNWP); Yushu Xian, elev. 3550 m, 23 July 1980, *Z. D. Wei 2172* (HNWP); Gonghe Xian, elev. 3200 m, 12 July 1981, *R. F. Huang CG81–226* (HNWP); Tongde Xian, elev. 3100–3800 m, 27 July–19 Aug. 1990, *Y. H. Wu 5104, 6404, 6540, 6789, 6889, 6918, 7078* (all HNWP); Tongde Xian, elev. 3440 m, 10 Aug. 1990, *Y. H. Wu 6192* (HNWP); Henan Monggolzu Zizhixian, 30 Aug.–6 Sep. 1990, *Y. H. Wu 7450, 7526, 7575, 7583, 7623* (all HNWP); Menyuan Huizu Zizhixian, elev. 3200 m, 19 July 1991, *Y. H. Wu 7643* (HNWP); Maqên Xian, along the Qêm Qu, W of Maqên, 34°41′23″N, 99°40′03″E, elev. 3850 m, 27 July 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 393* (BM, CAS, HNWP, MO); Maqên Xian, Dawu Xiang, along the Gequ He, N of Maqên on road to Jiangrang hydroelectric plant, 34°38′08″N, 100°14′37″E, elev. 3600 m, 31 July 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 589* (A, BM, CAS, E, HNWP, MO); Darlag Xian, Jianshe Xiang, Nari, along the Dar Qu on S side of the Huang He, 33°41′38″N, 99°25′52″E, elev. 4050 m, 10 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 1088* (A, BM, CAS, HNWP, MO); Madoi Xian, Huashixia Xiang, along the Changma He, ca. 9 km S of Huashixia, 35°01′22″N, 98°51′38″E, elev. 4300–4400 m, 19 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert* 1505 (A, BM, CAS, HNWP, MO).

GENTIANACEAE

Comastoma jigzhiense T. N. Ho & J. Q. Liu, sp. nov. TYPE: China. Qinghai: Jigzhi Xian, elev. 4500 m, 1 Aug. 1971, *Golo Exped. 416* (holotype, HNWP).

Haec species *Comastomati falcato* (Turczaninow ex Karelin & Kirilov) Toyokuni similis, sed ab eo calyce lobis erectis ovatis vel ovato-lanceolatis, apice obtuso, corolla lobis tubo brevioribus orbiculatis vel late oblongis, apice rotundato differt.

Biennials 4–8 cm tall. Stem ascending, branched from base, lower internodes short. Leaves mostly basal; petiole to ca. 2 cm; leaf blade spatulate to obovate-spatulate, 4–12 × 2–5 mm, base narrowed, apex rounded to obtuse, midvein distinct. Flowers terminal, solitary; pedicel tinged purple, ascending, 4–6(–12) cm, often scapelike. Calyx 3–9 mm, ⅓–½ as long as corolla, tube shallowly 5-saccate at base; lobes unequal, ovate to ovate-lanceolate, apex obtuse, midvein distinct. Corolla blue, dark blue, or blue-purple, salverform, 10–20 × 3–6 mm, apically 5-lobed; lobes 4.5–7.5 × 2.5–3.5 mm, shorter than tube, orbicular to broadly oblong, base with 2 scales, apex rounded; scales fringed with nonvascular white fimbriae. Nectaries 10, at base of corolla tube. Stamens inserted at middle of corolla tube; filaments 5–6 mm, linear, base decurrent into wings of corolla tube; anthers blue, ellipsoid, ca. 1.5 mm. Style indistinct; stigma lobes nearly orbicular. Capsules narrowly ellipsoid, 1–1.5 cm. Seeds brown, nearly globose, ca. 0.7 mm diam.; seed coat smooth.

Comastoma jigzhiense is closely allied to *C. falcatum* (Turczaninow ex Karelin & Kirilov) Toyokuni but is distinguished by several characters, including calyx lobes that are erect and ovate to ovate-lanceolate and by corolla lobes that are shorter than the corolla tube and are orbicular to broadly oblong with a rounded apex.

Habitat. Alpine meadows on steep slopes, often dominated by *Kobresia* spp., often in open sites created by overgrazing and other disturbance. Elevation 4200–4600 m.

Paratypes. CHINA. **Qinghai:** Jigzhi Xian, elev. 4500 m, 25 July 1971, *Tibetan Medic. Exped. 515* (HNWP); Jigzhi Xian, elev. 4200–4600 m, 9 Aug. 1971, *Tibetan Medic. Exped. 591* (HNWP); Jigzhi Xian, elev. 4200–4600 m, 19 Aug. 1971, *Golo Exped. 587* (HNWP); Maqên Xian, elev. 4500 m, 20 July 1976, *Maqên Exped. 357* (HNWP); Maqên Xian, Xueshan Xiang, Caigongka, W of Maqên, 34°38′N, 99°44′E, elev. 4300–4600 m, 28 July 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 478* (CAS, HNWP); Maqên Xian, Dawu Xiang, Hetu Shan, at pass between Gyumgo and Maqên, 34°28′09″N, 100°23′33″E, elev. 4220 m, 2 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 652* (A, BM, CAS, HNWP, MO); Maqên Xian, Dawu Xiang, Heitu Shan, E of pass between Gyumgo and Maqên, 34°27′38″N, 100°24′06″E, elev. 4300–4500 m, 2 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 668* (BM, CAS, HNWP).

Gentiana clarkei Kusnezow var. **lutescens** T. N. Ho & J. Q. Liu, var. nov. TYPE: China. Qinghai: Madoi Xian, Heihai Xiang, Doucuo, between Wenquan and Huashixia, 35°21′21″N, 99°08′02″E, elev. 4190 m, 19 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 1426* (holotype, HNWP; isotypes, BM, CAS, MO).

A *Gentiana clarkei* var. *clarkei* corolla lutescente, plicis triangulatis integris differt.

Plants of this variety are distinguished from *Gentiana clarkei* var. *clarkei* by the white corolla turning yellow-green with age and by triangular entire plicae. In variety *clarkei* the corolla is blue with obtuse ovate serrulate plicae.

Habitat. Flat steppe vegetation with scattered tussock grasses. Elevation ca. 4200 m.

SAXIFRAGACEAE

Parnassia qinghaiensis J. T. Pan, sp. nov. TYPE: China. Qinghai: Yushu Xian, elev. 4250 m, 23 July 1964, *Yushu Exped. 578* (holotype, HNWP).

Haec species *Parnassiae venustae* Jien affinis, sed ab ea bractea ad basin scapi inserta, nervis sepalorum sub apice confluentibus, staminodiis apice 3–5-dentatis, basi cum petalis et tubo calycino conjunctis, filamentis basi cum tubo calycino conjuncto, ovario semisupero differt.

Herbs, perennial, ca. 2 cm tall. Radical leaves 8 or 9; petiole 8–10 mm, widening at base into a membranous sheath, margin brown ciliate; leaf blade coriaceous, cordate-reniform, 4–6 × 5–8 mm, glabrous, with brown dots, base cordate, apex obtuse. Scapes several, glabrous; bracteal leaf with petiole to 1 mm, margin brown ciliate; blade subcordate, 3.3 × 3.5 mm, glabrous. Flower solitary. Calyx tube ca. 2 mm; lobes subovate, 3–3.3 × 2–2.5 mm, with brown dots, both surfaces glabrous, apex obtuse, veins 5 or 6. Corolla pale yellow-green; lobes obovate, 4.3–5 × 3–3.5 mm, base truncate to auriculate and with a claw connate to calyx tube and staminodes, margin erose, apex retuse. Stamens to 4.3 mm; filaments subulate, adnate at base to calyx tube. Staminodes subspatulate, 2–2.2 × 0.8–1 mm, apex 3–5-dentate. Ovary half-superior, ovoid, ca. 2.5 mm; style to 1.5 mm, apex 3-lobed. Ripe capsules opening to expose seeds in an apparent splash cup.

Parnassia qinghaiensis is allied to *P. venusta* Jien but with bracts inserted at the base of the scape, sepal nerves confluent at the apex, staminode apices 3–5-dentate, petal base connate with the calyx tube, filament base connate with the calyx tube, and the ovary half-superior.

Habitat. Dense turf in alpine meadows. Elevation ca. 4200 m.

Paratype. CHINA. **Qinghai:** Darlag Xian, NW of Manzhang Pass, between Darlag and Baima, 33°17′51″N, 100°25′55″E, elev. 4230 m, 12 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 1199* (CAS, HNWP).

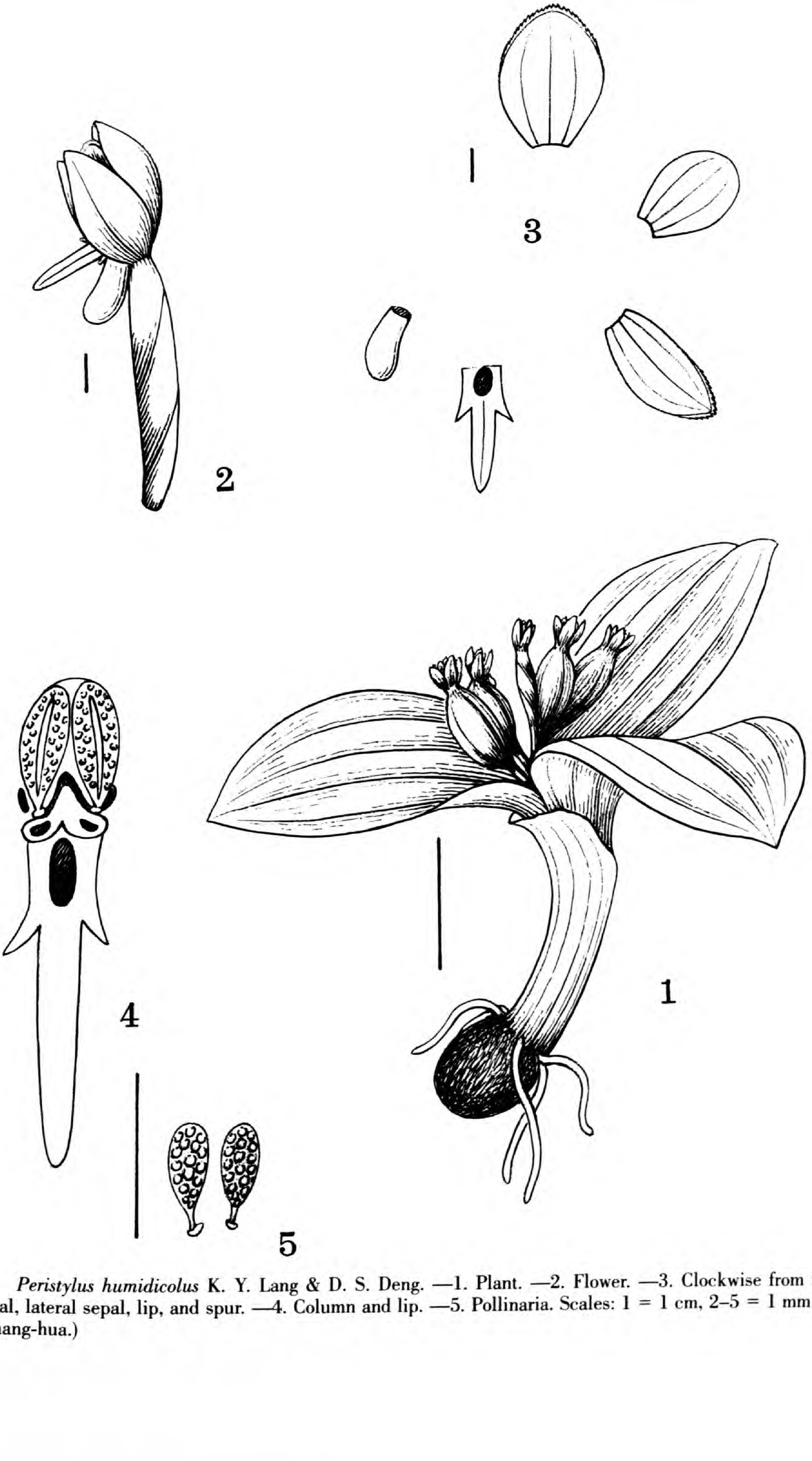

Figure 2. *Peristylus humidicolus* K. Y. Lang & D. S. Deng. —1. Plant. —2. Flower. —3. Clockwise from top: mid sepal, petal, lateral sepal, lip, and spur. —4. Column and lip. —5. Pollinaria. Scales: 1 = 1 cm, 2–5 = 1 mm. (Drawn by Wu Zhang-hua.)

SCROPHULARIACEAE

Pedicularis armata Maximowicz var. **trimaculata** X. F. Lu, var. nov. TYPE: China. Qinghai: Henan Monggolzu Zizhixian, Serlong Xiang, Xiazetan, elev. 3200–3310 m, 2 Sep. 1990, *Y. H. Wu 7464* (holotype, HNWP).

A *Pedicularidi armata* var. *armata* labio infero corollae ut in galea maculis tribus marroninis linearibus vel anguste ellipticis ornato differt.

This variety is distinguished from *Pedicularis armata* var. *armata* by the lower lip of the corolla as in a galea, with three crimson or maroon, linear or narrowly elliptic spots.

Habitat. Alpine meadows in moist areas on sunny slopes and in turf. Elevation 3000–4000 m.

Paratypes. CHINA. **Gansu:** Xiahe Xian, Meiwu Xiang, elev. 3390 m, 18 Aug. 1980, *Y. He s.n.* (LZU); Tianzhu Zangzu Zizhixian, Jingqian He, elev. 3400 m, 14 July 1991, *R. F. Huang 2521, T. N. Ho 2198* (both HNWP); Luqu Xian, Gahai, elev. 3850 m, 12 Aug. 1991, *Taohe Exped. 621, 703* (both LZU). **Qinghai:** Jigzhi Xian, near W bank of the Jigzhi He, elev. 3520–3700 m, 1965, *Z. D. Wei 6500264* (LZU); Jigzhi Xian, Niabaoshan, Xunmucuo Hu, elev. 4000 m, 13 July 1971, *Xizang Med. Exped. 559* (HNWP); Huzhu Tuzu Zizhixian, Beishan Natural Forest Factory, elev. 3000 m, 14 July 1982, *B. Z. Guo 25602* (HNWP); Ledu Xian, Yaocaotai forest, Donggou, elev. 3800 m, 22 July 1986, *Y. H. Wu 3326* (HNWP); Huzhu Tuzu Zizhixian, Dabanshan, Langya He, elev. 3100 m, 31 Aug. 1988, *J. T. Pan 70* (HNWP); Baima Xian, Makehe forest, Rizhao Shan, elev. 3400–3800 m, 9 July 1983, *W. Y. Wang 26933, 26768* (both HNWP); Henan Monggolzu Zizhixian, elev. 3280–3310 m, 2 Sep.1990, *Y. H. Wu 7469* (HNWP); Darlag Xian, just N of Manzhang, along the Manzhang He, between Darlag and Baima, 33°17′51″N, 100°25′55″E, elev. 4000 m, 12 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 1187* (BM, CAS, HNWP, MO).

ORCHIDACEAE

Peristylus humidicolus K. Y. Lang & D. S. Deng, sp. nov. TYPE: China. Qinghai: Maqên Xian, Dawu Xiang, Muchang, SE of Maqên, 34°20′03″N, 100°30′34″E, elev. 3980 m, 5 Aug. 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 807* (holotype, HNWP; isotypes, AMES, BM, CAS, MO). Figure 2.

Haec species inter *Peristylos* planta humiliore 4–4.5 cm alta, scapo brevissimo, floribus ebracteatis, sepalo intermedio ovato-rotundato, petalis obovato-rotundatis, labello trilobo, lobo intermedio ligulato-lineari, lobis lateralibus parvis, triangulatis, apice acuminatis bene distincta.

Herbs, terrestrial, perennial, erect, 4–4.5 cm tall. Tuber globose, 8–10 mm, fleshy. Stem stout, 0.8–1.5 cm. Leaves 3 or 4, crowded at top of stem, spreading; petiole 3–5 mm including sheath; leaf blade ovate-elliptic to ovate-lanceolate, 2.5–3 × 1.2–2 mm, base rounded to broadly cuneate, apex acute. Inflorescence a 4- or 5-flowered raceme, later corymb-like because ovary and pedicel of lower flower are thickened and elongated. Pedicel 5–9 × 1–2 mm wide. Flowers yellow-green, small, without bracts, petals and lip thicker than sepals. Sepals 3-veined, apex white marginate and denticulate; mid sepal cymbiform-erect, ovate-orbicular, ca. 4 × 3 mm; lateral sepals spreading, obliquely elliptic-lanceolate, ca. 4 × 2 mm. Petals erect, connivent with mid sepal forming a hood above column, ovate-rounded, ca. 3 × 2 mm, apex rounded, veins 3. Lip porrect, 3.5 mm long, 3-lobed; mid lobe ligulate-linear, 2.5 × 0.8 mm, apex obtuse; lateral lobes small, triangular, apex acuminate; spur oblong, ca. 2 mm, ca. 1 mm diam., apex obtuse. Column 2.5 mm. Anthers erect, 2-locular, apex obtuse, locules parallel; staminodes 2, hemispherical at bilateral anther near base. Pollinaria 2; pollinia narrowly elliptic, granular, caudicle short and elliptic, disc naked viscid; rostellum large between anther locules. Stigmas 2, protuberate, elliptic, under rostellum. Ovary contorted, cylindric to obovate, 6–10 × 2–6 mm.

Peristylus humidicolus is unique in the genus. It has no distinctly allied species and is distinct from any of the Tibetan species (Lang, 1987). This new species is easily recognized by its stout and short stem, pedicels that are elongate and ovaries that become contorted with age, and flowers without bracteoles.

Habitat. Growing on the sides of tall tussocks in a very wet area on a slight slope with slow-flowing water. Elevation ca. 4000 m.

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One New Species and One New Subspecies of *Cissus* (Vitaceae) from Colombia

Julio Antonio Lombardi
Departamento de Taxonomia e Morfologia Vegetais, Instituto de Biologia, Universidade Estadual de Campinas, Campinas, SP, Brazil. Current address: Departamento de Botânica, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Av. Antônio Carlos 6627, 31270-110, Belo Horizonte, MG, Brazil

ABSTRACT. *Cissus colombiensis* and *C. verticillata* subsp. *colombiana,* new taxa of Vitaceae, are described from Colombia. In addition to descriptions and illustrations, comments on their probable relationships and distributions are presented.

Cissus L. has approximately 55 species in South America and is the largest genus in the Vitaceae. Many of the species described by Baker (1871; placed in the genus *Vitis*), and Planchon (1887) were considered synonyms in a recent taxonomic survey by the author (Lombardi, 1995), while one new species and one new subspecies were found in Colombia: *Cissus colombiensis* and *C. verticillata* subsp. *colombiana.*

Cissus colombiensis Lombardi, sp. nov. TYPE: Colombia. Antióquia: Frontino, Corregimiento Nutibara, Región Murí, camino hacia La Blanquita, 1440 m, 10 July 1986, *Acevedo et al. 1204* (holotype, NY). Figure 1.

Frutex scandens, foliis ternatis, hispidis, *C. ulmifoliae* (Baker) Planchon similis, sed inflorescentia haud umbelliformi, calyce urceolato, fructibus 1.5 cm longis, 1 cm latis, seminibus raphe rugosa, differt.

Liana, stem hispid, terete. Trichomes chiefly multicellular and not secretory, mixed with sparse not secretory and unicellular trichomes, and secretory trichomes. Tendrils with several bifurcate branches, hispid, adhesive discs not seen; scales ca. 0.15 cm long, triangular, puberulent, ciliate. Stipules ca. 0.4 cm long, 0.3 cm wide, subfalcate, fleshy, glabrous, the base gibbous, caducous. Petioles 1.4–8.5 cm long, terete, hispid to villous. Leaf blades ternately compound, much reduced in reproductive shoots; central petiolules 0.35–2.7 cm long, lateral petiolules 0–1.8 cm long, hispid to villous; blades of central leaflets subelliptic, elliptic to obovate, 4.3–18.8 cm long, 1.3–9.7 cm wide, blades of lateral leaflets subovate, subelliptic to elliptic, 3.6–14.35 cm long, 1.15–7.3 cm wide, central and lateral leaflets herbaceous, sparsely hispid to hispid chiefly along the prominent veins on the abaxial side, sparsely puberulent along the veins on the adaxial side, the base subreniform, oblique, cuneate to rounded, the apex acuminate to acute, the margin denticulate. Compound cymes elongated, the peduncle 1.8–3.5 cm long, puberulent; the bracts triangular, 0.1–0.2 cm long, the base gibbous, puberulent, ciliate. Flowers greenish; pedicels 0.25–0.3 cm long, puberulent; calyx truncate, 0.1–0.15 cm long, 0.2–0.3 cm diam., urceolate, fleshy, glabrous; corolla tetramerous, 0.15–0.25 cm long, 0.15–0.3 cm diam., petals coherent, the margin elevated in the junction, caducous, papillose; stamens 4, connective deltate, granular, drying slightly dark brown, anther dehiscence extrorse; disc apex concave with central depression; the style conic, the stigma slightly clavate. Fruit purple, subspherical, with sparse lenticels, 1.5 cm long, 1 cm wide. Seed 1, subobconic, 1.1 cm long, 0.9 cm wide, the hilum acute, the raphe prominent and crispate, the sides rugose.

This species is named after Colombia, the country with the most complete collections. It is distinctive among the South American trifoliate species by its large leaves and flowers, the hispid leaves prominently nerved, the elongate inflorescence, the urceolate calyx, and the peculiar seeds.

This species is similar to *Cissus ulmifolia* (Baker) Planchon, but differs in the urceolate calyx, the elongate inflorescence (umbelliform in *Cissus ulmifolia*), and in the seeds with a crispate raphe and rugose sides (raphe not crispate and sides deeply sulcate in *Cissus ulmifolia*).

The apparent disjunct distribution of *Cissus colombiensis* probably can be explained by a lack of collections of this species, a large liana in the rainforests of the Amazon basin and adjacent areas.

Paratypes. COLOMBIA. **Boyacá:** upper Chapon, 100 mi. NW de Bogotá, 6500 ft., high forest fronts, 8 Aug. 1932, *Lawrance 397* (A—2 sheets, F, S). BRAZIL. **Amazonas:** Novo Japurá, rio Japurá, margem direita, mata de várzea, 9 Nov. 1982, *Amaral et al. 379* (NY); São Paulo

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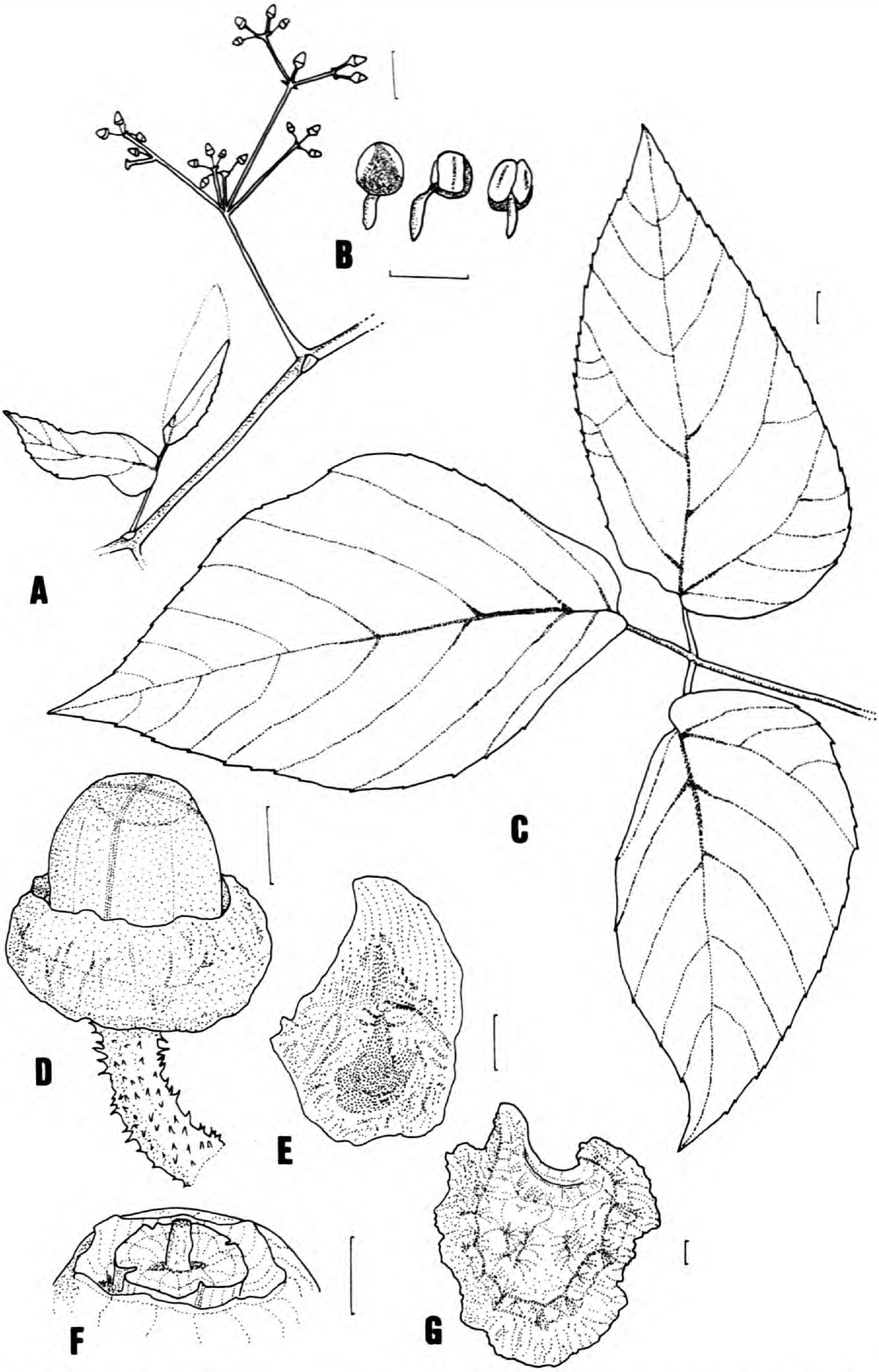

Figure 1. *Cissus colombiensis* Lombardi. —A. Reproductive branch. —B. Stamens, ventral, lateral, and dorsal views. —C. Vegetative leaf. —D. Flower bud. —E. Stipule. —F. Nectariferous disc and pistil. —G. Seed. A–F from *Acevedo et al. 1204*; G from *Lawrance 397*. Scales A, C = 1 cm, B, D–G = 1 mm. Drawn by the author.

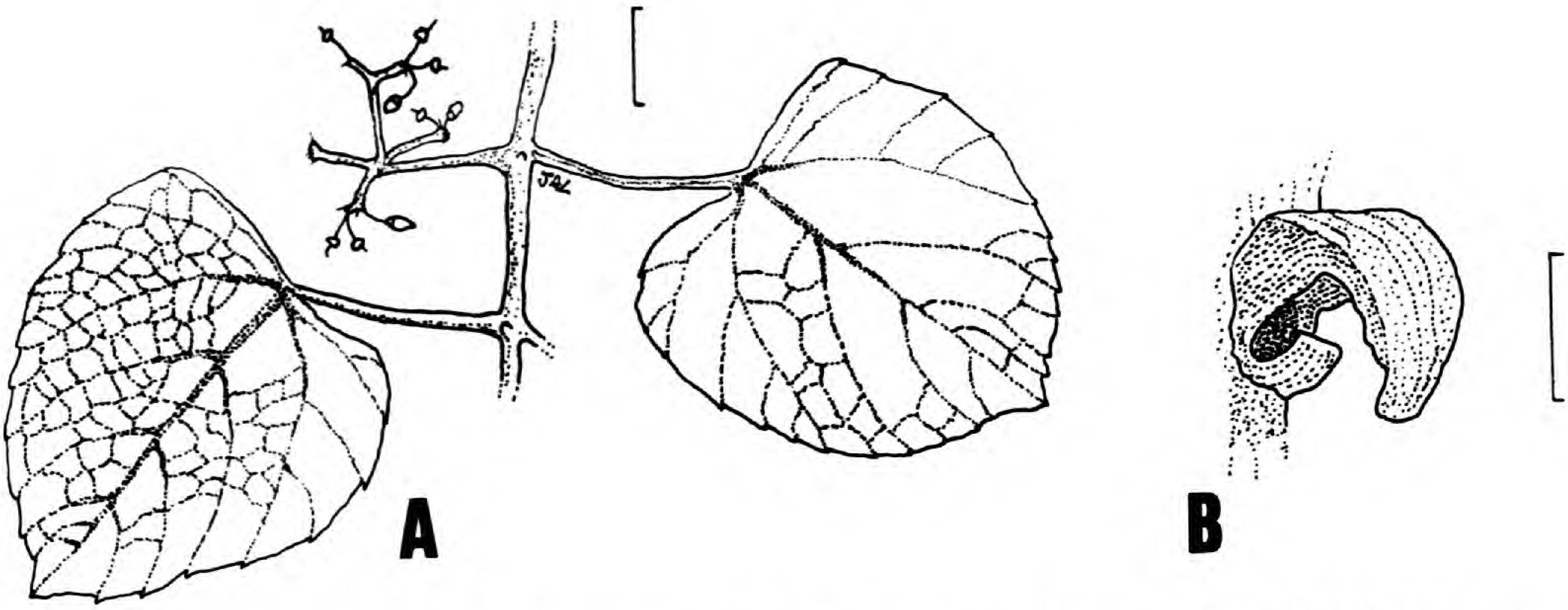

Figure 2. *Cissus verticillata* subsp. *colombiana* Lombardi. —A. Reproductive branch. —B. Stipule. A, B from *Haught 4182*. Scales A = 1 cm; B = 1 mm. Drawn by the author.

de Olivença, várzea, 21 May 1945, *Fróes 20945* (F). BOLIVIA. **La Paz:** Nor Yungas, Serrania de Bella Vista, 17.6 km N of the bridge to Carrasco, 1600 m, 11 June 1985, *Solomon 13980* (M, U), *Solomon 13983* (U).

Cissus verticillata subsp. **colombiana** Lombardi, subsp. nov. TYPE: Colombia. Magdalena: dry hills 12 km W of Codazzi, ca. 100 m, 26 May 1944, *Haught 4182* (holotype, F; isotype, S). Figure 2.

C. verticillatae (L.) Nicolson & Jarvis subsp. *verticillatae* similis, sed folia in ramis vegetativis suborbicularia, in ramis fertilibus depresso-ovata, transverso-elliptica vel deltoidea, basi cuneata vel reniformia, stipularum margine flectere ad basem et apicem, et in inflorescentia 1.4–2.0 cm longo, 1.45–2.7 cm lato longo differt.

Stem glabrous. Tendrils bifurcate. Stipules ovate to spatulate, glabrous, the base rounded with reflected margin, the apex reflected. Leaves alternate; petioles 0.8–3 cm long, glabrous; blade simple and entire, in the vegetative shoots subcircular, in the reproductive shoots depressed ovate, transversely elliptic to deltate, 2–6.2 cm long, 1.9–7.1 cm wide. Inflorescence glabrous, pauciflorous, 1.4–2.0 cm long, 1.45–2.7 cm wide; the peduncle 0.55–1.85 cm long. Flowers greenish to sometimes reddish; pedicels 0.1–0.3 cm long; calyx 0.1 cm long, 0.1–0.15 cm diam.; corolla 0.1–0.2 cm long, 0.1–0.15 cm diam., slightly granulose. Fruit spherical, 0.4 cm diam.

Cissus verticillata is a very variable species, with a wide range of variation in indumentum, leaf shape, and rarely in flower color (pink to red in some collections); these phenotypic forms have been given several specific or infraspecific epithets (for a South American account see Lombardi, 1995).

Subspecies *colombiana* has leaves that are subcircular on vegetative shoots, and depressed ovate, transversely elliptic to deltate on reproductive shoots (in subspecies *verticillata* they are ovate, triangular, lanceolate, elliptic, obovate, wide-ovate to subpanduriform on vegetative shoots, and ovate, oblong to triangular on reproductive shoots); stipules with margin and apex reflected (only apex reflected in subspecies *verticillata*); and smaller and pauciflorous inflorescences (3.5–7.4 cm long, 3.0–5.9 cm wide, and multiflorous in subspecies *verticillata*).

The peculiar leaf shape, and the restricted geographic occurrence of this variation, not encountered in the rest of the distribution area of *Cissus verticillata* (south Florida to North Argentina), justify the recognition of subspecies *colombiana* as a distinct entity.

Paratypes. COLOMBIA. **Atlántico:** Magdalena, Santa Marta, 100 ft., Aug. 1898–1901, *H. H. Smith 570* (BM); Santa Marta, near seacoast, Sep. 1898–1901, *H. H. Smith 1319* (BR); Santa Marta, 500 ft., July 1898–1901, *H. H. Smith 2724* (BM, BR, E, F, L, S, U). VENEZUELA. **Aragua:** Maracay, Faculdad de Agronomía, cerro con bosque caducifolio, detras del Instituto de Botánica Agrícola, 29 Aug. 1974, *Guevara 1753* (F); Maracay, 1934, *Vogl 1294* (M). **Carabobo:** environs de El Palito, 50 m, 24 Sep. 1920, *Pittier 9084* (Z). **Distrito Federal:** bosque seco en las faldas costañeras frente el mar, entre Punta Picure y Oricao, 100–200 m, 1 July 1966, *Steyermark & Aristeguieta 115* (F). **Falcón:** Dtto. Silva, bosque tropofilo por encima de la línea de peñascos calcáreos, al S de la Punta Faustino, al SE de Chichiriviche, 15–25 m, 29 Aug. 1974, *Steyermark & Manara 110404* (U). **Nueva Esparta:** Isla Margarita, 0–850 m, Aug. 1955, *Bernardi 2391* (NY); Island of Margarita, 1 Aug. 1901, *Miller 244* (ARIZ, F).

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Five New Species of *Cissus* (Vitaceae) from Northern Brazil

Julio Antonio Lombardi

Departamento de Morfologia e Sistemática Vegetais, Universidade Estadual de Campinas, Campinas, SP, Brazil. Present address: Departamento de Botânica, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Av. Antônio Carlos 6627, 31270–110, Belo Horizonte, MG, Brazil

ABSTRACT. *Cissus acreensis, C. amapaensis, C. apendiculata, C. araguainensis,* and *C. paraensis,* new species of Vitaceae, are described from northern Brazil. These species are distinct in many characters, mainly trichomes, leaf dimorphism, flower disc, fruits, and seeds. In addition to descriptions and illustrations, comments on probable relationships and distributions are presented.

Cissus, with approximately 350 species (Mabberley, 1987), is the largest genus of Vitaceae. The 31 species described and listed by Baker (1871) in the genus *Vitis* were transferred to *Cissus* by Planchon (1887). Since his work few other species have been described from Brazil (but see Malme, 1901; Hoehne, 1915, 1938; Kuhlmann, 1938). While working on a taxonomic survey of *Cissus* in South America, five undescribed species were found in northern Brazil: *Cissus acreensis, C. amapaensis, C. apendiculata, C. araguainensis,* and *C. paraensis.*

Cissus acreensis Lombardi, sp. nov. TYPE: Brazil. Acre: Cruzeiro do Sul, rio Juruá, km 18 road Cruzeiro do Sul to Japiim, forest on terra firme, 26 Oct. 1966, *Prance et al. 2843* (holotype, UEC; isotype, NY). Figure 1A–F.

Frutex scandens, *C. verticillatae* (L.) Nicolson & Jarvis similis, sed in ramis vegetabilibus foliis triangularibus et in ramis fertilibus foliis ellipticis vel obovatis, concoloribus, et epicarpo incrassato differt.

Liana, stems glabrous, terete. Tendrils not seen. Stipules 0.1 cm long, 0.15 cm wide, deltate, fleshy, glabrous, caducous. Petioles 1–4 cm long, canaliculate, glabrous. Leaf blades simple and entire, triangular on vegetative shoots, elliptic to obovate on reproductive shoots, 5–7 cm long, 1.7–5.5 cm wide, herbaceous, glabrous, drying dark, concolorous, the base reniform to cuneate, the apex acuminate, the margin denticulate. Inflorescence flat-topped, glabrous; the peduncle 0.5–2 cm long; the bracts triangular, 0.1 cm long, glabrous, ciliate. Flowers greenish to pinkish; pedicels 0.1–0.2 cm long, glabrous; calyx truncate, the lobes obscure-triangular, 0.1 cm long, 0.1–0.2 cm diam., fleshy, glabrous; corolla tetramerous, 0.1–0.2 cm long, 0.1–0.15 diam., petals coherent, caducous, glabrous; stamens 4, connective cuneiform, granular, drying clear, anther latrorse; disc side concave, apex convex; the style terete, the stigma not apparent. Fruit purple, botuliform, smooth, thick-skinned, 1.5 cm long, 0.8 cm wide. Seed 1, subfusiform, 1.2 cm long, 0.5 cm wide, the hilum acute, the raphe obscure, the sides irregularly rugose.

This species is known from the state of Acre in Brazil, and for this is named "acreensis." It grows in borders of primary and secondary vegetation.

Cissus acreensis differs from other South American species of *Cissus* by its simple leaves and large seeds in thick-skinned fruits. It is similar to *C. verticillata* subsp. *verticillata,* but differs in having concolorous and dimorphic leaves that dry dark, thick-skinned fruits, and bigger seeds.

Paratypes. BRAZIL. **Acre:** Cruzeiro do Sul, Monte Belo, margem esquerda do rio Moa, 15 Feb. 1976, *Marinho 198* (NY); Cruzeiro do Sul, próximo ao aeroporto, projeto RADAM, 16 Feb. 1976, *Monteiro & Damião 435* (MG); rio Acre, Seringöel Auristella, Mar. 1911, *Ule 9581* (L).

Cissus amapaensis Lombardi, sp. nov. TYPE: Brazil. Amapá: Mazagão, área do experimento de manejo do convênio JARI/EMBRAPA, floresta tropical primária de terra firme, 19 June 1986, *M. J. Pires & N. T. Silva 1234* (holotype, NY). Figure 1G–I.

Frutex scandens, pilosus, pilis malpighiaceis, folis ternatis, *C. erosae* Richard similis, sed foliolis apice acuminatis vel caudatis, inflorescentia in ramis subaphyllis differt.

Liana, stems glabrous to sericeous on nodes, terete. Trichomes malpighiaceous. Tendrils with several bifurcate branches, adhesive discs not seen, glabrous; scales not seen. Stipules 0.2–0.3 cm long, 0.15–0.35 cm wide, triangular, fleshy, glabrous, ciliate, persistent. Petioles 4–4.5 cm long, canaliculate, glabrous. Leaves absent on the distal portion

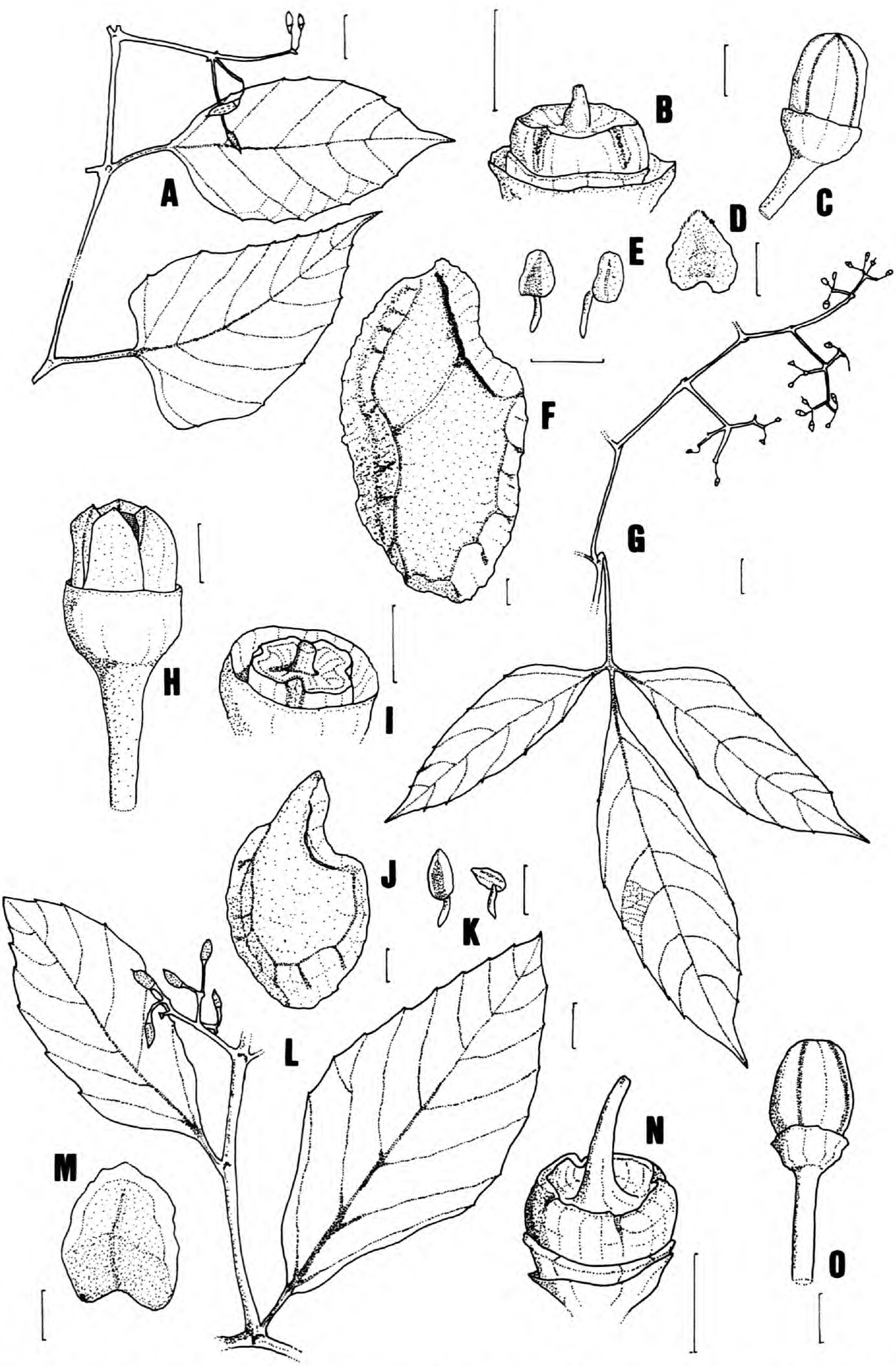

Figure 1. A–F, *Cissus acreensis* Lombardi. —A. Reproductive branch above and vegetative leaf below. —B. Nectariferous disc and pistil. —C. Flower bud. —D. Stipule. —E. Stamens, ventral and lateral views. —F. Seed. G–I, *Cissus amapaensis* Lombardi. —G. Reproductive branch. —H. Flower bud. —I. Nectariferous disc and pistil. J–O, *Cissus araguainensis* Lombardi. —J. Seed. —K. Stamens, ventral and lateral views. —L. Reproductive branch above and vegetative leaf below. —M. Stipule. —N. Nectariferous disc and pistil. —O. Flower bud. A–E drawn from *Prance et al. 2843*; F from *Monteiro & Damião 435*; G–I from *M. J. Pires & N. T. Silva 1234*; J from *Irwin et al. 21191*; K–O from *Irwin et al. 21084a*. Scales: A, G and L = 1 cm; B–F, H–K and M–O = 1 mm. Drawn by the author.

of reproductive shoots, blade ternately compound; central petiolules 1–1.5 cm long, laterals 0.3 cm long, the base sericeous; blades of central leaflets elliptic, 11.5–12 cm long, 3–3.5 cm wide, blades of lateral leaflets subelliptic, 7.9–9.4 cm long, 2–2.7 cm wide, herbaceous, glabrous on adaxial side, sparsely sericeous on midvein on abaxial side, the base cuneate, the apex acuminate to caudate, the margin denticulate. Inflorescence flat-topped, apex sparsely sericeous; the peduncle 1.5–1.7 cm long; the bracts deltate, 0.1 cm long, the base sericeous, ciliate. Flowers red; pedicels 0.25–0.3 cm long, glabrous; calyx truncate, 0.15 cm long, 0.2 cm diam., fleshy, papillose, glabrous; corolla tetramerous, 0.15 cm long, 0.15 cm diam., petals coherent, caducous, papillose, glabrous; stamens 4, connective deltate, granular, drying dark, anther extrorse; disc apex obconic; the style conic, the stigma slightly clavate. Fruit not seen. Seed not seen.

This species is known from a unique collection in the rainforest of Amapá State in Brazil, and for this is named "amapaensis." I have failed to locate other specimens and isotypes in Museu Göeldi (MG), Instituto de Pesquisas da Amazônia (INPA), and Centro de Pesquisas do Trópico úmido (IAN) herbaria. The presumed restricted distribution of this species places it in an endangered situation.

This species differs from other trifoliolate South American *Cissus* species by acuminate to caudate leaflets and malpighiaceous trichomes. It is similar to *C. erosa* subsp. *erosa* but differs in the caudate apex and shape of the leaflets, inflorescences borne in reproductive shoots with leafless apices and longer flowers.

Cissus araguainensis Lombardi, sp. nov. TYPE: Brazil. Tocantins: cut-over gallery forest, land of George Yunes & Cia, Araguaína, rio das Lontras, ca. 300 m, 13 Mar. 1968, *Irwin et al. 21084a* (holotype, UB [as *21084*]). Figure 1J–O.

Frutex scandens, pilosus, pilis uni et bicellularibus et malpighiaceis, *C. verticillatae* (L.) Nicolson & Jarvis similis, sed pilis, foliis elipticis, parum dicoloribus; pedicellis puberulis; semine subpyriformi, 0.7 cm longo, 0.3 cm lato differt.

Liana, stems puberulous, sometimes with elliptic lenticels, terete. Trichomes unicellular to bicellular and adpressed malpighiaceous. Tendrils not branched, glabrous, adhesive discs not seen; scales 0.1 cm long, deltate, glabrous, ciliate. Stipules 0.2–0.3 cm long, 0.15–0.2 cm wide, triangular to elliptic, fleshy, puberulent, ciliate and sinuate, persistent. Petioles 0.4–1.7 cm long, canaliculate, sparsely puberulent in the base. Leaf blades simple and entire, elliptic, 5.7–13.5 cm long, 1.5–6.2 cm wide, herbaceous, glabrescent to puberulent on the abaxial side, the veins on the abaxial side with minuscule spines, slightly bicolored, the base cuneate, the apex acuminate, the margin denticulate. Inflorescence flat-topped, puberulent; the peduncle 1.2–2.5 cm long; the bracts triangular, 0.1–0.15 cm long, glabrous, ciliate. Flowers greenish; pedicels 0.15–0.25 cm long, sparsely puberulent; calyx truncate, 0.05–0.1 cm long, 0.1 cm diam., fleshy, puberulent on the base; corolla tetramerous, 0.1–0.2 cm long, 0.1–0.15 cm diam., petals coherent, caducous, glabrous; stamens 4, connective cuneiform, granular, drying clear, anther latrorse; disc side concave, apex convex; the style terete, the stigma slightly clavate. Fruit purple, subspheric, smooth, 0.5 cm diam. Seed 1, subpyriform, 0.7 cm long, 0.3 cm wide, the hilum acute, the raphe prominent and transversely grooved, the sides smooth.

This species is named for the type locality, and is known from other states in northern Brazil where it occurs in borders of forests and savanna areas (cerrado). I know of no explanation for this apparent disjunction, except for the general lack of liana collections, chiefly in the Amazon basin.

This species differs from other simple-leaved species by seed shape and the combination of unicellular, bicellular, and malpighiaceous hairs. It is similar to *Cissus verticillata* subsp. *verticillata*, but differs in having bicolored leaves, in seed shape, and in the presence of malpighiaceous hairs.

Paratypes. BRAZIL. **Maranhão:** Fortuna, lugar Caiçara a 15 km SE de Fortuna, 05°48′S, 44°03′W, 21 Feb. 1983, *J. U. Santos et al. 633* (F, MO, NY). **Pará:** Conceição do Araguaia, ca. 20 km W of Redenção, near córrego São João and Troncamento Santa Teresa, ca. 08°03′S, 50°10′W, 350–620 m, 8 Feb. 1980, *Plowman et al. 8480* (MO, NY). **Tocantins:** land of George Yunes & Cia, Araguaína, at rio das Lontras, ca. 300 m, 14 Mar. 1968, *Irwin et al. 21191* (NY, UB); margem direita do rio Tocantins, canteiro de obras da Usina Hidrelétrica da Serra da Mesa, 23 Feb. 1991, *B. A. S. Pereira et al. 1544* (US).

Cissus apendiculata Lombardi, sp. nov. TYPE: Brazil. Pará: Marabá, Serra dos Carajás, canga do N-4, 25 Jan. 1985, *Nascimento & Bahia 961* (holotype, MG). Figure 2A–F.

Frutex scandens, pilosus, pilis longis et ferrugineis; foliis ternatis, *C. surinamensi* Descoings similis, sed calyce basi 1–3 apendiculata, apendiculis ligulatis differt.

Liana, stems hispid, terete. Trichomes not ramified, multicellular, long or short and not secretory or rarely capitate and secretory. Tendrils with several bifurcate branches, with adhesive discs, his-

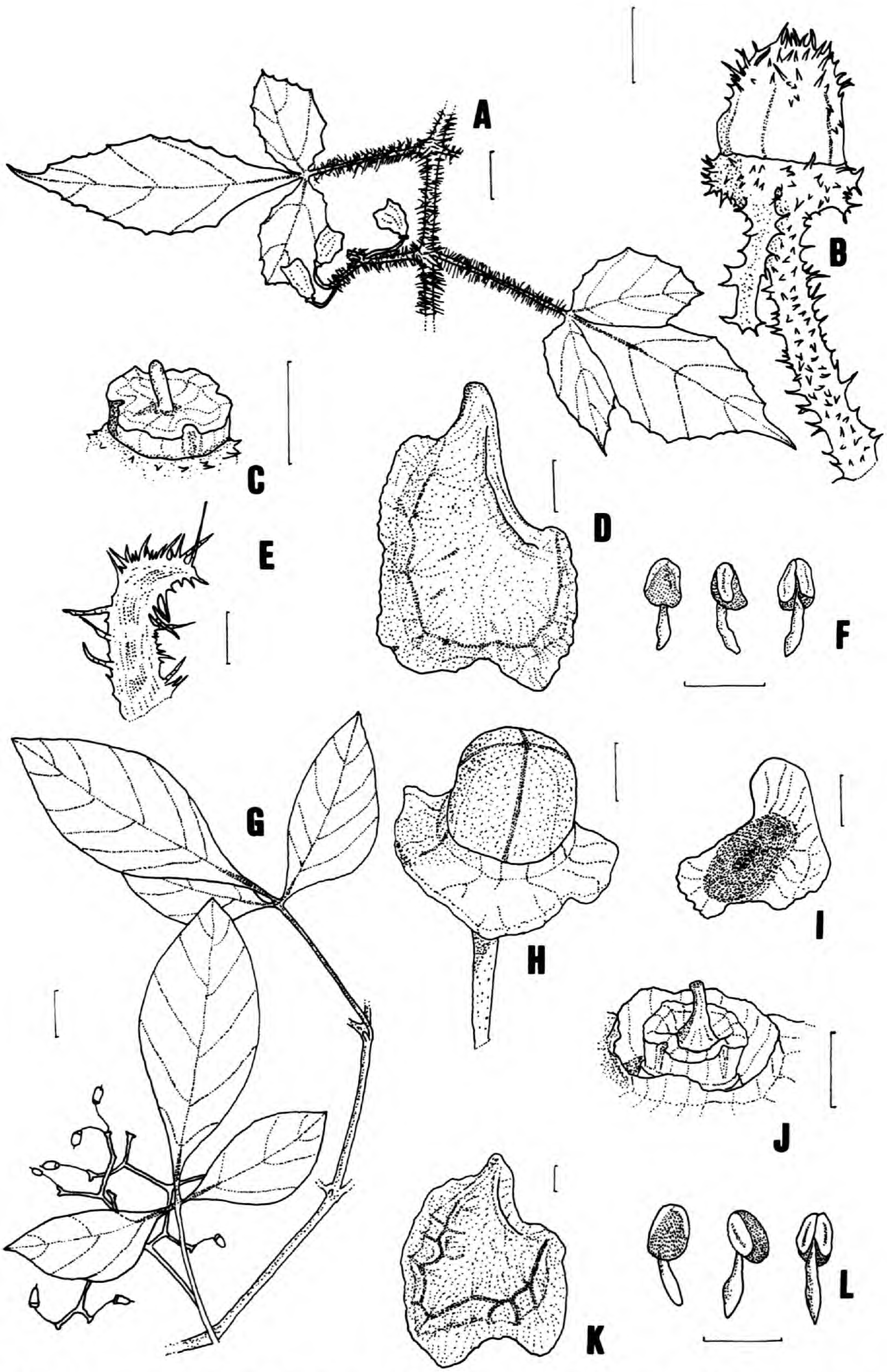

Figure 2. A–F, *Cissus apendiculata* Lombardi. —A. Reproductive branch. —B. Flower bud. —C. Nectariferous disc and pistil. —D. Seed. —E. Stipule. —F. Stamens, ventral, lateral, and dorsal views. G–L, *Cissus paraensis* Lombardi. —G. Reproductive branch. —H. Flower bud. —I. Stipule. —J. Nectariferous disc and pistil. —K. Seed. —L. Stamens, ventral, lateral, and dorsal views. A and D drawn from *A. S. L. Silva et al. 1940*; B, C and E, F from *Nascimento & Bahia 961*; G, K from *Plowman et al. 9612*; H, J, and L from *Lisboa et al. 1256*; I from *M. J. P. Pires et al. 838*. Scales: A and G = 1 cm; B–F and H–L = 1 mm. Drawn by the author.

pid; scales triangular, 0.1 cm long, hispid, ciliate. Stipules 0.3–0.6 cm long, 0.2–0.3 cm wide, falcate, membranous, hispid, ciliate, persistent. Petioles 2.3–4 cm long, canaliculate, hispid. Leaf blades ternately compound; central petiolules 0–0.3 cm long, laterals 0–0.1 cm long, hispid; blades of central leaflets rhombic to elliptic, 4–8.7 cm long, 1.5–5.3 cm wide, blades of lateral leaflets subelliptic, 2.1–5.3 cm long, 1–3.4 cm wide, herbaceous, hispid to sparsely hispid, the base cuneate, the apex acuminate to caudate, the margin denticulate. Inflorescence flat-topped, hispid; the peduncle 1.4–1.8 cm long; the bracts triangular, 0.1 cm long, hispid, ciliate. Flowers greenish; pedicels 0.25–0.35 cm long, hispid; calyx truncate, 0.05–0.1 cm long, 0.1–0.15 cm diam., fleshy, hispid; laterally appendicular with 1–3 lingulate lobes, lobes 0.2 cm long, ciliate; corolla tetramerous, 0.1–0.15 cm long, 0.1–0.15 cm diam., petals coherent, caducous, the apex hispid; stamens 4, connective deltate, granular, drying dark, anther extrorse; disc apex concave with a central depression; the style terete, the stigma slightly clavate. Fruit purple, conic, drying sulcate, smooth to tuberculate, 1.0 cm long, 0.65 cm wide. Seed 1, subdolabriform, 0.8 cm long, 0.5 cm wide, the apex obcordate, the raphe prominent and transversely grooved, the sides slightly rugose.

This species is known from northeastern Brazil, chiefly in areas of iron mining (the "cangas") in the Serra dos Carajás, Pará State, and savanna areas (cerrado). The intense commercial exploration of this area is a menace for this species in the area of principal (and type) collections.

The unique calyx of *Cissus apendiculata* differs from that of all other species of *Cissus.* I know of no similar species in the Neotropics. The relationships of this species are therefore obscure, despite some similarity to *Cissus surinamensis* Descoings in leaf aspect.

Paratypes. BRAZIL. **Maranhão:** Monção, rio Pindaré, June 1944, *Fróes 20253* (NY). **Pará:** Monte Alegre, Airí, 6 May 1953, *Andrade-Lima 53–1391* (IPA); Serra dos Carajás, 20–25 km NW of Serra Norte mining camp, ca. 05°55'S, 50°26'W, 6 Dec. 1981, *Daly et al. 1776* (F, NY); Serra dos Carajás, Marabá, N-4, 20 Mar. 1984, *A. S. L. Silva et al. 1940* (MG, NY). **Tocantins:** ca. 5 km N of Araguaína, ca. 300 m, 14 Mar. 1968, *Irwin et al. 21176* (UB).

Cissus paraensis Lombardi, sp. nov. TYPE: Brazil. Pará: Tucuruí, km 25 S of Represa Tucuruí on road (BR 422) to Breu Branco, ca. 03°52'S, 49°44'W, 90 m, 15 Mar. 1980, *Plowman et al. 9612* (holotype, MG; isotypes, F, NY). Figure 2G–L.

Frutex scandens, foliis ternatis, *C. trigonae* Willdenow ex Schultes & Schultes f. similis, sed stipulis et bracteis basi gibbosis, basi calice disciforme differt.

Liana, stems glabrous to rarely sparsely puberulent, terete to winged on older stems. Trichomes rare and not ramified, multicellular. Tendrils with several bifurcate branches, with adhesive discs, glabrous; scales 0.1 cm long, triangular, glabrous, the base gibbous. Stipules 0.3–0.6 cm long, 0.2–0.4 cm wide, deltate, fleshy, glabrous to rarely puberulent in its gibbosity, the base gibbous and drying dark, the margin darkened and revolute. Petioles 1.7–8.3 cm long, canaliculate, glabrous to rarely puberulent. Leaf blades ternately compound; central petiolules 0–1.4 cm long, laterals 0–0.5 cm long, glabrous to rarely puberulent; blades of central leaflets elliptic to obtrullate, 3.5–17.4 cm long, 1–10.1 cm wide, blades of lateral leaflets subelliptic, 1.4–12.9 cm long, 0.5–7.9 cm wide, herbaceous, glabrous to rarely puberulent, chiefly along the veins on the abaxial side, the base cuneate, the lateral leaflets rarely lobulate, the apex acute to acuminate, the margin denticulate. Inflorescence flat-topped, glabrous to rarely puberulent; the peduncle 1.1–6.2 cm long; the bracts triangular, 0.15–0.2 cm long, the base gibbous and drying dark, the margin crispate. Flowers greenish to rarely red; pedicels 0.2–0.35 cm long, papillose, glabrous to rarely puberulent; calyx truncate, 0.1–0.15 cm long, 0.2–0.5 cm diam., fleshy, glabrous to rarely puberulent, the base laterally discoid; corolla tetramerous, 0.1–0.2 cm long, 0.1–0.3 cm diam., petals coherent, caducous, glabrous to rarely puberulent; stamens 4, connective deltate, granular, drying dark, anther extrorse; disc green, the apex concave with a central depression; the style terete, the stigma slightly clavate. Fruit purple, subspheric, with sparse lenticels, 1 cm long, 0.7 cm wide. Seed 1, subrectangular to subpyriform, 0.85 cm long, 0.65 cm wide, the hilum obtuse, the apex emarginate, the raphe prominent and transversely grooved, the sides rugose.

This species is named for Pará State in Brazil, where the type material was collected. It occurs in the secondary and primary forests and savannas (campina and campinarana). This species differs from others with ternately compound leaves in its stipules and bracts that are prominently gibbous and dark on drying, and in its discoid calyx.

Cissus paraensis is similar to *C. trigona* Willdenow ex Schultes & Schultes f., but can be easily distinguished by the smaller leaves and seeds, the discoid calyx, and fruits that are not thick-skinned.

Paratypes. BRAZIL. **Acre:** Rio Branco, Rio Branco-

Porto Velho Highway, between km 22–42, 28 Mar. 1979, *Albuquerque et al. 1276* (NY, US). **Amazonas:** Manicoré, BR 230, 120 km de Humaitá, reserva indígena dos Tenharim, 07°55′S, 62°00′W, 15 Apr. 1985, *Cid 5531* (F, MG, NY, US). **Pará:** Almeirim, monte Dourado, área da água Azul, 01°05′S, 52°70′W, 26 Mar. 1986, *M. J. Pires et al. 838* (INPA, MG, NY); Tucuruí, margem direita do rio Tocantins, BR 263, ramal à direita do km 16, 29 Jan. 1980, *Lisboa et al. 1256* (INPA, NY).

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A New Combination in *Cleistocalyx* (Myrtaceae)

J. Parnell
School of Botany, Trinity College Dublin, Ireland

P. Chantaranothai
Department of Biology, Khon Kaen University, Khon Kaen, Thailand

ABSTRACT. The new combination *Cleistocalyx nervosum* (DC.) A. J. G. H. Kostermans var. *paniala* (Roxburgh) J. Parnell & P. Chantaranothai is made.

A new combination in *Cleistocalyx* is necessary to validate our forthcoming account of the Myrtaceae of Thailand.

Cleistocalyx nervosum (DC.) A. J. G. H. Kostermans var. **paniala** (Roxburgh) J. Parnell & P. Chantaranothai, comb. nov. Basionym: *Eugenia paniala* Roxburgh, Fl. Ind. ed. 2, 2: 489. 1832. *Cleistocalyx operculatus* (Roxburgh) Merrill & L. M. Perry var. *paniala* P. Chantaranothai & J. Parnell, Kew Bull. 48: 591. 1993. *Eugenia operculata* Roxburgh var. *paniala* (Roxburgh) Duthie in Hook. f., Fl. Br. Ind. 2: 498. 1879. TYPE: Ic. Roxb. no. 2255 (K).

The vegetative characters of variety *paniala* are the same as for variety *operculatus*, but the petals are larger (> 4.2 mm) and the fruits are oblong-globose. The inflorescence is also slightly smaller.

Acknowledgments. I thank E. Nic Lughadha, D. Middleton, and M. Jebb for commenting on an early draft of this paper.

A New Combination in *Polystichum* (Dryopteridaceae)

J. P. Roux

National Botanical Institute, Compton Herbarium, Private Bag X7, Claremont 7735,
South Africa

ABSTRACT. A new combination is made in the fern genus *Polystichum*: *P. crinulosum* (Desvaux) J. P. Roux.

The following combination has been found necessary in preparing a treatment of the fern genus *Polystichum* in Africa, Macaronesia, Madagascar, and the Mascarene region.

Polystichum crinulosum (Desvaux) J. P. Roux, comb. nov. Basionym: *Aspidium crinulosum* Desvaux, Mém. Soc. Linn. Paris 6: 249. 1827. TYPE: Habitat in insula Mauritii (Mauritius). *Sine coll. s.n.* (lectotype, designated here, P; isolectotype, B-96929).

The collection designated here as lectotype of *Polystichum crinulosum* conforms in all respects with the original description of the species. Desvaux described the species as originating from "C. Bonae spei" or the Cape of Good Hope. The sheet chosen as lectotype formed part of his herbarium but bears two labels giving Mauritius as the source. This is more likely correct as the plant does not conform with any of the African species. The collector of the material remains unknown as it is neither stated in the original description nor provided on the label. The isolectotype consists of a pinna only and is clearly the one missing from the lower part of the lectotype. The fragment is kept in a capsule bearing the handwriting of G. Mettenius.

Polystichum crinulosum was placed under *P. aculeatum* var. 1 by Christensen (1905), whereas Kuhn (1868) considered it conspecific with *P. ammifolium* (Poiret) C. Christensen (as *Aspidium ammifolium* Desvaux).

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New Taxa and a New Rank of *Selaginella* (Selaginellaceae) from Madagascar and the Comoros

Saša Stefanović and France Rakotondrainibe

École Pratique des Hautes études, Laboratoire de Phytomorphologie, Muséum National d'Histoire Naturelle, 16, rue Buffon, F-75005 Paris, France

ABSTRACT. Two new species of *Selaginella* from Madagascar, *S. bemarahensis* and *S. marinii,* are described and illustrated, as are a new subspecies of *S. nivea* Alston and a new form of *S. fissidentoides* (Hooker & Greville) Spring var. *fissidentoides.* The Malagasy species *S. fissidentoides* is segregated into two varieties, one of which has been previously known as *S. amphirrhizos* A. Braun ex Hieronymus. The taxonomic position and closest relationships of each taxon are briefly discussed.

The monogeneric family Selaginellaceae comprises about 700 species distributed throughout the world, but for the most part concentrated in tropical and subtropical areas. The most recent infrageneric classification of the genus *Selaginella* (Jermy, 1986) recognized five subgenera.

The last complete account of the family in Madagascar and the Comoros was made by A. H. G. Alston (1932), who listed eleven species of *Selaginella* as occurring in that area. Two additional Malagasy species were established, one by R. M. Tryon (1955) and one by W. Rauh and W. Hagemann (1991). During revision of this family for the *Flore de Madagascar et des Comores,* made possible by increased collecting in the last 40 years (specimens have been studied from B, BM, K, P), one existing taxon has been divided and four distinct taxa have been noted. They are described in this paper, so that the names can be used in the Flora treatment. Two species, *S. bemarahensis* and *S. marinii,* belong to the subgenus *Heterostachys* Baker, and one subspecies, *S. nivea* subsp. *humbertii,* to the subgenus *Tetragonostachys* Jermy. *Selaginella fissidentoides* var. *amphirrhizos* and *S. fissidentoides* fo. *ovata* (of var. *fissidentoides*) belong to the subgenus *Stachygynandrum* (P. Beauvois) Baker.

At present, fifteen species of *Selaginella* are recognized in Madagascar and the Comoros, one of them represented by two subspecies and one by two varieties and one form.

The descriptive terms referring to shape, surface, and structure of spores follow terminology used by A. F. Tryon and B. Lugardon (1991).

1. **Selaginella bemarahensis** S. Stefanović & Rakotondrainibe, sp. nov. TYPE: Madagascar. Mahajanga: Reserve Naturelle de Bemaraha, au sud-est d'Antsalova, 18°45′S, 44°48′E, 400 m, 23 Aug. 1987, *Phillipson 2257* (holotype, P; isotype, MO not seen). Figure 1A, B.

Species haec, inter species subgeneris *Heterostachys* Baker, habitu parvulo et muscoso ad *S. perpusillam* Baker accedens, sed foliis lateralibus et medianis similaribus (praeter staturam), foliorum mediorum apice acuto et foliorum lateralium marginibus et sporophyllorum ventralium denticulatis (non ciliatis) ab ea differt.

Plants tiny, moss-like, slender, without rhizome, forming mats. Main stem suberect to erect, 2–4.5 cm long, outline lanceolate, rarely or not branched, provided with rhizophores. Branches, when present, short and unbranched. Rhizophores dorsal, situated on the lower half of the stem, 2–8 mm long and very fine, straw-yellow, dichotomizing 2–3 times. Leaves dimorphic, pale green, herbaceous, widely spaced on the main stem, contiguous toward the tips of the main stem and branches. Lateral leaves subequal, lanceolate, 1.8–3 mm long, 0.6–1 mm wide, midrib apparent, base symmetrical and blunt, apex acute, margin subentire to denticulate all around the leaf. Axillary leaves similar to lateral but equal. Median leaves also similar to lateral leaves but smaller, 1.2–1.8 mm long, 0.5–0.8 mm wide. Strobili solitary, inserted terminally on main stem and branch tips, bilateral, resupinate, 5–8 mm long and 1.5–2 mm wide. Sporophylls dimorphic, spreading, margins denticulate. Dorsal sporophylls ovate-lanceolate, 1–1.5 mm long and 0.4–0.6 mm wide, keeled, keel well developed and denticulate, base blunt, apex acute. Ventral sporophylls ovate, 0.9–1.1 mm long and 0.4–0.6 mm wide, slightly or not keeled, base blunt, apex acute-acuminate. Megaspores light lemon yellow, 278–287 μm diam., spherical, trilete, with laesura nearly equaling the radius, surface finely tuberculate on both proximal and distal face (Fig. 2A). Microspores bright orange, 35–38 μm diam., tetrahedral-globose, trilete, with laesura nearly equaling the radius, surface laevigate to finely granulate on both proximal and

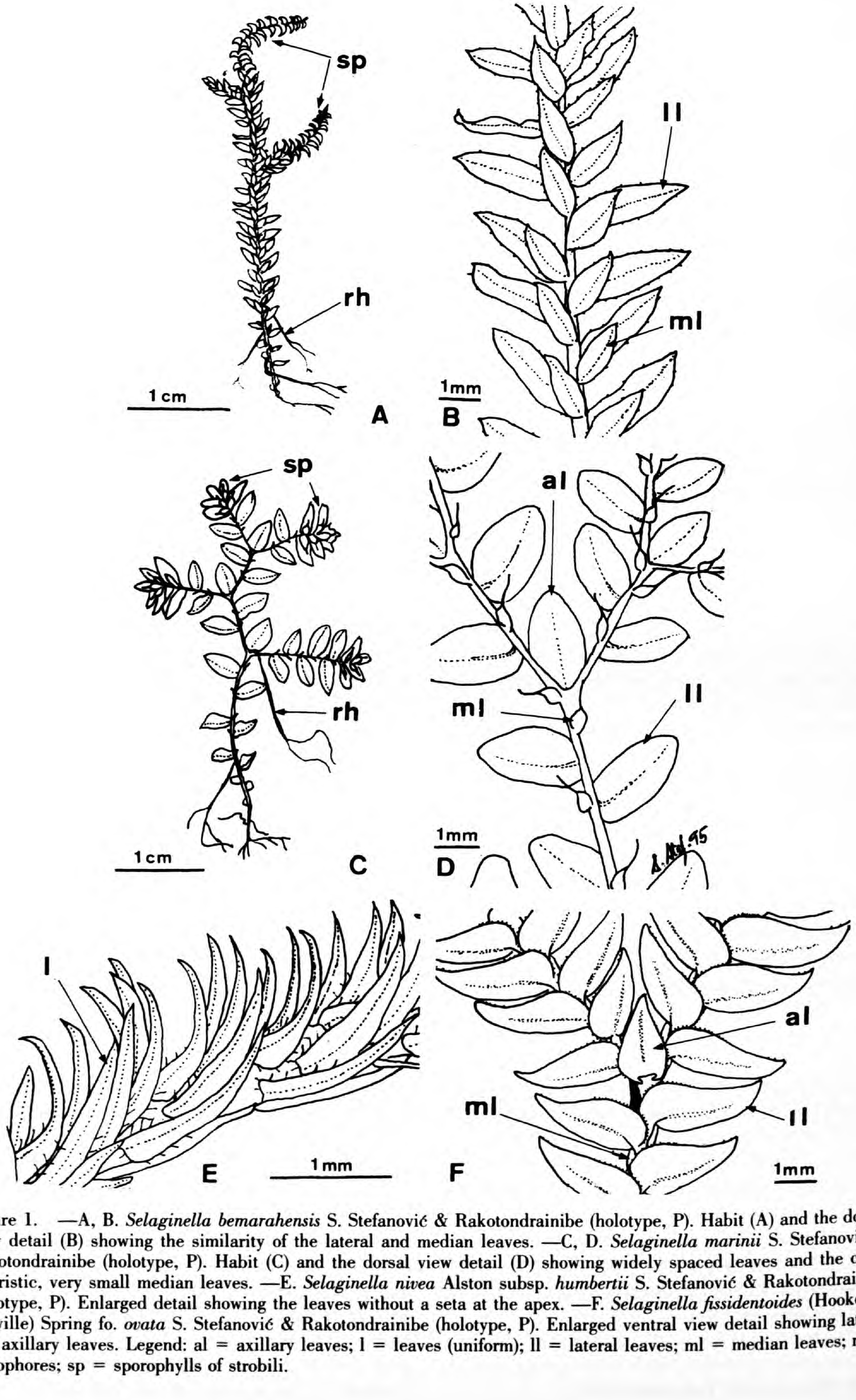

Figure 1. —A, B. *Selaginella bemarahensis* S. Stefanović & Rakotondrainibe (holotype, P). Habit (A) and the dorsal view detail (B) showing the similarity of the lateral and median leaves. —C, D. *Selaginella marinii* S. Stefanović & Rakotondrainibe (holotype, P). Habit (C) and the dorsal view detail (D) showing widely spaced leaves and the characteristic, very small median leaves. —E. *Selaginella nivea* Alston subsp. *humbertii* S. Stefanović & Rakotondrainibe (holotype, P). Enlarged detail showing the leaves without a seta at the apex. —F. *Selaginella fissidentoides* (Hooker & Greville) Spring fo. *ovata* S. Stefanović & Rakotondrainibe (holotype, P). Enlarged ventral view detail showing lateral and axillary leaves. Legend: al = axillary leaves; l = leaves (uniform); ll = lateral leaves; ml = median leaves; rh = rhizophores; sp = sporophylls of strobili.

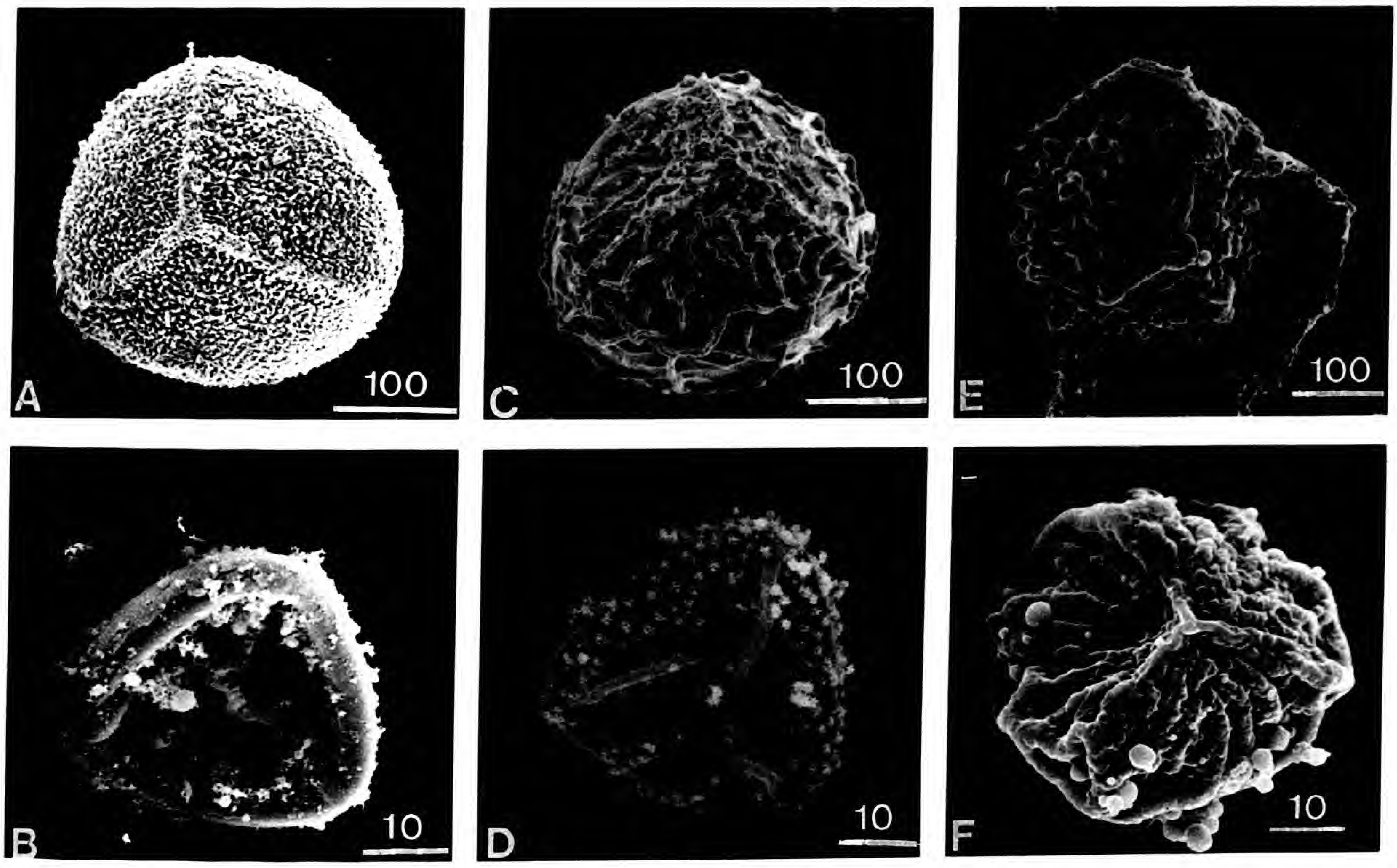

Figure 2. Scanning electron (SEM) micrographs of the spores from holotype specimens (scale bars in μm). —A. Megaspore of *S. bemarahensis.* —B. Microspore of *S. bemarahensis.* —C. Megaspore of *S. marinii.* —D. Microspore of *S. marinii.* —E. Megaspore of *S. nivea* subsp. *humbertii.* —F. Microspore of *S. nivea* subsp. *humbertii.*

distal face, with amorphous background pattern (Fig. 2B).

Both known collections of this species are from central-west Madagascar, Reserve Naturelle de Bemaraha, where the species grows on rocks and mud banks in shade along streams, at an elevation of about 400–500 m (Fig. 3A). The species is named after the type locality.

Following the taxonomic arrangement of the genus *Selaginella* proposed by Jermy (1986), *S. bemarahensis,* through its bilateral and resupinate strobili and dimorphic sporophylls, belongs to the subgenus *Heterostachys* Baker.

Selaginella bemarahensis is characterized by the striking similarity of its lateral and median leaves (except in size), a feature that is rare among species of this subgenus. *Selaginella perpusilla* Baker (an African and Malagasy species), like *S. bemarahensis,* is a very small, moss-like plant, rarely branched, with relatively large strobili. It differs from *S. bemarahensis* in its deltoid outline, more unequal lateral leaves with ciliate upper margins, acuminate median leaves, more compact strobili, and ciliate ventral sporophylls.

Paratype. MADAGASCAR. 12 km à l'est-sud-est d'Ankiliromotsy, 26 km au sud-est d'Antsalova, 30 Mar. 1993, *Villiers, Klackenberg & Badré 4995* (P).

2. Selaginella marinii S. Stefanović & Rakotondrainibe, sp. nov. TYPE: Madagascar. Antsiranana: Reserve Speciale de Manongarivo, Mt. Antsatrotro, 14°06′S, 48°25′E, 1220 m, 20 May 1992, *Rakotondrainibe 1677* (holotype, P). Figure 1C, D.

Species haec, inter species subgeneris *Heterostachys* Baker, habitu, foliorum lateralium marginibus denticulatis vel integris et foliorum mediorum apice acuminato ad *S. hildebrandtii* A. Braun ex Hieronymus similis, sed foliorum mediorum marginibus integris (non dentatis), foliorum lateralium foliis medianis valde minoribus et sporophyllorum ventralium marginibus ciliatis (non dentatis) differt.

Plants slender, without rhizomes, forming mats. Main stem suberect to erect, 3–8 cm long, outline lanceolate, branched, provided with rhizophores. Branches bifurcated 1–2 times. Rhizophores dorsal, situated on the lower half of the stem, 0.5–2 cm long and very fine, straw yellow to pale green, dichotomizing 2–3 times. Leaves dimorphic, metallic pale green, herbaceous, widely spaced to narrowly spaced, frequently appearing to be grouped in pairs, midrib slightly or not apparent. Lateral leaves subequal, oblong, 1.5–2.6 mm long, 0.7–1.3 mm wide, base asymmetrical and blunt, apex acute, margin subentire to denticulate all around the leaf. Axillary leaves similar to lateral leaves but equal. Median leaves subequal, lanceolate, very small,

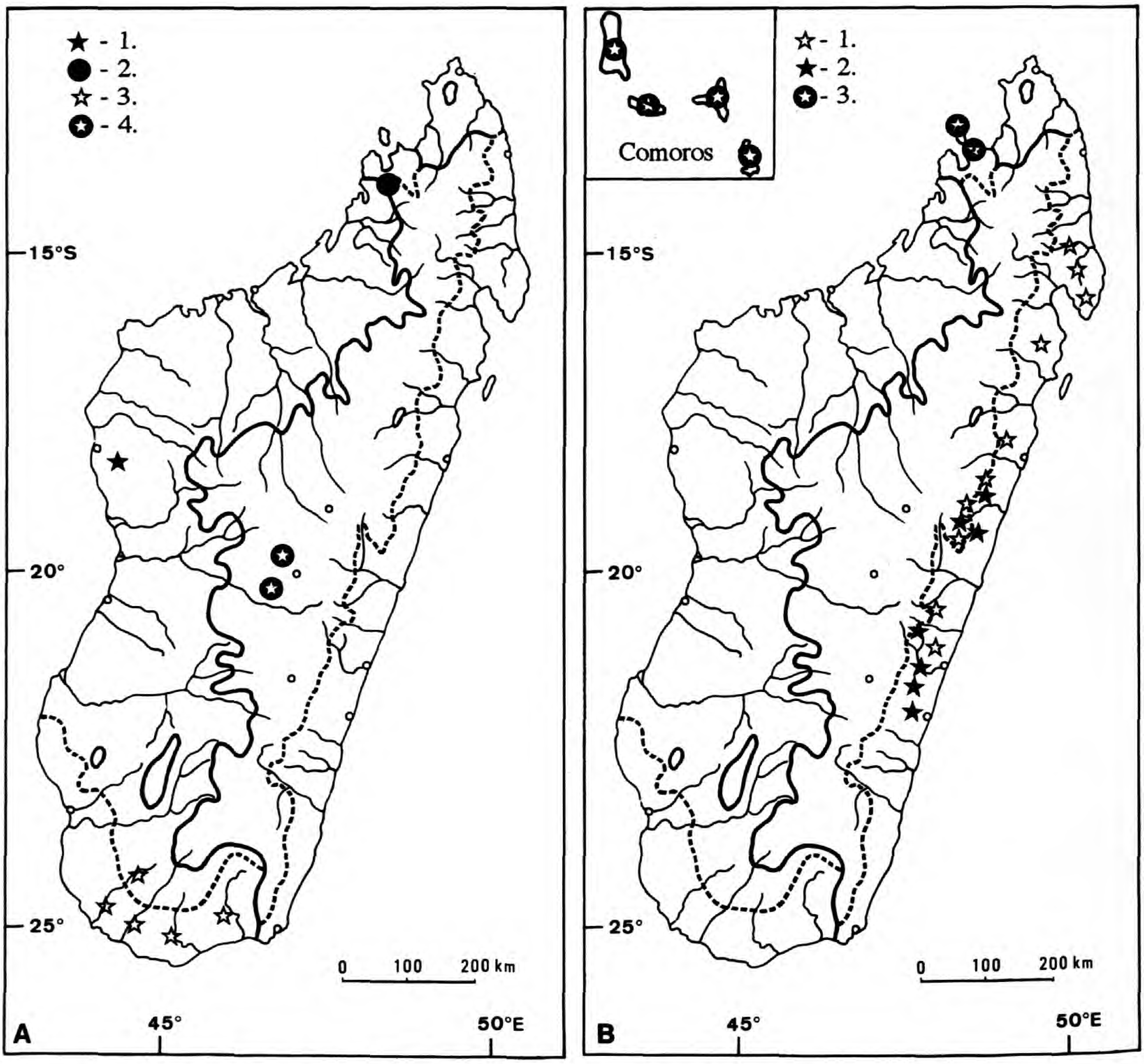

Figure 3. Map of Madagascar. Legend: full bold lines and dashed lines show major phytogeographic division (for more details, see H. Humbert, 1955). —A. Distribution of *S. bemarahensis* (1), *S. marinii* (2), *S. nivea* subsp. *nivea* (3) and subsp. *humbertii* (4). —B. Distribution of *S. fissidentoides* fo. *fissidentoides* (1), fo. *ovata* (2), and var. *amphirrhizos* (3).

0.8–1.5 mm long and only 0.2–0.5 mm wide, base broadly cuneate, apex abruptly and long-acuminate, margins entire. Strobili solitary, inserted terminally on main stem and branch tips, bilateral, resupinate, 2–5 mm long and 3–4 mm wide. Sporophylls dimorphic. Dorsal sporophylls oblong-lanceolate, 1.6–2.1 mm long and 0.6–0.8 mm wide, keeled, keel slightly developed and hyaline, base blunt, apex acute, margins denticulate. Ventral sporophylls ovate, 0.9–1.2 mm long and 0.4–0.6 mm wide, slightly or not keeled, base blunt, apex gradually acuminate, margins ciliate. Megaspores pale yellow, 250–270 μm diam., tetrahedral-globose, trilete, with laesura equaling the radius, surface broken reticulate on both proximal and distal face, with finely echinulate background pattern (Fig. 2C). Microspores brownish red, 32–38 μm diam., tetrahedral-globose, trilete, with laesura equaling the radius, surface laevigate on both proximal and distal face, with stellate crystal background pattern (Fig. 2D).

The three collections in existence so far are from Domaine Sambirano of northwest Madagascar, Reserve Speciale de Manongarivo, where the species grows in colonies on rocks in shade, at an elevation of 600–1300 m (Fig. 3A). The species is named after biologist Marin Vulić.

Based on its bilateral and resupinate strobili and dimorphic sporophylls this species also belongs to subgenus *Heterostachys* Baker.

The combination of widely spaced, spreading leaves and the great difference in size between the lateral and median leaves frequently gives an impression that the leaves are grouped in pairs. This allows a new species to be easily recognized. *Selaginella marinii* resembles the Comorian species *S. hildebrandtii* A. Braun ex Hieronymus, both belonging to the same subgenus, in its lanceolate habit outline, shape of the lateral and median leaves, and acuminate median leaves. The two species can be distinguished by the median leaves and the ventral sporophylls. In *S. marinii* the median leaves are entire and very small compared to the laterals, and the ventral sporophylls are clearly ciliate. In *S. hildebrandtii,* however, the median leaves are dentate and about half the size of the laterals, and the ventral sporophylls are dentate.

Paratypes. MADAGASCAR. Manongarivo, Mt. Bekolosy, Apr.–June 1890, *Last 1890* (BM); Antsiranana, Reserve Speciale de Manongarivo, à l'est d'Ankaramy, Mt. Antsatrotro, 600–900 m, 26–30 Mar. 1993, *Malcomber, Rakotomalaza, Raharilala 2311* (P).

3. Selaginella nivea Alston ex Alston in C. Christensen, Dansk Bot. Ark. 7: 194, 1932. TYPE: Madagascar. Environs d'Ampanihy, Sud-Ouest [domaine], June 1910, *Perrier de la Bâthie 8303* (holotype, BM; isotype, P).

Selaginella nivea was first mentioned by A. H. G. Alston, ms. in sched., then by H. Perrier de la Bâthie (Feb. 1932), nom. nud.; it was described and validated by A. H. G. Alston in June 1932.

The present study of this species shows that *Selaginella nivea* includes two distinct taxa that differ in some morphological features as well as in geographic distribution (subsp. *nivea* occurs at low elevations in southern Madagascar, whereas subsp. *humbertii* is found at much higher elevations in central Madagascar).

Because of its prostrate stems, spirally arranged and uniform leaves, tetragonal strobili, absence of rhizomes and stolons, as well as presence of rhizophores over the entire main stem, this species belongs to subgenus *Tetragonostachys* Jermy.

Selaginella nivea Alston ex Alston subsp. **nivea**

The type subspecies is characterized by its 1–2-cm-long dorsal rhizophores, generally ramified throughout their length; by its setae at the leaf apex, ¼–⅓ as long as the blade; and by ciliate leaf margins with the longest cilia ⅕–¼ as long as the width of the blade. Megaspores are light yellow, 391–402 μm diam., spherical, trilete, with laesura ½ the radius, surface low tuberculate on proximal face, laevigate on distal face, very irregularly perforate on both faces. Microspores are light brown, 38–44 μm diam., tetrahedral-globose, trilete, with laesura ¾ to nearly equaling the radius, surface shortly irregularly striate on both proximal and distal face.

In Madagascar, *Selaginella nivea* subsp. *nivea* occurs only in the extreme south, on rocks in xerophilous bush (among *Euphorbia* spp. and *Didierea* spp.), at an elevation of 100–300 m (Fig. 3A). This subspecies is also known from a few localities in East Africa (Mozambique, Botswana, Zimbabwe).

Selaginella nivea Alston subsp. **humbertii** S. Stefanović & Rakotondrainibe, subsp. nov. TYPE: Madagascar. Ouest Betsileo: à l'ouest de l'Itremo [Massif de l'Itremo, 20°36'S, 46°39'E], 1500–1700 m, 17–22 Jan. & 18–22 Apr. 1955, *Humbert 28366* (holotype, P). Figure 1E.

Subspecies haec a subspecies typica foliorum apice sine seta, ciliis longissimis ⅙–⅕ laminae latitudinis aequantibus et rhizophoris ramosis solum ad extremitates praecipue differt.

Plants with stems 7–10 cm long. Rhizophores dorsal, present throughout the main stem and branches, 3–5 cm long and 0.4 mm diam., dichotomizing only at their extremities. Main stem cylindrical, 0.5–0.8 mm diam. Leaves uniform, herbaceous, 1–1.5 mm long, 0.2–0.25 mm wide, apex acute to acuminate, without seta, margins dentate or ciliate toward the base of the leaf, the longest cilia ⅙–⅕ as long as the width of the blade. Megaspores light yellow, 314–419 μm diam., tetrahedral-globose, trilete, with laesura ¾ the radius, surface areolate verrucate on both proximal and distal face (Fig. 2E). Microspores light brown, 42–45 μm diam., tetrahedral-globose, trilete, with laesura equaling the radius, surface deeply striate on both proximal and distal face, striae regular and parallel with the laesura on proximal face, ± irregular on distal face (Fig. 2F).

This taxon is known, so far, only from two localities in central Madagascar, Mt. Itremo and Mt. Ibity, where it grows on sheltered and westward slopes, on gneiss or quartz soil, at an elevation of 1600–2000 m (Fig. 3A). The subspecies is named in honor of the French botanist and great expert on the Malagasy flora, H. Humbert, who collected the type specimen.

Selaginella nivea subsp. *humbertii* differs mainly from the type subspecies in the absence of setae at the leaf apex and in the rhizophores dichotomizing only at their extremities. These macromorphological features combined with different spore surface patterns and geographic distribution strongly support the present segregation into two taxa.

Paratypes. MADAGASCAR. Chaîne quartzitique de l'Itremo, 1700 m, Sep. 1956, *Bosser 9863* (P); chaîne à 6 km au sud de l'Itremo, 1700 m, Sep. 1956, *Bosser 9975* (P); sud-ouest Antsiraba, pentes du Mt. Ibity, vers 2000 m, 28 Mar. 1972, *Cremers 1975* (P); sud de l'Ibity, 2000 m, 14 Jan. 1973, *Guillaumet 4272* (P).

4. **Selaginella fissidentoides** (Hooker & Greville) Spring, Bull. Acad. Roy. Sci. Bruxelles 8 (12): 142. 1841. *Lycopodium fissidentoides* Hooker & Greville in Hooker, Bot. Misc. 2: 395. 1831. TYPE: Madagascar. *Lyall 267* (holotype, K).

This species, originally established by W. J. Hooker and R. K. Greville (1831) as *Lycopodium fissidentoides,* was transferred by A. H. G. Spring (1841) to the genus *Selaginella.* J. G. Baker (1883) placed in synonymy with *S. fissidentoides* another taxon, *S. amphirrhizos,* since according to him "*S. amphirrhizos* A. Braun, from Johanna Island, Hildebrandt 1808 [type], seems to be a luxuriant form of this species [*S. fissidentoides*]." *Selaginella amphirrhizos* was first mentioned by A. Braun, ms. in sched., then by M. Kuhn (1879) and C. Salomon (1883), nom. nud., and finally was described and validated as a new species by G. Hieronymus (1902). In his study on the species of *Selaginella* from Madagascar, A. H. G. Alston (1932) also treated these two taxa as synonyms, adding that "*S. amphirrhizos* has broader, more oblong lateral leaves than the typical form," as did C. F. Reed (1966) in his *Index Selaginellarum.*

The present study of *Selaginella fissidentoides* now shows that this species is comprised of three segregates (two varieties and one form). These taxa, one occurring in east central Madagascar (var. *fissidentoides*) and the other found only on the Comoros and Nossi-Bé (var. *amphirrhizos*), are treated here as varieties because of their well-defined and constant differences in morphology and in geographic distribution. One population belonging to variety *fissidentoides,* but differing in some morphological characters, is described as a new form.

Selaginella fissidentoides is the only Malagasy species of the subgenus *Stachygynandrum* Baker with creeping stems, prostrate branches, and rhizophores present over the entire main stem.

Selaginella fissidentoides (Hooker & Greville) Spring fo. **fissidentoides**

This type form is characterized by its slightly sickle-shaped lanceolate lateral leaves, which are not auriculate at the base, with a rather blunt apex and a midrib that is apparent but does not reach the apex; and by its auriculate median leaves with a blunt auricle. The axillary leaves are lanceolate.

It occurs in dense and humid forests throughout the length of the east coast of Madagascar (Fig. 3B).

Selaginella fissidentoides (Hooker & Greville) Spring fo. **ovata** S. Stefanović & Rakotondrainibe, fo. nov. TYPE: Madagascar. Est-Centre: forêt d'Analamazaotra, 800 m, *Perrier de la Bâthie 6087* (holotype, P). Figure 1F.

A forma typica foliorum lateralium parte acroscopica semiovata, foliis lateralibus inaequilaterioribus et foliis axillaribus ovatis differt.

These plants are similar to the type form, but differ in having an aspect of more unequal lateral leaves since the acroscopic part of these is semiovate (not semi-lanceolate). The axillary leaves are also ovate.

This form occurs, like form *fissidentoides,* on the east coast of Madagascar, but its distribution is limited only to the southern part of the area where the variety is found (Fig. 3B), supporting its segregation as a distinct taxon.

Paratypes. MADAGASCAR. Forêt d'Analamazaotra, Dec. 1905, *d'Alleizette 51* (P, B); Périnet, 2 Sep. 1951, *Benoist 1113* (P); Vondrozo, Tsararano, Dec. 1963, *Bosser 18597* (P); Fanovana, 10 July 1942, *Decary 18131* (P); forêt à feuilles persistantes, bords de Torrents entre Sandrangato et Anosibe, 800–1100 m, 3–7 Nov. 1952, *Léandri & Capuron 1578* (P); forêt orientale sur le Mt. Vatovavy, bassin du Mananjary, 250 m, Oct. 1911, *Perrier de la Bâthie 8260* (BM).

Selaginella fissidentoides (Hooker & Greville) Spring var. **amphirrhizos** (A. Braun ex Hieronymus) S. Stefanović & Rakotondrainibe, stat. nov. Basionym: *Selaginella amphirrhizos* A. Braun ex Hieronymus in Engler & Prantl, Nat. Pflanzenfam. 1 (4): 705. 1902. TYPE: Comores. Comoro-Insel Johanna, 500–1000 m, June–Aug. 1875, *Hildebrandt 1808* (holotype, B; isotype, P).

Nomina nuda of this variety are discussed above in the general observations concerning *Selaginella fissidentoides.*

This more robust variety is characterized by its slightly auriculate lateral leaves, with a mucronate apex and midrib reaching the apex and by auriculate median leaves with an acute auricle curved toward the outside at its apex (at least on the main stem).

It occurs on the Comoros and Nossi-Bé (Fig. 3B), so the morphological differences from variety *fissidentoides* are supported by geographic distribution.

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Taxonomic Notes on the Tribe Psychotrieae (Rubiaceae) in Panama, Western Colombia, and Ecuador

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The new combinations *Faramea papirifolia* (Standley ex Steyermark) C. M. Taylor, *Palicourea amplissima* (Standley ex Steyermark) C. M. Taylor, *Palicourea dimorphandrioides* (Dwyer) C. M. Taylor, *Palicourea grandistipula* (Standley ex Steyermark) C. M. Taylor, *Palicourea remyana* (Baillon) C. M. Taylor, *Psychotria diguana* (Standley ex Steyermark) C. M. Taylor, *Psychotria dives* (Standley) C. M. Taylor, and *Rudgea vallis* (Standley ex Steyermark) C. M. Taylor are made; the new name *Palicourea tunjaënsis* C. M. Taylor is provided for *Psychotria boyacana* Standley; and *Palicourea acanthacea* Standley ex Steyermark ex C. M. Taylor is published based on "*Cephaëlis acanthacea,*" an invalid name.

Psychotrieae A. Richard ex Dumortier include the largest number of species of Rubiaceae in the Neotropics, most of them in *Psychotria* L. (perhaps 700 neotropical species, fide Hamilton, 1989). The species of this tribe are united by the combination of drupaceous, usually fleshy fruits with two planoconvex pyrenes each bearing a single seed, hermaphroditic flowers, and valvate corolla aestivation (Steyermark, 1974). In the Neotropics, the Psychotrieae are represented by at least 11 genera, most of them separated from *Psychotria* by one character or a suite of correlated characteristics. Steyermark (1974) provided a key to the neotropical genera of this tribe. The generic placement of some neotropical species of Psychotrieae has been problematic, particularly in cases where the diagnostic generic characteristics were not present on the material studied, such as species placed in *Palicourea* Aublet based only on fruiting material or those placed in *Rudgea* Salisbury based on specimens that lack stipules.

Rudgea (ca. 165 species, all neotropical) is distinguished from other genera of Psychotrieae by its fimbriate or fimbriate-glandular stipules. The fimbriae or glandular appendages may be persistent but are more often caducous and consequently present only on young stipules at the stem apex, and thus can easily be overlooked.

Palicourea (ca. 200 species, all neotropical) is distinguished from *Psychotria* only by corolla morphology (Taylor, 1989): in *Palicourea* the clearly developed corolla tube is swollen at the base, usually asymmetrically so, and bears an internal ring of dense pubescence just above the basal swelling, presumably protecting it from nectar robbing. In other genera of Psychotrieae the corolla tubes are straight and symmetrical at the base and glabrous or variously pubescent internally but never have the distinctive pattern seen in *Palicourea.* Species of *Psychotria* and *Palicourea* in which the corolla was not examined for these characters may not be placed in the correct genus.

Previously, species of *Psychotria* with capitate to subcapitate inflorescences subtended by well-developed bracts were separated as *Cephaëlis* Swartz. However, as shown by Steyermark (1972; also discussed by Taylor, 1994, Taylor & Lorence, 1992, and Taylor et al., 1991), *Cephaëlis* is polyphyletic and is better combined with *Psychotria* (the older name). This taxonomic rearrangement necessitates new combinations for species originally described in *Cephaëlis.* Generally, placement of a species in *Cephaëlis* has been based entirely on inflorescence structure, but species may be better placed in a genus other than *Psychotria,* or even in another tribe, as in several cases described below.

During review of specimens of Rubiaceae from central Panama and northwestern South America, the need for the following generic transfers and synonymizations became evident.

Faramea papirifolia (Standley ex Steyermark) C. M. Taylor, comb. nov. Basionym: *Cephaëlis papirifolia* Standley ex Steyermark, Acta Biol. Venez. 4: 21. 1964. TYPE: Colombia. "Valle: río Calima (región del Chocó), margen derecha, lomas frente a quebrada de la Brea, alt. 30–50 m, 18, 22 May 1946," *José Cuatrecasas 21078* (holotype, US 2825318; isotype, VEN not seen).

Faramea caput-anguis Dwyer & M. V. Hayden, Ann. Missouri Bot. Gard. 55: 29. 1968. Syn. nov. TYPE: Panama. Panamá: Cerro Jefe, 29 July 1967, *J. Dwyer & G. Gauger 7375* (holotype, MO 1961869; isotypes, GH not seen, K not seen, NY not seen, UC not seen, US not seen).

NOVON 6: 210–214. 1996.

Comparison of the holotype specimens of *Cephaëlis papirifolia* and *Faramea caput-anguis* shows that these two names apply to the same distinctive species. Steyermark placed this species in *Cephaëlis* based on its capitate inflorescences enclosed by well-developed bracts and probably also its general similarity (in particular in its swollen peduncles, inflorescence size and shape, and relatively long white corollas) to several species of *Psychotria* found in the same region (e.g., *P. cuatrecasasii* (Standley ex Steyermark) C. M. Taylor, *P. cordobensis* (Standley ex Steyermark) C. M. Taylor, *P. diguana* (Standley ex Steyermark) C. M. Taylor). However, this species is better placed in *Faramea* (Coussareeae Hooker f.) based on its flattened costate young internodes, interpetiolar stipules twisted in bud, and thin-walled seeds that are solitary in each fruit (e.g., *McPherson 7506,* MO).

Palicourea acanthacea Standley ex Steyermark ex C. M. Taylor, sp. nov. *Cephaëlis acanthacea* Standley ex Steyermark, Acta Biol. Venez. 4: 8, figs. 4, 5. 1964, nom. invalid. TYPE: Colombia. Valle: río Calima (región del Chocó), La Trojita, 5–80 m alt., 19 Feb.–10 Mar. 1944, *José Cuatrecasas 16572* (holotype, F 1153741 (fl); isotypes, F 1153740, F 1153742 (lf)).

In addition to its subcapitate inflorescences with well-developed bracts, this species bears the diagnostic corolla characters of *Palicourea* and is here transferred to that genus. It is similar to several other species of *Palicourea* of the same region (all presently undescribed). Steyermark originally designated what he considered one specimen as the "holotype," but this was mounted on two separate sheets, F—1153741 with only the inflorescence, and F—1153742 with only the leaves. Unfortunately the nomenclatural codes in effect during and since 1964 specify that a holotype may be only one specimen, so his name was not validly published.

Palicourea amplissima (Standley ex Steyermark) C. M. Taylor, comb. nov. Basionym: *Psychotria amplissima* Standley ex Steyermark, Acta Biol. Venez. 4: 90, fig. 45. 1964. TYPE: Colombia. "Valle: río Calima (región del Chocó), entre La Esperanza y Bellavista, alt. 5–10 m, 8 Mar. 1944," *José Cuatrecasas 16787* (holotype, F 1153799; isotype, F 1153798).

This species was placed in *Psychotria* by Steyermark based on the pattern of the internal pubescence of the corolla. This pubescence comprises a dense villous ring internally near the middle of the tube, a continuous less densely pubescent zone above it, and another villous ring at the top of the corolla tube, so the throat is barbate. This pubescence pattern is similar to that of the corollas of *Palicourea mexiae* Standley and *Palicourea gomezii* C. M. Taylor, which are included in *Palicourea* based on their corollas with a characteristic swollen gibbous base topped by an internal pubescent ring. The type collection of *Psychotria amplissima* has only immature corollas, but swollen, strongly gibbous bases are evident even on these buds and the species is here transferred to *Palicourea.* It is similar to *Palicourea mexiae* and *Palicourea gomezii* vegetatively as well as in corolla features. Additional collections of this species with more mature inflorescences (*Juncosa 556,* MO; *Loiaza & Cogollo 303,* JAUM, MO) have subsessile to shortly pedunculate branched inflorescences similar to those of these last two species, rather than the sessile, subcapitate, apparently very young inflorescences of the type collection.

Palicourea dimorphandrioides (Dwyer) C. M. Taylor, comb. nov. Basionym: *Cephaëlis dimorphandrioides* Dwyer, Ann. Missouri Bot. Gard. 67: 66. 1980. TYPE: Panama. Veraguas: valley of Río Dos Bocas on road between Alto Piedras (above Santa Fe) and Calovebora, 350–400 m, 19 Aug. 1974, *T. Croat 27470* (holotype, MO 2201358).

Although its inflorescences are densely congested, this species bears the diagnostic corolla characters of *Palicourea* and is here transferred to that genus. The inflorescence is densely paniculate with usually 4–10 pairs of short lateral branches, each consisting of subsessile cymules arranged along a subsessile central axis 4–7 cm long, so it is not strictly capitate as its description in *Cephaëlis* implied. This species is now known from Chiriquí (*Churchill et al. 4741,* MO) and Bocas del Toro (*Knapp 5102,* MO) in western Panama to Antioquia, Colombia (*Gentry et al. 76164,* MO), and apparently to as far south as Nariño, Colombia (*de Benavides 1335,* MO, but in poor condition).

Palicourea grandistipula (Standley ex Steyermark) C. M. Taylor, comb. nov. Basionym: *Cephaëlis grandistipula* Standley ex Steyermark, Acta Biol. Venez. 4: 19, fig. 9. 1964. TYPE: Colombia. "Valle: Costa del Pacífico, bahía de Buenaventura, quebrada de Aguadulce, alt. 0–10 m, 11 Nov. 1945," *José Cuatrecasas 19750* (holotype, F; isotype, US 1564328).

Cephaëlis spectabilis Standley ex Steyermark, Acta Biol. Venez. 4: 21. 1964. Syn. nov. TYPE: Colombia. "Valle: Costa del Pacífico, río Yurumanquí, Veneral, alt. 5–50 m, 28 Jan.–10 Feb. 1944," *José Cuatrecasas 15734* (holotype, F; isotypes, US 2772254, US 2272255, US 2272256).

This species is similar to *Palicourea amplissima,* in particular in corolla shape, size, and pubescence; the discussion presented under that species regarding generic placement applies also to this species.

The names *Cephaëlis grandistipula* and *C. spectabilis* were published simultaneously with the remark that they might be equivalent, which appears to be the case with more material now available. Steyermark separated them based on the number of corolla lobes (five in *C. grandistipula* vs. four in *C. spectabilis*), reportedly different patterns of internal pubescence of the corolla tubes, and the anthers included in *C. grandistipula* versus exserted in *C. spectabilis.* The type collection of *C. spectabilis* is the only collection so far seen with four corolla lobes; each flower also has four stamens, and five calyx lobes. An occasional flower or plant with four rather than five corolla lobes occurs in many species of *Psychotria* and *Palicourea,* and when this variant is noted it has usually not been separated taxonomically (e.g., descriptions in Steyermark, 1974). This same variation does not seem any more significant here, particularly when the number of calyx lobes is consistently five. What differences between these species Steyermark saw in corolla pubescence is not explained, and is not clear from his species descriptions: he described the corolla of *C. grandistipula* as "intus supra basin corollae 6–7 mm dense barbato hic ad faucem dense villoso, parte basilari 6 mm glabra excepta," and that of *C. spectabilis* as "intus 7 mm supra basin dense barbato hic ad faucem villoso parte basali glabra." These seem rather to be equivalent patterns of pubescence, particularly given that both descriptions were based on immature corollas. Instead of a species-level distinction, the difference in anther position Steyermark observed can equally well be interpreted as evidence of distyly in this species, with the two collections representing, respectively, a long-styled flower with the anthers included and a short-styled flower with the anthers partially to wholly exserted. Distyly is predominant in both *Psychotria* and *Palicourea,* and would be expected in *Palicourea grandistipula,* although this condition was sometimes overlooked by Steyermark (e.g., descriptions in Steyermark, 1974). The selection of the name *C. grandistipula* over *C. spectabilis* is based on the more extensive and accurate description (in particular noting five rather than four corolla lobes) and the illustration presented for this first name.

Palicourea remyana (Baillon) C. M. Taylor, comb. nov. Basionym: *Uragoga remyana* Baillon, Adansonia 12: 253. 1879. *Cephaëlis remyana* (Baillon) Standley, Publ. Field Columbian Mus., Bot. Ser. 7: 220. 1931. TYPE: Ecuador. Bolívar: "in sylvis inter Guaranda et Bodegas," *Remy s.n.* (holotype, P not seen, photo (Rockefeller neg. #37223) MO).

Cephaëlis jacobinoides Standley, Publ. Field Columbian Mus., Bot. Ser. 7: 221. 1931. Syn. nov. TYPE: Ecuador. At the foot of Mount Chimborazo, Río Chasuan, 900 m, June 1860, *R. Spruce 6188* (holotype, K not seen; isotype, W, photo (Rockefeller neg. #31142) MO).

This species bears the diagnostic corolla characters of *Palicourea* (*Albert de Escobar 952,* MO, TEX) and is here transferred to that genus. Standley did not describe the internal corolla pubescence of either *Cephaëlis remyana* or *C. jacobinoides,* nor did he note any features that distinguish them. None are evident in the materials available, and these names are here considered synonymous.

Palicourea tunjaënsis C. M. Taylor, nom. nov. Replaced name: *Psychotria boyacana* Standley, Field Mus. Nat. Hist., Bot. Ser. 11: 234. 1936, not *Palicourea boyacana* Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 194. 1940. TYPE: Colombia. Boyacá: "La Chapón, alt. 1050 meters, edge of forest, July 14 1932," *A. E. Lawrance 317* (holotype, F not seen; isotypes, MO 1039030, MO 1572718).

Standley described this species based on a single collection with immature inflorescences. With more material available, this species clearly bears the diagnostic corolla characters of *Palicourea* (*Gilardo-Cañas et al. 1070,* HUA, MO), and is here transferred to that genus. It clearly possesses the corolla characteristics that distinguish *Palicourea.* Accordingly, this new name is provided, which refers to the capital city of the department for which Standley originally named this species.

Psychotria diguana (Standley ex Steyermark) C. M. Taylor, comb. nov. Basionym: *Cephaëlis diguana* Standley ex Steyermark, Acta Biol. Venez. 4: 14. 1964. TYPE: Colombia. "Valle: Cordillera Occidental, vertiente occidental, hoya del río Digua, quebrada del río San Juan, arriba de Queremal, Las Colonias, alt. 1,950–2,050 m, 20 Mar. 1947," *José Cuatrecasas 23906* (holotype, US 2825317; isotypes, F not seen, VEN not seen).

Cephaëlis grandiflora Standley ex Steyermark, Acta Biol. Venez. 4: 17, fig. 8. 1964, not *Psychotria grandiflora* H. Mann, Proc. Amer. Acad. 7: 170. 1867. TYPE: Colombia. "Valle: Costa del Pacífico, río Cajambre, Barco, alt. 5–80 m, 21–30 Apr. 1944," *José Cuatrecasas 17229* (holotype, F 1168909).

Within *Psychotria*, this species belongs to subgenus *Heteropsychotria* Steyermark, within which it is distinguished by its flowering heads three in each terminal inflorescence and relatively long white corollas. *Psychotria diguana* is similar to *P. cuatrecasasii* (Standley ex Steyermark) C. M. Taylor, with solitary flowering heads and shorter corollas, and to *Faramea papirifolia*, with flowering heads solitary in the leaf axils and fruits with solitary thin-walled seeds. It is also similar to *Cephaëlis longiflora* Standley [Publ. Field Columbian Mus., Bot. Ser. 7: 79. 1930, not *Psychotria longiflora* (Aublet) Willdenow, Sp. pl. 1: 971. 1797, not *Psychotria longiflora* Poiret in Lamarck, Encycl. 5: 704. 1804], which was originally distinguished by its inflorescences with "numerous" capitula, i.e., more than three. (Standley's original description of *C. longiflora* appears to contain a typographical error in the corolla length, which is given as "4 mm" but should be "4 cm.") More material is needed to evaluate the distinctions between *P. diguana* and *C. longiflora*, and transfer of this *Cephaëlis* species to *Psychotria* (or another genus) is postponed until more material becomes available.

Steyermark separated *Cephaëlis grandiflora* by its relatively smaller leaves, flower heads, calyx limbs, and corollas and fewer secondary leaf veins. However, with more material now available, these names can be seen to describe extremes of continuous variation in these characters.

Psychotria dives (Standley) C. M. Taylor, comb. nov. Basionym: *Palicourea dives* Standley, Publ. Field Columbian Mus., Bot. Ser. 7: 130. 1930. TYPE: Colombia. "Santa Rosa, October 24, 1876," *Ed. André 4283* (holotype, K not seen; isotype, F 591329).

This species is transferred to *Psychotria* based on its straight corolla tube with the internal pubescence found in the uppermost portion, rather than the basally swollen corolla tube with a discrete internal ring of pubescence near the middle that characterizes *Palicourea*. *Psychotria dives* was apparently assigned to *Palicourea* by Standley based on its well-developed corolla tubes and brightly colored inflorescences. It is similar in this respect to *Psychotria humboldtiana* (Chamisso) Müller Argoviensis of Venezuela and Brazil, and to *Psychotria campyloneuroides* (Standley) C. M. Taylor, which is sympatric but distinguished by its inflorescence bracts reniform to orbicular versus narrowly elliptic in *Psychotria dives*, and its strongly congested inflorescences versus open cymose in *Psychotria dives*.

In his original description Standley gave the type locality for this species as "Santa Rosa" and the collection date as "October 24, 1876." However, Smith (1965) documented André's departure from South America for France in August 1876, so this seems unlikely to be the actual date of collection. The date and more specific locality taken from Smith's compilation are: Colombia. Pasto, Pasto to Túquerres, Santa Rosa hacienda, 15–16 May 1876. One other Santa Rosa appears in André's itinerary, in Tungurahua in central Ecuador, where André collected in July 1876. The Santa Rosa locality and date cited here are much closer to the date and locality where André made the paratype collection of this same species, "Cugambe" (Smith, 1965: Quebrada de Cuyambé, Túquerres, Colombia), "May 23, 1876," *André 3499*, and several recent collections of *Psychotria dives* have been made in this same region, while the species is not yet known from Ecuador.

Rudgea vallis (Standley ex Steyermark) C. M. Taylor, comb. nov. Basionym: *Cephaëlis vallis* Standley ex Steyermark, Acta Biol. Venez. 4: 22, fig. 10. 1964. TYPE: Colombia. "Valle: Cordillera Occidental, vertiente occidental, hoya del río Sanquininí, lado izquierdo, La Laguna, alt. 1,240–1,400 m, 10–20 Dec. 1943," *José Cuatrecasas 15528* (holotype, US not seen, photo MO 3157929).

This species was placed in *Cephaëlis* by Steyermark based on its capitate inflorescence enclosed by a pair of enlarged foliaceous bracts. On the type collection the stipules at the stem apex are not in good condition, but on additional material now available (*Gentry 65432*, MO; *Ramos 2371*, CUVC, MO) the distalmost stipules bear several well-developed caducous glandular appendages 1–2 mm long. The presence of such appendages is diagnostic of *Rudgea*, and accordingly this species is transferred to that genus.

Acknowledgments. I thank the curators of COL, CUVC, F, HUA, TEX, TULV, and US for making specimens available for study, and A. Cogollo, G. Davidse, R. E. Gereau, and M. Crosby for helpful comments.

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New Species and a New Combination in Rubiaceae from Central and South America

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri, 63166-0299, U.S.A.

ABSTRACT. The new combination *Alibertia utleyorum* (Dwyer) C. M. Taylor is made, and the new species *Alibertia premontana, Pentagonia involucrata, Remijia uniflora,* and *Rudgea sanblasensis* are described and illustrated.

During the review of specimens of neotropical Rubiaceae for preparation of floristic treatments for Mesoamerica and the Venezuelan Guayana and identification of materials for institutional inventory projects, the need for the following new combination became evident, and several undescribed species were discovered.

NEW COMBINATION

Alibertia utleyorum (Dwyer) C. M. Taylor, comb. nov. Basionym: *Duroia utleyorum* Dwyer in Burger & Taylor, Fieldiana, Bot., n.s. 33: 127. 1993. TYPE: Costa Rica. Puntarenas: adjacent to airfield, Rincón de Osa, 6–7 Feb. 1974, *R. Liesner 1774* (holotype, CR; isotype, MO 3030387).

This distinctive species was described in *Duroia* (Gardenieae) based primarily on its dense pilosulous pubescence on all parts, including the stipules, and its solitary sessile pistillate flowers and fruits. With more material now available that includes vegetative stem apices, it is evident that this species clearly lacks the calyptrate caducous stipules that distinguish *Duroia,* and thus cannot be retained in this genus. Neotropical generic limits in Gardenieae are not completely resolved, and the correct placement of this species is not clear. Based on the distinctions outlined by Steyermark (1974), this species could be placed in either *Alibertia* or *Borojoa.* The corollas are six-parted as in *Borojoa,* but the inflorescences lack the other feature that distinguishes *Borojoa*: the characteristic two to three pairs of subtending, leafless, involucral stipules. *Duroia utleyorum* agrees with *Alibertia* in all characters except the six-parted rather than three- to five-parted corollas. *Duroia utleyorum* is here transferred to *Alibertia* because of its greater agreement with the characteristics of this genus.

This species is now known from wet forest at 20–200 m elevation in eastern Costa Rica, as well as from the Osa Peninsula.

Additional specimens examined. COSTA RICA. **Heredia:** near Puerto Viejo along road near Río Sucio, *Croat 35728* (MO); along bank of Río Toro, about 10 km upstream from the confluence with the Río Sarapiquí, *Hartshorn 1486* (MO). **Limón:** hills between headwaters of Quebrada Mata de Limón and upper branches of Quebrada Tigre, Finca Anai, 9°34′N, 82°40′W, *Grayum et al. 4459* (CR, MO); cantón de Talamanca, Amubri, camino al noreste del pueblo, entre Katsi y Sheuab, 9°31′30″N, 82°55′30″W, *Hammel et al. 17526* (CR, MO); cantón de Talamanca, Amubri, margen derecho del Río Larí, lomas aledañas a Cachabri, 9°29′30″N, 82°59′40″W, *G. Herrera 3059* (CR, MO).

NEW SPECIES

Alibertia premontana C. M. Taylor, sp. nov. TYPE: Costa Rica. Alajuela: Reserva Biológica Monteverde, Valle del Río Peñas Blancas, fila de Toro, sendero Pipilacha y Campo Tres, 10°N, 84°W, 900–1100 m, 21 Jan. 1991 (fr), *W. Haber & E. Cruz 10630* (holotype, MO 4234216; isotype, CR not seen). Figure 1.

A congeneris mesoamericanis stipulis 4–7 mm longis, limbo calycino ca. 3 mm longo, corolla ex tubo 14–17 mm longo ac lobulis quatuor 11–12 mm longis constante distincta; sylvam premontanum humidum habitat.

Small trees, flowering at 2 m tall, to 18 m tall; stems glabrous. *Leaf* blades elliptic, 6–12 cm long, 2.5–5.5 cm wide, at apex acute to somewhat acuminate with rather slender tips 5–15 mm long, at base acute, chartaceous to subcoriaceous, glabrous except for tuft domatia in the leaf axils, adaxially matte or dull to occasionally rather shiny; secondary veins 6–7 pairs, ascending, occasionally looping to interconnect near apex; petioles 5–20 mm long, glabrous; stipules interpetiolar and also shortly fused intrapetiolarly, deciduous with or before the leaves, typically breaking off to leave a line or short truncate base, glabrous, the interpetiolar portion triangular to deltoid, 4–7 mm long, acute, ciliolate; apical buds typically resinous. *Staminate inflorescences* terminal, capitate, sessile, ebracteate

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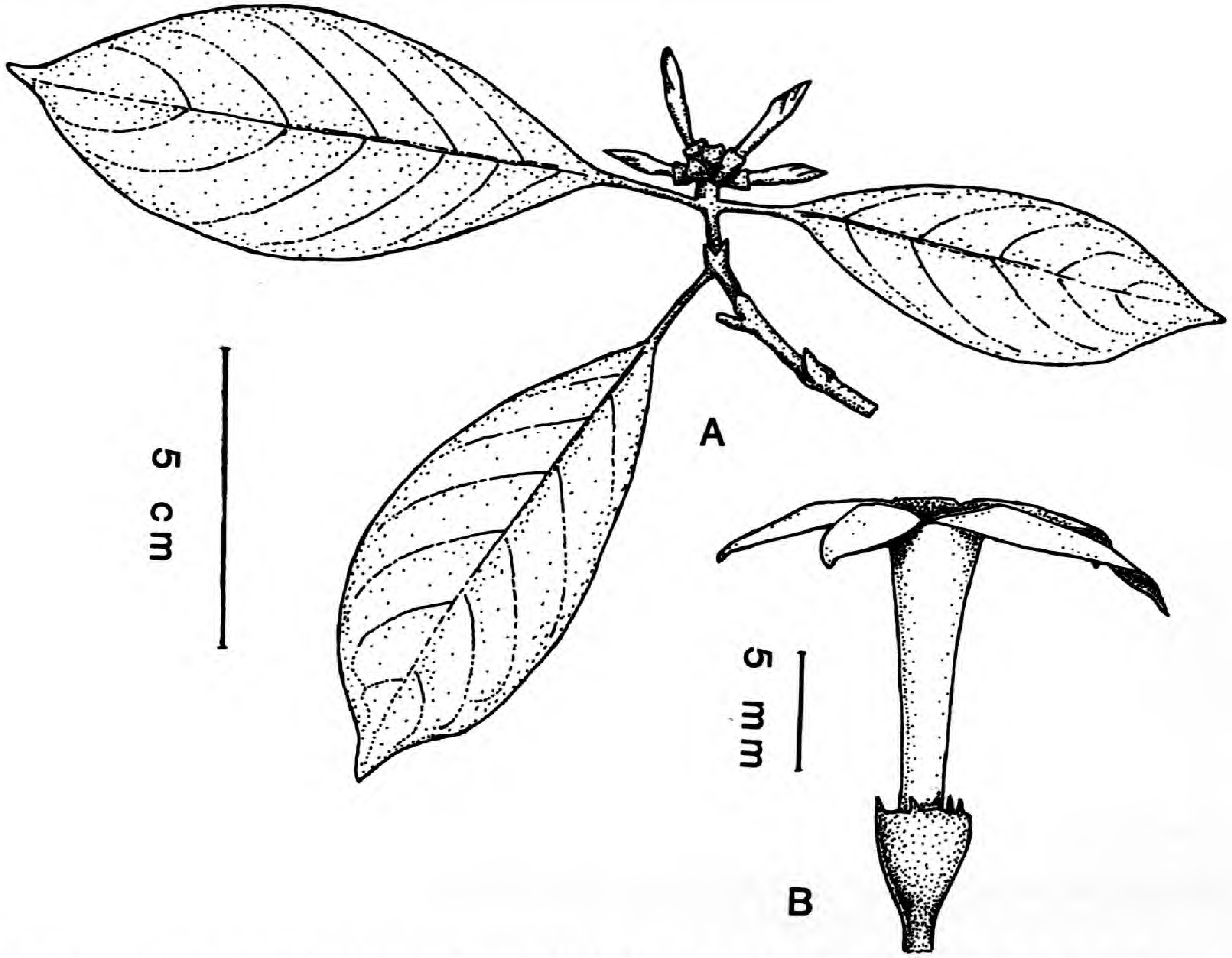

Figure 1. *Alibertia premontana* C. M. Taylor. —A. Habit; based on *Folsom & Dressler 5606* (MO). —B. Staminate flower; based on *Folsom et al. 4743* (MO).

(subtended by the vegetative stipules at the subtending node); *flowers* 3–9, sometimes with stipes to 1 mm long; calyx green, glabrous to puberulous, limb ca. 3 mm long, subtruncate to 5-denticulate or with 5 separated linear lobes 1–1.2 mm long; corolla salverform, white to cream, externally densely tomentose throughout, internally glabrous in lower half of tube, densely velutinous in upper half, tube slightly funnelform, 14–17 mm long, ca. 1.2 mm diam. at base, ca. 3 mm diam. at top; lobes 4, lanceolate, 11–12 mm long, ca. 4 mm wide, acute to acuminate; stamens 4, included, attached in top part of tube, anthers sessile, 8.5–9 mm long; pistillode ca. 11 mm long. *Pistillate inflorescences* and *flowers* not seen. *Fruits* solitary, terminal, sessile, globose, on dried specimens 2.5–4 cm diam., fleshy throughout with pericarp smooth, often rather shiny, leathery to perhaps ligneous, ca. 1–2 mm thick; seeds angled, to at least 8 mm long, with testa brown, finely striate. Collected in flower August, September, November, in fruit December–February, April, May, and November.

Distribution and habitat. In wet premontane forest at 800–1700 m, Costa Rica (Cordillera Tilarán) to western Panama (Chiriquí).

This new species is distinguished among Central American species of *Alibertia* by its relatively short stipules, leaves that are usually dull or matte on the upper surface, and relatively long calyx limb and corolla lobes, in contrast to stipules 7–20 mm long and leaves that are generally shiny and smooth on the upper surface in *A. edulis* (L. C. Richard) A. Richard ex DC., and a calyx limb 1 mm long or shorter and corolla lobes 1.5–3 mm long in *A. garapatica* Karsten. These last two species are generally found in moist to usually dry forest from sea level to 500 m, or rarely to 1000 m in the case of *A. edulis*, which is typically found along watercourses.

This new species is placed in *Alibertia* based on its dioecious, sessile, terminal inflorescences with the corollas four-parted, solitary pistillate flowers and fruits, and lack of leafless involucral stipules subtending the inflorescence (Steyermark, 1974).

Paratypes. COSTA RICA. **Alajuela:** Bosque Eterno de Los Niños, Río Peñas Blancas, Quebrada Gata, riachuelo de Fernando Villalobos, 10°23′N, 84°42′W, *Bello et al. 2172* (CR, MO); Bosque Eterno de Los Niños, Río Peñas Blancas, Quebrada Gata, Los Pérez, 10°23′N, 84°42′W, *Bello et al. 2191* (CR, MO); Bosque Eterno de Los Niños, Reserva de Arenal, Río Peñas Blancas, Quebrada Agua Gata, Finca Villalobos, *Bello et al. 2216* (CR, MO); Reserva Forestal de San Ramón, 10°12′54″N, 84°36′28″W, *G. Herrera & Mora 195* (CR, MO). PANAMA. **Bocas del Toro/Chiriquí Border:** Cerro Colorado, road to Bocas del Toro, end of mountain access road, just above face of mine, *Folsom et al. 4743* (MO); vicinity of Cerro Colorado, along mining road on [continental] divide, 8°35′N, 81°50′W, *McPherson 13644* (MO). **Chiriquí:** Cerro Colorado, along mining road 24 km above bridge over Río San Felix (N of village of San Felix), *Croat 48477* (MO); Cerro Colorado, top, Bocas Road, *Folsom & Collins 1740* (MO); Fortuna Dam site, *Folsom et al. 5606* (MO); vicinity of Fortuna Dam, in valley S of lake, *McPherson & Aranda 10120* (MO); valley of El Hornito, vicinity of Fortuna Dam, *McPherson 12525* (MO).

Pentagonia involucrata C. M. Taylor, sp. nov. TYPE: Ecuador. Esmeraldas: cantón de San Lorenzo, parroquia Ricaurte, Centro Pambilar, 01°08′N, 78°36′W, 500 m, 21 Jan. 1993, *C. Aulestia & M. Aulestia 998* (holotype, MO 4671395; isotype, QCNE). Figure 2.

A congeneris foliis 19–31 × 6–9.5 cm nervos secundarios 15–20-jugatos gerentibus, floribus solitariis, pedunculos 3.5–7.5 cm longo, bracteis foliaribus 13–22 × 9–12 mm, limbo calycino 25–35 mm longo in lobulos quinque ellipticos ad lanceolatos desinente distincta.

Small trees flowering at 4 m tall, to 10 m tall, branched, glabrous throughout; stems rather succulent, quadrate, strongly 4-ridged when dry. *Leaf* blades entire, narrowly elliptic, 19–31 cm long, 6–9.5 cm wide, at apex acute to slightly acuminate, at base cuneate, papyraceous to chartaceous, adaxially smooth, abaxially finely striate and perhaps pale; secondary veins 15–20 pairs, extending to near the margins, sometimes looping weakly to interconnect; petioles 2–4.5 cm long; stipules strongly twisted and somewhat resinous or mucilaginous in bud, caducous or sometimes persisting with the leaves, narrowly triangular, 3–4.5 cm long, acute to slightly acuminate. *Flowers* not seen. *Fruits* solitary in leaf axils with flexuous peduncles 3.5–7.5 cm long, pendulous at maturity, subtended by 2–4 cycles of bracts, the proximal pair sometimes reduced and borne near the middle of the peduncle, the distalmost 1–2 pairs accrescent, elliptic to ovate, 13–22 mm long, 9–12 mm wide, obtuse to rounded, longitudinally finely striate or perhaps finely parallel-veined; berry ellipsoid, 3–3.5 cm long, 2.5–3 cm diam., glabrous to moderately hirsutulous, smooth to minutely lenticellate, becoming coffee-brown, with persistent calyx limb glabrous, with

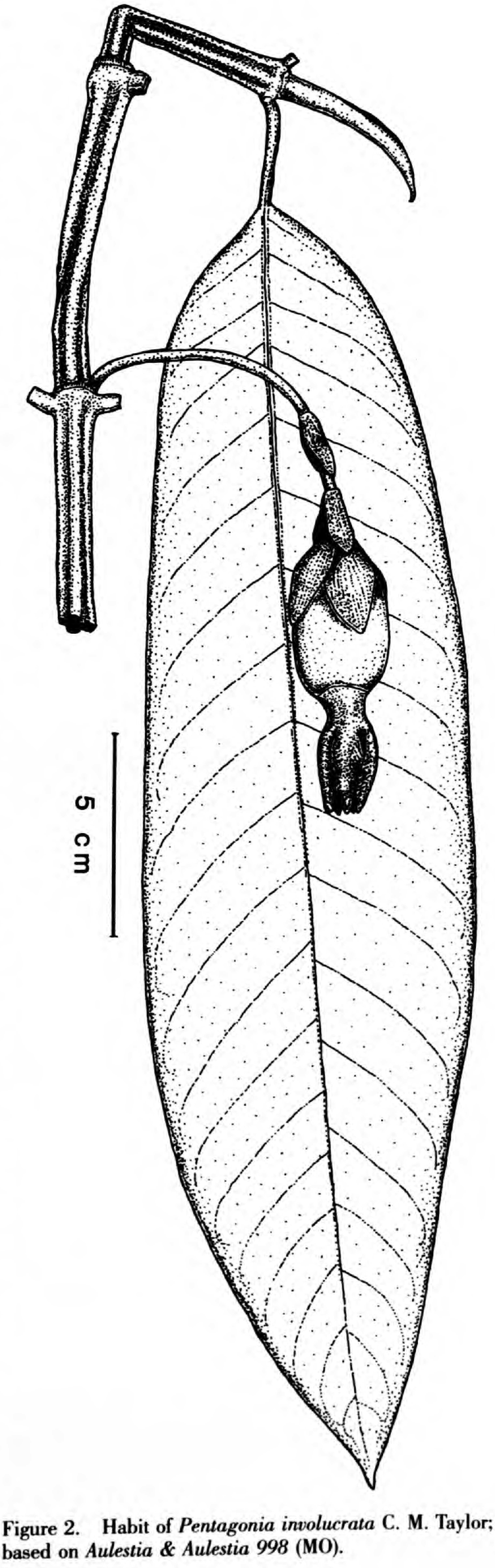

Figure 2. Habit of *Pentagonia involucrata* C. M. Taylor; based on *Aulestia & Aulestia 998* (MO).

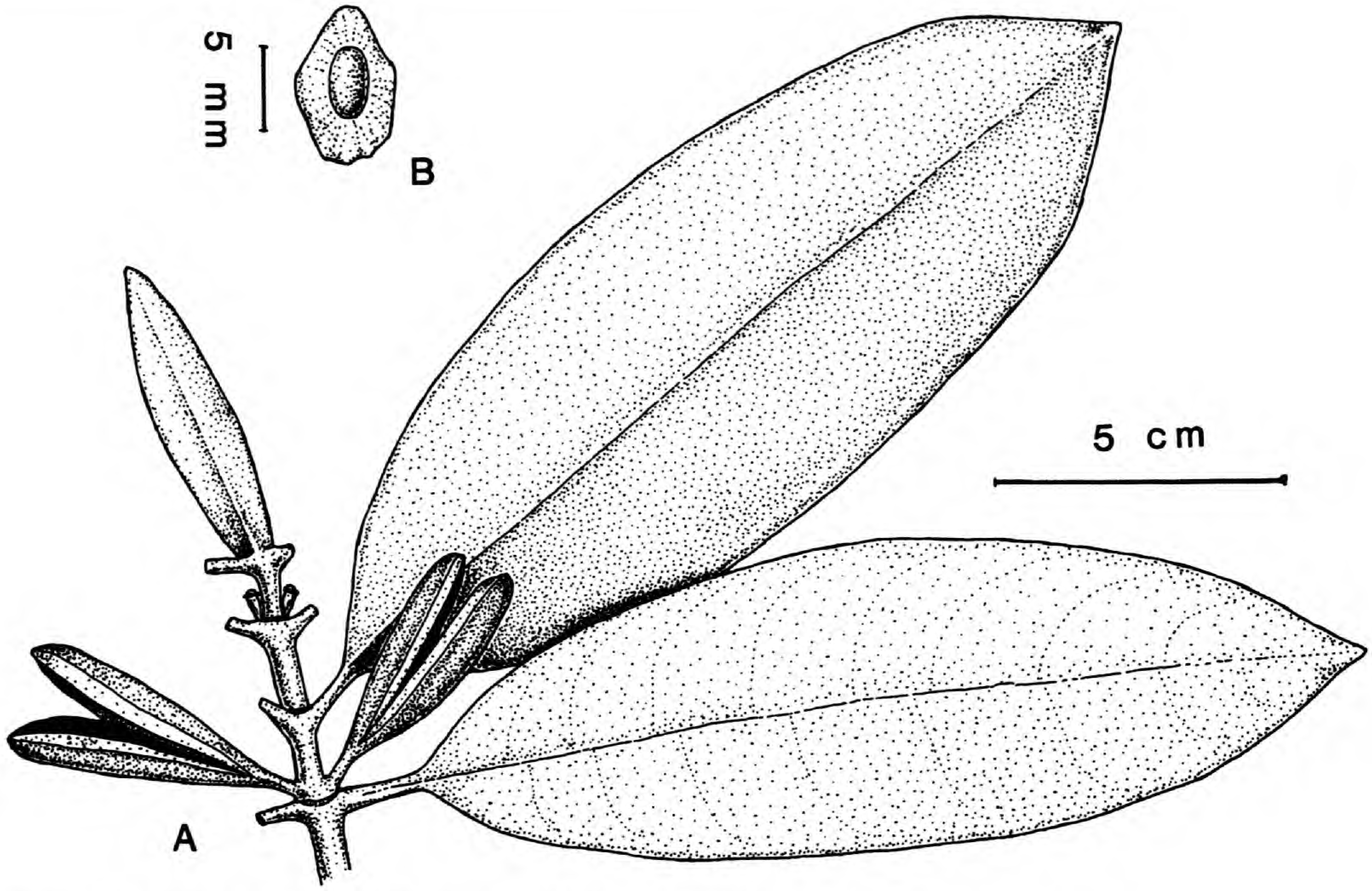

Figure 3. *Remijia uniflora* C. M. Taylor. —A. Habit. —B. Seed. Based on *Gröger 753,* MO.

tube 5–10 mm long, with lobes 5, chartaceous, elliptic to lanceolate, 20–24 mm long, imbricated, obtuse to acute. Collected in fruit January, March, and October.

Distribution and habitat. In wet forest in northeastern Ecuador at 250–500 m.

This new species is placed in *Pentagonia* based on its succulent habit, carnose baccate fruits, and leaves with the abaxial surfaces finely striate. Within this genus, *P. involucrata* is distinguished by its combination of branched habit, relatively small leaves, fruits solitary on well-developed peduncles and subtended by several cycles of bracts, and relatively long, regularly lobed calyx limb. The specific epithet refers to the bracts that subtend the fruits. Although *Pentagonia* is characterized as "usually unbranched pachycaul treelets" with the leaves "very large, usually 50 cm or more long" (Gentry, 1993), several previously described species are also well-branched shrubs or small trees that may reach 18–20 m in height and generally have leaves that are 10–40 cm long (e.g., *P. costaricensis* (Standley) W. Burger & C. M. Taylor and *P. parvifolia* Steyermark). *Pentagonia involucrata* is similar to *P. parvifolia* Steyermark, which can be distinguished by its leaves with 5–6 pairs of secondary veins, ebracteate flowers and fruits that may be solitary but are more often 2–3 per axil, peduncles 5–10 mm long, and a calyx limb 8–10 mm long that is lobed to the base.

Paratypes. ECUADOR. **Esmeraldas:** cantón Elroy Alfaro, parroquia Luis Vargas Torres, Reserva Ecológica Cotacachi-Cayapas, río Santiago, estero Pote, 00°49′N, 78°45′W, *Tirado et al. 578* (MO, QCNE), *594* (MO, QCNE); cantón San Lorenzo, Reserva Indígena Awá, cañon del río Mira, comunidad "La Unión," 01°02′N, 78°26′W, *Rubio et al. 1148* (MO, QCNE); cantón de San Lorenzo, parroquia Ricaurte, centro Pambilar, 01°08′N, 78°36′W, *C. Aulestia & M. Aulestia 903* (MO, QCNE).

Remijia uniflora C. M. Taylor, sp. nov. TYPE: Venezuela. Amazonas: al margen meridional de la Sierra Cuao-Sipapo, 04°59′N, 67°18′W, 650 m, 16 Feb. 1993, *A. Gröger 753* (holotype, MO 4619867; isotype, VEN not seen). Figure 3.

A congeneris floribus fructibusque subsessilibus solitariis, foliis glabris coriaceis nervos secundarios vix manifestos gerentibus, stipulis ca. 53 mm longis, capsula glabra 4–4.5 cm longa distincta.

Shrubs 2–3 m tall; stems densely hirsutulous to pilosulous, becoming glabrescent with age. *Leaves* paired; blades elliptic, 13.5–17.5 cm long, 4.7–5.5 cm wide, at apex acute to slightly acuminate, at base cuneate, glabrous, coriaceous; secondary veins ca. 15 pairs, hardly evident, the minor venation equally pronounced and finely reticulated;

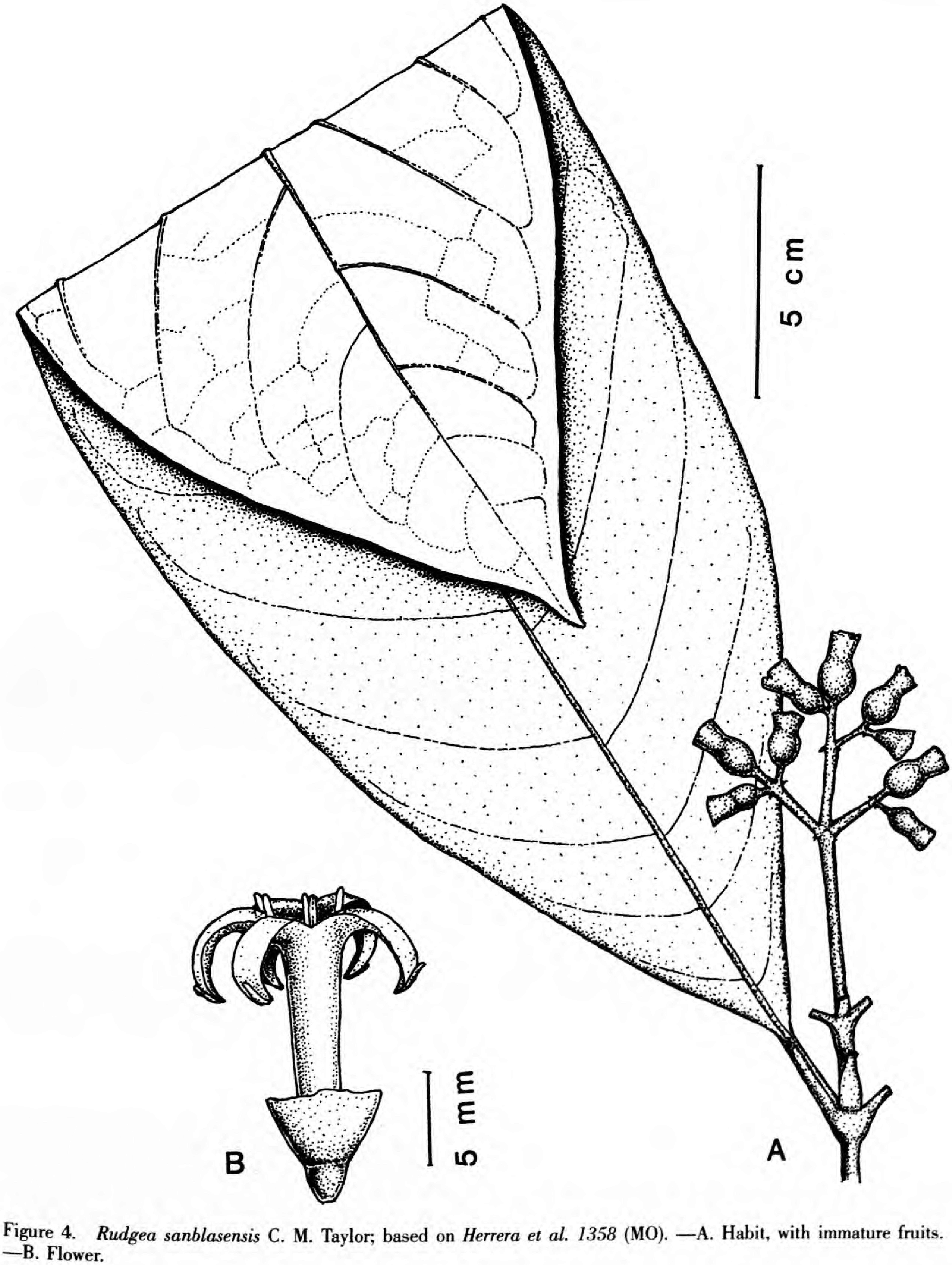

Figure 4. *Rudgea sanblasensis* C. M. Taylor; based on *Herrera et al. 1358* (MO). —A. Habit, with immature fruits. —B. Flower.

petioles 10–13 mm long, glabrous; stipules held flat against each other in bud, caducous, subcoriaceous, ligulate, ca. 53 mm long, ca. 12 mm wide, at apex acute, sparsely to moderately pilosulous, somewhat costate. *Flowers* not seen. *Fruits* solitary in axils, subsessile; capsules ellipsoid-oblong, 4–4.5 cm long, ca. 1 cm diam., with a stipe 5–8 mm long, chartaceous to rather ligneous, glabrous, smooth, septicidally and basipetally dehiscent, entire at apex; *seeds* erect, imbricated, flattened, numerous, elliptic, 5–6 mm long, 2.5–3 mm wide, flattened, with a membranaceous brown circumferential wing rather irregularly 1–4 mm wide, entire.

Distribution and habitat. Known only from the type collection.

This species is placed in *Remijia* based on its axillary capsular fruits with numerous winged flattened seeds that are erect and imbricated. Within *Remijia* this species is distinguished by its solitary subsessile flowers and fruits, and its coriaceous leaves with the secondary veins hardly discernible among the finely reticulated minor venation. Solitary subsessile flowers are otherwise only found in *R. reducta* Steyermark, which is easily distinguished by its dense hirsute pubescence on all parts, leaves with well-marked secondary veins, stipules 10–17 mm long, and obovate to broadly oblong capsules 13–32 mm long.

Rudgea sanblasensis C. M. Taylor, sp. nov. TYPE: Panama. San Blas: río Playón Chico, Dukandi, vecinidad de la Isla Playón Chico, 09°15'N, 78°15'W, 30 m, 6 Sep. 1993, *H. Herrera et al. 1358* (holotype, MO 4671394; isotype, PMA). Figure 4.

A *Rudgea raveniana, R. skutchii,* et *R. trifurcata* stipulis 11–15 mm longis, limbo calycino 4–7 mm longo, tubo corollino ca. 12 mm longo, lobulis corollinis 12–14 mm longis appendicibus apicalibus ca. 2 mm longis munitis distincta.

Shrubs ca. 5 m tall; stems glabrous. *Leaves* paired; blades elliptic, 21–34 cm long, 8–13 cm wide, at apex acute to slightly acuminate, at base acute to cuneate, papyraceous to chartaceous, glabrous throughout, perhaps pale below; secondary veins 8–13 pairs, usually looping to interconnect in the distal part of the blade, without domatia; petioles 13–35 mm long, glabrous; *stipules* interpetiolar and also shortly fused intrapetiolarly, deciduous before the leaves, glabrous, the interpetiolar portion triangular, 11–15 mm long, obtuse to rounded or shortly truncate, with 5–15 closely set acicular glandular fimbriae 1–1.5 mm long. *Inflorescences* terminal, paniculiform-cymose, glabrous; peduncles 3–5 cm long, strongly flattened, subtended by a reduced stipule 1–3 mm long with persistent fimbriae; cymes pyramidal, 1.5–2.5 cm long and wide, branched 1–2 times, axis and branches strongly flattened, bracts minute; *flowers* subsessile in cymules of 2–3; calyx glabrous, hypanthium turbinate, 2–4 mm long, limb 4–7 mm long, truncate; corolla salverform, white, carnose, glabrous, tube ca. 12 mm long, lobes narrowly triangular, 12–14 mm long, acute, triangular in cross section, with apical appendages ca. 2 mm long; anthers linear, partially exserted, ca. 7 mm long; style ca. 5 mm long, stigma branches 2, linear, included, ca. 1 mm long. Immature *fruits* ellipsoid, to at least 17 mm long and 13 mm diam., glabrous, smooth, with calyx limb persistent, with pedicels elongating to 2–4 mm long. Collected in flower in September, in immature fruit in October.

Distribution and habitat. In moist or wet forest at 30–450 m in northeastern Panama.

This species is placed in *Rudgea* based on its stipules with well-developed glandular fimbriae, valvate corolla lobes, and drupaceous fruits with two pyrenes. Within *Rudgea* this species is distinguished by its relatively large leaves that are apparently pale abaxially, relatively long stipules, and well-developed calyx limb. It is similar to and probably closely related to *R. skutchii* Standley and *R. trifurcata* Gómez-Laurito, both of which can be distinguished by their leaves 5–18 cm long and stipules 3–10 mm long, and also to *R. raveniana* W. Burger, which can be distinguished by its stipules 2–2.5 mm long, calyx limb 3–4 mm long, and corollas with tubes ca. 4 mm long and appendaged lobes ca. 6 mm long.

Paratypes. PANAMA. **San Blas:** río Playón Chico, vecinidad de Neba Dummat, caminando por el filo del sureste, 09°14.5'N, 78°15'W, *H. Herrera et al. 1402* (MO, PMA).

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Some Nomenclatural Adjustments in the Commelinaceae, Hypoxidaceae, Lauraceae, Rubiaceae, Sapotaceae, and Zingiberaceae of the Malay Peninsula

I. M. Turner
Department of Botany, National University of Singapore, Singapore 119260

ABSTRACT. The following new combinations are provided for the flora of the Malay Peninsula: *Amischotolype griffithii* (C. B. Clarke) I. M. Turner, *Amischotolype irritans* (Ridley) I. M. Turner, *Amischotolype monosperma* (C. B. Clarke) I. M. Turner, *Molineria latifolia* (Dryander) Kurz var. *megacarpa* (Ridley) I. M. Turner, *Litsea ochracea* (Blume) Boerlage var. *oblanceolata* (Gamble) I. M. Turner, *Litsea umbellata* (Loureiro) Merrill var. *fuscotomentosa* (Meisner) I. M. Turner, *Coptophyllum sylvestre* (Ridley) I. M. Turner, *Spermacoce pilulifera* (Ridley) I. M. Turner, *Spermacoce parviceps* (Ridley) I. M. Turner, *Pouteria glabra* (Ridley) I. M. Turner, *Alpinia malaccensis* (Burman) Roscoe var. *nobilis* (Ridley) I. M. Turner, *Alpinia vitellina* (Lindley) Ridley var. *cannaefolia* (Ridley) I. M. Turner, *Etlingera maingayi* (Baker) R. M. Smith var. *longibracteata* (Holttum) I. M. Turner, *Etlingera metriochilos* (Griffith) R. M. Smith var. *rubrostriata* (Holttum) I. M. Turner, *Etlingera metriochilos* var. *major* (Holttum) I. M. Turner, *Etlingera metriochilos* var. *petiolata* (Holttum) I. M. Turner, and *Etlingera metriochilos* var. *grandiflora* (Holttum) I. M. Turner.

In order to bring the nomenclature for the flora of the Malay Peninsula into line with modern systematic treatments for a forthcoming checklist, it is necessary to introduce a number of new combinations at specific and varietal levels in the Commelinaceae, Hypoxidaceae, Lauraceae, Rubiaceae, Sapotaceae, and Zingiberaceae.

COMMELINACEAE

A small group of species of wet tropical and subtropical forest understory herbs of Southeast Asian Commelinaceae has long been referred to the genus *Forrestia* A. Richard (1834). Unfortunately, this name is a later homonym of *Forrestia* Rafinesque (1806), a synonym of *Ceanothus* L. (Rhamnaceae). The next available name for the genus is *Amischotolype* Hasskarl (1863). The genus is in need of revision, but in the meantime transfers to *Amischotolype* are made for the three remaining untransferred species occurring in the Malay Peninsula.

Amischotolype griffithii (C. B. Clarke) I. M. Turner, comb. nov. Basionym: *Forrestia griffithii* C. B. Clarke in A. DC., Monogr. Phan. 3: 236. 1881. SYNTYPES: Peninsular Malaysia. "Malacca," *Maingay 1712* (lectotype, selected here, K); "Ager Punnus" (presumably a misspelling of an orthographic variant of Air Panas, i.e., hotspring), *Griffith 5485* (K).

Amischotolype irritans (Ridley) I. M. Turner, comb. nov. Basionym: *Forrestia irritans* Ridley, J. Straits Branch Roy. Asiat. Soc. 41: 38. 1903. SYNTYPES: Peninsular Malaysia. "Selangor, on the Tras Route at the 15th mile," *H. N. Ridley s.n.* (lectotype, selected here, SING); "Perak, Bujong Malacca," *H. N. Ridley 9784* (SING); "Sungei Ujong, Bukit Kupayiang," *N. Cantley s.n.* (SING).

Amischotolype monosperma (C. B. Clarke) I. M. Turner, comb. nov. Basionym: *Forrestia monosperma* C. B. Clarke, Bull. Herb. Boissier 6: 359. 1898. TYPE: "Aus Perak in den botan. Garten zu Pinang und von hier in die Gärten zu Singapur, Buitenzorg u. s. w. eingeführt."

In the description of this species Clarke said that it was originally collected from Perak and grown in the Botanic Gardens at Penang and later Singapore, Bogor, and elsewhere, but he did not mention any herbarium material. There is a single specimen in a type cover at Kew (*Ridley 4599*) annotated "*Forrestia monosperma* sp. nova C. B. Clarke m.s.," but it was collected at Kuala Lumpur, making the sheet a poor candidate for typification. The herbaria at Geneva, Hamburg, and Leiden do not contain any type material of this species (A. Charpin (G), pers. comm.; H.-H. Poppendieck (HBG), pers. comm.; M. Roos (L), pers. comm.).

HYPOXIDACEAE

The genus *Molineria* Colla is frequently included within *Curculigo* Gaertner. But, as Henderson (1987) has written "Though there are similarities between the two, there are differences in such fundamental attributes as stem system, flowers, fruit and seeds which warrant keeping them distinct." *Curculigo megacarpa* Ridley is the only Malayan species without a combination in *Molineria*. This deficiency is dealt with below.

Molineria latifolia (Dryander) Herbert ex Kurz var. **megacarpa** (Ridley) I. M. Turner, comb. nov. Basionym: *Curculigo megacarpa* Ridley, J. Straits Branch Roy. Asiat. Soc. 41: 33. 1903. *Curculigo latifolia* Dryander var. *megacarpa* (Ridley) Geerinck, Fl. Males. ser. I 11 (2): 369. 1993. TYPE: Peninsular Malaysia. "Perak, in forests on the Thaiping Hills," *H. N. Ridley 11407* (holotype, SING).

LAURACEAE

It is necessary to correct two minor nomenclatural errors introduced in the account of the Lauraceae of Malaya made by Kochummen (1989). He attempted to reduce *Litsea oblanceolata* Gamble to a variety of *Litsea ochracea* (Blume) Boerlage. However, as no direct reference to the place of publication of the basionym was made, the transfer was invalid. It is validated below.

Litsea ochracea (Blume) Boerlage var. **oblanceolata** (Gamble) Kochummen ex I. M. Turner, comb. nov. Basionym: *Litsea oblanceolata* Gamble, Bull. Misc. Inform. 1910: 362. 1910. SYNTYPES: Peninsular Malaysia. "Perak: moist places near Larut," *King's collector (Kunstler) 2020* (lectotype, selected here, K); *King's collector 1952* (K).

Kochummen (1989) erroneously assigned the authorship of *Litsea umbellata* var. *fuscotomentosa* to Meisner, referring to the publication where Meisner described *Tetranthera amara* var. *fuscotomentosa*, without citing the latter name. The combination has never formally been made. The necessary transfer of Meisner's variety to *Litsea umbellata* is completed below.

Litsea umbellata (Loureiro) Merrill var. **fuscotomentosa** (Meisner) I. M. Turner, comb. nov. Basionym: *Tetranthera amara* (Blume) Nees var. *fuscotomentosa* Meisner in DC., Prod. 15: 190. 1864. *Litsea amara* Blume var. *fuscotomentosa* (Meisner) Hooker f., Fl. Brit. India 5: 163. 1877. SYNTYPES: Peninsular Malaysia. Penang, *Phillips s.n.* (lectotype, selected here, K); *Zolling n. 467* (not seen).

RUBIACEAE

In his account of one of the early plant collecting trips to the east coast of the Malay Peninsula, Ridley (1893) described a species in the new rubiaceous genus *Pomazota*. Bremekamp (1947) recognized that this species belonged in the same genus as species already described in *Coptophyllum* Korthals. However, as Korthals's name was predated by *Coptophyllum* G. Gardner, Bremekamp accepted *Pomazota* as the correct name for the larger genus. Subsequently, however, *Coptophyllum* Korthals has been accepted as a conserved name, and the type species of *Pomazota* is duly transferred to it below.

When describing *Pomazota sylvestris*, Ridley wrote that the plant was "plentiful in open pathways in Pulau Tawar woods" but did not refer to any herbarium specimens. The excellent plate accompanying the description could be used as the type, but there is one collection of Ridley's in SING from Pulau Tawar predating the publication. This has been annotated by C. X. Furtado as "the type of the species and the genus." This specimen is now formally designated the lectotype of *Pomazota sylvestris* Ridley and hence also that of the genus *Pomazota* Ridley.

Coptophyllum sylvestre (Ridley) I. M. Turner, comb. nov. Basionym: *Pomazota sylvestris* Ridley, Trans. Linn. Soc. London, Bot. 3: 308. 1893. TYPE: Peninsular Malaysia. Pahang, "plentiful in open pathways in Pulau Tawar woods," *H. N. Ridley 2230* (lectotype, selected here, SING).

The majority of recent treatments, e.g., Verdcourt (1976) and Fosberg et al. (1993), have reduced *Borreria* G. F. W. Meyer to a section of *Spermacoce* L. Two apparently endemic species, described from Malaya by Ridley, require combinations in *Spermacoce*.

Spermacoce pilulifera (Ridley) I. M. Turner, comb. nov. Basionym: *Borreria pilulifera* Ridley, J. Straits Branch Roy. Asiat. Soc. 86: 299. 1922. TYPE: Peninsular Malaysia. "Roadsides, Selangor, Klang Gates," 1 Jan. 1921, *H. N. Ridley* (holotype, K).

Spermacoce parviceps (Ridley) I. M. Turner, comb. nov. Basionym: *Borreria parviceps* Ridley, J. Straits Branch Roy. Asiat. Soc. 86: 299. 1922. TYPE: Peninsular Malaysia. "Roadsides, Negri Sembilan, Bukit Tangga Pass," 23 Dec. 1920, *H. N. Ridley* (holotype, SING; isotype, K).

SAPOTACEAE

In order to follow Pennington's (1991) generic classification of the Sapotaceae, it is necessary to transfer the following, narrowly endemic, species from the mountains of Malaya to *Pouteria.*

Pouteria glabra (Ridley) I. M. Turner, comb. nov. Basionym: *Sideroxylon glabrum* Ridley, J. Straits Branch Roy. Asiat. Soc. 61: 28. 1912. *Planchonella glabra* (Ridley) Lam, Bull. Jard. Bot. Buitenzorg 7: 217. 1925. TYPE: Peninsular Malaysia. "Selangor: Sempang Mines," *H. N. Ridley 15770* (holotype, SING (not located recently); isotype, K).

ZINGIBERACEAE

A recent tendency to recognize larger, more inclusive genera in the Zingiberaceae has meant that several varieties of species recognized in Malaya by Holttum (1950) need to be transferred to the appropriate positions in *Alpinia* and *Etlingera.*

Alpinia malaccensis (Burman) Roscoe var. **nobilis** (Ridley) I. M. Turner, comb. nov. Basionym: *Alpinia nobilis* Ridley, J. Straits Branch Roy. Asiat. Soc. 32: 169. 1899. *Catimbium malaccense* (Burman) Holttum var. *nobilis* (Ridley) Holttum, Gard. Bull. Singapore 13: 155. 1950. TYPE: Singapore. Cultivated in Botanic Gardens, *H. N. Ridley 4617* (lectotype, selected by Smith (1990), K).

Alpinia vitellina (Lindley) Ridley var. **cannaefolia** (Ridley) I. M. Turner, comb. nov. Basionym: *Alpinia cannaefolia* Ridley, J. Straits Branch Roy. Asiat. Soc. 32: 174. 1899. *Cenolophon vitellinum* (Lindley) Horan var. *cannaefolium* (Ridley) Holttum, Gard. Bull. Singapore 13: 138. 1950. TYPE: Peninsular Malaysia. "Selangor, Dusun Tua," May 1896, *H. N. Ridley* (lectotype, selected by Smith (1990), K; isolectotype, SING).

Etlingera maingayi (Baker) R. M. Smith var. **longibracteata** (Holttum) I. M. Turner, comb. nov. Basionym: *Phaeomeria maingayi* (Baker) K. Schumann var. *longibracteata* Holttum, Gard. Bull. Singapore 13: 180. 1950. TYPE: Peninsular Malaysia. "Pahang, Tembeling," *M. R. Henderson SFN 24522* (holotype, SING).

Etlingera metriochilos (Griffith) R. M. Smith var. **rubrostriata** (Holttum) I. M. Turner, comb. nov. Basionym: *Achasma sphaerocephalum* (Baker) Holttum var. *rubrostriatum* Holttum, Gard. Bull. Singapore 13: 190. 1950. TYPE: Peninsular Malaysia. "Selangor, near the Gap," *E. J. H. Corner SFN 30776* (holotype, SING).

Etlingera metriochilos (Griffith) R. M. Smith var. **major** (Holttum) I. M. Turner, comb. nov. Basionym: *Achasma sphaerocephalum* (Baker) Holttum var. *majus* Holttum, Gard. Bull. Singapore 13: 190. 1950. TYPE: Peninsular Malaysia. "Trengganu, Bukit Kajang, Kemaman," *E. J. H. Corner SFN 30205* (holotype, SING).

Etlingera metriochilos (Griffith) R. M. Smith var. **petiolata** (Holttum) I. M. Turner, comb. nov. Basionym: *Achasma sphaerocephalum* (Baker) Holttum var. *petiolatum* Holttum, Gard. Bull. Singapore 13: 191. 1950. SYNTYPES: Peninsular Malaysia. "Johore, Ulu Segun, G. Panti," *E. J. H. Corner SFN 30745* (lectotype, selected here, SING); "Perak, G. Keledang," *H. N. Ridley 9575* (SING).

Etlingera metriochilos (Griffith) R. M. Smith var. **grandiflora** (Holttum) I. M. Turner, comb. nov. Basionym: *Achasma sphaerocephalum* (Baker) Holttum var. *grandiflorum* Holttum, Gard. Bull. Singapore 13: 191. 1950. TYPE: Peninsular Malaysia. "Trengganu, Bukit Kajang, Kemaman," *E. J. H. Corner SFN 30234* (holotype, SING).

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Scaevola hobdyi (Goodeniaceae), an Enigmatic New Species from West Maui, Hawaiian Islands

Warren L. Wagner
Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. *Scaevola hobdyi* is a newly described species from the West Maui Mountains, Hawaiian Islands. It is unusual among the other Hawaiian species of *Scaevola* sect. *Scaevola* in its linear leaves, apparently small flowers, and compact habit. It is not clear if this species represents a separate introduction from the Australian region or is a highly specialized derivative of the primary Hawaiian lineage. This imperfectly known species has been collected only once and is likely extinct.

In 1980 Robert Hobdy, a Hawaii State Forester on Maui, collected a single specimen of a plant with tufted leaves and flower buds, but no flowers or fruit. It represented a plant that he had never seen before and he saw only a single individual along the 'Eke Trail on West Maui, a moderately disturbed wet forest area. He sent it to the Bishop Museum where Harold St. John annotated it as *Lysimachia.* Derral Herbst and I saw it several years later during the writing of the *Manual of the Flowering Plants of Hawai'i* but, because the specimen had no flowers or fruit, we were unable to place it in a family. Tim Flynn of the National Tropical Botanical Garden finally suggested that it represented an unusual member of the Goodeniaceae, a suggestion with which we agreed. I sent the specimen to Roger Carolin at the National Herbarium of New South Wales in Australia. He confirmed it as an undescribed species of *Scaevola.* Hobdy and other local botanists have repeatedly searched for additional plants of this species over the past decade without success. It has now been 15 years since its collection and it appears unlikely to be rediscovered. So, despite the lack of good material, because it is clearly highly distinctive, I am here describing it.

Scaevola hobdyi W. L. Wagner, sp. nov. TYPE: U.S.A. Hawaiian Islands. Maui: West Maui, Lahaina District, West Maui Mountains, along 'Eke Trail, 3250 ft. (990 m), 23 Oct. 1980, *R. Hobdy 930* (holotype, BISH-439628). Figure 1.

Scaevola foliis linearis spiraliter dispositis et caespitosis ad extremitates ramorum; floribus 1–3 axillaribus cymis lobis; calycis irregularibus, 0.5–1.5 mm longis; corolla immaturi 12 mm longi.

Small branched shrub, ca. 20–30 cm tall; stems branched from near the base of the plant, up to ca. 5 mm diam. when dried, the older ones glabrous, pale brown, young growth strigillose, green. Leaves spirally arranged, closely spaced toward the tips of the branches, forming tufts, linear, 4.5–8 cm long, 1.5–2 mm wide, the midrib conspicuously raised on the abaxial side, somewhat folded on the adaxial side, margins involute, strigillose, more densely so toward the base, and progressively sparser toward the apex, glabrate in age, the hairs unbranched, apex acute, sessile; axils with a tuft of pale tan hair. Flowers 1 to 3 in axillary cymes, arranged on elongating lateral branches; peduncle (in bud) 1–4 cm long; bracteoles, much smaller than the leaves, 5–8 mm long; sessile in bracteole axils. Sepals connate into an undulate rim at base, the lobes immature, irregular in length, 0.5–1.5 mm long. Corolla known from a single bud, asymmetrically fusiform, 12 mm long, strigillose externally, at least when very immature, more glabrate as it develops. Staminal filaments about the same length as the developing corolla tube, ca. 6.5 mm long. Anthers (developing) 3.5 mm long. Fruit unknown.

This distinctive species is known only from the holotype. Given the decadent status of the site where it was collected, the species is unfortunately probably extinct.

The axillary inflorescence structure and spiral leaf arrangement suggest that *Scaevola hobdyi* is a member of *Scaevola* sect. *Scaevola* following the classification scheme of Carolin (1990; Carolin et al., 1992). Of the three sections recognized by Carolin, only two have extra-Australian representatives, and only *Scaevola* sect. *Scaevola* extends beyond the Malesian region. All 10 of the Hawaiian endemic species are thus members of *Scaevola* sect. *Scaevola,* although they have diversified from at least three separate colonizations (Patterson, 1990, 1995), or perhaps only two colonizations (D. Ho-

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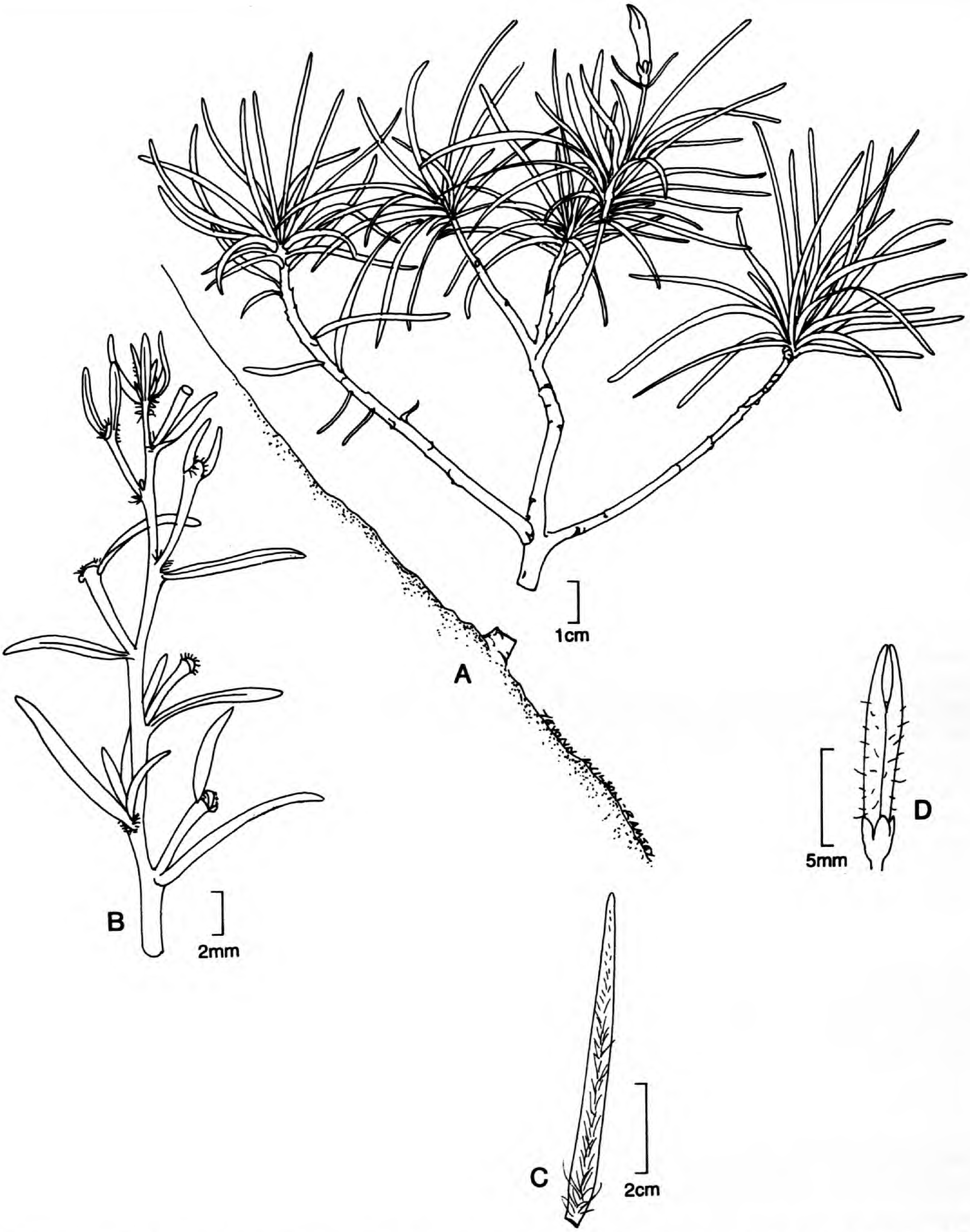

Figure 1. A–D. *Scaevola hobdyi* W. L. Wagner, all from the holotype and a 35-mm slide of the holotype plant provided by R. Hobdy. —A. Habit. —B. Post-flowering inflorescence. —C. Immature leaf, to show strigillose surface. —D. Immature bud, distorted by pressing.

warth & W. L. Wagner, unpublished). *Scaevola hobdyi* appears to have no close relationship to other Hawaiian species, and presumably represents a separate long-distance dispersal event directly from Australia, adding one additional colonization to the numbers given above.

Etymology. I am pleased to honor Robert Hobdy, Forestry Manager, Maui District, Division of Forestry and Wildlife, State of Hawaii, a superb naturalist and among those dedicated to preserving the natural resources of the Hawaiian Islands.

Acknowledgments. I thank Yevonn Wilson-Ramsey for expertly rendering the illustration with funds provided by the Smithsonian Institution Walcott fund. I appreciate the help of Dan Nicolson, who provided the Latin translation and comments on an early draft of the manuscript. I also thank Robynn Shannon for editing the manuscript, the Bishop Museum (BISH) for the loan of the holotype of this species, and Dianella Howarth for sharing the data she gathered from the specimen.

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A New Name in *Geranium* (Geraniaceae) for the *Flora of China*

Carlos Aedo and Félix Muñoz Garmendia
Real Jardín Botánico de Madrid, Plaza de Murillo 2, E-28014 Madrid, Spain (e-mail addresses: aedo@ma-rjb.csic.es and felix@ma-rjb.csic.es)

Abstract. A new name, *Geranium tanii* Aedo & Muñoz Garmendia, is proposed for the illegitimate later homonym *Geranium trifoliatum* Z. M. Tan.

While preparing an index of specific names in *Geranium*, we encountered a problem concerning nomenclature of the Chinese *G. trifoliatum* recently described by Tan (1990). Andrews (1805–1806) used this epithet for a South African *Geranium* now recognized as *Pelargonium trifoliatum* (Andrews) Sweet (Sweet, 1826). According to Article 53.1 of the Tokyo Code, Tan's name is illegitimate due to later homonymy. Thus, the following name change is necessary.

Geranium tanii Aedo & Muñoz Garmendia, nom. nov. Replaced name: *Geranium trifoliatum* Z. M. Tan, in Bull. Bot. Res., Harbin 14(3): 231. 1990, nom. illeg. Not Andrews (1805).

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New Taxa and Combinations in Moraceae and Cecropiaceae from Central and South America

C. C. Berg
Arboretum and Botanical Garden (ARBOHA), Botanical Institute, University of Bergen, N-5067 Store Milde, Norway

P. Franco Rosselli
Universidad Nacional de Colombia, Instituto de Ciencias Naturales, Museo de Historia Natural, Bogotá, Colombia

ABSTRACT. Taxonomic studies of Moraceae and Cecropiaceae of Central America and the Andean region led to establishment of the following new taxa and combinations in Moraceae: *Brosimum multinervium* C. C. Berg, *Ficus carchiana* C. C. Berg, *F. cotinifolia* Kunth var. *hondurensis* (Standley & L. O. Williams) C. C. Berg, *F. osensis* C. C. Berg, *F. rieberiana* C. C. Berg, *Maquira guianensis* Aublet subsp. *costaricana* (Standley) C. C. Berg, *Naucleopsis capirensis* C. C. Berg, *N. herrerensis* C. C. Berg, *N. humilis* C. C. Berg, *N. naga* Pittier subsp. *meridionalis* C. C. Berg, *N. straminea* C. C. Berg, *N. ulei* (Warburg) Ducke subsp. *puberula* C. C. Berg, *N. velutina* C. C. Berg, *Pseudolmedia glabrata* (Liebmann) C. C. Berg, *Sorocea jaramilloi* C. C. Berg, *S. pubivena* Hemsley subsp. *oligotricha* (Akkermans & C. C. Berg) C. C. Berg, *S. pubivena* Hemsley subsp. *hirtella* (Mildbraed) C. C. Berg, *S. ruminata* C. C. Berg, *S. sprucei* (Baillon) Macbride subsp. *subumbellata* C. C. Berg; and in Cecropiaceae: *Cecropia annulata* C. C. Berg & P. Franco, *C. heterochroma* C. C. Berg & P. Franco, *C. puberula* C. C. Berg & P. Franco, *C. tacuna* C. C. Berg & P. Franco, *Coussapoa david-smithii* C. C. Berg, and *C. villosa* Poeppig & Endlicher subsp. *polycephala* C. C. Berg. For *Ficus intramarginalis* (Liebmann) Miquel a lectotype is designated.

In connection with floristic treatments (*Flora Mesoamericana* and the *Flora of Ecuador*), a revision of the genus *Cecropia*, and less specific studies on Moraceae and Cecropiaceae of the Andean region, several new taxa have been found in the material studied. Some new combinations have to be made in addition to those of *Cecropia, Coussapoa,* and *Pourouma* recently published in the *Flora of Ecuador* (Berg & Franco, 1993).

MORACEAE

1. **Brosimum multinervium** C. C. Berg, sp. nov. TYPE: Ecuador. Pastaza: road Coca–Auca, ca. 115 km S of Coca, 4–6 km S of Río Tigüino, 22–28 Feb. 1989 (infl.), *Zak 3955* (holotype, QCNE; isotype, BG). Figure 1.

Brosimo parinarioidi et *B. utili* affinis, divergens ab utraque venis lateralibus magis numerosis.

Tree up to 40 m tall. Leafy twigs 3–5 mm thick, sparsely to rather densely brown-puberulous to whitish-pubescent. Lamina coriaceous, elliptic to oblong to (sub)ovate, 12–30 × 6–19 cm, apex shortly and abruptly acuminate, base cordate to truncate (to obtuse), margin entire, often ± revolute; upper surface puberulous on the midrib, lower surface densely brown-puberulous to -subvelutinous on the veins; lateral veins (30–)40–50 pairs, often some of them furcate, tertiary venation for the greater part scalariform; petiole 0.5–1.5 cm long, densely brown-puberulous, epidermis flaking off; stipules 4.5–9 cm long, densely brown-puberulous to brown- to whitish-pubescent. Inflorescences solitary in the leaf axils, initially deflexed; peduncle 2–6.5 cm long, the lower part sparsely puberulous, the upper part densely minutely puberulous and with a few bracts, the uppermost part broadened; staminate inflorescences discoid to subturbinate, ca. 1 cm diam.; perianth lacking (?); stamen 1, filament ca. 0.5 mm long, anther ca. 0.2 mm long; pistillate inflorescences subglobose to subturbinate, 0.8–1.2 cm diam., with a single pistillate flower in the center; stigmas 1–2 mm long; bracts ca. 1 mm diam., minutely puberulous.

This new species is related to *Brosimum parinarioides* Ducke and *B. utile* (HBK) Pittier. It can be easily recognized by the great number of lateral veins ((30–)40–50 pairs). In the two related species the number of lateral veins varies between 12 and 32.

Paratypes. ECUADOR. **Pastaza:** as the type locality, 7–9 Jan. 1989 (♀), *Hurtado et al. 1300* (BG, MO, QCNE),

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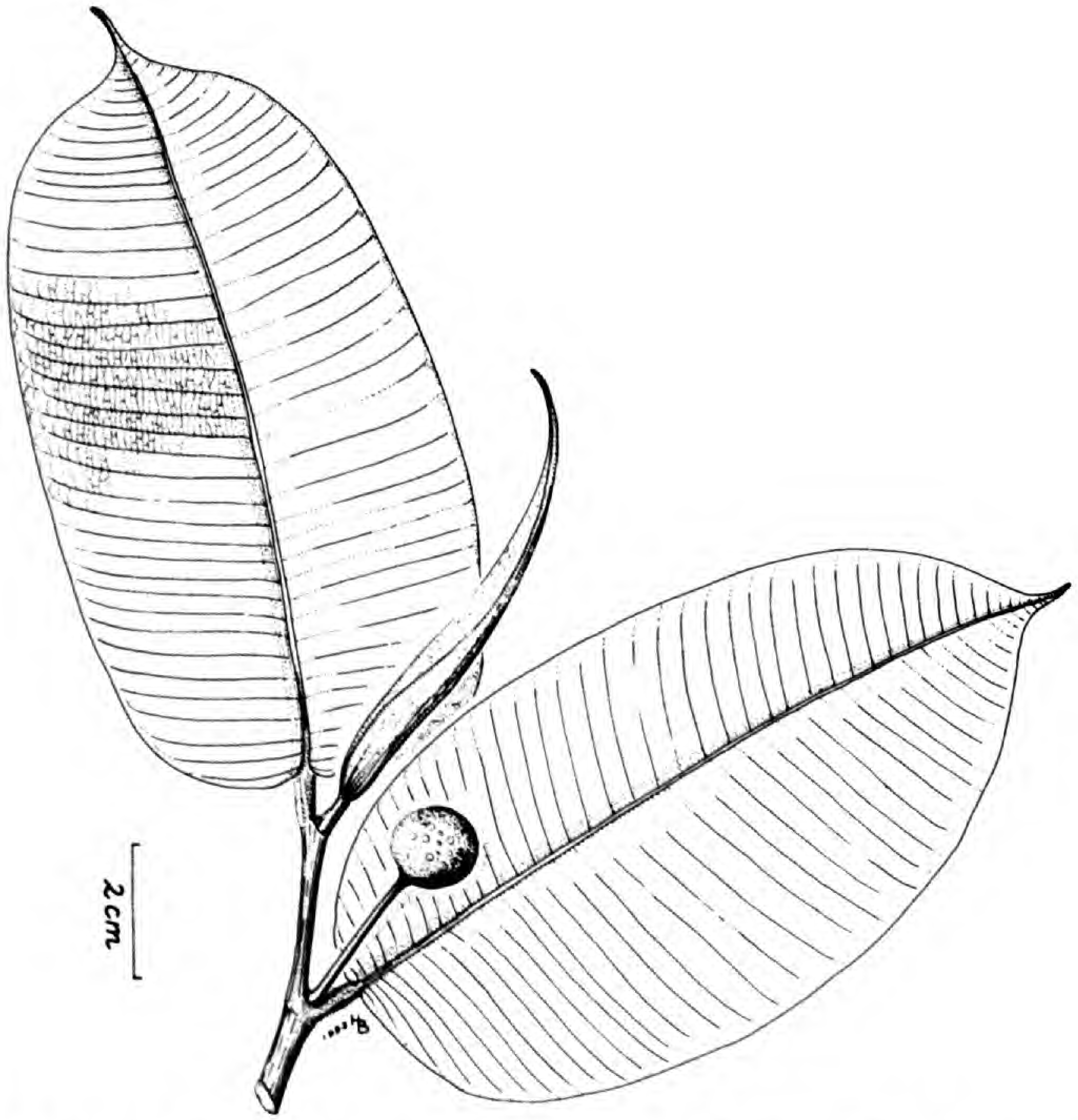


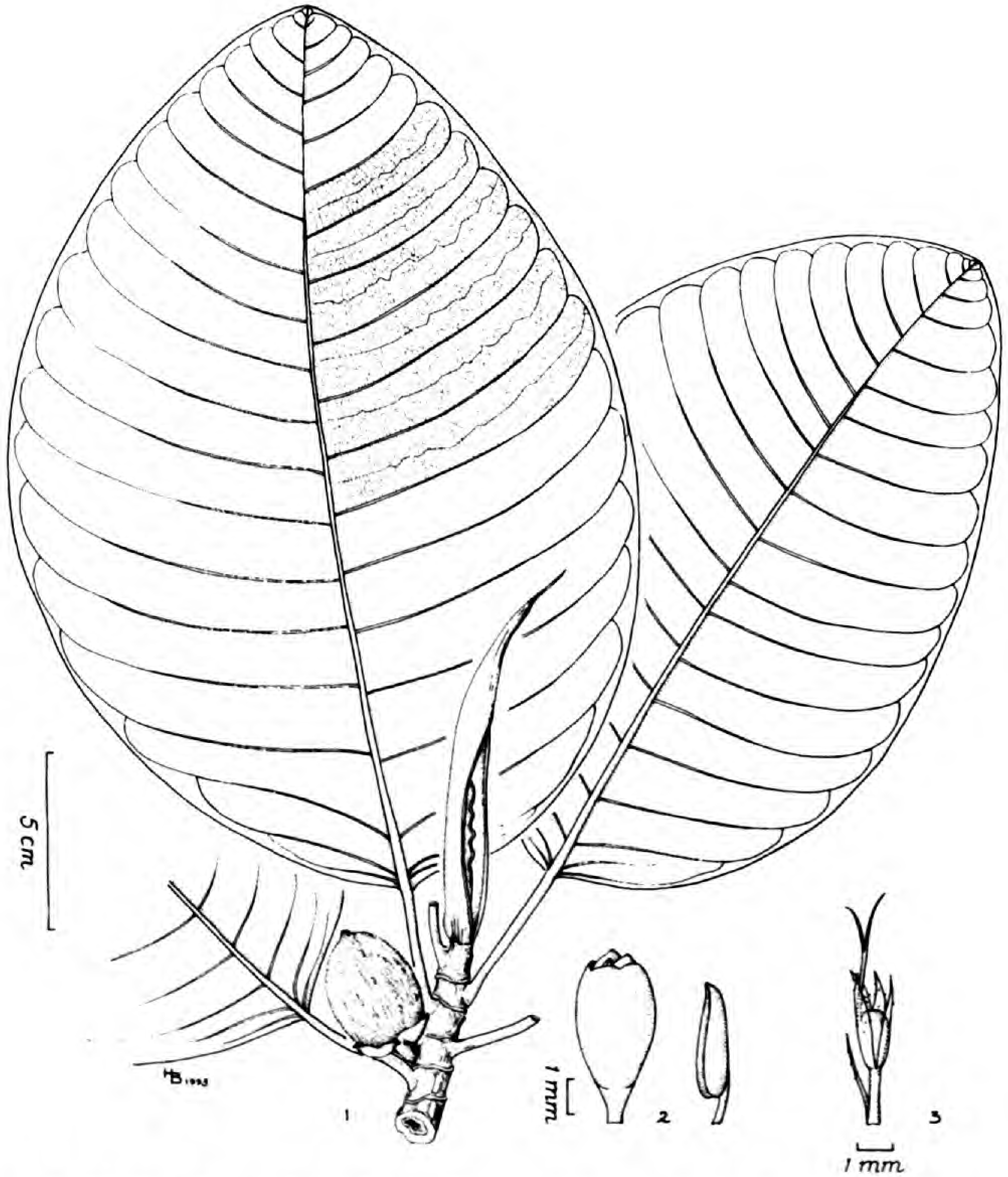


Figure 1 (left). *Brosimum multinervium* C. C. Berg. Leafy twig with inflorescence (*Hurtado et al. 1300*). Figure 2 (right). *Ficus carchiana* C. C. Berg. —1. Leafy twig with inflorescence (*Rubio et al. 661*). —2. Staminate flower and stamen (*Pennington et al. 10501*). —3. Long-styled pistillate flower and interfloral bract (*Pennington et al. 10501*).

26–31 Jan. 1989 (st), *Neill et al. 8789* (BG, QCNE), 24 May 1989 (♀), *Rubio 131* (BG, QCNE), 22–28 Feb. 1989 (♀), *Zak 3976* (QCNE) and *4005* (QCNE), 1–9 Apr. 1989 (♀), *Zak & Rubio 4244* (BG, QCNE) and *4349* (BG, QCNE); road Coca–Auca, same but 120 km S of Coca, 17 July 1989 (♂), *Gudiño 62* (BG, QCNE). **Sucumbios:** Dureno, 30 Apr. 1986 (st), *Cerón 286* (BG, QAME). PERU. **Ucayali:** prov. Coronel Portillo, San Alejandro, 6 Dec. 1973 (st), *Ceijos Bellido 1a* (BG); prov. Coronel Portillo, Carretera Marginal, 22 km S of km 86, 11 Feb. 1981 (♀), *Gentry et al. 31198* (U).

2. Ficus carchiana C. C. Berg, sp. nov. TYPE: Ecuador. Carchi: below Maldonado, 1300 m, 9 Oct. 1982, *Pennington et al. 10501* (holotype, QCA; isotypes, BG, K, QCNE). Figure 2.

Ceteris speciebus consubgeneribus cum stipulis longis (ca. 10 cm) distinguenda, paginis latioribus et bracteis basalibus grandibus.

Tree up to 25 m tall. Leafy twigs 8–10 mm thick, glabrous. Lamina coriaceous, elliptic to ovate, 18–30 × 11–21 cm, apex obtuse to subacute to subacuminate, base rounded to subcord(ul)ate; upper surface glabrous, lower surface with sparse brown elongate pluricellular hairs on (the lower parts of the) main veins, white capitate pluricellular hairs in the areoles; lateral veins 14–20 pairs, tertiary venation reticulate; petiole 3–4.5 cm long, glabrous; stipules 10–11 cm long, glabrous, drying dark brown. Figs solitary in the leaf axils, subsessile; basal bracts 3, ca. 10–12 mm long; receptacle ellipsoid to subglobose, when dry ca. 3.5–4 × 2–3 cm, in fruit up to 5 × 4.5 cm (when fresh 6.5 × 5.5 cm), puberulous to subhispidulous; wall rather thick; ostiole ca. 1 mm diam. in plane or apiculate apex of the receptacle. Staminate flowers pedicellate; perianth tubular, ca. 3.5 mm long, 3–4-lobed, glabrous. Pistillate flowers pedicellate or sessile; tepals 4, free, lanceolate, ca. 2.5 mm long, sparsely minutely puberulous; stigmas 2. Interfloral bracts numerous, lanceolate, 2–2.5 mm long, sparsely minutely puberulous.

Ficus carchiana belongs to subgenus *Pharmacosycea.* It can be distinguished from other species of this subgenus by the broad and thickly coriaceous leaves and the long stipules, both drying brownish instead of greenish, as often occurs in subgenus *Pharmacosycea.*

The species is apparently a component of submontane wet forest.

Paratypes. PANAMA. **Darién:** Serranía del Darién, trail Cerro Mali–Río Pucuro, ca. 1200 m, 20 July 1976 (st), *Gentry et al. 16833A* (MO). COLOMBIA. **Nariño:** La Planada Reserve, 7 km from Chucunes, 1800 m, 22 Dec. 1987, *Gentry et al. 59733* (MO). ECUADOR. **Carchi:** trail Chical–Maldonado, 1250–1400 m, 26 Sep. 1979, *Gentry et al. 26618* (BG, QCA). **Esmeraldas:** cantón Esmeraldas, 10 km SW of Lita, 800 m, 10 Sep. 1990, *Rubio et al. 661* (BG, MO, QCNE); Alto Tambo, near Lita, 13 Apr. 1992, *Tipaz et al. 788* (QCNE).

3. Ficus cotinifolia Kunth var. **hondurensis** (Standley & L. O. Williams) C. C. Berg, comb. et stat. nov. Basionym: *Ficus hondurensis* Standley & L. O. Williams, Ceiba 1: 78. 1950. TYPE: Honduras. Morazán: Las Meses, 1 Jan. 1946, *Valerio R. 3674* (holotype, EAP not seen; isotype, US).

This variety is distinct from the typical variety in the pedunculate figs.

4. Ficus intramarginalis (Liebmann) Miquel, Ann. Mus. Bot. Lugduno-Batavum 3: 297. 1867. *Urostigma intramarginale* Liebmann, Kongel. Danske Vidensk. Selsk. Naturvidensk. Math. Afh., Ser. 5, 2: 320. 1851. TYPE: Costa Rica. Near Turrialba, May 1847, *Oersted 14317*—the element consisting of a leafy twig and leaves (lectotype, designated here, C).

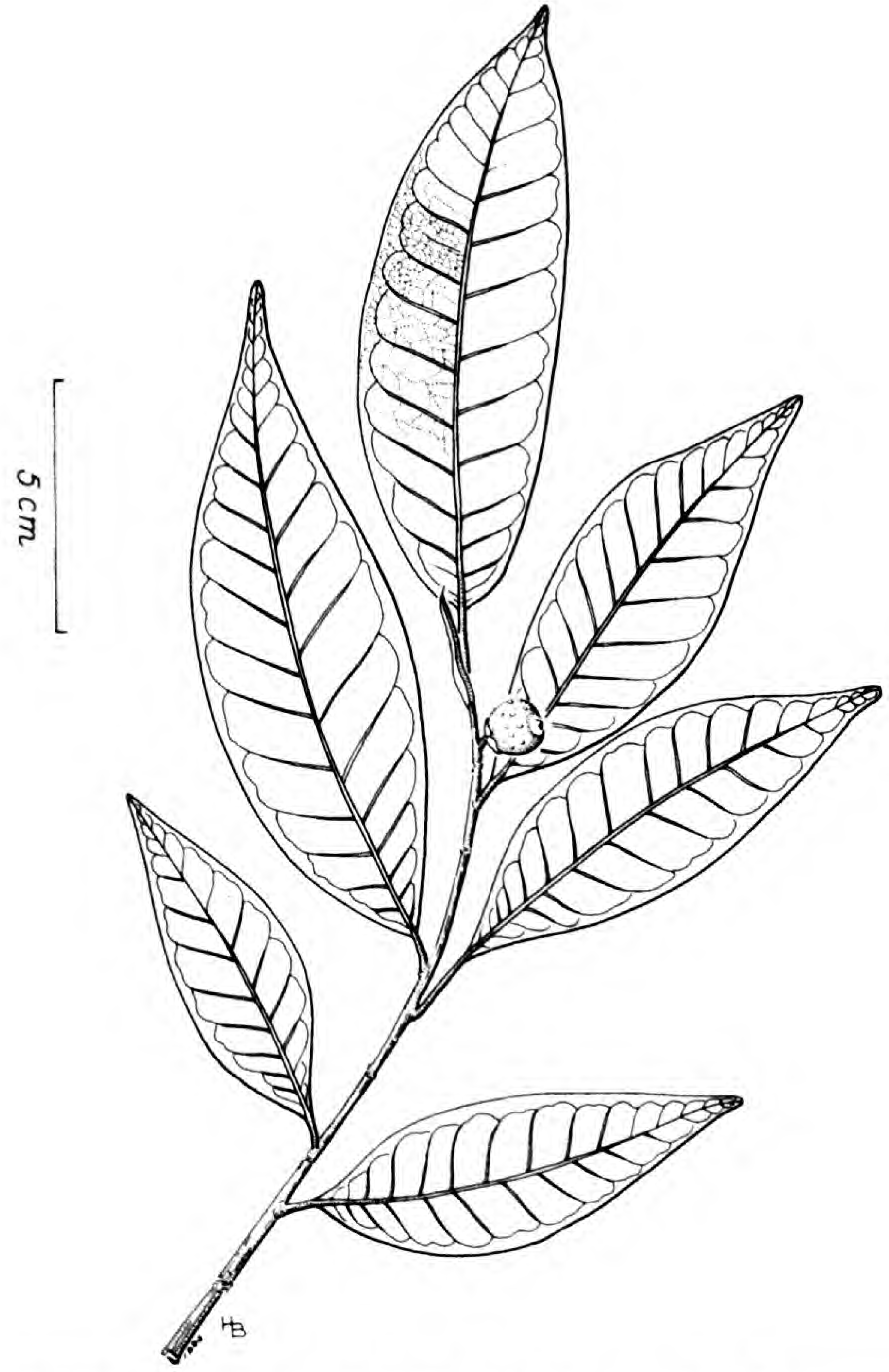
As a consequence of the lectotypification, the name will be transferred into the synonymy of *Coussapoa villosa* Poeppig & Endlicher, in accordance with the suggestion by Standley (1937). The other part of the type collection, a leafless twig with some figs, probably belongs to *Ficus turrialbana* W. Burger (Burger, 1977).

5. Ficus osensis C. C. Berg, sp. nov. TYPE: Costa Rica. Puntarenas: Punta Banco, 22 Aug. 1988 (fl), *Chavarría Díaz 307* (holotype, MO). Figure 3.

Fico americanae probaliter affinis, a qua differt stipulis satis longioribus et ficis subsessilis.

Tree up to 30 m tall. Leafy twigs 1.5–3 mm thick, glabrous. Lamina 6.5–12 × 1.7–4.2 cm, oblong to lanceolate, apex acuminate, base obtuse; both surfaces glabrous; lateral veins 10–16 pairs, the basal pair unbranched, tertiary venation reticulate; petiole 0.4–1.8 cm long; stipules 0.9–2 cm long, glabrous, drying blackish to dark brown. Figs in the leaf axils; peduncle up to ca. 0.2 mm long; basal bracts 2, 1.5–2 mm; receptacle 0.6–0.7 cm diam. (when dry), globose, glabrous, at maturity green (?); ostiole ca. 1.5 mm diam., umbonate.

Ficus osensis belongs to subgenus *Urostigma* and is probably related to *F. americana* Aublet, from which it differs in its leaf venation, the relatively long stipules, and the subsessile figs.



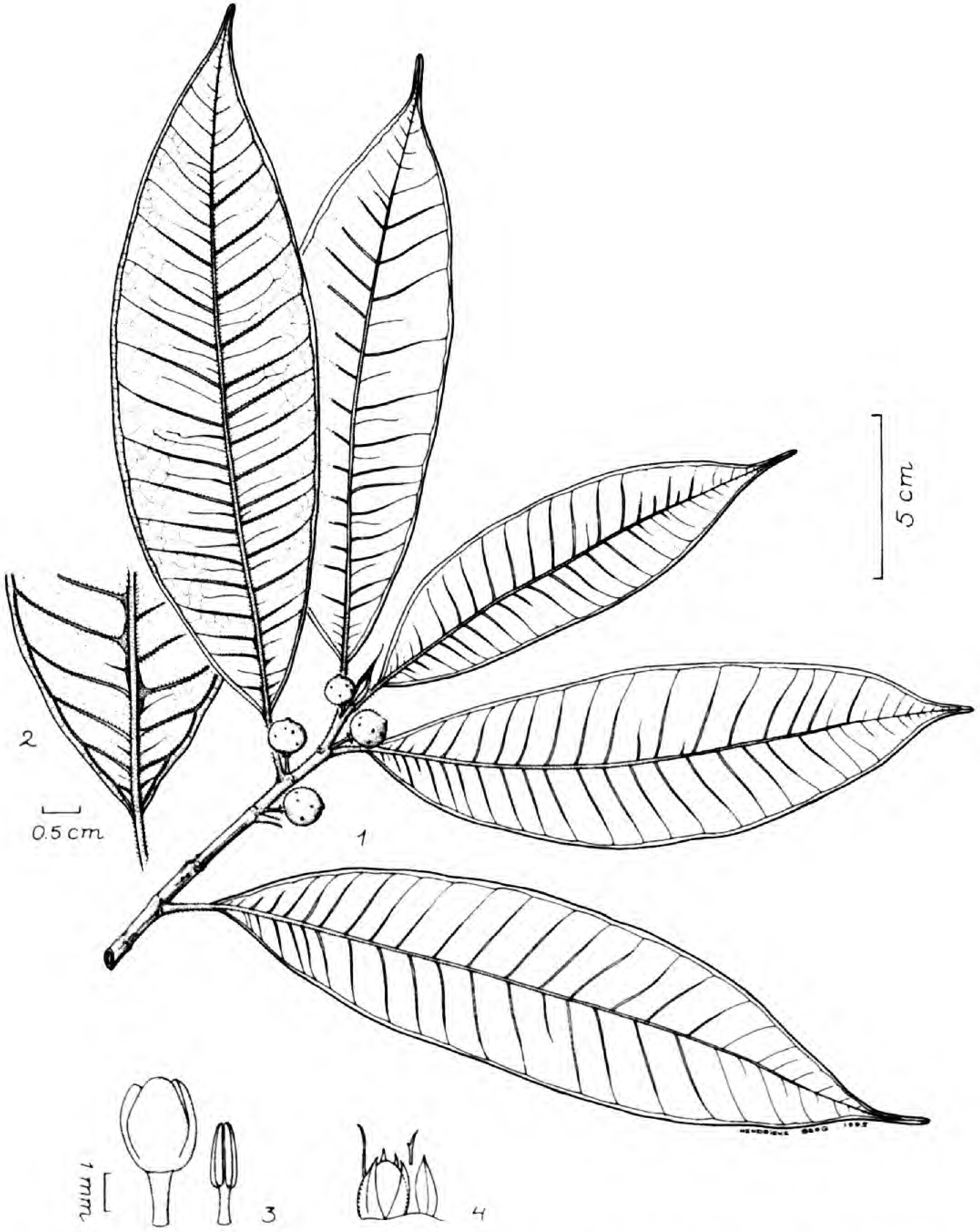


Figure 3 (left). *Ficus osensis* C. C. Berg. Leafy twig with inflorescence (*Harmon 148*). Figure 4 (right). *Ficus rieberiana* C. C. Berg. —1. Leafy twig with inflorescences (*Rubio et al. 1068*). —2. Glandular spots (*Rubio et al. 1068*). —3. Staminate flower and stamen (*Rubio et al. 1068*). —4. Long-styled pistillate flower, interfloral bract, style, and stigma of short-styled pistillate flower (*Rubio et al. 1068*).

The state of the type specimen did not allow dissection of the fig to describe the floral structures.

Paratype. COSTA RICA. **Puntarenas:** cantón Osa, Campanario o Playa San Josecito, Sierpe, 13 Oct. 1990 (st), *Harmon 148* (MO).

6. **Ficus rieberiana** C. C. Berg, sp. nov. TYPE: Ecuador. Carchi: Reserva Awa, 1500 m, 16–30 Nov. 1990, *Rubio et al. 1068* (holotype, QCNE; isotype, BG). Figure 4.

Ceteris speciebus consubgeneribus distinguenda, paginis chartaceis vel subcoriaceis subter indumentis densis; vena submarginali distincta venas laterales connectenti; maculis glandulosis ceraceis irregulariter formatis et/vel locatis.

Tree up to 25 m tall. Leafy twigs 2–4 mm thick, white hirtellous. Lamina chartaceous to subcoriaceous, oblong to lanceolate to subobovate, 6–24 × 2–9 cm, acuminate to subcaudate, base acute to subobtuse; upper surface glabrous, lower surface ± densely white hirtellous to subtomentose on the veins, ± sunken capitate pluricellular hairs in the areoles; lateral veins ca. 15–25 pairs, connected by rather distinct submarginal veins, lower lateral veins rather weak and usually running perpendicular to the midrib, tertiary venation reticulate; waxy glandular spots irregularly extended along the midrib, or (also) additional spots up to the 5th pair of lateral veins; petiole 0.7–2.5 cm long, hirtellous; stipules 1–2.5(–4) cm long, sparsely or densely hairy. Figs solitary or in pairs in the leaf axils; peduncle 0.3–0.6 cm long, sparsely puberulous; basal bracts 3, ca. 1–1.5 mm long, glabrous; receptacle when dry ca. 0.8–1.2 cm diam., often very short (= ca. 1 mm long) stipitate, puberulous to subhirtellous, maculate; ostiole 0.5–1 mm diam. in the apiculate apex of the receptacle. Staminate flowers pedicellate; tepals 4, ca. 2.5 mm long, basally connate, glabrous; stamens 2, anthers lanceolate to oblong, ca. 1.8 mm long. Pistillate flowers pedunculate or sessile; tepals 4, ca. 1.5 mm long, basally connate, glabrous; stigma 1, or in short-styled flowers sometimes a very short second stigmatic branch. Interfloral bracts few, oblong to lanceolate, ca. 1.5 mm long, glabrous.

Ficus rieberiana belongs to subgenus *Pharmacosycea.* It can be distinguished from other species of this subgenus by the rather dense indumentum on the veins of the lower surface of the chartaceous to subcoriaceous lamina and the distinct submarginal veins connecting the lateral veins, and irregular number, shape and/or position of the waxy glandular spots along the midrib beneath. Species of subgenus *Pharmacosycea* normally have two similar glandular spots at the base of the midrib beneath. A characteristic feature of subgenus *Pharmacosycea* is the presence of two stigmas; in *F. rieberiana,* however, the style bears only one stigma.

Gentry et al. 24343 (BG, HUA) [from Colombia. Chocó: Río Yuto, between Lloró and La Vuelta, 100 m, 18 Jan. 1979 (st)] probably belongs to this species. The lower lateral veins are somewhat different from the collections listed below and, according to the label, it has figs turning red, an unusual phenomenon in subgenus *Pharmacosycea.*

The epithet *rieberiana* is chosen to commemorate the contribution of Bjarne Rieber to the establishment of university greenhouse research facilities for *Ficus* at the Norwegian Arboretum at Store Milde, Norway.

Paratypes. ECUADOR. **Carchi:** cantón Tulcan, Tobar Donoso, 650–1000 m, 19–28 June 1992, *Tipaz et al. 1358* (QCNE) and *1546* (QCNE). **Pichincha:** Maquipucuna, 5 km E of Nanegal, 1550 m, 11 Feb. 1991 (st), *Gentry et al. 73216* (MO); Reserva Forestal ENDESA, Río Silanche, 10 km N of km 113 on road Quito–Puerto Quito, 650–700 m, 7 Dec. 1984, *Jaramillo 7411* (GB, MO, NY, QCA); old road Quito–Santo Domingo de los Colorados, km 59, Reserva Florística-Ecológica "Río Guajalito," 1800–2000 m, 24 Sep. 1988, *Zak & Jaramillo 3829* (BG, JUAM, MO).

7. **Maquira guianensis** Aublet, Hist. Pl. Guiane 2, Suppl.: 36. 1775. TYPE: French Guiana. Without locality, *Aublet s.n.* (holotype, BM).

In the revision of *Maquira* (Berg, 1972) five species were distinguished within the genus. The two closely related taxa, *M. guianensis* and *M. costaricana,* could be readily told apart, both morphologically and geographically. However, more recent collections made in western Ecuador and in the Upper Amazon Basin reduced considerably the geographical gap between the two taxa, as well as their morphological distinctness, as can be perceived from the descriptions and distributions of the two taxa presented below. These aspects support treatment of the two taxa at the rank of subspecies.

7a. **Maquira guianensis** Aublet subsp. **guianensis**

Tree up to 25 m tall. Involucral bracts densely brownish puberulous. Peduncle of the staminate inflorescence 0.5–2 cm long. Peduncle of the pistillate inflorescence 0.5–1.6 cm long; pistillate flowers usually more than 20 (up to 50). Fruiting perianth subobovoid, often ± distinctly ribbed, brown velutinous, with a ± truncate apex.

Distribution. Guianas, eastern Venezuela (Bolívar), and Amazonian Brazil (Amapá, Pará, Mato Grosso, and Roraima).

7b. Maquira guianensis Aublet subsp. **costaricana** (Standley) C. C. Berg, comb. et stat. nov. Basionym: *Perebea costaricana* Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 390. 1937. *Maquira costaricana* (Standley) C. C. Berg, Acta Bot. Neerl. 18: 463. 1969. TYPE: Costa Rica. Limón: near Guápiles, *Standley 37037* (holotype, US).

Tree up to 15(–30) m. Involucral bracts (rather) sparsely whitish puberulous. Peduncle of the staminate inflorescence 0.2–0.8 cm long. Peduncle of the pistillate inflorescence up to 0.8 cm long; flowers ca. 10–35; fruiting perianth ellipsoid to obovoid, not or hardly ribbed, (sub)glabrous or sparsely to densely yellowish puberulous, with an obtuse to rounded apex.

Distribution. Nicaragua through western Colombia to western Ecuador, and in the Upper Amazon Basin, extending to eastern Venezuela (Bolívar).

In western Ecuador the fruiting perianth of *Maquira guianensis* subsp. *costaricana* is often sparsely to densely yellow puberulous, and some of the specimens from this area (Río Palenque Biological Station) have been distributed under the name *M. grandis* Gentry. In Central America the pistillate inflorescences often contain more than 20 flowers, while in western Ecuador and east of the Andes the inflorescences usually contain less than 20.

In Central America and western Colombia, the trees appear to start flowering when small, a feature shared with some other species of the same tribe, e.g., *Helicostylis tomentosa* (Poeppig & Endlicher) Rusby and *Perebea angustifolia* (Poeppig & Endlicher) C. C. Berg.

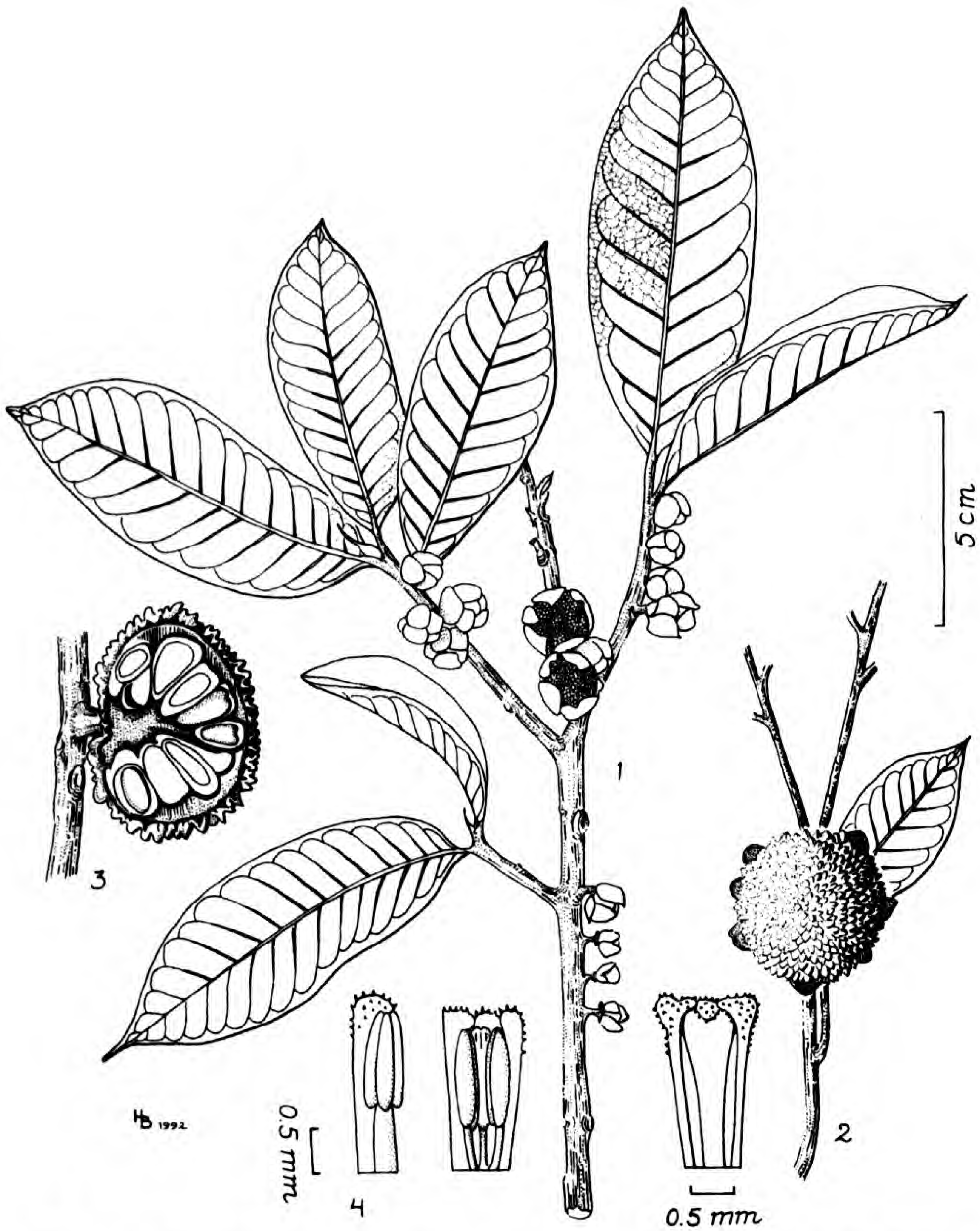
8. Naucleopsis capirensis C. C. Berg, sp. nov. TYPE: Panama. Panamá: W of Interamerican Hwy., near Capira, ca. 60 km W of Panama City, on road to Cerro Campana, ca. 800 m, 21 Mar. 1985 (♂), *McPherson 6913* (holotype, MO; isotypes, BG, BM, CR, MEXU, PMA). Figure 5.

Naucleopsi nagae affinis, a qua differt e.g. absentia bractearum in pedunculis staminarum inflorescentarum, sepalis brevioribus pistillatorum florum et stipulis brevioribus.

Tree up to 15 m tall. Leafy twigs 2–3 mm thick, (sparsely) puberulous, periderm flaking off. Lamina oblong, (5–)8–15(–21) × (1.7–)3–5.5(–7.5) cm, coriaceous, apex acuminate to subcaudate, base obtuse to rounded, margin (in dry material) often ± revolute; upper surface glabrous (or sparsely puberulous at the base of the midrib), lower surface glabrous or sparsely puberulous on (the base of) the midrib; lateral veins 10–16 pairs, tertiary venation reticulate; petiole 0.2–0.8 cm long, epidermis flaking off; stipules 0.3–1 cm long, puberulous, caducous. Staminate inflorescences in the leaf axils and below the leaves, ca. 1–1.5 cm diam.; peduncle 0.2–0.3 mm long, not bracteate; involucral bracts in 4–5 series, broadly ovate to semicircular to suborbicular, the outer ones minutely puberulous, the inner ones only ciliolate; perianth ca. 2 mm long, tepals 2–7, often ± cucullate, minutely puberulous in the upper part; stamens 3–5, filaments 0.6–0.8 mm long, anthers oblong to elliptic, 0.7–1 × 0.3–0.4 mm. Pistillate inflorescences 1.5–3 cm, in fruit (3–)5.5–9 cm diam., subsessile or peduncle up to 0.6 cm long; involucral bracts in 6–8 series, broadly to narrowly ovate, minutely puberulous to submuriculate, the inner ones up to 1.5 cm long; flowers numerous; free parts of the tepals spinelike to pyramidate, minutely puberulous to submuriculate; style 2–5 mm long, stigmas filiform, 4–7 mm long. Infructescences 4–7(–10) cm diam., free parts of the tepals up to 1 cm long.

Paratypes. COSTA RICA. **Alajuela:** Reserva de Arenal, Río Peñas Blancas, Quebrada Aguagata, Finca "Villalobos," 1000 m, 20 Apr. 1990 (st), *Bello et al. 2218* (MO); Reserva Forestal San Ramón, Campamento Río Lorencito, 900–1000 m, 2 Sep. 1989 (st), *Gómez-Laurito 11828* (F); San Carlos, Peñas Blancas, 10 July 1985 (♀ fl-fr), *Haber & Bello C. 1960* (BG, MO); Reserva Biológica Monteverde, Río Peñas Blancas, 15 May 1987 (♀ fl), *Haber & Bello 7033* (BG), 13 June 1987 (♀ fr), *Haber & Cruz 7221* (MO); Reserva Biológica Monteverde, Finca "Novo," 23 July 1987 (♀ fr), *Haber & Bello 7339* (BG); Reserva Biológica Monteverde, Brillante, 1500 m, 8 Sep. 1987 (♀ fr), *Haber & Lawton 7507* (MO); Upala, Bijagua El Pilón, Cerro La Carmela, 700 m, 8 July 1988 (♀ fl-fr), *Herrera 2018* (BG, F, MO, TEX). **Heredia:** Parque Nacional Braulio Carillo, Estación Magsay, 16 June 1991 (st), *Aguilar 167* (MO). **Guanacaste:** Parque Nacional Guanacaste, Estación Mengo, Volcán Cacao, 1400 m, 14 July 1989 (♀ fr), *II INBIO 176* (BG, MO). **Puntarenas:** 1 mi. due S of San Vito de Java, ca. 1150 m, 18 Aug. 1967 (♂), *Raven 21897* (BG, F, MO, PMA). PANAMA. **Darién:** trail from Cana to Colombian border, Río Setigandí, 19 Apr. 1980 (st), *Gentry et al. 28590* (MO); Cerro Campamiento, E of Tres Bocas, Cuasi–Cana trail, 29 Apr. 1968 (♀ fl-fr), *Kirkbride & Duke 1226* (MO, NY). **Panamá:** trail Zamora–Campana National Park, 14 May 1992 (♀ fl-fr), *Correa 8911* (SCZ); Cerro Campana, above Su-Lin Hotel, 16 Sep. 1971 (♀ fr), *Gentry 1854* (MO).

The cited collections from Costa Rica and Panama are quite uniform. Several specimens from Co-



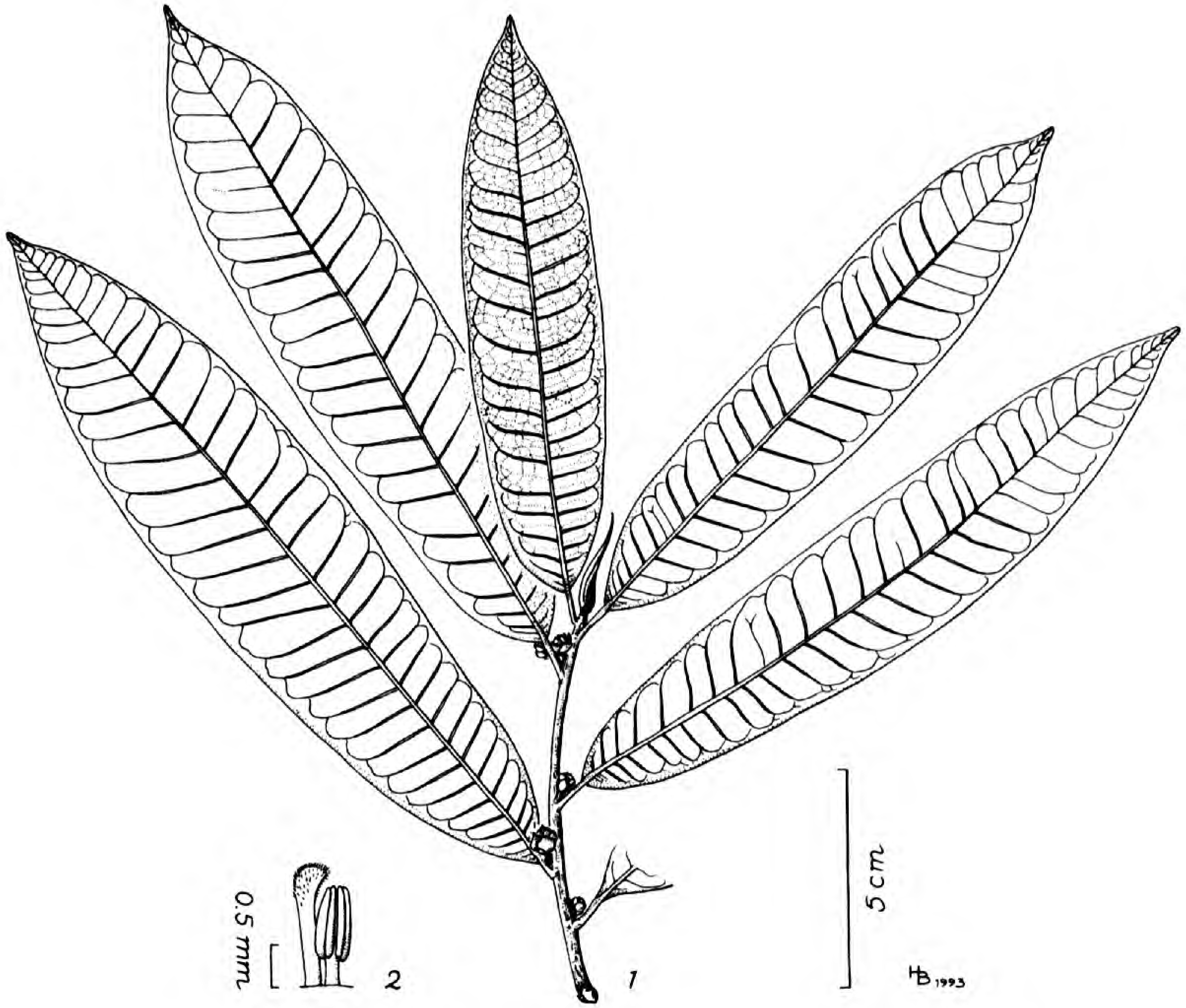


Figure 5 (left). *Naucleopsis capirensis* C. C. Berg. —1. Leafy twig with staminate inflorescences (*McPherson 6913*). —2. Leafy twig with pistillate inflorescence (*Haber et al. 1960*). —3. Infructescence (*Haber et al. 1960*). —4. Staminate flower and stamens (*McPherson 6913*). Figure 6 (right). *Naucleopsis herrerensis* C. C. Berg. —1. Leafy twig with staminate inflorescences (*Bernardi 16201*). —2. Tepal and stamen (*Bernardi 16201*).

lombia and Ecuador probably belong to this species and may represent two subspecies:

COLOMBIA. **Antioquia:** mun. Frontino, cgto. Nutibara, Río Cuevas, 1800–2000 m, 17 Mar. 1984 (♂), *D. Sánchez et al. 60* (BG, MEDEL), 1700 m, 18 Mar. 1985 (♀ fr), *D. Sánchez et al. 166* (BG, MEDEL); mun. Frontino, vrda. Venados, Parque Nacional Natural "Las Orquideas," 880 m, June 1988 (♂ juv.), *H. Triana et al. 56* (COL). These specimens differ from the Central American ones in: (1) the trees becoming up to ca. 35 m tall, (2) the fully mature infructescences becoming probably about 10 cm diam., with the free parts of tepals becoming up to 2.5 cm long, and (3) the fruits ca. 2.5 × 1.5 cm. The stigmas are conical and similar to those found in the collections cited below. The petiole can be up to 1.5 cm long. The staminate inflorescences are subsessile.

COLOMBIA. **Nariño:** mun. Barbacoas, cgto. Altaquer, vrda. El Barro, Reserva Natural Río Ñambí, 1325 m, 5 Dec. 1993 (st), *Betancur et al. 4631* (COL). **Valle:** Alto Río Anchicayá, Yatacué, 17 July 1984 (♀ fl), *Gentry & Monsalve 48260* (BG, JUAM, MO). ECUADOR. **Carchi:** Awá Reserve, Gualpí Chico area, 1330 m, 20 Jan. 1988 (♀ fl-fr), *Hoover et al. 2827* (BG, QCA); cantón Tulcan, Gualpí Alto, 1800 m, 15–28 June 1991 (♂), *Rubio et al. 1723* (QCNE), (♀ fl-fr), *Rubio et al. 1746* (QCNE); cantón Tulcan, Reserva Indígena Awá, Gualpí Medio, 900 m, 21 May 1992 (♀), *Quelal et al. 576* (QCNE); cantón Tulcan, Tobar Donoso, 650–1000 m, 19–28 June 1992 (♂), *Tipaz et al. 1309* (QCNE), (♀ fr), *Tipaz et al. 1362* (QCNE). **Carchi/Esmeraldas:** near Lita, 20 May 1987 (♀ fl-fr), *van der Werff 9525* (BG, MO, QAME) and *9527* (AAU, BG). **Esmeraldas:** cantón San Lorenzo, Reserva Indígena Awá, Río Mira, 10 km W of Alto Tambo, 16–26 Mar. 1991 (♂), *Rubio et al. 1268* (BG, QCNE); cantón San Lorenzo, Reserva Indígena Awá, Ricaurte, Balsareño, Río Palabí, 15–29 Apr. 1992 (st), *Rubio et al. 1409* (BG). These specimens differ from the Central American ones in: (1) the free parts of the tepals being distinctly broadened at the base, (2) the conical stigmas, (3) the narrower lamina (lanceolate to oblong), and (4) longer petioles. In addition, the inflorescences and infructescences appear to be smaller, down to 0.5 cm and ca. 2.5 cm in diameter.

Further exploration may provide material eliminating the morphological discontinuities between the groups of specimens cited above.

Naucleopsis capirensis is related to *N. naga*, from which it differs, e.g., in the absence of bracts on the peduncle of the staminate inflorescences, the shorter tepals of the pistillate flowers, and the shorter stipules.

9. **Naucleopsis herrerensis** C. C. Berg, sp. nov. TYPE: Peru. Loreto: prov. Requena, Jenaro Herrera, arboretum (tree 7/65), Aug.–Sep. 1976 (♂), *Bernardi 16201* (holotype, G; isotype, BG). Figure 6.

Folia margine in parte plus minusve revoluto, involuto basi versus; venae laterales 12–26 binatae; stipulae 1–1.8 cm longae.

Tree up to ca. 25 m. Leafy twigs 1.5–3.5 mm thick, sparsely to densely appressed-puberulous, periderm (in older parts) flaking off. Lamina lanceolate, 6.5–24 × 1.3–6 cm, coriaceous, apex acuminate to subacute, acumen often acute, base acute to obtuse, *margin partly ± revolute, but always at the base involute*; both surfaces glabrous; lateral veins 12–26 pairs, tertiary venation reticulate or partly scalariform; petiole 0.5–1.8 cm long, appresssed-puberulous, epidermis often ± flaking off; stipules 1–1.5 cm long, (brownish) appressed-puberulous. Staminate inflorescences on distinct spurs in the leaf axils, up to 6 together, ca. 1 cm diam.; peduncle 0.2–0.3 cm long; involucral bracts in ca. 5 series, broadly ovate to semicircular to suborbicular, appressed-puberulous; perianth 1.5–2 mm long, tepals 4–5, free or basally connate; stamens 3–4, filaments 0.3–0.4 mm long, anthers oblong to elliptic, 0.6–0.8 × 0.3–0.4 mm. Pistillate inflorescences (juvenile!) below the leaves. Infructescences (immature!) ca. 6 cm diam., sessile; involucral bracts in ca. 6 series, broadly to narrowly ovate, puberulous; flowers numerous; free parts of the tepals aculeate to subulate, up to 1 cm long, minutely puberulous to subhispidulous; style 5–6 mm long, stigmas subulate, 2–3 mm long.

Naucleopsis herrerensis can be recognized by the relatively narrow leaves with the margin (partly) more or less revolute, but toward the base distinctly involute. It is possibly related to *N. ulei* (Warburg) Ducke, resembling in vegetative parts the small-leaved form of this species occurring in the Middle and Lower Amazon Basin (see below). However, it is clearly different in the shape and size of the staminate inflorescences, the absence of very short internodes, and the distinctly loop-connected lower lateral veins of the lamina.

Paratypes. COLOMBIA. **Caquetá:** Morelia, 4 Nov. 1941 (♀ juv.), *Sneidern A. 1283* (NY). ECUADOR. **Napo:** Parque Nacional Yasuní, "Maxus" road, km 40, 10 Sep. 1994 (♀ juv.), *Aulestia 2754* (QCNE), 14 Sep. 1994 (st), *Aulestia et al. 2772* (QCNE), km 52.5–52.7, 5 Sep. 1993 (st), *Dik 262* (QCNE), km 53–60, 6 Oct. 1993 (st), *Dik 595* (QCNE); Parque Nacional Yasuní, Pozo petrolero "Daimi 2," 26 May–8 June 1988 (♂), *Cerón et al. 4135* (QCNE); cantón Archidona, road Hollín–Loreto, Río Huataraco, 800–1000 m, 23–30 Aug. 1989 (st), *Cerón et al. 7485* (QCNE); Parque Nacional Yasuní, Pozo petrolero "Amo 2," 9–19 Jan. 1988 (♀ fl-fr), *Neill et al. 8335* (BG, QAME, QCNE); Reserva Floristica "El Chuncho," 5 km N of Coca, 23 May 1993 (♂), *Palacios 10791* (QCNE). **Pastaza:** Mission Shandia, Jatun Yaku River, 17 Aug. 1957 (♀ fl), *Barclay 4982* (COL). **Sucumbios:** Reserva Faunistica Cuyabeno, near Laguna Grande, 19–21 Mar. 1991 (st), *Berg s.n.* (BG). PERU. **Loreto:** prov. Requena, dtto. Sapuena, Jenaro Herrera, 1971 (st), *Flores 1a* (BG); prov. Maynas, Río Nanay, Mishana, 28 Feb. 1979 (st), *Gentry et al. 25244* (MO), 6 Jan. 1983 (st), *Gentry et al. 39201* (BG); prov. Requena, Jenaro Herrera, 23 Feb. 1987 (st), *Gentry et al. 56423* (MO), 25 Aug. 1976 (♂), *Revilla 1185* (MO).

10. Naucleopsis humilis C. C. Berg, sp. nov. TYPE: Ecuador. Pastaza: Río Curaray, near Laguna Garzayacu, 20–26 Aug. 1985 (♂), *Neill et al. 6663* (holotype, QCNE; isotypes, BG, MO, QAME). Figure 7.

Naucleopsi ulei similis, a qua differt, e.g. statura parva arborum, stipulis inflorescentiisque minoribus.

Treelet up to 3 m tall. Leafy twigs 3–5 mm thick, appressed-puberulous, periderm flaking off. Lamina coriaceous, subobovate to oblanceolate, (9.5–)20–45 × (2–)5–10 cm, apex subcaudate to acuminate, base subacute to obtuse (to rounded), margin entire; upper surface glabrous, lower surface puberulous on the base of the midrib; lateral veins ca. (15–)25–30 pairs, tertiary venation largely scalariform to largely reticulate; petiole 1–2.5 cm long, minutely puberulous; stipules 0.5–1.5 cm long, striate, yellowish appressed-puberulous, subpersistent or caducous. Staminate inflorescences on up to 0.4-cm-long spurs, ca. 0.2–0.3 cm diam.; peduncle ca. 0.2 cm long, bracteate; involucral bracts in ca. 5 series, broadly ovate to oblong, the inner ones glabrous; flowers 4–6; perianth 2–2.5 mm long, tepals 3–5, basally connate, glabrous; stamens 1 or 2, filaments 3–3.5 mm long, thick, anthers elliptic, 0.5–0.6 × 0.3–0.4 mm. Pistillate inflorescences solitary in the leaf axils, ca. 1 cm diam., sessile; involucral bracts in ca. 6 series, broadly ovate, minutely puberulous; flowers few; free parts of the tepals subulate to aculeate, 0.3–0.6 cm long, minutely puberulous; stigmas vittiform, ca. 3 mm long. Infructescences subglobose, 2–3 cm diam., at maturity yellow; free parts of the tepals 0.5–0.7 cm long; fruits 3–6, ca. 0.6–0.7 cm long.

Naucleopsis humilis is apparently an element of periodically inundated riverine forest. It is closely related to *N. ulei* (Warburg) Ducke, from which it differs in the small size of the trees, the smaller stipules, and the smaller inflorescences.

Paratypes. COLOMBIA. **Caquetá:** near Araracuara, 20 Nov. 1991 (st), *Duivenvoorden et al. 1207* (BG), 5 Dec. 1991 (st), *Duivenvoorden et al. 2319* (BG), 8 Dec. 1991 (st), *Duivenvoorden et al. 2449* (BG, MO); Río Caquetá, 1 km above the mouth of Río Caguán, 29 Apr. 1953 (♂), *Romero-Castañeda 4151* (COL), (♀ fl-fr), *Romero-Castañeda 4152* (COL). ECUADOR. **Napo:** Parque Nacional Yasuní, Lagunas de Garza Cocha, 22 Sep. 1988 (♀ fr), *Cerón et al. 5098* (AAU, MO, QAME, QCNE); Río Yasuní, 80 km upriver from Nuevo Rocafuerte, 17 Sep. 1977 (♀ fl-fr), *Foster 3714* (QAME, QCA, S). **Pastaza:** Lorocachi, 31 May 1980 (♂), *Jaramillo et al. 31580* (AAU). PERU. **Loreto:** prov. Maynas, Varadero de Mazoan, from Río Amazonas to Río Napo, 22 Aug. 1972 (♂), *Croat 19523* (MO); prov. Maynas, Caserío Mishana, 30 km SW of Iquitos, 16 Aug. 1980 (♀ fl-fr), *Foster 4341* (BG); prov. Maynas, Quebrada Yanamono, Explorama tourist camp, 5 Nov. 1979 (♀ fr), *Gentry et al. 27483* (BG, MO), 13 Nov. 1979 (st), *Gentry et al. 27962* (MO), 27 July 1980 (♂), *Gentry et al. 29149* (MO), 18 Feb. 1981 (♀ fr), *Gentry et al. 31402* (MO), 4 July 1983 (♂), *Gentry et al. 42552* (MO), 8 July 1983 (♀ fl), *Gentry et al. 42798* (BG); prov. Maynas, 1 km S of Indiana, 17 June 1987 (♂), *Gentry et al. 54637* (MO); prov. Maynas, Río Amazonas, ca. 2 km W of Indiana, Explorama Inn, 12 Feb. 1987 (♀ fr), *Gentry et al. 55731* (BG, MO), 18 Feb. 1988 (♀ fl-fr), *Gentry et al. 61645* (MO), 20 Feb. 1988 (♂), *Gentry et al. 61767* (BG, MO); prov. Maynas, Río Amazonas, near Indiana, 15 Feb. 1989 (♂), *Gentry et al. 65793* (BG, MO); prov. Maynas, Caserío Gamitana, Reserva del Río Mazán, 21 June 1990 (♂), *Grández et al. 1608* (BG, MO); prov. Maynas, Río Amazonas, Yanamono, 26 June 1984 (♀ fr), *R. Vásquez et al. 5173* (MO); prov. Maynas, Quistococha, 27 Sep. 1984 (♀ fr), *Vásquez et al. 5601* (BG, MO); prov. Maynas, Indiana, 15 May 1989 (♀ fl-fr), *Vásquez et al. 12138* (BG, MO); prov. Maynas, Santa Maria de Nanay, Quebrada Yarina, 22 May 1989 (♀ fl-fr), *Vázquez et al. 12236* (BG, MO); prov. Maynas, Indiana, 23 Mar. 1990 (♂), *Vásquez et al. 13634* (BG, MO), 11 July 1990 (st), *R. Vásquez et al. 14085* (MO).

11. Naucleopsis naga Pittier, Contr. U.S. Natl. Herb. 13: 440. 1912. TYPE: Costa Rica. Plains of Santa Clara, "La Colombiana," (♀), *Pittier* (IFCR) *13444* (holotype, US).

Two subspecies can be recognized:

11a. Naucleopsis naga Pittier subsp. **naga**

Lamina at the lower surface glabrous and the smaller veins plane; stipules up to 3.5 cm long.

Distribution. Honduras to Colombia: Antioquia, Chocó, and Valle.

11b. Naucleopsis naga Pittier subsp. **meridionalis** C. C. Berg, subsp. nov. TYPE: Colombia. Nariño: La Planada Reserve, near Ricaurte, 21 Dec. 1987 (♀ fr), *Gentry et al. 59669* (holotype, PSO; isotypes, BG, COL, MO, SI).

Pagina inferna folii puberula vel subhispidula (tum scabridula); venae parviores plus minusve prominentes; stipulae usque ad 1.5 cm longae.

Lamina at the lower surface puberulous or subhispidulous (and then scabridulous) and the smaller veins ± prominent; stipules up to 1.5 cm long.

Paratypes. COLOMBIA. **Antioquia:** mun. Frontino, cgto. Nutibarra, source of Río Cuevas, 1700–2000 m, 18 July 1987 (♀ fl-fr), *D. Sánchez et al. 1479* (MEDEL). **Nariño:** La Planada Reserve, near Ricaurte, 1800 m, 25 July 1986 (st), *Gentry et al. 55101* (BG), 15 Nov. 1987 (♀ fl-fr), *Restrepo & Mondragón 409* (MO). ECUADOR. **Carchi:** cantón Mira, El Carmen, road to Chical, 1600–1800 m, 10 Feb. 1992 (♂), *Palacios et al. 9674* (QCNE), 2000–

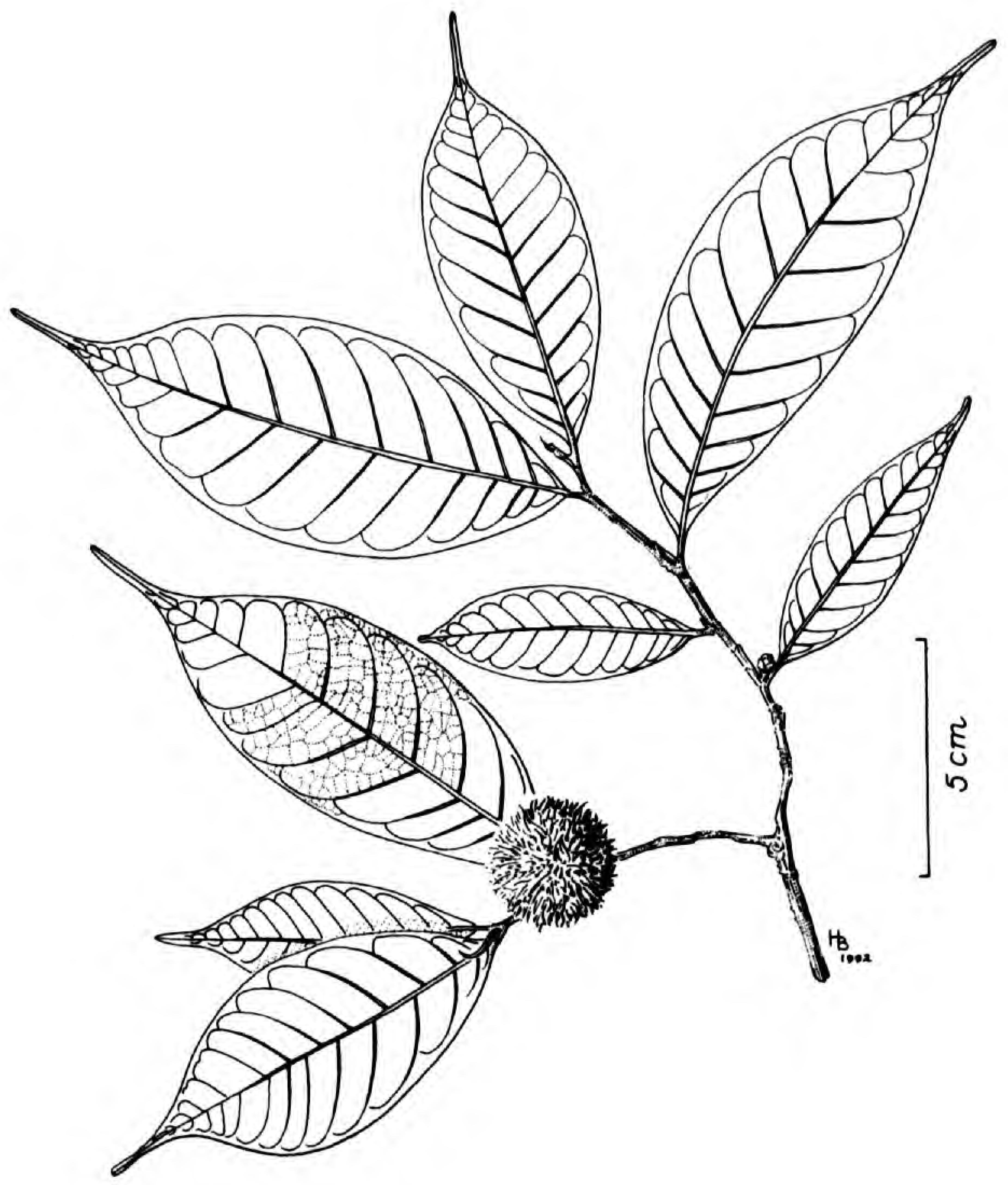


Figure 7 (left). *Naucleopsis humilis* C. C. Berg. —1. Leafy twig with pistillate inflorescence (*Gentry et al. 61645*). —2. Parts of twigs with stipules only (*Vásquez et al. 5173*). —3. Leafless twig with staminate inflorescences (*Neill et al. 6663*). —4. Staminate flower (*Neill et al. 6663*). Figure 8 (right). *Naucleopsis straminea* C. C. Berg. Leafy twig with fruiting pistillate inflorescence (*Gentry et al. 36924*).

2200 m, *Palacios et al. 9691* (QCNE). **Cotopaxi:** road Quevedo–Latacunga, 3 km E of El Palmar, 800 m, 5 Apr. 1980 (♂), *Dodson & Gentry 10240* (BG, MO, QCNE). **Esmeraldas:** Río Lita, 4.5 km WNW of Lita, 600 m, 8 May 1987 (♂), *Daly & Acevedo R. 5150* (BG, MO, NY, QCA).

The two subspecies occur sympatrically in Ecuador and Colombia. The differentiation into an entity with glabrous leaves and one with leaves being hairy beneath is similar to the situation found in *N. ulei.* However, in *N. naga* the two morphological entities are more different than in *N. ulei,* and may prove to be distinct at the species level.

12. Naucleopsis straminea C. C. Berg, sp. nov. TYPE: Colombia. Chocó: 31 km E of Quibdó, ca. 14 km E of Tutunendo, 300–450 m, 14 June 1982 (♀ fl-fr), *Gentry et al. 36924* (holotype, COL; isotypes, BG, JUAM, MO). Figure 8.

Naucleopsi krukovii affinis, a qua differt in numero parviore venarum lateralium et partibus longioribus liberalis tepalorum florum pistillorum.

Tree up to 15 m tall. Leafy twigs 1.5–2.5 mm thick, puberulous to hirtellous, periderm flaking off. Lamina elliptic to oblong to subobovate, 6–15 × 1.8–5 cm, subcoriaceous, apex (sub)caudate, base (sub)acute; both surfaces glabrous; lateral veins 8–13 pairs, tertiary venation reticulate; petiole 0.3–0.8 cm long, puberulous, epidermis ± flaking off; stipules 0.5–1 cm long, sparsely puberulous, subpersistent or caducous. Pistillate inflorescences in the leaf axils or just below the leaves, 1.2–2 cm diam., subsessile; involucre with broadly ovate to oblong bracts in ca. 5 rows, the inner ones ± scarious and subglabrous (and straw-colored when dry); flowers ca. 5–10; free parts of the tepals subulate, sparsely minutely puberulous, ca. 0.3–0.6 cm long (and straw-colored when dry); stigmas ca. 2 mm long. Infructescences subglobose, 2.5–4 cm diam.; free parts of the tepals up to 1 cm long, subulate (to aculeate).

Naucleopsis straminea is related to the Amazonian *N. krukovii* (Standley) C. C. Berg, from which it differs in the smaller number of lateral veins (8–13 vs. 15–23 pairs) and the longer and more slender free parts of the tepals of the pistillate flower (up to at least 1 cm and subulate vs. up to 0.7 cm and conical).

Paratypes. PANAMA. **Darién:** between Cana and Altos de Nique, trail Río Seteganti–Río Alto Tuira, 19 Apr. 1992 (st), *Foster 14254* (SCZ). COLOMBIA. **Antioquia:** mun. Mutatá, road to Pavarandogrande, 3 km beyond Río Sucio, 8 Dec. 1982 (♀ fr), *Bernal et al. 436* (COL); between Villa Arteaga and Chirorodó, El Tigre, 1 Oct. 1961 (♀ fl-fr), *Cuatrecasas et al. 26142* (COL).

13. Naucleopsis ulei (Warburg) Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 38. 1922. TYPE: Peru. Loreto: Iquitos, *Ule 6257* (lectotype, selected by Berg (1972), B).

Two subspecies can be recognized.

13a. Naucleopsis ulei (Warburg) Ducke subsp. **ulei**

Lamina at the lower surface glabrous (except for the minute brown or whitish pluricellular trichomes) or only hairy ar the base of the midrib; base cordate to subacute; lower lateral veins often not distinctly loop-connected, particularly if the base of the lamina is rounded to subacute.

Distribution. Upper Amazon Basin (Brazil, Ecuador, Peru, and Bolivia).

This taxon may include *Naucleopsis amara* Ducke (recognized as a distinct species by Berg (1972)) and may represent a form from the Lower and Middle Amazon Basin with relatively small leaves (mostly up to 30 cm long) and often with a rounded to subacute base. This form gradually passes into the more typical form from the Upper Amazon Basin with larger leaves (mostly up to 50 cm long) and often with a rounded to cordate base.

13b. Naucleopsis ulei (Warburg) Ducke subsp. **puberula** C. C. Berg, subsp. nov. TYPE: Panama. Panamá: Cordillera de San Blas, ca. 20 km NE of Chepo, 12 Dec. 1973 (♀ fl), *Berg & Nee 313* (holotype, MO; isotypes, AAU, BG).

Pagina inferna folii veneris puberulis vel hispidulis (tum scabridulis); basis cordata vel rotundata; venae laterales infernae distincte brochidodromae.

Lamina at the lower surface (sparsely) puberulous or subhispidulous (and then scabridulous) on the veins; base cordate to rounded (to obtuse); lower lateral veins distinctly loop-connected.

Paratypes. COSTA RICA. **Limón:** Reserva Indígena Talamanca, road Amburi–Cachabri, 27 June 1989 (♀ fl), *Chacón 8* (BG). **Puntarenas:** Reserva Forestal Golfo Dulce, Osa Península, 15 km W of Rincón, 3 June 1988 (♀ fl-fr), *Hammel et al. 16990* (MO); Parque Nacional Corcovado, Gira de Corcovado, Arco de Piedras-Río Corcovado, 16 June 1989 (♀ fl-fr), *Kernan 1150* (BG). PANAMA. **Coclé:** 9.4 km above El Cope, 20 Jan. 1978 (st), *Croat 44752* (MO). **Colón:** Santa Rita Ridge road, between Transisthmian Hwy. and Agua Clara, 11 Dec. 1973 (♂), *Berg & Nee 301* (AAU, BG), *Berg & Dressler 307* (BG, MO, NY); Santa Rita East Ridge, 23 Mar. 1968 (♀ fl), *Correa & Dressler 891* (MO); Santa Rita Ridge, 20.7 km from Transisthmian Hwy., 22 Mar. 1992 (st), *Foster 14079* (SCZ); Santa Rita Ridge road, 4 mi. from Transisthmian Hwy., 11 Dec. 1973 (♂), *Gentry et al. 8825* (MO);

Santa Rita Ridge, 11 Jan. 1987 (♀ fl), *McPherson 10262* (MO). **Panamá:** Cerro Jefe, Altos de Pacora, 18.2 km E of Cerro Azul (village), 5 Jan. 1975 (♀ fl), *Gentry & Mori 13416* (MO); 10 km NE of Altos de Pacora, 6 Mar. 1975 (♀ fl-fr), *Mori & Kallunki 4946* (MO). **San Blas:** Cangandi, 16 Dec. 1985, *de Nevers et al. 6516* (MO). COLOMBIA. **Antioquia:** near Villa Arteaga, 6 Dec. 1948 (♀ fl-fr), *F. López et al. 31* (MEDEL); mun. Zaragoza, cgto. Providencia, 11 Feb. 1971 (♀ fl), *Soejarto et al. 2760* (COL). **Chocó:** mun. Riosucio, Urabá region, Cerros del Cuchillo, 13 Aug. 1987 (♀ fr), *Cárdenas 286* (JUAM, MO), 11 Sep. 1987 (♀ fl-fr), *Cárdenas 445* (JUAM), 16 Nov. 1987 (st), *Cárdenas 867* (JUAM, MO), 15 Jan. 1988 (♀ fr), *Cárdenas 1032* (JUAM, MO), 23 Mar. 1988 (♀ fl), *Cárdenas 1459* (JUAM, MO), 30 June 1988 (♀ fl-fr), *Cárdenas 2287* (JUAM); rd. Quibdó–Tutunendo, 3 km W of Tutunendo, 8 Jan. 1981 (st), *Gentry et al. 30334* (JUAM); Río Mecana, ca. 10 km E of Mecana, 7 Mar. 1983 (♀ fl), *Gentry & Juncosa 41060* (BG, COL, JUAM, MO). **Cordoba:** junction of Río Tigre and Río Manos, 28 July 1988 (st), *Gentry & Cuadros V. 63892* (MO). **Nariño:** near Tumaco, Río Rosario, 5 km above Santa María, 21 June 1955 (♀ fl), *Romero-Castañeda 5194* (COL). ECUADOR. **Esmeraldas:** cantón San Lorenzo, Reserva Etnica Awá, Centro Guadualito, 20–29 July 1992 (♀ fl-fr), *Aulestia et al. 43* (QCNE); cantón San Lorenzo, Reserva Etnica Awá, Ricaurte, Centro Pambilar, 21 Jan. 1993 (♀ fl-fr), *Aulestia et al. 1009* (QCNE); Mataje, 6 Sep. 1991 (♂), *Jaramillo et al. 13819* (QCA); Eloy Alfaro, Charco Vicente, Río San Miguel de Cayapas, 20–27 Mar. 1993 (♀ fl-fr), *Mendéz et al. 157* (QCNE); cantón Eloy Alfaro, San Miguel, Río Cayapas, 3–5 Sep. 1993 (st), *Palacios et al. 11145* (QCNE); cantón Eloy Alfaro, Reserva Ecológica Cotacachi-Cayapas, Charco Vicente, Río San Miguel, 20–31 Sep. 1993 (♀ fl), *Tirado et al. 450* (QCNE); cantón Eloy Alfaro, Reserva Ecológica Cotacachi-Cayapas, Luis Vargas Torres, 23–27 Oct. 1993 (♀ fl-fr), *Tirado et al. 514* (QCNE).

14. **Naucleopsis velutina** C. C. Berg, sp. nov. TYPE: Peru. Loreto: prov. Maynas, Iquitos, Allpahuayo, Estación Experimental de IIAP, 23 Aug. 1990 (♂), *R. Vásquez et al. 14263* (holotype, MO).

Naucleopsi macrophyllae et *N. ripariae* affinis, divergens ab utraque stipulis petiolisque brevibus; inflorescentiis pistillatis partibus liberis tepalorum dispersis.

Tree up to 25 m tall. Leafy twigs 3–4 mm thick, brown (sub)velutinous. Lamina coriaceous, oblong, 22–40 × 8–14 cm, apex acuminate, base obtuse to rounded; upper surface sparsely puberulous on the midrib, lower surface brownish (sub)velutinous on the veins; lateral veins 18–26 pairs, tertiary venation largely scalariform; petiole 0.5–1 cm long, brown velutinous; stipules 0.5–1 cm long, densely brownish to whitish hirtellous to subvelutinous. Staminate inflorescences 2–5 together in the leaf axils and below the leaves, 0.8–1.3 cm diam.; peduncle 0.3–0.5 cm long, bracteate; involucral bracts in ca. 7 series, broadly ovate to semicircular, densely yellowish to brownish puberulous to subvelutinous; perianth ca. 2.5–3 mm long, tepals 4–6, basally connate (or free), ± densely yellow hairy. Infructescences 6–8 cm diam., (sub)sessile; involucral bracts in 6–8 series, ovate to lanceolate, yellow strigose to subsericeous, the inner ones up to 2 cm long; flowers/fruits numerous; free parts of the tepals dispersed, aculeate, yellow strigose to subsericeous; style ca. 4 mm long, stigmas 2–3 mm long, long-tongue-shaped.

Naucleopsis velutina is related to *N. macrophylla* Miquel and *N. riparia* C. C. Berg. It differs from both in the short stipules and petioles. The pistillate inflorescences are clearly different in the absence of distinct perianths, the slender aculeate, yellow subsericeous, loosely arranged free parts of the tepals, and the short stigmas.

Paratype. PERU. **Loreto:** prov Maynas, Quebrada Yanomono, Río Amazonas, above mouth of Río Napo, 5 Nov. 1979 (♀ fr), *Gentry et al. 27466* (BG, MO).

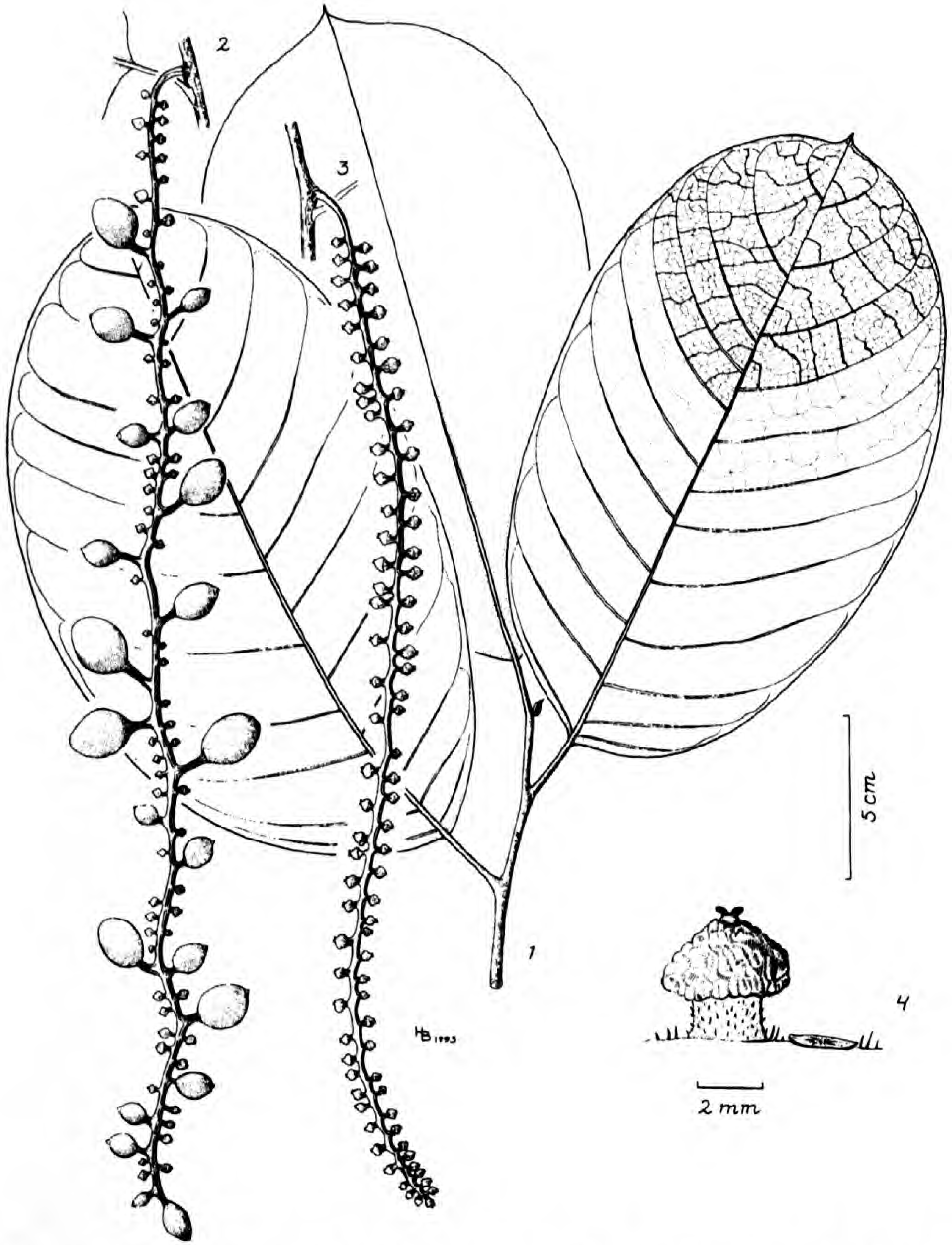
15. **Pseudolmedia glabrata** (Liebmann) C. C. Berg, comb. nov. Basionym: *Trophis glabrata* Liebmann, Kongel. Danske Vidensk. Selsk. Naturvidensk. Math. Afh., Ser. 5, 2: 314. 1851. TYPE: Mexico. Palenque: near Misantla, Mar. 1841, *Liebmann 14274* (lectotype, designated here, C).

The description of *Trophis glabrata* is based on two sterile collections (*Liebmann 14274* and *14276*), both belonging to the *Pseudolmedia* species treated as *Pseudolmedia oxyphyllaria* Donnell Smith in Berg (1972: 31).

16. **Sorocea jaramilloi** C. C. Berg, sp. nov. TYPE: Ecuador. Pichincha: road Quito–Puerto Quito, km 113, 10 km N of road, Reserva Forestal ENDESA, 22 Aug. 1984 (♀ fl-fr), *Jaramillo 7055* (holotype, QCA; isotypes, AAU, GB, MO, QCA). Figure 9.

Laminis grandibus, inaequilateralibus et inflorescentiis pistillatis longis distincta.

Tree up to 20 m tall. Leafy twigs 2–5 m thick, minutely puberulous, the older parts conspicuously lenticellate. Lamina elliptic, (5–)10–35 × (3–)7–17 cm, ± inequilateral, (sub)coriaceous, apex ± abruptly acuminate, base rounded to obtuse at the broad side, acute to obtuse at the narrow side, margin entire; upper surface minutely puberulous, ± densely so on the main veins, lower surface minutely puberulous on the (main) veins; lateral veins 8–10 pairs, tertiary venation reticulate or partly scalariform; petiole (1.5–)2.5–3.5(–5) cm long, minutely puberulous; stipules 0.3–0.8 cm long, puberulous. Staminate inflorescences in the leaf axils,



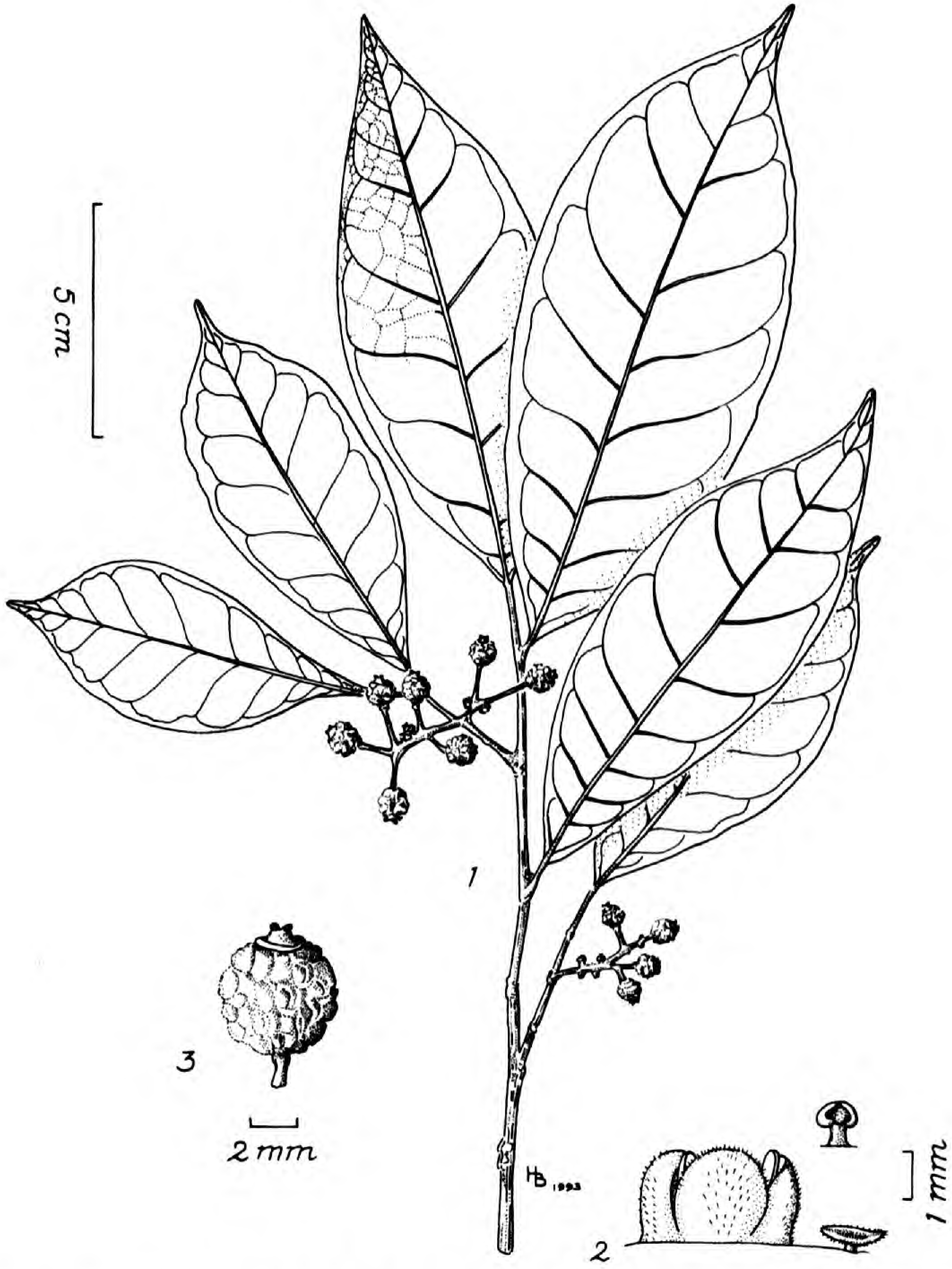


Figure 9 (left). *Sorocea jaramilloi* C. C. Berg. —1. Leafy twig (*Jaramillo 7055*). —2. Pistillate inflorescence (*Jaramillo 7055*). —3. Pistillate inflorescence (*Jaramillo 6791*). —4. Pistillate flower and bract (*Jaramillo 7055*). Figure 10 (right). *Sorocea ruminata* C. C. Berg. —1. Leafy twig with pistillate inflorescences (*Herrera et al. 975*). —2. Staminate flower, stamen, and bract (*Gentry 6554*). —3. Fruiting pistillate flower (*Herrera et al. 975*).

pendulous, ca. 15–45 cm long, including a 0.5–1.8-cm-long, sparsely puberulous peduncle; rachis sparsely puberulous; flowers ± spaced, broadly sessile; perianth 4-parted, 2.5–3 mm high, sparsely ciliolate; stamens 4, isomorphic or anisomorphic, at anthesis straight or slightly incurved, filaments 0.2–0.6 mm long, anthers 0.8–1.2 × 0.7–1.2 mm, connective broad, not apiculate. Pistillate inflorescences in the leaf axils or below the leaves, pendulous, ca. 6–17 cm, in fruit up to 40 cm long; peduncle 0.5–3 cm long, minutely puberulous; rachis minutely yellowish puberulous; flowers ca. 20–60; pedicel 0.1–0.2 cm, in fruit up to 1.5 cm long, yellowish puberulous; perianth 2–2.5 mm high, minutely puberulous, in the upper part ± ruminate; stigmas ovate, ca. 0.5 mm long. Fruiting perianth ellipsoid to globose, 2–2.5 cm long, black.

Paratypes. COLOMBIA. **Valle:** ca. 16 km NW of Buenaventura, 28 May 1987 (st), *Faber-Langendoen et al. 751* (BG); mun. Buenaventura, Bajo Anchicayá, 19 Oct. 1989 (st), *Gentry et al. 68492* (COL). ECUADOR. **Carchi:** Gualpí Alto, 18–25 May 1985 (♂), *Thomsen 58829* (QCA, QCNE); cantón Tulcan, Reserva Indígena Awá, Gualpí Medio, 23–27 May 1992 (♀ fl-fr), *Tipaz et al. 1041* (QCNE), (♂), *Tipaz et al. 1044* (QCNE). **Esmeraldas:** cantón Eloy Alfaro, Reserva Ecológica Cotacachi-Cajapas, Charco Vicente, Río San Miguel, 20–27 Mar. 1993 (st), *Méndez et al. 116* (QCNE), 6–9 Sep. 1993 (♀ fr), *Palacios et al. 11356* (QCNE); Alto Tambo, 13 May 1992 (♀ fl-fr), *Quelal et al. 521* (QCNE). **Los Ríos/Pichincha:** El Centinela, Montañas de Ila, road Patricia Pilar–24 Mayo, km 12, 6 Apr. 1980 (♂), *Dodson et al. 10278* (MO), 23 May 1983 (st), *Dodson et al. 13806* (MO). **Pichincha:** road Quito–Puerto Quito, km 113, 10 km N of road, Reserva Forestal ENDESA, Río Silanchi, 26 May 1984 (♀ fl-fr), *Jaramillo 6597* (QCA, mixed with *Naucleopsis chiguila* Benoist), 10 July 1984 (♀ fl-fr), *Jaramillo 6791* (AAU, GB, MO, NY, QCA).

17. **Sorocea pubivena** Hemsley, Biol. Centr. Amer. Bot. 3: 150. 1883. TYPE: "Guatemala," (♀), *Friedrichsthal s.n.* (holotype, K).

Some species of *Sorocea* (*S. cufodontisii* W. Burger, *S. faustiana* Cuatrecasas, *S. hirtella* Mildbraed, and *S. pubivena* Hemsley) that have been treated as distinct previously (Berg & Akkermans, 1985), have proven to belong to a single taxonomical entity with at least three subdivisions.

17a. **Sorocea pubivena** Hemsley subsp. **pubivena**

Sorocea cufodontisii W. Burger, Acta Bot. Neerl. 11: 447. 1962, as *S. cufodontii.* Syn. nov. TYPE: Costa Rica. Puntarenas: Puerto Jiménez, 4 Apr. 1930 (♂), *Cufodontis 200* (holotype, F).

Leafy twigs puberulous to hirtellous. Lamina subcoriaceous to chartaceous, margin ± distinctly dentate to denticulate or (especially if the lower lamina surface is sparsely puberulous) entire; upper surface minutely puberulous on the midrib, lower surface hirtellous or densely to sparsely patent-puberulous. Pistillate inflorescences in fruit up to 20 cm long; flowers ca. 15–60(–100). Fruiting perianth ellipsoid to (sub)ovoid to subglobose, 1–1.4 × 0.8–1.2 cm, (partly) ± densely puberulous, distinctly pedicellate.

Distribution. Nicaragua to western Panama.

17b. **Sorocea pubivena** Hemsley subsp. **oligotricha** (Akkermans & C. C. Berg) C. C. Berg, comb. nov. Basionym: *Sorocea hirtella* Mildbraed subsp. *oligotricha* Akkermans & C. C. Berg, Proc. Kon. Ned. Akad. Wetensch., C, Biol. 88: 383. 1985. TYPE: Brazil. Amazonas: mun. São Paulo de Olivença, Palmares, 11 Sep.–26 Oct. 1936 (♀ fl-fr), *Krukoff 8157* (holotype, U; isotypes, BM, F, G, GH, K, LE, MICH, MO, NY, US).

Sorocea faustiana Cuatrecasas, Ciencia (Mexico) 24(5/6): 185. 1966. Syn. nov. TYPE: Colombia. Valle: Río Anchicayá, El Prado, 4 Aug. 1943 (♀ fl-fr), *Cuatrecasas 14836* (holotype, F).

Leafy twigs sparsely appressed- (to patent-)puberulous. Lamina subcoriaceous to coriaceous, margin usually entire; upper surface minutely puberulous on the midrib or entirely glabrous, lower surface sparsely appressed- (or patent-)puberulous on the main veins. Pistillate inflorescence in fruit up to 10 cm long; flowers ca. 5–25; fruiting perianth (sub)globose, 1–2.5 × 1–2 cm, subglabrous, mostly distinctly pedicellate.

Distribution. Upper Amazon Basin, Guyana, eastern and northern Venezuela, northern and western Colombia, eastern Panama, and northwestern Ecuador.

The material from Guyana, eastern Venezuela, and the adjacent parts of Brazil has laminas completely glabrous above. The fruiting perianth tends to be somewhat smaller than elsewhere in the range of distribution.

17c. **Sorocea pubivena** Hemsley subsp. **hirtella** (Mildbraed) C. C. Berg, comb. et stat. nov. Basionym: *Sorocea hirtella* Mildbraed, Notizbl. Bot. Gart. Berlin-Dahlem 10: 183. 1927. TYPE: Peru. Loreto: Pongo de Manseriche, (♂), *Tessmann 4016* (holotype, B; isotypes, F, G, NY, US).

Sorocea opima Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. 11: 64. 1931. TYPE: Peru. Loreto: Caballo–Cocha, Aug. 1929 (♀ fr), *Ll. Williams 2337* (holotype, F; isotype, US).

Leafy twigs whitish to brownish subhirsute to hirtellous. Lamina chartaceous to subcoriaceous (or coriaceous), margin entire (or obscurely) dentate to denticulate; upper surface minutely puberulous on the midrib; lower surface (rather) densely hirtellous to puberulous on the veins or at least on the midrib; lateral veins often connected with a slightly arcuate submarginal vein. Pistillate inflorescences in fruit up to 10 cm long; flowers 3–15(–25). Fruiting perianth usually subglobose, sometimes ovoid, subcylindrical or oblate, 1–2(–2.5) × 1–2(–2.5) cm, puberulous to hirtellous, sometimes subsessile.

Distribution. Upper Amazon Basin: Peru, Ecuador, Colombia, Venezuela, and adjacent parts of Amazonian Brazil.

Taking into account the total morphological variation within subspecies *hirtella* and subspecies *oligotricha*, the differences between the two taxa seem to be quite small. It is, therefore, noteworthy that in a locality in Ecuador (Río Cuyabeno, Laguna Grande) the two taxa occurred side by side and were in flower simultaneously, yet intermediates were lacking. Another difference between the two taxa in that locality could be that the subspecies *hirtella* starts flowering earlier, as much smaller trees, than subspecies *oligotricha.* Whether this species-like behavior can also be found in other regions where the ranges of the two taxa overlap is not known, nor whether this might represent a case (in Moraceae and other families) in which (infraspecific) entities are morphologically clearly distinct in one area, but intergrade in another.

18. Sorocea ruminata C. C. Berg, sp. nov. TYPE: Panama. Darién: Parque Nacional Darién, between Campamento Casa Vieja and Cerro Sapo, 22 May 1991 (♀ fl-fr), *Herrera et al. 975* (holotype, MO; isotypes, BG, BM, CR, MEXU, PMA). Figure 10.

Soroceae affini affinis, a qua differt, e.g. marginibus folii semper integris, floribus sessilibus sub anthesi et perianthio statu fructifero ruminato glabratoque.

Shrubs or trees up to 12(–20) m tall. Leafy twigs 1–2.5 mm thick, sparsely minutely puberulous. Lamina oblong to elliptic (to lanceolate), 3.5–17 × 1.5–6.5 cm, broadest at or above the middle, ± inequilateral, coriaceous, apex acuminate, base acute to rounded, margin entire; upper surface minutely puberulous on midrib, lower surface sparsely, minutely puberulous on the (base of the) midrib; venation (almost) plane above, prominent beneath; lateral veins 8–12 pairs, tertiary venation reticulate (or tending to scalariform); petiole 0.3–0.8 cm long, 1–2 mm thick, (minutely) puberulous; stipules 0.3–0.5 mm long, (minutely) puberulous, caducous. Staminate inflorescences patent (?), 0.8–4.5 cm long, including the 0.1–0.2-cm-long, puberulous peduncle; flowers rather crowded to disperse, narrowly to broadly sessile; perianth 4-parted, 1–1.5 mm high, ciliolate, outside sparsely minutely puberulous; stamens (3–)4, straight, isomorphic, filaments 0.5–1.2 mm long, anthers ca. 0.3–0.7 × 0.4–0.7 mm, connective broad, apiculate. Pistillate inflorescences patent (?), 0.5–3 cm, in fruit up to 5 cm long, including the 0.1–0.8-cm-long, puberulous peduncle; rachis sparsely, minutely puberulous; flowers 3–12, (sub)sessile, in fruit up to 1 cm long, pedicellate, pedicel (very) sparsely hispidulous to minutely puberulous; perianth ca. 2 mm high, glabrous, the upper part hemispherical to broadly ovoid; stigmas tongue-shaped, ca. 1 mm long, coarsely papillate. Fruiting perianth subglobose, ca. 1–1.5 × 1–1.5 cm, with the apical part ± discoid and the lower part with a ruminate, almost glabrous surface.

Sorocea ruminata differs from *S. affinis* Hemsley in the consistently entire leaf margins, the flowers being sessile at anthesis, and the ruminate and glabrous fruiting perianth. The inflorescences are more compact and the lamina more coriaceous than in *S. affinis.* The fruiting perianth is sometimes covered by white mycelium, as found in several other *Sorocea* species.

Most of the material referred to this new species has been initially identified (Berg & Akkermans, 1985) as *S. faustiana* Cuatrecasas, which proved to be a synonym of *Sorocea pubivena* subsp. *oligotricha* (Akkermans & C. C. Berg) C. C. Berg (see above).

Paratypes. PANAMA. **Canal Zone:** Barro Colorado Island, 1960 (♂), *Ebinger 161* (MO). **Coclé:** road to Celesito, 12 mi. from Llano Grande, 16 Dec. 1983 (♂), *Churchill et al. 4117* (MO). **Colón:** Santa Rita Ridge road, between Transisthmian Hwy. and Agua Clara, 11 Dec. 1973 (st), *Berg et al. 302* (U) and *309* (BG, U); Santa Rita Ridge, E of Transisthmian Hwy., 16 Dec. 1972 (♂), *Gentry 6554* (NY); Santa Rita Ridge, E of Panamá–Colón Hwy., 13 May 1986 (♀ fl-fr), *McPherson 9166* (BG, MO). **Darién:** Cerro Pirre, 4 Aug. 1967 (♀ fr), *Bristan 1231* (MO, US); Manene, mouth of Río Cuasi, 28 Apr. 1968 (♀ fl), *Kirkbride et al. 1393* (MO, NY); Cerro Pirre, above Renare camp, 28 July 1988 (♀ fl-fr), *McPherson 12640* (BG, BM); Río Tuquesa, lower Tuquesa mining camp "Charco Chiva," 5 July 1975 (♀ fl-fr), *Mori 6984* (BG, MO, U); Río Tuquesa, middle Tuquesa mining camp "Charco Peje," 8 July 1975 (♀ fr), *Mori 7033* (MO, PMA); near Cana, 23 June 1959 (♀ fr), *Stern et al. 662* (MO, US). **Panamá:** ca. 20 km NE of Chepo, 12 Dec. 1973 (st), *Berg et al. 336* (BG, U); El Llano–Carti road, km 8.7, 3 Sep. 1977 (st), *Berg et al. 403* (BG) and *405* (BG); Cerro Campana, 22 June 1972 (♂), *Croat 17191* (MO); Cerro Jefe, La

Eneida, 25 Mar. 1968 (♀ fl), *Dressler 3461* (MO); El Llano–Carti road, km 12–16, 5 May 1973 (♀ fl-fr), *Kennedy et al. 3158* (MO, NY); foothills of Serranía de Majé, Río Piratí, 16 May 1982 (st), *Knapp et al. 5142* (MO); El Llano–Carti road, 8.2 mi. from Pan-American Hwy., 6 Jan. 1982 (♀ fr), *Knapp 5902* (MO, PMA, U); Cerro Jefe, road Alto Pacora–Cerro Brewster, km 4.5–5, 19 June 1988 (♀ fl-fr), *McPherson 12597* (BG, MO). **San Blas:** Cangandí, 19 May 1985 (♀ fl-fr), *de Nevers et al. 5772* (BG, MO, NY, PMA), 27 Mar. 1986 (st), *de Nevers et al. 7455* (MO) and *7527* (MO, PMA). COLOMBIA. **Chocó:** mun. Riosucio, Urabá region, Cerros del Cuchillo, 19 Apr. 1988 (♂), *Cárdenas 1727* (JAUM), 20 May 1989 (♀ fl-fr), *Cárdenas 2008* (JUAM), 24 June 1988 (♀ fl-fr), *Cárdenas 2121* (JAUM); trail Alto Curiche–Camp Curiche, E of Boca Curiche, 20 May 1967 (♀ fl-fr), *Duke et al. 11301* (NY, US); Upper Río Baudó, Resguardo Indígena Emberá, Quebrada de Condoto, 3 June 1985 (st), *La Rotta et al. 680* (COL).

19. Sorocea sprucei (Baillon) Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. 11: 16. 1931. TYPE: Peru. San Martín: near Tarapoto, (♀), *Spruce 4483* (holotype, P; isotypes, B, BM, C, F, G, K, LE, NY).

In addition to the typical subspecies, ranging from Venezuela to northern Brazil and Colombia and occurring disjunctly in Peru (San Martín), and subspecies *saxicola* (Hassler) C. C. Berg, ranging from Bolivia to Argentina (cf. Berg & Akkermans, 1985), a third subspecies from drier parts of western Ecuador and the adjacent part of Peru, can be recognized.

19a. Sorocea sprucei (Baillon) Macbride subsp. **subumbellata** C. C. Berg, subsp. nov. TYPE: Ecuador. Guayas: road Guayaquil–Nobol, km 14, 21 Jan. 1985 (♀ fl-fr), *Harling et al. 21069* (holotype, GB; isotypes, BG, QCA).

Inflorescentiis pistillatis subumbellatis cum pedicellis in fructu usque ad 3.5 cm longis distincta.

Shrub or treelet up to 8 m tall, sometimes lianescent. Lamina oblong to elliptic to (sub)obovate, 3–11 × 1.5–5.5 cm, apex acuminate to subacute, base rounded (to obtuse), margin faintly to distinctly (serrate-)dentate; venation ± impressed above, prominent beneath. Pistillate inflorescences subumbellate; peduncle 0.3–1, in fruit up to 3.5 cm long; flowers 3–12(–18); pedicels 1–1.8 cm, in fruit up to 3.5 cm long; pedicels and immature fruiting perianths (brownish) red.

An illustration of a leafy twig with pistillate inflorescences can be found in Berg and Akkermans (1985: 388, fig. 4, 2). Staminate material of this taxon has not yet been collected.

Paratypes. ECUADOR. **El Oro:** Santa Rosa, 17 Mar. 1955 (♀ fl-fr), *Asplund 15775* (S); 60 km SE of Arenillas, on road to Loja, ca. 400 m, 13 Nov. 1982 (♀ fl-fr), *Pennington et al. 10720* (QCA, QCNE, U); cantón Arenillas, road Arenillas–Piedras, 16 Feb. 1976 (♀ fl-fr), *Plowman 5471* (GH, S, U); road Guayaquil–Salinas, km 7, 18 Mar. 1980 (♀ fl-fr), *Dodson et al. 9601* (F, MO, U). **Guayas:** Chongón, 4 Feb. 1955 (♀ fl-fr), *Asplund 15330* (S); Cerro Azul, W of Guayaquil, 8 Feb. 1955 (♀ fl-fr), *Asplund 15361* (S), 10 Feb. 1955 (♀ fl-fr), *Asplund 15389* (S); road Guayaquil–Daule, km 21, Capeira, 23 Sep. 1981 (st), *Dodson et al. 11454* (F). **Loja:** Puento Chico, 12 km N of Alamor, 760 m, 9 Aug. 1975 (st), *Samaniego et al. 50* (LOJA, QAME, US). PERU. **Tumbes:** prov. Tumbes, Pampas de Hospital, El Caucho, 22 Jan. 1989 (♀ fl), *Díaz et al. 3224* (BG, MO).

CECROPIACEAE

1. Cecropia annulata C. C. Berg & P. Franco, sp. nov. TYPE: Bolivia. La Paz: near Sapecho, 1 Mar. 1994 (♀ fl-fr), *Berg 1704* (holotype, LPB; isotypes, BG, COL, MO, NY).

Cecropiae englerianae et *C. polystachyae* similis; a *C. engleriana* e.g. stigmatibus comosis vel subpeltatis, a *C. polystachya* e.g. venis lateralis marginalis brochidodromis differt.

Tree up to 25 m tall; trunk with prominent (annular) scars of the stipules. Leafy twigs 2–4.5 cm thick, (dark) green, hispidulous with curved to uncinate hairs. Lamina subcoriaceous to coriaceous, ca. 30 × 30–75 × 75 cm, segments 8–10, free parts of the upper segments obovate to elliptic, the upper ones sometimes slightly lobate, incisions $^{6}/_{10}$–$^{8}/_{10}$(–$^{9}/_{10}$) the distance to the petiole, apices obtuse; upper surface smooth to scabridulous, sparsely to rather densely minutely puberulous to strigillose on the (main) veins, initially sparse arachnoid indumentum, lower surface sparsely puberulous to strigillose with straight or uncinate hairs on the (main) veins, arachnoid indumentum (almost) confined to the areoles or almost absent; lateral veins 11–16 (–20) pairs, marginally loop-connected, the lower ones branched; petiole ca. 25–70 cm long, sparsely (minutely) puberulous and also with sparse arachnoid indumentum; trichilia fused, the brown indumentum intermixed with (rather) short white hairs; stipules 12–20(–28) cm long, orange-red to pinkish or partly whitish, caducous, outside (appressed-)puberulous to hirtellous, or on the ribs to subhirsute, also with dense arachnoid indumentum and rather dense brown pluricellular hairs, inside ± densely hairy. Staminate inflorescences solitary or in pairs, peduncle patent, spikes ± spreading to pendulous; peduncle 9–13 cm long, with sparse arachnoid indumentum and brown pluricellular hairs; spathe 12–15 cm long, white, outside with dense arachnoid indumentum and sparse brown pluricellular hairs, inside glabrous or sparsely hairy; spikes ca. 10–25, 6–17 × ca. 0.3 cm (yellow to pale orange), stipes 0.8–1.3 cm long, sparsely puberulous in the upper part; rachis hairy; perianth tubular, 1–1.5 mm long, glabrous; anthers ca. 0.5 mm long, detached at anthesis. Pistillate inflorescences solitary or in pairs, pendulous; peduncle 9.5–19 cm long, sparsely puberulous to hirtellous (to subhispid); spathe not seen; spikes 4–5(–6), 9–17 × (0.5–)0.7–0.8 cm, sessile or with up to 0.5-cm-long, minutely puberulous stipes; rachis hairy; perianth 1.5–2 mm long, apex convex, punctate to muriculate, arachnoid hairs below the apex or also on the margin of the apex; stigma comose to subpeltate. Fruit ellipsoid, ca. 1.8 mm long, smooth.

Cecropia annulata is apparently closely related to *C. polystachya* Trécul. It differs from the latter in the marginally loop-connected lateral veins in the free part of the midsegment, in the (very) sparse arachnoid indumentum on the petiole, in the short or rather short white (unicellular) hairs in the trichilia, and in the midsegment being not (or rarely slightly) lobate. However, *C. annulata* also resembles *C. engleriana* Snethlage, from which it differs in the less deeply incised lamina, in the smaller number of lateral veins in the free part of the midsegment, and in the non-peltate stigmas. The characters of this species look like a mixture of the two species named above and could indicate an origin by hybridization. The species is relatively rare in secondary growth. In the field it can be easily recognized by the orange to pinkish young leaves.

Paratypes. BOLIVIA. **Beni:** prov. Ballivián, Serranía del Pilón, 8–10 km from, Yucumo, 19 May 1989 (♀ fl-fr), *D. N. Smith et al. 13264* (BG, LPB). **La Paz:** prov. Sud Yungas, near Sapecho, 26–28 Feb. 1994 (st), *Berg 1698A* (BG), (♂), *Berg 1699* (AAU, BG, LPB, MO), (♂), *Berg 1701* (BG, COL, LPB); near Tucupi (= Tullupi), ca. 30 km SE of Palos Blanco, near Río Beni, 5 Mar. 1994 (♀), *Berg 1717* (AAU, BG, LPB, MO, NY).

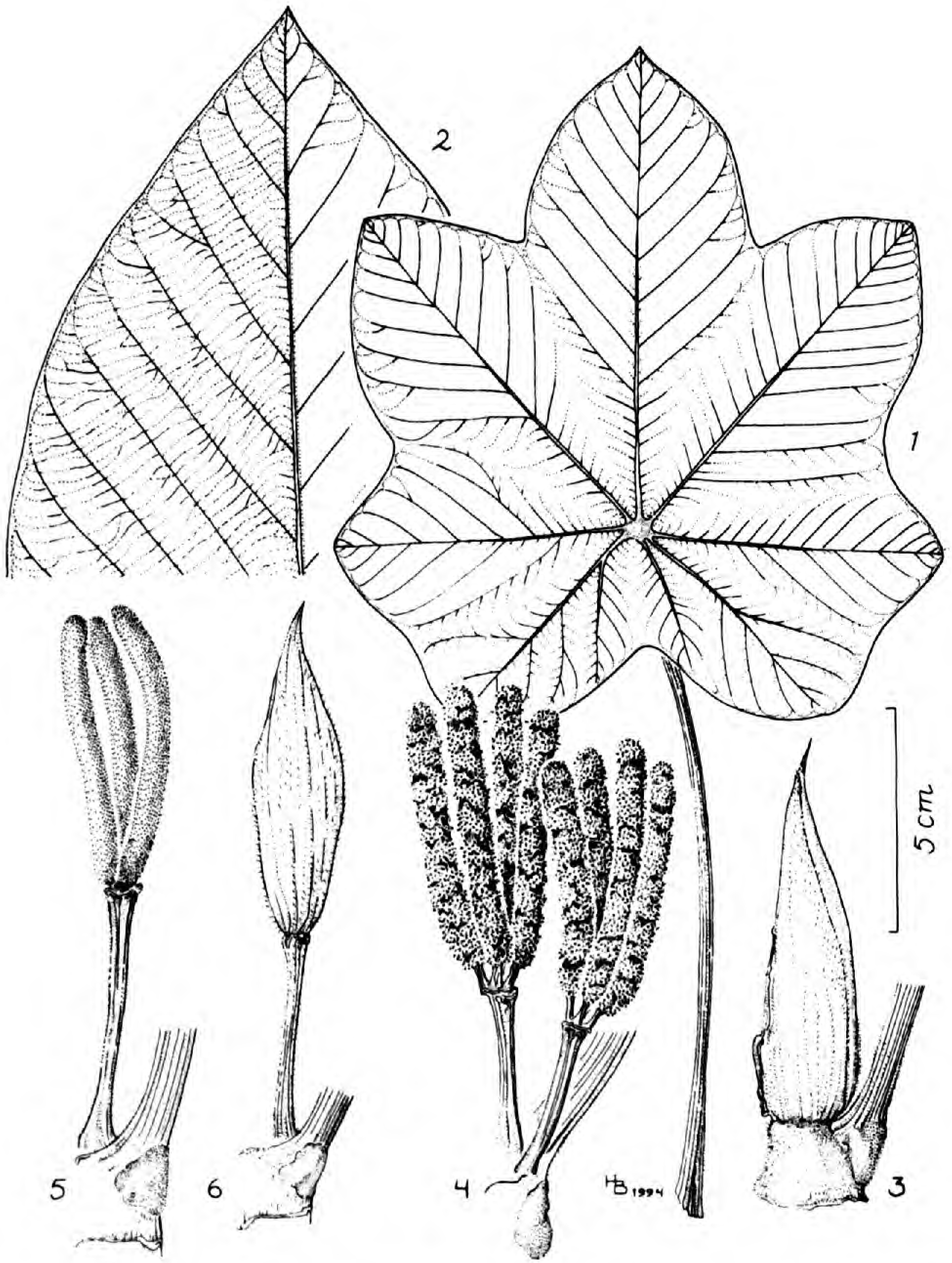
2. Cecropia heterochroma C. C. Berg & P. Franco, sp. nov. TYPE: Panama. Veraguas: road Escuela Agricola Alto Piedra–Río Dos Bocas, km 10, 26 July 1974 (♀ fl), *Croat 25880* (holotype, MO; isotype, BG). Figure 11.

Lamina cum incisuris paucis subtus indumento arachnoideo sparsissimo. Inflorescencentiae pistillatae patentis 2–4 spicis, 3–10 cm longis.

Tree up to 8 m tall. Leafy twigs 2–5 cm thick, green or purplish, densely hirtellous with uncinate hairs. Lamina chartaceous, ca. 35 × 35–75 × 75 cm, green or purplish beneath, segments 6–8, incisions $^{3}/_{10}$–$^{5}/_{10}$ the distance to the petiole, apices subacuminate to rounded; upper surface minutely hispidulous, scabridulous, lower surface minutely puberulous with curved hairs on the veins, arachnoid indumentum very sparse, soon disappearing; lateral veins in the free part of the midsegment ca. 10–12 pairs, submarginally loop-connected, some of them branched; petiole 30–55 cm long, green or purplish, puberulous, partly hirtellous to subhispid with uncinate hairs; trichilia fused, brown indumentum intermixed with short white hairs; stipules 5–10 cm long, green or reddish, outside subhirtellous to subhispid with uncinate hairs, inside glabrous. Staminate inflorescences in pairs, patent; peduncle 3–6.5 cm long, reddish or purplish, hirtellous to subhirsute to subhispid; spathe 8–14 cm long, reddish, purplish, or greenish, outside sparsely hirtellous and often with dense brown pluricellular trichomes, inside glabrous; spikes 4–5, 3–6.5 × 0.3–0.4 cm, stipes up to 0.5 cm long; rachis glabrous; perianth 1.5–2 mm long, glabrous; anthers 0.6–0.8 mm long, oblong to lanceolate in outline, not detached at anthesis. Pistillate inflorescences solitary, patent; peduncle 8–12 cm, red to purplish, puberulous to hirtellous; spathe ca. 10–15 cm, color and indumentum as in the staminate ones; spikes (1–)2–4, 3–10 × 0.4–0.6 cm, in fruit up to 15 × ca. 1 cm, (sub)sessile; rachis glabrous; perianth 1.5–2 mm long, arachnoid hairs below the apex, apex convex, glabrous; stigmas penicellate. Fruit ellipsoid, 2.5–3 mm long, smooth, brown.

Cecropia heterochroma has a form with the lamina purplish underneath, occurring side by side with a form with the lamina pale green underneath.

Paratypes. PANAMA. **Bocas del Toro:** Isla Bastimentos, 22 Mar. 1993 (♀ fl-fr), *Foster et al. 14728* (SCZ). **Colón:** Santa Rita Ridge road, between Transisthmian Hwy. and Agua Clara, 11 Dec. 1973 (♀ fl), *Berg 299* (BG); Santa Rita Ridge, 1 Mar. 1971 (♀ fl), *Croat 13887* (BG, MO); Santa Rita Ridge road, 4–6 km from Transisthmian Hwy., 13 Apr. 1976 (♂), *Croat 34288* (MO); Santa Rita Ridge, 20 Sep. 1972 (♂), *Gentry 6109* (BG, MO); Santa Rita Ridge road, 21–26 km from Transisthmian Hwy., 4 July 1982 (♀ fr), *Knapp 5844* (BG, MO). **Darién:** Parque Nacional Darién, Cruce de Mono, 5 Nov. 1989 (st), *Fisher 52* (BG). **Panamá:** Cerro Jefe, 30 Aug. 1977 (♀ fl-fr), *Berg et al. 393* (BG), (♂), *Berg et al. 394* (BG); El Llano–Carti road, km 7, 3 Sep. 1977 (♂), *Berg et al. 401* (BG); Cerro Jefe, 27 Jan. 1966 (♂), *Blum et al. 2097* (MO), 12 Feb. 1966 (♂), *Blum et al. 2205* (MO), (♀ fl), *Blum et al. 2206* (MO); Campo Tres, 5 km NE of Altos de Pacora, 9 Mar. 1973 (♂), *Busey 822* (BG, MO); Cerro Jefe, 1000 m, *Carrasquilla 2177* (MO, PMA); Cerro Jefe, 25 Aug. 1972 (♀ fr), *Correa et al. 1806* (MO, PMA); 3 mi. N of Cerro Azul, 26 July 1970 (♀ fl-fr), *Croat 11587* (BG, MO); Cerro Jefe, 23 June 1972 (♀ fl), *Croat 17338* (MO); El Llano–Carti road, km 12, 1 Aug. 1974 (♀ fl), *Croat 26079* (MO), 6 Apr. 1973 (♀ fr), *Dressler 4326* (PMA); 3 mi. N of Cerro Azul, 1 Jan. 1972 (♀ fl), *Dwyer et al. 3447* (US); Cerro Jefe, 19 Aug. 1989 (♀ fl), *Fisher 23* and *31* (BG); El



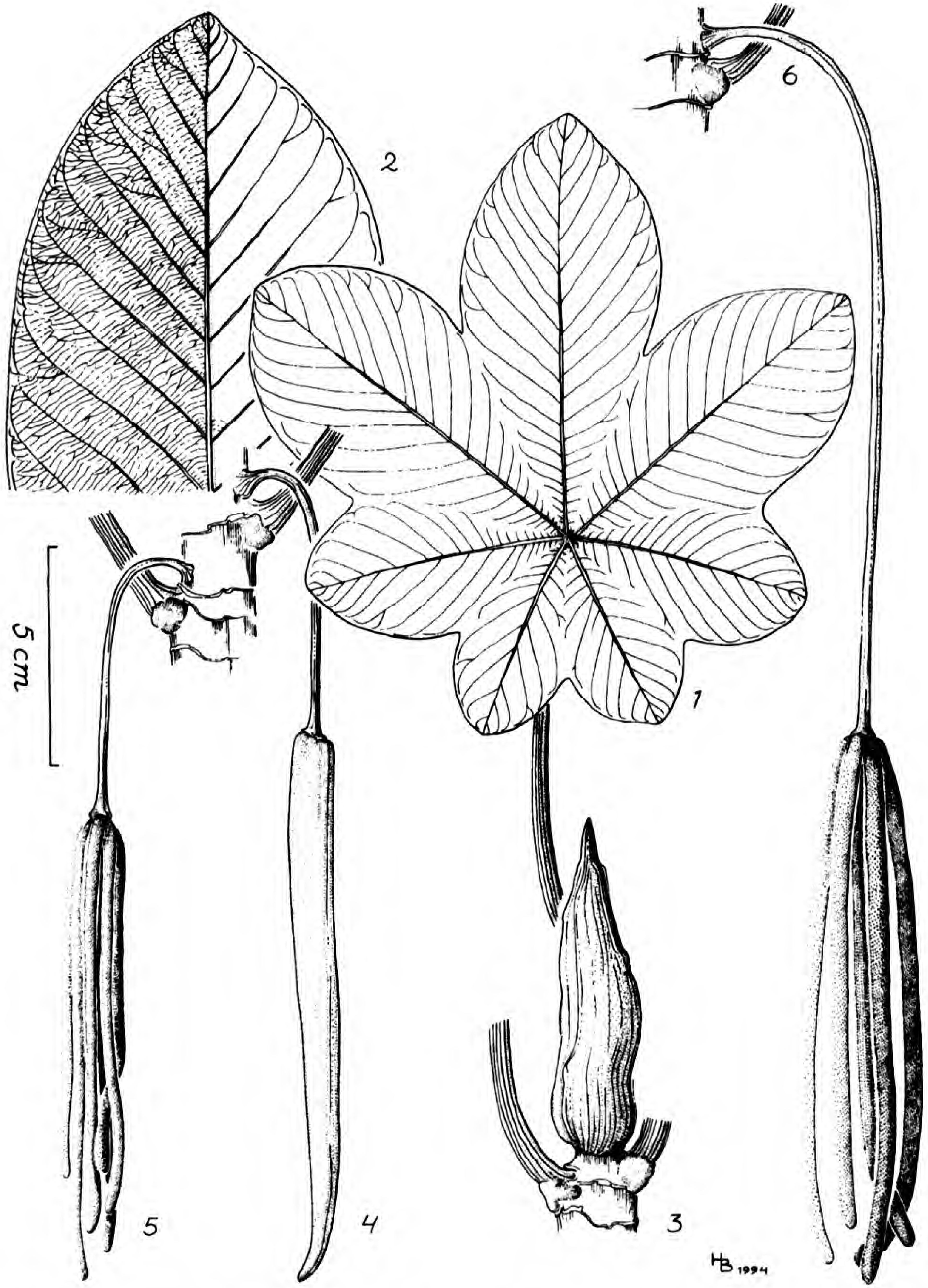


Figure 11 (left). *Cecropia heterochroma* C. C. Berg & P. Franco. —1. Lamina shape, reduced (*de Nevers 4953*). —2. Leaf venation (*de Nevers 4953*). —3. Stipules (*Berg 299*). —4. Staminate inflorescences (*de Nevers 3752*). —5. Pistillate inflorescence (*de Nevers 4953*). —6. Pistillate inflorescence with spathe (*de Nevers 4953*). Figure 12 (right). *Cecropia puberula* C. C. Berg & P. Franco. —1. Lamina shape, reduced (*Berg et al. 1639*). —2. Leaf venation (*Berg et al. 1639*). —3. Stipules (*Berg et al. 1640*). —4. Staminate inflorescence with spathe (*Berg et al. 1639*). —5. Staminate inflorescence (*Berg et al. 1639*). —6. Pistillate inflorescence (*Berg et al. 1640*).

Llano–Carti road, km 8.7, 31 Oct. 1977 (♀ fl), *Folsom et al. 6161* (BG, MO); Cerro Jefe, 13 Sep. 1970 (♀ fl-fr), *Foster et al. 1896* (PMA, US), 1 Jan. 1972 (♀ fl-fr), *Gentry et al. 3447* (NY), 1 Apr. 1972 (♀ fl), *Gentry 4895* (MO); Cerro Jefe, Altos de Pacora, 18.2 km E of Cerro Azul village, 5 Jan. 1975 (st), *Gentry et al. 13422* (F, MO); Cerro Jefe, 15 Aug. 1982 (♀ fl), *Hamilton et al. 616* (MO); Cerro Jefe, 29 July 1967 (♀ fl-fr + ♂), *Kirkbride et al. 21* (MO, NY); Campo Tres, 3 mi. NE of Altos de Pacora, 10 Mar. 1973 (♂), *Liesner 517* (BG, MO); El Llano–Carti road, km 18, 2 Mar. 1975 (♀ fl-fr), *Mori et al. 5122* (BG, MO); El Llano–Carti road, km 14, 28 Mar. 1974 (♀ fl), *Nee et al. 11004* (BG, MO, NY, PMA); Cerro Azul, 24 Mar. 1969 (♀ fl-fr), *Porter et al. 4068* (BG, MO). **San Blas:** Nusagandi, 16 Aug. 1989 (♀ fl), *Fisher 19* (BG), (♂), *Fisher 20* (BG), 18 Aug. 1989 (st), *Fisher 29* and *30* (BG); Nusagandi, NW of Punta Mamá, 13 Aug. 1984 (♀ fl-fr), *de Nevers et al. 3731* (MO, PMA); El Llano–Carti road, Continental Divide, 25 Aug. 1984 (♂), *de Nevers 3752* (BG, MO); El Llano–Carti road, km. 19.1, 4 Mar. 1985 (♀ fl), *de Nevers et al. 4953* (BG, MO, PMA); El Llano–Carti road, 13 Mar. 1986 (♀), *de Nevers et al. 7378* (BG, MO, PMA); Nusagandi, El Llano–Carti road, ca. km 20, 29 Apr. 1992 (♂), *Paredes 680* (SCZ), (♀ fl), *Paredes 681* (SCZ), 1 May 1992 (♀ fl), *Paredes 924* (SCZ). **Veraguas:** road Escuela Agricola Alto Piedra–Calovebora, km 11, 30 Aug. 1974 (♀ fl-fr), *Croat 27567* (MO); Río Dos Bocas, 15.6 km NW of Santa Fé, 31 Aug. 1974 (♂), *Croat 27627* (MO). COLOMBIA. **Valle:** mun. Buenaventura, Bajo Calima region, road Buenaventura–Malaga, km. 51.3, 9 Feb. 1990 (♂), *Croat et al. 70406* (BG, MO).

3. Cecropia puberula C. C. Berg & P. Franco, sp. nov. TYPE: Peru. Ucayali: near San Miquel de Semuya, S of Campo Verde, 12 Aug. 1988 (♂), *Berg et al. 1639* (holotype, MOL; isotypes, AAU, BG COL, MO, NY, U). Figure 12.

Cecropiae latilobae affinis, a qua differt venis lateralis submarginale brochidodromis.

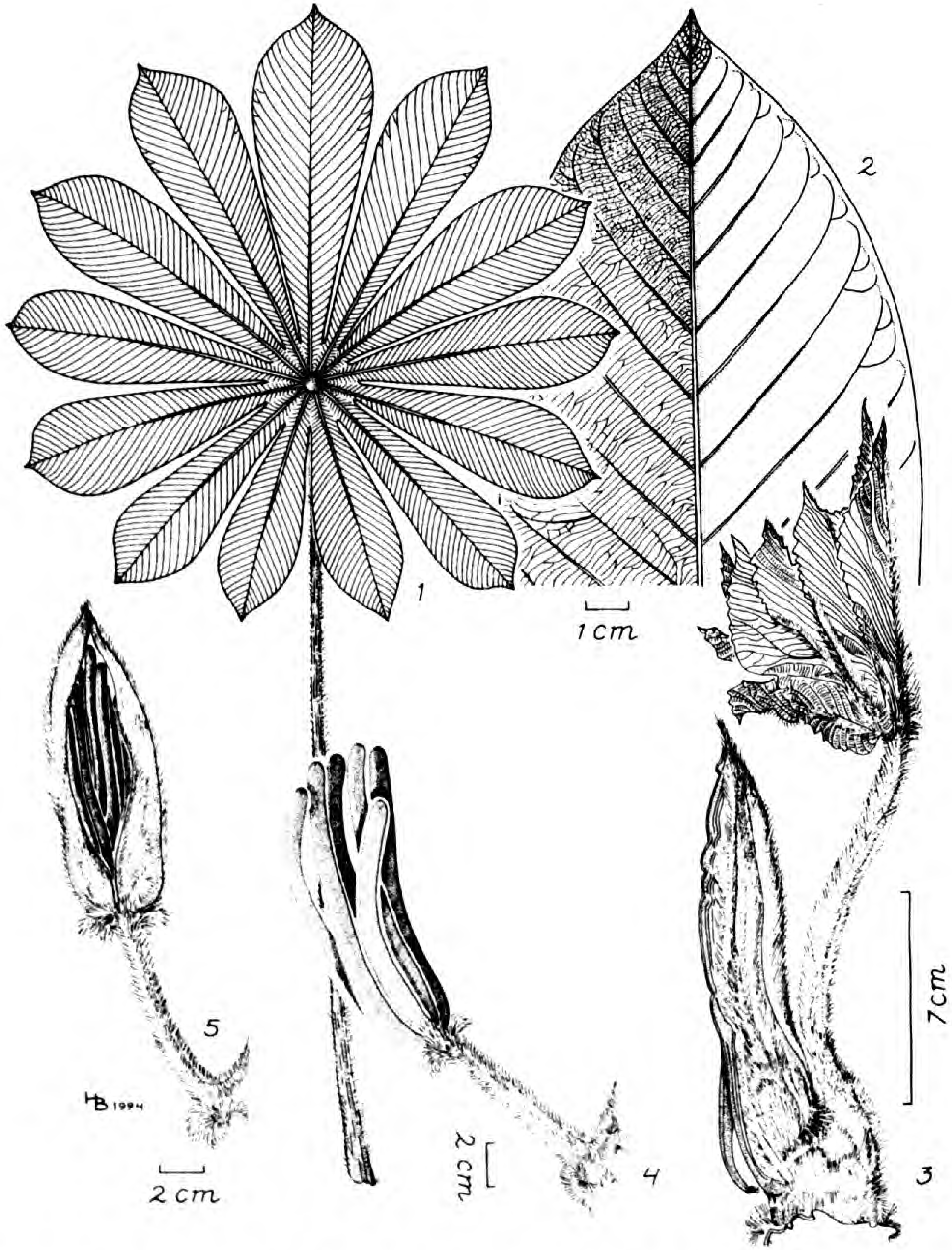
Tree up to 15 m tall. Leafy twigs 1.5–5 cm thick, green or slightly bluish, puberulous to subhispidulous (with curved to uncinate hairs) and also with dense brown pluricellular hairs, sometimes young parts bluish due to a waxy layer; internodes 0.5–1 cm long. Lamina chartaceous to subcoriaceous, ca. (10 × 10–)25 × 25–60 × 60 cm, segments (5–)9–11, free part of upper segments ovate to elliptic, incisions $^5\!/_{10}$–$^7\!/_{10}$ the distance to the petiole, apices short-acuminate to obtuse to rounded; upper surface scabrous, (rather sparsely) hispidulous; lower surface rather densely minutely puberulous on the veins and (especially on the smaller veins) also sparse much longer (uncinate to straight) hairs, arachnoid indument in the areoles and on the smaller veins or almost confined to the leaf margin; lateral veins in the free part of the midsegment ca. 11–16 pairs, 0.5–1.5 cm from each other, submarginally (to almost marginally) loop-connected, most of them branched; petiole ca. 15–40 cm, long, minutely puberulous; trichilia fused, only with brown indument (of pluricellular hairs); stipules 5–12 cm long, green, red(dish) or red-brown to brown, subpersistent, outside puberulous (to subhirtellous), inside densely sericeous to subvillous. Staminate inflorescences in pairs, pendulous; peduncle 6–9 cm long, puberulous; spathe 7–18 cm long, greenish, outside puberulous and with sparse arachnoid indumentum, inside glabrous; spikes 8–15, 4–8 × 0.2–0.3 cm, sessile, rachis (sub)glabrous; perianth ca. 1 mm high, puberulous on the margin of the apex; anthers ca. 0.3–0.5 mm long, detached at anthesis. Pistillate inflorescences in pairs, pendulous; peduncle 15–25 cm long, puberulous to hispidulous; spathe 9–16 cm long, greenish, outside puberulous (to hirtellous) or also with sparse to rather dense arachnoid indumentum, inside glabrous or sparsely puberulous; spikes 4–5, 12–20 × 0.8–1 cm, in fruit up to 35 × 1.2 cm, sessile; rachis hairy; perianth ca. 2 mm high, apex convex, sparsely muriculate, arachnoid hairs below the apex; stigma comose-penicillate. Fruit oblongoid to subobovoid, ca. 2 mm long, smooth.

Cecropia puberula shows strong similarities to *C. latiloba,* from which it differs in the lateral veins being more or less distinctly submarginally loop-connected. Moreover, *C. latiloba* Miquel is a species occurring in periodically inundated places, while *C. puberula* is a species of non-inundated places, probably a tree-fall-gap pioneer. The morphological differences are so small that one could consider them as only valid for distinction at the subspecific level.

Paratypes. PERU. **Cuzco:** prov. Paucartambo, between Pilcopata and Atalaya, 29 July 1988 (♀), *Berg et al. 1604* (BG, COL, USM); prov. Paucartambo, between San Jorge and Salazar, Río Tono, ca. 600 m, 1 Aug. 1988 (♀), *Berg et al. 1623* (BG, USM). **Huánuco:** prov. Puerto Inca, dtto. Llullapichis, DANTAS, 18 July 1989 (♀ fl-fr), *Kröll S. 508* (BG); prov. Pachitea, ca. 26 km S of Puerto Inca, 21 Sep. 1988 (♀), *Morawetz et al. 15–21988* (BG); prov. Leoncio Prado, dtto. Rupa Rupa, E of Tingo María, near Cerro Quemado, 10 Apr. 1978 (♀ fl-fr), *Schunke V. 10593* (BG). **Madre de Dios:** prov. Tambopata, Cuzco Amazónico, 14 July 1991 (♀ fl-fr), *Fisher 210* (BG) and *211* (BG), 13 Dec. 1989 (st), *Gentry et al. 68643* (BG, MO), 14 June 1989 (♀), *Núñez et al. 10727* (BG). **Uyacali:** near San Miquel de Semuya, S of Campo Verde, 12 Aug. 1988 (♀), *Berg et al. 1640* (BG, COL, K, MO, MOL).

4. Cecropia tacuna C. C. Berg & P. Franco, sp. nov. TYPE: Peru. Pasco: prov. Oxapampa, 5 km E of Oxapampa, 1850 m, 23 May 1983 (♀ fl-fr), *D. N. Smith 4179* (holotype, MO; isotypes, BG, K). Figure 13.

Indumento villoso in diversis partibus et foliis grandibus cum incisuris numerosis distincta.



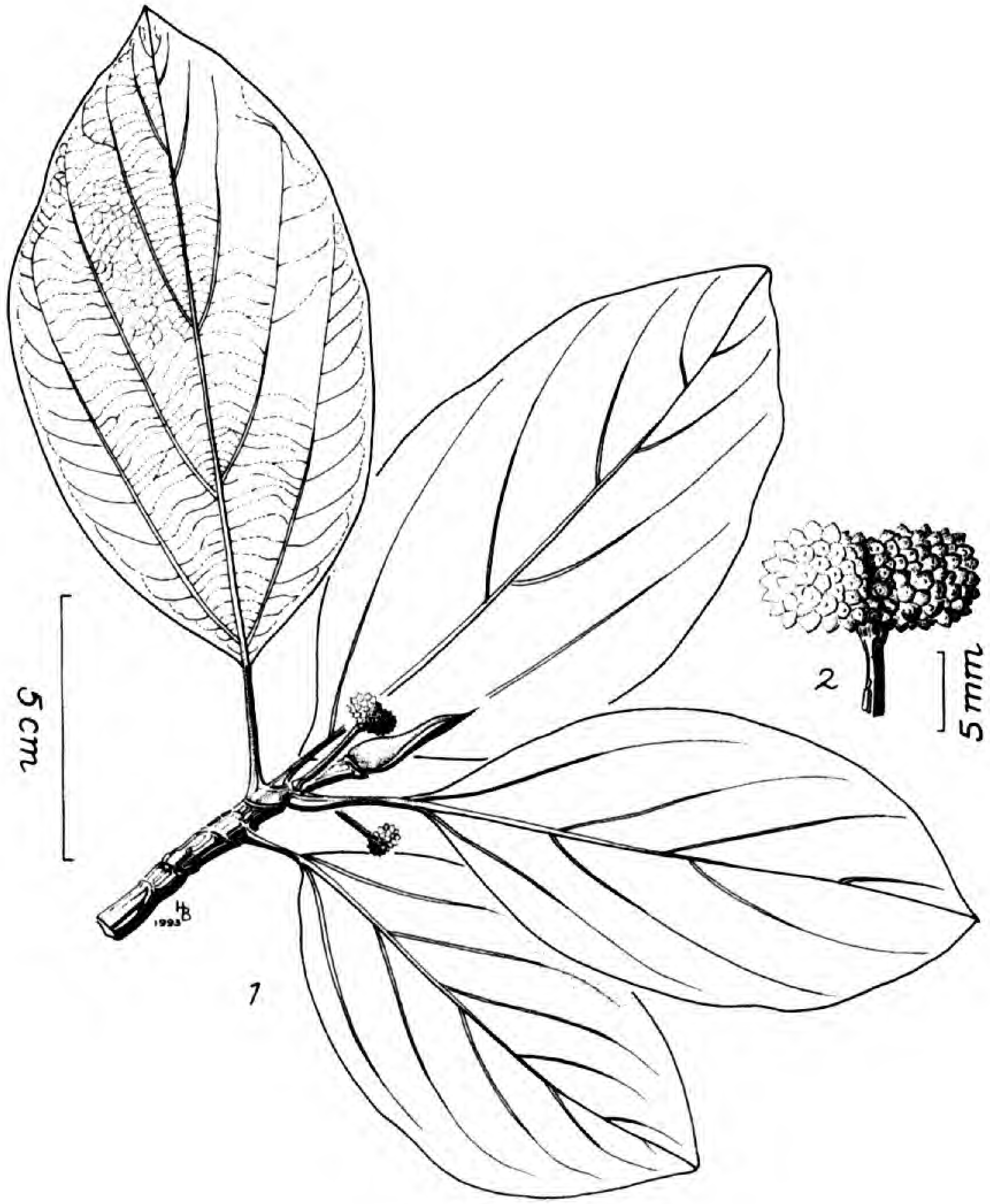


Figure 13 (left). *Cecropia tacuna* C. C. Berg & P. Franco. —1. Lamina shape, reduced (*Berg et al. 1635*). —2. Leaf venation (*Berg et al. 1635*). —3. Stipules and young leaf (*Berg et al. 1635*). —4. Staminate inflorescence and spathe (*Berg et al. 1634*). —5. Pistillate inflorescence (*Berg et al. 1635*). Figure 14 (right). *Coussapoa david-smithii* C. C. Berg. —1. Leafy twig with pistillate inflorescences (*D. N. Smith 13919*). —2. Fruiting pistillate inflorescence (*D. N. Smith 13919*).

Tree up to ca. 30 m tall. Leafy twigs 4–8 cm thick, green, densely villous and with filiform brown pluricellular hairs. Lamina (sub)coriaceous, ca. 50 × 50–100 × 100 cm, segments 13–18 (on new shoots down to 8), incisions ca. $\frac{7}{10}$–$\frac{8}{10}$ the distance to the petiole, segments oblanceolate, apices subacuminate to acute; upper surface scabrous to scabridulous, sparsely to rather densely hispidulous to subhispid or largely hirsute to subvillous and with sparse to dense filiform, brown pluricellular hairs, "umbilicus" very prominent and villous, lower surface ± sparsely subvillous and with filiform brown pluricellular hairs or also sparse white arachnoid indumentum on the main veins, varying to pilose (to subtomentose) on the lesser veins, arachnoid indumentum in the areoles and on the reticulum; lateral veins in the free part of the midsegment 30–35 pairs, up to 1.3 cm from each other, mostly unbranched, submarginally (and ± faintly) loop-connected; petiole 40–80 cm long, ± densely (sub)villous and with filiform brown pluricellular hairs and sparse white arachnoid indumentum, glabrescent; trichilia absent or sometimes present (?); stipules 15–30 cm long, caducous, outside densely white villous, inside sparsely hairy. Staminate inflorescences in pairs, patent with the spikes curved upwards, subtended by up to 13-cm-long bracts; peduncle 5–12 cm long, ± densely white villous (at least in the upper part) and also or only with filiform brown pluricellular hairs, often also with sparse white arachnoid indumentum; spathe 14–20 cm long, green, with dense filiform brown pluricellular hairs and sparsely villous, glabrescent; spikes ca. 10–20, 12–19 × 0.3–0.5 cm, with 0.5–1-cm-long stipules; perianth ca. 1.2 mm long, apex plane, sparsely to densely muriculate, below the apex short arachnoid indumentum; anthers ca. 0.5 mm long, detached at anthesis, thecae appendiculate. Pistillate inflorescences in pairs, patent with the spikes curved upward, subtended by up to 13-cm-long bracts; peduncle 5–9 cm long, with indumentum similar to the staminate inflorescence; spathe 9–14 cm long, green, with dense filiform brown pluricellular hairs and sparsely villous; spikes 3–7, (sub)sessile, 6–13 × ca. 0.5 cm, in fruit up to 21 × 1.5 cm; perianth ca. 1.5 mm long; apex plane, muriculate, long white arachnoid indumentum below the apex; stigma small, comose. Fruit narrowly ellipsoid, ca. 1.5 mm long, finely tuberculate.

Cecropia tacuna is *the* montane species in the southern Andean part of Peru and is easily recognizable by the villous indumentum on various young plant parts and the large leaves with numerous segments. It seems to be related to the Bolivian montane species *C. elongata* Rusby.

The epithet chosen is the local name often cited on the labels of the collections of this species.

Paratypes. PERU. **Ayacucho:** between Huanta and Río Apurimac, 750–1000 m, 7–17 Nov. 1929 (juv.), *Killip et al. 23117* (NY, US). **Cuzco:** prov. Paucartambo, road Pilcopata–Paucartambo, ca. 2000 m, 2 Aug. 1988 (♂), *Berg et al. 1634* (BG, USM), 2200–2300 m, 2 Aug. 1988 (♀), *Berg et al. 1635* (BG, COL, USM); prov. Paucartambo, km 132, 2260–2290 m, 27 June 1978 (st), *Gentry et al. 23564* (BG); prov. Urubamba, near Machu Picchu, 2000 m, 4 July 1972 (♂), *Muller 2861* (LZ); prov. Urubamba, near Machu Picchu, Río Mandor, 2055 m, 2 June 1982 (♂), *Peyton et al. 374* (MO); prov. Paucartambo, Kosñipata, 2700 m, 4 July 1972 (♂), *Vargas C. 15490* (US). **Huánuco:** Huánuco–Tingo Maria road, Carpish, 2400 m, 10 Mar. 1982 (♂), *Gentry et al. 36153* (BG, MO). **Pasco:** prov. Oxapampa, Río Boqueria, ca. 26 km from Oxapampa via Río Yamaquizu, 2040 m, 3 June 1982 (♂), *D. N. Smith et al. 1832* (BG, MO); prov. Oxapampa, 5 km SE of Oxapampa, 1850 m, 9 Apr. 1983 (♂), *D. N. Smith 3663* (BG, MO); prov. Oxapampa, Huancabamba, Río Yanachaga, 2280 m, 26 May 1983 (♀ fl), *D. N. Smith et al. 4196* (BG, MO); prov. Oxapampa, Oxapampa–Villa Rica road, 29 Sep. 1983 (♀ fl-fr), *D. N. Smith et al. 5340* (BG, MO); prov. Oxapampa, Río San Albert valley, E of Oxapampa, 2300 m, 4 July 1984 (st), *D. N. Smith et al. 7608* (BG, MO); prov. Oxapampa, Yonachaga via Río San Daniel, 2500 m, 17 July 1984 (st), *D. N. Smith et al. 7848* (BG, MO); prov. Oxapampa, Río Alberto valley, E of Oxapampa, slopes of Cord. Yonachaga, 2400 m, 23 July 1984 (st), *D. N. Smith et al. 7974* (MO); prov. Oxapampa, Palmazú, 2100 m, 28 Sep. 1984 (♀ fl-fr), *D. N. Smith 8555* (BG, MO).

5. **Coussapoa david-smithii** C. C. Berg, sp. nov. TYPE: Bolivia. La Paz: prov. Sud Yungas, road Huancané–San Isidro, km 7, 2300 m, 13 Dec. 1989 (♀ fr), *D. N. Smith 13919* (holotype, MO; isotypes, BG, LPB). Figure 14.

Coussapoae jatun-sachensi similis, a qua differt e.g. stipulis glabratis ramunculisque foliatis.

Tree 13 m tall. Leafy twigs 4–8 mm thick, glabrous. Lamina oblong to subobovate, 11–22 × 4.5–12 cm, coriaceous, apex short-acuminate to subacute, base (sub)acute; both surfaces glabrous; lateral veins 4–5 pairs, basal pair (and mostly also other pairs) branched, usually departing from the midrib well above the base, reaching the margin above or at the middle of the lamina; petiole 2.5–6.5 cm long, glabrous; stipules 1.2–2.5 cm long, glabrous. Pistillate inflorescences unbranched (or branched); (common) peduncle 1.5–3 cm long, glabrous; head(s) 1 (or 2), hemispherical to subglobose, 0.8–1.2 cm diam. (in fruit); perianth (sub)glabrous. Interfloral bracts absent.

This montane species resembles the lowland Ec-

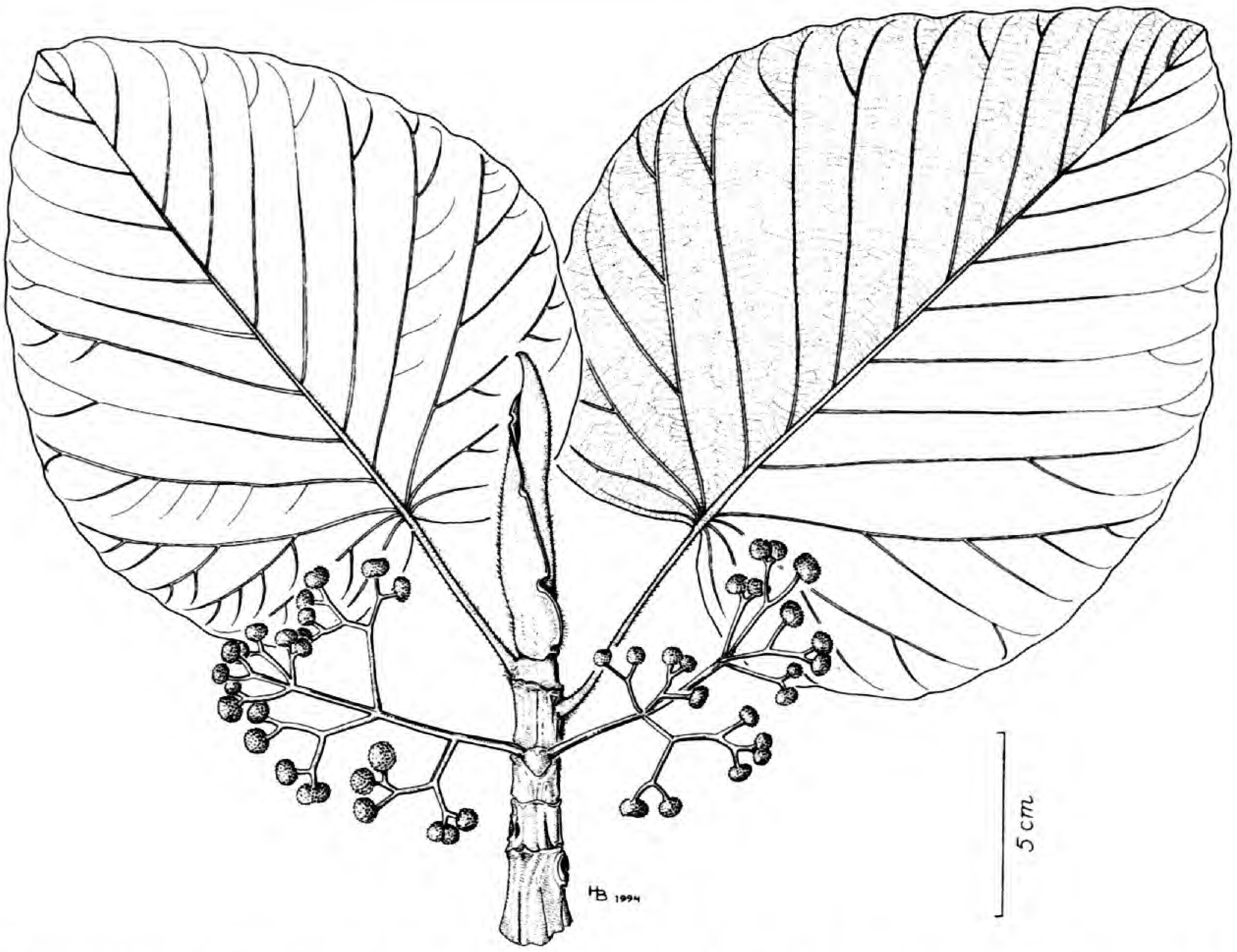


Figure 15. *Coussapoa villosa* subsp. *polycephala* C. C. Berg. Leafy twig with pistillate inflorescences (*Uribe-Uribe 364*).

uadorian species *Coussapoa jatun-sachensis* C. C. Berg (Berg & Franco, 1993). Montane taxa are rare in the genus (cf. Berg et al., 1990).

The epithet is chosen to commemorate the collecting activities of the late David N. Smith, who provided so much useful material to science.

6. Coussapoa villosa Poeppig & Endlicher subsp. **polycephala** C. C. Berg, subsp. nov. TYPE: Colombia. Cundinamarca: mun. Tena, Laguna Pedro Palo, 2000–2100 m, 7 Mar. 1988 (♀ fl-fr), *Franco et al. 2422* (holotype, COL; isotype, BG). Figure 15.

Plurimis venis lateralibus ramosis et usque ad viginti capitulis in inflorescentia pistillata distincta.

Most lateral veins branched (furcate). Pistillate inflorescences with 10–20 flower heads, in fruit up to ca. 1 cm in diameter; common peduncle 3–6 cm long. Peduncle of staminate inflorescences 1.2–4 cm long.

In most of the collections of *Coussapoa villosa* the lateral veins are usually unbranched, except for the basal pair, and the pistillate inflorescences are unicapitate. However, in some lowland collections from Central America the pistillate inflorescences may have more than one flower head, occasionally up to four heads. The combination of multicapitate pistillate inflorescences and the commonly branched lateral veins, as found in the material listed above, justifies recognition of a distinct subspecies, apparently confined to a small area and occurring at altitudes between 1600 and 2200 m. This subspecies appears to be identical to the Late Pliocene leaf material from the Guasca Valley in Colombia, described and discussed by Wijninga and Kuhry (1993).

Recognition of subspecies *polycephala* may lead to reconsidering the rank of *C. duquei* Standley (Berg et al., 1990), and possibly reducing it to another (sub)montane subspecies of *C. villosa.*

Paratypes. COLOMBIA. **Cundinamarca:** mun. Tena, 2200 m, 14 May 1983 (♂), *Barrera et al. 62* (COL); between El Salto and El Colegio, 1470 m, 10 Mar. 1940 (♂), *Cuatrecasas 8291* (COL); near Albán, Aug. 1962 (♂ fl-fr), *Fernández-Pérez F-3* (COL); mun. Tena, near Laguna Pedro Palo, 3 km N of Tena, 2080 m, 19 May 1952 (♂), *Fernández-Pérez et al. 1458* (COL); Tena, Río Bogotá, below Santandercito, 1650 m, 15 Mar. 1986 (♂), *Franco et al. 2410* (COL); mun. Tena, Laguna Pedro Palo, 2000–2100 m, 7 Mar. 1988 (♂), *Franco et al. 2422A* (BG, COL); Río Bogotá, 1600 m, 1939 (♂), *Uribe-Uribe 364* (COL). **Tolima:** near Juntas, (♂), *Saavedra s.n.* (COL).

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Diplusodon bolivianus sp. nov. (Lythraceae), the First Report of the Genus for Bolivia

Taciana Barbosa Cavalcanti
Centro Nacional de Pesquisa de Recursos Genéticos e Biotecnologia, CENARGEN, SAIN, Parque Rural, CP 02372, CEP, 70.849-970, Brasília, D.F., Brazil

Shirley A. Graham
Department of Biological Sciences, Kent State University, Kent, Ohio 44242, U.S.A.

ABSTRACT. *Diplusodon bolivianus,* a new species from Dept. Santa Cruz, Bolivia, is described and illustrated. Comparison is made to *D. hirsutus,* which it most closely resembles in floral morphology. This is the first report of *Diplusodon* for Bolivia and the first record of the genus occurring outside Brazil.

Diplusodon is a genus of showy, often highly floriferous shrubs until now considered endemic to Brazil. A new monograph recognizes 59 species, without infrageneric divisions (Cavalcanti, 1995). The genus is most diverse in the savannas and campos rupestres of the states of Goias and Minas Gerais, especially in the Serra Geral do Paraná of Goias and the Cadeia do Espinhaço of Minas Gerais. A collection made in Parque Nacional Noel Kempff Mercado, Dept. Santa Cruz, Bolivia, records the presence of *Diplusodon* outside Brazil for the first time. The specimens represent a new species that is most similar in its floral characters to *D. hirsutus* (Chamisso & Schlechtendal) DC. of Minas Gerais and Bahia.

Diplusodon bolivianus T. Cavalcanti & S. A. Graham, sp. nov. TYPE: Bolivia. Santa Cruz: Velasco, Parque Nacional Noel Kempff M., Campamento Las Gamas, mosaico de cerrado, campo rupestre, pampas humedas y bosque de galeria, 14°49′S, 60°23′W, 900 m, 28 Mar. 1993, *Killeen, Panfil & Arroyo 4845* (holotype, MO; isotypes, CEN, KE-Graham). Figure 1A–J.

Habitu *D. oblongo* Pohl similis. A *D. hirsuto* (Chamisso & Schlechtendal) DC. foliis eucamptodromis ellipticis latioribus, indumento paginarum inferiorum et superiorum densiore, inflorescentia frondo-bracteosa, staminibus sepalis brevioribus differt.

Shrubs 1.5 m, branchlets subquadrangular, all parts densely and finely hirsute to sericeous, the hairs simple, pale yellow to white, to 0.5 mm long. *Leaves* petiolate, petioles 1.0–6.0 mm; blades 20.0–40.0 × 9.0–20.0 mm, crowded and overlapping distally on short axillary branches, chartaceous, eucamptodromous, elliptic to broadly elliptic, venation eucamptodromous, apex obtuse, minutely acuminate, base acute, margin often subrevolute, slightly ciliate, adaxial surface sparsely hirsute, abaxial surface more densely hirsute, lateral vein pairs 4–6, adaxially inconspicuous, abaxially more prominent, raised, brown in dry state. *Inflorescences* distinctly terminal, compound with racemose, short, axillary co-inflorescences (diplobotrys), foliage leaves gradually but conspicuously reduced acropetally to form the bracts of the inflorescence (frondo-bracteose); flowers crowded on pedicels 0–1 mm long; bracteoles (prophylls) 3.2–3.8 × 1.0–2.5 mm, oblong to obovate, densely hirsute abaxially, extending to about midpoint of the floral tube. *Floral tubes* 4.5–6.0 × 4 mm, campanulate, densely hirsute to sericeous; sepals 6, ca. 1.5 mm long, glabrous within; appendages of the epicalyx 1.0–1.5 mm long, less than or equal to the length of the sepals, triangular, spreading, sometimes curved or in-rolled at the tips; petals 6, 6.0–8.0 × 4.0–5.0 mm, elliptic, rose; stamens 12, included to scarcely exserted; ovary 3.0 × 2.8–3.0 mm, glabrous; style 5.5–6.0 mm long, long-exserted; stigma capitate; ovules 13–17. *Capsules* rounded, brownish red; seeds 3–11, 1.8–2.0 × 1.5–1.9 mm.

Phenology. Probably flowering at least from January to March; collected in fruit in March.

Distribution. Known only from the margin of a gallery forest and the adjacent cerrado in Parque Nacional Noel Kempff M., Campamento Las Gamas, at 900 m.

Among the species of *Diplusodon* with pinnately veined leaves, appendage-bearing campanulate floral tubes, and rounded capsules, *Diplusodon bolivianus* is distinguished by a pale yellow to whitish, densely hirsute to sericeous indument, and 12 stamens that are included or scarcely exceed the se-

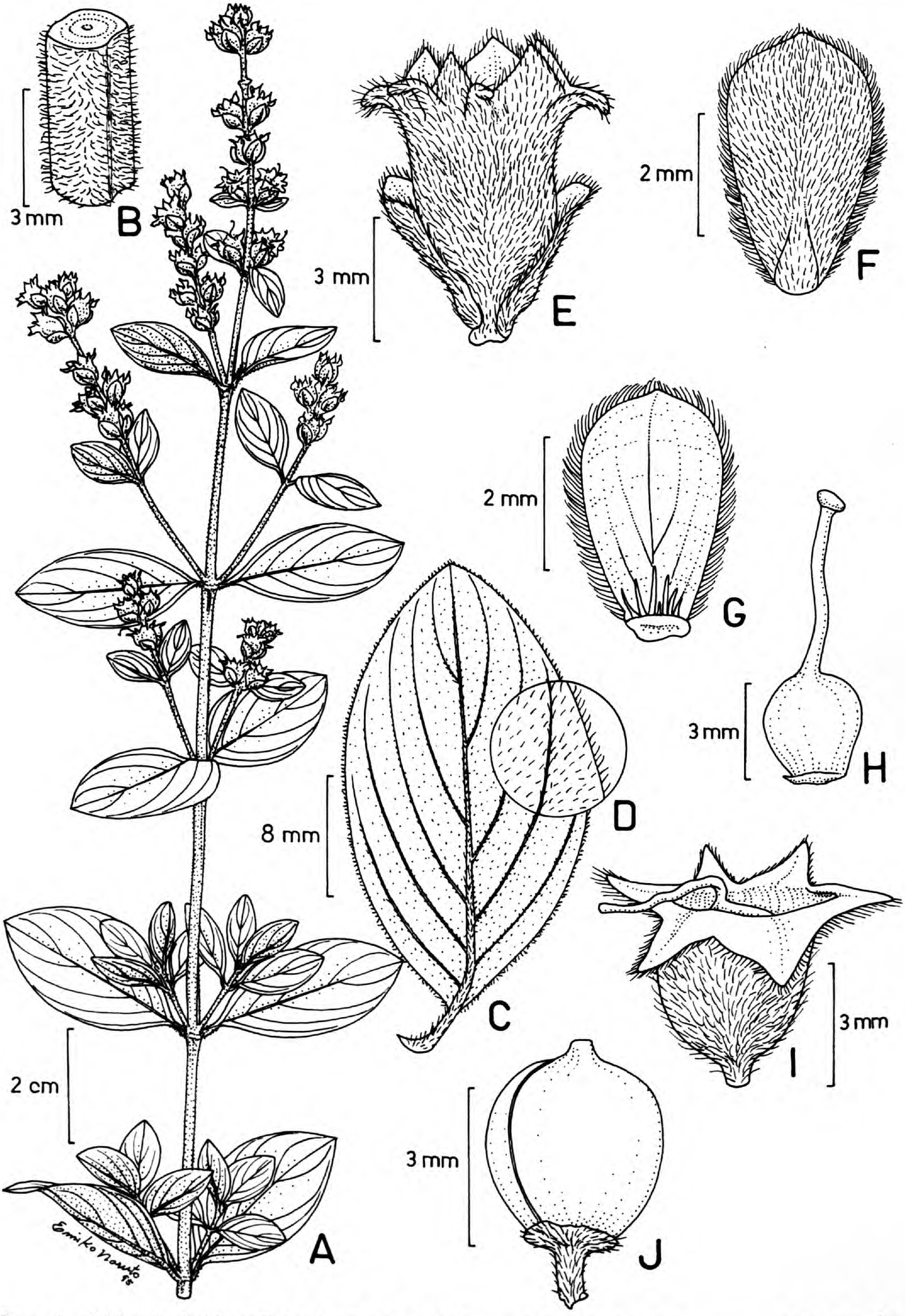

Figure 1. *Diplusodon bolivianus* T. Cavalcanti & S. A. Graham. —A. Branch of the inflorescence. —B. Section of an internode. —C. Leaf, abaxial surface. —D. Detail of leaf indument. —E. Floral tube, without petals. —F. Bracteole, abaxial surface. —G. Bracteole, adaxial surface, with dissected stipules at the base. —H. Pistil. —I. Persistent floral tube surrounding the mature capsule. —J. Capsule. Drawn from the isotype at CEN.

pals. The new species resembles *D. oblongus* vegetatively, especially by its similar basic leaf venation pattern, leaf shape and size, and by its more or less distinct terminal bracteate inflorescence. In the floral morphological features important for establishing natural relationships, however, it most closely resembles *D. hirsutus*—and within this highly variable species, those plants with large leaves and consistently subrevolute leaf margins. *Diplusodon hirsutus* differs from *D. bolivianus* by a leafier, more extended inflorescence (frondose in *D. hirsutus* vs. frondo-bracteose in *D. bolivianus*), narrower less hirsute leaves with acrodromous leaf venation, and 12–15 stamens that extend well beyond the sepals. The species are geographically separated by approximately 1800 km. Seven other species of *Diplusodon* grow in Mato Grosso, Brazil, in much closer proximity to *D. bolivianus,* but none resemble *D. bolivianus* as closely as does *D. hirsutus.*

Acknowledgments. We gratefully acknowledge the contribution of Tim Killeen, Director of the Flora of Parque Nacional Noel Kempff M. Project, and his co-workers who collected this new species, and the Missouri Botanical Garden for sharing duplicates. The illustrations are by Emiko Noruto.

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Two New Species in *Marcgravia* (Marcgraviaceae) from Central and Adjacent South America

Stefan Dressler
Rijksherbarium/Hortus Botanicus, P.O. Box 9514, NL-2300 RA Leiden, The Netherlands

ABSTRACT. Two species are described as new: *Marcgravia panamensis* (subg. *Orthothalamium–Pauciflorae*), a new species from Panama, is the only species of the genus having leaves with dotted abaxial surfaces but only a few erect flowers per inflorescence. *Marcgravia roonii* (subg. *Orthothalamium–Multiflorae*), a new species from Costa Rica, Colombia, and Ecuador, has the typical leaves of *M. nervosa* but a completely different inflorescence structure. *Marcgravia membranacea* is considered to be a synonym of *M. nervosa.*

Studies toward a revision of the Central American species of the type genus from the Marcgraviaceae revealed two new species from this area, with one also ranging in the northwestern part of South America. One of the new species is (so far known) a rare endemic collected on several sites along the road from El Llano to Carti (Province Panamá) and on the Continental Divide in Comarca de San Blas of Panama. The other is also rare, in wet rainforests, but has a wider range: known from Costa Rica, Panama, Colombia, and Ecuador. This taxon was already annotated as new by A. C. de Roon, Utrecht, who agreed in choosing another name for it. Both species are described here in order to make the names available for a treatment in a forthcoming volume of *Flora Mesoamericana,* where a complete account of the family will be given (Dressler & collaborators, in prep.). The features that distinguish them from the taxa treated in the *Flora of Panama* (de Roon, 1970) are to be found in the remarks section of the respective species.

The generic delimitation of Wittmack (1878) is still commonly accepted, but it is not very satisfactory. Some of his entities are obviously artificial groups and rather formally derived "containers" (e.g., tribes *Pauciflorae* and *Multiflorae* of subg. *Orthothalamium* to which the new species should be assigned). Nevertheless these "groups" are of good diagnostic value. A revision of the entire genus, which presumably will result in proposing a more natural generic delimitation, is intended by the author.

Marcgravia panamensis S. Dressler, sp. nov. TYPE: Panama. Prov. Panamá: along El Llano–Carti road, 16–18.5 km N of Pan-Am Hwy. at El Llano, 400–450 m, 28 Mar. 1974, *Nee & Tyson 11001* (holotype, NY; isotype, MO). Figure 1.

Haec species ad subg. *Orthothalamium* pertinet; folia coriacea venatione obscura infra punctis nigris glandulosis, inflorescentiae pauci-(8–13)flores non rotate expansae, in medio nectariis 2–3 distincta pedicellatis. *Marcgraviae serrae* de Roon affinis glandularum hypophyllarum basilaminarium praesentia laminarium absentia differt.

Woody liana; fertile branches terete to quadrangular, grayish to reddish brown, with only few small (max. 1.3 × 0.7 mm), inconspicuous, darker, circular to elongate lenticels, scattered or in rows. Adult leaves distinctly petiolate (3–9 mm), petiole 1.5–2 mm diam., stoutly semi- to subterete, canaliculate above; blade elliptical, sometimes slightly asymmetrical, apically acuminate, acumen up to 20 mm long, basally attenuate to acute, 50–135 mm long, 15–45 mm wide, margin entire, in sicco coriaceous, midrib sulcate above, prominent beneath, lateral veins obsolete; hypophyllous glands—submarginal: small (diam. up to 0.4 mm), solid, circular, dark glands near the margin, not visible from above, 2–4 mm distance in between; basilaminar: one raised, round to oval, poriform gland in the lower third of the blade, often relatively far from base, up to 1 mm diam., sometimes perforation not distinguishable; laminar: lower surface punctated with scattered solid dark minute (up to 0.2 mm diam.) round glands; juvenile leaves broadly ovate, basally cordate, sparsely punctate beneath. Inflorescences erect, roughish, shortly pedunculate (1–2 cm) with only 8–13 fertile and 2–3 sterile flowers (nectaries), the few flowers conspicuously oblique inserting at the rachis, hence not horizontally spreading like the spokes of a wheel, the rachis shortly conical, 5–8 mm long, 4–5 mm diam.; nectaries yellow-green, pitcher- or sac-shaped, terminally not or slightly testiform, distinctly stalked, free stalk 4–8(–10) mm long, 1–1.3 mm diam., terete, only few and tiny, inconspicuous lenticels, often bent downward, the cup tubular, clavate, sub-

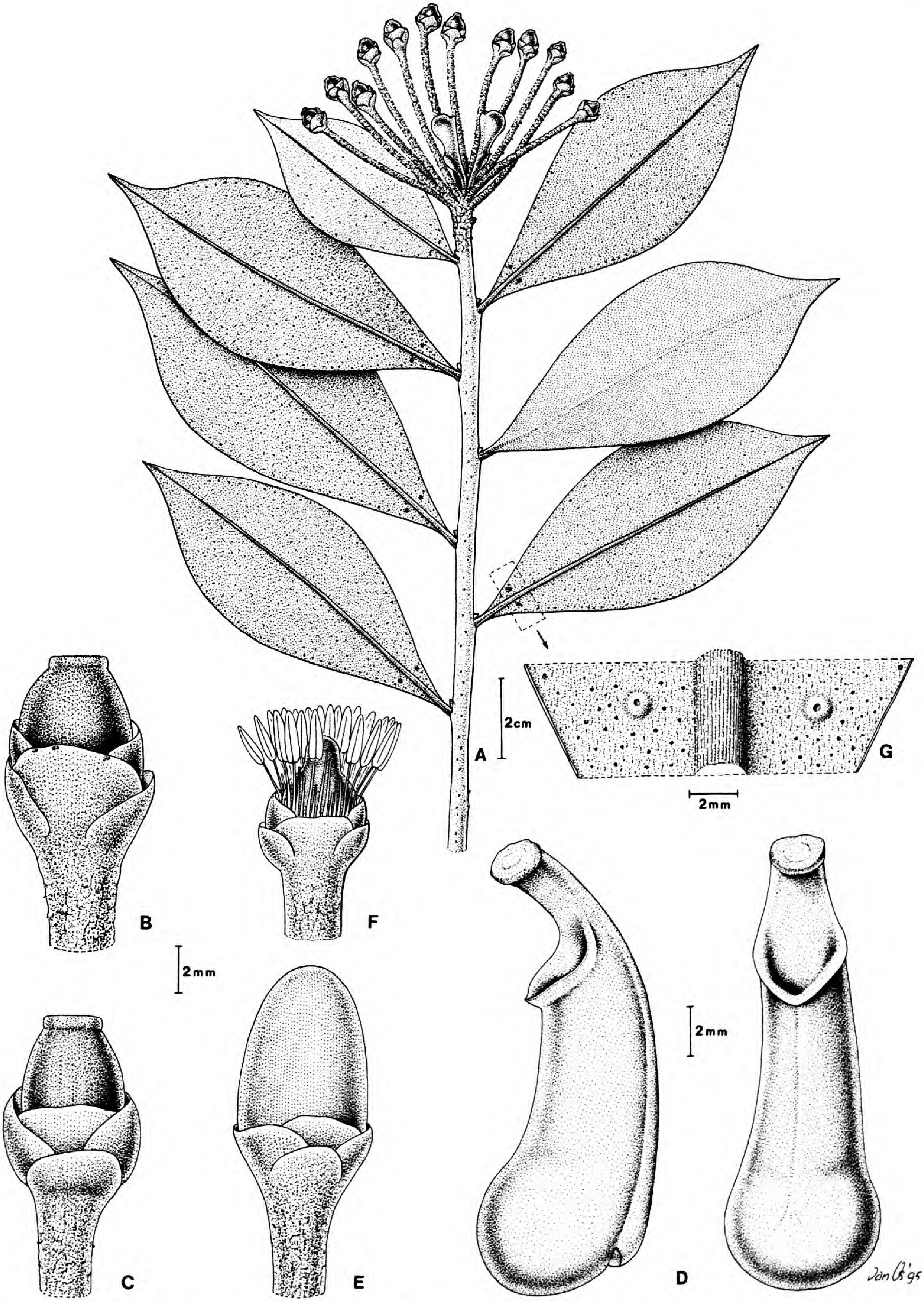

Figure 1. *Marcgravia panamensis* S. Dressler. —A. Flowering branch. —B, C. Flower (after anthesis). —D. Nectaries. —E. Flower (before anthesis). —F. Flower (in anthesis). —G. Detail of abaxial leaf surface showing the basilaminar and the scattered laminar glands. A–E, *Liesner 1146* (US); F, *Nee & Tyson 11001* (NY).

terminally a very small, indistinct sterile bud, 8–14 mm long, up to 5–6 mm diam., the inflated part 3–4 mm diam., orifice ascending the pedicel, limb oblique, slightly protruding. Flowers erect on roughish to lepidote, inconspicuously lenticellate pedicels, the latter 28–45 mm long, (1–)1.5–2 mm diam., with small (up to 0.2 mm diam.), roundish lenticels, better developed when fruiting; 2 sepaloid bracteoles directly subtending the calyx, semicircular to broadly triangular-ovate, subcoriaceous with entire, slightly thinned margin, 2–2.5 mm wide, up to 1.5 mm long; sepals equal, broadly semicircular to reniform, 4–5 mm wide, 2–2.3 mm long, subcoriaceous with entire, only slightly thinned margin with very few dark glandular spots, sepals adpressed to outspread; corolla in vivo greenish to greenish brown, narrow ovoidal with slightly asymmetrical obtuse apex, (6–)7–10 mm long, up to (4–)5–6 mm diam.; stamens 38 (30–40?), filaments in vivo pale green, linear, flattened, ca. 3 mm long prior to anthesis, ca. 6 mm long after anthesis, ca. 0.5 mm wide, anthers in vivo white, linear with obtuse apex, ca. 2 mm long, ca. 0.8 mm wide; ovary globoidal, apically narrowed into a ca. 1-mm-long style, 3–4 mm diam., ca. 4 mm high (incl. style), 8 locules (7–9?), stigma umbonate to crateriform, ca. 1.5 mm diam. Fruit (depressed) globose, apically umbonate, roughish, ribbed (locules), 6–10 mm diam., 6–9 mm high, style 0.5–1.5 mm long, ca. 1.5–2 mm diam., calyx (adpressed to) outspread.

Superficially this species resembles *Marcgravia serrae* de Roon from Costa Rica and Panama and could be confused with it. However, *Marcgravia panamensis* is clearly distinguishable by its depauperate inflorescences having only 8–13 flowers and usually 2 nectaries, which places it in Wittmack's category *Pauciflorae* of subgenus *Orthothalamium* Delpino. The leaves are smaller and have only basilaminar glands but no laminar ones (except the tiny solid glands) and are coriaceous in sicco without visible lateral venation. Nevertheless, both species are closely related.

Distribution. Endemic to the Cordillera de San Blas in Panama. So far this species is only known from several localities along the road between El Llano (Province Panamá) and Carti-Tupile (Province San Blas).

Ecology. Wet primary rainforest, 200–760 m altitude, rare.

Remarks. According to present knowledge *Marcgravia panamensis* is confined to Panamá and San Blas Provinces only. There are thirteen collections known to me, and all were collected along the road between El Llano and Carti or in the mountains nearby. Thus it seems to be a rare local endemic of the Cordillera de San Blas.

The epithet for this species alludes to the very restricted distribution in Panama.

The inflorescence is unusual in having the flowers obliquely inserted at the rachis and not spread radially like the spokes of a wheel. This feature is known to me only from the rare endemic of the Cocos Island *M. waferi* Standley (subg. *Plagiothalamium*).

Paratypes. PANAMA. **Prov. Panamá:** along El Llano–Carti road, 6 mi. from Pan-Am Hwy., 1200 ft., 10 May 1979, *Hammel 7344* (MO); 11 km from Pan-Am Hwy., 350 m, 13 Apr. 1975, *Mori et al. 5595* (MO); 12.7 km from Pan-Am Hwy., 350 m, 15 Feb. 1975, *Mori et al. 4679* (MO, US); 14 km from Pan-Am Hwy., 200–500 m, 20 Feb. 1973, *Kennedy 2506* (MO, US); 15.5 km N of El Llano, 400 m, 13 Feb. 1973, *Busey 360* (AAU, MO); from 12 mi. above Pan-Am Hwy. to Continental Divide, 26–27 Mar. 1973, *Liesner 1146* (MO, US), 30 Mar. 1973, *Liesner 1326* (MO, US); continental divide to 1 mi. from divide, 300–500 m, 30 Mar. 1973, *Liesner 1277* (MO); 20.7 km from Pan-Am Hwy., 350 m, 20 Mar. 1975, *Mori & Kallunki 5121* (MO, US); near top of Cerro Jefe, 1 Jan. 1972, *Gentry & Dwyer 3449* (MO). **Prov. San Blas:** trail along Continental Divide, 9°20'N, 78°56'W, 400 m, 23 July 1986, *Mc Donagh et al. 305* (BM); Cerro Habú, 9°23'N, 78°49'W, 2500 ft., 19 Dec. 1980, *Sytsma et al. 2691* (MO).

Marcgravia roonii S. Dressler, sp. nov. TYPE: Colombia. Dept. El Valle: Río Digua Valley, Río Blanco, 600 m, 2–5 Apr. 1939, *Killip 34790* (holotype, BM; isotype, US not seen, photo in U). Figure 2.

Marcgraviae nervosae Triana & Planchon similis, foliis maioribus, inflorescentiis aliquantum latioribus 8–15 cm diam., magis rotatis floribus erectis, pedicellis longioribus 30–50 mm longis, staminibus pluribus, ovario glabro differt.

Robust woody liana, ultimate branchlets terete to quadrangular, slightly zigzagged, with few scattered inconspicuous lenticels (ca. 0.5–1 mm diam.). Adult leaves very large; petioles stout, semi- to subterete, abaxially distinctly canaliculate, (3–)6–17 mm long, (2.5–)3–5 mm diam.; blade oblong, slightly obovate, apically shortly acuminate, rarely only acute, acumen 15–25 mm long, basally rounded to acute, very shortly attenuate, 18–46 cm long, 6–17 cm wide, margin entire, in sicco thin chartaceous (to membranaceous), midrib and lateral veins slightly prominent to obscure from above, prominent and mostly hirsute from beneath, lower surface of leaves shortly hirsute to glabrous; hypophyllous glands small, mostly inconspicuous and hardly visible with the naked eye, marginal: minute

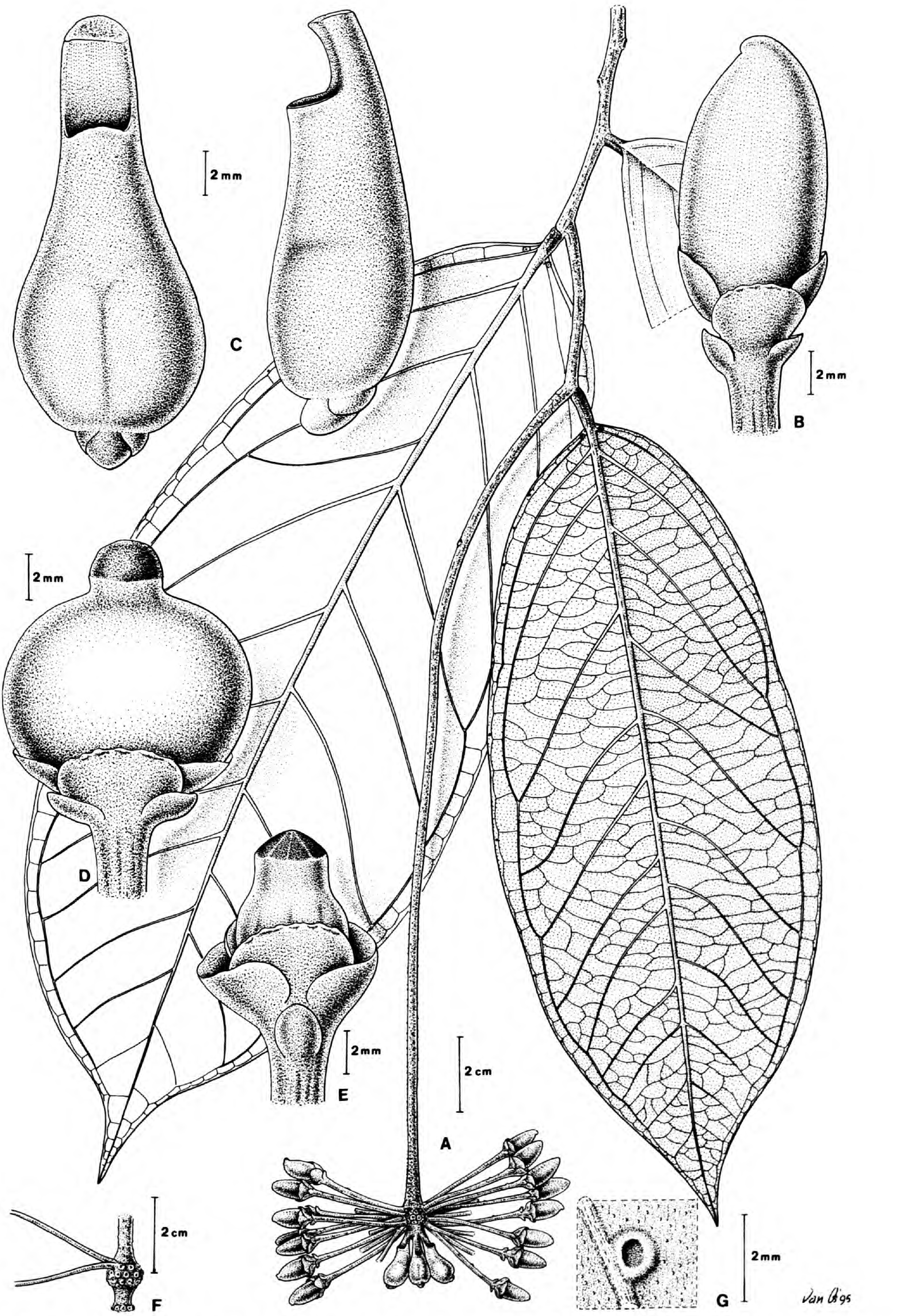

Figure 2. *Marcgravia roonii* S. Dressler. —A. Flowering branch. —B. Flower (before anthesis). —C. Nectaries. —D. Young fruit. —E. Flower (after anthesis). —F. Rachis. Note the interstice between the scars of flower pedicels and nectaries. —G. Basilaminar hypophyllous gland. A–C, F, G, *Killip 34790* (BM); D, *Játiva & Epling 1073* (S); E, *Játiva & Epling 535* (S).

(ca. 0.5 mm diam.), dark, solid, semicircular glands in the margin; basilaminar: 1 conspicuous, oval (max. 1.2 × 1.6 mm), raised crateriform gland, mostly associated with the most basal secondary vein; laminar: 5–12 oval, small (up to 1 mm diam.), crateriform glands with large perforation submarginal from the base to the apex of the leaf, often inconspicuous; juvenile leaves not seen. Inflorescences pendent on relatively long (15–20 cm) peduncles, roughish, with ca. 30–70 fertile and 6–10 sterile flowers (nectaries), the rachis extremely contracted, globose, 8–16 mm diam., with an apical extension (insertion of the nectaries, 3–4 mm long, 4–6 mm diam.) sometimes separated by a short interstice (2–3 mm long), hence the fertile flowers all in a horizontal wheel of 8–15 cm diam., subtended by the nectaries; nectaries small, urceolate, pitcher-shaped, shortly stalked, the free stalk 4–5 mm long, nearly terete, slightly lenticellate outside, the cup tubular, clavate, often terminally testiform, terminally a well-developed sterile bud, 13–19 mm long, 8–11 mm diam., the inflated part 3–4 mm, the orifice not ascending to the pedicel, the opening narrow, margin slightly widened with an acute abaxial lip. Flowers erect (rarely slightly arched upward) on pedicels, the latter 30–50(–59 in fruit) mm long, 1–3 mm diam., lepidote to roughish, rarely hirsute, with scattered conspicuous protruding elongate lenticels (1 × 2 mm); bracteoles directly subtending the sepals to 1–3 mm set apart, sepaloid, semicircular to obtusely triangular, 2.5–3 mm long, ca. 2–5 mm wide, margin thinned with dark glandular spots; sepals (sub)equal, semicircular to reniform, outspread from the corolla, ca. 4 mm long, 5–7 mm wide, margin entire with conspicuous dark glands, gnawed while fruiting; corolla cylindrical-ovoidal to ovoidal, apically slightly asymmetrically conical to obtuse, 10–13 mm long, 5–7 mm diam. basally; stamens numerous (ca. 93 counted), the filaments long linear to very narrowly triangular, flattened, before flowering ca. 8 mm long, ca. 0.5 mm wide, the anthers yellowish white, narrowly triangular, ca. 2 mm long, ca. 1 mm wide; ovary pyriform, basally globoidal, apically contracted into stout style, 4–5 mm diam., 6–7 mm high including style, 9–10 locules, longitudinally striated, glabrous, style 1–2 mm long, terminating into a conspicuous mammiform stigma, 1.5–2 mm diam. Fruit depressed globose, roughish, 10–13 mm diam., 7–9 mm high, apiculate, style ca. 2 mm diam., 1.5–2.5 mm high, subapically contracted.

Marcgravia roonii is easily identified by its very large chartaceous leaves (the largest in the genus known to me) which may be hirsute beneath (at least at the veins) and show a prominent venation but a rather inconspicuous glandular pattern; large, long-peduncled, whorled inflorescences with lots of erect flowers and only few, small nectaries; a globoidally contracted rachis and a glabrous pyriform ovary with a conspicuous stigma.

Distribution. Known from Costa Rica, Panama, Colombia, and Ecuador.

Ecology. Wet primary rainforest, 50–1600 m altitude, obviously rare.

Remarks. This new species resembles *Marcgravia nervosa* Triana & Planchon but it is easily distinguishable by having huge leaves, many erect flowers (subg. *Orthothalamium–Multiflorae*) and lacking the bristles on the ovary. Being vegetatively very similar both species are doubtlessly closely related and form a pair of species that has evolved in two different directions: their diverging inflorescence structures (many flowers, (nearly) erect on long pedicels vs. few flowers obliquely inserted on short, curved pedicels) are very likely to have developed in response to different pollinators. I observed the same phenomenon (differing mainly in the insertion angle of the flowers) in another pair of closely related species from Brazil: *M. comosa* K. Presl and *M. eichleriana* Wittmack.

Two collections from Panama (*McPherson 6793* (MO), *8093* (MO)) show intermediate features with their more strongly bent flowers on shorter pedicels, although the high number of flowers places them in *M. roonii*. Their inflorescences are still premature and it is possible that they may develop the typical shape later.

Both *Marcgravia roonii* and *M. nervosa* require high humidity and occur in very wet virgin forests, often beside rivers. At least in Mesoamerica there seems to exist an altitudinal separation, with *M. nervosa* occurring at lower altitudes (mostly up to 1100 m) than *M. roonii* (above 1000 m) (an observation also made by B. Hammel, in litt. 1995). With more collections this difference may disappear as *M. roonii* was collected in South America on lower altitudes.

I chose the epithet to honor Adrianus Cornelis de Roon, Utrecht, who enriched our knowledge of the Marcgraviaceae by working many years on this family. He had already recognized that this was an undescribed species by annotating the collection selected as type.

Paratypes. COSTA RICA. **Prov. Punta Arenas:** Finca Las Cruces about 5 km S of San Vito de Java, *Utley 10A* (MO). **Prov. Limón:** Cantón de Limón, Cerro Muchilla, Fila Matama, Cordillera de Talamanca, 850 m, 9°47′40″N, 83°06′30″W, 8 Apr. 1989, *Robles & Chacón 2714* (MO). PANAMA. **Prov. Bocas del Toro:** on gravel road branching N from main Fortuna Dam–Chiriquí Grande road, 1.1 mi. from junction, 1200 m, 8°45′N, 82°15′W, 11 Mar. 1985, *McPherson 6793* (MO), 1150 m, 18 Jan. 1986, *McPherson 8093* (MO). **Prov. Chiriquí:** Fortuna Dam region, above northern edge of lake, 1100 m, 8°45′N, 82°15′W, 27 Apr. 1986, *McPherson 9072* (MO), 8 Feb. 1987, *McPherson 10418* (MO), 1400–1600 m, 15 Sep. 1977, *Folsom et al. 5603* (MO); La Fortuna Hydroelectric Project, S side of river, 20 Mar. 1978, *Hammel 2043* (MO); Cerro Pinola, 15 Mar. 1981, *Hím & Gordon 200* (MO); a 1.5 km de campamento Bijao-Fortuna, 20 Mar. 1976, *Mendoza J. Mendieta II & Mayo 276* (MO). ECUADOR. **Prov. Pichincha:** Río Toachi near Santo Domingo, 700 m, 18 July 1963, *Játiva & Epling 535* (S). **Prov. Esmeraldas:** Río Pambil, Estero Pena Lisa, 50 m, 5 July 1966, *Játiva & Epling 1073* (S).

Marcgravia nervosa Triana & Planchon, Ann. Sci. Nat. Bot., 4. Sér. 17: 363. 1862 TYPE: Colombia, *Triana s.n.* (holotype, P; isotype, P).

Marcgravia membranacea Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 697. 1937. Syn. nov. TYPE: Costa Rica. Prov. Cartago: near Pejivalle, 900 m, *Standley & Valerio 47089* (holotype, F not seen; isotype, US).

Marcgravia membranacea Standley differs from *M. nervosa* Triana & Planchon only in having glabrous abaxial leaf surfaces. As I could not find other separating features I consider them to be conspecific, especially because the density of the indumentum of *M. nervosa* is variable. The lower leaf surface indumentum in *M. roonii,* the most closely related species, also ranges from hirsute to glabrous. There is no evidence that this variation is confined to a certain area; on the contrary, one can find both types growing in the same place.

Acknowledgments. It is a pleasure to thank Ad de Roon, who gave his advice and the permission to use his name. I am most grateful to Jan H. van Os for preparing the beautiful and instructive drawings and Jan Frits Veldkamp for helping with the Latin diagnoses.

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Reduction of *Schizostylis* (Iridaceae: Ixioideae) in *Hesperantha*

Peter Goldblatt
B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

John C. Manning
National Botanical Institute, P. Bag X7, Claremont 7735, South Africa

ABSTRACT. *Schizostylis* has the floral synapomorphies of the African genus *Hesperantha*, including style branches dividing at the mouth of the floral tube, long laxly spreading style branches, and articulated anthers twisted to face inward. The basic chromosome number of *Schizostylis*, $x = 13$, is shared in Ixioideae by *Hesperantha*, *Geissorhiza*, and a few species of *Romulea*. *Schizostylis* then differs from *Hesperantha* only in its red flowers (occasionally pink) and, more importantly, in its rootstock, a short rhizome. Most species of *Hesperantha* have white or pink flowers, occasionally yellow or purple, and all have corms with hard woody tunics. We suggest that *Schizostylis*, which is semi-aquatic and grows along streams in seasonally or permanently waterlogged ground, has acquired a rhizome secondarily by loss of the corm. Neither the rhizome nor the red flower is sufficient grounds to warrant generic separation from *Hesperantha*.

Schizostylis, a monotypic, or at best ditypic, genus of southern African Iridaceae subfamily Ixioideae, extends from the Drakensberg Escarpment of Eastern Cape Province, South Africa, northward through Lesotho, Swaziland, and Mpumalanga Province to eastern Zimbabwe. A plant of habitats that are waterlogged during its spring and summer growing season, *Schizostylis* grows along streams, wet seeps, and the edges of marshes (Goldblatt, 1991, 1993). Except in its rhizomatous rootstock and red (sometimes pink) flowers, *Schizostylis* closely resembles the large African genus *Hesperantha* (ca. 65 spp.) morphologically, and it has all of the critical floral features of that genus. These include green, soft-textured bracts; a well-developed perianth tube; a style dividing at the top of the perianth tube; long, spreading filiform style branches; and anthers twisted to face inward. The last three features are synapomorphies for *Hesperantha*. *Schizostylis* also shares a derived basic chromosome number, $x = 13$, with *Hesperantha*, *Geissorhiza*, and some species of *Romulea* (Goldblatt, 1971). Here we address the hypothesis that *Schizostylis* is not only immediately related to *Hesperantha* but is also closely related to species within that genus, thus nested in *Hesperantha*.

ROOTSTOCK

The primitive or plesiomorphic rootstock for all genera of subfamily Ixioideae (Goldblatt, 1990, 1991) is a corm that produces roots from below. A corm is considered one of several synapomorphies for this large subfamily of ca. 27 genera and 950 species. Solely because of its rhizomatous rootstock, *Schizostylis* was treated by Hutchinson (1934) as a member of tribe Aristeae (subfamily Nivenioideae sensu Goldblatt, 1990) despite its many morphological features being discordant with that tribe. *Schizostylis* has all the derived features of Ixioideae. These include flowers with a well-developed perianth tube, perianth lasting more than one day, and flowers sessile and subtended by two opposed floral bracts (inflorescence usually a spike). In their internal anatomy, the leaves of *Schizostylis* also accord with Ixioideae, having epidermal cells with sinuous margins and multiple papillae, and mesophyll cells elongated at right angles to the axis (Rudall & Goldblatt, 1991). In addition, *Schizostylis* has pollen grains typical of Ixioideae with perforate exine and a two-banded operculum, synapomorphies for Ixioideae (Goldblatt et al., 1991). There can be no doubt, then, that *Schizostylis* is a member of subfamily Ixioideae and that its floral specializations point to a close relationship with *Hesperantha*.

Similar rhizome-like rootstocks are known in a few other species of Ixioideae. These include *Gladiolus sempervirens* G. Lewis and *G. aquamontanus* Goldblatt & Vlok, both derived species of this large genus that grow in permanently moist habitats (Lewis et al., 1972; Goldblatt & Vlok, 1989). Likewise, some species of *Geissorhiza* that grow in wet habitats, e.g., *G. outeniquensis* Goldblatt, *G. cataractarum* Goldblatt (Goldblatt, 1985), *G. uliginosa*

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Goldblatt & J. C. Manning (Goldblatt & Manning, 1995), have corm tunics more or less membranous and the corms much reduced in size and very different from those of species from more conventional habitats. We suggest that the rhizome or reduced corms of these species are simply a habitat adaptation. Corms are primarily adapted for underground survival during a long dry season and short growing season and hence not suited to plants that grow in permanently wet sites. The rhizome of *Schizostylis* thus appears to be a secondary specialization, as suggested by Goldblatt (1971, 1991), associated with its aquatic habitat. The presence of corm-like axillary propagules on the stems of at least some *Schizostylis* plants strengthens the hypothesis that the rhizome is secondary in the genus. No member of any subfamily of Iridaceae produces axillary cormlets excepting those that have a cormous rootstock.

THE *SCHIZOSTYLIS* FLOWER

Although the flower of *Schizostylis* conforms in all its critical features to that of *Hesperantha*, it differs from all species of that genus (Goldblatt, 1984; Hilliard & Burtt, 1986) in its bright red color. It is also somewhat unusual in having a particularly long perianth tube, ca. 25–35 mm long. Several species of *Hesperantha* in eastern southern Africa, for example, *H. grandiflora* G. J. Lewis, *H. huttonii* (Baker) Hilliard & Burtt, *H. pulchra* Baker, and *H. scopulosa* Hilliard & Burtt, have comparably long or even longer tubes, but they all have pink flowers. Red flower color combined with a long perianth tube, prominent anthers, and a flowering season from mid to late summer are often associated with a specialized pollination syndrome (Johnson & Bond, 1994) using exclusively the butterfly *Aeropetes* (*Meneris*) *tulbaghia*. *Schizostylis* may be a member of this pollination guild although there are no published observations on the pollination of *S. coccinea*. Flowers of *Schizostylis* are thus no reason to exclude the genus from *Hesperantha*. Both the elongate perianth tube and the red flower color are almost certainly adaptations to a particular pollination system, and are not evidence of a fundamentally different ancestry.

DISCUSSION

Although a critical phylogenetic analysis of *Hesperantha* or of its allies is not available, it seems beyond reasonable doubt that there is no sound taxonomic reason to continue to recognize *Schizostylis* as a separate genus. It is almost certainly most closely allied to long-tubed, eastern southern African species of *Hesperantha*. Its distinguishing features, the rhizome and a long-tubed red flower are adaptations to a wet habitat and a particular pollinator, respectively. Neither feature is unique in Ixioideae. A rhizome-like rootstock or highly reduced corms are known in at least two other genera of the subfamily, in both of which they occur only in specialized species growing in perennially moist habitats. A specialized long- and narrow-tubed red flower is likewise found in a handful of species of other genera of the subfamily and, at least in some of these, e.g., *Gladiolus cardinalis* Curtis, *G. stephaniae* Obermeyer, *Tritoniopsis burchellii* (N. E. Brown) Goldblatt, *T. triticea* (Burman f.) Goldblatt, is known to be an adaptation for pollination by a particular insect, the butterfly *Aeropetes tulbaghia* (Johnson & Bond, 1994). Neither the loss of a corm and the reversion of the rootstock to a rhizome, nor an adaptation to a particular pollinator are alone sufficient grounds for recognition of a genus. This is particularly the case for a monotypic (or possibly ditypic) genus such as *Schizostylis* where its relationships can be confidently determined. We therefore propose reducing *Schizostylis* to synonymy in *Hesperantha*.

Hesperantha Ker Gawler, Konig & Sims Ann. Bot. 1: 224. 1805. TYPE: *Hesperantha falcata* (L.f.) Ker Gawler.

Schizostylis Backhouse & Harvey, Curtis's Bot. Mag. 90: pl. 5422. 1864. Syn. nov. TYPE: *Schizostylis coccinea* Backhouse & Harvey (= *Hesperantha coccinea* (Backhouse & Harvey) Goldblatt & J. C. Manning).

Hesperantha coccinea (Backhouse & Harvey) Goldblatt & J. C. Manning, comb. nov. Basionym: *Schizostylis coccinea* Backhouse & Harvey, Curtis's Bot. Mag. 90: pl. 5422. 1864. TYPE: South Africa. Eastern Cape: without precise locality or collector, cultivated in Britain, illustration in Curtis's Bot. Mag. 90: pl. 5422 (1864).

Schizostylis pauciflora Klatt (1867) appears to be no more than a pink-flowered form of *S. coccinea*, although both were recognized by Baker (1896). The two were treated as conspecific by Goldblatt (1993) and we endorse this treatment. Pink-flowered plants at least sometimes grow among those with red flowers and they have been recorded at several sites within the range of typical red-flowered *S. coccinea*. Thus, there is no geographical component to the distribution of the two flower colors in the species.

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Sinosenecio newcombei (Asteraceae: Senecioneae): A New Combination for a North American Plant in an Asiatic Genus

John P. Janovec and Theodore M. Barkley
Herbarium, Division of Biology, Kansas State University, Manhattan, Kansas 66506, U.S.A.

ABSTRACT. The plant long called *Senecio newcombei* Greene is a distinctive endemic of the Queen Charlotte Islands, B.C., Canada. Microcharacters, cytology, and gross morphology indicate its affinities with the tussilaginoid group of the Senecioneae and with the East Asian genus *Sinosenecio.* The new nomenclatural combination is made: *Sinosenecio newcombei* (Greene) J. P. Janovec & T. M. Barkley.

Work on generic treatments for the Flora of North America North of Mexico project has drawn our attention to the problematic *Senecio newcombei* Greene. The entity was described from a collection made by C. F. Newcombe in 1897 at the site of a Norwegian fishing camp just north of Kaisun on the west coast of Moresby Island, Queen Charlotte Islands, B.C., Canada, and was named in honor of the collector (Greene, 1897). Subsequent studies have agreed that the entity is restricted to the Queen Charlotte Islands, where it occurs on open, rocky, and boggy sites throughout the western coastlands and on the heathy rock-talus slopes of the Takakia Lake alpine region (Barkley, 1962, 1978, 1988; Calder & Taylor, 1968; Douglas, 1982). Greene (1897) treated the entity as a *Senecio* because of its evident gross morphology, and Barkley (1962) included it within the *Aurei* species-group as a matter of convenience. Calder and Taylor (1968) recognized that *S. newcombei* did not fit comfortably among the *Aurei* but suggested that it might be related to the aureoid *S. porteri* Greene, a distinctive monocephalous alpine species of the Colorado Rocky Mountains and apparently the Wallowa Mountains of northeastern Oregon. In 1988, Barkley excluded *S. newcombei* from the aureoid complex and suggested that it might have Asiatic affinities.

Since then, generic concepts within the Senecioneae have undergone revision. As recently as 1985, Barkley could argue for maintaining *Senecio* as a single, diverse genus, and this notion reflected American floristic traditions (Barkley, 1985a, b). Detailed studies, however, have made a compelling case for treating the various segregates as genera; many of them have been long-recognized as sections or other infrageneric groups within *Senecio* s.l. New data derived from morphological analyses and from biochemical/genetic investigations, plus the rigor of modern phylogenetic theory, combine to favor narrower generic concepts. Recognition of smaller, segregate genera was promoted in the 1970s by Robinson, often in collaboration with Brettell, in a series of papers centered upon the plants of southern North America and eastern Asia (see Barkley, 1985b, and Bremer, 1994, for citations). Nordenstam (1977, 1978) accepted a series of segregate genera in a world-wide catalog presented in connection with the symposium on the Biology and Chemistry of the Compositae, at the University of Reading, U.K., in the summer of 1975. Jeffrey treated the traditional *Senecio,* s.l., as a series of segregate genera in several papers, culminating in his generic catalog of *Senecioneae* (Jeffrey, 1992). Bremer also treated *Senecio,* s.l., as numerous segregates in his monumental review of the Asteraceae of the world (Bremer, 1994). He provided cladograms, based on morphological characters, of the evolutionary lineages within the Senecioneae, as he saw them, and he stressed the morphological distinctions between the subtribes Senecioninae and Tussilagininae, i.e., the senecionoid and tussilaginoid lineages. (The tussilaginoids were called "cacalioids" and "tephroseroids" in the older literature.) Barkley et al. (in press) summarized the distinctions among the segregates in these two lineages in Mexico and Central America and offered a justification for regarding them as genera.

The senecionoid lineage is characterized by having style branches with separate stigmatic lines, upper stamen filaments with swollen collars ("balusterform"), anthers often with thickenings in the lateral walls of the endothecial cells, and chromosome numbers based on $x = 10$ or 20 or numbers derived therefrom. In the tussilaginoid lineage, the stigmatic surface is entire or nearly so across the inner face of the style branch, the upper stamen filaments are cylindrical, the anthers often have thickenings in the transverse walls of the endothecial cells, and the chromosome numbers are

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based mostly on $x = 30$ or numbers derived therefrom, including numbers down to $x = 24$, presumably via aneuploid reduction (Bremer, 1994). The nature of the microcharacters in the Senecioneae is illustrated by photographs in Nordenstam (1978), Jeffrey & Chen (1984), and Wetter (1983).

Specimens of *Sinosenecio newcombei* were borrowed for study (cited below), and slides were made to observe microcharacters. The techniques for microcharacter analyses were learned by the first author from H. Robinson at the Smithsonian Insitution, and they are similar to those of Wetter (1983).

Sinosenecio newcombei uniformly has the entire stigmatic areas and the cylindrical stamen filaments of the tussalaginoid lineage and also has thickenings in the transverse walls of the endothecial cells, i.e., the thickenings are "polarized." In aspect and in these microcharacters, it clearly resembles the Asiatic tussilaginoid segregate genus *Sinosenecio* B. Nordenstam. The chromosome number for this species is $n = 24$, which is known from several counts (Taylor & Mulligan, 1968). This number occurs in some other tussilaginoid species but is apparently not known among senecionoid species.

The aureoid assemblage of *Senecio* is senecionoid in microcharacters, but it has a distinctive chromosome number of $n = 22$ or 23 or polyploid derivatives thereof. Moreover, it is distinguished by having pollen walls of a helianthoid rather than a senecioid structure (Bain & Walker, 1995). The aureoid assemblage is now recognized as the segregate genus *Packera* Löve & Löve, and it definitely does not include *Sinosenecio newcombei.*

Specimens referable to *Sinosenecio* were surveyed by the first author in the herbarium of The New York Botanical Garden (NY) and by both authors in the herbarium of the Missouri Botanical Garden (MO), and we conclude that *Sinosenecio newcombei* is comfortably similar to the Asiatic species of *Sinosenecio. Sinosenecio newcombei* resembles *S. homogyniphyllus* (Cumm.) B. Nordenstam, which was illustrated in Nordenstam (1978), and several of the species illustrated by Jeffrey and Chen (1984) in their account of the *Sinosenecio* in Eastern Asia. *Sinosenecio newcombei* appears to fall among the species referable to their subsection *Madarogyne.*

The recognition that a distinctive and highly restricted North American plant belongs to an otherwise Asiatic group raises biogeographic questions that are beyond the scope of this paper. It is remotely possible that the American plants derive from a relatively recent introduction, but *S. newcombei* is distinctive and is not known in Asia. More likely, *S. newcombei* is a locally adapted relict of some past distributional event.

The following new combination is made here:

Sinosenecio newcombei (Greene) J. P. Janovec & T. M. Barkley, comb. nov. Basionym: *Senecio newcombei* Greene, Pittonia 3: 249. 1897. Type: Canada. British Columbia: Queen Charlotte Islands, June 1897, *Newcombe s.n.* (US).

Specimens examined. CANADA. **British Columbia:** McClinton Bay, Graham Island, 18 June 1957, *Calder, Savile & Taylor 21605* (NY); Kootenay Inlet, Moresby Island, 21 July 1964, *Calder & Taylor 36195* (NY); Kaitgoro, 1903, *Newcombe s.n.* (MO-photo); Canoe Passage, 26 July 1910, *Spreadborough 91260* ex Herb. Geol. Survey of Canada (MO).

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A New Species of *Stenandrium* (Acanthaceae) from Grão-Mogol, Minas Gerais, Brazil

Cíntia Kameyama
Departamento de Botânica, Instituto de Biociências, Universidade de São Paulo, C.P. 11461, 05422-970, São Paulo, SP, Brazil

ABSTRACT. A new species, *Stenandrium stenophyllum*, is described and illustrated. It is related to *S. hatschbachii* Wasshausen but differs markedly from that taxon by its 3-verticillated leaves with narrow, linear-lanceolate blades. Both species are known only from Grão-Mogol, Minas Gerais, Brazil.

Stenandrium is a genus of perennial herbs and subshrubs with about 70 species that occur in tropical America and Africa, including Madagascar (Vollesen, 1992). In Brazil there are about 16 species, most of which grow in grasslands and savanna-like vegetation. During work on the floristic inventory of the "Campos Rupestres" vegetation in Grão-Mogol, Minas Gerais, coordinated by the Universidade de São Paulo, a new species of *Stenandrium* that shows close affinities to *S. hatschbachii* Wasshausen was found.

Stenandrium stenophyllum Kameyama, sp. nov. TYPE: Brazil. Minas Gerais: Grão-Mogol, Estrada para Cristália a ca. 800 m da ponte sobre o rio Itacambiruçu, ca. 750 m alt., 16°36′S 42°55′W, 14 jun. 1990 (fl, fr), *A. A. Oliveira, D. C. Zappi, J. R. Pirani & R. Simão-Bianchini CFCR 12982* (holotype, SPF; isotypes, K, MBM, RB, US). Figures 1, 2.

A *S. hatschbachii* Wasshausen cuj affinis sed foliis 3-verticillatis, linear-lanceolatis vel linearibus vel linear-falciformibus differt.

Caulescent subshrub 0.4–1.5 m tall, erect to decumbent. Stems terete, densely pubescent with white trichomes, 0.20–0.25 mm long. Leaves whorled, 3 at each node, sessile to subsessile, coriaceous, the blades linear-lanceolate to linear, sometimes linear-falcate, 3.5–6.0 cm long, 2–5 mm broad, attenuate at base, obtuse to acute at apex, sometimes acuminate or shortly mucronate, the upper surface dark green, sparsely and inconspicuously puberulous with very short eglandular trichomes, the lower surface paler green, inconspicuously puberulous with eglandular and glandular trichomes, the margin revolute. Inflorescence of terminal and subterminal spikes to 2.5 cm long, the spikes sessile or borne on peduncles to 6 mm long, pubescent like the stems, except with trichomes shorter (i.e., 0.15 mm long); the flowers opposite along the spike axis; bracts subulate, 4–6 mm long, 0.5 mm broad, pubescent like the leaves; bracteoles subulate, 4 mm long, 0.5 mm broad, pubescent like the leaves, calyx deeply lobed, 5–7 mm long, the lobes lanceolate, 1.2 mm wide, very sparsely pubescent; corolla whitish lilac to purple-red, 9–12 mm long, the tube 5–6 mm long, the upper lip pale pink to white, the lobes 3 mm long, the lower lip dark purple, the central lobe 5–5.5 mm long, the lateral lobes 4.2–4.8 mm long, stamens 1.3–1.7 mm long; anthers 1.1 mm long; pollen grains tricolpate, prolate, 49.4 × 33.5 μm, exine tectate-perforate, colpi membranes sparsely granulate; style filiform, stigma subclavate, asymmetrical. Capsule ellipsoid, 1.2 cm long, inconspicuously puberulous; seeds laterally flattened, semi-elliptic in outline, 3 mm long, 2 mm wide, densely pubescent with long, appressed trichomes bearing minute lateral barbs.

Stenandrium stenophyllum is closed allied to *S. hatschbachii* (Wasshausen, 1990): both species have similar inflorescences and flowers, but *S. hatschbachii* can be easily distinguished by the opposite, broader (9–14 mm broad), lanceolate to oblong leaves. In contrast, the leaves of the new species are 3-verticillate, linear-lanceolate to linear, 2–5 mm broad. Both species grow among shrubs and small trees in dense and drier vegetation on sandy soils with rocky outcrops. Both species have been collected only in Grão-Mogol.

Paratype. BRAZIL. **Minas Gerais:** Grão-Mogol, vale do Rio Itacambiruçu, ao longo da estrada para Cristália, 10 Nov. 1989, *J. R. Pirani, P. T. Sano, T. R. S. Silva & A. Freire-Fierro CFCR 12420* (SPF).

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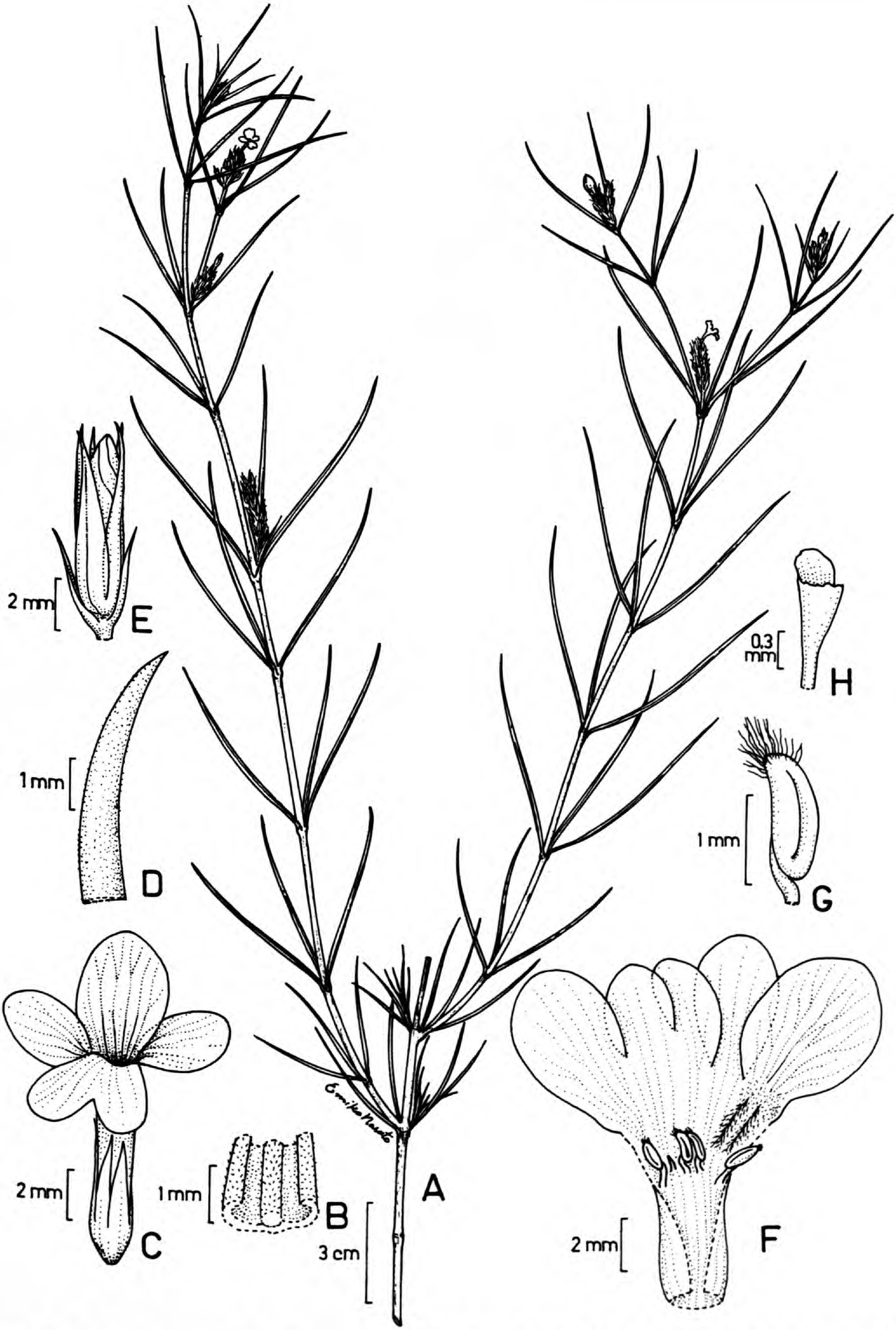

Figure 1. *Stenandrium stenophyllum* Kameyama. —A. Branch. —B. Detail of the leaf. —C. Calyx and corolla. —D. Bract. —E. Flower bud with bracteoles. —F. Corolla expanded. —G. Stamen. —H. Stigma. Drawings based on the holotype.

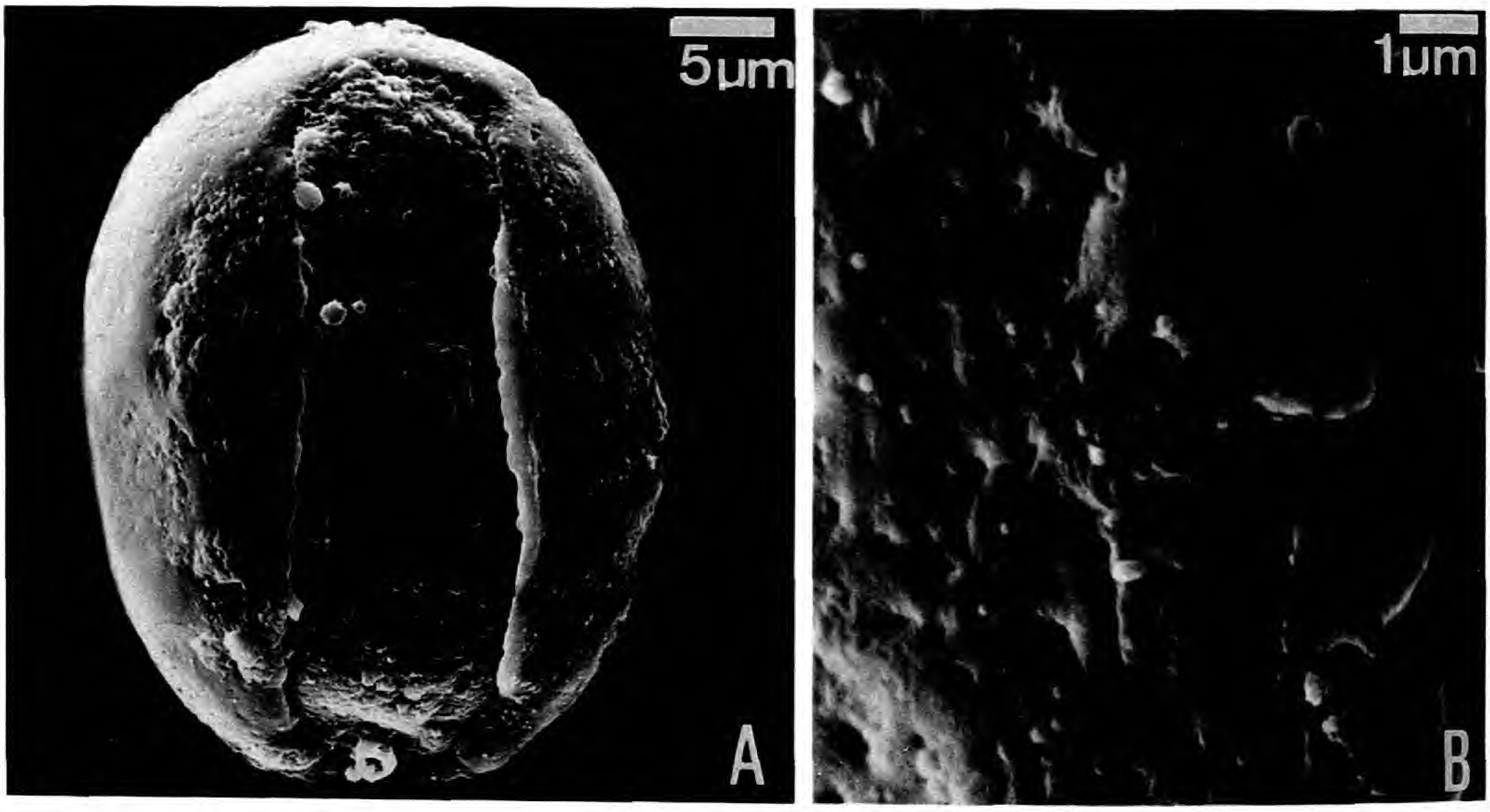

Figure 2. SEM photomicrographs of *Stenandrium stenophyllum* pollen. —A. Equatorial view. —B. Detail of the sculpturing. (*Oliveira et al. CFCR 12982.*)

pollen description, to Marcio V. Cruz from the Laboratório de Microscopia Eletrônica, IBUSP, for the photomicrographs, to Emiko Naruto for the line drawings, and to Raymond Harley for the English review.

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A New Combination and Two New Species in *Alafia* (Apocynaceae)

A. J. M. Leeuwenberg
Herbarium Vadense, 37 Gen. Foulkesweg, P.O. 8010, 6700 ED, Wageningen, The Netherlands

ABSTRACT. Due to the priority of the epithet, a new combination, *Alafia erythrophthalma* (K. Schumann) Leeuwenberg, is needed; *Alafia grandis* Stapf is placed into synonymy. Two new species, *A. falcata* Leeuwenberg and *A. velutina* Leeuwenberg, have been discovered among the collections made in Gabon by Le Testu.

Alafia erythrophthalma (K. Schumann) Leeuwenberg, comb. nov. Basionym: *Tabernaemontana erythrophthalma* K. Schumann, Bot. Jahrb. Syst. 23: 224. 1896. TYPE: Cameroun. Centre-Sud: Yaoundé, *Zenker & Staudt 701* (holotype, B†; lectotype, designated here, K; isolectotype, BM).

Alafia grandis Stapf, in Dyer, Fl. Trop. Afr. 4, 1: 196. 1902. Syn. nov. TYPE: Cameroun. Centre-Sud: Yaoundé, *Zenker & Staudt 213* (lectotype, designated by Pichon (1954), K).

Stapf found the name of Schumann on the herbarium specimen received from Berlin, but did not realize that the name had been validly published six years earlier; therefore, unfortunately, the simple name "*grandis*" has to be changed for this species.

Alafia falcata Leeuwenberg, sp. nov. TYPE: Gabon. Agouma, *Le Testu 5827* (holotype, P; isotypes, BM, BR, LISC, US, WAG).

Liana magna foliis oppositis ellipticis apice acuminatis vel fere caudatis utroque latere glabris. Inflorescentia terminalis multiflora densa pedunculo saepe perbrevi et pedicellis gracilibus. Sepala ovata apice rotundata extus puberula ciliata. Corolla alba vel cremea. Tubi pars basalis anguste cylindracea parte apicali campanulata circiter aequilonga. Lobi leviter falcati. Stamina inclusa antheris sessilibus anguste triangularibus apice acuminato et basi sagittata sterilibus. Ovarium puberulum carpellis duo separatis. Caput pistilli antheris coherens. Fructus ignotus.

Large liana. Branchlets glabrous. *Leaves*: petiole 3–5 mm long, glabrous; blade coriaceous when dried, elliptic, 2–2.3× as long as wide, 5.5–11 × 2.5–5.3 cm, acuminate to almost caudate at the apex, rounded or cuneate at the base, glabrous on both sides, with 6–10 pairs of upcurved secondary veins forming an angle of 50–70° with the costa; tertiary venation reticulate, conspicuous. *Inflorescence* terminal, many-flowered, 5.5–7.5 × 6–7.5 cm, dense. Peduncle 5–25 mm long, glabrous; pedicels 6–12 mm long, glabrous or sparsely puberulous. Bracts sepal-like and 0.5× as long as the sepals. *Flowers*: *Sepals* ovate, 1.5–2× as long as wide, 2.5–3 × 1.5–1.7 mm, rounded, puberulous outside, glabrous inside and with 1–2 large colleters; colleters 1.5 × 1–1.5 mm, lobed. *Corolla* white or cream, with an ovoid head in the mature bud about half as long as the tube, glabrous outside, long-ciliate at the part of the lobes covered in bud and shortly so or not at the other part, puberulous inside in a belt from the mouth to the insertion of the stamens or from the mouth down for only 4 mm, pubescent belt below insertion of stamens 1–2 mm wide; tube 7–9× as long as the calyx, 2–3× as long as the lobes, 22 mm long, 2 mm wide at the base and cylindrical for 11 mm, from there abruptly widened into the campanulate upper part, which is 5 mm wide near the insertion of the stamens and slightly narrowed toward the throat to 4 mm wide; lobes obliquely ovate, 0.36–0.5× as long as the tube, 1.9–2× as long as wide, 8–11 × 4–6 mm, slightly falcate, acute or obtuse, entire, spreading. *Stamens* with apex 3–4 mm below mouth of corolla tube, inserted 0.5–0.55 of the length of the corolla tube (at 11–12 mm from the base); anthers 4.5–7.5× as long as wide, 6.8–7.5 × 1–1.5 mm, sterile at the apex and for 1 mm, glabrous outside. *Pistil*: ovary ovoid, 2 × 1.5 × 1–1.2 mm, obtuse; style 10–11 mm long; pistil head of a cylinder 2 × 0.3 mm and a stigmoid apex about 0.1 × 0.1 mm. Fruit unknown.

Alafia falcata has slightly falcate corolla lobes. It has been confused with *A. multiflora* (Stapf) Stapf and *A. schumannii* Stapf because of the similarity of leaf shapes, but it is easily distinguished from both of them by the long narrow corolla base and the ovate acute or obtuse instead of obovate rounded corolla lobes.

Paratypes. GABON. Upper Ogooué R., Mougombou, *Le Testu 8849* (BM, BR, LISC, P, WAG); Abanga, *N. Hallé* 2374 (P).

Alafia velutina Leeuwenberg, sp. nov. TYPE: Gabon. Lastoursville, *Le Testu 7078* (holotype, US; isotypes, BM, G).

NOVON 6: 271–272. 1996.

Liana ramis lenticellis pallidis. Folia opposita petiolata lamina coriacea elliptica vel anguste elliptica apice breviter acuminata utroque latere glabra. Inflorescentia terminalis multiflora densa pedunculo pedicellisque brevibus. Sepala ovata apice obtusa extus puberula. Corolla alba extus parte superiore tubi et lobis utroque latere puberula velveto similia. Stamina inclusa antheris sessilibus triangularibus apice acuminato et basi sagittata sterilibus. Ovarium pubescens carpellis duo separatis. Caput pistilli antheris coherens. Fructus ignotus.

Liana. Branches dark brown, with pale brown lenticels; branchlets glabrous. *Leaves*: petiole 5–6 mm long, glabrous; blade coriaceous when dried, elliptic or narrowly elliptic, 2.4–3× as long as wide, 6–10.5 × 2.5–4 cm, shortly acuminate at the apex with an acute acumen, rounded or cuneate at the base, glabrous on both sides, with 5–8 pairs of rather straight secondary veins forming an angle of 50–90° with the costa; tertiary venation inconspicuous. *Inflorescence* terminal, many-flowered, 3–5 × 3–5 cm, dense. Peduncle 2–12 mm long, glabrous; pedicels 1–3 mm long, puberulous. Bracts sepal-like and about half as long as them. *Flowers*: *Sepals* ovate, 1.7× as long as wide, 2.5 × 1.5 mm, obtuse, puberulous outside, glabrous inside and without colleters. *Corolla* white, with an ovoid head in the mature bud about 0.4 of the bud length, puberulous outside on lobes and upper part of tube, obscurely ciliate, puberulous inside on lobes, otherwise glabrous (no hairs on filament ridges); tube 5.4 × as long as the calyx, 1.5× as long as the lobes, 13.5 mm long, 2 mm wide at the base, widened at the insertion of the stamens to 4.5 mm wide, again narrowed toward the throat to 4 mm wide; lobes obliquely elliptic, 0.7× as long as the tube, twice as long as wide, 9 × 4.5 mm, rounded, entire, spreading. *Stamens* with apex at mouth of corolla tube, inserted 0.6 mm of the length of the corolla tube (at 8 mm from the base); anthers 6 × 1 mm, sterile at the apex for 1 mm, glabrous outside. *Pistil*: ovary ovoid, 1.5 × 1.5 × 1 mm, obtuse; style 8 mm long, 0.2 mm wide at the base, 0.4 mm wide at the apex; pistil head a cylinder 0.8 × 0.3 mm with a stigmoid apex about 0.2 × 0.2 mm. *Fruit* unknown.

Like *Alafia falcata*, this species has also been confused with *A. multiflora* and *A. schumannii* by the shape of the leaves. *Alafia velutina* is most easily distinguished by the very short pedicels and the ovate corolla lobes which are puberulous on both sides resulting in a velvety appearance, while those of the other two species are obovate and glabrous except for the ciliate margins.

Alafia velutina grows in forest; it is known only from the type.

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Syringantha coulteri (Hooker f.) T. McDowell, a New Combination, and Remarks on the Relationships of the Monotypic Mexican Genus *Syringantha* Standley (Rubiaceae)

Tim McDowell
Department of Botany, Duke University, Durham, North Carolina 27708, U.S.A.
(author's e-mail address: timdmcd@acpub.duke.edu)

ABSTRACT. *Exostema coulteri* Hooker f. is transferred to the monotypic genus *Syringantha* Standley, and the new combination *Syringantha coulteri* (Hooker f.) T. McDowell is made. Analysis of leaf, flower, fruit, and pollen characters indicates the affinities of *Syringantha* are with the tribe Hamelieae. A description, illustrations, and micrographs of pollen and leaves of *S. coulteri* (Hooker f.) T. McDowell are provided.

HISTORY OF *SYRINGANTHA*

Exostema coulteri Hooker f. was first published by W. B. Hemsley (1879), who attributed the species to J. D. Hooker based on a manuscript in the Kew herbarium. The specific epithet honors Thomas Coulter (1793–1846), an Irish botanist and curator of the herbarium of Trinity College, Dublin, whose collections from central Mexico include the type for *E. coulteri.* The assignment of this species to the genus *Exostema* (Persoon) Bonpland is not discussed in the published description, but evidently was based on characters of the corolla, stamen, capsule, and seeds. In particular, a more or less tubular corolla, basifixed linear anthers with filaments inserted near the base of the corolla tube, and a septicidally dehiscent bilocular capsule with winged seeds are characters shared with the genus *Exostema.* However, the fully exserted stamens, for which *Exostema* was named, are lacking in *E. coulteri,* which has the stamens only partially exserted.

Standley (1921) maintained *E. coulteri* in his treatment of *Exostema* for the North American Flora, but noted "description compiled," and apparently did not see any specimens of this species. In the dichotomous key to the 26 species of *Exostema* included in Standley's treatment, *E. coulteri* is the only one with "Stamens included; corolla lobes short, rounded."

In 1930 Standley described the monotypic genus *Syringantha* Standley with one species, *Syringantha loranthoides* Standley, based on Mexican collections by Karwinsky on loan from the Leningrad Botanical Garden herbarium. Standley stated, "*Syringantha* is evidently a close relative of *Exostema* . . . but the corollas are conspicuously different," noting that the short, broad and erect corolla lobes of *Syringantha* contrast with the long, narrow and recurved lobes in *Exostema.* He overlooked *Syringantha*'s resemblance to the anomalous *Exostema* species *E. coulteri.*

Lorence recognized that *Syringantha loranthoides* is identical to *Exostema coulteri* and used the earlier name *E. coulteri* Hooker f. in his annotations of specimens and in a checklist of Mexican genera of the Rubiaceae (Lorence, 1990). This reduction of *S. loranthoides* to *E. coulteri* has been followed in a recent review of Rubiaceae classification by Robbrecht (1994).

In the course of a revision of the genus *Exostema* I have examined the morphology and pollen structure of *E. coulteri* and other *Exostema* species and have determined that *E. coulteri* should be excluded from *Exostema.* Differences between *Syringantha* and *Exostema* are summarized in Table 1. The synapomorphies for *Exostema*—the corolla with a narrowly cylindrical tube, ligulate recurved corolla lobes, and the anthers long exserted—are lacking in *Syringantha* (Fig. 1). *Syringantha* also lacks characters common to the genera closest to *Exostema,* notably *Coutarea* Aublet and *Portlandia* P. Browne (Andersson & Persson, 1991; Bremer, 1992), which include anthers with latrorse dehiscence and tricolporate pollen with spinulose, foveolate exine (Fig. 2). *Exostema* and closely related genera lack several characters of *Syringantha,* such as caducous stipules, a subconical nectar disc, and apiculate stamen connectives. Moreover, *Syringantha* has abundant raphide bundles in stems, leaves, flowers and fruits (Fig. 3), which have not been previously reported and are absent from all *Exostema* species (pers. obs.). Consequently, the monotypic genus *Syringantha* is here maintained, and the new combination *Syringantha coulteri* (Hooker f.) T. McDowell is made for this species.

Table 1. Comparison of selected characters of *Syringantha*, *Hamelia*, and *Exostema*.

Character	*Syringantha, Hamelia*	*Exostema*
Raphides	present	absent
Stipule persistence	caducous	persistent
Inflorescence branching	upper axes monochasial, secundiflorous	upper axes usually dichasial, never secundiflorous
Corolla color	bright yellow, orange or deep red	white turning pink, cream, tan or pale yellow
Stamen filament shape	flattened	terete-filiform
Anther dehiscence	introrse	latrorse
Connective shape	apiculate	not apiculate
Nectariferous disc shape	subconical	discoid
Funicular attachment on seed	at center of seed body	at edge of seed body
Pollen exine type	smooth, reticulate	spinulose, foveolate

RELATIONSHIPS OF *SYRINGANTHA*

Tribal affiliation of *Syringantha* is problematic. Traditional subfamilies and tribes have been based on a few characters, such as fruit type (Schumann, 1891) or presence of raphides (Bremekamp, 1966), and have been artificial groups. Because they have capsules and winged seeds, *Syringantha* and *Exostema* historically have been included in the tribe Cinchoneae (Robbrecht, 1988). Recent authors have allied *Exostema* and *Syringantha* with the tribe Condamineae (Andersson & Persson, 1991), and with a group of genera "associated with *Portlandia*" to be segregated from that tribe (Robbrecht, 1993), but have not evaluated *Syringantha* in detail. Raphides are presumably absent from these tribes, although exceptions to this pattern have been noted for certain genera (Robbrecht, 1988; Taylor, 1992). The combination of winged seeds, raphides, and imbricate corolla aestivation in *Syringantha* is incompatible with the subfamily and tribal groupings currently recognized (Robbrecht, 1988).

Syringantha may be closely related to the genus *Hamelia* Jacquin, a neotropical group of shrubs with fleshy fruits and many small wingless seeds. Despite the obvious difference in fruit and seed types, *Syringantha* and *Hamelia* share many vegetative, floral, and fruit traits. Both have raphides and deciduous stipules. Both have secundiflorus inflorescence axes and bright yellow corollas (also orange or red in *Hamelia*) with short, imbricate lobes. The subcylindrical, somewhat angular corolla shape in *Syringantha* resembles several *Hamelia* species. In both *Syringantha* and *Hamelia* there is a large, subconical ovarian disc that persists as a conspicuous extension of the fruit above the calyx limbs. In all *Hamelia* species the connective of the stamen is extended beyond the anthers into a short tip (Elias, 1976). *Syringantha* also has an apiculate connective. Pollen in *Hamelia* is similar to *Syringantha* pollen in type and size (Fig. 2). Finally, the restricted range of *Syringantha* in eastern Mexico falls within the wider neotropical distribution of *Hamelia* (Elias, 1976).

The tribe Hamelieae Kunth has been investigated in a cladistic study by Bremer (1987), who defined it as a monophyletic group of five neotropical genera. Lorence and Dwyer (1988) supported Bremer's circumscription of the tribe, but added two small Mexican genera (*Eizia* Standley and *Plocaniophyllon* T. S. Brandegee). The Hamelieae, which Bremer and Lorence consider a well supported natural group, is variable for characters such as fruit type (capsule or berry), corolla aestivation (imbricate or contorted), and pollen exine sculpting (smooth reticulate or spinulose foveolate) (Bremer, 1987; Lorence & Dwyer, 1988). Characters for the tribe as summarized by Robbrecht (1988) include raphides present, usually terminal inflorescences with flowers often yellow, and stamens inserted near corolla base, although these traits also occur in various tribes in the Rubioideae. Synapomorphies for the Hamelieae, according to Bremer (1987), include granulate or tuberculate exotestal cells, infloresence bracts scale-like or lacking, and aestivation imbricate or right-contorted. Lorence and Dwyer (1988) emphasized the importance of capsule dehiscence, which they described as initially loculicidal, to distinguish the dry-fruited genera of the tribe. The microstructure of the exotestal cell tangential walls of *Syringantha* has not been examined. *Syringantha* is consistent with the bract, inflorescence, and dehiscence character states for the Hamelieae.

The inclusion of *Syringantha* in the tribe Hamelieae would add winged seeds to this already

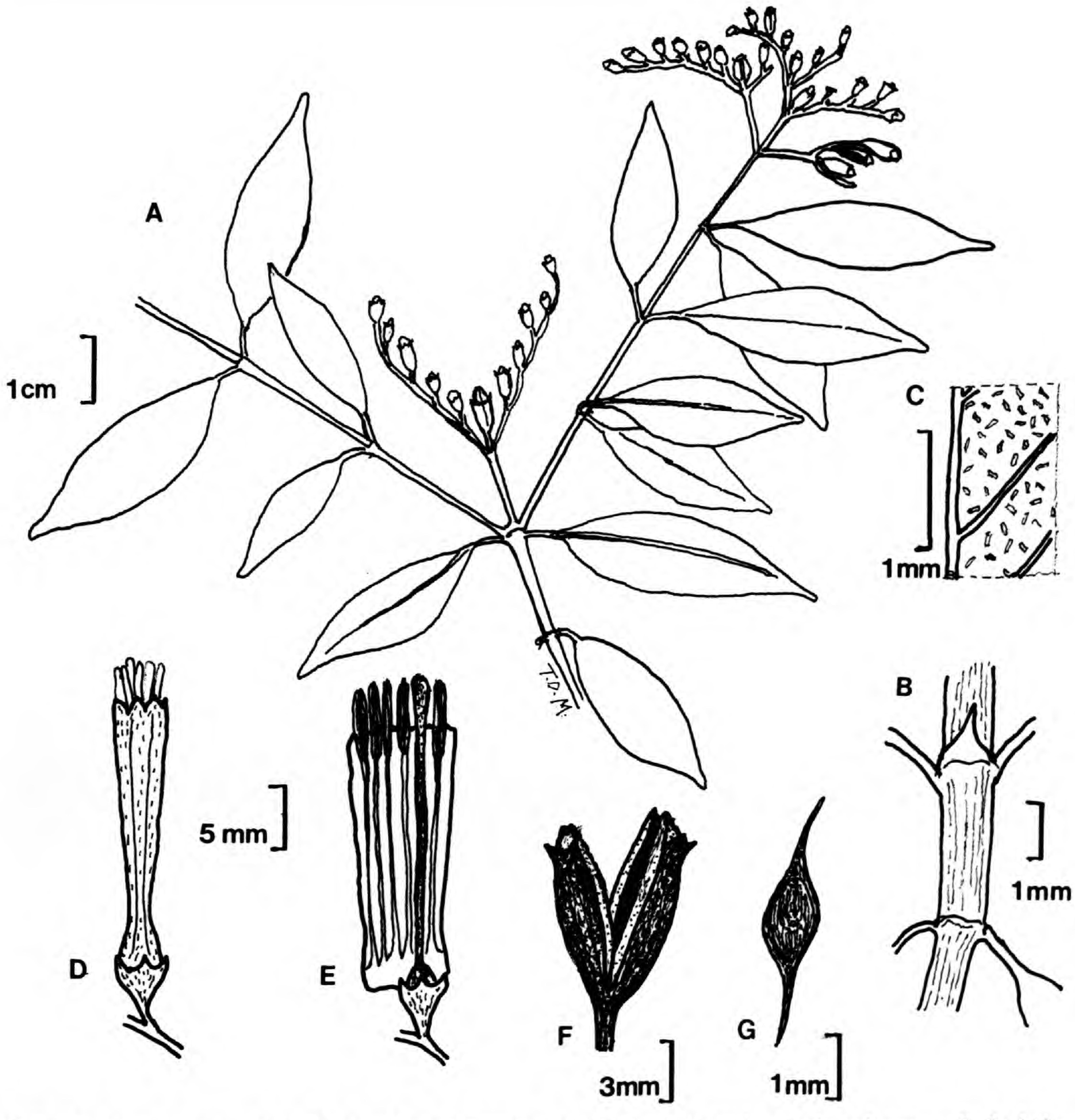

Figure 1. *Syringantha coulteri* (Hooker f.) T. McDowell. —A. Habit. —B. Node, stipule caducous. —C. Raphides in young leaf blade. —D. Flower. —E. Opened flower. —F. Dehiscent capsule. —G. Seed. (A, C, *Stanford et al. 2207*; B, D, *Webster & Armbruster 20526*; E, *Diaz Barriga 3872*; F, G, *Hernández M. & Rodriguez 4967*.)

diverse tribe. Bremekamp (1966) argued that winged seeds of different morphologies had arisen in various lineages, and that the character "winged seeds" was therefore unsuitable for defining a natural group. Recent analyses of Rubiaceae phylogeny have confirmed this conclusion (Bremer & Eriksson, 1992). Bremekamp (1952) transferred several genera with winged seeds from the Cinchoneae to the Hedyotideae, emphasizing the greater importance of characters such as raphides and exotestal cell pitting. A similar, albeit controversial, realignment of winged-seeded genera from the tribe Cinchoneae to a tribe of fleshy-fruited genera has been proposed by Bremer (1992), who transferred *Exostema* and allied genera to the tribe Chiococceae on the basis of morphological and chloroplast DNA characters.

The traditional, artificial subdivision of the Rubiaceae according to a few simple characters continues to confuse perceptions of phylogenetic relationships and character evolution within this large family. It has long been acknowledged that groups based on the characters of ovules per locule (one vs. many) and fruit type (dry vs. fleshy) do not represent evolutionary lineages (Verdcourt, 1958; Bremekamp, 1966). If the pluriovulate locule is prim-

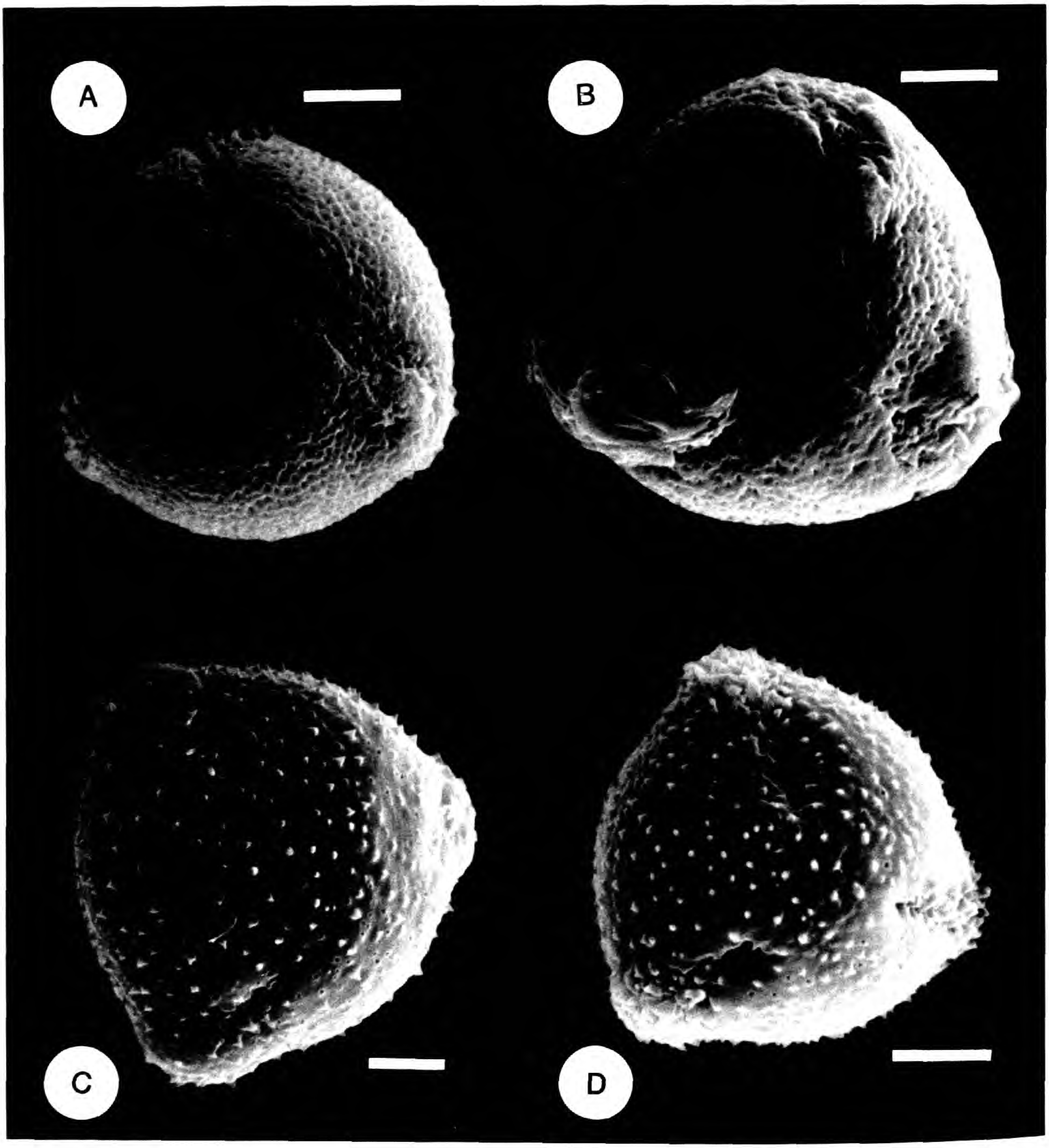

Figure 2. Pollen in scanning electron microscopy, polar view. —A. *Syringantha coulteri.* —B. *Hamelia patens* Jacquin. —C. *Exostema caribaeum* (Jacquin) Roemer & Schultes. —D. *Exostema mexicanum* A. Gray. Scale bars = 5 μm. (A. *Weaver 2116*; B. *C. Taylor 1383*; C. *T. McDowell 5009*; D. *Steyermark 51128.*)

itive in the Rubiaceae, and the fleshy fruit has been multiply derived, then a natural classification of the family will need to recognize a number of subfamilies or tribes in which diverse fruit types occur (Bremer & Eriksson, 1992). Similarly, if raphides evolved more than once in the family, their occurrence marks two or more lineages, and may be expected in various subfamilial taxa (Robbrecht, 1988; Taylor, 1992). For many taxa in the Rubiaceae, morphological characters such as raphide occurrence and pollen type have yet to be examined (Robbrecht, 1988). The investigation of molecular characters, such as chloroplast DNA restriction site studies (Bremer & Jansen, 1991) and DNA sequences (Bremer et al., 1995; Natali et al., 1995) is now under way for many Rubiaceae taxa. As additional morphological and molecular data are assembled and analyzed, evolutionary patterns in the Rubiaceae will be clarified. It seems likely that current concepts of subfamilial relationships and

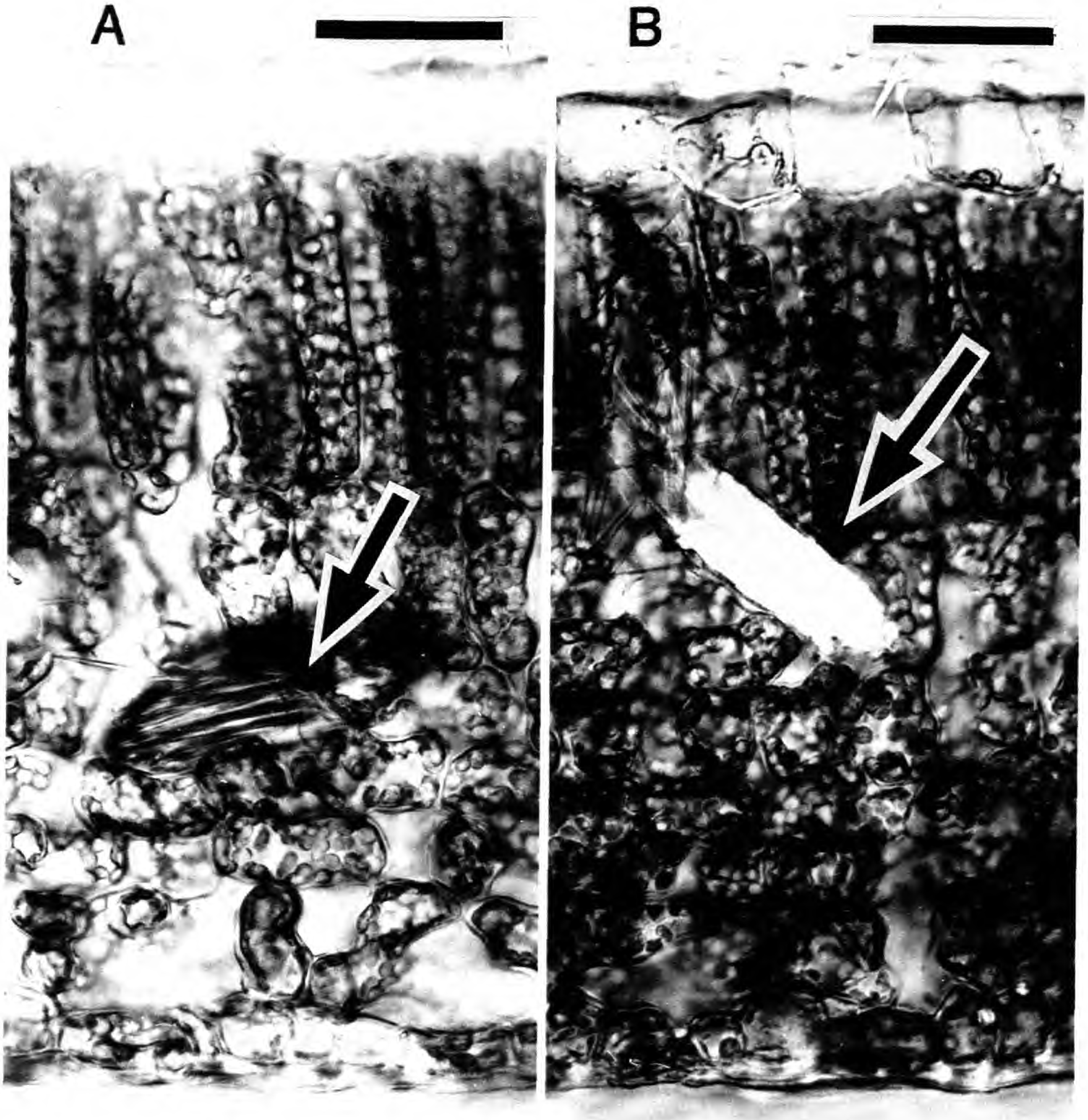

Figure 3. Transverse section of leaf of *Syringantha coulteri*, with raphide bundles indicated by arrows. —A. With one polarizing filter, needle crystals visible within and beside bundle. —B. With paired polarizing filters, raphide bundle birefringent. Scale bars = 50 μm. (A, B, *Lorence 5043*.)

character evolution in the Rubiaceae will change markedly as a natural system of classification develops.

TAXONOMY

Syringantha coulteri (Hooker f.) T. McDowell, comb. nov. Basionym: *Exostema coulteri* Hooker f., in Hemsley, Diagn. Pl. Nov. Mexic.: 32. 1879. TYPE: Mexico. Hidalgo: Zimapán, *Coulter 209* (holotype, K; isotype, MO).

Syringantha loranthoides Standley, Field Mus. Nat. Hist., Bot. Ser. 8(3): 153. 1930. TYPE: Mexico. Entre San Diego y la Hacienda de Santiaguillo, July 1842, *Karwinsky 308*, upper specimen (lectotype, selected here, LE; isolectotypes, MW, F-fragment).

Shrub 0.7–3.5 m high, with abundant raphides throughout, leafy branches 1–2 mm thick, terete to slightly flattened (obtusely tetragonal), young twigs puberulent-glabrescent, red-brown, bark dark gray or brown, smooth or furrowed (not fissured), sometimes with large, irregular lenticels; *stipules* 0.5–1(–2) mm long, triangular to subulate with thickening at base, glabrous, deciduous. *Leaves* with petioles 3–10 mm long, ca. 0.5 mm thick, canaliculate and puberulent to glabrescent, *leaf blades*

2.5–8 cm long, 0.4–2.2 cm wide, narrowly elliptic to lanceolate, base cuneate, apex briefly acuminate with tip rounded, chartaceous to subcoriaceous, surface finely bullate, margin often revolute, drying green to yellow-green, glabrous or slightly puberulent along midrib above, glabrous beneath (midrib and blade not recurved), midrib slightly raised and narrowly canaliculate above, slightly prominent beneath, lateral veins 3–6 per side, obscure or evident but not prominent, venation visible to 3° veins, domatia lacking, raphides visible in immature leaves. *Inflorescence* terminal, 3–6 cm high, 3–5 cm wide, a compound cyme with primary branching dichasial and lateral branches secundiflorus, main peduncles 1–2 cm long; *flowers* ca. 2 cm long, with pedicels 0.5–2 mm long, ca. 0.3 mm thick, bracteoles minute, linear, to 1 mm long; hypanthium 2–2.5 mm long, to 2.5 mm wide at top, tapering to base, glabrous, calyx lobes 0.5–1.5 mm long, triangular (rarely digitate); *corolla* bright yellow, glabrous, tube 14–20 mm long, 1.5–2.5 mm wide, subcylindrical, expanded at base and constricted above base, lobes 0.5–1.5 mm long, triangular, closing upon anthers and not recurved, raphides visible in corolla; *stamens* partially exserted, filaments flattened, conviviant (forming false tube) toward base, glabrous, inserted about 2 mm above the base of corolla tube, anthers 4–5 mm long, basifixed, dehiscence introrse by longitudinal slits, connective covering anthers abaxially and briefly apiculate, tip ca. 0.5 mm long; style subequal to stamens, narrowly clavate, with stigmatic surfaces linear; *capsule* 5–8 mm long, ca. 3 mm wide, ellipsoid, smooth or with fine costa, not lenticellate, brown, placentae elongate, axile and attached at center of septum, seeds ca. 12 per locule, attachment peltate near center of seed body with acuminate wings overlapping adjacent seeds; *seeds* 3–4 mm long, 0.5–1 mm wide including wing, brown, with elongate acuminate wings at each end of seed.

Phenology. Flowering from April to October (especially in June and July). Fruits persistent through much of year.

Distribution. Mexico, Sierra de Madre Oriental: States of Tamaulipas, Querétaro, and Hidalgo (San Luis de Potosi?). A plant of sclerophyllous thorn scrub (matorral) vegetation on rocky limestone slopes with thin soil, from 1000 to 2000 m elevation. The type locality for *Syringantha loranthoides* Standley, cited as between San Diego and Santiaguillo, is uncertain. No municipality or state was given in Standley's 1930 publication. A search of maps shows many villages in Mexico with those names. A likely placement for that locality, in the southeast part of the State of Guanajuato, is about 13 km northeast of the town of Acambaro, where there is a village named Santiaguillo with a village named Plaza de San Diego just 5 km to the northeast (Bartholomew, 1989). This would be an extension of the known range for specimens of *Syringantha* into an adjacent region. The Gray Herbarium Index lists the locality for *Syringantha loranthoides* as Chiapas, Mexico. This is far removed from the known range for this species, and is likely a misinterpretation of the original publication due to the occurrence of another village named Santiaguillo in that state.

The type material cited by Standley for *Syringantha loranthoides* includes four separate collections by Karwinsky, numbered 308, 308, 308b, and 308c, from the St. Petersburg (Leningrad) herbarium (LE). The collection dates and/or localities differ for each of these specimens. The lectotype is here designated as Karwinsky 308, upper specimen on sheet. "Type specimen" is written in Standley's handwriting beside this specimen, and its inflorescence bears many flowers. The additional Karwinsky collections are of the same entity, and also bear flowering material. There is a duplicate of the lectotype in Moscow (MW) and a fragment from it in the Field Museum (F).

Syringantha coulteri is a low xeric shrub with bright yellow flowers, corolla tube constricted near base, and corolla lobes overlapping opening of tube, and with linear stamens semi-exserted. Raphides are visible in corolla, fruit, and immature leaves. Seeds are small, brown, and waferlike, with wings acuminate at distal ends.

Additional specimens examined. MEXICO. **Hidalgo:** Municipio Jacala, rocky mountain side, 1250 m, *Chase 7333* (MO); Municipio Cardonal, 45 km E of Ixmizuilpan, base of Barrancas de Tolantongo, 1400 m, *Hernandez & Rodriguez 4967* (MEXU, MO); 10 km NW of Zimapán, 1000 m, *González Medrano 2369* (F, MEXU); 1/2 km N of Molanguito, *González Medrano 12789* (MEXU); Municipio Cardonal, Barranca de Tolantongo, *Hiriart & Ortiz 43* (MO); Santiaguillo, July 1842, *Karwinsky 308*–lower specimen (LE, F-fragment); El Pantario et in Santiaguillo, Apr. 1843, *Karwinsky 308b* (LE, MW, F-fragment); Santiaguillo, Oct. 1842, *Karwinsky 308c* (LE; F-fragment); 2–2.5 km NE Molanguito, 1950 m, *Lorence 5043* (MEXU); *Lorence 5044* (F, MEXU); NE of Jacala along highway, km 275–276, 1450 m, *Moore & Woods 3676*, (CM, GH, US); 11.2 m S of Jacala on Highway 85, 1850 m, *Weaver 2116* (MO). **Queretaro:** 8 km NE of La Lagunita, along the highway to Xilitla, 1400 m, *Diaz Barriga 3872* (MEXU); Municipio Matamoros, La Vuelta, 18 km NE of Landa de Matamoros, 1500 m, *Hernández & Tenorio 7184* (MEXU); 25 km NE of Landa, along road to El Lobo, 1350 m, *Rzedowski 9295* (MEXU). **Tamaulipas:** 4 km W of El Capulin, 25 km N of Tula, near turnoff to Bustamente, 1700 m, *González Medrano 13191* (MO, MEXU); 4 km SE of Bustamante toward La Presita and Tula, 23°25'N, 99°45'W, 1600 m, *Johnston et al. 11173* (MEXU, MO); 5 km S of Hoja Verde, *Stanford et al 2207* (US); Jaucave, *Viereck 365* (US); 5 mi. NE of Palmillas, 23°22'N, 99°30W, 1180 m, *Webster & Armbruster 20526* (MO). Mexico, no locality: *Coulter 227* (K), *Coulter 410* (K).

Acknowledgments. I thank David Lorence for kindly sharing preserved material, as well as his notes and expertise on *Syringantha.* Lennart Andersson, Birgitta Bremer, Charlotte Talyor, and Mel Turner also provided helpful comments. The Department of Botany at Duke University supplied equipment and financial support. I am grateful to the curators of the following herbaria for making their collections available for study: CM, DUKE, F, GH, K, LE, MEXU, MO, US.

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Jaltomata sagastegui and *Jaltomata cajamarca* (Solanaceae), Two New Shrubs from Northern Peru

Thomas Mione and Lawrence A. Coe
Biological Sciences, Central Connecticut State University, New Britain, Connecticut 06050-4010, U.S.A.

ABSTRACT. *Jaltomata sagastegui* and *J. cajamarca*, both of Peru, Dept. Cajamarca, Prov. Contumazá, are described and shown in photographs. *Jaltomata sagastegui* is self-compatible and has a chromosome number of $n = 12$; the type was collected at 2500 m elevation. *Jaltomata cajamarca* grows between 1700 m and 2600 m elevation. Berries of both species are eaten by humans.

RESUMEN. *Jaltomata sagastegui* y *J. cajamarca*, las dos de Perú, dpto. Cajamarca, prov. Contumazá, se describen y muestran en fotografías. *Jaltomata sagastegui* es auto-compatible y tiene un número de cromosomas de $n = 12$; el tipo fue colectado a 2500 m s.n.m. *Jaltomata cajamarca* crece entre 1700 m y 2600 m s.n.m. Las bayas de las dos especies son comestibles.

Jaltomata Schlechtendal (including *Hebecladus* Miers) is a diverse genus of about 30 species of herbs and small shrubs that are widely distributed, from Arizona, U.S.A., to southern Bolivia, the Galápagos Islands, and the Greater Antilles. This paper is part of an ongoing series of studies of the systematics of this genus (D'Arcy et al., 1992; Davis, 1986; Davis & Bye, 1982; Knapp et al., 1991; Mione, 1992; Mione & Coe, 1992; Mione et al., 1993; Mione et al., 1994; Mione & Bye, 1996).

After careful study of taxonomic literature, herbarium specimens, and living plants of some 20 *Jaltomata* species, we recognize *J. sagastegui* and *J. cajamarca* as new species. In a study of phylogeny based on chloroplast DNA characters, these two species formed a monophyletic group within an otherwise unresolved lineage of *Jaltomata* species of South America and the Greater Antilles (Mione et al., 1994).

METHODS

Part of our approach has been to grow plants of as many accessions of *Jaltomata* as possible. For this study seeds were collected in the field when plants were pressed, and were kindly sent to T.M. by A. Sagástegui A. and M. O. Dillon (F). Plants were raised and studied in the greenhouse at the University of Connecticut, Storrs, and herbarium specimens of these plants were deposited at CONN. For each seed accession, we compared the morphology of field-collected herbarium specimens with greenhouse-grown living and herbarium specimens. This provided some understanding of the range of phenotypes possible from one accession, and allowed us to compare the three-dimensional corolla shape of living plants with the corolla as it appears when pressed at various angles. Specimens raised from seed always appeared conspecific with the field-collected specimen from which seeds were collected. Living plants of *J. sagastegui* were also used to assess stigma compatibility, and to obtain chromosome counts from meiocytes of immature anthers stained with acetic carmine.

Hair morphology was studied, and hairs were measured with wet mounts (including leaf cross sections) and toluidine blue stain. The indicated number of flowers per inflorescence includes open flowers and flower buds. Calyces of *Jaltomata* are accrescent, and the calyx was therefore measured separately at anthesis and at fruiting. Calyx lobe radius and calyx sinus radius were measured from the point of attachment of the pedicel. Corolla diameter was measured as the distance between the tip of a randomly chosen corolla lobe and another on the opposite side of the corolla, without flattening the corolla of living plants. Stamen length includes the anther. Pollen grain diameter was measured with a compound microscope after staining pollen 30 minutes in "cotton blue" stain. Stigma diameter was measured both on living material, by orienting the style vertically (stigma up) under a dissecting microscope, and on specimens pressed from greenhouse-grown plants. Style length includes the stigma. Calyx lobe radius and calyx sinus radius at fruiting were measured either from the point of attachment of the mature fruit or the center of the pedicel. Fruits, nearly spherical berries, were measured on isotypes for both species, and on living specimens for *J. sagastegui*. The descriptions are based primarily on greenhouse-grown plants (from seeds of the type collections), but are also based on the isotypes where noted.

Jaltomata sagastegui Mione, sp. nov. TYPE: Peru. Dept. Cajamarca, Prov. Contumazá: "alrededor de Guzmango, 2,500 m, borde de acequia, 9 Junio 1990," *A. Sagástegui A. 14388* (holotype, F; isotype, Mione herbarium). Figure 1.

Corolla tubulosa-brevis cum limbo rotato, limbus quinquelobus; stamina non exserta a corollae tubo; stylus 3.5–5 mm longus; calyx parvus fructifer, lobi radius ad 4.5 mm, sinus radius ad 3 mm.

Branching shrub to 1 m. Younger stems somewhat 4- or 5-sided, woody stems (brown) terete and hollow. Hairs of young stems dendritic, rarely forked or of the finger type, to 0.4 mm long. Leaves often geminate; ovate (Fig. 1a), the apex sometimes acuminate, margin entire or repand; 3.2–14 cm long, 1–6.5 cm wide; adaxially and abaxially tomentulose with interspersed dendritic and finger hairs 0.04–0.22 mm long. Inflorescence to 12-flowered; sometimes branched. Peduncles 9.5–28 mm long, longer than attached pedicels; green; straight (Fig. 1b); ligneous at fruiting; pedicels 4.5–7 mm long. Calyx at anthesis green; 5.1–6.5 mm diam.; lobe radius 2.6 mm; sinus radius 1.2 mm; abaxially tomentose with a dense covering of branched hairs (Fig. 1b); lobes reflexed. Corolla short-tubular with a rotate limb (Fig. 1b); limb with 5 corolla lobes alternating with 5 inconspicuous to absent lobules (Fig. 1a); white with two purple ovate maculae straddling the main vein to each corolla lobe; limb 11–14 mm diam.; tube 4–5 mm long and 4.5–5 mm diam. Stamens 3.2–3.4 mm long, not exserted beyond mouth of corolla tube (Fig. 1a). Filaments with finger hairs along basal 40–50%, the hairs to 0.5 mm long. Anthers, undehisced 1.6–2.0 × 1.3–1.5 mm. Pollen grains 75,000–93,000 per flower, 25–30 μm diam. Stigma (arrow, Fig. 1a) diameter 0.33–0.6 mm. Style length 3.5–5.4 mm, exserting 1–3 mm beyond anthers (Fig. 1a). Ovules 56–87 per ovary. Fruits 5–8 mm across (Fig. 1c), yellow-orange (type), orange (greenhouse). Calyx (fruiting) small (Fig. 1c): lobe radius to 4.5 mm, sinus radius to 3 mm. Chromosome number $n = 12$.

Jaltomata sagastegui, now known only from the type, is distributed at least in northern Peru, Dept. Cajamarca, prov. Contumazá. The type, collected in June, bears fruits. The herbarium label indicates that the fruits are eaten, and the local name is "canamuela." The specific epithet was chosen to honor the eminent Peruvian botanist Abundio Sagástegui Alva.

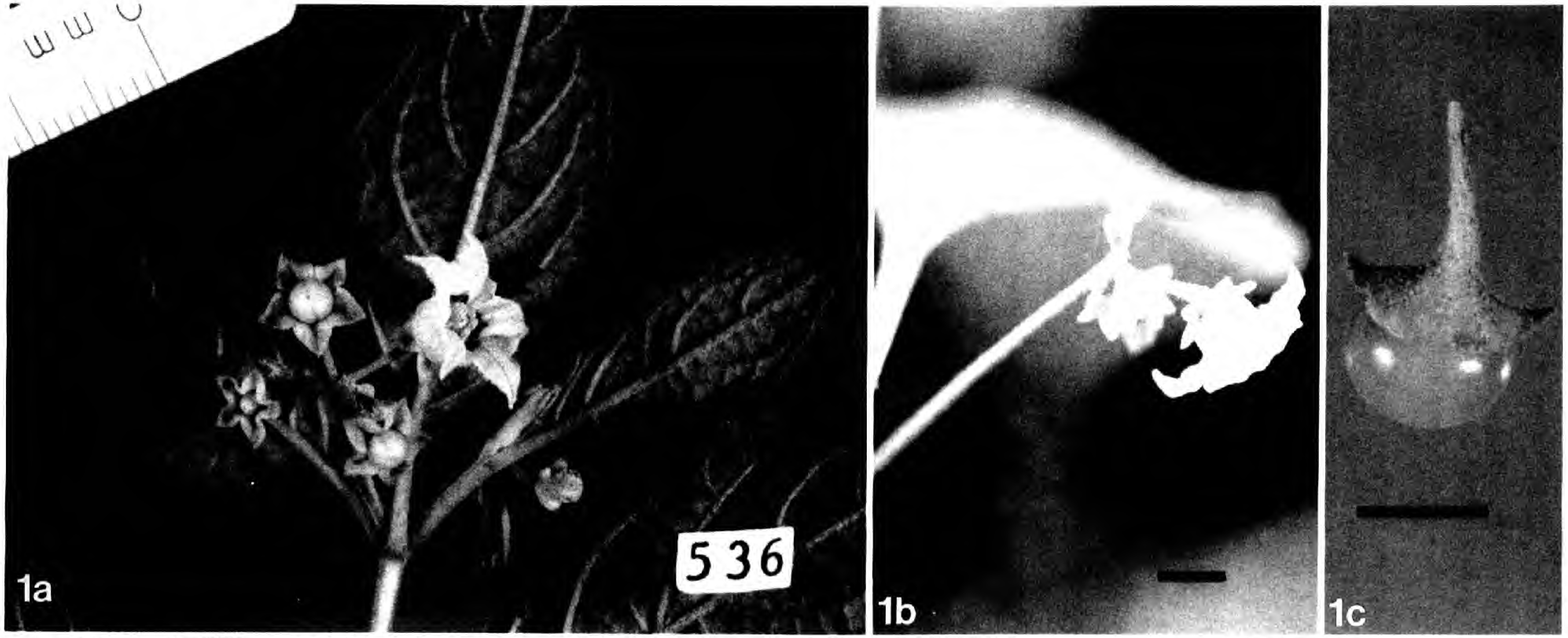
Jaltomata cajamarca Mione, sp. nov. TYPE: Peru. Dept. Cajamarca, Prov. Contumazá: "alrededores de Guzmango, 2,500 m, ladera con arbustos, 9 Junio 1990," *A. Sagástegui A. 14389* (holotype, F; isotypes, CONN, Mione herbarium). Figure 2a, b.

Corolla brevis recta-tubulosa cum limbo rotato, limbus cum quinque lobis alterantibus cum quinque minoribus sed conspicuis lobulis; stamina et stylus exserta a corollae tubo; stylus 5.5–11 mm longus; calyx parvus fructifer, lobi radius 3–5 mm, sinus radius 1.8–2.7 mm.

Branching shrub to 1 m. Younger stems angular with 4 or 5 projecting longitudinal ridges (Fig. 2b), older stems (brown) approaching terete. Young stems bearing both dendritic and finger hairs, to 2.2 mm long; older axes glabrate. Leaves often geminate; ovate, the apex sometimes acuminate; margin entire, repand, or less commonly bluntly toothed; 4–16 cm long, 2–5 cm wide; scabrous, especially the younger leaves; hairs adaxially either all dendritic or having interspersed dendritic and finger hairs, 0.07–0.3 mm long, abaxially mostly of the finger type, rarely gland-tipped, 0.05–0.2 mm long. Inflorescence to 17-flowered; sometimes branched (with four orders of axes on an isotype). Peduncle to 19 mm long; pedicel 4–13 mm long. Calyx at anthesis rotate; 6.3–7 mm diam.; lobe radius 2.7–3 mm; sinus radius 1–2 mm. Corolla short tubular with a rotate limb; the limb with 5 lobes alternating with 5 smaller lobules (Fig. 2a); limb 16–22 mm diam.; lobe radius 7.5–9 mm; sinus radius 4–5.5 mm; straight tube 3 mm long by 5 mm diam.; violet to white, with ring of purple at the tube-limb interface (Fig. 2a). Stamens 3.4–5.9 mm, exserting 1–4 mm beyond corolla tube (Fig. 2). Filaments villous on basal 45–90% (Fig. 2a), the finger hairs to 1 mm long. Anthers, dehisced 0.8–1 mm long. Pollen grains 105,000 per flower, 25–30 μm diam. Stigma 0.33–1.06 mm diam., usually noticeably broader than the style. Style 5.5–11 mm long, exserting a few mm beyond anthers. Ovules 76 per ovary. Fruits 3–5 mm diam., yellow-orange (type). Calyx (fruiting) stellate, small: lobe radius 3–5 mm, sinus radius 1.8–2.7 mm (isotype). Infructescence to 13-fruited (isotype).

Jaltomata cajamarca is distributed in northern Peru, Dept. Cajamarca, Prov. Contumazá. Its habitat is roadsides and hillsides with shrubs, between 1700 and 2600 m. Flowering and fruiting occur from March through June. The fruits are eaten (*Sagástegui 10315, 12546, 13050, 14121*), and the local name is "canamuela" (*Sagástegui 10315, 12546, 13050, 14121*).

Paratypes. PERU. **Dept. Cajamarca,** Prov. Contuma-


mm
536
1a
1b
1c


2a
2b

Table 1. Comparison of some characters of *Jaltomata sagastegui* and *J. cajamarca.*

	J. sagastegui	*J. cajamarca*
Young stem shape	somewhat 4 or 5-sided	4 or 5 projecting longitudinal ridges
Maximum hair length on young stems	0.4 mm	2.2 mm
Leaf margin	never toothed	sometimes toothed
Corolla lobules (alternate with 5 prominent lobes)	inconspicuous to absent	prominent
Stamen length	3.2–3.4 mm	3.4–5.9 mm
Stamens exserted beyond corolla tube	no	1–4 mm
Hairs borne along _____ of length of filament	40–50%	45–90%
Style length	3.5–5.4 mm	5.5–11 mm
Stigma diameter	0.33–0.6 mm	0.33–1.06 mm

zá: Yetón-Guzmango, 29 Apr. 1982, *A. Sagástegui A. et al. 10315* (HUT, MO); Andaloy (San Benito-Yetón), 28 Mar. 1985, *A. Sagástegui A. & S. Leiva G. 12546* (F); Andaloy (San Benito-Yetón), 23 Mar. 1988, *A. Sagástegui A. et al. 13050* (F, HUT); La Pampa (Guzmango), 7 May 1989, *A. Sagástegui A. 14121* (F, HUT); Yetón (San Benito-Guzmango), 7 Apr. 1990, *A. Sagástegui A. & C. Sagástegui C. 14254* (F); El Chorrillo (Cascas-Contumazá), 16 June 1994, *A. Sagástegui A. et al. 15301* (F).

Although similar, *Jaltomata sagastegui* and *J. cajamarca* are easily distinguished (Table 1). Both are superficially similar to *J. propinqua* (Miers) Mione & M. Nee of Peru, Dept. Lima, with which they share a short tubular corolla with a rotate limb. *Jaltomata propinqua,* however, has gland-tipped hairs and a style approximately twice the length of the stamens, while *J. sagastegui* and *J. cajamarca* essentially lack gland-tipped hairs, and their styles extend at most a few millimeters beyond the stamens. To our knowledge, no other *Jaltomata* species have a short-tubular corolla and a broad limb.

Reproductive biology. Jaltomata sagastegui (grown as T.M. accession 536) is self-compatible; fruits were usually set following manual self-pollination and were occasionally set in a pollinator-free greenhouse. When ripe fruits were manually removed articulation was at the base of the pedicel. *Jaltomata cajamarca* (grown as T.M. accession 537) did not set fruit following six manual self-pollinations, nor were fruits set from six interplant pollinations involving three different plants from seeds of the type collection. It is possible that this lack of fruit-set was due to suboptimal growing conditions. Thus, at this time no conclusion can be made about stigma compatibility of *J. cajamarca.* All other *Jaltomata* species (16) assessed to date are self-compatible. Crosses between *J. sagastegui* and *J. cajamarca* were not attempted, nor were other interspecific crosses involving these species.

Most *Jaltomata* species assessed to date are protogynous, with anthesis occurring early in the morning and anthers remaining undehisced during that day (Mione, 1992). *Jaltomata sagastegui* lacks protogyny. Observations made in early April 1992 indicated that all anthers dehisced prior to 8:00 a.m. on the day of anthesis. Although several *Jaltomata* species of Peru and Bolivia produce copious, bright red/orange nectar at the base of translucent corollas, *J. sagastegui* and *J. cajamarca* have neither of these features (Figs. 1, 2). Flowers of all Mesoamerican species of *Jaltomata* close at dusk for the night, while flowers of *J. sagastegui, J. cajamarca,* and many, but not all, of the other South American species remain open at night (Mione, 1992).

Acknowledgments. We thank the curators at B, BH, BM, C, COLO, F, GH, K, LD, LPB, MERF, MA, MO, NY, P, US, USD, and WIS for loan of specimens; Abundio Sagástegui A., Michael O. Dillon, and Segundo Leiva G. for seeds; W. B. Connolly for Latin translation; and Sandra Ek, Clint Morse, and James Mermigos for care of living plants. Supported by an N.S.F. doctoral dissertation grant to T.M. and Gregory J. Anderson, and two research grants from the Connecticut State University system to T.M.

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Figures 1, 2. 1a–c. *Jaltomata sagastegui* Mione (grown from seeds of *Sagástegui A. 14388*). —a. Shoot, flower with arrow indicating stigma. —b. Inflorescence, side view of flower. —c. Fruit with calyx. 2a, b. *Jaltomata cajamarca* Mione (grown from seeds of *Sagástegui A. 14389*). —a. Shoot, flower with exserted stamens and style. —b. Shoot with numerous open flowers. All bars = 5 mm.

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Novelties in *Prestonia* (Apocynaceae)

J. Francisco Morales
Instituto Nacional de Biodiversidad (INBio), Apto 22-3100, Santo Domingo de Heredia, Costa Rica

ABSTRACT. *Prestonia folsomii* is described from Colombia and Panama. A new combination, *Prestonia longifolia* (Sessé & Mocino) J. F. Morales, is proposed, and two new synonyms of *Prestonia portobellensis* are given.

In preparing the treatment of Apocynaceae for *Flora Mesoamericana*, I encountered the following novelties here described.

Prestonia folsomii J. F. Morales, sp. nov. TYPE: Colombia. Valle: Buenaventura Municipio, Bajo Calima region: along the road between Buenaventura–Malaga at km 51.3, deep gorge in virgin forest, 100 m, 8 Feb. 1990 (fl), *Croat & Watt 70348* (holotype, INB; isotypes, MO, USF). Figure 1.

A *Prestonia perplexa* foliis infra conspicuis puberulis, caulibus suberosis differt.

Liana, stems densely puberulent when young, soon usually becoming conspicuously suberose when fully mature. Leaves (2.5)4–12 × (1.8)2.5–5.5 cm, membranaceous, oblanceolate to oblong-obovate, caudate-mucronate at apex, cuneate to attenuate at base, very sparsely puberulent to glabrate above, beneath usually puberulent, eglandular; petiole 0.4–1.2 cm, stipular appendages interpetiolar, numerous. Inflorescence subumbelliform, racemose to subcorymbose, somewhat agglomerate, bearing 10–16 pale yellow flowers; peduncle 2.2–3.6 cm, pedicels 7–24 mm, both densely puberulent; bracts 2.5–4 × 1 mm, linear-ensiform, scarious; calyx lobes 8–13 × 3–4 mm, oblong-ovate to lanceolate, acute, very sparsely puberulent, soon becoming glabrate, the internal squamellae ca. 1 mm long, deltoid, glabrous, entire; corolla hypocrateriform, yellow or greenish yellow, glabrous or glabrate, tube 11–14 × 3–4 mm diam. at the orifice, epistaminal appendages ca. 2 mm, much surpassed by the anthers, inserted 1–1.5 mm below the faucal annulus; faucal annulus conspicuous, entire; lobes 1.2–1.4 cm × 8–9 mm, obliquely obovate to oblong-obovate, reflexed or widely spreading, usually obtuse; stamens inserted at about the upper ⅓ of the corolla tube, filaments inconspicuous, glabrous, anthers 4–4.5 mm, glabrous, narrowly sagittate, exserted ca. 2–3 mm; ovary ca. 1 mm, ovoid, glabrous, shorter than the nectary; stigma ca. 1 mm, style 8–9 mm; nectary 1.5–2 mm long, 5-lobed. Follicles unknown.

Prestonia folsomii is found in forest, secondary growth, thickets, and along roadsides from eastern Panama to southeastern Colombia, at 100–800 m.

This new species is closely related to *Prestonia exserta* (A. DC.) Standley, but differs notably in the deeply inserted epistaminal appendages much surpassed by the anthers. In addition, it is related to *Prestonia perplexa* Woodson, but is easily distinguished by its leaves, which are conspicuously puberulent beneath, and by its usually suberose stems.

Prestonia folsomii is named for James Folsom in recognition of his extensive fieldwork in Panama while employed by the Missouri Botanical Garden.

Paratypes. PANAMA. **Coclé:** new works, 7 km N of El Copé, 750–800 m, 18 Aug. 1977, *Folsom 4954* (MO). **San Blas:** El Llano–Cartí road, km 19, 350 m, 6 May 1985, *de Nevers et al. 5620* (MO), 11 Mar. 1986, *de Nevers et al. 7346* (MO, USF).

NOTES ON THE *PRESTONIA PORTOBELLENSIS* COMPLEX

When Woodson (1936) described *Prestonia guatemalensis* and *P. schippii* from Guatemala and Belize, respectively, he separated them from *P. portobellensis* (Beurling) Woodson by such features as the size of the calyx lobes, the exsertion of the epistaminal appendages, and the amount of inflorescence development. Examination of the types and additional collections from the type locality of the former species shows that the characters used by Woodson are continuously variable and thus not useful for species distinction. Therefore, two new synonyms of *P. portobellensis* are proposed here.

Prestonia portobellensis (Beurling) Woodson, Ann. Missouri Bot. Gard. 18: 553. 1931. *Echites portobellensis* Beurling, Kongl. Vetensk. Acad. Handl. 1854: 137. 1856. TYPE: Panama. Colón: Portobello, in silvis ad littora, Apr. 1826, *Billberg s.n.* (holotype, S not seen; photograph MO).

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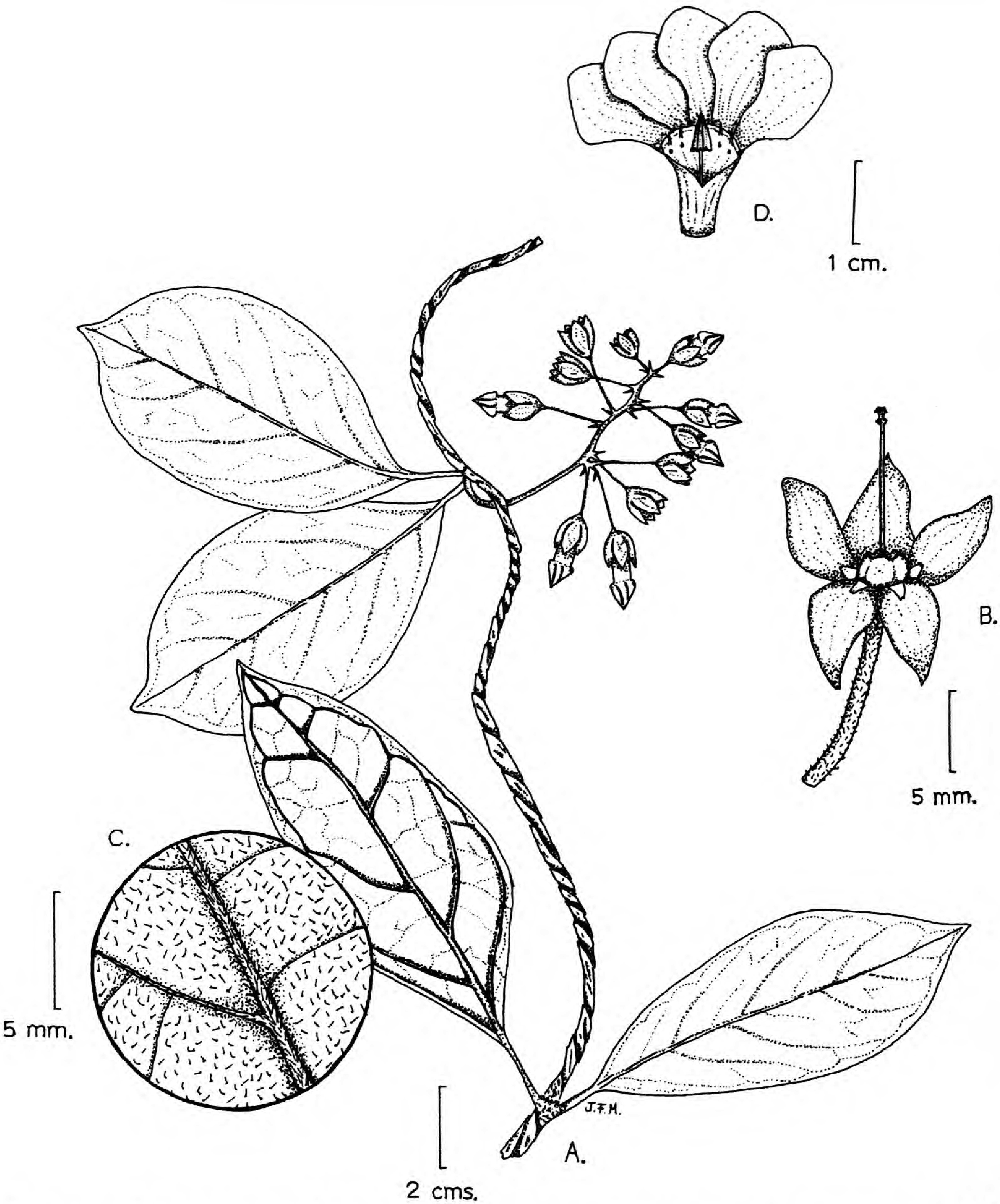

Figure 1. A–D. *Prestonia folsomii* J. F. Morales (*Croat & Watt 70348*). —A. Habit. —B. Calyx, nectary, stigma, style, and squamellae. —C. Pubescence of the leaves (beneath). —D. Open corolla showing anthers, epistaminal appendages, faucal annulus, and lobes.

Prestonia schippii Woodson, Ann. Missouri Bot. Gard. 23: 337. 1936. Syn. nov. TYPE: Belize. El Dorado, 80 m, Sep. 1922, *Schipp s-388* (holotype, F; photograph INB).
Prestonia guatemalensis Woodson, Ann. Missouri Bot. Gard. 23: 339. 1936. Syn. nov. TYPE: Guatemala. Alta Verapaz: Sepacuite, Oct. 1901, *Owen 1* (holotype, US; photograph INB).

In his monograph of the family, Woodson (1936) cited the name *Echites longifolia* Sessé & Mocino as "possibly referring to *Echites tuxtlensis* Standley" mainly due to the difficulty of interpreting the original descriptions of Sessé and Mocino and because of his inability to see type collections of the many species described by them, which are deposited in the Madrid (MA) herbarium.

However, in the process of preparing the Apocynaceae for the *Manual de las Plantas de Costa Rica* and *Flora Mesoamericana*, a fragment of the type collection of *E. longifolia*, as well as the type of *Prestonia concolor* (S. F. Blake) Woodson, were examined. I conclude that these are identical, and thus a new combination based on the Sessé and Mocino name is made here.

Prestonia longifolia (Sessé & Mocino) J. F. Morales, comb. nov. Basionym: *Echites longifolia* Sessé & Mocino, Fl. Mexic. 45. 1893. TYPE: Mexico. Without data, *Sessé et al. 5077* (holotype, MA not seen; fragment, F).

Belandra concolor S. F. Blake, Contr. Gray Herb. 52: 78. 1917. Syn. nov. *Prestonia concolor* (S. F. Blake) Woodson, in Standley & Record, Field Mus. Nat. Hist., Bot. Ser. 12: 327. 1936. TYPE: Belize. Low banks of Río Grande, 25 Mar. 1907, *Peck 953* (holotype, GH).

Prestonia dentigera Woodson, Ann. Missouri Bot. Gard. 26: 258. 1939. Syn. nov. TYPE: Costa Rica. San José: vicinity of El General, Jan. 1939, *Skutch 3864*, (holotype, US).

Prestonia longifolia belongs to the section *Annulares* Woodson and is closely related to *P. portobellensis* (Beurling) Woodson, which has oblong to oblong-lanceolate calyx lobes that are usually thick and apically acute to obtuse. However, sometimes in *P. portobellensis* the calyx is reduced and thus can be confused with the former species. In addition, both occur in the same geographical area: *P. longifolia* ranges from Mexico to Panama, while *P. portobellensis* ranges from Mexico to Colombia. The two species can be separated by the following key:

1a. Calyx lobes triangular-ovate to deltate, long-acuminate, 3–6 mm long; leaves usually thin and membranaceous . . . . *P. longifolia*
1b. Calyx lobes oblong to oblong-lanceolate, obtuse to acute, rarely acuminate (then larger than 10 mm), (7)9–18 mm long; leaves thick and subcoriaceous . . . . *P. portobellensis*

Acknowledgments. I thank the curators of CR, DUKE, F, GH, MEXU, MO, NY, US, and USJ for providing specimens for examination and the loan of material. I thank Michael Grayum and Alvaro Fernández for critical comments on the manuscript and consultation. Herbarium work in the United States was supported by NSF grant DEB-9300814—Manual to the Plants of Costa Rica to the Missouri Botanical Garden, Barry Hammel and Mike Grayum, co-principal investigators.

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Notes on Marsdenieae (Asclepiadaceae)—A New, Unusual Species of *Hoya* from Northern Borneo

Ralf Omlor
Universität Kaiserslautern, FB Biologie, Abteilung Systematische Botanik, Postfach 3049, 67653 Kaiserslautern, Germany

ABSTRACT. *Hoya telosmoides* R. Omlor sp. nov. from northern Borneo is described and illustrated. Its systematic position is discussed, and an introduction is given to the major subgroups of the Marsdenieae and their delimitation.

The following description of a new species of *Hoya* R. Brown has resulted from my work on a generic revision of the tribe Marsdenieae in Asclepiadaceae. Since the attribution of this new species to the genus *Hoya* is not self-evident, and since at present there is no consensus as to how most genera of the tribe are to be defined, it is necessary to give a short introduction on the delimitation and the major subgroups of the Marsdenieae.

In a broad taxonomic sense the Marsdenieae comprise some 500 species in about 60 genera (a list of all validly published generic names can be found in Liede & Albers (1994)), which are distributed throughout the tropical and subtropical regions of the world. The taxonomic delimitation of the group is difficult and the tribal concept—as well as the tribal name—has been subject to repeated change (e.g., Endlicher, 1838; Decaisne, 1844; Bentham, 1868, 1876; Schumann, 1895). At present the Marsdenieae are circumscribed within subfamily Asclepiadoideae by longitudinal dehiscence of the thecae, erect or ascending pollinia, and anthers with membranous terminal appendages (Bruyns & Forster, 1991). With exception of the membranous anther appendages these characters also apply to the Stapelieae, but the latter can be distinguished by the pellucid germination zone on the apex or the inner side of their pollinia, (Bruyns & Forster, 1991). Delimited by this differentiation of the pollinia, the Stapelieae sensu Bruyns & Forster are almost certainly a monophyletic group. In sharp contrast, the Marsdenieae cannot be defined by synapomorphies; instead, they have always been a conglomeration of several generic groups that do not necessarily belong together. Since the last complete generic revision of the Marsdenieae (Schumann, 1895) about 37 new generic names have been attributed to the tribe and a number of genera have been transferred from the Marsdenieae to other tribes:

The delimitation of the Stapelieae by means of the pellucid germination zone on the apex or inner side of the pollinia resulted in the transfer of *Tenaris* E. Meyer (Brown, 1902), *Heterostemma* Wight & Arnott (Schill & Jäkel, 1978; Bruyns & Forster, 1991), *Pentasachme* Wallich (Bruyns & Forster, 1991), and *Swynnertonia* S. Moore (Liede & Albers, 1994) from the Marsdenieae to the Stapelieae. For the same reason the genus *Emplectanthus* N. E. Brown should also be transferred to the Stapelieae. The minute pollinia of this genus have an apical germination mouth, and the corona consists of staminal lobes and additional interstaminal, pouch-like segments. Terminal anther appendages are lacking. N. E. Brown (1902) already described these characters, but placed the genus in the Marsdenieae because it resembles some species of *Tylophora* R. Brown in habit very closely. Brown (1902) argued that *Emplectanthus* might be a generic hybrid between *Tylophora* and *Riocreuxia* Decaisne, but there is no evidence for this hypothesis.

The genera *Rhynchostigma* Bentham (Brown, 1902) and *Trichosandra* Decaisne (Friedmann, 1990) were transferred from the Marsdenieae to the Secamoneae in subfamily Secamonoideae.

Only recently Kunze et al. (1994) pointed out the isolated position of *Fockea* Endlicher and *Cibirhiza* Bruyns within the Marsdenieae and established the new tribe Fockeeae to accommodate them. Both genera are distinguished from the Marsdenieae by their sometimes large tuberous rootstock, by the complexity of their corona, and by the primitive state of their translator to which the pollinia are directly attached, instead of being linked via caudicles as is the case in all other members of the Asclepiadoideae (Kunze, 1993). An important deviation from Asclepiadoideae not mentioned by Kunze et al. (1994) is that in *Fockea* and *Cibirhiza* the pollinia are composed of rhomboidal and T-shaped pollen tetrads. In this respect the Fockeeae agree with the Periplocaceae and Secamonoideae (commonly regarded as the most primitive groups

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of Asclepiadaceae s.l.), whereas the Asclepiadoideae generally are characterized by linear pollen tetrads as the result of two successive meiotic divisions (Safwat, 1962). This observation substantiates the hypothesis of Kunze et al. (1994) that the Fockeeae represent the most primitive group within the Asclepiadoideae.

Despite all these rearrangements, the Marsdenieae still include some genera that do not fit comfortably within the tribe. The reason for this lies in the vague delimitation from the Asclepiadeae, which is entirely based on the orientation of the pollinia: "erect or horizontal" in Marsdenieae versus "pendulous" in Asclepiadeae (Bruyns & Forster, 1991). The pendulous position of the pollinia is generally regarded as the apomorphic state (e.g., Wanntorp, 1988: 21), but the transition from erect to pendulous pollinia may have occurred several times in the evolution of Asclepiadoideae. Apart from the Gonolobeae, which are probably derived from the Asclepiadeae, almost all genera with an intermediate condition (i.e., caudicles attached laterally in the middle part of the pollinia) or with variable orientation of the pollinia have been attributed to the Marsdenieae. These "intermediate genera" fall into two apparently unrelated groups, namely the *Tylophora* group in the Old World, and a group of New World genera at least consisting of *Barjonia* Decaisne, *Nephradenia* Decaisne, *Jobinia* Fournier, and *Vailia* Rusby. Though crucial for an understanding of the phylogeny of Asclepiadoideae, the affinities of all these "intermediate genera" are poorly understood.

If these "intermediate genera" are left aside, eventually the "natural core" of Marsdenieae remains. It is primarily a group of woody perennial lianas or twining shrubs with simple staminal coronas (rarely a corolline corona), undifferentiated, erect, elongated pollinia, and flattened, comose, sometimes broadly margined, smooth seeds. Representatives of this basal type of Marsdenieae are found throughout the warmer regions of the world. A second, more advanced group is confined to southern Asia, Malesia, and Australia. This group mainly consists of herbaceous vines or climbing or dependent epiphytes with often fleshy leaves and persistent inflorescences that produce flowers for several seasons. The corona lobes in this group are staminal, often horizontally spreading, and generally consisting of an inner tip that is appressed to the anthers and a variable outer part with revolute lateral margins. The seeds are comose, spindle-shaped, and lack differentiated margins, and the pollinia—this is the most significant deviation from the rest of the Marsdenieae—have a conspicuous, pellucid germination zone on their outer margin (Schill & Dannenbaum, 1984).

The most prominent representative of this sharply distinguished group is the genus *Hoya*; in the following sections I will refer to these "derived" Marsdenieae informally as the "*Hoya* group." Besides the large genus *Hoya*, which is here understood in the broad taxonomic sense circumscribed by Forster and Liddle (1990) (thus including *Physostelma* Wight and *Cyrtoceras* Bennett), the group further comprises *Absolmsia spartioides* (Bentham) Kuntze, a highly specialized epiphytic subshrub from Borneo (see Gilbert et al., 1995: 14), and in my view *Micholitzia obcordata* N. E. Brown, which was recently reviewed by Goyder and Kent (1994). The monotypic, little known Malesian genera *Oreosparte* Schlechter and *Heynella* Backer might also belong here, but this still has to be confirmed.

Although clearly differentiated from the rest of the Marsdenieae, the *Hoya* group is not equal in rank to the Stapelieae. Whereas all the important characters of the Stapelieae (pollinia with apical germination mouth, corona consisting of staminal and interstaminal segments, succulent stems, lack of membranous anther appendages) do not occur in the Marsdenieae, the characters which in combination distinguish the *Hoya* group can individually be found—to varying degree and in various states—in other Marsdenieae too:

Epiphytic life form, herbaceous growth, fleshy leaves, and spindle-shaped, unmargined seeds are also characteristic of the genus *Dischidia* R. Brown and its segregates. With regard to floral characters, however, the Dischidias are not fundamentally different from the "basal" Marsdenieae (e.g., *Marsdenia tinctoria* R. Brown).

Persistent, racemiform contracted inflorescences occur in several Southeast Asian Marsdenieae (e.g., *Dischidanthus urceolatus* (Decaisne) Tsiang, *Gongronema wallichii* Decaisne, *Thozetia racemosa* F. Mueller ex Bentham, *Clemensiella mariae* (Schlechter) Schlechter, and probably all *Dischidia* species).

Resemblances to the floral characters that most sharply distinguish the *Hoya* group can be recognized in the genus *Telosma* Coville. In many, if not all, *Telosma* species the outer margin in the lower half of the pollinia is strongly flattened (sometimes even pellucid) and generally curved forward (toward the anthers). This type of pollinia can be regarded as intermediate between the undifferentiated pollinia of all other "basal" Marsdenieae and the derived pollinia of the *Hoya* group. Apart from the pollinia, there also are similarities concerning the construction of the staminal corona. In *Telosma* the corona consists of laminar lobes, which adaxially bear a filiform appendage (Liede & Kunze, 1993: fig 2A). From this model the complex corona of the *Hoya* group can easily be derived by the recurvation of the lateral margins of the laminar segment and the shift in its orientation from erect to horizontal.

Concerning its vegetative characters, however, *Telosma* is exceedingly different from the members of the *Hoya* group. The *Telosma* species all are woody climbers with thin, cordate leaves, salver-shaped flowers, and flattened, broadly margined seeds. With respect to these characters a close relationship between these plants and the *Hoya* group appears rather unlikely. Their vague similarities with the *Hoya* group would perhaps deserve no attention, were there not a *Hoya* species with a *Telosma*-like corolla.

Hoya telosmoides R. Omlor, sp. nov. TYPE: Malaysia. Sabah: Mt. Kinabalu, Tenompok, 1500 m, 7 June 1932, *Clemens 29828* (holotype, BM; isotype, K). Figures 1, 2.

Ab omnibus speciebus *Hoyarum* adhuc cognitis corolla tubo urceolato intus villoso, fauce contracto, segmentis patentibus linearibus-triangularibus recedit.

Herbaceous glabrous vine. Stems twining, cylindrical, about 3 mm diam.; internodes 8–25 cm long. Leaves opposite, petiolate; lamina narrowly elliptic or elliptic-oblanceolate, shining, (80–)100–130 × (25–)30–55 mm, coriaceous, apex acuminate or attenuate, base acute or cuneate, with a pair of glands at least when young, margin slightly revolute, the midrib clearly elevated on the lower surface, secondary venation less conspicuous, consisting of 4–7 brochidodromous veins branching from the midrib at a wide acute or an almost right angle; petiole 8–13 mm long. Inflorescences occurring singly at the nodes, clearly interpetiolar, long pedunculate (40–55 mm), pendulous, umbelliform with up to ca. 18 flowers, persistent, rachis with scars of previous flowers; pedicels 15–20 mm long, glabrous. Flowers 10–15 mm long, up to 20 mm diam. Sepals lanceolate-ovate, 2 × 0.8 mm, apex rounded, alternating with single glands, glabrous. Corolla fleshy, having an inflated tube that is slightly constricted at its top, and bearing five narrowly triangular, erect or slightly spreading lobes, outside glabrous, pale yellow tinged with purple; corolla tube 5.5–6.5 mm long, inside densely covered with long unicellular, recurved trichomes, at its base bulged between the calyx lobes, the throat narrowed (almost segmented) by infolds below the sinuses of the petals; free corolla lobes up to 10 mm long, glabrous, margins slightly recurved. Gynostegium ca. 4.5 mm high, almost completely filling the corolla tube. Corona staminal, fleshy, slightly spreading, about as high as the sterile part of the stamens; corona lobes connate with the back of the stamens, adaxially elongated into a free, ovate tip about 0.4 mm long which is appressed to the stamens, lobes laterally compressed, abaxially broadened into a massive erect process with revolute lateral margins and truncate apex; the corona lobes with a finely striated, hard surface. Anthers erect, terminated by an ovate hyaline appendage, ca. 1.5 mm long, with rounded or retuse-bilobed apex. Pollinia erect, oblong-obovate, compressed, 0.7 × 0.3 mm, with a lateral "pellucid margin." Corpusculum 0.45 × 0.28 mm. Carpels glabrous, style head with short conical appendage, not exceeding the anthers. Fruits and seeds unknown.

Because of its unusual corolla *Hoya telosmoides* does not at first sight look like a true *Hoya*. Instead it might be taken for a *Dischidia* or a *Telosma* species, or for a near relative of *Gongronema filipes* Kerr, which superficially resembles it very closely. However, the herbaceous growth, the fleshy elliptic leaves, and the umbelliform inflorescence with scars of previous flowers indicate a relationship with the *Hoya* group. This is fully confirmed by the floral characters. The gynostegium (Fig. 1C), though superficially similar to that of *Gongronema filipes* Kerr or *Gongronema wallichii* Decaisne, reveals all the typical characters of the *Hoya* group: The corona is solid, with a finely striated surface, and the abaxial lobes have revolute lateral margins (Fig. 1D). In the older literature the last character often is simply described as "corona lobes dorsally sulcate." However, very many corona lobes are "sulcate," at least in their basal part; the crucial point is whether the furrow results from revolute margins, as this serves to distinguish the *Hoya* group from other Marsdenieae.

Together with the peculiar construction of the corona lobes, the shape of the pollinarium (Fig. 1A) unequivocally places this new species in the *Hoya* group. Elongated, compressed pollinia with the characteristic germination zone along the entire outer margin do not occur elsewhere in the Marsdenieae (see above), and the shape of the corpusculum with the caudicles attached in the middle part likewise is typical of the *Hoya* group.

While the incorporation of the new species in the *Hoya* group is thereby strongly supported, its affinities within that group are much more difficult to assess. A modern, complete revision of *Hoya*, which probably comprises over 100 species, is not avail-

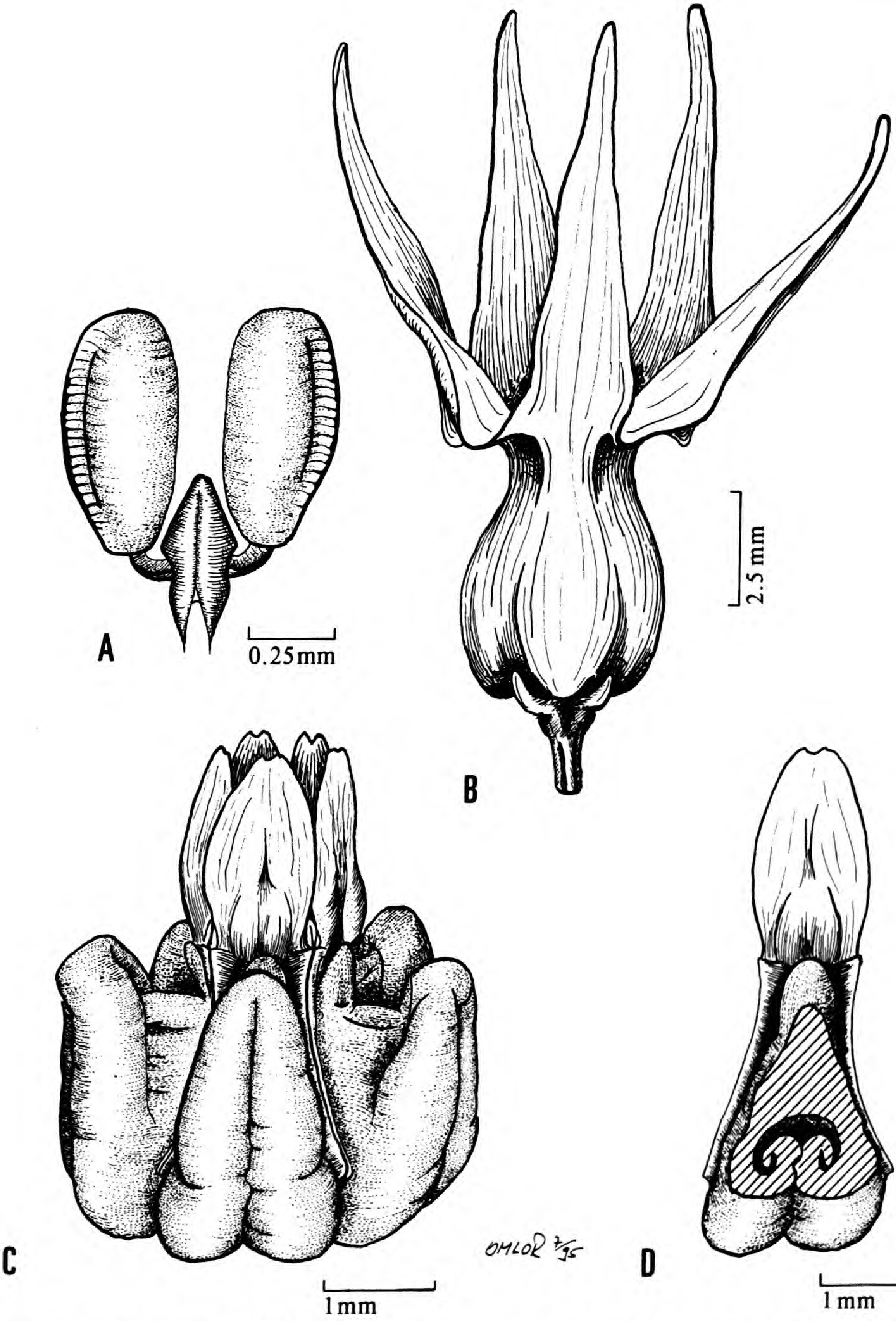

Figure 1. *Hoya telosmoides* R. Omlor. —A. Pollinarium. —B. Flower. —C. Gynostegium. —D. Dorsal view of a stamen, corona lobe sectioned to illustrate the revolute margins. All drawn from *Clemens 30259*.

FLORA OF MT. KINABALU.

Clemens' Expedition.

Name

Collectors, J. & M. S. Clemens.

B. N. Borneo: Mt. Kinabalu

Locality Tenompok

Habitat Jungle

Altitude above sea 5,000 ft.

Tree, shrub, vine, herb

Height of plant ft.

Diameter, breast high ft.

Flower .Lemon interior, outer petals and base tinged with purple (Colour, odour, etc.)

Fruit Very fragrant (Kind, use, odour, colour, etc.)

Special notes

Economic uses

No. Date June 7/32.

Figure 2. Holotype of *Hoya telosmoides* (*Clemens 29828* (BM)).

able, and neither the delimitation nor the infrageneric classification of the genus has yet been satisfactorily resolved. Important recent contributions to the taxonomy of *Hoya* are provided by Rintz's (1978) revision of the Malaysian species and by Forster and Liddle's (1990) treatment of the Australian species. In both accounts *Hoya* is treated in a broad taxonomic sense, including the somewhat deviating *Physostelma* Wight (= *Hoya campanulata* Blume group) and *Cyrtoceras* Bennett (= *Hoya multiflora* Blume).

In this broad taxonomic sense the genus *Hoya* shows a wide variation in floral characters: Whereas most species of the genus have flowers with a deeply lobed rotate, often reflexed corolla, a few species, e.g., *H. campanulata* Blume, have broad-campanulate flowers. A small number of species are exceptional in having pollinia lacking the typical germination zone otherwise characteristic of the *Hoya* group. These are *H. mitrata* Kerr (Rintz, 1978) and a group of species—such as *H. coronaria* Blume (Rintz, 1978: 505) or *H. lauterbachii* Schumann (Forster & Liddle, 1990: 220)—which Schlechter (1914) united in his section *Eriostemma*. *Hoya pusilla* Rintz differs by atypical corona lobes that lack the characteristic revolute margins. These are only a few, notable examples for *Hoya* species with deviating characters. Rintz (1978) described in detail the morphological variation present in *Hoya*.

If the genus *Hoya* is accepted in the broad taxonomic sense circumscribed by Forster and Liddle (1990), the new species presented here can casually be ascribed to it. Although differing by the shape of its corolla from all hitherto known species of *Hoya*, *H. telosmoides* entirely agrees in the remaining diagnostic characters of the genus. It must be considered that species with campanulate flowers and the above-listed species with more fundamental deviations are (well founded) commonly accepted in *Hoya*. Within *Hoya* the new species occupies an isolated position and should therefore be classified in a separate section.

It has to be mentioned that two monotypic genera of uncertain affinities might be related to *Hoya telosmoides*. One of these, the genus *Oreosparte*, was established by Schlechter (1916) for an exceptional, *Hoya*-like species he had collected in the mountains of Minahassa on Celebes. This species, *Oreosparte celebica* Schlechter, is described as having a campanulate, inside minutely pubescent corolla tube with a contracted throat and lanceolate, spreading lobes. Apparently *Oreosparte* concurs with *Hoya telosmoides* in shape of the corolla, but it is described as having a stalked gynostegium and a corona similar in shape to the corona of *Hoya multiflora*. I have been unable to locate any material of *Oreosparte celebica*. The holotype (*Schlechter 20512*) was apparently destroyed along with the major part of the Berlin Herbarium in 1943 (Hiepko, 1978; Nicholas, 1992). From Schlechter's Asclepiadaceae collection at B only a few *Hoya* and *Dischidia* specimens remained (Hiepko, pers. comm.). However, the plant must have been rather common in the mountains of Minahassa, since Schlechter (1916) reported that its filiform stems have been used to bundle the collections during the expedition. Therefore it may be assumed that duplicates had been collected and distributed to other herbaria. It would be appreciated if any information concerning the existence of such isotypes were to be communicated to the author.

The second monotypic genus that might be related to *Hoya telosmoides* is *Heynella* Backer from Java. *Heynella lactea* Backer, according to the description, is characterized by a salver-shaped corolla with a flask-shaped tube, and ovate-oblong, slightly spreading lobes (Bakhuizen, 1950). It is distinguished from *Hoya telosmoides* by its epiphytic nonclimbing habit and by terminal inflorescences (a rather doubtful observation). Furthermore, in contrast to *Hoya telosmoides* the free lobes of the corolla are considerably shorter than the corolla tube. Unfortunately, the type material of *Heynella lactea*, located at BO, Indonesia (Forster & Liddle, 1994), could not be sent on loan for study.

Neither in the case of *Oreosparte* nor in *Heynella* can it be judged from the protologue whether the pollinia have the lateral pellucid germination zone and whether the corona lobes exhibit the characteristic revolute margins. For the time being, the taxonomic position of these genera within the Marsdenieae must therefore remain uncertain.

At present *Hoya telosmoides* is known only from two areas in northern Borneo, where it is found twining in lower and upper stories of mountain forest, at altitudes of 800–1500 m.

Paratypes. MALAYSIA. **Sabah:** Mt. Kinabalu, Tenompok, 1500 m, 15 June 1932, *Clemens 30259* (K); Mt. Kinabalu, Penibukan, 1200–1500 m, 10 Jan. 1933, top of 80 ft. tree, *Clemens 30868* (BM). **Sarawak:** Gunong Api, ulu Melinau, Tutoh, Baram District, NE flank of mountain, 4°07'N, 115°15'E, 880 m, 30 Sep. 1971, "small climber in understorey, inflorescence pendulous, corolla pale yellow, waxy, corona sunk, anthers reddish brown," *Anderson 30815* (K).

Acknowledgments. The present contribution resulted from my ongoing work on a generic revision of Marsdenieae and is based on the examination of herbarium material of some 200 species borrowed mainly from B, BM, HBG, K, M, and P after extensive study of their collections; individual specimens have been provided by IBSC, L, and US. A list of the specimens examined is available upon request. I am indebted to the directors of the cited herbaria for permission to study their collections and for sending specimens on loan. Furthermore, I express my gratitude to Herbert Huber, under whose guidance this work was done. My sincerest thanks also go to David J. Goyder for valuable discussions and suggestions, to Wolfgang Stuppy for critically reading the manuscript, and to Andreas Stern for taking the photograph of the holotype. This work was supported by a grant from the LGFG-Kommission Rheinland-Pfalz.

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Three New Species from Palas Valley, District Kohistan, North West Frontier Province, Pakistan

Rubina A. Rafiq
National Herbarium, National Agricultural Research Centre, Islamabad, Pakistan

ABSTRACT. *Delphinium palasianum, Jasminum leptophyllum,* and *Pseudomertensia flavescens* are described from Palas Valley, District Kohistan, North West Frontier Province (NWFP), Pakistan. Their taxonomic relationships are discussed.

Three new species were discovered during identification of plants collected from Palas Valley. Palas is among those remote areas of the northwestern Himalaya whose botany has been little studied, and no plant inventory of the valley exists. Botanical surveys in the Palas Valley were initiated under the auspices of the BirdLife/WWF, Himalayan Jungle Project. A first survey and plant collections were made in late summer 1992, followed by more collections in 1993 and 1994.

Palas Valley, a large watershed of over 1000 km^2, lies east of the River Indus in District Kohistan, Hazara Division, NWFP, among the front ranges of the westernmost extension of the Himalayas—the Kohistan Arc. Altitudes range from ca. 1000 m to 5151 m. The topography is rugged and precipitous, with a number of narrow gorges. The main river, the Musha'ga, is about 75 km long and joins the River Indus at 73°05'E, 35°08'N. Palas has warm to hot summers, and cold winters. Climatic figures are not available, but the estimated mean annual precipitation is 900 mm to 1350 mm. Precipitation falls mostly as winter snow. Palas receives summer rains, but is somewhat sheltered from the monsoon by mountains to the south.

Delphinium palasianum Rubina Rafiq, sp. nov. TYPE: Pakistan. Kohistan: Ilobek, ca. 2400 m, Palas valley, 19 Aug. 1993, *Rubina Rafiq 13908* (holotype, RAW; isotypes, RAW, W).

Species maxime affinis *Delphinio denudato* Wallich foliorum florumque forma sed differt inflorescentiis ramosissimis paniculatis multifloris, floribus luteis et folliculis majoribus, 1.5–1.8 cm longis.

Erect perennial. Rootstock woody, slender rhizome-like, covered with fibrous bases of old leaves. Stems erect, terete, ca. 1 m tall, divaricately branched above; branches spreading, subglabrous below, white retrorsely strigulose above. Radical leaves withered at anthesis; petioles up to 20 cm long; lamina 3–5-partite, segments divided to base, coarsely toothed; upper cauline leaves with shorter petioles, lamina divided almost to base into 3–5 linear entire segments. Inflorescences divaricately branched paniculate; bracteoles linear, attached near middle of pedicel. Flowers yellow, 2.5–3 cm long. Pedicels 3–8 cm long, retorsely white pubescent. Sepals yellow, slightly pubescent; spur 1.3–1.5 cm long, longer than sepals, pilose, cylindric, gibberulate below apex. Petals yellow; upper petal obliquely bidentate, pilose; lower petal ovate-elliptic, bearded below middle, deeply cleft. Stamens glabrous; filaments widened below; anthers yellow. Carpels densely strigose hairy. Follicles 3, 1.5–1.8 cm long; style ca. 3 mm long, suberect, divergent at tips, slightly to densely strigose with yellow hairs. Seeds dark brown, scales longer than broad, irregularly arranged.

Habitat. Exposed dry stony slopes at 2400–2700 m. Not very common in the area but occasionally seen growing among small shrubs on avalanche scree slopes in open kind of shrubby vegetation or on the margin of dry temperate coniferous forest with little undergrowth.

Delphinium palasianum resembles *D. denudatum* Wallich ex Hooker f. & Thomson in the shape of leaf and flowers. It can be easily distinguished by its many-flowered, profusely branched paniculate inflorescence, yellow flowers, and larger follicles. This is similar to an undescribed yellow-flowering species mentioned by H. Riedl (1991).

Jasminum leptophyllum Rubina Rafiq, sp. nov. TYPE: Pakistan. Kohistan: above Ban-gah, ca. 1900 m, Palas Valley, 23 Aug. 1993, *Rubina Rafiq 14091* (holotype, RAW).

Species nova e sectione *Alternifolia* foliis alternantibus corolla lutea, maxime affinis *Jasmino florido* Bunge et *J. fruticanti* L. calycis dentibus lineari-subulatis tubo calycis longioribus, sed differt ab his speciebus foliis sessilibus, indivisis, anguste linearibus, corolla majore 3 cm fere longa, floribus paucioribus.

Profusely branched erect shrub ca. 1 m tall. Shoots dark gray, angled or ribbed, glabrous.

Leaves unifoliolate, sessile or subsessile; blade 2.5–2.8 cm long, 1.2–2 mm wide, glabrous, narrowly linear-lanceolate, margins recurved, apex blunt, apiculate. Inflorescences terminal, glabrous, cymose, 1–3-flowered. Pedicels 5–10 mm long. Flowers bright yellow, ca. 3 cm long, heterostylous, fragrant. Calyx glabrous, tube 1.5–2.0 mm long; lobes linear, ca. 3 mm long. Corolla tube ca. 2.2 cm long; lobes elliptic. Stamens 2, attached to corolla tube. Ovary 2-loculed; ovules 2 in each locule. Fruit a bilobed two-seeded berry, light brown when ripe.

Habitat. Open dry steep slopes with rocky and stony soil in the subtropical and warm temperate area of Palas Valley at 1500–2200 m. Known only from the type locality; a small population is confined to a narrow gorge in the *Quercus balloot-Olea ferruginea* zone. *Jasminum leptophyllum* is a subdominant species growing with other associated shrubs, such as *Jasminum humile* L., *Isodon rugosus* (Wallich ex Bentham) Codd, *Abelia triflora* R. Brown, *Pistacia khinjuk* Stocks, *Fraxinus xanthoxyloides* (G. Don) DC., and *Cotoneaster* spp.

Jasminum leptophyllum is related to the members of section *Alternifolia* DC. in having alternate leaves and bright yellow corollas. *Jasminum leptophyllum* is the only species in the section with consistently simple, alternate and very narrow leaves; all other members of the section have at least some leaves compound and broader leaflets. It resembles *J. floridum* Bunge and *J. fruticans* L. in having linear subulate calyx teeth longer than the calyx tube. However, it can easily be differentiated from both species by its simple, narrow, linear, sessile leaves, larger corollas, and fewer flowers. This is the only wild species from Pakistan with bright yellow flowers and simple, alternate leaves.

Pseudomertensia flavescens Rubina Rafiq, sp. nov. TYPE: Pakistan. Kohistan: TikohSar, 3000–3500 m, Palas Valley, 16 June 1994, *Rubina Rafiq 14291* (holotype, RAW; isotypes, RAW, W).

Species affinis *Pseudomertensiae trollii* (Melchior) Stewart & Kazmi, sed calyx dimidium vel ⅔ longitudinis tubi corollae attingens, filamenta 4–5 mm longa, corolla lutea vel alba, folia 3–4 cm longa, 3–5 mm lata. Flores *P. trollii* azurei usque ad obscure purpurei, folia latiora, calyx *P. trollii* var. *trollii* tubum corollae aequans, filamenta 4–5 mm longa, calyx *P. trollii* var. *edelbergii* (Rechinger f. & Riedl) Kazmi tubo corollae brevior, filamenta 2.5 mm longa.

Rhizomatous perennial with few ascending shoots. Branches suberect, 3–8 cm. Basal leaves shorter than upper leaves, with indistinct petioles broader at base and clasping shoots; middle cauline leaves gradually narrowed into elongated petiole, broader at base, with ciliate margin clasping shoots; blade ca. 3–3.5 cm long, 3–5 mm wide, elliptic-lanceolate, entire, covered on both surfaces with thin appressed trichomes. Flowering shoots mostly leafless or sometimes with a single sessile leaf arising from base of vegetative shoots. Inflorescences cymose, terminal, simple, short, curved. Calyx divided to base, ca. 4 mm long; lobes erect, narrowly linear, densely hairy at margins. Corolla yellow or white, tube 6–7 mm long, cylindric-campanulate; lobes ca. 2 mm long, oblong, rounded, spreading; throat scales well developed, broader than long. Stamens exserted from corolla tube; filaments ca. 4 mm long; anthers sagittate. Style exceeding corolla; stigma capitate. Nutlets 4, ovoid-trigonal, glabrous, smooth, shining, dark brown.

Distribution and habitat. *Pseudomertensia* is a small genus represented by 11 species endemic to northwest Himalaya. Two populations of *P. flavescens* were seen in the Palas Valley: one with white flowers growing in shady areas in temperate coniferous forest from 2500 to 2900 m, and the other with yellow flowers growing in open sunny exposed subalpine slopes from 3000 to 3500 m. Other species of *Pseudomertensia* growing in the area are *P. sericophylla* (Riedl) Y. Nasir, *P. trollii* (Melchior) Stewart & Kazmi, and *P. moltkioides* (Royle ex Bentham) Kazmi.

Pseudomertensia flavescens resembles the closely related *P. trollii* (Melchior) Stewart & Kazmi in having exserted stamens and a corolla tube longer than the calyx. It differs in having smaller and narrower leaves and yellow and white flowers. The calyx in *P. trollii* var. *trollii* is subequal to the corolla tube and the filaments are 4–5 mm long, whereas in variety *edelbergii* (Rechinger f. & Riedl) Kazmi it is shorter than the corolla tube and the filaments are ca. 2.5 mm long. In *P. flavescens* the calyx is ½–⅔ of corolla tube and the filaments are 4–5 mm long. *Pseudomertensia parvifolia* (Decaisne) Riedl differs in having the calyx equaling the corolla and corolla lobes acutish and erect as opposed to rounded and spreading in *P. flavescens.*

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Naeen of HJP, and Sikander Hayat of NARC; and to the people of Palas for their hospitality. I thank the directors of the herbaria, Natural History Museum, Vienna, and the Royal Botanic Gardens, Kew, for providing facilities to me to study the specimens and type material. H. Riedl kindly provided the Latin descriptions, and he, Ihsan Al-Shehbaz, and Guy Duke critically reviewed the manuscript. This paper was prepared while studying for a doctorate on the flora of Palas at Vienna and was made possible by generous financial assistance from the Austrian government and HJP. HJP (1991–1994) was implemented by BirdLife International in partnership with the NWFP Forest, Fisheries and Wildlife Department, World-Wide Fund for Nature (WWF), National Council for Conservation of Wildlife and World Pheasant Association; HJP was financed predominantly by the British Overseas Development Administration (ODA), WWF, US Fish and Wildlife Service, and Biodiversity Support Program (a USAID-funded joint venture of WWF-US, the Nature Conservancy, and World Resources Institute).

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More New Species and a New Combination in Rubiaceae from Costa Rica and Panama

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. The new species *Faramea correae* C. M. Taylor, *F. permagnifolia* Dwyer ex C. M. Taylor, *F. sanblasensis* C. M. Taylor, *Psychotria deneversii* C. M. Taylor, *P. purpureocapitata* Dwyer ex C. M. Taylor, *Rudgea hemisphaerica* Dwyer ex C. M. Taylor, *R. mandevilliifolia* Dwyer ex C. M. Taylor, and *R. mcphersonii* Dwyer ex C. M. Taylor are described and illustrated, and the new combination *Rudgea panamensis* (Dwyer) C. M. Taylor is made based on *Cephaëlis panamensis* Dwyer.

During study of material recently collected in Costa Rica and Panama for preparation of the *Flora Mesoamericana,* the following new species and the need for the following new combination were discovered. The taxa belong to the tribes Coussareae and Psychotrieae. They are arranged here by tribe, and alphabetically within each tribe. Generic characteristics, keys to these genera, and an outline of most of the species with which these new taxa can be confused were presented by Burger and Taylor (1993).

TRIBE COUSSAREAE

Faramea correae C. M. Taylor, sp. nov. TYPE: Panama. Panamá: Parque Nacional Altos de Campana, Sendero de Interpretación, 1 km al este del campamento de los guardaparques de INRENARE, 8°40′N, 79°55′W, 800–900 m, 9 Sep. 1993, *M. D. Correa A., E. Montenegro & E. Hidalgo 9983* (holotype, PMA-38229; isotypes, MO–4641338, MO–4658116). Figure 1C, D.

Haec species a congeneris foliis sessilibus lanceolato-ellipticis basi ex rotundatis subcordatis, floribus subsessilibus fasciculatis ac fructibus subglobosis distincta.

Shrubs and small trees, flowering at 3 m tall, to 5 m tall, glabrous throughout; stems laterally flattened, becoming subterete with age. *Leaves* sessile, with *blades* elliptic to lance-elliptic, 8–18 cm long, 2.5–7 cm wide, at apex acuminate with slender tips 8–15 mm long, at base rounded to subcordate, chartaceous; secondary veins 8–11 pairs, spreading widely, looping broadly to interconnect near margins, with the lesser venation finely reticulated, thickened to slightly raised adaxially, plane abaxially; *stipules* interpetiolar, caducous through fragmentation, triangular, 2–5 mm long, smooth, acute to shortly aristate. *Flowers* terminal, fasciculate, 2–8, subsessile, ebracteate, with hypanthium turbinate, ca. 1 mm long; *calyx limb* glabrous, ca. 2 mm long, truncate; *corolla* in bud salverform, white flushed with violet, glabrous externally, tube ca. 12 mm long, ca. 2 mm diam. near the middle, lobes 4, ca. 6 mm long, narrowly triangular, acute. *Fruits* subglobose, ca. 1 cm diam., smooth, glabrous. Collected in wet forest in central Panama at 800–900 m, with flower buds in September, young fruit in December.

Faramea correae is distinguished by its sessile lance-elliptic leaves, which are rounded to subcordate at the base, subsessile fasciculate flowers, and subglobose fruits. It is similar and probably closely related to *F. sanblasensis* C. M. Taylor (below), which can be distinguished by its generally larger leaves, cymose inflorescences, and pedicellate flowers. The specific epithet honors Mireya Correa, a Panamanian botanist whose extensive work has greatly advanced knowledge of the country's flora. She notes that the leaves of this species frequently have on their abaxial surface a waxy substance produced by larvae identified as that of a scale insect by Don Windsor (pers. comm.).

Paratypes. PANAMA. **Panamá:** Parque Nacional Altos de Campana, Sendero de Interpretación, 1 km al este del campamento de los guardaparques de INRENARE, 8°40′N, 79°55′W, *M. D. Correa A., E. Montenegro & E. Hidalgo 9318* (MO, PMA).

Faramea permagnifolia Dwyer ex C. M. Taylor, sp. nov. TYPE: Costa Rica. Puntarenas: Osa Peninsula, in forest ca. 9 km W of Rincón on road to Rancho Quemado, 8°39′N, 83°32′W, 200 m, 26 May 1986, *B. Hammel, M. Grayum & G. de Nevers 15212* (holotype, CR; isotypes, MO–4658114, MO–4658115). Figure 1B.

Haec species a congeneris foliis subsessilibus sat grandibus ex oblanceolatis obovatis basi breve truncatis, flo-

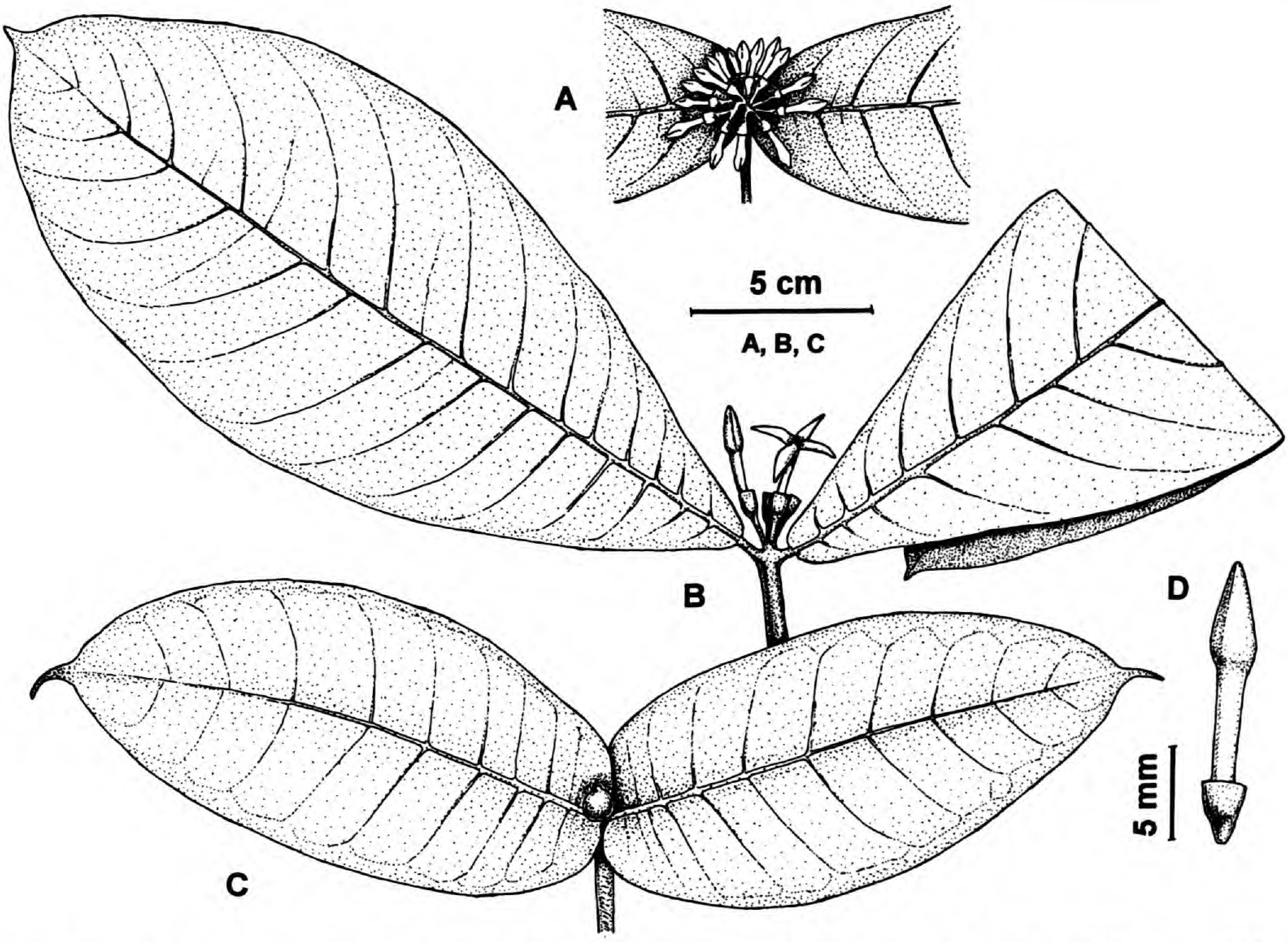

Figure 1. —A. *Faramea sanblasensis* C. M. Taylor, inflorescence; based on *de Nevers et al. 5491.* —B. *F. permagnifolia* Dwyer ex C. M. Taylor, habit; based on *Hammel 15212.* C, D, *F. correae* C. M. Taylor. —C. Habit; based on *Correa et al. 9318.* —D. Flower; based on *Correa et al. 9983.* A, B, C to 5-cm scale; D to 5-mm scale.

ribus in fasciculos terminales breves dispositis ac fructibus subglobosis distincta.

Shrubs and small trees, flowering at 2.5 m tall, to 5 m tall, glabrous; stems laterally flattened and remaining so with age. *Leaves* subsessile, with *blades* oblanceolate to obovate, 20–41 cm long, 7.5–18 cm wide, at apex shortly acuminate with slender tips 5–12 mm long, toward the base tapered, at base shortly truncate to rounded, chartaceous, apparently pale abaxially; secondary veins 13–18 pairs, spreading, usually looping to interconnect near margins, with the lesser venation reticulated, thickened to slightly raised adaxially, plane abaxially; *petioles* 1–5 mm long; *stipules* interpetiolar and also shortly united intrapetiolarly, caducous, the interpetiolar portion triangular, 2–10 mm long, aristate with tips 1–3 mm long. *Flowers* terminal, 3–6, fasciculate, ebracteate, peduncles 3–8 mm long, with hypanthium turbinate, 2–5 mm long; *calyx limb* 2.5–3 mm long, glabrous, truncate to denticulate; *corolla* salverform, white or bluish white (perhaps with age), glabrous throughout, tube 17–18 mm long, ca. 1.5 mm diam. near the middle, lobes 4(5), narrowly triangular to linear, ca. 12 mm long, acute, triangular in cross section; *anthers* 4, included in distal part of tube, subsessile, linear, ca. 7 mm long; *style* and *stigma* not seen. *Fruit* subglobose, ca. 13 × 16 mm, smooth, glabrous. Collected in wet forest near Golfo Dulce in Costa Rica at ca. 200 m, in flower in May, in fruit in November.

Faramea permagnifolia is distinguished by its relatively large oblanceolate or obovate leaves, which are subsessile, shortly truncate at the base, and pale abaxially, its flowers in short terminal fascicles, and its subglobose relatively large fruits. The specific epithet refers to the relatively large leaves. This new species is similar to *F. sanblasensis* C. M. Taylor (below), which is distinguished by its leaves that are rounded to subcordate at the base and cymose inflorescences. Vegetatively *F. permagnifolia* strongly resembles several species of *Rudgea*, notably *R. sanblasensis* C. M. Taylor (Taylor, 1996a) and *R. hemisphaerica* Dwyer ex C. M. Taylor (below), which can be separated by their stipules with caducous glandular appendages, pedunculate usually branched inflorescences, and drupaceous fruits with two hard pyrenes versus the single-seeded baccate fruits found in *Faramea.*

Paratypes. COSTA RICA. **Puntarenas:** N and W of the airfield, ca. 5 km W of Rincón de Osa, 8°42'N, 83°31'W, *Burger & Liesner 7242* (MO); Cantón de Osa, Reserva Forestal Golfo Dulce, en el sur del valle de Rancho Quemado, 15 km al oeste de Rincón, 8°40'N, 83°34'W, *Hammel et al. 17864* (CR, MO); Reserva Forestal Golfo Dulce, camino a Rancho Quemado, en la cuenca de la quebrada Bengas, 8°42'N, 83°33'W, *Hammel & Aguilar 18725* (CR, MO); trail from Rincón de Osa to Rancho Quemado, *Kennedy 1955* (MO); Reserva Forestal Golfo Dulce, cerca de la laguna Chocuaco, Rancho Quemado, en el sendero al Cerro Brujo, 8°43'N, 83°35'W, *Morales et al. 2096* (CR, F, MO); upper Aguabuena, 5 km W of Rincón, 8°43'N, 83°31'W, *Thomsen 373* (CR, MO).

Faramea sanblasensis C. M. Taylor, sp. nov. TYPE: Panama. Comarca de San Blas: Cerro Brewster, headwaters of Río Cangandí, 9°18'N, 79°16'W, 630 m, 24 Apr. 1985, *G. de Nevers, H. Herrera, B. Hammel & S. Charnley 5491* (holotype, PMA-38230; isotype, MO-4658117). Figure 1A.

Haec species a congeneris foliis sessilibus subsessilibusve sat grandibus basi ex rotundatis subcordatis, inflorescentia cymosa brevi ac fructibus subglobosis distincta.

Shrubs and small trees, flowering at 4 m tall, to 5 m tall, glabrous throughout; stems laterally flattened, becoming subterete with age. *Leaves* sessile or subsessile, with *blades* elliptic to lance-elliptic, 18–46 cm long, 11–18 cm wide, at apex acuminate with slender tips 8–15 mm long, at base rounded to subcordate, chartaceous; secondary veins 12–18 pairs, spreading widely, looping broadly to interconnect near margins, with the lesser venation finely reticulated, thickened to slightly raised adaxially, plane abaxially; *stipules* interpetiolar, persistent or often deciduous through fragmentation, triangular, 2–10 mm long, somewhat costate, acute to shortly aristate. *Inflorescences* terminal and sometimes in most distal axils, congested-cymose, ebracteate, peduncles 2–10 mm long, pedicels 2–12 mm long, hypanthium 1–1.5 mm long, turbinate; *calyx limb* 2.5–3 mm long, glabrous, truncate; *corolla* salverform, white, externally glabrous, internally glabrous except villous at stamen attachment, lobes 5–6, narrowly triangular to linear, ca. 5 mm long, acute; *anthers* partially exserted, linear, ca. 4 mm long; *stigma* capitate, ca. 1 mm long, included. *Fruit* subglobose, 10–11 × 14–15 mm, purple, smooth, glabrous. Collected in wet forest in eastern Panama at 50–180 m, in flower in April, in fruit in July and August.

Faramea sanblasensis is distinguished by its sessile, relatively large, lance-elliptic leaves that are rounded to subcordate at the base, flowers in rather short terminal cymes, and subglobose fruits. It is similar and probably closely related to *F. correae* C. M. Taylor; their distinctions are outlined above. The specific epithet refers to the region from which this species is known.

Paratypes. PANAMA. **Comarca de San Blas:** cordillera frente a la Isla Narganá, ribera del río Diablo, *Galdames 1480* (MO); río Diablo y vecindad de Duque Sui, a unos 10 km de la costa frente a la Isla de Narganá, ruta hacia Cerro Ibedón, 9°22'N, 78°35'W, *Herrera et al. 1178* (MO, PMA); vecindad del río Diablo, tierra firme frente a la Isla Narganá, a unos 15 km de la costa, 9°22'N, 78°35'W, *Herrera et al. 1198* (MO, PMA, US); vecindad del río Diablo, 8–9 km de la costa, 9°23'N, 78°34'W, *Herrera et al. 1728* (MO, PMA).

TRIBE PSYCHOTRIEAE

Psychotria deneversii C. M. Taylor, sp. nov. TYPE: Panama. Comarca de San Blas: El Llano–Cartí Road, 18 km from Interamerican Highway, headwaters of Atlantic-draining creeks, 9°19'N, 78°55'W, 300 m, 7 Sep. 1984, *G. de Nevers 3861* (holotype, PMA-38224; isotype, MO-4658111). Figure 2C, D.

Haec species a congeneris foliis subsessilibus sat grandibus ex oblanceolatis obovatis, inflorescentia subcapitata pedunculata, limbo calycino sat longo ac corolla insuete longa distincta.

Rather succulent, suffrutescent herbs or small trees, flowering at 1.5 m tall, to 4 m tall; stems glabrescent, rather quadrate. *Leaf blades* sessile to subsessile, oblanceolate to obovate, 40–49 cm long, 18–19 cm wide, at apex rather abruptly acuminate with tips 1–1.5 cm long, tapered toward base, at base truncate to subcordate, papyraceous, above glabrous to minutely puberulous, below moderately to densely puberulous to pilosulous throughout though often more densely so on principal veins; secondary veins 19–20 pairs, broadly curved, ascending, usually extending to the margins, above the costa prominulous and sharply angled and the remaining venation plane, below the costa prominent, the secondary veins prominulous, and the remaining venation prominulous or thickened; stipules united around the stem into a continuous, subtruncate sheath with two lobes on each side, deciduous with the leaves, glabrescent or moderately to densely puberulous or pilosulous, sheath ca. 2 mm long, lobes narrowly triangular, 9–12 mm long, acute. *Inflorescences* terminal, subcapitate, erect, green to purple; peduncles 8–14 cm long, puberulous to pilosulous, laterally flattened, heads cylindrical, 3.5–6 × 3–6 cm; *flowers* borne in glomerules or densely congested cymules of 5–20, with

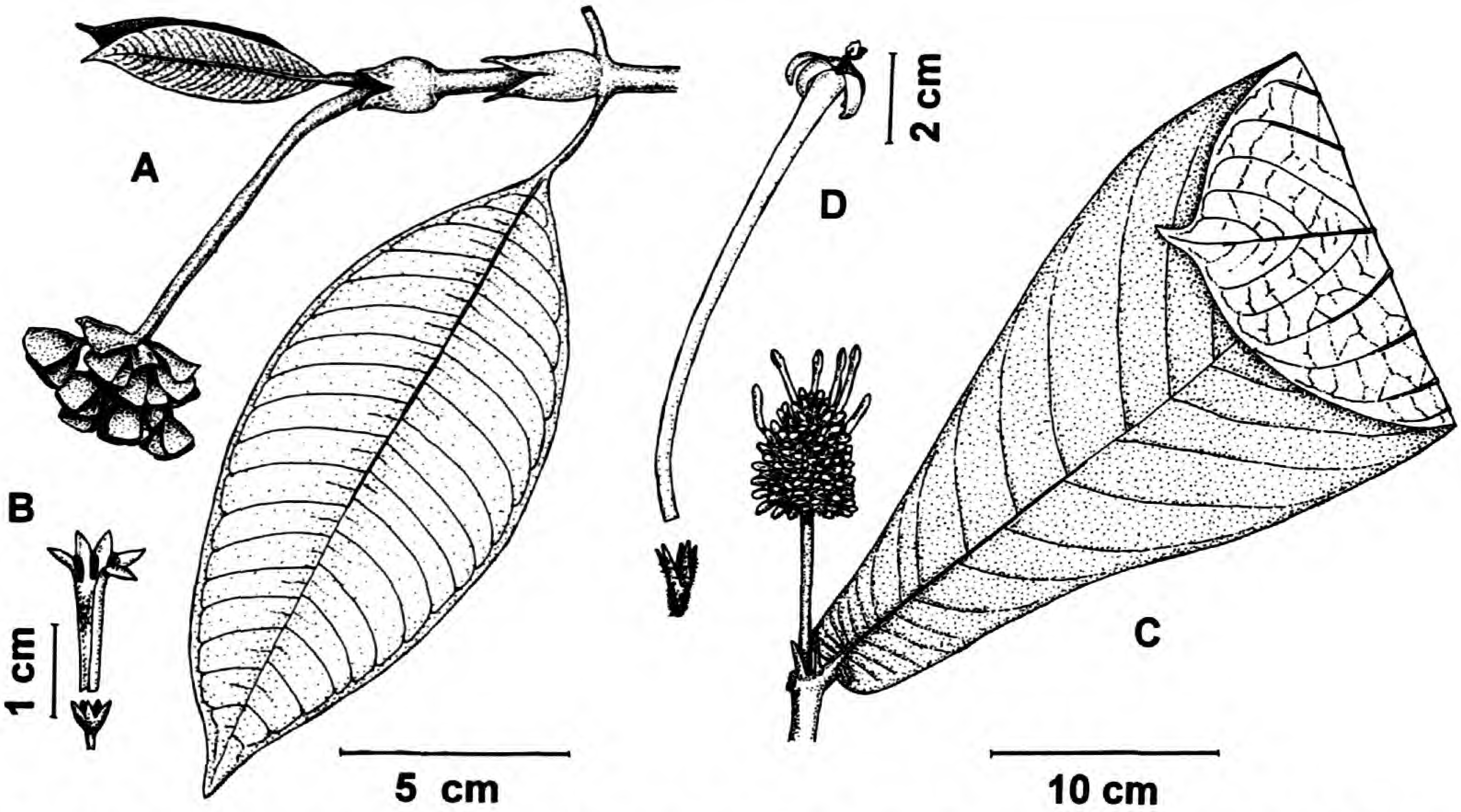

Figure 2. A, B, *Psychotria purpureocapitata* Dwyer ex C. M. Taylor; based on *Antonio 1072.* —A. Habit. —B. Flower, partially dissected. C, D, *Psychotria deneversii* C. M. Taylor; based on *de Nevers 3861.* —C. Habit. —D. Flower, with calyx and corolla separated. A to 5-cm scale; B to 1-cm scale, C to 10-cm scale; D to 2-cm scale.

hypanthium turbinate, ca. 2 mm long, densely short-pilosulous; *calyx limb* sparsely to moderately short-pilosulous, membranaceous, 5–8 mm long, divided nearly to base, lobes 5, linear to narrowly triangular, acute; *corolla* salverform, white, externally sparsely to moderately pilosulous, internally glabrous except villous in distalmost $\frac{1}{3}$ of tube, tube uniformly cylindrical, ca. 5 cm long, ca. 1.5 mm diam., lobes 5, triangular, ca. 5 mm long; anthers included, ca. 4 mm long, positioned just below top of tube; *style* villosulous on upper $\frac{1}{3}$–$\frac{1}{2}$, stigmas 2, exserted, ca. 1.5 mm long, flattened, suborbicular; disk annular, ca. 0.5 mm high. *Fruits* obovoid, ca. 5 × 6 mm, somewhat flattened laterally. Collected in wet forest in eastern Panama at 300–350 m, in flower in September and November and in young fruit in November.

Psychotria deneversii is distinguished by its relatively large, oblanceolate to obovate, subsessile leaves, subcapitate pedunculate inflorescences, relatively long calyx limb, and unusually long corollas. It is similar to *Palicourea dimorphandroides* (Dwyer) C. M. Taylor (Taylor, 1996b) and *Palicourea grandistipula* (Steyermark) C. M. Taylor (Taylor, 1996b), both of eastern Panama and northwestern and western Colombia. These can be separated by their shorter corollas, which are gibbous and swollen at the base and pubescent internally in the lower part of the tube. The specific epithet commemorates Greg de Nevers, whose extensive and careful collecting has greatly advanced our knowledge of the Panamanian flora, in particular that of the San Blas region.

Only one flowering collection has been seen, but its flowers (described above) conform to the general long-styled morphology found in neotropical *Psychotria,* and it seems likely that this species is distylous. The collection in which the "inflorescence" is described as purple actually also bears young fruits, and it seems likely that the inflorescences of this species follow the most common pattern in neotropical *Psychotria* and change from green in flower to purple in the fruiting stage.

Paratype. PANAMA. **Comarca de San Blas:** El Llano–Cartí road, Km 19.1, 9°19′N, 78°55′W, *de Nevers et al. 6188* (MO, PMA).

Psychotria purpureocapitata Dwyer ex C. M. Taylor, sp. nov. TYPE: Panama. Coclé: El Copé on Pacific side, $\frac{1}{2}$ hour walk from sawmill, 2400 ft. [774 m], 16 Oct. 1979, *T. Antonio 2154* (holotype, PMA; isotype, MO–4658112). Figure 2A, B.

Haec species a congeneris stipulis sat grandibus interpetiolaribus profunde bilobatis, foliorum nervis secundariis crebris multis in venam submarginalem validam coalitis, inflorescentia subcapitata capitatave dense bracteata ex viridi purpurea pedunculo longo flexuoso insidente ac corolla alba distincta.

Subshrubs or shrubs, flowering at 0.6 m tall, to

1.5 m tall, stems quadrate or sometimes flattened, becoming rather terete with age, glabrous or appressed-puberulous or -pilosulous, becoming glabrescent with age. *Leaves* paired, *blades* elliptic, 9–20 cm long, 3–10 cm wide, at apex acuminate with tips 6–20 mm long, at base cuneate to usually obtuse or sometimes rounded, papyraceous, above glabrous or sometimes minutely puberulous along midrib, below moderately to densely appressed-pilosulous to -puberulous throughout though usually more densely so on costa and secondary veins, often becoming glabrescent with age; secondary veins 16–28 pairs, spreading, broadly curved, uniting in submarginal vein ca. 0.5–1 mm from the margin, this vein straight or slightly undulating and as well marked as the secondary veins, usually 1(2) very weak intersecondary veins present between pairs of secondary veins, above the costa prominulous, the secondary veins thickened to a little raised, and the remaining venation plane, below the costa prominulous to prominent, the secondary veins prominulous, and the minor venation plane; margins thinly cartilaginous, entire or minutely ciliolate; *stipules* persistent, interpetiolar, moderately to densely villosulous to villous, ovate, 9–19 mm long, bilobed for ca. ½, the lobes narrowly triangular, acute to usually acuminate, the sinus acute. *Inflorescences* terminal or usually pseudoaxillary by sympodial continuation of the axis from an axillary bud, deflexed to pendulous, capitate to subcapitate, densely bracteate; peduncles sparsely to rather densely appressed-villosulous to -villous, flexuous, 6.5–14 cm long, heads 1.5–2.5 cm long, 3–5.5 cm wide, unbranched or branched 1–2 times and corymbiform; bracts green or purple to deep purple, glabrous or puberulous, entire, the external bracts fused into a continuous involucre 10–15 mm long, truncate, splitting irregularly, the floral bracts elliptic to ovate or spatulate, 5–10 mm long, obtuse or rounded to truncate; *flowers* sessile in dense glomerules of 5–10, each flower subtended by a floral bract and the glomerule enclosed by 2–4 additional bracts; hypanthium cylindrical, ca. 1 mm long, glabrous; *calyx limb* membranaceous, green, glabrous, 2–2.5 mm long, lobed for ca. ¾–⅘, lobes narrowly triangular to linear, unequal by up to 10% on an individual flower, acute; *corolla* slenderly funnelform, white, glabrous externally, glabrous internally except villosulous in middle of tube, tube 8–9 mm long, ca. 1 mm diam., lobes 5, narrowly triangular, 2.5–3 mm long, acute; *anthers* narrowly oblong, in short-styled form partially exserted, ca. 2 mm long, in long-styled form positioned just above middle of tube, ca. 1.3 mm long; stigmas 2, in short-styled form linear, positioned just below top of corolla tube, ca. 1.5 mm long, in long-styled form subglobose, ca. 1 mm long, exserted. *Fruit* ellipsoid, ca. 4 × 3.5 mm; pyrenes 2, planoconvex, with 4–5 low longitudinal angles. Collected in wet forest in western Panama at 400–850 m, in flower in June, and October through December.

Psychotria purpureocapitata is distinguished by its relatively large stipules, which are interpetiolar and deeply bilobed, leaves with numerous closely set secondary veins uniting in a strong submarginal vein, capitate to subcapitate, densely bracteate, green to purple inflorescences borne on long flexuous peduncles, and white corollas. It is similar and probably closely related to *P. campyloneuroides* (Standley) C. M. Taylor (Taylor, 1994) of coastal southwestern Colombia and northwestern Ecuador, which can be distinguished by its dense pilosulous or villous to tomentulose pubescence on vegetative parts and inflorescences, leaves with well-developed intersecondary veins, and calyx limb ca. 1.5 mm long. *Psychotria purpureocapitata* is also similar to *P. elata* (Swartz) Hammel, which can be distinguished easily by its stipules united around the stem into a continuous sheath and leaves with the secondary veins prominulous adaxially and relatively more strongly developed here than on the abaxial surface, in contrast to more strongly developed on the abaxial surface in *P. purpureocapitata.*

Apparently the inflorescences are green at the beginning of anthesis and become purple as the fruit matures, which occurs to some extent concurrently with continued flowering.

Paratypes. PANAMA. **Coclé:** Alto Calvario, ca. 6 km N of El Copé, on Atlantic slope along trail which leads W off old lumber trail which leads down to Las Ricas, Limón and San Juan, 9°39′N, 80°36′W, *Croat 68714* (MO), *68823* (MO); area surrounding Rivera Sawmill, Alto Calvario, 7 km N of El Copé, *Folsom & Collins 6446* (MO), *6466* (MO). **Panamá:** trail to top of Cerro Pelado, *Antonio 1072* (MO); area surrounding Rancho Chorro, mountains above Tortí Arriba, *Folsom et al. 6612* (MO, PMA), *6662* (MO).

Rudgea hemisphaerica Dwyer ex C. M. Taylor, sp. nov. TYPE: Panama. Comarca de San Blas: El Llano–Cartí road, 19.1 km from Interamerican Highway, 9°19′N, 78°55′W, 350 m, 5 Mar. 1985, *G. de Nevers, H. Herrera & S. Charnley 4962* (holotype, PMA-38235: isotype, MO-4658113). Figure 3A, B.

Haec species a congeneris foliis ex subsessilibus brevipetiolatis oblanceolatis abaxialiter pallidis, inflorescentia capitata sessili ac fructibus sat grandibus distincta.

Shrubs or small trees flowering at 1 m tall, to 3 m tall, glabrous; stems terete. *Leaf blades* subses-

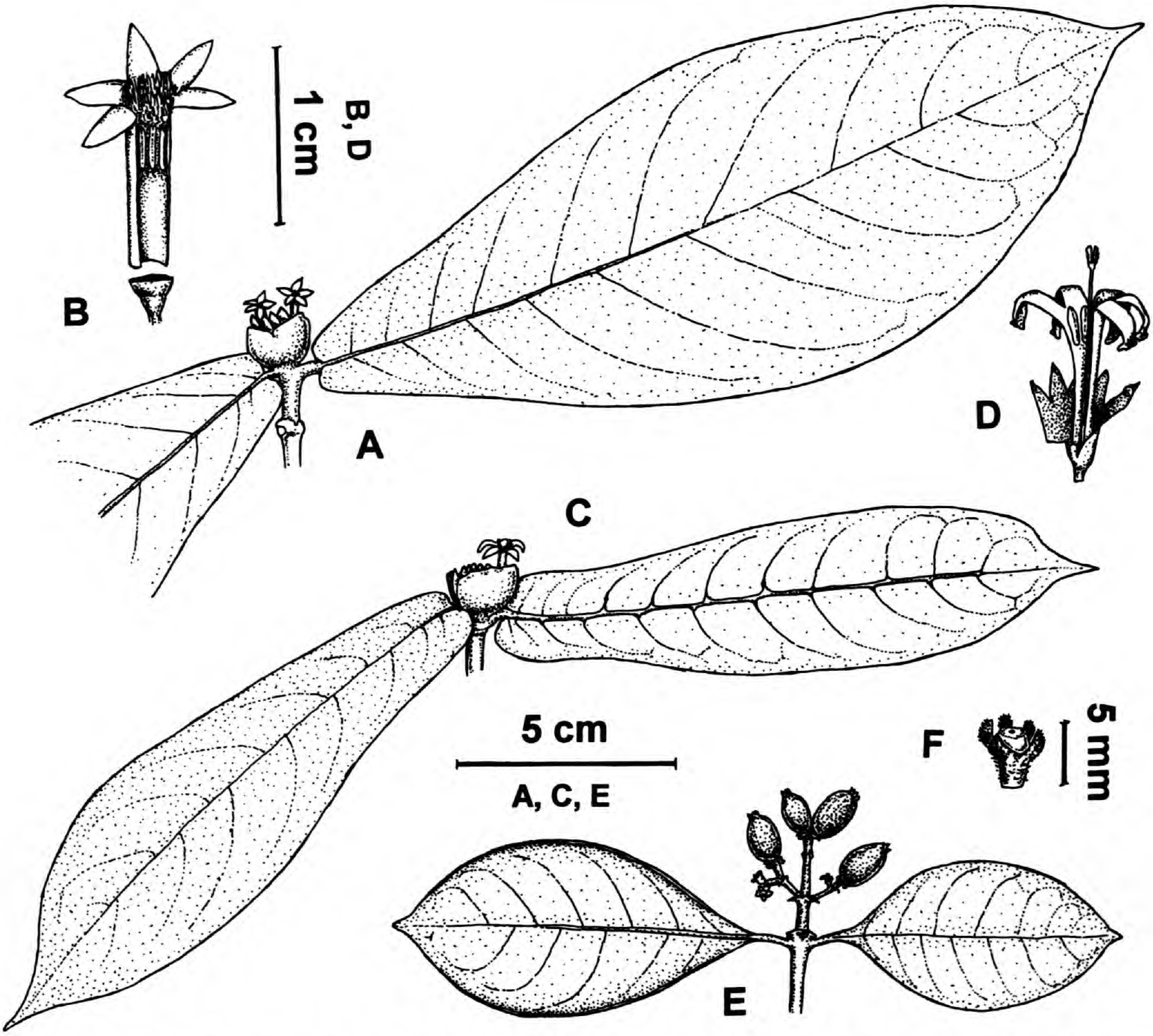

Figure 3. A, B, *Rudgea hemisphaerica* Dwyer ex C. M. Taylor; based on *de Nevers et al. 4962.* —A. Habit. —B. Flower, partially dissected. C, D, *Rudgea mandevilliifolia* Dwyer ex C. M. Taylor. —C. Habit; based on *Croat 48863.* —D. Flower, partially dissected; based on *Antonio 2850.* E, F, *Rudgea mcphersonii* Dwyer ex C. M. Taylor; based on *McPherson 11771.* —E. Habit. —F. Calyx, hypanthium, and disk. A, C, E to 5-cm scale; B, D to 1-cm scale; F, to 5-mm scale.

sile to shortly petiolate, oblanceolate, 18.5–30 cm long, 7.5–14 cm wide, at apex acuminate with rather slender tips 10–15 mm long, toward the base tapered, at base shortly truncate to subcordate, chartaceous, sometimes pale abaxially; secondary veins 9–13 pairs, spreading to ascending, usually looping broadly to interconnect at least in distal half of blade, lesser venation reticulated, plane adaxially, thickened to a little raised abaxially; *petioles* 1–15 mm long; *stipules* interpetiolar, caducous, ligulate to ovate, 5–16 mm long, truncate to rounded, apical margin densely set with caducous glandular appendages ca. 1 mm long. *Inflorescences* terminal, capitate, sessile, 1.5–2 cm long, enclosed in persisting vegetative stipules, floral bracts triangular, 0.5–1 mm long; *flowers* 15–25 per inflorescence, distylous, with hypanthium glabrous, turbinate or hemispherical, ca. 1 mm long; *calyx limb* glabrous, ca. 1 mm long, truncate; *corolla* salverform, white, externally glabrous, internally villous in distal half of tube and barbate in throat, tube 10.5–11 mm long, ca. 1.5 mm diam. near middle, lobes 5, narrowly triangular, 4–4.5 mm long, acute; *anthers* narrowly oblong, in long-styled form included and ca. 2.5 mm long, in short-styled form partially exserted and ca. 4 mm long; *style* and *stigma* not seen. *Fruits* ellipsoid to usually ovoid, ca. 18 × 10 mm, glabrous; *pyrenes* 2 per fruit, planoconvex, dorsally with 3–5 low longitudinal ridges. Collected in wet forest in eastern Panama at 320–400 m, in flower in February, March, and May, in fruit June–August.

Rudgea hemisphaerica is distinguished by its oblanceolate leaves, which are subsessile to shortly petiolate and pale abaxially, sessile capitate inflorescences, and relatively large fruits. The specific epithet refers to the shape of the inflorescences. This new species is similar in aspect to *R. pittieri* Standley, which can be distinguished by its elliptic leaves 13–22 cm long with petioles 1–2 cm long and subsessile to shortly pedunculate, subcapitate to capitate inflorescences, which are densely bracteate, with triangular to ovate bracts 15–20 mm long. It is similar vegetatively also to *Faramea permagnifolia* (above) and *R. mandevilliifolia* (below), whose respective distinctions are discussed under each of these species, and to *R. sanblasensis* (Taylor, 1996a), which can be distinguished by its long-pedunculate, open-cymose inflorescence.

Although styles and stigmas have not been seen in good condition, the difference in position and size of the anthers among the specimens seen suggests that this species is distylous. This condition is common, or probably predominant, in *Rudgea* (pers. obs.). The collection data from one specimen (*de Nevers et al. 5884*) report that the flowers of this species are visited by the Long-Tailed Hermit Hummingbird (*Phaethornis superciliosus*).

Paratypes. PANAMA. **Panamá:** El Llano–Cartí road, 1 mi. past sawmill on dirt road, *Antonio 2529* (MO); camino de Llano a Cartí, entre los 14 a 18 kms de la carretera a Chelp, *Correa et al. 1857* (MO, PMA). **Comarca de San Blas:** trail along Continental Divide, 9°20′N, 78°56′W, *McDonagh et al. 296* (BM, MO); Nusagandi, along continental divide on El Llano–Cartí road, 9°19′N, 78°15′W, *de Nevers & Pérez 3698* (MO, PMA); El Llano–Cartí road, Km 18.3, 9°19′N, 78°55′W, *de Nevers et al. 5884* (MO, PMA), *5993* (MO, PMA); El Llano–Cartí road, Km L6 [sic], 9°19′N, 78°55′W, *de Nevers et al. 7374* (MO, PMA); El Llano–Cartí road, 12 mi. from Pan American Highway, *Sytsma & Andersson 4487* (MO, PMA).

Rudgea mandevilliifolia Dwyer ex C. M. Taylor, sp. nov. TYPE: Panama. Chiriquí: vicinity of Planes de Hornito beyond Gualaca, ca. 23 km E of Finca Linares, 1400–1900 m, 28 Nov. 1979, *T. B. Croat 48863* (holotype, MO–3615290). Figure 3C, D.

Haec species a congeneris foliis sessilibus oblanceolatis abaxialiter pallidis, inflorescentia capitata bracteata sessili ac limbi calycini sat longi tubo bene evoluto distincta.

Shrubs or small trees, flowering at 1–1.5 m tall, glabrous; stems terete. *Leaves* sessile, *blades* oblanceolate, 6.5–16.5 cm long, 1.7–5 cm wide, at apex acute to usually acuminate with tips 6–15 mm long, tapered toward base, at base truncate to usually subcordate, papyraceous, glabrous, pale abaxially; secondary veins 8–11 pairs, spreading, to some extent looping to interconnect near apex, midrib prominulous and the remaining venation plane above, the midrib thickened to prominulous, the secondary veins somewhat thickened, and the remaining venation plane abaxially; *stipules* interpetiolar and sometimes shortly fused intrapetiolarly, caducous, broadly deltoid to ligulate, ca. 2 mm long, apex densely set with glandular fimbriae 1–2 mm long. *Inflorescences* terminal, sessile, capitate, 1–1.3 cm long, enclosed by involucral bracts (or modified stipules) 4–10 mm long, floral bracts narrowly triangular to linear, 6–8 mm long; *flowers* 10–15 per inflorescence, distylous, with hypanthium turbinate, glabrous, ca. 1 mm long; *calyx limb* glabrous, green, membranaceous, with tube ca. 5 mm long, lobes 5, narrowly triangular, acute, 2.5–3 mm long, sinuses and lobes somewhat unequal on an individual flower; *corolla* salverform, white, externally glabrous, internally glabrous except moderately villosulous at stamen attachment (i.e., at top of tube in short-styled form and in upper ½ in long-styled form), tube 9–9.5 mm long, 1.5–2 mm diam., lobes 5, narrowly triangular, 5–6 mm long, acute and shortly appendaged at apex; *anthers* 5, narrowly oblong, in short-styled form exserted and ca. 3 mm long, in long-styled form included, positioned just below top of tube, and ca. 3.2 mm long; *stigmas* linear, in short-styled form ca. 2 mm long and positioned just below top of tube, in long-styled form ca. 1.5 mm long and well exserted. *Fruits* not seen. Collected in wet forest in western Panama at 1400–1900 m, in flower in November.

Rudgea mandevilliifolia is distinguished by its sessile oblanceolate leaves, which are pale abaxially, sessile, capitate, bracteate inflorescences, and relatively long calyx limb with a well-developed tube. It is similar in general aspect to *R. hemisphaerica*, which can be distinguished by its truncate calyx limb ca. 1 mm long, and to *R. panamensis*, whose relationship to *Rudgea mandevilliifolia* is discussed below.

Paratype. PANAMA. **Colón:** vicinity of Los Planes de Hornito, along road to Fortuna Dam, N of Gualaca on Río Chiriquí, 2–3 km E of Finca Linares, *Antonio 2850* (MO, PMA).

Rudgea mcphersonii Dwyer ex C. M. Taylor, sp. nov. TYPE: Panama. Colón: Santa Rita ridge, SE of Colón, 10–11 road-miles from trans-isthmian highway, 9°25′N, 79°40′W, 450 m, 18 Sep. 1987, *G. McPherson 11771* (holotype, PMA; isotype, MO–3646497). Figure 3E, F.

Haec species a congeneris mesoamericanis inflorescentia ex glomerulis sessilibus in pseudopaniculam ramificatam dispositis constante distincta.

Trees flowering at 8 m tall, to 20 m tall, stems terete, glabrous or pilosulous becoming glabrescent with age. *Leaf blades* elliptic, 5–10.5 cm long, 2–5.5 cm wide, at apex shortly acuminate with deltoid tips 3–5 mm long, at base cuneate to obtuse, subcoriaceous, above glabrous and nitid, below glabrous and paler; secondary veins 6–7 pairs, spreading, often looping to interconnect at least near apex or sometimes reticulating, adaxially the venation plane or the midrib somewhat sulcate, abaxially the midrib prominulous and the secondary veins and some of the lesser venation usually thickened, margins revolute; petioles 5–12 mm long, glabrous or shortly pilosulous adaxially; *stipules* caducous often by fragmentation, united around the stem into a continuous sheath 1.5–3 mm long, margins membranaceous becoming somewhat indurate, interpetiolar portion truncate to broadly triangular, entire, with a dense group of deciduous glandular appendages 0.5–1 mm long borne in its center. *Inflorescences* terminal, pyramidal, paniculate, pilosulous to villosulous, peduncles 0.5–2 cm long, panicles 1.5–2 cm long, with 1–2 pairs of secondary branches, bracts narrowly triangular to deltoid, 0.5–1.5 mm long, acute; *flowers* borne in sessile glomerules of 3–6, with hypanthium ca. 1 mm long, turbinate, puberulous to pilosulous; *calyx limb* externally pilosulous or villosulous, ca. 1.5 mm long, divided nearly to base, lobes 5, narrowly triangular, acute, adaxially glabrous except pilosulous near apex; *corolla, anthers, stigma,* and *style* not seen; *disk* annular, ca. 1 mm high. *Fruits* ellipsoid, ca. 14 × 8 mm, glabrous, yellow to yellow-orange; *pyrenes* 2 per fruit, planoconvex, outer layer chartaceous with 3–5 low longitudinal ridges. Collected in wet forest in central Panama at 350–450 m, in fruit in September and October.

Rudgea mcphersonii is distinguished among Central American species of *Rudgea* by its inflorescence structure: it is the only species known from Central America with sessile glomerules of flowers in a branched paniculate arrangement. It is similar and perhaps closely related to to *R. crassiloba* (Bentham) Robinson of lowland northeastern South America, which can be separated by its stipule sheath ca. 1 mm long, four-merous calyx limb 1–1.1 mm long, and fruits 7 × 4–5 mm. The yellow or orange fruits found in both of these species are unusual in *Rudgea,* which more typically has white fruits. The name honors Gordon McPherson, whose fieldwork has greatly advanced our knowledge of the Panamanian flora.

Paratypes. PANAMA. **Colón:** Santa Rita ridge, 20–22 km from Transisthmica Highway, 9°24′N, 79°39′W, *Sytsma 1350* (MO), 20–25 km from Transisthmian Highway, *Sytsma 1534* (MO).

Rudgea panamensis (Dwyer) C. M. Taylor, comb. nov. Basionym: *Cephaëlis panamensis* Dwyer, Ann. Missouri Bot. Gard. 67: 77. 1980. TYPE: Panama. Colón: Río Guanche, ca. 2.5 km upriver from bridge on road to Portobelo, 10–100 m, 14 Dec. 1974, *S. Mori & J. Kallunki 3714* (holotype, MO–2353037; isotypes, MO–2353038, PMA-22701).

This species was originally described from a fruiting branch said by the collectors to have been found on the ground, apparently after falling from some unlocated plant, and doubtfully placed by Dwyer in *Cephaëlis.* It is only known from this single collection. The fruit morphology and inflorescence structure are congruent with the characteristics of *Cephaëlis* (now included in *Psychotria,* e.g., Taylor, 1994), but these same characters may be found in other genera of Psychotrieae as well. *Rudgea* is distinguished from *Psychotria* by its glandular-fimbriate stipules, but *C. panamensis* has caducous stipules. None remain on its type collection. The combination of a generally obovoid fruit shape, smooth pyrenes, a truncate calyx limb, and caducous stipules found in *C. panamensis* is characteristic of *Rudgea* but rarely (or perhaps never) seen in *Psychotria.* The general aspect of *C. panamensis* is similar to several other species of *Rudgea* from western Panama, while it does not resemble any *Cephaëlis* species known from Panama or Costa Rica. Therefore, this species is here transferred to *Rudgea.*

Rudgea panamensis is distinguished by its oblanceolate leaves, which are subsessile to shortly petiolate and truncate to subcordate at the base; subsessile, subcapitate to shortly cymose inflorescences; obovoid fruits with smooth pyrenes; and truncate calyx limb ca. 1.5 mm long. It is similar in aspect to *R. hemisphaerica,* which can be distinguished by its inflorescences, which are enclosed by a truncate stipular sheath 1.5–2 cm long and larger fruits, and to *R. mandevilliifolia* Dwyer, which can be distinguished by its sessile, bracteate, capitate inflorescences. *Rudgea panamensis* and *R. mandevilliifolia* are similar enough that they could conceivably be conspecific, but the infructescence on the one collection known of *C. panamensis* has lost any bracts it might have had, and more collections in different reproductive stages are needed to evaluate the relationship between these species.

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The Untenability of *Myrsine africana* L. var. *glandulosa* J. M. Zhang (Myrsinaceae)

Wu Zheng-yi and Peng Hua

Herbarium, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650204,
Yunnan, People's Republic of China

ABSTRACT. *Myrsine africana* L. var. *glandulosa* J. M. Zhang is a new synonym of *M. africana* var. *africana*.

Zhang (1995) described *Myrsine africana* var. *glandulosa* as a new taxon, and he indicated that it differs from the type variety in having fruits with dense black glands 0.5–1 mm long, "pericarpio dense nigris glandulosis 0.5–1 mm longis." An examination of the paratypes at KUN (e.g., *C. W. Wang 83690* and *J. S. Xin 6* from Yunnan and *C. P. Song 39512* from Sichuan) readily reveals that that the alleged "black glands" on the fruits represent nothing but fungal infection. This fungal infestation appears to be quite common on fruiting material, and additional diseased collections (all of which are at KUN) not examined by Zhang are: CHINA. **Yunnan:** Yongren, *H. T. Tsai 52848*; Kunming, *C. W. Wang 62650, 62785*; Lijiang, *T. T. Yü 8139*; Zhongdian, *K. M. Feng 3123*; Heqing, *R. C. Ching 24212*; Xundian, *F. T. Wang 5884*; Luquan, *P. I. Mao 1817*; Songming, *P. Y. Chiu 54209, 60697*; Mengzi, *C. W. Wang 83468*. **Sichuan:** Muli, *S. K. Wu 3326.*

The fungus is believed to be a species of *Heydenia* Keiss of the Deuteromycetae (Imperfect Fungi), and the hemispherical black tops of sporocladia were misinterpreted by Zhang (1995) as glands. In addition to *Myrsine africana,* the fungus also infests *M. semiserrata* Wallich (Tai, 1979), and both species of *Myrsine* are distributed in the greater part of South China (Chen, 1979).

Myrsine africana L., Sp. Pl. 1: 196. 1753.

Myrsine africana var. *glandulosa* J. M. Zhang, Bull. Bot. Res., Harbin 15: 47. 1995. Syn. nov. TYPE: China. Gansu: Wenxian, Bikou, 7 Apr. 1964, 700 m, *T. P. Wang 18881* (holotype, WUG).

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NOVON 6: 307. 1996.

The Generic Affinity of *Echidnium spruceanum* Schott and Its Placement in *Dracontium* (Araceae)

Guanghua Zhu
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Echidnium spruceanum* Schott is transferred to *Dracontium* as *D. spruceanum* (Schott) G. Zhu. The original observation of unilocular ovaries with two ovules per locule on the holotype is here considered to have been erroneous. *Dracontium carderi* Hooker f., *D. costaricense* Engler, *D. trianae* Engler, *D. loretense* K. Krause, and *D. ornatum* K. Krause are placed in synonymy under *D. spruceanum.* A lectotype is designated for the name *D. trianae.*

A year after Schott (1857) described the monotypic genus *Echidnium,* based on *E. schomburghii,* he described a second species, *E. spruceanum* (Schott, 1858). He asserted that *E. spruceanum* differs from *Dracontium* in having unilocular ovaries with two ovules. Based on these same characters, Engler (1878: 118) transferred this species to *Cyrtosperma.* It has since remained in *Cyrtosperma,* although Engler (1889: 124) transferred the genus *Echidnium* to *Dracontium* as *Dracontium* sect. *Echidnium* Engler. The type of *E. spruceanum* has a three-parted, highly subdivided leaf typical of *Dracontium,* but not of *Cyrtosperma,* which has simple hastate to sagittate leaves. Hay (1988: 457) referred *E. spruceanum* to *Dracontium,* based on his notion that the number of ovarian locules cannot be used as a generic character in this group, but he did not make a new combination. Based on the same assumption, Bogner (1985) accepted *Echidnium* in the synonymy of *Dracontium* and made a new combination, but the species *E. spruceanum* was not discussed.

Spruce 2406 (K) is apparently the single element studied by Schott (1858) when he described *E. spruceanum,* and thus it is the holotype of the name. This specimen was annotated by Schott, although no collector and number but only the herbarium ("Herb. Hook.") were cited in the protologue.

The supposedly unilocular ovary of *Echidnium spruceanum* may be spurious. Because of the underdeveloped spadix and the poor condition of the specimen, ovary characters cannot be evaluated from the holotype (Richard Keating, pers. comm.). The holotype agrees overall with the genus *Dracontium* as noted above, and there is no doubt that this species should be properly placed in *Dracontium.* Unilocular ovaries do not occur in *Dracontium* and this genus never has more than one ovule in each locule (Zhu, 1995). Specimens clearly conspecific with *Spruce 2406* never have unilocular ovaries nor two or more ovules per locule. The original observation of unilocular ovaries with two ovules per locule on the holotype is here considered to have been erroneous. Epitypification is not necessary because identification of this species does not depend on ovarian characters (Greuter et al., 1994).

Dracontium spruceanum, as here circumscribed, is the most widely distributed species in the genus. It ranges from the Talamanca lowands on the Atlantic slope of Costa Rica to the Chocó region on the Pacific slope of Colombia, and throughout the Amazonian portions of Colombia, Ecuador, Peru, and Brazil. This species can be identifed by its long peduncle, erect to slightly arching spathe, which is gradually acuminate above and has its margins broadly overlapping near the base, and by its translucent area of the inner spathe surface two to four times higher than the spadix (Zhu, 1995).

Subsequent to Schott's (1858) original publication, *Dracontium spruceanum* was redescribed five times, as *D. carderi* Hooker f., *D. costaricense* Engler, *D. trianae* Engler, *D. loretense* K. Krause, and *D. ornatum* K. Krause. These names have been frequently used for specimens from different localities.

The foregoing names are for the first time here placed in synonymy under *Dracontium spruceanum,* the nomenclature of which may be summarized as follows:

Dracontium spruceanum (Schott) G. Zhu, comb. nov. Basionym: *Echidnium spruceanum* Schott, Oesterr. Bot. Z. 8: 350. 1858. *Cyrtosperma spruceanum* (Schott) Engler in Mart., Fl. bras. III. 2: 118. 1878. TYPE: Brazil. Amazonas: São Gabriel, *Spruce 2406* (holotype, K).

Dracontium carderi Hooker f., Bot. Mag. t. 6523. 1880. Syn. nov. TYPE: Cultivated plant at Royal Botanical Gardens, Kew, originally collected by Carder in Colombia, exact locality unknown, April 1879, *Brown s.n.* (holotype, K 3 sheets).

Dracontium costaricense Engler, Pflanzenr. IV. 23C (Heft 48): 44. 1911. Syn. nov. TYPE: Costa Rica. Limón: Talamanca, forest of Shirores, 100 m, *Pittier 9232* (holotype, B; isotype, BR).

Dracontium trianae Engler, Pflanzenr. IV. 23C (Heft 48): 44. 1911. Syn. nov. TYPE: Colombia. Meta: Villavicencio, 400 m, *Triana 691* (lectotype, here designated, BM; isolectotype, COL).

Dracontium loretense K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 11: 617. 1932. Syn. nov. TYPE: Peru. Loreto: lower Río Huallaga, 155–210 m, Oct.–Nov. 1929, *Williams 5144* (holotype, F; isotype, US).

Dracontium ornatum K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 15: 40. 1940. Syn. nov. TYPE: Ecuador. Pastaza: above Mera, 1100 m, 16 Nov. 1938, *Schultze-Rhonhof 2998* (holotype, B, on the same sheet with *Schultze-Rhonhof 3031*).

The protologue of *Dracontium trianae* cited two specimens, *Triana 691* and *Triana 289*. According to the *Code* (Greuter et al., 1994), a lectotype may be selected for this name. *Triana 691* (BM, COL) is the only fertile specimen and is represented in two herbaria; it is therefore designated here as the lectotype. *Triana 289* (BM) thus becomes an excluded syntype.

Acknowledgments. I thank Thomas Croat, Mike Grayum, Charlotte Taylor, William D'Arcy, Richard Keating, and Petra Malesevich for comments on the manuscript and other assistance. The following herbaria have provided specimens for this study: B, BM, BR, COL, F, K, US. The research was conducted at the Missouri Botanical Garden and was partially supported by NSF doctoral dissertation research grant DEB-9310171 to T. Croat and G. H. Zhu, and by a grant from the Andrew W. Mellon Foundation to G. H. Zhu.

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New Species of Paniceae (Poaceae: Panicoideae) from Brazil

Fernando O. Zuloaga and Osvaldo Morrone
Instituto de Botánica Darwinion, Labardén 200, Casilla de Correo 22, San Isidro 1642, Argentina

ABSTRACT. Two species of *Panicum*, *P. sendulskyii* and *P. nutabundum*, and a new species of the genus *Urochloa*, *U. decidua*, are described, illustrated, and compared with putatively related species. *Panicum sendulskyii* belongs to subgenus *Dichanthelium* and *P. nutabundum* to section *Parvifolia* of *Panicum*. *Urochloa decidua* is an endemic of campos rupestres of Bahia, Brazil.

While continuing our studies of Paniceae from South America, two new species of *Panicum* L. and one of the genus *Urochloa* P. Beauvois have been discovered, and are here described and compared with related taxa.

Panicum sendulskyii Zuloaga & Morrone, sp. nov. TYPE: Brazil. Minas Gerais: Municipio de Jaboticatubas, ao longo da rodovia Lagoa Santa–Conceição do Mato Dentro–Diamantina, 9 Dec. 1971, *Sendulsky et al. 414* (holotype, SP; isotypes, MO, SI, US). Figures 1, 4.

Panico heliophilo Chase ex Zuloaga & Morrone affine sed gramen annuum, vaginis et laminis glabris, spiculis anguste ovatis, gluma supera et lemme infero 9-nerviis, 0.6–0.8 mm quam anthoecio supero longioribus, palea infera quam anthoecio supero longiore differt.

Annual. Culms tangled, leaning on the adjacent vegetation, the basal portion decumbent and geniculate, the upper portion erect, up to 100 cm tall, branching at the lower nodes, many-noded; internodes cylindric or slightly compressed, 2.5–9 cm long, hollow, glabrous; nodes pale, shortly pilose or glabrous. Sheaths shorter than the internodes, one margin long-ciliate with papillose-pilose hairs, otherwise glabrous; auricles absent; collar pubescent or glabrous. Ligules membranous-ciliate, 0.4–0.8 mm long, with hairs beneath at the base of the blade. Blades linear-lanceolate, 2.5–9 cm long, 0.3–0.6 cm wide, flat, rounded or subcordate at the base, the apex attenuate, glabrous, the margins scaberulous, ciliate toward the base. Peduncles exserted, up to 25 cm long, cylindric, glabrous. Inflorescences terminal and axillary, lax, diffuse, 3–8 cm long, 2.5–7 cm wide; branches opposite or alternate, divergent; main axis and branches flexuous, glabrous; axils of the branches shortly pilose or glabrous; pedicels filiform, 1.5–5 mm long, glabrous. Spikelets solitary, narrowly ovoid, 2.8–3.2 mm long, 1 mm wide, glabrous, acute, greenish; upper glume and lower lemma subequal, 0.6–0.8 mm longer than the upper anthecium. Lower glume 1.8–2 mm long, ⅔ or shorter than the length of the spikelet, herbaceous, 1–3-nerved, not embracing the upper glume at its base. Upper glume as long as the spikelet, 9-nerved, with conspicuous nerves. Lower lemma glumiform, 9-nerved. Lower palea narrowly lanceolate, 2.2–2.4 mm long, 0.4–0.6 mm wide, hyaline, the margins denticulate; lower flower absent. Upper anthecium ellipsoid, 2–2.4 mm long, 0.7–0.8 mm wide, indurate, pale, minutely papillose, the apex crestate, greenish and shortly pilose; stamens 3, the anthers 0.6–1 mm long; lodicules 2, 0.3 mm long, truncate, hyaline. Caryopsis ellipsoid, 1.6 mm long, 0.8 mm wide; hilum punctiform; embryo ⅓ the length of the caryopsis.

Paratype. BRAZIL. **Minas Gerais:** Municipio de Jaboticatubas, ao longo da rodovia Lagoa Santã–Conceição do Mato Dentro, BR-010, Serra do Cipó, km 121, 19°20′N, 43°30′W, 1380 m, campo rupestre, 23 Feb. 1993, *F. O. Zuloaga & O. Morrone 4705* (MO, SI).

This new species belongs to subgenus *Dichanthelium* Hitchcock & Chase due to its lax and diffuse inflorescences, narrowly ovoid spikelets, and upper anthecium indurate, smooth, apiculate and papillose all over its surface. Within this subgenus, *Panicum sendulskyii* is included in section *Dichanthelium*, which is characterized by having membranous-ciliate ligules, spikelets with the upper glume and lower lemma 7–9(–15)-nerved, and upper anthecium apiculate and pilose or scabrous toward the apex (Zuloaga et al., 1993). This species is related to *P. heliophilum* Chase ex Zuloaga & Morrone, *P. aequivaginatum* Swallen, and *P. surrectum* Chase ex Zuloaga & Morrone. *Panicum heliophilum* is a perennial species with sheaths and blades hirsute, the blades rigid, spikelets ellipsoid, hirsute with the upper glume and lower lemma 7-nerved, as long as the upper anthecium, and the lower palea less than ¾ the length of the upper anthecium. Additionally, in *Panicum heliophilum* the lower

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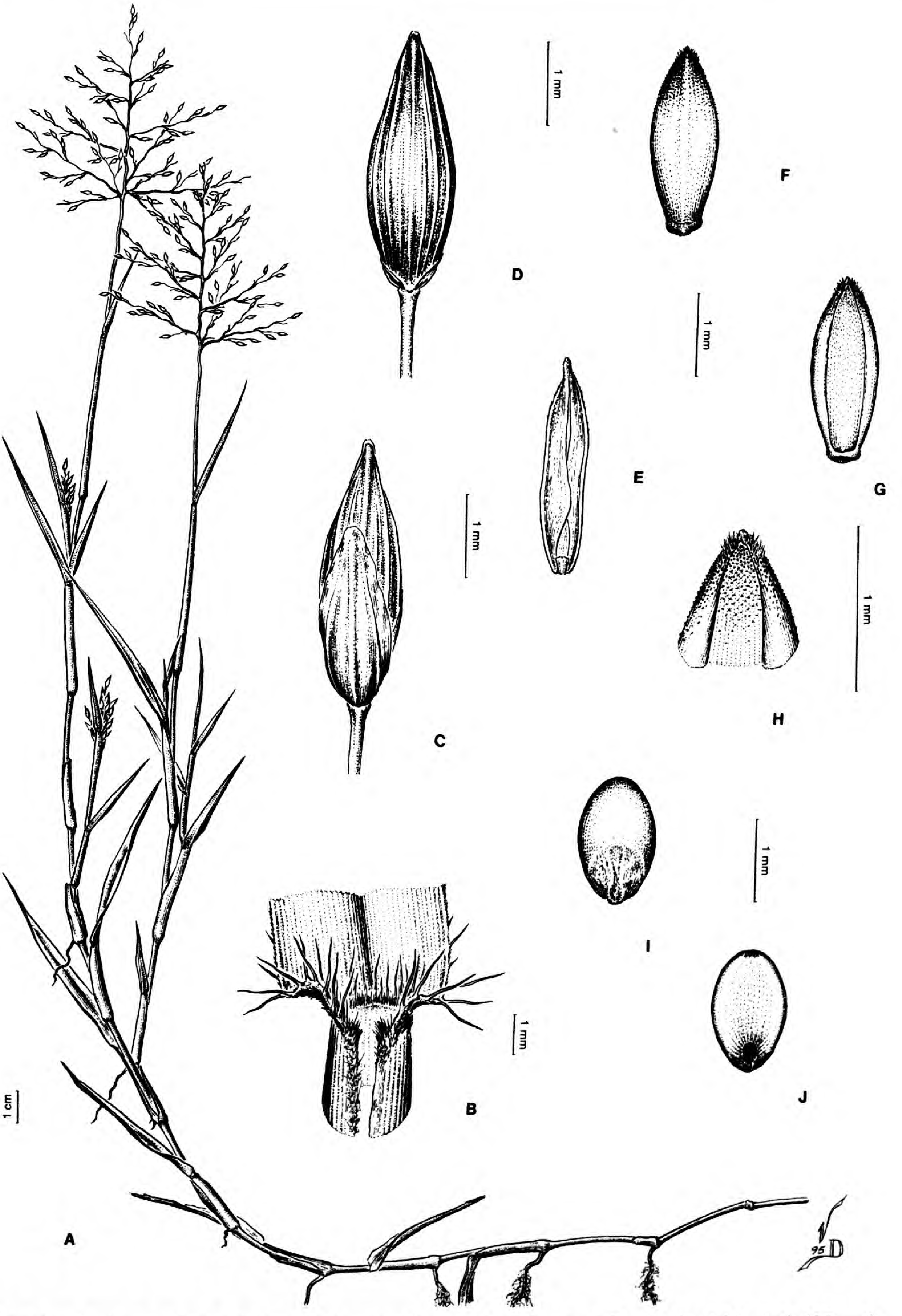

Figure 1. *Panicum sendulskyii* Zuloaga & Morrone, illustrated from the type collection (*Sendulsky et al. 414*). —A. Habit. —B. Ligular area of a leaf. —C. Spikelet, ventral view. —D. Spikelet, dorsal view. —E. Lower palea. —F. Upper anthecium, dorsal view. —G. Upper anthecium, ventral view. —H. Detail of the apex of the upper anthecium. —I. Caryopsis, embryo side. —J. Caryopsis, hilum side.

sheaths are superposed and persistent, without the corresponding blades, at maturity of the plant. *Panicum aequivaginatum* differs by having ellipsoid spikelets 1.7–2.5 mm long, 0.7 mm wide, with a short internode between the lower and upper glume, upper glume and lower lemma not longer than the upper anthecium, the upper glume usually not covering the apex of the anthecium, lower palea ¾ or less the length of the upper anthecium, and the upper anthecium glabrous. Finally, *P. surrectum* can be distinguished by its perennial habit, inflorescences terminal, the main axis with or without glands, spikelets ellipsoid, 1.8–2.2 mm long, upper glume and lower lemma not longer than the upper anthecium, and lower flower male or absent.

Consequently, these species and other related taxa of subgenus *Dichanthelium* may be distinguished as follows:

1. Spikelets pubescent 2
1. Spikelets glabrous 3
2(1). Annual; spikelets 1.5–1.9 mm long; lower glume ⅓–½ as long as the spikelet; blades ovate-lanceolate, 3–10 cm long, 0.8–2.1 cm wide, cordate, amplexicaulous . . . . *P. sciurotoides*
2. Perennial; spikelets 2.6–3.1 mm long; lower glume ¾ as long as the spikelet; blades linear-lanceolate, 4–5(–12) cm long, 0.3(–1) cm wide, subcordate, not amplexicaulous . . . *P. heliophilum*
3(1). Upper glume and lower lemma 0.6–0.8 mm longer than the upper anthecium; spikelets narrowly ovoid, 2.8–3.2 mm long . . . . . *P. sendulskyii*
3. Upper glume and lower lemma as long as the upper anthecium; spikelets ellipsoid, 1.8–2.5 mm long 4
4(3). Annual; spikelets with a short internode between the lower and upper glume; main axis of the inflorescences without glands; lower palea ¾ or less as long as the upper anthecium; lower flower absent . . . . *P. aequivaginatum*
4. Perennial; spikelets without a conspicuous internode between the lower and upper glume; main axis of the inflorescences with or without glands; lower palea as long as the upper anthecium, lower flower present or absent . . . . *P. surrectum*

The specific epithet of the new species honors Tatiana Sendulsky, collector of the type and renowned Brazilian agrostologist.

Morrone et al. (1995) recently reported a chromosome count for this species as n = ca. 30, which differs from all previous reports for taxa of subgenus *Dichanthelium*, all of which up to now had a basic chromosome number of $x = 9$.

Panicum sendulskyii grows in "campos rupestres" of the Serra do Cipó in Minas Gerais, growing as diffuse plants leaning on the adjacent vegetation. "Campos rupestres" are a particular vegetation type within the cerrado in Brazil, occurring between 800 and 2000 m in elevation on mountain tops and some high plateau areas. They are characterized by the presence of outcropping rocks and a largely endemic flora, where species of Velloziaceae, Poaceae, Xyridaceae, and Cyperaceae are common (Eiten, 1978).

Panicum nutabundum Zuloaga & Morrone, sp. nov. TYPE: Brazil. Pará: Serra do Cachimbo, 425 m, 12 Dec. 1956, *J. M. Pires, G. A. Black, J. J. Wurdack & Nilo 6153* (holotype, UB; isotype, US 2463450). Figures 2, 4.

Panico parvifolio Lamarck affine sed spiculis ellipsoideis, 1.8–2 mm longis, oblique positis, gluma infera quam spicula ½ longiore, spiculis in basi anthoecio superioris stipitatis.

Plants annual. Culms densely branching at the lower nodes, decumbent and rooting at the lower nodes to erect; erect portion of the culms 10–20 cm tall, many-noded; internodes 0.7–2 cm long, cylindric, glabrous, smooth and hollow, pale or purplish; nodes brownish, sparsely pilose. Sheaths shorter than the internodes, papillose-pilose, the margins ciliate. Ligules membranous, ca. 0.4 mm long, brownish, glabrous; collar pilose or glabrous. Blades lanceolate, 1–2.5 cm long, 0.2–0.4 cm wide, flat, ascendent, hirsute, occasionally the upper blades glabrous, the base attenuate and the apex acute, the margins smooth, papillose-pilose toward the base. Peduncles partially included to exserted, up to 10 cm long, cylindric, glabrous, greenish or tinged with purple. Inflorescences lax, diffuse, (1–)1.5–2.5 cm long, (0.5–)1–2 cm wide; branches alternate, divergent; main axis and axis of the branches flexuous, glabrous; axils of the branches glabrous; pedicels filiform, glabrous. Spikelets solitary, obliquely placed on the pedicels, ellipsoid, 1.8–2 mm long, 1 mm wide, glabrous, obtuse to subacute, greenish to purplish; upper glume and lower lemma as long as the spikelet, 5-nerved. Lower glume 0.8–1 mm long, ½ as long as the spikelet or shorter, not embracing the upper glume at its base, 1–3-nerved. Lower palea lanceolate, 1.2–1.6 mm long, 0.3–0.5 mm wide, hyaline, glabrous; lower flower staminate or sterile, the anthers 3, 0.8–1.2 mm long, or absent. Upper anthecium ellipsoid, 1.5–1.6 mm long, 0.8 mm wide, indurate, pale, shortly stipitate, papillose and with bicellular microhairs; stamens 3, the anthers 0.8–1 mm long, purplish; lodicules 2, 0.2 mm long, conduplicate, truncate. Caryopsis not seen.

Paratype. BRAZIL. **Pará:** Serra do Cachimbo, 425 m, no campo, 17 Dec. 1956, *J. M. Pires, G. A. Black, J. J. Wurdack & N. T. Silva 6388* (US).

This species is only known from the Serra do

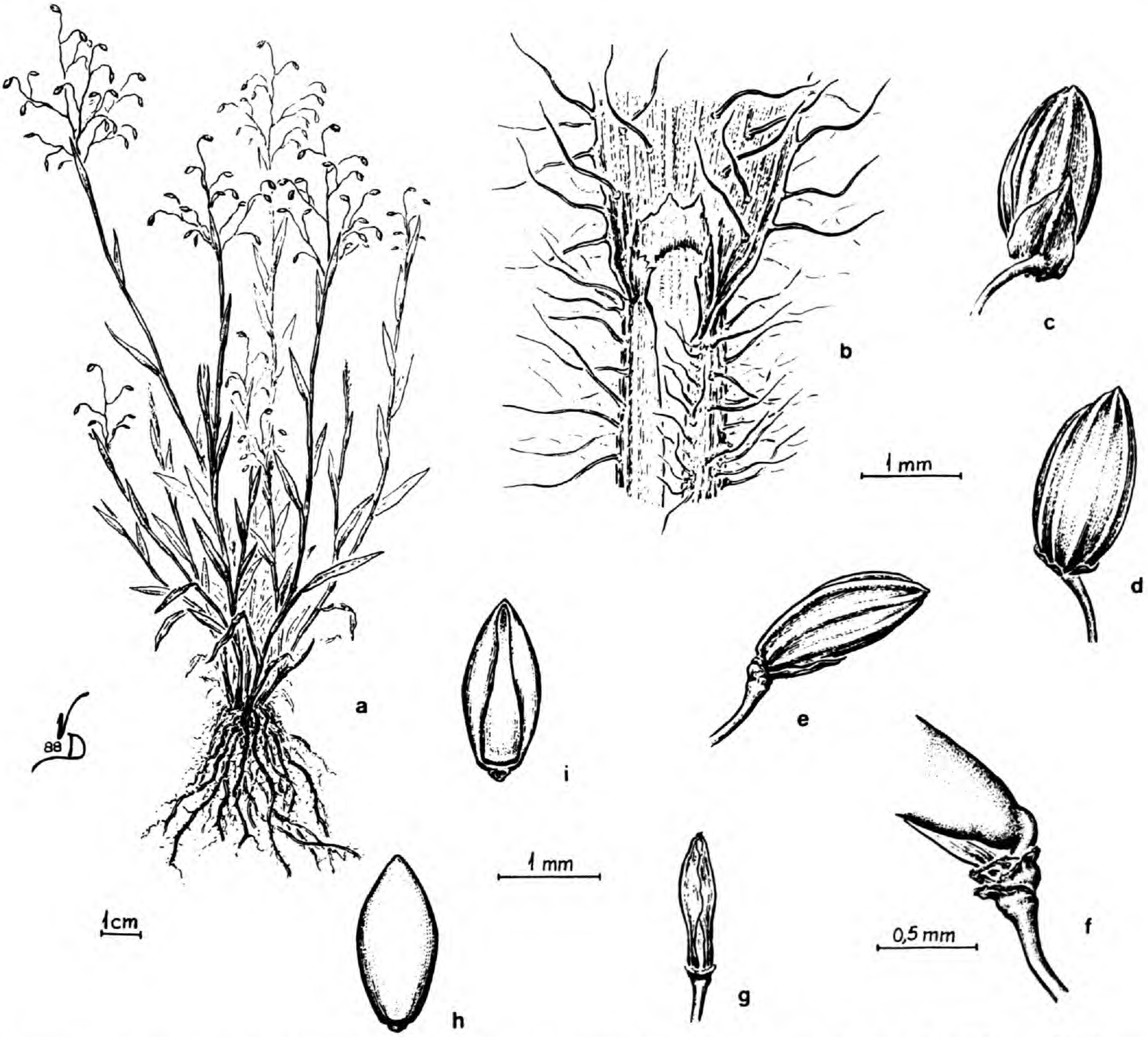

Figure 2. *Panicum nutabundum* Zuloaga & Morrone, illustrated from the specimen *Pires et al. 6388.* —a. Habit. —b. Ligular area of a leaf. —c. Spikelet, ventral view. —d. Spikelet, dorsal view. —e. Spikelet, lateral view. —f. Base of the spikelet showing insertion and stipe below the upper anthecium (partially dissected). —g. Lower palea. —h. Upper anthecium, dorsal view. —i. Upper anthecium, ventral view, stipe at the base.

Cachimbo in Pará, where it grows in low campos. Eiten (1978) classified the vegetation of Serra do Cachimbo as Amazonian campos, and described the area as plateau tops of medium altitude with special rock types like quarzite. According to this author, this area also has sandy podsolic soils and supports short-grass-herb fields, closed scrub and scrub savanna, with a species composition very different from the typical cerrado.

Panicum nutabundum belongs to section *Parvifolia* (Hitchcock & Chase) Pilger of subgenus *Phanopyrum* (Rafinesque) Pilger, due to its spikelets with the lower glume 1–3-nerved, upper glume and lower lemma 5-nerved, and upper anthecium indurate, papillose and with bicellular microhairs all over its surface (Zuloaga, 1987). Within this section it is clearly distinguished by its spikelets obliquely set on the pedicels, a character only shared with *Panicum hirtum* Lamarck. *Panicum hirtum* differs by its ovate-lanceolate blades with a cordate, amplexicaulous base, ligules membranous-ciliate, branches of the inflorescence with conspicuous yellowish glandular bands, spikelets sparsely to densely hispid, with the lower glume almost as long as the spikelet, upper glume and lower lemma 0.4 mm longer than the upper anthecium, and upper anthecium with globose bicellular microhairs.

The habit of this new species resembles that of *P. parvifolium* Lamarck and *P. cyanescens* Nees ex Trinius. *Panicum parvifolium* is a species with globose spikelets 1–1.8 mm long, not obliquely set on the pedicels, lower glume ¾ to ⅘ as long as the spikelet, and with upper anthecium not stipitate. Finally, *P. cyanescens* is a bigger, perennial plant,

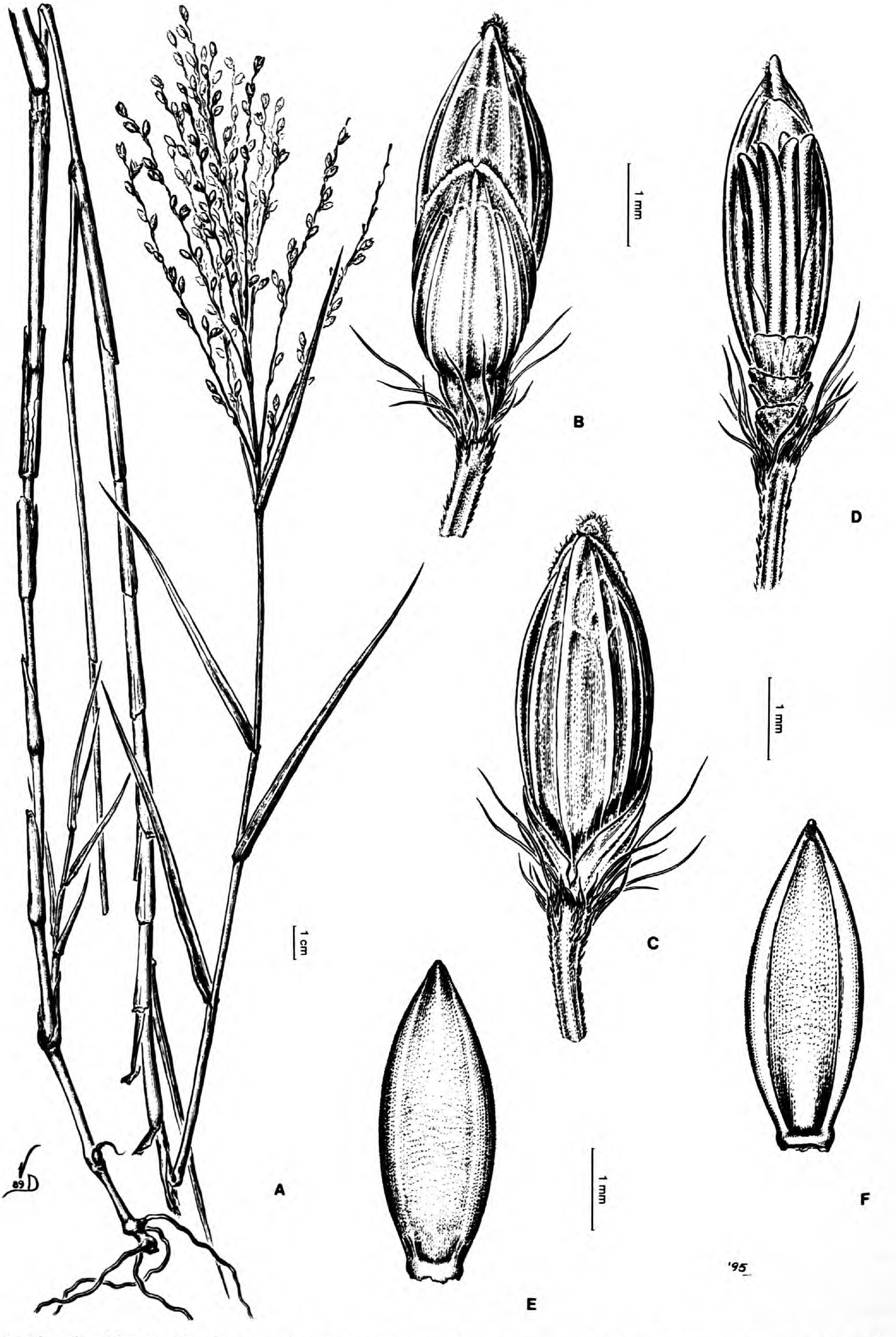

Figure 3. *Urochloa decidua* Morrone & Zuloaga, illustrated from the type collection (*Noblick & Pinto 2792*). —A. Habit. —B. Spikelet, ventral view. —C. Spikelet, dorsal view. —D. Lower palea and pedicel (partially dissected). —E. Upper anthecium, dorsal view. —F. Upper anthecium, ventral view.

30–85 cm tall, with blades up to 14 cm long and panicles up to 18 cm long, spikelets globose, not obliquely set on the pedicels, the upper glume ¾ to ⅘ the length of the spikelet, and with upper anthecium not stipitate.

The differences among *Panicum nutabundum* and related species are summarized in the following key:

1. Spikelets obliquely set on the pedicels; upper anthecium stipitate at the base 2
1. Spikelets not obliquely set on the pedicels; upper anthecium without a stipe 3
2(1). Blades ovate-lanceolate, 1.5–6 cm long, 0.5–2 cm wide, amplexicaulous; ligules membranous-ciliate; branches of the inflorescence with conspicuous yellowish glandular bands; spikelets hispid, lower glume as long as the spikelet, or slightly shorter; upper glume and lower lemma 0.4 mm longer than the upper anthecium . . . . *P. hirtum*
2. Blades lanceolate, 1–2.5 cm long, 0.2–0.4 cm wide, attenuate at the base; ligules membranous; branches of the inflorescence without glands; spikelets glabrous; lower glume ½ as long as the spikelet; upper glume and lower lemma as long as the upper anthecium . . . . *P. nutabundum*
3(1). Spikelets ellipsoid, acute, with the upper glume and lower lemma longer than the upper anthecium; lower palea small; lower flower absent; blades 0.8–1.5 cm long, 0.1–0.4 mm wide . . . . *P. machrisianum*
3. Spikelets obovoid, globose, with the upper glume and lower lemma as long as the upper anthecium or the upper glume not covering the apex of the upper anthecium; lower palea conspicuous, as long as the upper anthecium; lower flower male; blades 0.7–14 cm long, 0.2–1.5 cm wide 4
4(3). Culms erect, rhizome-like, 30–85 cm tall; blades lanceolate, 3–14 cm long, 0.3–1.5 cm wide; inflorescences 7–18 cm long . . *P. cyanescens*
4. Culms decumbent, rooting and branching at the lower nodes, not rhizome-like, 6–40 cm tall; blades ovate-lanceolate, 0.7–3.3(–4) cm long, 0.2–0.7 cm wide; inflorescences 1–6(–7.5) cm long . . . .*P. parvifolium*

Urochloa decidua Morrone & Zuloaga, sp. nov. TYPE: Brazil. Bahia: Palmeiras, Pai Inácio, BR-242, 12°27′S, 41°28′W, 1000–1060 m, 19 Nov. 1983, erva em touceiras de 1 m de altura, frequente em campo rupestre, *L. R. Noblick & A. Pinto 2792* (holotype, CEPEC-49111; isotypes, CEPEC-35263, MO-3304058, photo SI, SI). Figures 3, 4, 5A–C.

Urochloae acuminatae (Renvoize) Morrone & Zuloaga affine sed nodis, vaginis et laminis glabris, laminis lineari-lanceolatis 7–10(–12) cm longis, 0.2–0.5(–1) cm latis; inflorescentia 11–15(–24) cm longa, racemis 6–12 cm longis, spiculis 4.4–4.8 mm longis differt.

Figure 4. Distribution of *Panicum sendulskyii, P. nutabundum,* and *Urochloa decidua.*

Plants perennial, caespitose, with 20–40 geniculate to erect culms, with intravaginal branching. Culms 1–2.10 m tall, many noded; internodes 20–45, 2.5–10 cm long, 0.2–0.4 cm diam., lignified, smooth, glabrous, pale to brownish, fistulous; nodes glabrous, with a distinct circular line. Sheaths longer than the internodes, imbricate, loose, pale, persistent in the lower and middle portion of culms, laciniate to deciduous toward the base. Ligules membranous-ciliate, 1.2–2 mm long; collar glabrous. Blades linear-lanceolate, 7–10(–12) cm long, 0.2–0.5(–1) cm wide, flat or involute, glabrous, rounded at the base and with the apex attenuate, persistent toward the upper portion of the culms, deciduous toward the base, with a disarticulation in the junction with the sheaths; 3–6 persistent blades per culm. Peduncles subexserted, 8–18 cm long, glabrous, smooth. Inflorescences terminal, lax and diffuse, 11–15(–24) cm long, 4–8 cm wide; main axis wavy, glabrous, smooth; axils of the branches glabrous; lateral branches 6–20, alternate to subopposite, occasionally whorled toward the base; axis of the branches triquetrous, 6–12 cm long, 0.3 mm wide, ending in a spikelet; second order branches occasionally present at the base of the inflorescence; pedicels triquetrous, 1.2–3 mm long, scaberulous, pilose toward the apex with flexuous, whitish hairs. Spikelets solitary, ellipsoid,

Figure 5A–C. Habit photographs of *Urochloa decidua.* —A. Mature flowering plant. —B. Detail of the base of the plant. —C. Detail of the inflorescence. —D. Habit photographs of *U. acuminata,* mature flowering plant.

4.4–4.8 mm long, 1.6–1.8 mm wide, obtuse to acute, stipitate at the base, greenish or purplish; upper glume and lower lemma subequal, ciliate at the apex, otherwise glabrous. Lower glume 3.2–4 mm long, ½–¾ as long as the spikelet, ciliolate at the apex, the rest of the surface glabrous, embracing the upper glume at its base, 7-nerved, the nerves anastomosing at the apex. Upper glume 3.6–4 mm long, not covering the apex of the upper anthecium, membranous, 7-nerved. Lower lemma glumiform, as long as the spikelet, 5-nerved. Lower palea ellipsoid, as long as the upper anthecium, hyaline, the upper margins denticulate, 2-nerved; lower flower male. Stamens 3, the anthers 2.4 mm long. Upper anthecium ellipsoid, 3.6–4 mm long, 1.5–1.6 mm wide, plano-convex, indurate, stramineous, transversely rugose with verrucose papillae; apex of the lemma pilose, crestate and compressed; stamens 3, the anthers 2.4–2.8 mm long, brownish; lodicules 2, ca. 0.5 mm long, conduplicate, truncate, hyaline; stigma 2, plumose, free from the base. Caryopsis not seen.

Paratype. BRAZIL. **Bahia:** Mun. Palmeiras, Pai Inácio, Morro do Pai Inácio, campo rupestre, 1070 m, 12°30'S, 41°35'W, 11 Feb. 1994, *F. O. Zuloaga, O. Morrone & J. Pensiero 4787* (IBGE, MO, SI, US).

Urochloa decidua is most closely related to *U. acuminata* (Renvoize) Morrone & Zuloaga, which differs its extravaginal innovations, nodes, sheaths and blades pubescent, blades lanceolate, 20–40 cm long, 1.5–2 cm wide, with nearly 6 to 13 blades per culm, inflorescences pyramidal, with the lower branches up to 26 cm long, axils of the branches shortly pilose, and spikelets (5.6–)6–6.8 mm long, 2.2–2.4 mm wide. *Urochloa acuminata* grows in margins of woods over sandy or limestone soils (Fig. 5D).

Urochloa decidua grows in "campos rupestres" of Bahia, between 1000 and 1070 m elevation, on outcropping rocks associated with species of *Panicum* section *Lorea*, Velloziaceae, Melastomataceae, and Eriocaulaceae. The plants are bambusiform, with lignified, many-noded culms, covered by persistent leaf sheaths (Fig. 5A). Leaf blades are deciduous, with only 3–6 blades persistent at the upper portion of each culm.

Morrone et al. (1995) recently reported a chromosome count for *U. decidua* of n = ca. 14 (based on the specimen *Zuloaga et al. 4787*). These authors also mentioned a chromosome count of $n = 13$ for *U. acuminata.*

Acknowledgments. We thank Vladimiro Dudás for the illustrations and Marcelo Vázquez Avila for the Latin diagnosis. Fieldwork in Brazil was carried out under grant # 4611-91 from the National Geographic Society, to whom we are grateful.

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A New *Miconia* (Melastomataceae) from Celaque National Park, Honduras

Frank Almeda

Department of Botany, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, U.S.A.

ABSTRACT. *Miconia celaquensis,* from the montane cloud forests of Celaque National Park, Honduras, is described, illustrated, and compared with *Miconia ravenii* of Chiapas, Mexico, and *Miconia tuerckheimii* of southern Mexico and Guatemala. This new species appears to be the only *Miconia* restricted to Honduras and the second species of Melastomataceae endemic to the country.

Unlike other Central American countries with extensive highland areas, Honduras is surprisingly depauperate in endemic species of Melastomataceae. Of the 107 taxa of melastomes presently known from Honduras, only *Henriettella hondurensis* Wurdack previously has been thought to be endemic to the country. Of the 42 species of *Miconia* occurring in Honduras, *Miconia celaquensis,* the species described here, is the sole member of its genus and the only other melastome endemic to Honduras. Most Honduran Melastomataceae belong to that widespread element of the neotropical flora that extends from southern Mexico through Central America to tropical Andean South America and Brazil. Fifteen species of Melastomataceae that occur in Honduras are found elsewhere only in Guatemala and southern Mexico; 10 others extend beyond the Honduran border from Nicaragua to South America. The affinities of both endemic Honduran melastomes are with congeners that are restricted to montane areas of Guatemala and adjacent Mexico, a significant secondary center of radiation for the Melastomataceae of the Mesoamerican region.

Miconia celaquensis Almeda, sp. nov. TYPE: Honduras. Lempira: Campo Naranjo, 10 km SW of Gracias, Celaque National Park, 14°33'N, 88°40”W, elev. 2550 m, 16 May 1992, *Thomas & Mejía 329* (holotype, CAS; isotypes, EAP, HEH, MO, TEFH). Figure 1.

Ramuli sulcato-quadrangulati sicut petioli inflorescentiaque pilis laevibus sparse induti pilis laevibus glanduliferis sparse intermixtis et sicut foliorum venae primariae subtus hypanthiaque pilis stipitato-stellatis erectis modice armati. Lamina 7–15.3 × 4.3–10.6 cm cordata vel ovata, 5–7-plinervata, supra modice strigosa, pilis simplicibus 1–3 mm longis, subtus pilis laevibus et pilis laevibus glanduliferis et pilis stellulatis vel barbellatis sparsiuscule vel modice puberuli. Panicula 3.5–7.5 cm longa multiflora; flores plerumque 4-meri. Ovarium 4-loculare ⅔ inferum apice in collum circum stylum protracto collo modice glanduloso-setuloso, pilis 0.1 mm longis.

Shrub 0.5–2 m tall. The sulcate-quadrangulate uppermost branchlets, petioles, and inflorescences moderately covered with a mixture of simple flexuous hairs (1.5–2 mm long), spreading stipitate-stellate hairs (0.25 mm long), glandular hairs (0.5 mm long), and an inconspicuous basement scattering of minute glands. Leaves of a pair subequal to somewhat unequal in size; petioles 3–6.7 cm long; blades membranaceous and brittle when dry, 7–15.3 × 4.3–10.6 cm, cordate varying to ovate, apex acuminate, base cordate to broadly rounded but sometimes varying to slightly oblique on the larger cordate leaves, margin denticulate to crenulate; 5–7-plinerved with the innermost pair of primary nerves diverging from median nerve 3–5 mm above the blade base, moderately covered adaxially with appressed or antrorsely spreading smooth hairs (1–

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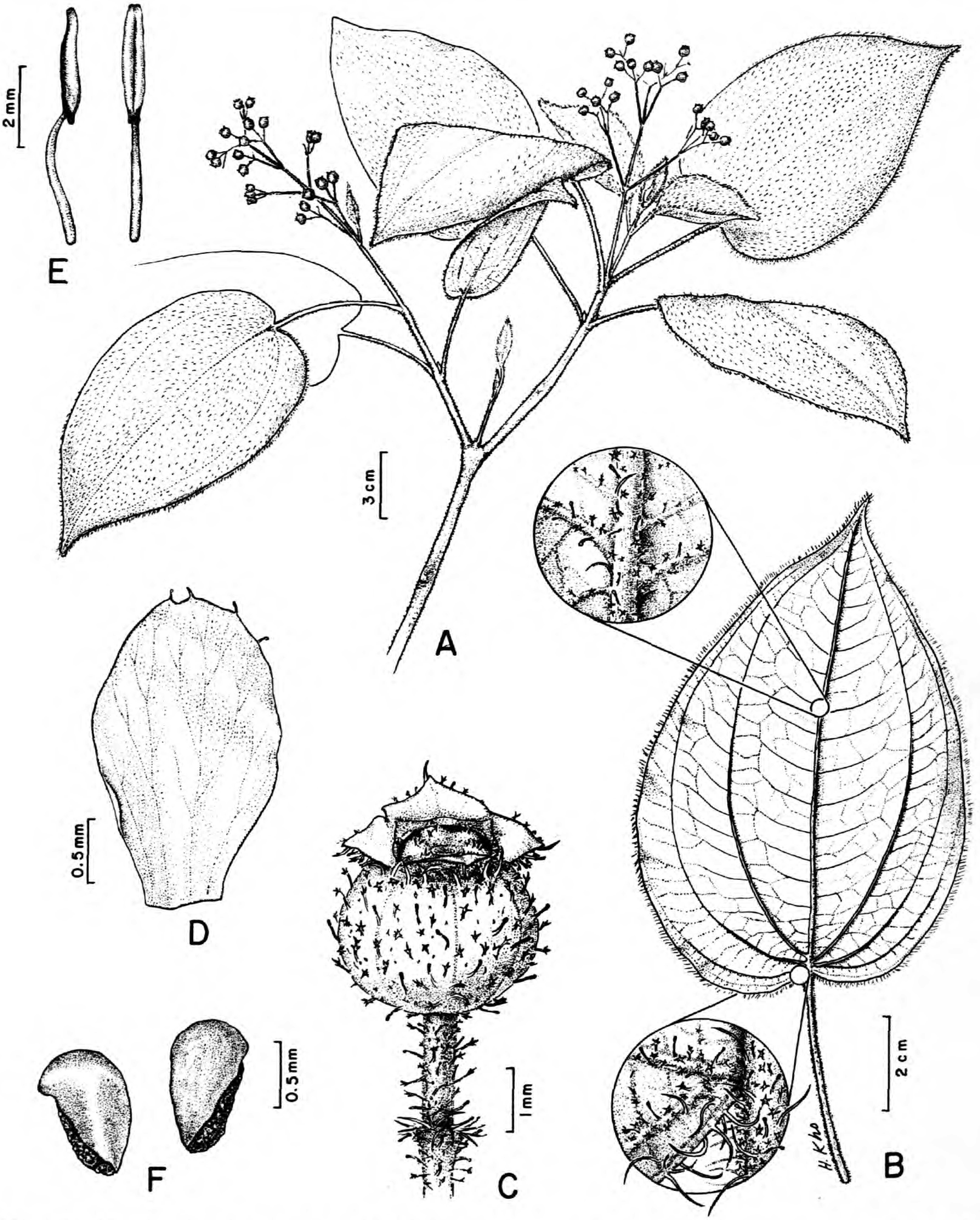

Figure 1. *Miconia celaquensis* Almeda. —A. Habit. —B. Representative leaf (abaxial surface) with enlargement of pubescence details. —C. Fruiting hypanthium. —D. Petal. —E. Stamens, lateral view (left) and ventral view (right). —F. Seeds. (A from the holotype; B from *D'Arcy 17925*; C & F from *Hazlett 2377*; D & E from *Davidse & Zúniga 34778*.)

3 mm long) and a scattering of subsessile or short-stalked glandular hairs, abaxially beset with a moderate to sparse mixture of smooth hairs (1–1.5 mm long), apically barbellate to stipitate-stellate hairs (0.25–0.5 mm long), gland-tipped hairs (0.25–0.5 mm long), and minute subsessile glands on the elevated primaries and prominulous network of higher order veins. Inflorescence terminal but sometimes appearing pseudolateral because of elongation of axillary shoots, 3.5–7.5 cm long, pan-

iculiform with ultimate branchlets terminating in simple cymes; bracts of rachis nodes paired, linear-oblong, 2–4 × 0.25 mm, glabrous adaxially and moderately covered with stipitate-stellate and minute glands abaxially; bracteoles linear to acicular, 1–2 mm long (including solitary apical hair) and less than 0.25 mm wide, sparsely beset abaxially with glandular and/or stipitate-stellate hairs. Pedicels 0.5–1 mm long at anthesis lengthening to 2–3.5 mm long in fruit. Hypanthia (at anthesis) campanulate 2.5–3 mm long to the torus (vascular ring), moderately covered with a mixture of spreading glandular and stipitate-stellate hairs and an inconspicuous scattering of minute glandular hairs. Calyx lobes (on fruiting hypanthia) prevailingly 4 but varying to 5, glabrous adaxially, with a sparse pubescence like that of the hypanthium abaxially, deltoid, 1 mm long and 1–1.5 mm wide basally; exterior calyx teeth subulate, 0.5–1 mm long, adnate to and exceeding the calyx lobes. Petals 4–5 in number, glabrous, white but sometimes tinged with pink, elliptic-obovate, obtuse to rounded or somewhat retuse at the apex, 4–5 × 2.5–3 mm, the margin entire and sometimes sparingly glandular-ciliolate. Stamens 8 or 10 in number, isomorphic; filaments glabrous, 2.5–3.5 mm long; anthers 2.5–3.5 mm long, yellow, linear-oblong, slightly notched apically with a somewhat dorsally inclined pore, connective thickened dorsally and prolonged basally into a caudiform lobe 0.25 mm long at the base of each anther sac. Ovary ⅔ inferior, 4-locular, essentially glabrous with an inconspicuous glandular-ciliolate (hairs 0.1 mm long) apical collar that surrounds the stylar scar. Style glabrous, 7–7.5 mm long, incurved apically; stigma truncate to punctiform. Berry red turning purple at maturity, globose, 3–4 mm long and 4–5 mm diam. Seeds numerous, ovoid to ellipsoid, 0.75–1 mm long, stramineous or tan, smooth and nitid varying to somewhat angulate on the lateral faces, the lateral raphe extending for much of the seed length.

Distribution. Locally common in mixed cloud forest of *Pinus, Quercus, Persea,* and *Weinmannia* at 2400–2600 m on Montaña de Celaque in Celaque National Park, a 44,000-acre parcel that protects the highest peak (9400 ft.) in Honduras. All available flowering specimens were collected in May, whereas fruiting collections have been made in November and January.

Miconia celaquensis is characterized by prevailingly 4-merous flowers, 4-locular ovary, comparatively short inflorescences (3.5–7.5 cm long), deltoid calyx lobes (1 × 1–1.5 mm), anther connectives that are prolonged basally into short caudiform lobes at the base of each anther sac (Fig. 1E), and varying mixtures of diagnostic hair types on the branchlets, petioles, inflorescences, hypanthia, and abaxial foliar surfaces.

In having elongate, linear-subulate anther thecae and a regularly lobed campanulate calyx, *Miconia celaquensis* is best placed in section *Octomeris* as defined by Cogniaux (1891). Within this section, the affinities of *Miconia celaquensis* are with *M. ravenii* Wurdack and *M. tuerckheimii* Cogniaux, both of which also have prevailingly 4-merous flowers, a 4-locular ovary, and a variety of similar but not identical combinations of hair types on hypanthia and vegetative organs. *Miconia ravenii,* which is endemic to the central plateau of Chiapas, Mexico, differs in having longer inflorescences (10–15 cm), oblate calyx lobes (0.5–0.7 mm long), somewhat ventrally inclined anther pores, and modally larger leaves that are 7–9-plinerved. The nature of the pubescence is the most diagnostic character that can be used to separate *M. ravenii* from *M. celaquensis.* In the former, the branchlets, petioles, inflorescence rachis, and hypanthia are covered with a mixture of spreading barbellate, apically bifid, and stipitate-stellate hairs that are underlain by an inconspicuous scattering of minute glands. In *M. celaquensis,* the same organs are covered with pubescence, but the abundance of each hair type appears to vary from one vegetative organ to another. For the most part, however, the stipitate-stellate hairs predominate with a sparser admixture of gland-tipped hairs and simple flexuous hairs. The same sparse scattering of minute glands is also evident in *M. celaquensis.* Diagnostic mixtures of hair types can also be found on the abaxial foliar surfaces of each species. In *M. ravenii* the lower leaf surface is moderately covered with stipitate-stellate hairs and a scattering of minute glands. In *M. celaquensis,* however, the hair cover is a moderate to sparse mixture of simple spreading hairs, apically bifid hairs, stipitate-stellate hairs, simple gland-tipped hairs, and the sparse inconspicuous sessile or subsessile glands.

Miconia tuerckheimii of southern Mexico (Oaxaca and Chiapas) and Guatemala also differs from *M. celaquensis* in having oblate calyx lobes (0.5 mm long) and longer inflorescences ((11–)15–28 cm). The most conspicuous differences, however, are in the combination of hair types on vegetative and floral organs. In *M. tuerckheimii* the pubescence of branchlets, petioles, and inflorescences consists of a dense to moderate mixture of stellate hairs, stipitate-stellate hairs (with short to long stipes), spreading glandular hairs that project well beyond all other hair types, and a ground layer scattering of glands. In *M. celaquensis* the hair covering on these same organs is moderate to sparse, but the smooth simple hairs (which are completely lacking in *M. tuerckheimii*) are the only ones that commonly exceed the other hair types in length. Pubescence of the abaxial foliar surfaces of *M. tuerckheimii* also differs markedly from *M. celaquensis.* The lower leaf surfaces of the latter are beset with the five different kinds of hairs enumerated above. Only stipitate-stellate hairs and the minute glands are produced on the lower leaf surfaces of *M. tuerckheimii.*

Another consistent character that separates *M. ravenii* and *M. tuerckheimii* from *M. celaquensis* is the length of the simple hairs on adaxial foliar surfaces. In the first two species, the hairs are invariably 0.25–1 mm in length (vs. 1–3 mm in *M. celaquensis*).

Chromosome number, although still unknown for *M. celaquensis,* may prove to be another useful character to separate this new species and its close relatives. A count of $n = 17$ was reported for a Chiapas population of *M. tuerckheimii* (Almeda & Chuang, 1992), whereas the single available count for *M. ravenii* (also from Chiapas) is $n = 68$, an octoploid based on $x = 17$ (Almeda, in press).

Another more distant relative of *M. celaquensis* is *M. jitotolana* Wurdack, a Chiapas endemic that was compared with *M. ravenii* by Wurdack (1967: 270). It differs from all three species of *Miconia* discussed above in having prevailingly 5-merous flowers and 5-locular ovaries. It further differs from *M. celaquensis* by its oblate calyx lobes (ca. 0.25 mm long), ventrally inclined anther pores, anther connectives that are thickened dorsally but not prolonged below the thecae, and an eglandular lobulate ovary collar surrounding the stylar scar.

Paratypes. HONDURAS. **Lempira:** Celaque National Park, around Río Arcagual, 15 Nov. 1991 (fr), *Thomas et al. 79* (CAS, MO); Campo Naranjo, 10 km SW of Gracias, 14°32'N, 88°39'W, 13 May 1992 (fl), *D'Arcy 17925* (MO); Montaña de Celaque, SE portion of the massif, valley of Río Arcagual on the plateau, 14°33'26"N, 88°40'00"W, 26–27 May 1991 (fl), *Davidse & Zúniga 34778* (EAP, MO); Montaña de Celaque, 18–22 Nov. 1974 (fr), *Hazlett 2377* (MO); Montaña de Celaque, 15 km SO de Gracias, 20 Jan. 1991 (fr), *Rodriguez 109* (TEFH).

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A New Variety of *Ficus semicordata* (Moraceae) from Nepal

S. M. Amatya
Director, Forest Survey Division, Forest Research and Survey Centre,
Babar Mahal, Kathmandu, Nepal

ABSTRACT. *Ficus semicordata* Buchanan-Hamilton ex J. E. Smith is known as a Khanyu tree in Nepal, and is locally used as a forage tree. Nepalese farmers distinguish two kinds of Khanyu based on the fodder quality: khasro and rai. Farmers tend to prefer rai khanyu because they believe that livestock fed with rai khanyu give higher milk yields, whereas khasro khanyu has an adverse effect on milk production and tends to reduce it. It was only in the late 1980s that researchers distinguished two types of Khanyu. It appears that both kinds of Khanyu were included in the studies made by earlier taxonomists and others using the general scientific name of *F. semicordata,* as these workers do not mention the different local names of this species. Detailed taxonomic and ecological studies revealed that in Nepal two varieties of khanyu occur in Nepal: the typical variety and var. *montana,* described herein.

Ficus semicordata Buchanan-Hamilton ex J. E. Smith is one of thirty-five species of *Ficus* or fig tree occurring in the kingdom of Nepal (Hara et al., 1982: 209–211). It is a common tree belonging to the family Moraceae. In the Nepali language it is known as a Khanyu tree, meaning fruits edible. The species has a natural distribution throughout Nepal, from the Terai (elevation 200 m) to the Mid-Hills (elevation 2000 m). It is gregarious in nature and particularly common on the sides of ravines, along water courses, and in forests.

Ficus semicordata is a light-demanding species, but seedlings and saplings can withstand a little shade. Flowering and fruiting take place chiefly from May to September (Brandis, 1906: 606; Polunin & Stainton, 1984: 370) but can occur sporadically throughout the year. The leaves are an excellent source of fodder for cattle and goats, and it is one of the most important fodder species in Nepal.

This species was first collected in Nepal in 1802 by Buchanan-Hamilton, who suggested the name *Ficus semicordata* on account of the pronounced unequal heart-shaped base of the leaf.

Nepalese people informally distinguish two varieties of Khanyu: khasro and rai khanyu (Amatya, 1989). Scientific examination of the species at Oxford University, U.K., also suggested that two taxonomic varieties of Khanyu tree occur in Nepal. The principal distinctions between these two varieties are as follows.

Ficus semicordata Buchanan-Hamilton ex J. E. Smith var. **semicordata**

Small to medium-sized (10–12 m) tree, with dark gray bark; the young shoots roughish pubescent; leaves elliptical-lanceolate, average length 21 cm, average breadth 7.7 cm; leaf margin serrate (tooth size variable); upper surface scabrous; hairs on the mid-vein and lateral veins tomentose, lower lamina villous. Lamina pinnately nerved, with 6 basal and 9–14 pairs of lateral veins; tertiary venation semicraspedodromous; average petiole length 1.1 cm. Receptacles (figs), fleshy, 1.5–2.5 cm diam.; peduncles 0.3–1.5 cm long, collar or basal bracts 3(–4), at the end of the peduncle, pubescent. Flowers minute, of four types, unisexual, on the inner walls of the receptacle. Latex creamy white. Mid-ribs of the fresh leaves creamy white. Vernacular name: khasro khanyu.

In Nepal this variety occurs from 200 to 2000 m altitude. The distribution extends to Central India, Himalayas, Myanmar (Burma), Thailand, southern China, Indo-China, and Malaysia (Corner, 1960).

This is the typical form of the species. The type specimen is kept in the Smith Herbarium at the Linnean Society of London (LINN). It was first named by Corner (1960), when he distinguished it from *Ficus semicordata* var. *conglomerata.*

There are various collections of *Ficus semicordata* in the herbaria of K, OXF, CGE, BM, and CAL. Most taxonomists, in their collections, have identified *Ficus semicordata* as *Ficus cunia* Buchanan-Hamilton ex Roxburgh; some have used the name *Ficus conglomerata* Roxburgh as well. Corner's (1960) monographic studies on the genus *Ficus* have greatly clarified the taxomony and nomenclature.

Ficus semicordata var. **montana** Amatya, var. nov. TYPE: Nepal. Terai: 1806, *F. Buchanan s.n.* (holotype, LINN).

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Arbor latice cremieo-albo vel roseo; folia elliptico-lanceolata; superficies laevis, pagina inferior pilis strigosis in costa et nervis lateralibus vestita; costa foliorum recentium rosea. Lamina pinnatinervis septem jugis nervorum basalium, 10–21 jugis nervorum lateralium; venatio tertiaria brochidodroma. Flores tetramorphi, plerumque unisexuales. Nomen vernaculum rai khanyu.

A small to medium-sized (10–12 m) tree with dark bark; the young shoots roughish pubescent; leaves elliptical-lanceolate, average length 25 cm, average breadth 10 cm; leaf margin serrulate or entire; upper surface smooth; hairs on mid-veins and lateral nerves strigose, appressed. Lamina pinnately nerved, with 7 basal and 10–21 pairs of lateral veins; tertiary venation brochidodromous; average petiole length 1.4 cm. Receptacles (figs) fleshy, 1.0–1.5 cm diam., peduncles 0.4–1.1 cm long; collar or basal bracts 3, rarely 4, at the end of peduncle, glabrous. Flowers minute, of four types, normally unisexual, occurring on the inner walls of the receptacle. Latex creamy white to pink. Mid-ribs of fresh leaves pink. Vernacular name: rai khanyu.

In Nepal this variety has a narrower range at relatively high elevations (1400–2000 m). It may occur at these altitudes in neighboring countries (Bhutan, Myanmar, and India).

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Dilleniaceae Novae Neotropicae: VI. A New Species of *Tetracera* from Panama

Gerardo Aymard C.
UNELLEZ-Guanare, Programa de R.N.R. Herbario Universitario (PORT), Mesa de Cavacas, Edo. Portuguesa, Venezuela 3323.
Current address: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. As a result of examination of the Missouri Botanical Garden Dilleniaceae collection, a new species of *Tetracera* was found. *Tetracera macphersonii,* from Panama, is described and illustrated, and its relationships are discussed. A key to the species of *Tetracera* from Mesoamerica is provided.

RESUMEN. Como resultado de la revisión de la colección de la familia Dilleniaceae depositada en el Jardín Botánico de Missouri, U.S.A., se describe una nueva especie del género *Tetracera (T. macphersonii)* de Panamá. Se discuten sus relaciones con las especies afines. Se presenta una ilustración y una clave de las especies del género presentes en Mesoamérica.

Tetracera L. is remarkable within the Dilleniaceae because it is the only genus that is present in both hemispheres (pantropical), and its flowers are unisexual and bisexual (androdioecious in all neotropical species; Kubitzki, 1970) in an otherwise entirely bisexual family (Dickison, 1968; Hoogland, 1951, 1952, 1953, 1972; Kubitzki, 1970).

Tetracera macphersonii Aymard, sp. nov. TYPE: Panama. Province Panamá: along El Llano–Carti road, near Nussagandi, wet forest, 9°15′ N, 79°00′W, 350 m, 21 July 1986, *G. McPherson 9753* (holotype, PMA; isotype, MO). Figure 1.

Species nova quae a *T. asperula* Miquel foliis ellipticis vel obovato-ellipticis, 3–8 cm longis, 1.5–4 cm latis, thyrso 2.5–3 cm longo, 2–3 floribus, pedicello 2–3 mm longo, sepalis 9 haud ciliatis, fructu ex folliculis 3 constante, 10–11 mm longo, rostrum 2–3 longum terminante, semine unico in quaque locula differt.

Liana. Branches sparsely stellate-pubescent, glabrescent. Leaves subcoriaceous, scabrous, elliptic or obovate-elliptic, 3–8 cm long, 1.5–4 cm wide, the base cuneate or obtuse, the apex rounded or acute, margins entire, often subrevolute from middle to apex of the blade, the veins raised below, with 5–8 parallel nerves on each side of mid-nerve, convergent toward margin, lepidote-stellate above, glabrous beneath except along the midrib and secondary nerves, these sparsely appressed-pubescent, petiole 1.2–1.7 cm long, subulate, canaliculate, appressed-pubescent. Inflorescence an axillary, rarely terminal, 2–3 flowered thyrse, 2.5–3 cm long, appressed-pubescent, with stellate and simple trichomes; pedicel 2–3 mm long, densely stellate-pubescent. Flowers bisexual; sepals 9, suborbicular, unequal, eciliate, the outer three 4–6 mm long, sparsely lepidote-stellate without, glabrous within, internal six 5–8 mm long, lepidote-stellate without, glabrous within; petals not seen; stamens 80–100, 3.5–4 mm long, the filaments glabrous, the anthers ca. 0.5 mm long. Fruit of three follicles each 10–11 mm long, coriaceous, smooth, shining and glabrous externally, opening by longitudinal slits, rostrate, the rostrum 2–3 mm long; seed 1 per locule, 2–4 mm long, black, with aril longer than seed and deeply lacerate.

Distribution and ecology. Only known from the type collection: El Llano–Carti road, near Nussagandi, restricted to mesothermic humid forests.

Because of its scabrous leaves and inflorescences in thyrses, *T. macphersonii* belongs to the section *Tetracera* (Kubitzki, 1970). It is most similar to *T. asperula* Miquel, but differs in its elliptic or obovate-elliptic leaves 3–8 cm long, 1.5–4 cm wide (vs. lanceolate or lanceolate-elliptic leaves 7–19 cm long, 3–8 cm wide); inflorescences 2.5–3 cm long, pedicel 2–3 mm long, inflorescences with 2–3 flowers and sepals 9, eciliate (vs. inflorescences 8–20 cm long, pedicel 4–20 mm long, with 3–6 flowers and sepals 5–6, ciliate), and fruits with 3 follicles, 10–11 mm long, rostrum 2–3 mm long, seed 1 per locule (vs. fruits with 4–5 follicles, 14–17 mm long, rostrum 1 mm long, seeds 2–several per locule).

KEY TO THE MESOAMERICAN SPECIES OF *TETRACERA*

1. Nervation craspedromous; sepals sericeous inside 2

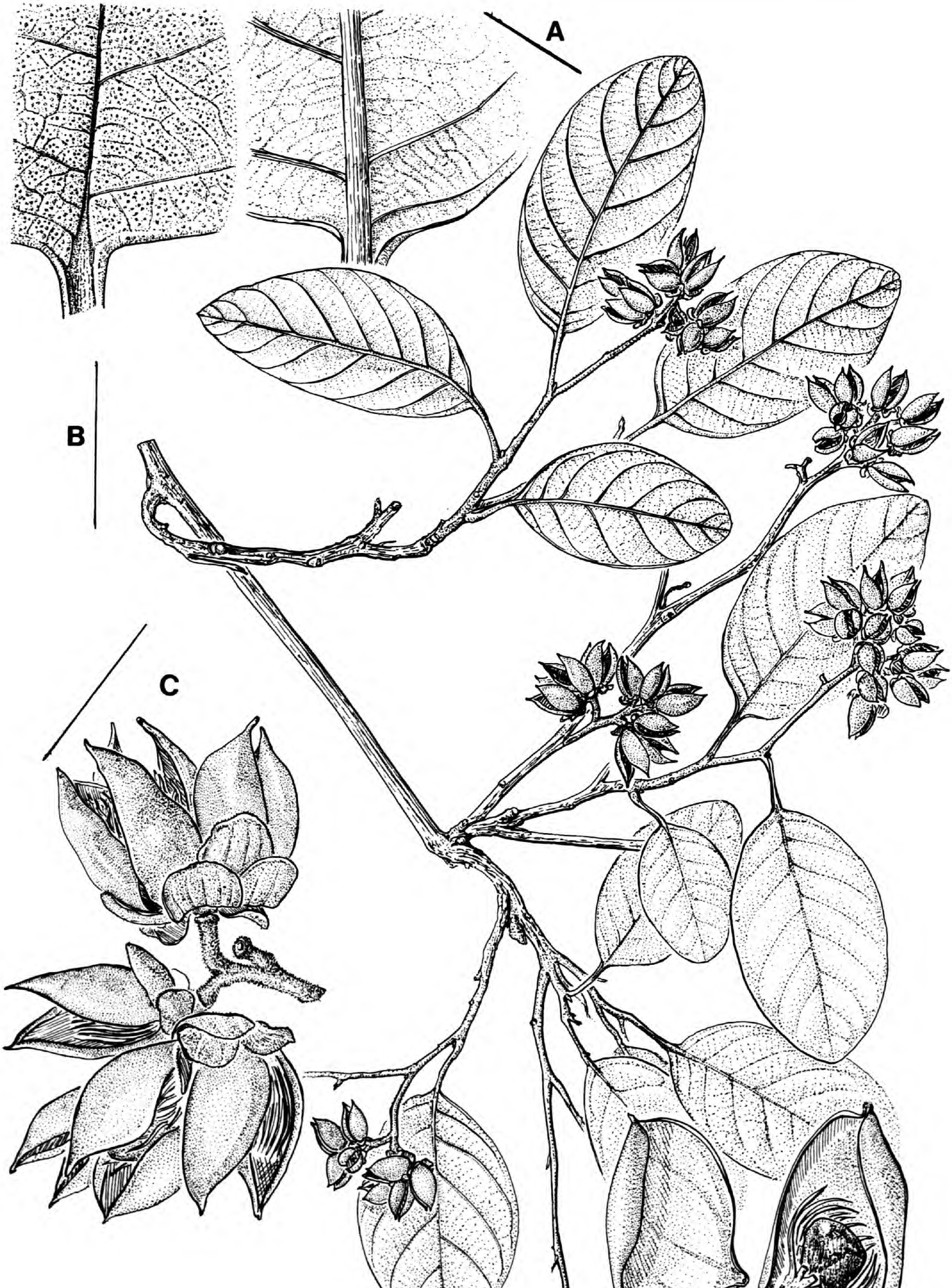

Figure 1. *Tetracera macphersonii* Aymard (*G. McPherson 9753*, MO, PMA). —A. Base of both faces of the leaf lamina. —B. Habit. —C. Follicles. —D. Seed with an aril deeply lacerate. Scale: A, C, D = 1 cm; B = 5 cm.

1. Nervation brochidodromous; sepals glabrous inside 4
2(1). Leaves abruptly attenuate at base; follicles 1 . . . *T. portobellensis* Beurling (Mexico to Panama)
2. Leaves rounded to narrowly cuneate at base; follicles 3–5 3
3(2). Leaves glabrescent beneath; flower buds globose; follicles glabrous to sparsely strigose at apex . . . . . . *T. volubilis* L. subsp. *volubilis* (Mexico toPanama)
3. Leaves pilose beneath; flower buds obovate; follicles densely tomentose . . . . *T. volubilis* subsp. *mollis* (Standley) Kubitzki (Mexico to Panama)
4(1). Leaves dentate . . . . *T. hydrophila* Triana & Planchon (Belize to Panama)
4. Leaves entire or subsinuate 5
5(4). Petioles appressed-pubescent (simple trichomes); inflorescences 2.5–3 cm long; pedicel 3 mm long; sepals 9; follicles glabrous . . . . *T. macphersonii* Aymard (Panama)
5. Petioles stellate-pubescent; inflorescences 10–30 cm long; pedicel 0.5–1 mm long; sepals 5; follicles sparsely pilose at apex . . . . *T. willdenowiana* Steudel subsp. *willdenowiana* (Guatemala, Belize, Panama)

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Novelties in Guianian *Endlicheria* (Lauraceae)

Andre Chanderbali
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.; and
Department of Biology, 8001 Natural Bridge Road, St. Louis, Missouri 63121-4499, U.S.A.

ABSTRACT. Two new species of *Endlicheria* are described, illustrated, and discussed. *Endlicheria canescens* has hitherto been confused with *Ocotea endlicheriopsis* Mez, and *Endlicheria chalisea* was previously known only by the densely pubescent cupules of fruiting material.

Two undescribed species were encountered during preparation of a revision of the Guianian members of *Endlicheria.* Described by Nees in 1833, this neotropical genus currently accommodates all dioecious Lauraceae that possess exinvolucrate thyrsoid or thyrso-paniculate inflorescences and two-thecous anthers. Although this generic concept has attracted recent criticism (Rohwer et al., 1991), it is maintained while the genus awaits monographic attention. At the species level, taxonomic delimitation in *Endlicheria* is complicated by dioecy. Species circumscription depends on the association of male and female specimens and must confront sexual dimorphism in floral structures. Fortunately, vegetative features are relatively constant between the sexes and may be used to support species concepts based on floral characters. Each of the new species here proposed is circumscribed by unique combinations of vegetative and reproductive features.

Endlicheria canescens Chanderbali, sp. nov. TYPE: Suriname. Sarramacca R., Toekoemoetoe Ck., 5 Oct. 1944 (fl), *Maguire 24898a* (holotype, MO; isotypes, K, NY, US). Figure 1.

A ceteris speciebus *Endlicheriae* habito magno et pilis erectis in pagina interiori tepalorum recedit.

Trees to 35 m tall, and up to 50 cm DBH; from terra firme forests. Branchlets initially angular, soon terete; densely covered with short (up to ca. 0.3 mm), straight to crookedly erect reddish brown hairs; eventually becoming glabrous. Terminal buds similarly densely covered with short, erect reddish brown hairs. Petioles 1.5–2.5 cm long; sulcate along most of their length, dorsoventrally flattened and broadly canaliculate near the base; indument consisting of the same dense cover of short, erect reddish brown hairs found on the branchlets. Leaves 10–20 × 5–8 cm; alternate and evenly spaced along the twigs; elliptic with recurved margins; chartaceous. Leaf apex acuminate; base obtuse, often obliquely meeting the petiole. Venation essentially pinnate, with 4–7 pairs of secondary veins. Midrib and secondary veins impressed above, strongly raised below. Intercostal venation scalariform, consisting of roughly parallel tertiaries that are arranged perpendicular to the midvein. Tertiary veins flat above, strongly raised below. Upper and lower leaf surfaces with the same indumentum as the petioles and twigs; more densely pubescent on the veins. Indument usually persistent only on the veins of the upper leaf surface but persistent on the entire lower leaf surface. *Inflorescences* borne in the axils of the foliage leaves; thyrso-paniculate; often up to 15 cm long. Inflorescence peduncle and lateral branches covered by the same short, erect indument as the twigs. Pedicels and distal internodes of cymes well developed, individual flowers clearly distinguishable. Bracts of lateral branches and bracteoles subtending individual flowers narrowly lanceolate in shape; to 4 mm and 1.5 mm long, respectively; densely covered with erect hairs; caducous at anthesis. Flowers distinctly pedicellate. Pedicels 2–3 mm long; bearing a sparse cover of erect brownish yellow hairs. *Male flowers* pale yellow-green; ca. 5 mm diam. at anthesis. Hypanthium broadly infundibuliform; ca. 2 mm deep × 3 mm wide; outer surface with a sparse cover of short, erect brownish yellow hairs; inner surface densely covered with short, erect gray-white hairs. Tepals ca. 1.5 × 1.5 mm wide; obovate; at anthesis patent, causing the internal floral structures to be clearly exposed; outer surface bearing a lax cover of ascendingly erect reddish brown hairs that becomes sparser toward the margins where it is replaced by a dense cover of extremely curly dark red hairs; inner surface covered by a dense growth of erect gray-white hairs. Stamens of all whorls with pubescent filaments that are indistinctly differentiated from their two-thecous anthers. Anthers of the outer two whorls of stamens ovate; thecae introrse-latrorse; connectives acutely elongated. Anthers of the inner or third whorl of stamens obovate; thecae extrorse-latrorse; connectives not extended. Basal glands essentially globose, broadly apiculate; sessile. Pistillode fusiform, glabrous. *Female flowers* generally similar to male flowers but different in the glabrous inner surface of the hypanthium and the slightly smaller sterile stamens all of which possess distinctly narrower filaments. Ovary superior, half enclosed by the hypanthium; completely glabrous; stigma reniform, supported by a short thick style. *Cupules* fleshy, sub-hemispherical, ca. 1.5–1.7 cm diam., margin simple and entire, walls heavily thickened, glabrous without, densely sericeous within. Fruiting pedicel 2–3 mm long. Berries spheroid, up to 0.7 cm long.

Collections of *Endlicheria canescens* have mistakenly been considered to be conspecific with *Ocotea endlicheriopsis* Mez (Mez, 1889), and used to justify the combination *Endlicheria endlicheriopsis* (Mez) Kostermans (Kostermans, 1936). The holotype material of *Ocotea endlicheriopsis* specified by Mez is *Melinon 605* from French Guiana. I have not seen this specimen, but I have seen three other Melinon collections (*Melinon s.n., 36,* and *276*; all from French Guiana and deposited at P). These specimens have been annotated as isotypes but were not cited in the original publication of *Ocotea endlicheriopsis,* and were not listed among those seen by Mez (1892). However, they agree with the description of *Ocotea endlicheriopsis* and correspond well with the type photograph of *Melinon 605* located at MO. Given the possibility that there may have been errors in the numbering of these sheets, I am prepared to accept them as isotypes. These are all fruiting collections, but examination of the few persistent flowers has revealed that the anthers are unquestionably four-thecous in the manner characteristic of *Ocotea.* In addition, the tightly crinkled indument of these specimens is characteristic of a few *Ocotea* species including *O. rufovestita* Ducke and *O. indirectinervia* C. K Allen, but unmatched in *Endlicheria.* Therefore, Mez's generic placement of Melinon's collections was correctly determined, and the collections of *Endlicheria* that have been associated with the name *Endlicheria endlicheriopsis* represent an undescribed species.

Although having finally received taxonomic recognition, *Endlicheria canescens* still remains poorly collected and therefore poorly understood. The available material indicates that individuals of this species are canopy trees reaching up to 35 m in height and 50 cm DBH. The flowers are relatively large and robust for *Endlicheria,* and perhaps the most striking feature of these is the dense cover of grayish bristle-like hairs on the inner surface of the tepals. These are often rendered even more conspicuous by the tendency of the tepals to spread widely open at anthesis. The lower leaf surfaces sometimes bear flattened waxy globules that collectively furnish a glaucous appearance. However, specimens treated with alcohol or subjected to excessive heat during drying may not show this character.

Distribution. *Endlicheria canescens* is known from the montane evergreen forests around the Guyana–Venezuela border and from the lowland evergreen forests of Suriname, Ecuador, and Peru. See Figure 2.

Phenology. Flowering specimens have been collected in January, June, September, and October.

Paratypes. ECUADOR. **Napo:** Aguarico Canton, Reserva Faunística Cuyabeno, Río Zancudo, 230 m, 5 Oct. 1991 (fl), *Palacios et al. 8164* (MO), *Palacios et al. 8165* (MO); Parque Nacional Yasuni, 200 m, 28 May–8 June 1988 (fr), *Ceron & Hurtado 3882* (MO). GUYANA. **Essequibo:** Upper Mazaruni R. Basin, Kamarang R., 24 Oct. 1960 (fl), *Tillett & Tillett 45789* (K, NY, US). PERU. **Loreto:** Prov. de Alto Amazonas, Cerros Campanquiz at Pongo de Manseriche, Río Maranon, 30–550 m, 19–21 Oct. 1962 (fl), *Wurdack 2362* (NY). SURINAME. Natuurpark Brownsberg, 23 June 1925 (fl), *Forest Bureau 6884* (MO, U), 10 Sep. 1969 (fl), *LLB 12570* (MO, U), June 1917 (fl), *Forest Bureau 2936* (MO, U), 10 Sep. 1917 (fl), *Forest Bureau 3197* (NY, U), June 1922 (fl), *Forest Bureau 5884* (U, US). VENEZUELA. **Bolívar:** between San Ignacio de Yaruni and San Francisco de Yaruni, 1200 m, 4 Jan. 1975 (fl), *Steyermark 111387* (NY).

Endlicheria chalisea Chanderbali, sp. nov. TYPE: Guyana. Potaro-Siparuni region, Kato and vicinity, dry forest N of town, 750 m, 19 Mar. 1989 (fl), *Hahn et al. 5795* (holotype, MO; isotype, U). Figure 3.

Ad subgenus *Ampelodaphne* ob inflorescentias condensatas pertinens sed foliis alternis et insigniter cupulis extus dense aureo-tomentosis distinguenda.

Medium-sized *trees* usually about 8 m tall and ca. 10 cm DBH, rarely up to 20 m tall; known only from terra firme forests. Branchlets initially cylindrical; densely covered with relatively long (up to ca. 1 mm) rigidly erect yellowish or flaxen hairs, at last becoming glabrous. Terminal buds similarly densely covered with ascendingly erect rather stiff hairs. Petioles 2.5–5.5 cm long, semiterete; indument consisting of the same stiffly erect hairs found on the branchlets. Leaves relatively large, 15–30 × 7–13 cm; alternate, in flowering material apparently distally clustered but the internodes eventually extend and the leaves of fruiting material are widely spaced along the twigs; obovate with recurved margins; charta-

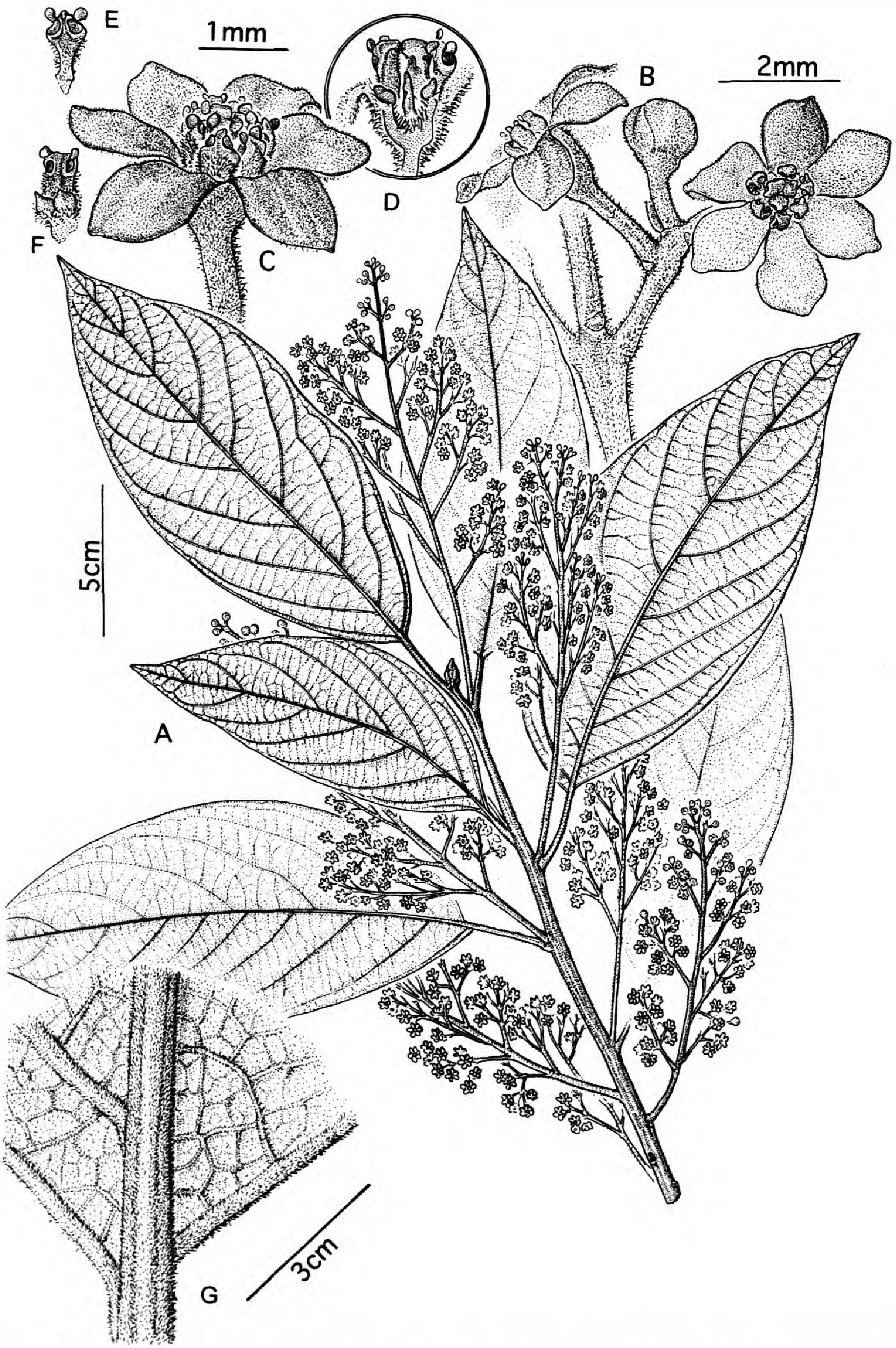

Figure 1. *Endlicheria canescens* Chanderbali. —A. Flowering branchlet, showing widely spaced leaves and axillary inflorescences. —B. Cymose branchlet, showing bracteoles only beneath floral buds. —C. Male flower, showing pubescent tepals and filaments. —D. Longitudinal section of a male flower, showing pistillode and pubescent interior of

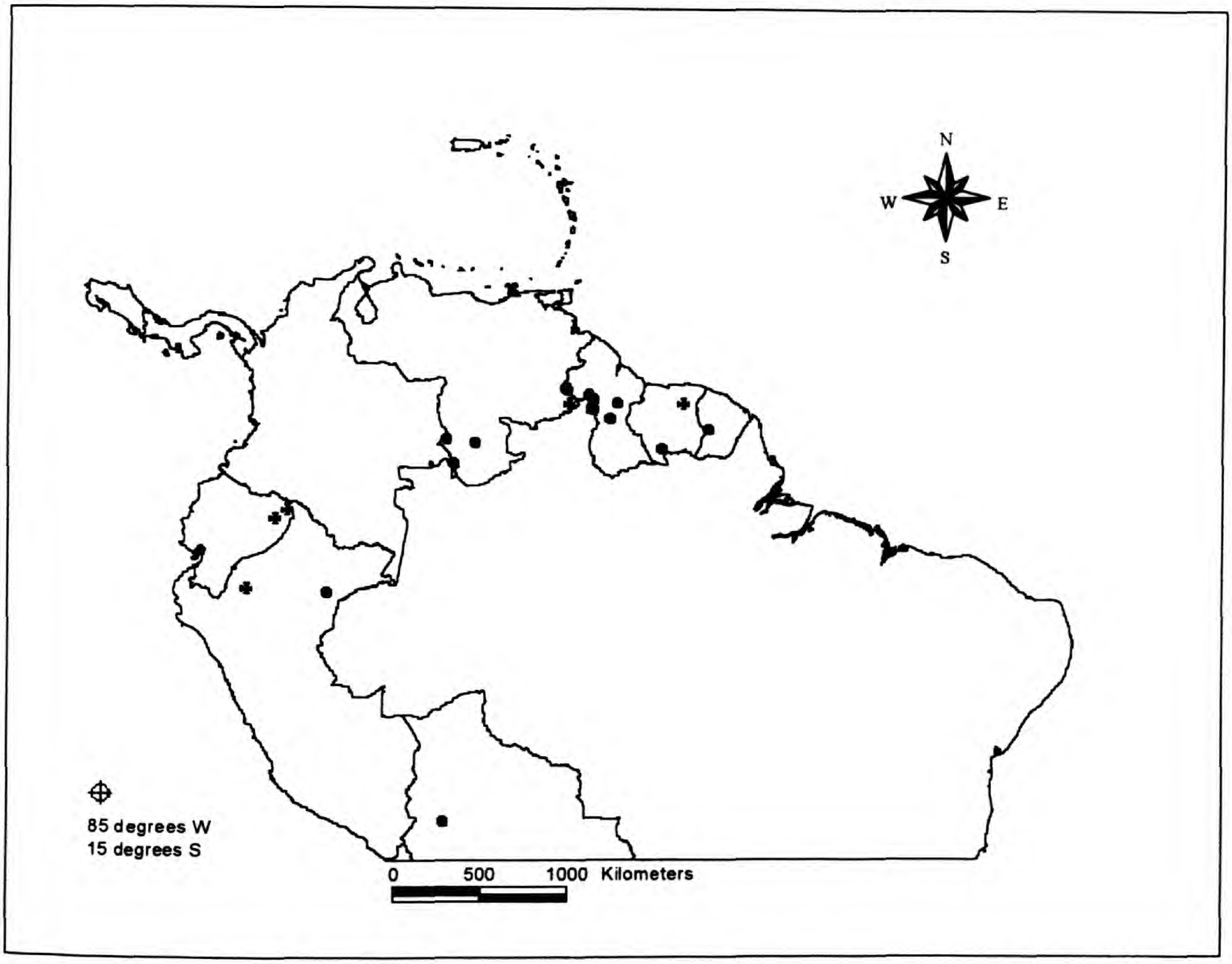

Figure 2. Distribution of *Endlicheria canescens* Chanderbali (✣), and *E. chalisea* Chanderbali (●). The map of the Neotropics was generated from the Digital Charts of the World Database by the GIS software ARCINFO, and the distribution points were generated by Arcview from geographical coordinates on specimen labels.

ceous. Leaf apex acuminate; base acute. Venation essentially pinnate, with 6–14 pairs of secondary veins. Midveins impressed above, strongly raised below. Secondary veins slightly convex above, strongly raised below. Intercostal venation mixed, dominated by lateral intersecondaries in the inner and percurrent tertiaries in the outer half. Tertiary veins ± level with the leaf surface above, strongly raised below. Upper and lower leaf surfaces with the same indumentum characteristic of the twigs; more densely pubescent on the veins. Indument usually persistent only on the veins of the upper leaf surface but persistent on the entire lower leaf surface. *Inflorescences* borne in the axils of the foliage leaves; thyrso-paniculate often up to 7 cm long. Inflorescence peduncle and lateral branches pubescent as the twigs. Pedicels and distal internodes of cymes shortened, flowers arranged in dense clusters. Bracts of lateral branches, and bracteoles subtending individual flowers, lanceolate in shape; to 3 mm and 1 mm long, respectively; densely covered with ascendingly erect hairs; persistent at anthesis. Flowers ± sessile. *Male flowers* off-white; ca. 3 mm diam. at anthesis. Hypanthium infundibuliform; ca. 1 mm deep × 1 mm wide; outer surface densely covered with long, crookedly erect, flaxen to reddish brown hairs; inner surface completely covered with short appressed hairs. Tepals ca. 1.3 × 1.0 mm, elliptic; at anthesis erect and not revealing the internal floral structures or the very tips slightly recurved and the internal structures scarcely exposed; outer surface bearing a markedly sparser cover of the erect hairs found on the hypanthium below; inner

←

the hypanthium. —E. Stamen of series II, showing protruding connective and latrorse-introrse dehiscence. —F. Stamen of series III, showing indistinct filaments and apiculate basal glands. —G. Lower leaf surface, showing oblique base. A–G, drawn from holotype.

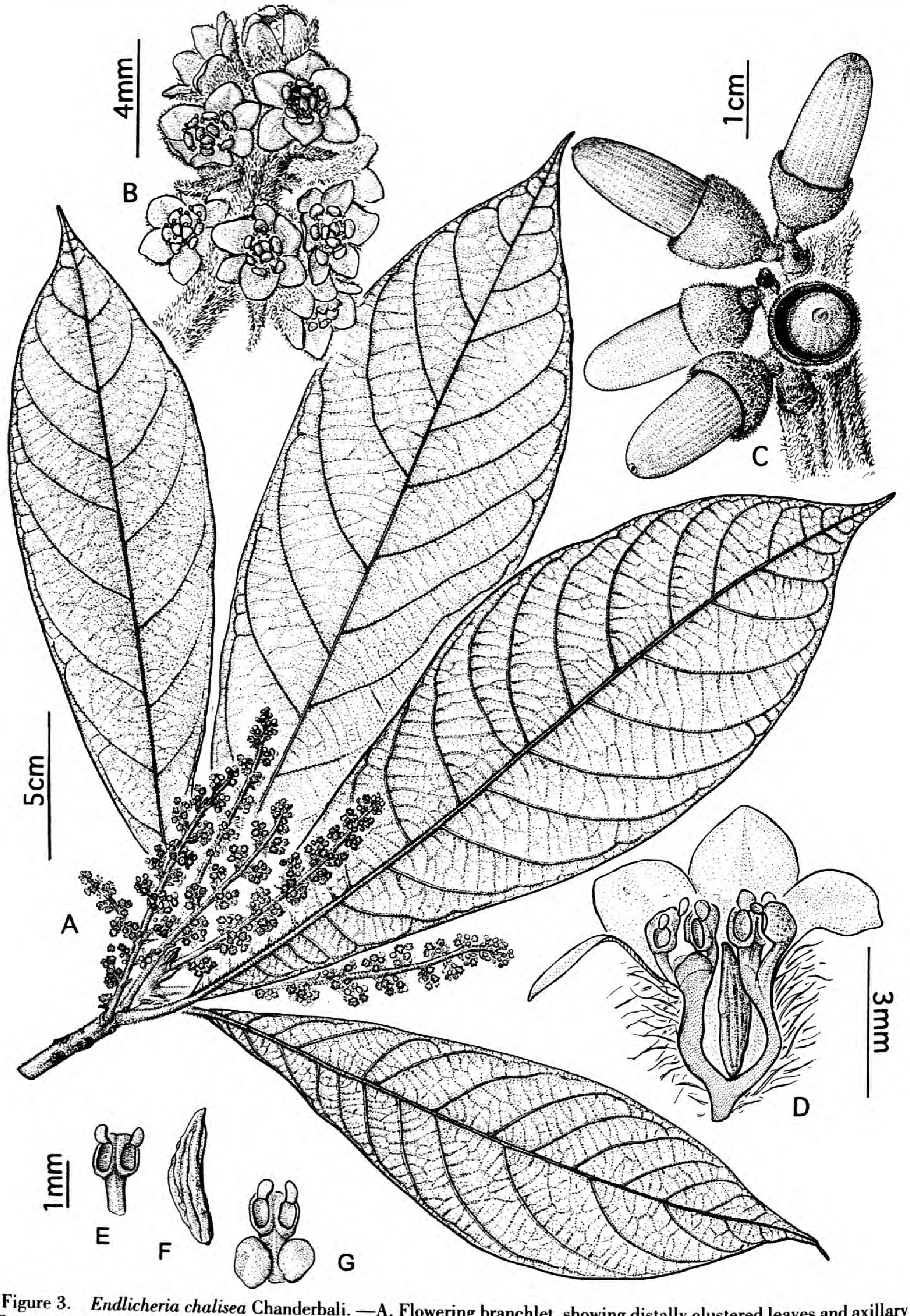

Figure 3. *Endlicheria chalisea* Chanderbali. —A. Flowering branchlet, showing distally clustered leaves and axillary inflorescences with densely clustered flowers. —B. Inflorescence branchlet, showing persistent bracteoles. —C. Fruits, showing large berries in densely pubescent subsessile cupules. —D. Longitudinal section of a male flower, showing pistillode and short appressed hairs of the hypanthium. —E. Stamen of series I, showing distinct filament, large thecae and latrorse-introrse dehiscence. —F. Pistillode. —G. Stamen of series III, showing distinct filaments and sessile basal globose glands. A, B and D–G drawn from holotype, C drawn from *Acevedo 3432.*

surface entirely glabrous except for a dense papillose indumentum on the tepal tips. Stamens of all whorls with glabrous filaments that are distinctly narrower below their two-thecous anthers. Anthers of the outer two whorls depressed elliptic to depressed ovate; thecae introrse-latrorse; connectives apically expanded into a broad flat ridge. Anthers of the inner or third whorl of stamens oblong to depressed oblong; thecae extrorse-latrorse; connectives not apically extended. Basal glands essentially globose; sessile. Staminodes reaching about ¼ the length of the inner whorl of stamens; usually bearing a distinctly swollen elliptic-ovate head. Pistillode fusiform, glabrous. *Female flowers* generally similar to male flowers but different in the glabrous inner surface of the hypanthium and the slightly smaller sterile stamens with pubescent filaments. Ovary superior, glabrous; stigma 3-lobed. *Cupules* fleshy; hemispherical; ca. 1.7–2 cm diam.; margin simple and entire; outer surface densely covered with persistent, slightly crooked golden or reddish brown erect hairs similar to those of the branchlets; inner surface densely covered with golden or reddish brown appressed hairs. Fruiting pedicel absent or very short and as densely pubescent as the cupules; fruits ± sessile. Berries elliptic to oblong, often up to 4 cm long.

Endlicheria chalisea, named for its golden pubescent cupules, represents the latest addition to the subgenus *Ampelodaphne* Mez. Such densely pubescent cupules are otherwise unknown in *Endlicheria.* Fruiting specimens are therefore easily distinguished from related species, but flowering specimens are not as conspicuous. Flowering material bear the densely flowered bracteate inflorescences typical for the subgenus and have either been annotated as *Endlicheria sp.* or attributed to other species. However, the combination of alternate (as opposed to sub-verticillate) leaves, distinctly sessile flowers, and relatively large sessile basal glands allows distinction of flowering specimens of this species from its closest relatives. Most specimens of *E. chalisea* bear obovate leaves. However, a fruiting collection from the Merume Mts., Guyana (*Tillett 43990*), and a flowering specimen from the Arboretum Jenaro Herrera, Peru (*Valcarcel & Chota 1/98*), have broadly elliptic leaves. The fruiting specimen has pubescent cupules, but these are rather decrepit and may be diseased, as indicated on the label. The flowering specimen has smaller flowers and stamens with more slender filaments but otherwise conforms well with flowering material from the Guianas. These specimens may represent a different species but are included in *E. chalisea* because the variation in leaf shape, fruit development, and floral structures is entirely within the range exhibited by many species of lauraceous genera.

Distribution. Submontane evergreen forests in the Guianas, Venezuela, and Bolivia and the lowland evergreen forests of the Brazilian and Peruvian Amazon. See Figure 2.

Phenology. Flowering specimens have been collected in March, June, July, and August. Fruiting collections have been made in February, March, April, June, August, and November.

Paratypes. BOLIVIA. **La Paz:** Sud Yungas Province, 7 km de Huancané en carretera a San Isidro, 2300 m, 13 Dec. 1989 (fl), *Smith et al. 13908* (MO). BRAZIL. **Amazonas:** Manaus, Reserva Forestal Ducke, 27 June 1964 (fl), *Rodrigues & Loureiro 5926* (MO); Mun. de Presidente Figueredo, Estrada do Canteiro, Usina Hidroeletrica de Balbina, 230 m, 15 July 1990 (fl), *Cid Ferreira et al. 7582* (MO, NY). **Pará:** Mun. Oriximina, Rio Trombetas, terra firme adjacent to lago Moura, 25 Aug. 1980 (fl), *Cid Ferreira et al. 1832* (MO). FRENCH GUIANA. Rivière Grand Inini-Bassin du Maroni, 11 Aug. 1990 (st), *Sabatier & Prévost 3195* (MO). GUYANA. **Essequibo:** Bartica–Potaro Road, 107 mil., 16 Nov. 1963 (fr), *Fanshawe* in *Forest Dept. 4237* (MO); Cuyuni-Mazaruni region, along Koatse R., ca. 2 km W of Pong R., ca. 5 hrs. walk from Chinoweing, 600–650 m, 25 Feb. 1987 (fr), *Pipoly et al. 10607* (MO); Mabura Region, Kurupukari main, 6 km, 23 Mar. 1994 (fr), *Ek & Hammond 1033* (MO); N. Pakaraimas, Ciong Valley, Manawarrai Mt., 2000 m, 1 June 1995 (fr), *Mutchnick 1464* (MO); U. Takatu-U. Rupununi, road from Lethem to 25 km past Surama Village entrance, 90–110 m, 28 Feb. 1990 (fr), *Acevedo 3432* (MO); Upper Mazaruni R. Basin, Mt. Ayangana, 800–900 m, 16 Aug. 1960 (fr), *Tillett et al. 45163* (K, MO, NY, US); Upper Mazaruni R. Basin, Partang R. Perume Mts., 1140 m, July 1960 (fr), *Tillett et al. 43990* (K, MO, NY, US). PERU. **Loreto:** Requena, Arboretum Jenaro Herrera, 8 July 1986 (fl), *Valcarcel & Chota 1/98* (MO). VENEZUELA. **Amazonas:** Atabapo, Alto Río Casiquiare, 160 m, 6 Mar. 1990 (fr), *Aymard & Delgado 8483* (MO); Atabapo, Caserio Paloma, Río Atacari, Nov. 1989 (fr), *Velasco 1032* (NY, MO); San Carlos de Río Negro, ca. 20 km S of confluence of Río Negro and Brazo Casiquiare, 4.3 km NNE on Solano Road, 119 m, Feb. 1982 (fr), *Clark & Maquirino 8324* (NY, MO).

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Six New Species of *Neurolepis* (Poaceae: Bambusoideae: Bambuseae) from Ecuador and Peru

Lynn G. Clark
Department of Botany, Iowa State University, Ames, Iowa 50011, U.S.A.

ABSTRACT. Six new species, *Neurolepis asymmetrica, N. fimbriligulata, N. laegaardii, N. nana, N. rigida,* and *N. villosa,* are described and illustrated. Two subspecies are recognized within *N. fimbriligulata*: *N. fimbriligulata* subsp. *peruviana* and subsp. *fimbriligulata.* All taxa except for *N. fimbriligulata* subsp. *peruviana* are endemic to Ecuador; *N. fimbriligulata* subsp. *peruviana* is known only from Peru. These species were all formerly included within a broadly defined *N. aristata* (Munro) Pilger because of the presence of an awn on glumes I and II. A table comparing the six new taxa in Ecuador and *N. aristata* is provided.

Revision of the high Andean bamboo genus *Neurolepis* Meissner for the Flora of Ecuador has revealed the existence of six new species, which are here described and illustrated. All six, as well as *N. acuminatissima* (Munro) Pilger, *N. stuebelii* (Pilger) Pilger, and *N. weberbaueri* Pilger, were previously included within a very broadly circumscribed *N. aristata* (Munro) Pilger based on the presence of a well-developed awn on glumes I and II (Soderstrom, 1969), but discontinuities in variation and distribution among these six taxa are sufficient to warrant recognition at the species level. *Neurolepis acuminatissima, N. stuebelii,* and *N. weberbaueri* are now recognized as species distinct from *N. aristata* (Clark, unpublished data). A total of 12 described species of *Neurolepis,* including the six described herein and *N. stuebelii* and *N. weberbaueri,* is now known from Ecuador. With the exception of *N. fimbriligulata* and *N. laegaardii,* the other species are each restricted to one cordillera or the other in Ecuador. Among the new taxa, *N. asymmetrica, N. nana,* and *N. rigida* occur in the Eastern Cordillera, whereas *N. villosa* is found only in the Western Cordillera. *Neurolepis fimbriligulata* is principally from the Western Cordillera, with one population on the western slope of the Eastern Cordillera, and conversely, *N. laegaardii* is primarily from the Eastern Cordillera, with one population in the Western Cordillera.

The lack of vegetative branching of the aerial culms is characteristic of *Neurolepis* (McClure, 1973; Davidse & Clark, 1996). Rhizome bracts intergrade into culm leaves acropetally along each culm, making it difficult to distinguish between the two. Culm leaves usually exhibit blades, but successive culm leaves each produce a longer blade, which adds to the difficulty of characterizing the culm leaves; therefore descriptions of the culm leaves, usually an important and even diagnostic source of characters in other bamboo genera, are brief. The transition from culm leaves to foliage leaves is usually rather abrupt in *Neurolepis.* Foliage leaf morphology is very useful in distinguishing among species of *Neurolepis.* The juncture of the sheath and blade, including the sheath summit, the inner ligule, and the blade base, is critical for species identification, and should always be collected. Because the development of the pseudopetiole is so variable among the species of *Neurolepis,* the length of the pseudopetiole is excluded from the length of the blade in the descriptions.

Terminology to describe the inflorescences follows Troll (1964), Soderstrom and Londoño (1988), and Weberling (1992). The synflorescence was measured from the lowermost primary paracladium (or paracladia) to the apex of the main axis (rachis); a measurement for the peduncle is given separately, where data are available. Variation in the development of spikelets, particularly the awns of glumes I and II, is correlated with position in the synflorescence. Spikelets terminating the main axis and the primary and secondary paracladia are often slightly larger and exhibit the greatest awn development, whereas those spikelets terminating tertiary or higher order paracladia are often smaller and show markedly less awn development. Measurements were taken from the most and least developed functional spikelets to provide a full range of variation.

Measurements for the descriptions and comparisons in Table 1 were taken from virtually all specimens cited in this paper, including holo- and isotypes. When possible, two leaves were measured per specimen, but frequently only one complete leaf was available. Usually two spikelets per flowering specimen were measured.

NOVON 6: 335–350. 1996.

Neurolepis asymmetrica L. G. Clark, sp. nov. TYPE: Ecuador. Loja: páramo at road Yangana–Cerro Toledo, 3150 m, 26 Feb. 1985 (fl), *S. Lægaard 53681* (holotype, QCA; isotypes, AAU, LOJA, QCNE). Figure 1A–C.

Culmi synflorescentiis inclusis 2–2.5 m alti, 0.8–1.5 m alti sine synflorescentiis, simplices, erecti. Vaginae foliorum valde involutae, glabrae, apex marginis superpositi prolongatus, scariosus, involvens; laminae foliorum (27–) 35–65(–85) cm longae, (1.5–)2–3.3 cm latae, ratio long./lat. = 17–28(–43), lineari-lanceolatae, erectae, glabrae, costa valde excentrica; pseudopetiolus variabilis, (1.5–2.5–)9–17.5 cm longus. Synflorescentiae (21–)30–47 cm longae, 7–10 cm latae; rhachis glabra; paracladia primaria basalia (8–)11–21 cm longa. Spiculae 3.6–4.4 mm longae; gluma I variabilis, 1.3–1.6 vel 3–4.1 mm longa, 0.25–1-plo longior quam lemma, squamiformis vel mucronata vel aristata, enervis vel 1-nervis; gluma II 3–4.4 mm longa, 0.6–1.1-plo longior quam lemma, subulata vel aristata, 1-vel 3-nervis; gluma III 2.4–3.5 mm longa, 0.6–1-plo longior quam lemma, mucronata vel subulata, 3-nervis; gluma IV 2.6–3.3 mm longa, 0.66–0.9-plo longior quam lemma, mucronata, 3-nervis; lemma 3.2–3.7 mm longum, mucronatum, 5-nervis; palea 3–3.7 mm longa.

Culms 0.5–0.7 cm diam., 0.8–1.5 m tall without synflorescences, 2–2.5 m tall with synflorescences, unbranched, erect. *Internodes* not observed. *Culm leaves* bladeless, mucronate, glabrous sheaths with the nerves raised toward the apex, the apicalmost ones sometimes developing a blade to 4 mm long. *Foliage leaves* with sheaths persistent, involute, abaxially glabrous, striate, nerves slightly raised, the overlapping margin scarious, glabrous or ciliate near the apex, the summit prolonged on the overlapping side into a scarious flange, this confluent with the inner ligule and also wrapping around the pseudopetiole; blades (27–)35–65(–85) cm long, (1.5–)2–3.3 cm wide, L:W = 17–28(–43), linear-lanceolate, erect, stiff, deciduous, adaxially glabrous, not tessellate, abaxially glabrous, ± weakly tessellate, the midrib eccentric, adaxially flush, prominent, ca. 2 mm wide, forming the bottom of a groove near the base, also slightly grooved along the lower ⅓ and then flat above, visible for nearly the full length, abaxially raised, prominent, ca. 1 mm wide, forming a keel along the lower ⅓–½, less prominent above but still visible for nearly the full length, wider part of the blade (1.4–)1.9–2.6 times as wide as the narrower part, the apex tapering, the base attenuate, the margins 0.3–0.4 mm wide, cartilaginous, glabrous; pseudopetiole variable, (1.5–2.5–)9–17.5 cm long on most leaves, 0.5–1 cm long on the flag leaves, glabrous, terete; outer ligule a mere rim to 0.5 mm long, glabrous; inner ligule 6–8 mm long, rounded, abaxially hispidulous. *Synflorescence* (21–)30–47 cm long from the lowermost branch, 7–10 cm wide, paniculate, pyramidal to ovate-pyramidal when mature, exserted from the subtending leaf when mature; peduncle variable, 7–21 cm long, terete, glabrous; rachis glabrous, ridged and grooved longitudinally; coflorescences numerous, the basal ones with 4 orders of branching; paracladia angular, glabrous or scabrous along the ridges, basally adaxially pulvinate, the primary paracladia somewhat spreading to ascending, the basalmost ones (8–)11–21 cm long, the basalmost one subtended by an asymmetrical scar with a bract 0.5 mm long, other primary paracladia each subtended by a similar scar until close to the apex, secondary and higher order paracladia ascending to somewhat spreading; pedicels 1–3 mm long. *Spikelets* 3.6–4.4 mm long, slightly laterally compressed but the fertile floret slightly dorsally compressed; glumes I and II abaxially scabrous-pubescent or scabrous along the midnerve only, adaxially pubescent on the upper ½; glume I variable, 1.3–1.6 to 3–4.1 mm long, 0.25–1 times the spikelet body, scalelike to mucronate to awned, when awned the body 1.5–2.5 mm long, the awn 1.4–1.6 mm long and scabrous, enervate or 1-nerved; glume II 3–4.4 mm long, 0.6–1.1 times the spikelet body, subulate to awned, the body 2–2.5 mm long, triangular, the awn 1–2.4 mm long, 1- or 3-nerved; glumes III and IV rounded-triangular, navicular, adaxially pubescent near the apex, 3-nerved; glume III 2.4–3.5 mm long, 0.6–1 times the spikelet body, mucronate or subulate, abaxially scabrous-pubescent at the apex; glume IV 2.6–3.3 mm long, 0.66–0.9 times the spikelet body, mucronate, abaxially glabrous or scabrous at the apex; lemma 3.2–3.7 mm long, mucronate, rounded-triangular, navicular, adaxially pubescent just below the apex, abaxially glabrous or scabrous near the apex, 5-nerved; palea 3–3.7 mm long, bimucronulate, adaxially pubescent just at the apex, abaxially glabrous or scabrous near the apex, sulcate only at the tips, 2- or 4-nerved. *Lodicules* 3, glabrous; the anterior pair ca. 9 mm long; the posterior one ca. 0.7 mm long. *Stamens* 3; anthers 1.5–2 mm long. *Fruit* unknown.

Phenology. Various flowering dates and lack of information on extent of blooming make it impossible to determine flowering behavior in this species at present.

Distribution. Eastern Cordillera of Loja, Ecuador; páramo, sometimes on ridges or in bogs; 3000–3400 m.

This species is characterized by having culms 0.8–1.5 m tall (without synflorescences); involute foliage leaf sheaths with the summit prolonged into a scarious flange on the overlapping side; pseudopetiolate blades (27–)35–65(–85) cm long and

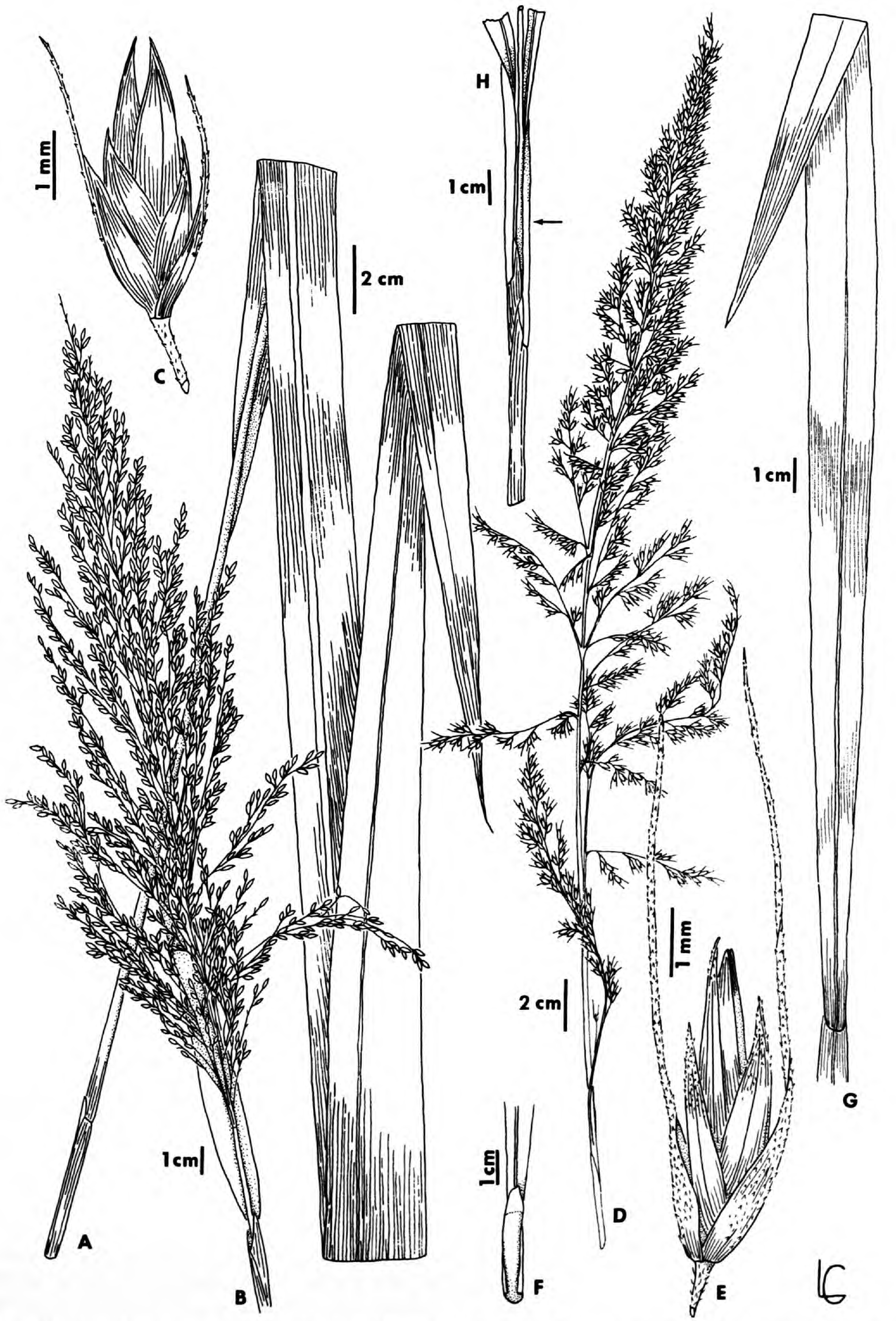

Figure 1. *Neurolepis asymmetrica* L. G. Clark and *N. rigida* L. G. Clark. A–C. *N. asymmetrica* (A, C based on *Lægaard 53681*; B based on *Lægaard 101904B*). —A. Leaf. —B. Synflorescence. —C. Spikelet. D–H. *N. rigida* (D–E, H based on *Øllgaard 38709*; F, G based on *Øllgaard 38222*). —D. Synflorescence. —E. Spikelet. —F. Ligular area of the leaf, adaxial view. —G. Leaf, abaxial view. —H. Ligular area of two leaves, showing a distinct pseudopetiole (arrow).

(1.5–)2–3.3 cm wide with a strongly eccentric midrib; an inner ligule 6–8 mm long; synflorescences (21–)30–47 cm long and 7–10 cm wide with the lowermost primary paracladia (8–)11–21 cm long; and spikelets 3.6–4.4 mm long with glume II well developed and 0.6–1 times as long as the spikelet body. *Neurolepis asymmetrica* is easily distinguished from *N. aristata* by its pseudopetiolate leaf blades with the eccentric midrib and spikelets with glume II (and sometimes glume I) aristate but no longer than the spikelet body (Table 1). *Neurolepis asymmetrica* appears to be endemic to the province of Loja, and at present is not known outside of Parque Nacional Podocarpus.

Neurolepis asymmetrica is most similar to *N. weberbaueri*, a poorly known species from Peru and Ecuador. Both share the involute foliage leaf sheaths with a scarious summit extension, pseudopetiolate blades with an eccentric midrib, and spikelets of the same size with glume II 0.6–1 times as long as the spikelet body. *Neurolepis weberbaueri*, however, consistently has much larger leaves and synflorescences such that there is virtually no overlap with *N. asymmetrica*, and the two are readily distinguishable. The blades in *N. weberbaueri* are (107–)148–180(–220) cm long and (3.2–)4–6.6 cm wide, and the synflorescences are (75–)90–108 cm long with the lowermost primary paracladia (15–)28–35 cm long. Further study of *N. weberbaueri* is needed.

Paratypes. ECUADOR. **Loja:** Parque Nacional Podocarpus, Cerro Toledo, 3350 m, 2 June 1992, *Clark et al. 1113* (AAU, ISC, QCA, US); Parque Nacional de Podocarpus, Cajanuma, few km S of Loja, 3000–3100 m, 5 Mar. 1987 (fl), *Grignon 84296* (AAU); Parque Nacional de Podocarpus, Cajanuma, at Casa de Predesur, 3050–3300 m, 24 Feb. 1985 (fl), *Lægaard 53642* (AAU, K, LOJA, QCA), 3400 m, 24 Feb. 1985 (fl), *Lægaard 53650* (AAU, LOJA, QCA); Parque Nacional de Podocarpus, along trail to Laguna de Compadre, 3200–3350 m, 25–26 Mar. 1992 (fl), *Lægaard 101904* (AAU, QCA), *Lægaard 101904B* (AAU, QCA); 17.3 km S of Loja at Parque Nacional Podocarpus Headquarters, growing along loop trail above the Headquarters, 2830–3100 m, 26 Apr. 1990 (fl), *Peterson et al. 8928* (K, QCA, QCNE, US); Parque Nacional Podocarpus, along road from Yangana to radio towers on Cerro Toledo, (2900–)3200 m, 29 Apr. 1987 (fl), *van der Werff & Palacios 9163* (MO, QCNE, US).

Neurolepis fimbriligulata L. G. Clark, sp. nov. TYPE: Ecuador. Pichincha: W side of Volcán Atacazo, along drinkwater canal, 3700–3750 m, 11 Aug. 1984 (fl), *S. Lægaard 52632* (holotype, QCA; isotypes, AAU, QCNE). Figure 2.

Culmi (1.5–)3–6 m alti, simplices, erecti. Vaginae foliorum glabrae vel hispidae versus apicem; laminae foliorum (28–)33–59(–63) cm longae, 3–6.3(–8.3) cm latae, ratio long./lat. = 7–18, lineari-lanceolatae, laxae, glabrae, costa centrica; pseudopetiolus 0.2–0.4 cm longus; ligula interna 2–20 mm longa, fimbriata; fimbriae (2–)10–50 mm longae. Synflorescentiae 59–84 cm longae, 12–20 cm latae; rhachis pubescens vel glabra; paracladia primaria basalia 18–34(–37) cm longa. Spiculae (3.6–)4–5.8 mm longae sine aristis; gluma I (4–)7–12.9 mm longa, (1–)1.3–2.7-plo longior quam lemma, aristata, 1-nervis; gluma II (2.6–)6–10.8 mm longa, (0.7–)1–2.1-plo longior quam lemma, aristata, 1(–3)-nervis; gluma III (2–)2.7–4.5 mm longa, 0.6–0.9-plo longior quam lemma, mucronata vel subulata, 3- vel 5-nervis; gluma IV 2.5–4.2(–4.9) mm longa, 0.7–1-plo longior quam lemma, mucronata vel breve subulata, 5-nervis; lemma (3–)4–5 mm longum, mucronatum, (5–)7-nervis; palea (3–)4–4.8 mm longa.

Culms 1–1.8 cm diam., (1.5–)3–6 m tall, unbranched, erect. *Internodes* 5–8 cm long near the base, (10–)15–21(–27.5) cm long above, hollow, terete, glabrous, shiny or dull; walls 1–2 mm thick. *Culm leaves* intergrading between rhizome bracts and foliage leaves, the basalmost consisting of bladeless, mucronate sheaths, abaxially hispid toward the apex, acropetally developing blades quickly, these at first about ½ the length of the sheath, articulated, becoming longer until they are indistinguishable from foliage leaf blades, the sheaths abaxially hispid on the upper half. *Foliage leaves* with sheaths persistent, abaxially glabrous or antrorsely hispid on the upper ½–⅔ (indument usually denser toward the summit) or the internerves pubescent toward the margins, usually rounded on the back, sometimes ± strongly keeled, the nerves usually not raised on basal sheaths, often raised on apical ones, the overlapping margin ciliate on the upper ½, the underlapping one ciliate near the apex, the summit often with a slight extension on one or both sides confluent with the inner ligule, usually with a tuft of cilia one each side, the lower leaves sometimes with a girdle present, 1–2 mm wide; blades (28–)33–59(–63) cm long, 3–6.3(–8.3) cm wide, L:W = 7–18, linear-lanceolate, lax, deciduous, adaxially glabrous, usually not tessellate, rarely weakly so, abaxially glabrous, strongly tessellate, the midrib centric, ± flush with the surfaces, adaxially and abaxially ± prominent along the lower half, sometimes for nearly the full length, the apex tapering, subulate, the base rounded to attenuate-rounded, the margins 0.3–0.6 mm wide, cartilaginous, glabrous to finely denticulate; pseudopetiole 0.2–0.4 cm long, usually well defined, adaxially and abaxially hispidulous, dewlaps usually well developed; outer ligule 0.5–1 mm long, usually slightly wavy, glabrous or pubescent, the margin ciliolate; inner ligule 2–20 mm long, vascularized, apically divided into well-developed fimbriae (2–)10–50 mm long, these basally flattened, apically fine and curly or flattened and straight for

Table 1. Comparison of *N. aristata*, *N. asymmetrica*, *N. fimbriligulata*, *N. laegaardii*, *N. nana*, *N. rigida*, and *N. villosa* in Ecuador.

Characters	*N. aristata*	*N. asymmetrica*	*N. fimbriligulata* subsp. *fimbriligulata*	*N. laegaardii*	*N. nana*	*N. rigida*	*N. villosa*
Foliage leaf blade	erect	erect	lax	erect	erect	erect	erect
Blade length (cm)	(13–)18–37(–50)	(27–)35–65(–85)	(28–)33–59(–63)	(8–)12–23(–26)	(11–)16–29(–39)	24–51(–63)	8–19(–27)
Blade width (cm)	1.6–3.2(–4.5)	(1.5–)2–3.3	3–6.3(–8.3)	1.7–2.6	(0.6–)0.8–1.4	1.1–2.1	1–1.6
Blade L:W	7–15(–17)	17–28(–43)	7–14	5–9	(10–)13–30(–50)	16–32(–44)	9–15(–17)
Midrib position	centric	eccentric	centric	centric	slightly eccentric	eccentric	centric
Pseudopetiole length (cm)	0.2–0.4(–0.6)	(1.5–2.5–)9–17.5	0.2–0.4	0.2–0.4	0.2–0.3	—	0.1–0.2
Inner ligule length (mm)	(1–)2–3	6–8	2–10	1–2	2–5	(3–)5–15	1–3
Fimbriae on inner ligule	—	—	+	+	+ in one population	+ or −	+
Fimbriae length (mm)	—	—	(2–)10–30	5–10	3–9	5–30	ca. 2
Synflorescence length (cm)	(19–)28–59(–75)	(21–)30–47	59–84	(16–)21–56	18–30(–37)	33–50(–68)	20–36(–41)
Synflorescence width (cm)	2–7	7–10	12–20	2–5	1–2	5–10	1–2
Basal primary paracladia length (cm)	(4–)6–15(–19)	(8–)11–21	18–34(–37)	(1.5–)3–14(–19)	2.5–5(–11)	9–17(–26)	1.5–3
Rachis indument	densely hirsute	glabrous	pubescent	finely pubescent	glabrous or pilose in one population	hirsute or hirsute-pilose or glabrous	villose
Spikelet length (mm) (excluding awns)	3.2–4.5(–5.1)	3.6–4.4	(4–)4.5–5.8	(3–)3.5–5	3.6–5.2(–6)	(3–)3.5–5	3–4(–4.4)
Ratio of glume I to spikelet length	(1–)1.3–2.6	0.25–1	1.3–2.7	2–3(–4)	(0.7–)1.1–1.7(–2)	1–2(–2.7)	(0.8–)1.2–2
Ratio of glume II to spikelet length	(0.8–)1–2.2(–3)	0.6–1.1	(0.7–)1–2.1	1.7–3	(0.7–)1.1–1.7(–2)	1–2(–2.7)	1–1.6(–2)
Distribution in Ecuador	E Cordillera, Azuay to Sucumbíos	E. Cordillera, Loja	W Cord., Pichincha & Cotopaxi; E Cord., Imbabura	E Cordillera, Loja	E Cordillera, Loja, Azuay & Morona-Santiago	E Cordillera, Napo to Morona-Santiago	W Cordillera, Azuay

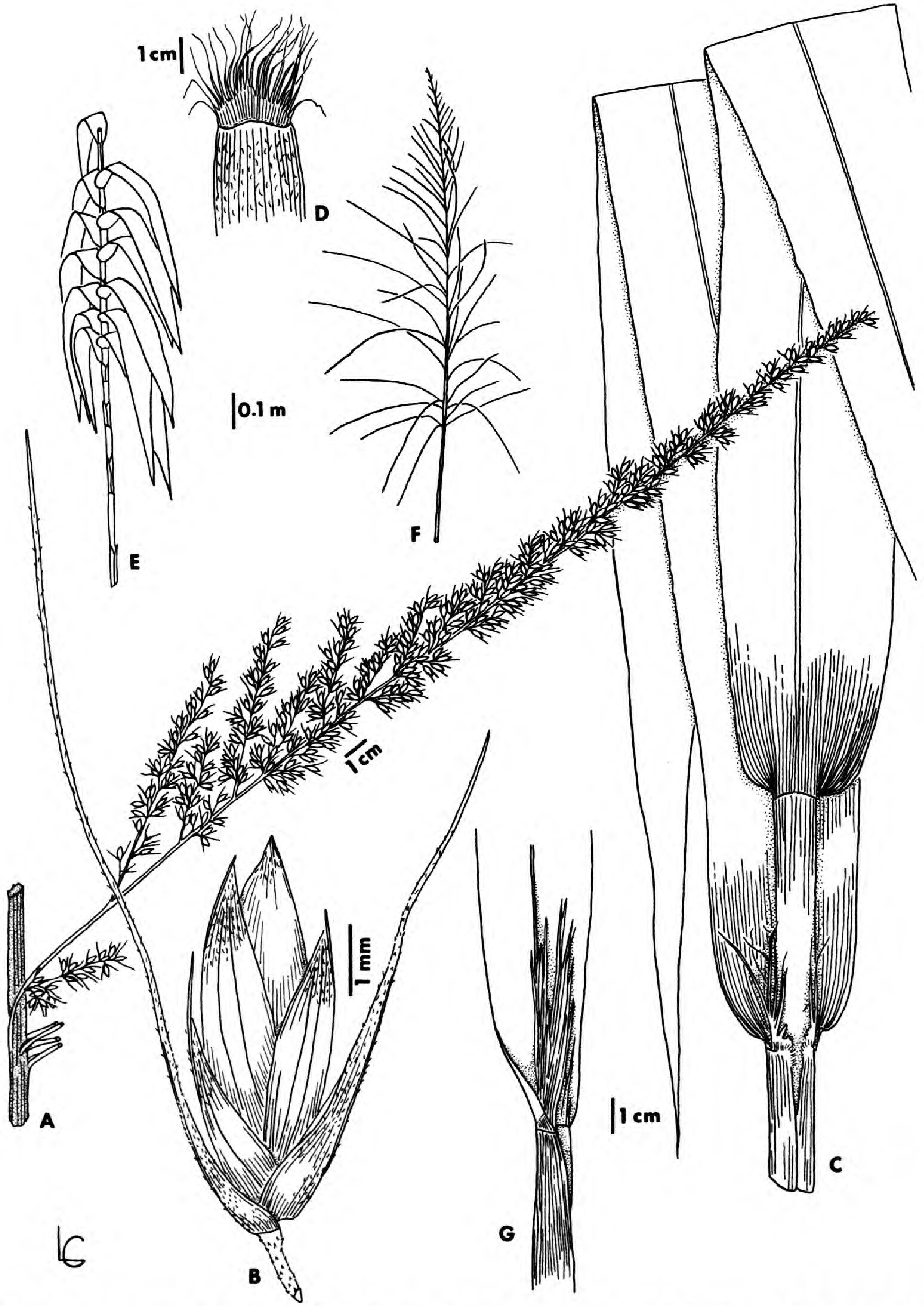

Figure 2. *Neurolepis fimbriligulata* L. G. Clark. A–F. *N. fimbriligulata* subsp. *fimbriligulata*. —A. Portion of synflorescence showing one primary paracladium. —B. Spikelet. —C. Two leaves. —D. Inner ligule, abaxial view. —E. Habit. —F. Synflorescence. —G. *N. fimbriligulata* subsp. *peruviana*, inner ligule, side view. (A based on *McClure 21425*; B based on *Lægaard 55677*; C based on *Lægaard 53257*; D based on *Young 172*; E, F based on photo of plants from Pichincha; G based on *Wurdack 1680*.)

the full length but narrowing toward the apex. *Synflorescence* 59–84 cm long from the lowermost branch, 12–20 cm wide, paniculate, pyramidal, usually exserted from the subtending leaf when mature; peduncle variable in length, often 10–14 cm long, terete, glabrous or hirsute; rachis pubescent or rarely glabrous, grooved above each primary paracladium, thus ridged and grooved longitudinally; coflorescences numerous, the basal ones with 3–4 orders of branching; paracladia angular, pubescent but hairs sparse in places, basally adaxially pulvinate, the pulvini well developed, yellow to brown, the primary paracladia appressed to the rachis when young, eventually spreading, the basalmost ones 18–34(–37) cm long, subtended by a usually ciliate scar, this disappearing in the apicalmost paracladia, secondary and higher order paracladia appressed to somewhat spreading; pedicels 0.5–2 mm long, angular, pubescent. *Spikelets* (3.6–)4–5.8 mm long excluding the awns, (3.7–6–)7.2–12.5 mm long including the awns, terete to slightly dorsally compressed; glumes I and II with the body adaxially pubescent, abaxially scabrous-pubescent, triangular, attenuate, the awn scabrous; glume I (4–) 7–12.9 mm long including the awn, (1–)1.3–2.7 times as long as the spikelet body, the body (1.2–) 2–4 mm long, 1-nerved, the awn (2.7–)4.8–9.6 mm long; glume II (2.6–)6–10.8 mm long including the awn, (0.7–)1–2.1 times as long as the spikelet body, the body 1.6–3.5 mm long, 1(–3)-nerved, the awn (2–)3.5–8 mm long; glumes III and IV rounded-triangular, slightly navicular, adaxially pubescent toward the apex, abaxially pubescent toward the apex; glume III (2–)2.7–4.5 mm long, 0.6–0.9 times as long as the spikelet body, mucronate to subulate, 3- or 5-nerved, the tip (0.4–)1–1.2 mm long; glume IV 2.5–4.2(–4.9) mm long, 0.7–1 times as long as the spikelet body, mucronate to short subulate, 5-nerved, the tip to 0.5 mm long; lemma (3–)4–5 mm long, mucronate, rounded-triangular, navicular, adaxially pubescent at the apex, abaxially with some scattered short hairs near the apex, (5–)7-nerved; palea (3–)4–4.8 mm long, bimucronulate, adaxially pubescent just at apex, abaxially with a few scattered hairs at the apex, sulcate only at the tips, 2- or 4-nerved. *Lodicules* 3, all strongly vascularized on the lower ½ to ⅔, apically sparsely ciliate; the anterior pair 1.3–1.7 mm long; the posterior one 0.8–1.5 mm long. *Ovary* glabrous. *Stamens* 3; anthers 2.8–3.2 mm long. *Fruit* unknown.

Phenology. The 1980 flowering of the Imbabura population (*Young 172*) was apparently gregarious, but a flowering collection of the same population from 1976 (*Øllgaard & Balslev 8556*) indicates that sporadic or continuous flowering may also occur. No data on extent of flowering in the other populations are available.

Distribution. Western Cordillera of Ecuador (Pichincha and Cotopaxi) with one population in the Eastern Cordillera (Imbabura), and in northern Peru; high montane forest, *Polylepis* forest, and remnants/secondary scrub of these forests; 3100–3850 m.

This species is named for its well-developed, fimbriate inner ligules. It is also characterized by the culms (1.5–)3–6 m tall; lax foliage leaf blades (28–)33–59(–63) cm long, 3–6.3(–8.3) cm wide, and L:W = 7–18; synflorescence 12–20 cm wide with the basal primary paracladia 18–34(–37) cm long; and spikelets with the body (3.6–)4–5.8 mm long. The combination of size, long fimbriate inner ligules, lax foliage leaf blades, and the wide inflorescence distinguish *N. fimbriligulata* from the other species with long awns on glumes I and II (Table 1).

The geographic disjunction between the Peruvian populations of this species and the Ecuadorian ones is striking, and certain features (in particular the leaf sheaths, relative width of the leaf blades, length and curliness of the fimbriae, and pubescence of the rachis and lemma) differ between these two groups of populations. I have elected to recognize two subspecies, but when the Peruvian taxon is better known, it may prove to represent a separate species.

A. **Neurolepis fimbriligulata** subsp. **fimbriligulata**

Foliage leaves with sheaths rounded on the back; blades with L:W = 7–14, the midrib ± prominent on the lower half; inner ligule 2–10 mm long, the fimbriae (2–)10–30 mm long, flattened at base, fine and curly at apex. *Synflorescence* with the rachis pubescent. *Spikelets* (4–)4.5–5.8 mm long excluding the awns; glume I 1.3–2.7 times as long as the spikelet body; lemma abaxially scabrous-pubescent toward the apex. Figure 2A–F.

Paratypes. ECUADOR. **Cotopaxi:** at Isinlivi, 3500 m, 2 July 1985, *Lægaard 54618* (AAU, QCA); about 19 mi. above Macuchi on the road from Pichilingue to Latacunga, 15 Oct. 1945 (fl), *McClure 21425* (US). **Imbabura:** Páramo de Mariano Acosta, Km 26 Yahuarcocha–Mariano Acosta, 3570 m, 8 Feb. 1992 (fl), *Lægaard 101198* (AAU, QCA); road Ibarra–Mariano Acosta, E of the pass, 3500–3600 m, 9 Aug. 1976 (fl), *Øllgaard & Balslev 8556* (AAU, F); Pimampiro Canton, Ibarra–Mariano Acosta, Loma Yaralpacunga, 3400 m, 3 Mar. 1992 (fl), *Palacios & Tipaz 9910* (QCNE); 22 km from Yuracruz on the road to Mariano Acosta, 3600 m, 9 June 1980 (fl), *Young 172* (AAU, QCA, US). **Pichincha:** foret des pentes occid. du Pichincha, 29 Nov. 1930 (fl), *Benoist 3342* (P); Malchinguí to Pomasqui, 3000–3600 m, 13 Aug. 1923 (fl), *Hitchcock 20863* (US); Volcán Atacazo, W slope, 17 km from San Juan, 3850 m, 25 Aug. 1980, *Holm-Nielsen & Asanza 25097* (AAU, QCA); along drinkwater canal on W side of Volcán Atacazo, 3750–3800 m, 24 Nov. 1985 (fl), *Lægaard 55677* (AAU); along drinkwater canal on W side of Atacazo, ca. 5 km S of Campamento, 3750 m, 28 Oct. 1984 (fl), *Lægaard 53257* (AAU); N side of Volcán Pichincha above Hacienda Yanacocha, 3800 m, 4 June 1985, *Lægaard 54464* (AAU, QCA), *54470* (AAU), *54471* (AAU, QCA), *54472* (AAU, QCA), *54473* (AAU, QCA), *54483* (AAU, QCA).

B. Neurolepis fimbriligulata subsp. **peruviana** L. G. Clark, subsp. nov. TYPE: Peru. Amazonas: Prov. Chachapoyas, S side of Molinopampa–Diosan pass, 3100 m, 8 Aug. 1962 (fl), *Wurdack 1636* (holotype, US—10 sheets; isotype, USM—1 sheet). Figure 2G.

Vaginae foliorum plus minusve valde carinatae; laminae ratio long./lat. = 13–18, costa plus minusve prominens pro fere longitudine laminorum; ligula interna 5–20 mm longa; fimbriae 20–50 mm longae, complanatae, rectae, angustatae ad apicem. Synflorescentiae rhachidi glabra. Spiculae 3.6–4 mm longae sine aristis; glume I 1–1.6-plo longior quam lemma; lemma abaxialiter glabrum.

Foliage leaves with sheaths ± strongly keeled; blades with L:W = 13–18, the midrib ± prominent for nearly the entire length; inner ligule 5–20 mm long, the fimbriae 20–50 mm long, flattened, straight, narrowed toward the apex. *Synflorescence* with the rachis glabrous. *Spikelets* 3.6–4 mm long excluding the awns; glume I 1–1.6 times as long as the spikelet body; lemma abaxially glabrous.

Paratypes. PERU. Locality unknown, 1909–1914 (fl), *Weberbauer 7159* (F). **Amazonas:** Prov. Chachapoyas, upper slopes and summit of Cerro Yama-uma above Taulia, 12–15 km SSE (145°) of Molinopampa, 3200–3400 m, 11 Aug. 1962 (fl), *Wurdack 1680* (F, K, US, USM).

Neurolepis laegaardii L. G. Clark, sp. nov. TYPE: Ecuador. Loja: Parque Nacional Podocarpus, Cerro Toledo, 3350 m, 2 June 1992 (fl), *L. Clark, S. Lægaard & M. J. Stern 1112* (holotype, QCA; isotypes, AAU, ISC, MO, QCNE, US). Figure 3A–D.

Culmi 0.15–0.8 m alti, simplices, erecti. Vaginae foliorum glabrae; laminae (8–)12–23(–26) cm longae, 1.7–2.6 cm latae, ratio long./lat. = 5–9, ovati- vel lineari-lanceolatae, erectae, adaxialiter glabrae in dimidio inferiore, scabrae-hispidae in dimidio superiore, abaxialiter glabrae, costa centrica; ligula interna 1–2 mm longa, fimbriata; fimbriae 5–10 mm longae. Synflorescentiae (16–) 21–56 cm longae, 2–5 cm latae; rhachis subtiliter pubescens; paracladia primaria basalia variabilia, (1.5–)3–14(–19) cm longa. Spiculae (3–) 3.5–5 mm longae sine aristis; gluma I (7.4–)9.6–18(–24) mm longa, 2–3(–4)-plo longior quam lemma, aristata, 1-nervis; gluma II (8.2–) 10.2–13 mm longa, 1.7–3-plo longior quam lemma, aristata, 1(–3)-nervis; glumae III et IV (1.8–)3.2–4.1 mm longae, (0.6–)0.7–0.9-plo longior quam lemma; gluma III subulata vel aristata, 3-nervis; gluma IV mucronata, 5-nervis; lemma (2.8–)3.6–4.5 mm longum, mucronulatum, (5–)7-nervis; palea (2.9–)3.6–4.2 mm longa.

Culms 0.3–0.6 cm diam., 0.15–0.8 m tall, unbranched, erect. *Internodes* 3–6(–12) cm long, hollow, terete; walls ca. 1 mm thick. *Culm leaves* with sheaths glabrous, the nerves not raised, the internerves appearing papillose, the margins ciliate, often densely so; blades small, mucronate. *Foliage leaves* often appearing crowded toward apex of culm; sheaths persistent, abaxially glabrous, the nerves not raised, the internerves appearing finely papillose under the dissecting microscope, the overlapping margin ciliate for the upper ½, densely so at the summit, the underlapping margin densely ciliate at least at the apex, the summit lacking any extensions; girdle absent; blades (8–)12–23(–26) cm long, 1.7–2.6 cm wide, L:W = 5–9, ovate- to linear-lanceolate, erect, stiff, deciduous, adaxially glabrous and weakly tessellate on the lower half, on the upper half the nerves scabrous-hispid with antrorse hairs and not tessellate, abaxially glabrous, not tessellate, the midrib centric, flush with the surfaces, adaxially and abaxially prominent along the lower half, the apex tapering, short subulate, the base rounded, often slightly clasping, the margins ca. 0.5 mm wide, cartilaginous, glabrous; pseudopetiole 0.2–0.4 mm long, ± well defined, abaxially glabrous, dewlaps often present, but well developed only on the largest leaves; outer ligule ca. 0.5 mm long, glabrous, wavy to erose; inner ligule 1–2 mm long, vascularized, the margin fimbriate with nerves extending into the fimbriae, fimbriae 5–10 mm long, flattened at the base. *Synflorescence* (16–)21–56 cm long from the lowermost branch, 2–5 cm wide, paniculate, narrowly pyramidal, exserted from the subtending leaf when mature; peduncle 3–10 cm long, finely striate, terete, mostly glabrous but with some vertical stripes of scattered pubescence; rachis finely pubescent, becoming ciliate on the ridges above the middle, grooved above each primary paracladium, thus grooved and ridged longitudinally; coflorescences numerous, the basal ones with 4 orders of branching; paracladia angular, pubescent, at least weakly basally adaxially pulvinate, the primary paracladia appressed, eventually spreading, the basalmost ones variable, (1.5–)3–14(–19) cm long, subtended by an asymmetrical scar, often a bract present also, this 3–4 mm long, papery, hispid in parts, the next primary paracladium subtended by a similar but smaller bract, sec-

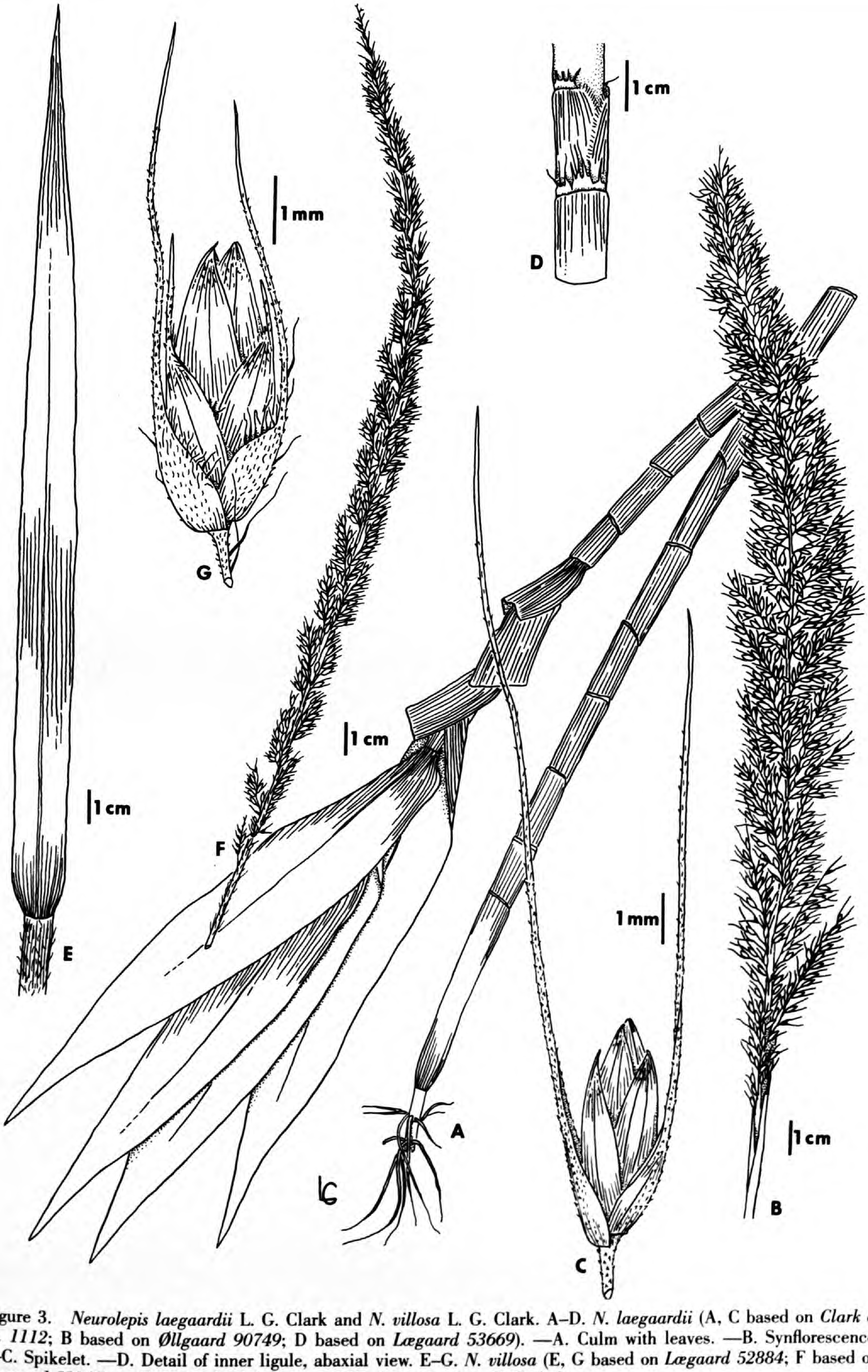

Figure 3. *Neurolepis laegaardii* L. G. Clark and *N. villosa* L. G. Clark. A–D. *N. laegaardii* (A, C based on *Clark et al. 1112*; B based on *Øllgaard 90749*; D based on *Lægaard 53669*). —A. Culm with leaves. —B. Synflorescence. —C. Spikelet. —D. Detail of inner ligule, abaxial view. E–G. *N. villosa* (E, G based on *Lægaard 52884*; F based on *Lægaard 52848*). —E. Leaf, abaxial view. —F. Synflorescence. —G. Spikelet.

ondary and higher order paracladia ± appressed; pedicels 0.5–2 mm long. *Spikelets* (3–)3.5–5 mm long excluding the awns, (6.8–)9.5–14.5(–24) mm long including the awns, terete to slightly dorsally compressed; glumes I and II with the body triangular, adaxially appressed pubescent, abaxially scabrous-pubescent, the midnerve and awn scabrous; glume I (7.4–)9.6–18(–24) mm long including the awn, 2–3(–4) times as long as the spikelet body, the body (1.4–)2–3.5 mm long, ± attenuate at the apex, 1-nerved, the awn (6–)8–14.5(–20) mm long; glume II (8.2–)10.2–13 mm long including the awn, 1.7–3 times as long as the spikelet body, the body (1–) 2–4 mm long, somewhat abruptly narrowed at the apex, 1(–3)-nerved, the awn (4–)5.8–9 mm long; glumes III and IV (1.8–)3.2–4.1 mm long, (0.6–)0.7–0.9 times as long as the spikelet body, rounded-triangular, somewhat navicular, adaxially appressed pubescent near the apex, abaxially with a few scattered hairs at the apex; glume III subulate to aristate, 3-nerved, the tip 0.5–1.3 mm long; glume IV mucronate, 5-nerved; lemma (2.8–)3.6–4.5 mm long, mucronulate, rounded, navicular, adaxially pubescent just below the apex, abaxially glabrous, (5–)7-nerved; palea (2.9–)3.6–4.2 mm long, usually slightly longer than the lemma, bimucronulate, adaxially appressed pubescent just below apex, abaxially glabrous, sulcate only between the tips, 2- or 4-nerved. *Lodicules* 3, vascularized, apically sparsely ciliate; the anterior pair ca. 1 mm long; the posterior one ca. 0.7 mm long. *Stamens* 3; anthers 2–2.5 mm long. *Fruit* unknown.

Phenology. Only two clumps were in flower at Cerro Toledo (the type locality) in 1992, and label data indicate that only some plants were flowering along the trail to Laguna de Compadre in the same year (*Lægaard 101905A*). The Cerro Toledo population had at least some plants in flower in 1985 (*Lægaard 53669*), as did the Laguna de Compadre population in 1989. Additional observations are needed to determine whether this species flowers continuously.

Distribution. Loja and Zamora–Chinchipe, Ecuador; páramo, sometimes dominant; 3200–3500 m.

This species is named in honor of Simon Lægaard (Aarhus University, Denmark), who has spent many years collecting and studying the grass flora of Ecuador. *Neurolepis laegaardii* is distinguished by the culms 0.15–0.8 m tall; foliage leaves often appearing crowded toward the apex of the culm; erect foliage leaf blades (8–)12–23(–26) cm long, 1.7–2.6 cm wide, and L:W = 5–9; fimbriate inner ligules with the fimbriae 5–10 mm long; synflorescence (16–)21–56 cm long; and spikelets with glume I 2–3(–4) times as long as the spikelet body and glume II 1.7–3 times as long as the spikelet body. This species has broader leaves and longer awns than any of the others in the *N. aristata* group (Table 1).

Paratypes. ECUADOR. Department unknown (probably Loja): Santa Barbara, 3200 m, *André 4499* (K, US). **Loja:** Horta–Naque, 3500–3800 m, 8 Nov. 1946 (fl), *Espinosa E954* (LOJA); Cerro Chinchilla "Parroquía Celén," 19 Sep. 1984 (fl), *Jaramillo 7313* (QCA); Fierro Urcu, Saraguro–Loja, Km 12.4 turnoff towards Fierro Urcu, Km 23.8, 3840 m, 6 Dec. 1994 (fl), *Jørgensen et al. 1197* (LOJA, QCNE); Parque Nacional de Podocarpus, Cajanuma, Casa de Predesur, 3400 m, 24 Feb. 1985 (fl), *Lægaard 53647* (AAU, QCA); Cerro Toledo, E of Yangana páramo, 3400–3500 m, 26 Feb. 1985 (fl), *Lægaard 53669* (AAU, LOJA, QCA, QCNE); Parque Nacional de Podocarpus, along trail to Laguna de Compadre, 3200–3350 m, 25–26 Mar. 1992 (fl), *Lægaard 101905A* (AAU, QCA), *101905B* (AAU, QCA); Parque Nacional de Podocarpus, along trail to Laguna de Compadre, 3200–3300 m, 25–26 Mar. 1992 (fl), *Lægaard 101924* (AAU); Fierro Urcu, 3700 m, 11 Jan. 1995 (fl), *Lozano C. 115* (LOJA); Parque Nacional de Podocarpus, vicinity of Lagunas de Compadre, c. 6 hours walking from the Centro de Información, 3000–3400 m, 21 Nov. 1989 (fl), *Madsen & Pedersen 86465* (AAU); Rumishitana, Laguna Estrella, Las Escobas, 19 Apr. 1978 (fl), *Vivar C. & Pasaca 999* (LOJA). **Loja/Zamora–Chinchipe:** Parque Nacional Podocarpus, crest of the Cordillera de los Andes E and SE of Nudo de Cajanuma, along trail from 'Centro de Información' to Lagunas del Compadre, 3250–3350 m, 2 Mar. 1989 (fl), *Øllgaard 90749* (AAU, LOJA, QCA, QCNE).

Neurolepis nana L. G. Clark, sp. nov. TYPE: Ecuador. Loja: Parque Nacional de Podocarpus, Cerro Toledo, along ridge, 3400 m, 2 June 1992 (fl), *L. Clark, S. Lægaard & M. J. Stern 1111* (holotype, QCA—3 sheets; isotypes, AAU, ISC, MO, QCNE, US). Figure 4.

Culmi synflorescentiis inclusis 0.2–1(–1.3) m alti, 0.2–0.5 m alti sine synflorescentiis, simplices, erecti. Vaginae foliorum glabrae; laminae (11–)16–29(–39) cm longae, (0.6–)0.8–1.4 cm latae, ratio long./lat. = (10–)13–30(–50), lineari-lanceolatae, erectae, adaxialiter scabridae vel glabrae, abaxialiter glabrae vel raro pilosae, costa tantum excentrica; ligula interna 2–5 mm longa, rotundata vel raro fimbriata; fimbriae 3–9 mm longae. Synflorescentiae 18–30(–37) cm longae, 1–2.5 cm latae; rhachis glabra vel raro pilosa; paracladia primaria basalia 2.5–5.5(–11) cm longa. Spiculae 3.6–5.2(–6) mm longae sine aristis; glumae I et II (0.7–)1.1–1.7(–2)-plo longior quam lemma, aristatae, 1- vel 3-nervis, aristae validae; gluma I (3.8–)5–8.3(–11) mm longa; gluma II 3.6–8.5(–10) mm longa; gluma III 2.8–4.2(–5) mm longa, (0.6–)0.7–0.9-plo longior quam lemma, acuta vel breve subulata, 3(–5)-nervis; gluma IV 3.1–4.3(–5) mm longa, 0.8–0.9(–1)-plo longior quam lemma, acuta vel mucronata, 5-nervis; lemma 3.8–4.9(–5.4) mm longum, acutum vel mucronatum, 5(–7)-nervis; palea 3.5–4.5(–5) mm longa.

Culms 2–4 mm diam., 0.2–1(–1.3) m tall, 0.2–

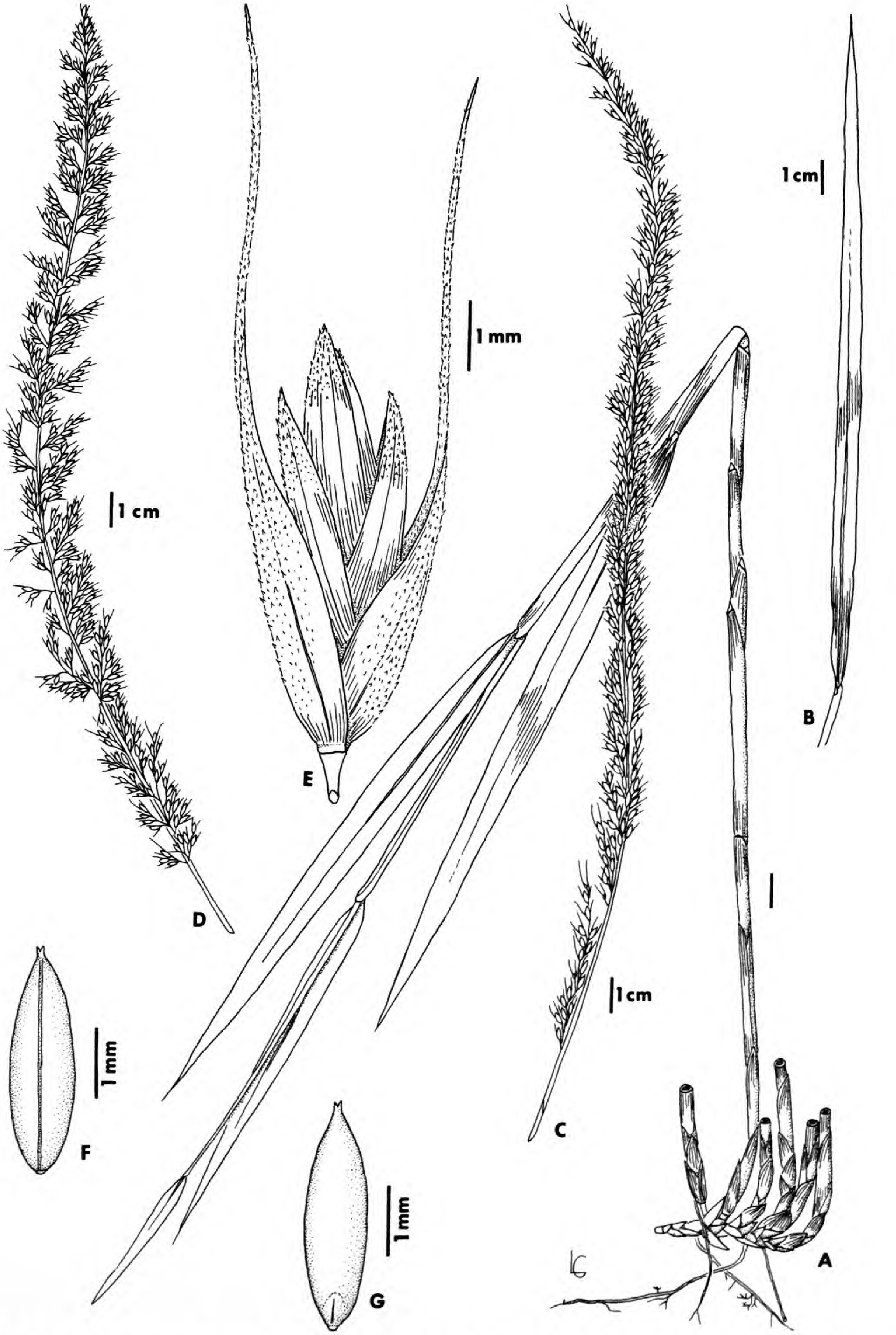

Figure 4. *Neurolepis nana* L. G. Clark (A, C, F, G based on *Clark et al. 1111*; B based on *Clark et al. 1082*; D based on *Lægaard 53815*; E based on *Madsen et al. 75650*). —A. Plant with rhizomes and leaves, Loja population. —B. Leaf, Azuay population. —C. Synflorescence, Loja population. —D. Synflorescence, Azuay population. —E. Spikelet. —F. Caryopsis, showing hilum. —G. Caryopsis, showing embryo.

0.5 m tall without inflorescences, unbranched, erect. *Internodes* 1–6.5 cm long, terete, glabrous. *Culm leaves* intergrading between rhizome bracts and foliage leaves, the basalmost consisting of bladeless, mucronate, glabrous sheaths with nerves evident but not raised, the more apical ones developing blades, the sheaths with nerves slightly raised and fairly prominent, the internerves appearing papillose, the margins scarious, the blades to 1.8 cm long, deciduous. *Foliage leaves* with sheaths persistent, keeled at least toward the apex, the midrib prominent near the apex, abaxially glabrous, the nerves raised, the internerves appearing papillose under the microscope, the margins scarious, the summit with a small extension on each side confluent with the inner ligule, or the overlapping margin sparsely ciliate and the internerves on that side pubescent toward the keel and summit, or the internerves pubescent to pilose for the upper ½–⅓; blades (11–)16–29(–39) cm long, (0.6–)0.8–1.4 cm wide, L:W = (10–)13–30(–50), linear-lanceolate, erect, stiff, deciduous, adaxially scabrid or glabrous, not tessellate, abaxially glabrous or ± densely pilose in one population, tessellate, the midrib slightly eccentric, sometimes this only noticeable toward the apex, adaxially flush with the surface, ca. 1 mm wide at the base, prominent on the basal half, becoming indistinguishable from the other nerves toward the apex, abaxially raised, not as wide but prominent or at least distinguishable for the full length, the apex tapering, subulate, the base attenuate or rounded-attenuate, the margins 0.5–0.7 mm wide, cartilaginous, glabrous or denticulate; pseudopetiole 0.2–0.3 cm long, well defined, glabrous, dewlaps absent; outer ligule 0.1–0.4 mm long, glabrous or ciliolate; inner ligule 2–5 mm long, chartaceous, glabrous, vascularized, usually rounded to asymmetrical, irregularly fimbriate in one population, the fimbriae 3–9 mm long. *Synflorescence* 18–30(–37) cm long from the lowermost branch, 1–2.5 cm wide, paniculate, linear, exserted from the subtending leaf when mature; peduncle variable, (5–)11–30(–44) cm long, terete to slightly flattened, glabrous, striate; rachis glabrous or pilose in one population, grooved above each primary paracladium, thus grooved and ridged longitudinally; coflorescences numerous, the basal ones with 3 orders of branching; paracladia angular, glabrous or pilose in one population, usually not pulvinate, rarely with moderately developed basal adaxial pulvini, the primary paracladia usually appressed to ascending, occasionally somewhat spreading, the basalmost ones 2.5–5.5(–11) cm long, subtended by an asymmetrical scar, often a bract present also, this 1–3 mm long, glabrous, somewhat more apical primary paracladia often subtended by a scar, secondary and higher order paracladia usually appressed but sometimes slightly spreading; pedicels 1–4 mm long, angular, glabrous or pubescent in one population. *Spikelets* 3.6–5.2(–6) mm long excluding the awns, 4.9–8.5(–10.8) mm long including the awns, slightly laterally compressed; glumes I and II (0.7–)1.1–1.7(–2) times as long as the spikelet body, the body attenuate, adaxially pubescent, abaxially scabrous, slightly less so near the margins, 1- or 3-nerved, the awn stout, scabrous; glume I (3.8–)5–8.3(–11) mm long including the awn, the body (1.5–)2–4.5 mm long, the awn (1.7–)2.3–5.5(–6.7) mm long; glume II 3.6–8.5(–10) mm long including the awn, the body 2–4 mm long, the awn 1.6–5(–7) mm long; glumes III and IV with the body rounded-triangular, navicular, adaxially pubescent toward the apex; glume III 2.8–4.2(–5) mm long, (0.6–)0.7–0.9 times as long as the spikelet body, acute to short subulate, abaxially scabrous on the upper ⅓, 3(–5)-nerved, the tip (when present) to 0.5 mm long; glume IV 3.1–4.3(–5) mm long, 0.8–0.9(–1) times as long as the spikelet body, acute to mucronate, abaxially scabrous on the upper ⅓ to glabrous, 3- or 5-nerved; lemma 3.8–4.9(–5.4) mm long, acute to mucronate, rounded-triangular, navicular, adaxially pubescent just below the apex, abaxially scabrous near the apex to glabrous, 5(–7)-nerved; palea 3.5–4.5(–5) mm long, bimucronulate, adaxially pubescent just at apex, abaxially scabrous near the apex to glabrous, sulcate only at the tips, 2(–4)-nerved. *Lodicules* 3, vascularized on the lower ½, apically glabrous; the anterior pair 1–2 mm long, asymmetrical; the posterior one 1–1.5 mm long, symmetrical. *Stamens* 3; anthers 2.2–2.5 mm long. *Fruit* a caryopsis (only one seen), 3.1 mm long, 1 mm wide, brown; persistent beak 0.2 mm long; hilum linear, reddish; embryo small, ca. 0.5 mm long.

Phenology. Flowering collections from 1976, 1984, 1985, 1988, and 1992 do not indicate any regular cycle of flowering in the various populations, and little information on extent of flowering is available. In 1992, both the Cerro Toledo population in Loja (*Clark et al. 1111*) and the Gualaceo-Limón population in Azuay (*Clark et al. 1088*) were mostly vegetative, suggesting that this species flowers sporadically or continuously.

Distribution. Eastern Cordillera of Ecuador in the provinces of Azuay, Loja, and Morona–Santiago; páramo; 3150–3600 m.

Neurolepis nana is one of the most diminutive members of this genus. It is characterized by the culms 0.2–0.5 m tall; blades (11–)16–29(–39) cm long, (0.6–)0.8–1.4 cm wide, and L:W = (10–)13–30(–50) with a slightly eccentric midrib; linear synflorescences 18–30(–37) cm long and 1–2.5 cm wide; and spikelets with glumes I and II abaxially scabrous with stout awns. This species is very similar to *N. villosa,* but the two are distinguished by the more rounded foliage leaf blade bases, villose leaf sheaths and rachis, smaller spikelets, and more delicate awns on glumes I and II of the latter (Table 1). In addition, *N. nana* is restricted to the Eastern Cordillera whereas *N. villosa* is endemic to the Western Cordillera. *Neurolepis nana* is also close to *N. rigida,* and the two are sympatric in Azuay. They are distinguished by the larger leaf blades and larger, more open and narrowly pyramidal synflorescences of *N. rigida* (Table 1).

The Azuay populations of *N. nana* differ from the Loja populations in having narrower foliage leaf blades (Fig. 4B), more open synflorescences (Fig. 4D), and glume IV, the lemma, and the palea abaxially glabrous or nearly so. In addition, the population of *N. nana* on the road from Gualaceo to Limón has an irregularly fimbriate inner ligule. The other population in Azuay, along the Sigsig–Chiguinda road, has nonfimbriate inner ligules but the foliage leaf sheaths are pilose on the upper ⅓–½, leaf blades are abaxially pilose, and the rachis is pilose.

Paratypes. ECUADOR. **Azuay:** at pass on road from Gualaceo to Limón (Gral. L. Plaza Gutierrez), 3420 m, 30 May 1992 (fl), *Clark et al. 1088* (AAU, ISC, MO, QCA, US); road Gualaceo–Sucuá, just W of pass, 3450 m, 23 Oct. 1984 (fl), *Lægaard 53215* (AAU); road Sigsig–Gualaquiza, in pass, 3300 m, 4 Mar. 1985 (fl), *Lægaard 53814* (AAU, QCA), *53815* (AAU, QCA); uppermost W slopes of the Cord. Oriental, 0.5–2 km N of (above) the pass on the Gualaceo–Limón road, 3500–3600 m, 4 Feb. 1988 (fl), *Molau & Eriksen 2917* (AAU, GB, QCA, QCNE). **Azuay/Morona–Santiago:** at pass on road between Sigsig and Chiguinda, 3300 m, 29 May 1992 (fl), *Clark et al. 1082* (AAU, ISC, MO, QCA, US). **Loja:** Horta–Naque, 3600–3800 m, 9 Nov. 1946 (fl), *Espinosa E-989* (LOJA, US); carretera Yangana–Toledo, 3420 m, 28 Dec. 1988 (fl), *Jaramillo 10596* (AAU, QCA); Parque Nacional de Podocarpus, Cajanuma, Casa de Predesur, 3050 m, 22 Feb. 1985, *Lægaard 53620* (LOJA); Parque Nacional de Podocarpus, Cajanuma, at Casa de Predesur, 3400 m, 24 Feb. 1985 (fl), *Lægaard 53654* (AAU, LOJA, QCA); Cerro Toledo, E of Yangana Páramo, 3400–3500 m, 26 Feb. 1985 (fl), *Lægaard 53671* (AAU, LOJA, QCA, QCNE), *53676* (AAU, K, LOJA, QCA, QCNE); páramo at road Yangana–Cerro Toledo, 3150 m, 26 Feb. 1985 (fl), *Lægaard 53679* (AAU); Parque Nacional de Podocarpus, along trail to Laguna de Compadre, 3200–3350 m, 25–26 Mar. 1992 (fl), *Lægaard 101921* (AAU, QCA), *101934* (AAU, QCA); sendero Amaluza–Palanda, cerca de la Laguna Arrebatadas, 3350 m, 4 Apr. 1985 (fl), *Larsen & Eriksen 18* (AAU, GB, QCA); Parque Nacional de Podocarpus, Cerro Toledo, 3350 m, 1 Dec. 1988 (fl), *Madsen et al. 75650* (AAU, LOJA, QCA, QCNE); muletrack Amaluza–Palanda, western slope, near the pass (at Laguna Areviatadas Pilares), 3350–3450 m, 22 Sep. 1976 (fl), *Øllgaard & Balslev 9701* (AAU, F), *9710* (AAU); Parque Nacional Podocarpus, Sep. 1991, *Vivar C. & Merino 3832* (LOJA); Amaluza, Laguna Chuquiragua, 1 Dec. 1983 (fl), *Vivar C. & Merino 1985* (LOJA). **Morona–Santiago:** road Sigsig–Gualaquiza, E of the pass, 3300 m, 31 Aug. 1985 (fl), *Lægaard 52818* (AAU); road Gualaceo–Limón, from the pass towards Limón, 3200–3400 m, 8 Feb. 1989 (fl), *van der Werff & Palacios 10477* (MO, QCNE).

Neurolepis rigida L. G. Clark, sp. nov. TYPE: Ecuador. Napo: Llanganati, páramo SE of Chosa Aucacocha, between Aucacocha and Pan de Azucar, 3800–3900 m, 15 May 1982 (fl), *B. Øllgaard, L. Holm-Nielsen, B. Boysen Larsen, L. P. Kvist, A. R. Jensen & S. Wium-Andersen 38498* (holotype, QCA; isotypes, AAU, F). Figure 1D–H.

Culmi synflorescentiis inclusis 1–2.5 m alti, 0.5–1 m alti sine synflorescentiis, simplices, erecti. Vaginae foliorum glabrae vel pubescentes; laminae 24–51(–63) cm longae, 1.1–2.1 cm latae, ratio long./lat. = 16–32(–44), lanceolatae, erectae, rigidae, adaxialiter glabrae, abaxialiter glabrae vel raro pilosae, costa tantum vel valde excentrica; ligula interna (3–)5–15 mm longa, rotundata vel irregularis vel erosa, efimbriata vel fimbriata; fimbriae 5–30 mm longae. Synflorescentiae 33–50(–68) cm longae, 5–10 cm latae; rhachis hirsuta vel hirsuti-pilosa vel raro glabra; paracladia primaria basalia 9–17(–26) cm longa. Spiculae (3–)3.5–5 mm longae sine aristis; glumae I et II 1–2(–2.7)-plo longior quam lemma, aristatae, abaxialiter scabrae, aristae plus minusve valde, scabrae; gluma I 6–8.5(–11) mm longa; gluma II 5.6–9.5(–13) mm longa; gluma III (2.4–)3–3.9(–5) mm longa, 0.66–1-plo longior quam lemma, mucronata vel breve subulata, 3-nervis; gluma IV (2.2–)2.8–4.5 mm longa, (0.68–)0.8–1-plo longior quam lemma, mucronata, 3-nervis; lemma (2.9–)3.5–5 mm longum, mucronatum, 5(–7)-nervis; palea (2.8–)3.5–4.5 mm longa.

Culms 0.4–0.8 cm diam., 1–2.5 m tall, 0.5–1 m tall without synflorescences, unbranched, erect. *Internodes* not observed. *Culm leaves* intergrading between rhizome bracts and foliage leaves, the basalmost consisting of bladeless, mucronate, glabrous sheaths with nerves slightly raised, the more apical ones with scarious margins, terminating in a mucro or a small blade up to 1.4 cm long. *Foliage leaves* with sheaths persistent, keeled toward the apex, abaxially glabrous or the internerves pubescent, in some pubescent only toward the apex, the margins scarious, the summit extended on each side for 4–11 mm and adnate to the inner ligule, the summit extensions glabrous or pubescent; blades 24–51(–63) cm long, 1.1–2.1 cm wide, L:W = 16–32(–44), lanceolate, erect, stiff, deciduous, adaxially glabrous, not tessellate, abaxially glabrous, rarely with scattered long weak hairs, tessellate, the midrib slightly to markedly eccentric, adaxially flush with the surface, 1(–1.5) mm wide at the base, prominent on the lower ⅓–½, abaxially 0.5–1 mm wide, projecting, forming a keel near the base, visible but not so prominent toward the apex, the apex tapering, subulate, the base attenuate, not pseudopetiolate although sometimes appearing slightly constricted for 1–3 cm above the juncture with the sheath, the margins 0.3–0.6 mm wide, cartilaginous, glabrous or denticulate; outer ligule 0.1–0.3 mm long, glabrous; inner ligule (3–)5–15 mm long, chartaceous, pubescent, vascularized, rounded to irregular or erose, in some fimbriate, the fimbriae 5–30 mm long, flattened. *Synflorescence* 33–50(–68) cm long from the lowermost branch, 5–10 cm wide, paniculate, narrowly pyramidal, exserted from the subtending leaf when mature; peduncle variable, (10–19–)30–66 cm long, terete, glabrous; rachis hirsute or hirsute-pilose, rarely glabrous, grooved above each primary paracladium, thus ridged and grooved longitudinally; coflorescences numerous, the basal ones with 4 orders of branching; paracladia angular, hirsute, basally adaxially pulvinate, the primary paracladia somewhat spreading to spreading, the basalmost ones 9–17(–26) cm long, subtended by an asymmetrical scar and also often a glabrous bract to 3 mm long, at least the more basal secondary paracladia on all primary paracladia spreading to ascending, tertiary and higher order paracladia somewhat spreading to appressed; pedicels 0.5–2 mm long, angular, scabrous-pubescent or the ridges ciliate. *Spikelets* (3–)3.5–5 mm long excluding the awns, (5.3–)6–9.5(–13) mm long including the awns, ± terete, the fertile floret usually slightly dorsally compressed; glumes I and II 1–2(–2.7) times the spikelet body, the body triangular, attenuate, adaxially pubescent, abaxially scabrous, slightly less so toward the base, the awn ± stout, scabrous for the full length; glume I 6–8.5(–11) mm long including the awn, the body 2.5–3 mm long, the awn 3.5–6.2(–8.5) mm long, 1-nerved; glume II 5.6–9.5(–13) mm long including the awn, the body 2–3 mm long, the awn 2.8–7(–10) mm long, 1(–3)-nerved; glumes III and IV triangular to rounded-triangular, ± navicular, adaxially pubescent toward the apex, 3-nerved; glume III (2.4–)3–3.9(–5) mm long, 0.66–1 times the spikelet body, mucronate or less commonly short subulate, abaxially scabrous or pubescent on the upper ½–⅓, rarely nearly glabrous, the tip (when present) to 0.4 mm long; glume IV (2.2–)2.8–4.5 mm long, (0.68–)0.8–1 times the spikelet body, mucronate, abaxially scabrous toward the apex or rarely glabrous; lemma (2.9–)3.5–5 mm long, mucronate, rounded-triangular, navicular, adaxially pubescent just below the apex, abaxially scabrous or pubescent toward the apex, in some glabrous, 5(–7)-nerved; palea (2.8–)3.5–4.5 mm long, bimucronulate, adaxially pubescent just at the apex, abaxially scabrid or pubescent just at the apex or glabrous in some, sulcate only at the tips, 2-nerved. *Lodicules* 3, strongly vascularized on the lower ½, apically glabrous, all 1.2–1.3 mm long. *Stamens* 3; anthers 1.5–3 mm long. *Fruit* unknown.

Phenology. All known collections of this species are flowering; different populations were in bloom during the 1980s, but no data on extent of flowering are available. The Azuay/Morona–Santiago population was mostly vegetative (*Clark et al. 1083*) suggesting that this species may be a continuous bloomer.

Distribution. Eastern Cordillera of Ecuador from Napo to Azuay/Morona–Santiago; páramo or upper montane forest; 3200–3900 m.

This species is named for its stiff foliage leaf blades, but *N. rigida* is also characterized by having non-pseudopetiolate leaf blades 24–51(–63) cm long and 1.1–2.1 cm wide with a slightly to markedly eccentric midrib and fairly prominent, cartilaginous margins 0.3–0.6 mm wide; an inner ligule (3–)5–15 mm long; synflorescence 33–50(–68) cm long and 5–10 cm wide with the primary paracladia spreading, the basalmost ones 9–17(–26) cm long; and glumes I and II awned and 1–2(–2.7) times the spikelet length with the awns relatively stout and scabrous for their full length. This species somewhat resembles *N. stuebelii* especially in the form of the synflorescence, but *N. stuebelii* has synflorescences (46–)70–96 cm long with the basalmost primary paracladia (9–15–)25–44 cm long, and vegetatively *N. stuebelii* has less rigid foliage leaf blades 97–157 cm long and 2.5–4.6 cm wide with thin, barely differentiated margins. *Neurolepis rigida* is closest to *N. nana*, but differs from that species in having larger, non-pseudopetiolate leaf blades, and longer, wider, and more open synflorescences (Table 1).

Paratypes. ECUADOR. **Azuay:** along road Gualaceo–Limón, 3100–3500 m, 25 ago. 1989 (fl), *van der Werff & Gudiño 11441* (MO, QCNE); swampy ground in Hoyada de Galápagos, between Huagrarancha and Loma de Galápagos, 3140–3505 m, 9 Jul. 1943 (fl), *Steyermark 53485* (F), *53486* (F). **Azuay/Morona–Santiago:** at pass on road between Sigsig and Chiguinda, Páramos de Matanga, 3300 m, 29 May 1992 (fl), *Clark et al. 1083* (AAU, ISC, QCA, US). **Chimborazo:** Riobamba Canton, Parque Nacional Sangay, Páramo de Pinllilligue, entre Alao y La Tranca, 3300–3700 m, 18 ago. 1990 (fl), *Cerón et al. 11845* (QCNE); W of pass Alao–Huamboya, 3750–3800 m, 11 Oct. 1985 (fl), *Lægaard 55426* (AAU); road ca. 10 km NE of Alao, at Cuspipacha, 3550–3600 m, 6 May 1982 (fl), *Øllgaard 38054* (AAU, QCA); from campsite above Río Alao (8.5 km E of Guardiana Alao by road), NNE to pass (via old route to Huamboya), 3350–3550 m, 20 May 1990 (fl), *Peterson et al. 9188* (QCA, QCNE, US); Parque Nacional Sangay, Changalay Chico, Río Ramos Tambo, junto al río, 3340 m, 18 Jul. 1991 (fl), *Valencia et al. 591* (QCA). **Chimborazo/Morona–Santiago:** trail Alao–Huamboya, around the pass, between Cuspipacha and alt. 3700 m on E slope, 3550–3950 m, 7 May 1982 (fl), *Øllgaard et al. 38222* (AAU, QCA). **Morona–Santiago (near the border with Azuay):** road in construction Sigsig–Gualaquiza, Cord. Matanga, 3200 m, 10 Apr. 1968 (fl), *Harling et al. 8160* (GB); road Sigsig–Gualaquiza, E of pass, 3300 m, 31 Aug. 1984 (fl), *Lægaard 52820* (AAU). **Napo:** Llanganati, N-facing slope towards the Río Golpe, just N of Chosa Aucacocha, 3600 m, 16 May 1982 (fl), *Øllgaard et al. 38709* (AAU). **Tungurahua:** Cord. de los Llanganates, at Río Verde Grande at base of Cerro Hermoso, 2 km WSW of the summit, 3800 m, 11 Nov. 1980 (fl), *Holm-Nielsen & Jaramillo 28411* (AAU, QCA).

Neurolepis villosa L. G. Clark, sp. nov. TYPE: Ecuador. Azuay: Páramo de Las Cajas W of Cuenca, 4000–4150 m, 2 Sep. 1984 (fl), *S. Lægaard 52884* (holotype, QCA; isotypes, AAU, QCNE). Figure 3E–G.

Culmi 0.3–1.2 m alti, simplices, erecti. Vaginae foliorum villosae vel raro glabrae; laminae 8–19(–27) cm longae, 1–1.6 cm latae, ratio long./lat. = 9–15(–17), lineari-lanceolatae, erectae, adaxialiter villosae in dimidio inferne, sparsim villosae vel glabrae in dimidio superne, abaxialiter glabrae vel sparsim villosae, interdum villosae non nisi ad basim, costa centrica; ligula interna 1–3 mm longa, ciliata vel fimbriata; fimbriae usque ad 2 mm longae. Synflorescentiae 20–36(–41) cm longae, 1–2 cm latae; rhachis dense villosa; paracladia primaria basalia 1.5–3 cm longa. Spiculae 3–4(–4.4) mm longae sine aristis; gluma I (3.5–)4.3–8 mm longa, (0.8–)1.2–2-plo longior quam lemma, aristata, 1-nervis; gluma II 4–7.4 mm longa, 1–1.6(–2)-plo longior quam lemma, aristata, 1-nervis; gluma III (2–)2.5–4.2 mm longa, 0.7–1-plo longior quam lemma, mucronata vel subulata, 1- vel 3-nervis; gluma IV 2.5–4 mm longa, 0.75–0.9(–1)-plo longior quam lemma, mucronata vel raro breve subulata, 3- vel 5-nervis; lemma 2.5–3.9 mm longum, mucronatum, (3–)5-nervis; palea 2.5–4 mm longa.

Culms 0.2–0.4 cm diam., 0.3–1.2 m tall, unbranched, erect. *Internodes* 1.7–3 cm long, hollow, terete, glabrous, striate, dull; walls ca. 1 mm thick. *Culm leaves* with sheaths striate, appressed hirsute at the base, the internerves appearing papillose, the margins ciliate toward the apex; blades ca. 2 mm long, mucronate. *Foliage leaves* with sheaths persistent, striate, abaxially appearing papillose over the entire surface, villose but irregularly so or rarely nearly glabrous, often villose or more densely villose toward the apex and margins, but sometimes more villose in the middle portion, the hairs ca. 2 mm long, whitish opaque, the nerves ± raised, the overlapping margin glabrous to ciliate, the underlapping margin glabrous, the summit on each side with a small extension confluent with the inner ligule, this usually villose or ciliate at least on the overlapping side; girdle absent; blades 8–19(–27) cm long, 1–1.6 cm wide, L:W = 9–15(–17), linear-lanceolate, erect, stiff, deciduous, adaxially villose on the lower half, this especially dense near the midrib, sometimes also the upper half sparsely villose, not tessellate, rarely weakly so, abaxially glabrous or sparsely villose, sometimes villose only near the base, strongly tessellate, the midrib centric, flush with both surfaces, adaxially and abaxially ± conspicuous along the lower half, the apex tapering, subulate, the base slightly rounded, the margins 0.3–0.4 mm wide, cartilaginous, denticulate; pseudopetiole 1–2 mm long, ± well defined, dewlaps not well developed; outer ligule 0.3–0.5 mm long, ciliolate or glabrous, irregular, wavy; inner ligule with the basal undivided portion 1–3 mm long, vascularized, the margin ciliate to shortly fimbriate, the fimbriae to 2 mm long. *Synflorescence* 20–36(–41) cm long from the lowermost branch, 1–2 cm wide, paniculate, narrowly pyramidal, exserted from the subtending leaf when mature; peduncle variable, 12–30 cm long, terete, villose; rachis densely villose, less densely so near the apex, grooved above each primary paracladium, thus ridged and grooved longitudinally; coflorescences numerous, the basal ones with 3 orders of branching; paracladia angular, villose, the secondary and tertiary ones less densely so, basally adaxially pulvinate, the pulvini well developed, yellow, the primary paracladia appressed when young, eventually somewhat spreading, the basalmost ones 1.5–3 cm long, subtended by an asymmetrical scar, secondary and higher order paracladia appressed; pedicels 0.5–1.5 mm long. *Spikelets* 3–4(–4.4) mm long excluding the awns, (3–)4–6.5(–7.6) mm long including the awns, terete to slightly dorsally compressed; glumes I and II with the body triangular, ± abruptly narrowed at the apex, awned, adaxially appressed-pubescent on the upper ½, abaxially scabrous-pubescent with a few longer hairs present along midnerve and margins, 1-nerved, the awn scabrous; glume I (3.5–)4.3–8 mm long including the awn, (0.8–)1.2–2 times as long as the spikelet body, the body 1.2–2 mm long, the awn (1.2–)2.5–6.8 mm long; glume II 4–7.4 mm long including the awn, 1–1.6(–2) times as long as the spikelet body, the body 1.5–2.5 mm long, the awn (1.9–)2.5–5.9 mm long; glumes III and IV rounded-triangular, slightly navicular, adaxially appressed-pubescent toward the apex, abaxially with a few hairs toward the apex, the margins ciliate toward the apex, the awn scabrous; glume III (2–)2.5–4.2 mm long, 0.7–1 times as long as the spikelet body, mucronate to subulate, 1- or 3-nerved, the tip to 1.2(–1.7) mm long; glume IV 2.5–4 mm long, 0.75–0.9(–1) times as long as the spikelet body, mucronate to rarely short subulate, 3- or 5-nerved, the tip to 0.5 mm long; lemma 2.5–3.9 mm long, mucronate, rounded-triangular, navicular, adaxially appressed-pubescent at the apex, abaxially with a few hairs toward the apex, (3–)5-nerved; palea 2.5–4 mm long, bimucronulate, adaxially pubescent at the apex, abaxially scabrous near apex, sulcate only at the tips, 2-nerved. *Lodicules* 3, all strongly vascularized on the lower ⅔, apically glabrous; the anterior pair ca. 1 mm long; the posterior one ca. 0.9 mm long. *Stamens* 3; anthers 1.2–2 mm long. *Fruit* unknown.

Phenology. All of the known flowering collections are from 1983 to 1985, but no notes on extent of flowering are available, so flowering behavior for this species cannot be determined.

Distribution. Endemic to the Western Cordillera of Ecuador in the province of Azuay; páramo and open areas in *Polylepis* forest; 3750–4150 m.

Neurolepis villosa is distinguished by its short pseudopetioles 0.1–0.2 cm long, inner ligule 1–3 mm long with cilia or short fimbriae to 2 mm long, narrow synflorescence 20–36(–41) cm long and 1–2 cm wide with the basal primary paracladia 1–3 cm long, as well as by the villose pubescence on the foliage leaf sheaths, adaxial surface of the leaf blades, the peduncle and rachis, and glumes I and II (Table 1). This species is most similar to *N. nana* (see discussion of that species).

Paratypes. ECUADOR. **Azuay:** Laguna Toreadora, Las Cajas, 3900 m, 9–10 Sep. 1983 (fl), *Larsen & Eriksen 45029* (AAU, QCA); Parque de Recreación Cajas, 4000–4100 m, 31 Aug. 1984 (fl), *Jaramillo 7177* (QCA); Parque de Recreación Cajas, 4000–4100 m, 2 Sep. 1984 (fl), *Jaramillo 7189* (GB, QCA); Páramo de las Cajas W of Cuenca, 4000–4150 m, 2 Sep. 1984 (fl), *Lægaard 52848* (AAU, QCA, QCNE); Páramo de Soldados, SW of Cuenca, 3750–3850 m, 3 Mar. 1985 (fl), *Lægaard 53799* (AAU, QCA); Páramo de Las Cajas, in the pass, 4100 m, 27 Aug. 1985 (fl), *Lægaard 55061* (AAU); Páramo de Las Cajas, in the pass, 4200 m, 27 Aug. 1985 (fl), *Lægaard 55067* (AAU, QCNE); Area Nacional de Recreación "Cajas," 19–23 Aug. 1985 (fl), *Ramsay et al. 136* (K); Totorococha–Mazan valley, Area Nacional de Recreación Cajas, 3750 m, 12 Sep. 1987 (fl), *Ramsay et al. 482* (QCA, QCNE); in vicinity of Toreador, between Molleturo and Quinoas, 3810–3930 m, 15 June 1943, *Steyermark 53186* (F, US).

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Passiflora trialata (Passifloraceae), a New Species of Granadilla (*Passiflora* subg. *Passiflora*) from French Guiana

Christian Feuillet
Department of Botany, NHB-166, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

John M. MacDougal
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. A new species, *Passiflora trialata* (Passifloraceae: subg. *Passiflora*), from French Guiana, South America, is described and illustrated from living cultivated material. Its affinities to the *P. quadrangularis* L. species complex are discussed.

Fieldwork in French Guiana by the senior author has resulted in the addition of several new species of passionflowers in several sections and subgenera (Feuillet & Cremers, 1984; Feuillet, 1986, 1994). There are now recorded 30 species of Passifloraceae including 27 species of *Passiflora* in French Guiana, of which 9 are endemic (modified from Feuillet, 1989). We describe here a species of *Passiflora* subg. *Passiflora,* closely allied to *P. alata* Curtis and the Giant Granadilla, *P. quadrangularis* L., and like them with angled-alate stems.

Two young plants were found sterile in 1988 by the senior author at Montagnes Tortue. Photographs were taken and one specimen was preserved. In 1991, on the slopes of the same table mountain, a sterile plant was found and cuttings were taken and brought into cultivation in Maryland, U.S.A. No herbarium specimen was made. Cuttings from this plant were distributed, but all the plants except one died. That plant flowered at the Missouri Botanical Garden in 1994–1996, and the description below is made almost entirely from that plant. The floral measurements are based on 10 fresh flowers.

Passiflora trialata Feuillet & J. MacDougal, sp. nov. TYPE: Cultivated in greenhouse at Missouri Botanical Garden 1991–1996, specimens made 7 Sep. 1994, from plant collected in French Guiana, roadside of Piste forestière de Bélizon, 21 km from Cayenne–Régina road (RN 2), 4°15'N, 52°30'W, 150 m, 30 Oct. 1991, by C. Feuillet, *MacDougal 6009* (holotype, US; isotypes, MO, P, AAU). Figures 1, 2.

Species haec in *Passiflora* subg. *Passiflora* pertinens; caulis 3-angulatocarinatus; stipulae 23–32 mm in longitudinem; folia non lobata, integra; petioli glandes duae, arietinorum cornuum instar, luteolae v. albidae; bractae latae, foliaceae, 6–8.6 × 3.5–6.5 cm, integrae, non glandulosae; floris cupula campanulata v. infundibuliformis; sepala non cornuta; corona erecta, duas extimas series subaequales et octo intimas series minus quam 3 mm longas constatas et tuberculis v. filamentis habens; androgynophorum 21–23 mm longum; fructus incognitus.

Climbing vine, adult size unknown but flowering in the greenhouse at 3 m long, glabrous and somewhat glaucous throughout. Stems sharply 3-angular and 3-carinate/alate in both juvenile and flowering material, the growing tip negatively geotropic, or on generally horizontal growth, the tip slightly inclined below horizontal but not cernuous, the stem becoming pink with light yellowish green wings. Phyllotaxy helical ⅖, appearing ½ at shoot tip. Prophylls of the vegetative ramifying bud 2, subequal or unequal in size. Stipules 23–32 × 8–13 mm, narrowly ovate to narrowly oblong-ovate, slightly eccentric, the margins entire, the apex acute; petioles triangular in cross section, alate, the lower wing connected with a stem wing, 2.8–5 cm long, 2-glandular, the glands narrowly ovoid in juvenile growth, at flowering nodes the glands 4–7 mm long, flattened conic (triangular), 4–5 mm wide at base (never narrowed at base) and sometimes distally elongate and curved like the horns of a ram, yellowish green to pale yellow (cream); laminas 15–26.5 × 8.5–16 cm, unlobed, ovate, with 7–10 main veins per side, yellowish green, not variegated, entire, the base obscurely or shallowly cordate, the apex abruptly acute. Peduncles 1 per node, 4.0–6.0(–7.5) cm long, 2 mm wide at base, 6–7 mm wide at insertion of bracts, sharply triangular and carinate-alate in cross section; bracts 3, adpressed at base but free to base, (6.0–)7.0–8.5(–9.4) cm long along midvein (6.5–10.0 cm total outline length), (3.5–)4.5–6.5 cm wide, ovate-triangular, shallowly cordate at base, apex acute or abruptly obtuse, foliose, eglandular, pale green to light yellowish green, glaucous, the margins entire; floral stipe 13–18 mm total length, including 5–6 mm hidden in toroid

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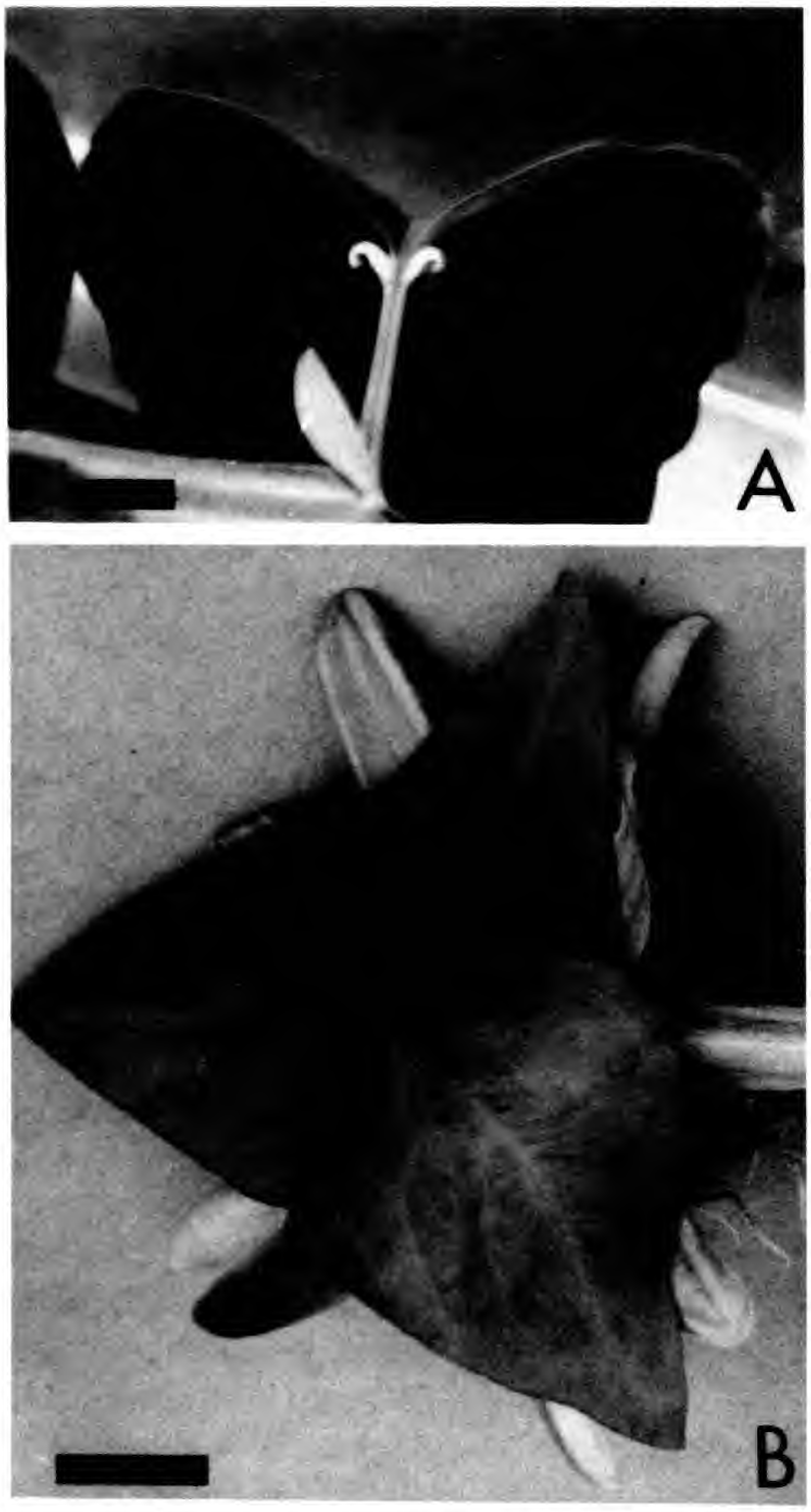

Figure 1. *Passiflora trialata* Feuillet & J. MacDougal. —A. Stem and leaves, showing petiolar nectaries and stipule. Scale bar = 2 cm. —B. Bracts at base of flower. Scale bar = 2 cm.

base of hypanthium; buds pendent, the buds not showing color before opening. Hypanthium/base of floral cup 18–20 mm diam., the floral cup 15–20 mm long total including 8–9 mm of cylindrical (hypanthium) base, ca. 30 mm wide at insertion of free perianth, pale yellowish green to greenish yellow and glaucous externally, the floral cup campanulate-funnelform. Flower pendent, open perianth 13–15 cm diam., with a white ring basally on perianth segments, the ring conspicuously separating visually the purplish banded corona from the background of the purplish perianth, the sexual organs visible within the darker corona as a white center. Sepals 44–60 × 18–25 mm, narrowly ovate-triangular, not carinate, without cornus, apex rounded, not or barely cucullate, reflexed 50–70° above horizontal at anthesis, light yellowish green externally, the two outermost with purplish hyaline margins to 3 mm wide, the inside whitish with fine purplish speckling mostly on proximal part, the speckling more reddish basally, edges flushed purple, the very base white, the apical ¼ also whitish. Petals 45–61 × 13–17 mm, narrowed at base, the attachment 6–8 mm wide; oblong-lanceolate to narrowly triangular-oblong, apex rounded, not reflexed, spreading horizontally at anthesis, externally uniformly medium light purple except base white with purple edges, the inside medium light purple to reddish purple, with fine reddish spots proximally in the center. Coronal filaments in 10–12 series, only the two outermost (radii) conspicuous, the two outermost 55–80 mm long, erect to slightly incurved at apex, subequal in length (the outermost slightly narrower at base), 7–13-banded white and purple, the bands purplish red basally, becoming violet distally, the distal 10–15 mm whitish, the filaments long-attenuate to soft slender tips, the tips somewhat incurved; inner ca. 8–10 series composed of reddish purple denticles and subulate setae always less than 3 mm long (ca. 3–5 rows of denticles, 3 rows of 1–1.8 mm long setae, and 2 rows of 2.5–2.7 mm long setae); operculum (innermost corona) single, 3–4 mm long, 14–15 mm outside diam., membranous, the margin turned distally against the column, subentire to denticulate, purplish red to reddish; nectary pale yellowish to whitish, with small raised annulus. Androgynophore widened at base but without constrictions or notable trochlea or limen ring; staminal filaments connate 21–23 mm along narrow portion of androgynophore, 28–32 mm long in longitudinal section from attachment of floral stipe to free portions of stamens, androgynophore 7 mm diam. at base near nectary, otherwise 3 mm diam., white with a single thin reddish ring (remnant of limen edge) on the wider base above level of operculum, the free staminal filaments 7–8 × 2.5–2.8 mm, narrowly oblong, pale yellowish green with a few reddish purple spots at apex; anthers 11–13 × 4–4.3 mm, attached 3.5 mm from one end (the proximal end in bud), held parallel to staminal filament, the connective not speckled or colored; anther–corona clearance 10–15 mm; pollen cream; absolute distance between nectar and pollen 30–40 mm. Ovary 11–13 × 5–6 mm, ellipsoid to oblong-ellipsoid, slightly 3-flattened, glabrous, cream to whitish, no gynophore visible; styles 8–9 mm long including stigmas, narrowed to 1 mm at base, 4 mm wide below stigmas, whitish, not spotted; stigmas 5–6.5 mm wide, depressed globose, barely bilobed adaxially, white. Fruit and seeds unknown. Germination type and chromosome number unknown.

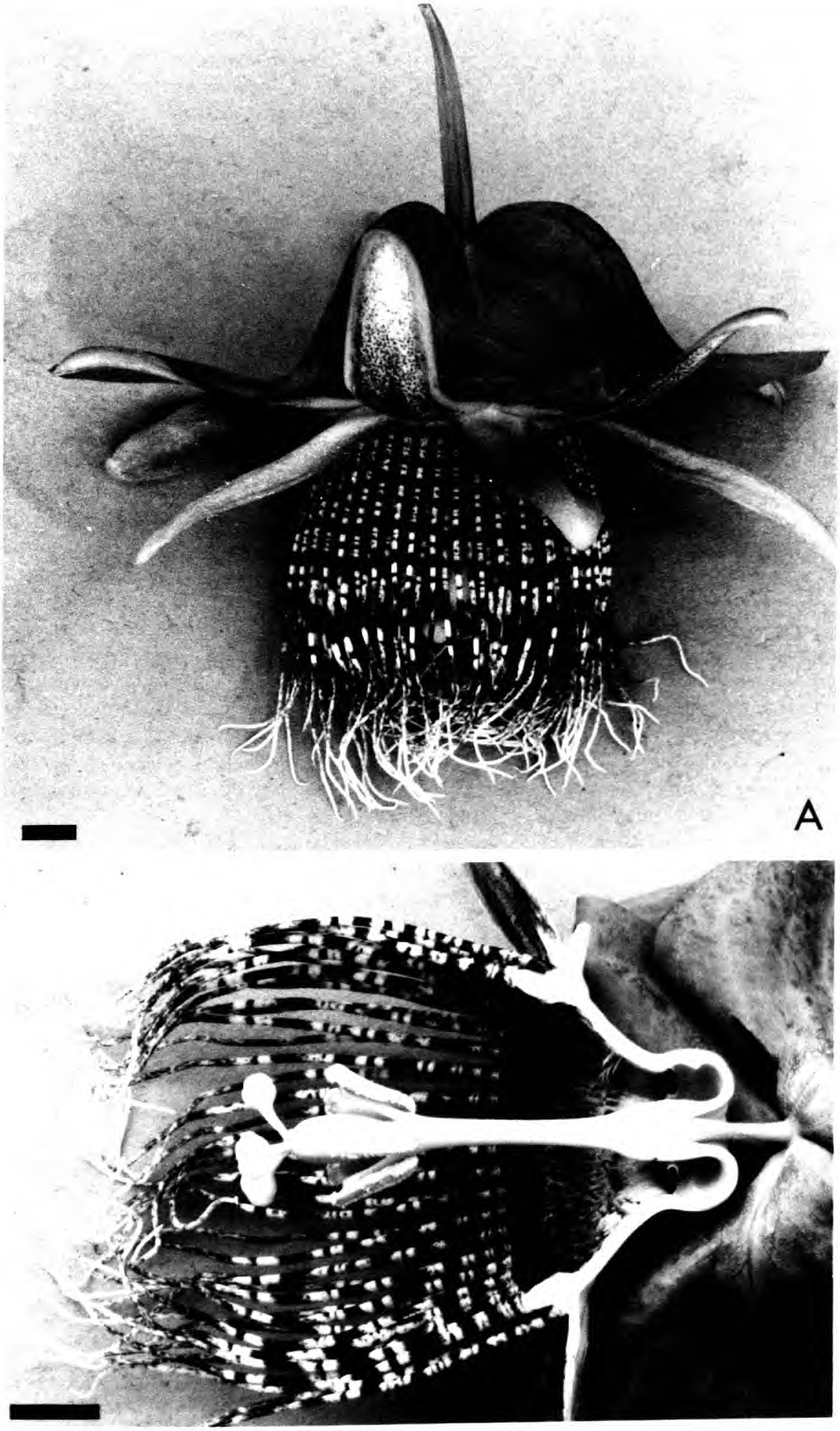

Figure 2. Flower of *Passiflora trialata* Feuillet & J. MacDougal. —A. Posture at anthesis, starting to close. Scale bar = 1 cm. —B. Longitudinal section. Scale bar = 1 cm.

Paratype. FRENCH GUIANA. Northern summit of Montagnes Tortue, Piste forestière de Bélizon, 9 km from Cayenne–Régina road (RN 2), 4°18'N, 52°22'W, 450 m, 20 June 1988, sterile, *Feuillet et al. 10287* (US).

Distribution and ecology. Known only from three plants growing in two localities 11 km apart in the rainforest of Montagnes Tortue of French Guiana. The two sterile plants observed in 1988 (*Feuillet et al. 10287*) inhabited an open low forest on lateritic crust on the flat top of a hill, 4–5 m from the edge of a gap in the canopy due to tree fall, with only pockets of strongly acidic soil 6–10 cm deep. This collection is mentioned in Feuillet (1989) in the Appendix as "*P.* sp. nov. 10." The type clone was collected from lateritic soil piles about 30 m from the forest edge, along a roadside heavily disturbed by the construction of a dirt road. Both localities receive 3–4 m of rainfall a year and are frequently foggy. Other species of *Passiflora* observed at the type locality within 200 m of *P. trialata* were: *P. amoena* Escobar, *P. candida* (Poeppig & Endlicher) Masters, *P. cirrhiflora* A. L. Jussieu, *P. coccinea* Aublet, *P. crenata* Feuillet & Cremers, *P. exura* Feuillet, *P. fanchonae* Feuillet, *P. garckei* Masters, *P. glandulosa* Cavanilles, *P. vespertilio* L., and one undescribed species related to *P. auriculata* Kunth (*P.* sp. nov. 4 in Feuillet, 1989). Twelve species of *Passiflora* in young stages of recolonization of a disturbed locality where rainfall exceeds 3 m a year is not exceptional in French Guiana, as documented for Montagnes de Kaw and Montagne des Nouragues (Feuillet, 1989).

Passiflora trialata is assigned to subgenus *Passiflora,* where it is close to *P. alata* Curtis and *P. quadrangularis* L. These species are part of a small species complex of large-flowered and large-fruited passionflowers with 3–4-angulate-winged stems that ranges naturally in the moist lowlands from Nicaragua to Brazil, and perhaps the West Indies, and now is known from French Guiana. Besides the new species, the complex includes at least four morphologically and geographically cohesive variants that could be recognized as species. They are separated by bract size and morphology, leaf venation, stipule size, petiolar nectaries, and especially floral coronal structure. *Passiflora alata* s. str. is originally from central Brazil (Matto Grosso, Minas Gerais) on the other side of the Amazon Basin. It is cultivated for fruit in non-Amazonian Brazil and some Andean countries on a small scale, and also as an ornamental in various tropical areas (particularly Veracruz, Mexico). A closely related variant, *P. phoenicia* Lindley, appears to be native in eastern Peru. The origin of *P. quadrangularis* has been the subject of wild guesses for a long time, but a form with relatively narrow stipules clearly is native from Nicaragua to lowland Colombia. Another variant of *P. quadrangularis* that is perhaps distinct is present in subandean Colombia to Peru, and is characterized by uniformly light violet corollas. It is locally cultivated for fruit and called "*tumbo*" or "*badea*" (pers. obs., Masters, 1883). *Passiflora quadrangularis* is widely (and in South America, anciently) cultivated in warm tropical regions, and there has been much domestication and selection for its large edible fruits, the largest in the family Passifloraceae. This, along with widespread hybridization in cultivation with its relatives like *P. alata,* confounds our understanding of the group. The complex was given the provisional name Quadrangulares by Harms (1925) subordinate to section but without rank. Masters (1869, 1871, 1872, 1877) recognized three species with several varieties in this complex, but the last monograph (Killip, 1938) recognized only two species with no varieties. Both *P. quadrangularis* and *P. alata* were described from cultivated material, and an early study of living material by Sowerby (1794) contrasted the coronal structures of the two: *Passiflora alata* has one floral operculum (membranous inner coronal series) covering the nectary, while *P. quadrangularis* has two floral opercula. Two opercula is an advanced character state by outgroup comparison to other species of subgenus *Passiflora. Passiflora trialata* has a single operculum.

At least *P. quadrangularis* has stems of seedlings and juveniles triangular, but a triangular stem at maturity appears to be diagnostic of the new species. Other diagnostic character states of *P. trialata* are the very large bracts, the lack of pulley-shaped swellings (trochleae) on the androgynophore, and the petiolar nectaries which are triangular or shaped like ram's horns.

In the greenhouse, flower buds break open shortly after midnight, with the corona exserted apically about 2 cm by 02:30 hrs. By 07:00 hrs. the perianth is open to horizontal, with reflection of the sepals maintained from 09:00 to 17:00 hrs. The floral odor is faint to light but distinctive, variously reported as resiny, spicy, like anise with terpene overtones, or like overheated plastic or burnt wiring.

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New *Eleocharis* (Cyperaceae) from Venezuela

M. Socorro González-Elizondo
CIIDIR y COFAA-IPN, Apdo. 738, Durango, Dgo., 34000 Mexico

A. A. Reznicek
University of Michigan Herbarium, North University Building, Ann Arbor, Michigan 48109, U.S.A.

ABSTRACT. Seven new species of *Eleocharis* are described based on study of material from the Venezuelan Guayana: *Eleocharis alveolatoides, E. atrospiculata, E. ayacuchensis, E. eglerioides, E. liesneri, E. steyermarkii,* and *E. venezuelensis. Eleocharis squamigera* is represented in the Venezuelan Guayana by a newly described subspecies, *E. squamigera* subsp. *straminea,* differing primarily in the pale color of the rhizome scales and glumes. Two new forms are also described, *E. debilis* forma *anomala,* differing from the typical form in having 3-branched styles and trigonous achenes mixed with the characteristic 2-branched styles and biconvex ones of this species, and *E. geniculata* forma *brunnea,* differing from typical *E. geniculata* in its brown achenes.

While compiling the treatment of *Eleocharis* R. Brown (Cyperaceae) for the flora of the Venezuelan Guayana project, several new and noteworthy taxa were discovered. Seven species, a subspecies, and two forms are described in this article. Several other potential new species and taxa requiring further study are present in the study area, and some of them are discussed, but not formally described, either because the material representing them is inadequate, or because they belong to groups where the species are very poorly understood.

Several morphological features are recorded here for the first time in *Eleocharis,* or in a particular group of *Eleocharis,* as follows: (1) branched, dimorphic culms (in *E. eglerioides* and in an undescribed species); (2) functionally staminate aerial spikelets (in *E. alveolatoides*); (3) isolated trigonous achenes mixed with the biconvex ones in a species of the section *Eleogenus*; and (4) basal, subterranean spikelets in species of section *Eleogenus* (formerly recorded only for species of sect. *Eleocharis,* series *Tenuissimae*).

In the descriptions, all measurments of the achenes include the rostrum (tubercle).

Eleocharis alveolatoides S. González & Reznicek, sp. nov. (Subgen. *Eleocharis,* series *Tenuissimae,* subser. *Chaetariae*). TYPE: Venezuela. Bolívar: Distrito Piar, lower section of Río Ambutuir, along trail to Uriman, 05°26′N, 62°40′W, 500 m, 1 Dec. 1982, *G. Davidse & O. Huber 23075* (holotype, MICH; isotype, MO).

Perennis, interdum annualis; rhizomatibus tenuissimus, oblique ascendente vel verticalibus; culmis 3–20 cm longis, 0.2–0.5 mm latis; vaginis scariosis, leviter inflatis ad apicem. Spiculis (4.5–)6–7.6 mm longis, linearis, acutis, plerumque staminatis praeter basalis fertilis; glumae floriferae 2–4, 4.2–6.3 mm longae, straminae vel purpurascentae. Achenium in basi culmorum situm, 2.0–2.6 mm longum, 1–1.3 mm latum, trigonum, obovatum, albidum vel pallide olivaceum, cancellatum; rostrum lanceolatum, acuminatum; setae hypoginae 4–6 vel abscens. Stylo trifido; antherae 2.2–2.5 mm longae. *Eleocharis alveolatae* Svenson affinis.

Perennial (sometimes annual?); rhizomes delicate, branched, loosely ascendent to vertical; culms 3–20 cm long, 0.2–0.5 mm wide, green, sometimes red-puncticulate, deeply angular sulcate to channeled, erect; sheaths loose, scarious, red or purple at the base, hyaline and somewhat inflated at the apex. Spikelets (4.5–)6–7.6 mm long, 0.7–1.3 mm wide, linear, acute, with 2–4 glumes, usually staminate, flattened, sometimes proliferous, the achenes growing solitary among the bases of the culms; glumes 4.2–6.3 mm long, 1–2 mm wide, membranous, linear-lanceolate, keeled, acute, with a narrow green to stramineous midvein and striolated, stramineous to dark purple sides, the margin and apex hyaline, the lowest glume reaching ⅔ to almost the length of the spikelet. Achene 2.0–2.6 mm long, 1–1.3 mm wide, trigonous, globular-obovoid, shortly and thickly stipitate, white to light olivaceous, deeply cancellate, each side with about 12–19 longitudinal series of 18–24 hexagonal or ± circular pits; rostrum 0.9–1.4 mm long, triangular-lanceolate, acuminate, broad at the base and usually deeply 3-lobulated and decurrent on the angles

Table 1. Morphological comparison of *Eleocharis alveolatoides* and *E. alveolata*.

Characters	*E. alveolatoides*	*E. alveolata*
Rhizome	present	absent
Culm length (cm)	3–20	2–5
Culm width (mm)	0.2–0.5	0.1–0.2
Spikelet length (mm)	(4.5–)6–7.6	1.8–3.6
Glume length (mm)	4.2–6.3	1.6–3
Glume width (mm)	1–2	0.9–1.3
Achene length (mm)	2.0–2.6	1–1.4
Achene width (mm)	1–1.3	0.5–0.7
Longitudinal rows of cells/face	12–19	11–12
Number of cells per row	18–24	15–16
Rostrum length (mm)	0.9–1.4	0.3–0.5
Bristles	4–6, or absent	absent
Anther length (mm)	2.2–2.5	1.1–1.5

of the achene, light brownish; hypogynous bristles 4–6 or absent, shorter or slightly longer than the achene, flat, light brown colored, finely toothed or smooth. Style trifid. Stamens 3, anthers 2.2–2.5 mm long, the connective short-prolonged.

Distribution. Probably endemic to the Venezuelan Guayana, thus far known only from the collections cited. In shallow water of ponds or along river edges, at about 500–1100 m. Fruiting in November, December, and March.

This species differs from *Eleocharis alveolata* Svenson in having slender, branched vertical rhizomes; longer, thicker, erect culms; spikelets and achenes twice as large; longer anthers; and the presence of bristles. Table 1 shows the main differences between the two species, which are similar in having linear-acute mostly staminate aerial spikelets with only 2–4 glumes, and achenes situated at the base of the plant. These two species also have deeply cancellate, obovate, stipitate achenes narrowed at the base and apex, with the rostrum elongate, trigonous, and acuminate from a broad base. *Eleocharis alveolata* Svenson [*Ekman 17788* GH, the type], was described from Cuba, and cited from Brazil. Later, Svenson (1937: 238) treated the collections from Brazil doubtfully as *E. glauca* Boeckeler ("since the material is too poor for definite determination"). *Eleocharis alveolatoides* is also vegetatively similar to the North American *E. baldwinii* (Torrey) Chapman, which differs in having fertile aerial spikelets and much smaller, darker and obscurely striolate achenes.

In *Eleocharis alveolatoides* the aerial spikelets are functionally staminate, the fruits being restricted to basal spikelets. Aerial male spikelets and basal female spikelets have been reported for the Australian genus *Crosslandia* (Bruhl, 1994), but the existence of some specimens of this genus with bisexual aerial spikelets was also recorded by Bruhl et al. (1992). Although only male aerial spikelets are known from *E. alveolatoides*, it is possible that bisexual aerial spikelets may occur.

Paratypes. VENEZUELA. **Bolívar:** Distrito Piar, at top of Salto Aicha near eastern base of Uaipan-tepui, 62°32′W, 5°38′N, 1100 m, 27–28 Nov. 1982, *G. Davidse & O. Huber 22859* (MO); road along the río Carao above Canaima, to Camp Ucaima, 550 m, 30 Mar. 1969, *H. Hertel & B. & F. Oberwinkler 15304* (VEN).

Eleocharis atrospiculata S. González & Reznicek, sp. nov. (Subgen. *Eleocharis*, sect. *Eleogenus*). TYPE: Venezuela. Amazonas: Depto. Atabapo: Cerro Marahuaca, cumbre, parte central de la Meseta Sur-Este, a lo largo de la Quebrada Yekuana, 3°40′30″N, 65°26′20″W, 2560 m, 10–12 Oct. 1983, *J. Steyermark 129582* (holotype, MO; isotype, NY).

Eleochari sellowianae affinis sed culmis 0.3–0.6 mm latis, spiculis paucifloris, glumis atrobrunneis vel atropurpureis, fere nigris, setis rufescentis differt.

Perennial, densely caespitose but with the tufts connected by slender stolons covered with long scales; culms 2–8 cm long, 0.3–0.6 mm wide, soft, somewhat spongy, longitudinally sulcate, very minutely white-puncticulate, erect; sheaths scarious, brown to black at the base, hyaline, inflated, rugose and divided at the apex. Spikelets 2–3.8 mm long, 1–1.5(–1.8) mm wide, ovate, the apex acute or subclaviform with the apex truncate, 2–7-flowered; glumes 1.4–2.4 mm long, 0.9–1.2 mm wide, the lowest ½ to almost the length of the spikelet, membranaceous, ovate, acute or obtuse, with a broad, green to stramineous midvein, and dark brown or purple, almost black sides, very narrowly hyaline or not hyaline at all at the apex. Achene 1.2–1.6 mm long, 0.6–0.8 mm wide, biconvex, obovate, narrowed to the base, olivaceous to dark brown, minutely puncticulate; rostrum 0.3–0.5(–0.6) mm long, lanceolate to mucroniform, acute to acuminate, ¼–⅓ the width of the achene, brown or whitish; hypogynous bristles 5–8, longer than the achene, dark reddish or brown, retrorsely toothed. Style bifid. Stamens 3, anthers 0.9–1.1 mm long, the connective inconspicuous.

Distribution. Probably endemic to the summit of Cerro Marahuaca, in the Territorio Federal Amazonas, on shallow ponds or along streams at 2300–2560 m. Fruiting is known from February and October.

Closely related to *Eleocharis sellowiana* Kunth, but having narrower culms, shorter, fewer-flowered, and much darker spikelets, dark colored bristles, and slightly darker and larger achenes. Other related species are *E. flavescens* Kunth and *E. olivaceonux* Simpson. *Eleocharis atrospiculata* can be separated from *E. flavescens* by its longer achenes, shorter and darker glumes, and darker bristles, and from *E. olivaceonux* by the enlarged, inflated apex of the sheaths (vs. narrowly acute), shorter spikelets, and longer achenes. The dark color of the glumes is a character common in species from high elevations.

Paratype. VENEZUELA. **Amazonas:** Depto. Atabapo, Cerro Marahuaca-Fhuif, cumbre, 3°35′N, 65°20′W, 2330–2470 m, 3–4 Feb. 1982, *J. Steyermark, M. Guariglia, N. Holmgren, J. Luteyn & S. Mori 126098* (VEN).

Eleocharis ayacuchensis S. González & Reznicek, sp. nov. (Subgen. *Scirpidium*). TYPE: Venezuela. Amazonas: Depto. Atures, en la carretera Pto. Ayacucho hacia El Burro, km 48, en el cruce de Betania de Topocho, laja 1 km al Este, 5°58′N, 67°22′W, 31 July 1993, *A. Gröger & A. Berg 1041* (holotype, NY).

Ut videtur annua; culmis 6–22 cm longis, capillaribus vel tenuioribus; vaginis scariosis, detergibilis. Spicula 2.2–7.8 mm longa, 8–60-flora, glumae floriferae 0.8–1.5 mm longae, purpurascentae, in carina viridae vel albae, ima saepe vacua. Achenium 0.7–0.9(–1) mm longum, 0.3–0.4 mm latum, fere teretibum, album vel luteum, longitudinaliter 15–21-striatum, inter strias transversim 33–65 trabeculatum; setae hypoginae 4–6, brevis, albescentes. Stylo trifido; antherae (0.2–)0.3–0.4 mm longae.

Apparently annual; culms 6–22 cm long, 0.2–0.4 mm wide, or up to 0.8 mm wide near the base, soft, light green, angular-sulcate to channeled longitudinally, irregularly septate transversally, especially near the base, erect, forming slender tufts; sheaths loose, scarious, inconspicuous. Spikelets 2.2–7.8 mm long, 1.2–2.8 mm wide, ovoid to linear, ± acute, 8–60-flowered; glumes polystichous, 0.8–1.5 mm long, 0.7–1 mm wide, membranous, ovate to elliptic, obtuse to truncate, often split at the apex, with a broad green to white midvein and reddish to dark purple sides, the margin and apex hyaline, the upper glumes keeled distally, the lowermost usually sterile and less than ⅓ the length of the spikelet. Achene 0.7–0.9(–1) mm long, 0.3–0.4 mm wide, very obtusely trigonous, almost terete, ellipsoid to narrowly obovoid, pericarp very fragile, white to grayish or yellowish, iridescent, translucent, with 15–21 longitudinal series of 33–65 transverse trabeculae each, the longitudinal ribs not elevated; rostrum ½–¾ as wide as the achene, conic-triangular to deltoid, somewhat spongy and light colored when mature; hypogynous bristles 4–6, shorter than the achene, white, delicate, finely toothed. Style trifid. Stamens usually 2, anthers (0.2–)0.3–0.4 mm long, gray-green to pale yellow, the connective shortly prolonged; filaments shiny purple to white.

Distribution. Known only from two collections from the Estado Amazonas. Aquatic or subaquatic, at about 75–130 m. Fruiting known to occur in July, but probably throughout the year.

This is the only species of subgenus *Scirpidium* known from the Venezuelan Guayana, and it differs from all other species of *Scirpidium* (except *E. tucumanensis* Barros), in having the lowest glume usually sterile. It is similar to the North American *E. bella* (Piper) Svenson in having short (0.3–0.4 mm) anthers and many-flowered, polystichous spikelets, but *E. bella* has sheaths inflated at the apex (not fugacious), obovate to linear-obovate achenes with 18–30 trabeculae, and bristles absent. Collections of *E. ayacuchensis* have been determined as *E. bonariensis* Nees and *E. radicans* (Poiret) Kunth, but both of these species are perennials and have achenes with elevated ribs. *Eleocharis ayacuchensis* also differs from *E. bonariensis* in lacking creeping rhizomes, having much shorter anthers and glumes, and having polystichous spikelets. *Eleocharis radicans* has very short anthers, but it differs in the spongy culms, pale green scales, and few-flowered (usually < 12-flowered) spikelets. Given the large range of variation found in the widely distributed *E. acicularis* (L.) Roemer & Schultes [e.g., anthers (0.5–) 0.6–1.2 mm long; spikelets 1–24-flowered], and based only on the descriptions, one could consider *E. ayacuchensis* as just an extreme of that variation. However, *E. acicularis* is a rhizomatous perennial with the anthers longer than 0.5 mm, the lower glumes often subdistichous, and it grows at higher elevations, (600–)1500–3500 m.

Paratype. VENEZUELA. Estación de piscicultura de Puerto Ayacucho, terreno situado entre la carretera hacia Samariapo y la pista de aterrizaje del aeropuerto de Puerto Ayacucho, aprox. 5°37′N, 67°36′W, 14 jul. 1977, *O. Huber 870a* (NY).

Eleocharis debilis forma **anomala** S. González & Reznicek, forma nov. (Subgen. *Eleocharis*, sect. *Eleogenus*). TYPE: Venezuela. Amazonas: Depto. Atabapo, Salto Yureba, Cerro Yureba, lower Ventuari, ca. 4°03′N, 66°01′W, 350 m, 14 Mar. 1985, *R. L. Liesner 18670* (holotype, MICH; isotypes, CIIDIR, MO).

A forma *Eleochari debili* spiculis aeriis et interdum in rhizomatibus situs; rhizomata oblique ascendente cum squamis purpureis instructa; vaginis scariosis, inflatis ad apicem; acheniis biconvexis raro trigonis differt. Perennis. Spiculis 3–6.5 mm longis, acutis, 2–8(–12)-floriferis; glumae floriferae subdisticae, 2.4–3.3 mm longae, straminae vel aureo-brunneae vel purpurascentae. Acheniis 1.2–1.5 mm longis, in rhizomatibus situm ad 1 mm latis, in aeriis spiculis situm 0.6–0.8 mm latis. Antherae 0.6–0.9(–1.2) mm longae.

Perennial, rhizomatous, the rhizomes slender, pale brown, or covered by purple scales. Culms 5–14(–19) cm long, 0.2–0.4 mm wide, finely sulcate, light green, slightly recurved; upper sheaths scarious, stramineous or purple at the base, hyaline and inflated at the apex. Spikelets 3–6.5 mm long, 1–2(–2.8) mm wide, ovate, acute, somewhat flattened, 2–8(–12)-flowered; glumes subdistichous, 2.4–3.3 mm long, 0.9–1.4 mm wide, the lowest ⅖ to ⅘ the length of the spikelet, membranaceous, elliptic to lanceolate, acute, with a narrow, green to stramineous midvein, and stramineous, golden brown or purple sides, the apex and margins narrowly hyaline; basal spikelets present, 1–3-flowered, occurring along the rhizomes as well as among the culms, chasmogamous, with long, slender styles. Achene 1.2–1.5 mm long, 0.6–0.8 mm wide on the aerial spikelets, up to 1 mm wide on the basal spikelets, biconvex or rarely trigonous, obovoid, shortly stipitate, dark purple to black, almost smooth; rostrum (0.25–)0.3–0.4(–0.45) mm long, triangular to deltoid, acuminate, broad and free at the base, ½–⅔ the width of the achene, whitish; hypogynous bristles 7–8, longer than the achene, dark reddish or brown, retrorsely toothed. Style bifid. Stamens 1–2, anthers 0.6–0.9(–1.2) mm long, the connective inconspicuous.

Distribution. Known from the Depto. Atabapo, Territorio Federal Amazonas, on hard, igneous rock banks of river and waterfall, patches of soil along river, and adjacent forest, at 350 m. Fruiting known in March.

Eleocharis debilis belongs to section *Eleogenus*, series *Maculosae*, which has 2-branched styles and biconvex achenes. The name *anomala* given to this form refers to the 3-branched styles and trigonous achenes mixed with the characteristic 2-branched styles and biconvex achenes of this group. This plant also differs from the forma *debilis* in having basal, sometimes proliferous spikelets growing both along the rhizome and among the culms, whereas in the forma *debilis*, when basal spikelets are present they occur only among the culms.

Eleocharis debilis has been described with smaller achenes (1–1.3 mm) and uninflated (or very slightly inflated) upper sheaths. According to Svenson (1939), the type of *E. debilis* is an annual, with whitened, acute (polystichous) spikes; however, he considered *E. macra*, with "perhaps a perennial rootstock," as apparently the same species. The form here described is also more or less similar to *E. capillacea* Kunth in the type of rhizomes, recurved culms, and aspect of the achenes, but it differs mainly in the longer culms and achenes, spikelets up to 12-flowered, and presence of basal spikelets. Plants from Minas Gerais, Brazil (e.g., *Irwin, Harley & Onishi 29531* and *29601*, MICH), with achenes up to 1.5 mm and ascendent, purple scaly rhizomes, could be related to the plant described here. They differ in having the apex of the sheath not inflated, and shorter (1.7–2.6 mm) glumes. The closely related *E. sintenisii* Boeckeler, from the West Indies, has also wide-creeping rootstocks, as well as black achenes up to 1.5 mm long, but it differs in the relatively firmer, acute, and not inflated apex of the upper sheath.

Similar basal spikelets along the rhizome and same aspect of the achenes are present in a form of *E. maculosa* (Vahl) Roemer & Schultes, known from Guatemala and Honduras. Its achenes are small (1–1.3 mm) or up to 1.6 mm long [e.g., *L. O. Williams et al. 43412* (MICH)], otherwise being similar to the typical form. It differs from the plant here described in having the lowest glume ovate to orbicular, (1.4–)1.7–2.4 mm wide, less than ½ the length of the spikelet, with a conspicuous, often split, membranous apex up to 1.9 mm long; and spikelets 4.5–13 mm long, up to 4 mm wide, and usually dark purple colored. Prior to the records of amphicarpy here presented for species of section *Eleogenus*, this feature was known in *Eleocharis* only for species of section *Eleocharis*, series *Tenuissimae*.

Eleocharis eglerioides S. González & Reznicek, sp. nov. (Subgen. *Limnochloa*). TYPE: Venezuela. Bolívar: Río Los Borrachos, between Santa Elena de Uairen and Brazilian frontier, 1.2 km N of Brazilian boundary, 1000 m, 3 Jan. 1975, *J. Steyermark 111368* (holotype, VEN, mixed with *Websteria confervoides*).

Egleriae fluctuanti L. T. Eiten modo ramificationibus, vaginatis culmis instructa et spiculae similis, sed differt fertile culmis non verticillatis in extremitatibus culmis tantum, acheniis superficie in quoque lateris 7–10-seriatis striatis cum cellulis transverse elongatis vel isodiametricis, inter strias leviter prominentibus, rostrum conicum vel obtuse-deltoideum, maturitate nigrum; setae hypoginae rudimentaris vel abscens.

Perennial, submerged aquatic, rooting in substrate. Main culms (rhizomes) elongated, noded, internodes 1–4 cm long, 0.5–1.1 mm wide, each node with a membranous, tubular sheath 7–17 mm long, open distally, rounded or acute at the hyaline apex, purple colored at least at the base; main culms branched from the nodes with false whorls of secondary culms 0.1–0.4 mm wide, false whorls lateral, alternately left and right along the main culm, the secondary culms sheathed at the base; fertile culms short, 1.6–4.6 cm long, pedunculiform, solitary on the 3–4 distal nodes of the main culm, with 2–4 secondary culms growing from the same node, fertile culms long sheathed, the sheath sometimes reaching up to the spikelet. Spikelets cylindric, 7–10 mm long, 1.3–1.5 mm wide when mature, 6–9-flowered, lowest glume fertile, sheathing the base of the spikelet, 2.6–4 mm long, appearing to be a continuation of the culm, pale green, ecarinate, the midnerve scarcely differentiated from the numerous and closely spaced lateral nerves, the margin and apex hyaline, easily torn; achenes 1.4–1.6 mm long (including the rostrum and stipe), 0.7–0.8 mm wide, obovoid to ellipsoid, plano-convex or compressed-trigonous, the abaxial angle represented by a wider and lighter ridge, each side with 7–10 rows of transversely elongated cells, which become isodiametric at the base of the achene, whitish to straw-colored; rostrum 0.2–0.3 mm long, conic or campanulate, dark brown to black; stipe ± 0.1 mm long, dark brown; bristles absent or 1–2, rudimentary; stamens (usually?) 2, the filaments short, anthers with two spongy, white basal appendages.

Distribution. Known from Venezuela, very close to the Brazilian border, and from a widely disjunct area in Bolivia, as a submerged aquatic in running water, at elevations of 50 and 1000 m. It is very possible that it is distributed in much of the intermediate area, in the Amazonas basin, and that some specimens identified as *Egleria* or *Websteria* in herbaria correspond to this plant. Fruiting known in January and February.

An annotation by S. S. Hooper (27 Feb. 1979) on the type specimen indicates that she recognized this plant as a new species: "*Eleocharis* sp. nov. *Egleria* (*Eleocharis*) *fluctuans* affinis." It was followed by a short Latin diagnosis. However, apparently Hooper never published it. The annotation also indicates her idea about reducing *Egleria* under *Eleocharis*, based probably on the striking morphological similarities between the plant here described and *Egleria fluctuans*. The only apparent differences we could find between *Egleria* and *Eleocharis* are: (a) the arrangement of the fertile culms, appearing whorled at the end of branches of the rhizome, among few to many capillary culms in *Egleria*, and solitary on the distal nodes of the rhizome, with only 2–4 secondary culms at the same node in *Eleocharis*; and (b) the type of rostrum, continuous with the body of the achene and widest at the middle, narrowing where it joins the achene in *Egleria*, and articulated and conic in *Eleocharis* (the articulate nature evident even in immature achenes). Other differences between *Eleocharis eglerioides* and *Egleria fluctuans* do not have a generic significance: the basal sheaths of the fertile culms in *E. fluctuans* (which are up to 15.2 cm long) are relatively short (0.3–2 cm long), membranous and hyaline, not covering most of the culm as in *Eleocharis eglerioides*, and the spikelets in *Egleria* are usually purple colored rather than pale green. As Eiten (1964) pointed out, *Egleria* has presumably evolved from a branched species of *Eleocharis*. The strong similarity of *Egleria* to *Eleocharis eglerioides* may suggest a relatively recent origin of *Egleria*.

Eleocharis eglerioides seems to be related to *E. elongata* Chapman and *E. robbinsii* Oakes, in the subgenus *Limnochloa*. Both species sometimes have trigonous or plano-convex achenes, with the abaxial angle and also the rostrum being similar to those of *E. eglerioides*. However, in *E. elongata* and *E. robbinsii* the epidermal cells of the achene are clearly transversely elongated, and robust, toothed bristles are present. In aquatic forms of *E. elongata* and *E. robbinsii* (e.g., *Fernald & Long 325*, MICH), the first steps in the evolution of noded, branched, dimorphic culms are observed in the form of pseudoverticillate, noded, stoloniferous culms borne from the base of the fascicles of erect culms, sometimes with slenderer secondary culms from the nodes. Whorls of capillary culms growing at the apex of the main culms are also known from the subgenus *Eleocharis*, in aquatic phases of the *E. retroflexa* complex.

The species here described is the only species in *Eleocharis* in which basal appendages of the anthers have been reported, similar to those in *Egleria*; however, slightly thickened bases of the anthers in *E. elongata* (e.g., *Nash 944*, MICH), could represent the first steps in the evolution of this feature, presumably useful in flotation. The anther appendages are slightly more prominent in the species here described than in *Egleria*.

The new species has been also confused with the genus *Websteria* (e.g., *Anderson 12013*, US), originally determined as *Scirpus [Websteria] confervoides* and later as *Egleria*. *Websteria* has been included in *Eleocharis* by Hooper (1973), Koyama (1985), and Tucker (1987). Eiten (1964) considered that *Websteria* evolved, like *Egleria*, from *Eleocharis*, but "from another part of the genus." *Eleocharis eglerioides* differs from *Websteria* mainly in the branching pattern of the main culms, the multiflorate spikelets, and in the plano-convex or compressed-trigonous, clearly tuberculate, bristleless achene. In fact, the achene of *Websteria* (biconvex, etuberculate but pointed at the apex into a cylindric prolongation) seems to be more similar to achenes of *Scirpus* s.l. than to any species of *Eleocharis.*

Paratype. BOLIVIA. **Depto. Beni:** 10–15 km SW of Guayamerin on road to Fiberalta, edge of forest and adjacent drainage ditch with gently flowing water, ± 50 m, 7 Feb. 1978, *W. R. Anderson 12013* (US).

Eleocharis geniculata (L.) Roemer & Schultes forma **brunnea** S. González & Reznicek, forma nov. TYPE: Venezuela. Delta Amacuro: Depto. Pedernales (boundary with Depto. Tucupita), sand beach bordering open sandy mud flats and wet depressions, mouth of Caño Guiniquina, between Punta Araguabisi and Punta Baja, at Barra Guiniquina, 9°30′N, 60°58′W, 18 Oct. 1977, *J. Steyermark, R. Liesner & F. Delascio 114868* (holotype, MO; isotype, NY).

A forma *geniculata* acheniis brunneis differt.

Annual in dense tufts. Culms 6–38 cm tall 0.3–1.1 mm wide; sheaths pale brown at the base, greenish above, with an oblique, hyaline apex. Spikelets 2.5–5 mm long, 2.5–4.5 mm wide, ± globose to short ovoid, ca. 20–80-flowered; glumes 1.4–2.2 mm long, 0.9–1.4 mm wide, membranous, ovate to broadly ovate, obtuse, pale brown with hyaline margins and a darker brown center. Achene 0.9–1.0 mm long, 0.6–0.7 mm wide, obovoid, biconvex, brown to reddish brown, smooth, shiny; rostrum white, pyramidal, 0.3 mm wide at base; bristles absent to slightly exceeding the achene, reddish brown. Style bifid. Stamens 3, anthers 0.5–0.8 mm long.

It differs from the widely variable and widely distributed forma *geniculata* in the color of the achenes, which are consistently brown to reddish brown when mature in the form described here, and shiny black (sometimes brown when immature) in the typical form.

Distribution. Known only from the Territorio Federal Delta Amacuro, Depto. Pedernales, in sandy places, at 50 m.

Eleocharis geniculata forma *brunnea* can range from a delicate plant 6–15 cm long, with developed perianth bristles, to a relatively robust plant up to 38 cm long, the bristles very reduced to absent (e.g., *Steyermark et al. 114864*). This last specimen was first recognized as a possible new variety by Guaglianone (1987, annotation label and drawing). Since this plant is known only from three collections from the same place and date, it is by no means certain that it is a morphogeographical variety. The shiny, black achenes of the widespread *E. geniculata* are, however, so distinctive that it seems reasonable to name this apparently local variant with brown to reddish brown achenes. It is also interesting because only purple to black, not brown, achenes were known previously from species of the subseries *Rigidae,* to which *E. geniculata* belongs.

Paratypes. VENEZUELA. **Delta Amacuro:** Depto. Pedernales (boundary with Depto. Tucupita), sand beach bordering open sandy mud flats and wet depressions, mouth of Caño Guiniquina, between Punta Araguabisi and Punta Baja, at Barra Guiniquina, 18 Oct. 1977, *J. Steyermark, R. Liesner & F. Delascio 114864* (MO, NY); *J. Steyermark, R. Liesner & F. Delascio 114930* (MO, VEN).

Eleocharis liesneri S. González & Reznicek, sp. nov. (Subgen. *Limnochloa*). TYPE: Venezuela. Bolívar: Gran Sabana, ca. 10 km SW of Karaurin Tepui at junction of Río Karaurin and Río Asadon (Río Sanpa), gallery forest, 5°19′N, 61°03′W, 900–1000 m, riverbank, 23 Apr. 1988, *R. Liesner 23698* (holotype, MO; isotype, NY).

Perennis, culmis cespitosis, 40–65 cm longis, 2–4.4 mm crassis, teretibus vel levissimae trigonis ad apicem, haud septatis, medulla spongiosa; vaginis scariosis, stramineus vel purpurascens; spiculis 1.6–2.4 cm longis, 3.9–4.5 mm crassis, 12–26-floribus, glumis 5.5–6.2 mm longis, angustatis; acheniis 2.8–3.2 mm longis, 1.6–1.9 mm latis, biconvexis, utroque lateris cum cellulis 23–26-seriatis striatis, ad apicem contractis.

Perennial, caespitose from coarse roots; culms erect, 40–65 cm long, 2–4.4 mm wide, terete or very obtusely trigonous at the apex, rigid, dull, dark green (when dry), many and finely white-striolated with rows of cells with large silica bodies; sheaths loose, scarious, open distally and easily torn, stramineous or purple at the base, membranous and subhyaline at the acute apex. Spikelets angular-cylindric, 1.6–2.4 cm long, 3.9–4.5 mm wide, ± acute, 12–26-flowered, glumes ± in 4 rows, 5.5–6.2 mm long, 2.4–3.2 mm wide, rather loosely imbricate, oblong, obtuse to subacute, coriaceous, ecarinate, the midnerve scarcely differentiated from the prominent, numerous, and closely spaced lateral nerves, the sides green to brownish, the margin and apex abruptly hyaline, easily torn; lowest glume (fertile?), 3.8–4.8 mm long, sheathing the base of the spikelet, appearing to be a continuation of the culm. Achenes 2.8–3.2 mm long, 1.6–1.9 mm wide, obovoid to broadly obpyriform, turgid, biconvex, each side with 23–26 rows of transversely oblong cells, which can become isodiametric at the base of the achene, shiny pale brown, at the apex contracted into a very short neck that is expanded at the base of the rostrum; rostrum 0.5–1 mm long, flattened, subquadrangular, widest at the base, grayish to black; bristles 6–7, in two series, united at the base, coarse, up to 5.2 mm long, stramineous to reddish brown, retrorsely toothed; stamens (usually?) 2, the filaments dark colored proximally, flattened and subhyaline distally.

Distribution. Known only from the type locality, in Estado Bolívar, Gran Sabana, on riverbank in a gallery forest, at 900–1000 m. Fruiting in April.

Though it could appear to be a slenderer form of *Eleocharis strobilacea* Pedersen, from Argentina and Paraguay, *E. liesneri* has narrower and fewer-flowered spikelets (12–26-flowered vs. up to 70-flowered), longer glumes with the exposed portion longer than broad, and wider achenes (1.6–1.9 mm wide vs. ± 1.2 mm wide), with more abundant rows of cells per face, a truncate versus acute rostrum, and relatively longer bristles. Because of its terete culms, *E. liesneri* also bears a superficial resemblance to *E. interstincta* and *E. cellulosa*, differing from both of them in the narrower, coarsely nerved glumes, and in achenes contracted below the apex and then expanded at the base of the rostrum, which is thus broader than its articulation with the main body of the achene. Other differences from *E. interstincta* are non-septate culms and narrower spikelets. From *E. cellulosa* it differs in the longer glumes, the toothed bristles, and the longer rostrum of the achene. In the general aspect of the culms, spikelets, and glumes, *E. liesneri* is similar to the Australian *E. brassii* S. T. Blake, which, however, has the achenes deeply pitted, the epidermal cells hexagonal, the apex not or scarcely constricted, and the bristles smaller. The shape of the achene and rostrum are similar to those of *E. acutangula* and *E. philippinensis* Svenson, from which *E. liesneri* differs mainly in its terete rather than angular culms, longer glumes, and larger achenes with more rows of cells.

The species is named after Ronald Liesner, who collected the type, as well as many other interesting plants in Venezuela.

Eleocharis squamigera Svenson subsp. **straminea** S. González & Reznicek, subsp. nov. TYPE: Venezuela. Bolívar: Mount Roraima, between Rondón Camp and base of sandstone bluffs, *J. A. Steyermark 58985* (holotype, NY; isotype, NY).

Eleochari squamigerae Svenson subsp. *squamigerae* similis sed differt rhizomata cum squamis stramineis vel flavis vel atrobrunneis instructa; acheniis 1.2–1.4 mm longis, luteolis, in adaxialis lateris cum cellulis 9–12-seriatis striatis, inter strias non prominentibus.

Perennial, in tufts or sometimes more scattered on a scaly rhizome up to 1.3 mm thick, rhizome scales yellowish to dark brown. Culms 3–32 mm long, 0.2–0.5 mm wide, sometimes strongly curved; sheaths ± loose, pale brown below, greenish above, oblique. Spikelets 2.5–5.5 mm long, ca. 1.5–3.5 mm wide, ellipsoid, 4–12-flowered; glumes 1.5–2.2 mm long, 0.9–1.2 mm wide, membranous, ovate, obtuse, whitish to pale yellowish. Achene 1.2–1.4 mm long, 0.6–0.8 mm wide, trigonous with thickened angles, obovate, buff to pale yellow, with 9–12 rows of cells but lacking pronounced ridges separating the rows; rostrum 0.4 mm wide, pyramidal, pale brown; bristles shorter than the achene, brown, Style trifid. Stamens 2, anthers 0.6–0.8 mm long.

The main differences between the subspecies *straminea* and *squamigera* are the straw or yellow to dark brown color of the rhizome scales in the former versus reddish to purple in the latter, the whitish to yellowish glumes versus pinkish to purple, and the color and ornamentation of the achenes, which are slightly larger, buff or pale yellowish, and lacking elevated longitudinal ridges separating the rows of cells in subspecies *straminea* versus pale yellowish to olivaceous or pale brown, with distinct longitudinal ridges in subspecies *squamigera*.

Distribution. Known from the State of Bolívar and Territorio Federal Amazonas, on forested slopes and along river banks, sometimes forming dense masses, at 1800–2255 m. *Eleocharis squamigera* was described from Jaguariahyva, Brazil (southwest of São Pablo).

In *Eleocharis squamigera* subsp. *squamigera*, the ornamentation of the achenes is similar to that of several species of subgenus *Limnochloa* (Svenson's *Mutatae*), i.e., several rows of trabeculae separated by longitudinal elevated costae. The achenes of the subspecies here described have an ornamentation more similar to that of several species of the subgenus *Eleocharis* series *Tenuissimae*, i.e., the longitudinal costae are not elevated and the shape of the cells varies from horizontal (trabeculae-like) to hexagonal or irregular.

Paratypes. VENEZUELA. **Bolívar:** Auyán tepui, cumbre de parte central del brazo noroeste (división occidental del cerro) al sur de avioneta de Jimmy Angel, *J. A. Steyermark 93563* (NY, VEN); Chimantá Massif, Central Section, W branch of headwaters of Río Tirica above Upper Falls, 2091 m, 17 Feb. 1955, *J. A. Steyermark &*

J. J. Wurdack 915 (NY—2 sheets); Chimantá Massif, Torono-tepui, along banks of Cano Mojado, 1894–1909 m, 20 Feb. 1955, *J. A. Steyermark & J. J. Wurdack 959* (NY); Distr. Piar, Macizo del Chimantá, sector centro-noreste del Chimantá-tepui, cabeceras orientales del Caño Chimantá, 5°18'N, 62°09'W, ± 2000 m, 26–29 Jan. 1983, *J. A. Steyermark, O. Huber & V. Carreño 128201* (MO). **Amazonas:** Depto. Río Negro, Cerro de la Neblina, Camp II, 2.5–3.5 km NE Pico Phelps (= Neblina), 2085–2100 m, 28 Jan. 1985, *V. A. Funk 6715* (NY).

Eleocharis steyermarkii S. González & Reznicek, sp. nov. (Subgen. *Eleocharis*, series *Tenuissimae*, subseries *Sulcatae*). TYPE: Venezuela. Bolívar: km 201.9 (km "189–190" of carretera sign), carretera El Dorado hacia Santa Elena de Uairén, al sur de El Dorado, in dense clumps along swampy margin of stream, 1200–1400 m, 19–22 Feb. 1972, *J. Steyermark et al. 105478* (holotype, NY; isotypes, NY, VEN).

Perennis; culmis (15–)20–40 cm longis, (0.5–)0.7–2.2(–3) mm latis. Spiculis 5–11 mm longis, (2.1–)2.9–4.8 mm latis, ovatis vel lanceolatis, subacutis; glumae floriferae 2.5–3.6 mm longae, (1.2–)1.5–2.2 mm latae; acheniis (1.4–)1.5–1.9 mm longis, (0.7–)0.8–1 mm latis, obovatis vel orbicularis, rostris pyramidalis.

Perennial from short or somewhat elongated rhizomes. Culms (15–)20–40 cm long, (0.5–)0.7–2.2(–3) mm wide, often flexible and soft, not or finely sulcate, erect; upper sheaths scarious, red, purple or stramineous at the base, membranous, acute or sometimes torn at the apex. Spikelets 5–11 mm long, (2.1–)2.9–4.8 mm wide, ovoid to lanceoloid, subacute, (7–)15–40-flowered; glumes 2.5–3.6 mm long, (1.2–)1.5–2.2 mm wide, membranous to subcoriaceous, elliptic, obtuse to emarginate, with a green to stramineous midvein, and reddish to dark purple or almost black sides, the apex and margins broadly hyaline, the margin of the lowest glume 0.2–0.8 mm wide. Achene (1.4–)1.5–1.9 mm long, (0.7–)0.8–1 mm wide, trigonous to plano-convex, obovoid, obpyriform or orbicular, gradually stipitate, whitish to yellowish, almost smooth or finely longitudinally striolated; rostrum pyramidal, its base as broad as the apex of the achene, not or slightly decurrent on the angles, whitish to brown; hypogynous bristles 6–7, shorter or slightly longer than the achene, white to light reddish, retrorsely toothed. Style trifid. Stamens 3, anthers (0.6–)0.9–1.7 mm long, the filaments up to 2 mm long.

Distribution. Known from Estado Bolívar, forming dense clumps in wet savannas and along swampy margins of streams and rivers, 900–2120 m. Fruiting known from February to April.

Eleocharis steyermarkii is probably related to *E. pachystyla*, from which it differs in having ovoid to ovoid-lanceoloid (vs. obovoid to rhomboid) spikelets; the lowest 1 mm of the rachilla with 0–4 transversely elongated scars (vs. lowest 1 mm with several closely placed transversely elongated scars, which are different from the prominent, not transversely elongated scars on the rest of the rachilla); middle glumes wider (2.5–3.6 × 1.5–2.2 mm vs. 2–3.1 × 1–1.2 mm); margins of lowest glume conspicuously hyaline (0.2–0.8 mm vs. 0.1–0.3 mm); and lighter colored bristles (whitish to light reddish vs. reddish to dark brown).

Delicate forms of *Eleocharis steyermarkii* could be confused with *E. filiculmis* Kunth or with *E. almensis* D. A. Simpson. From *E. filiculmis* they differ mainly in the larger glumes and achenes, and the less densely flowered, subacute spikelets. From *E. almensis* (holotype, *Harley et al. 25305*, K) they differ in the wider culms, larger, darker purple glumes, wider achenes that are capped by a rostrum as wide as the achenes, and larger anthers.

Paratypes. VENEZUELA. **Bolívar:** Gran Sabana, ca. 10 km SW of Karaurin Tepui at junction of río Karaurin and Río Asadon (Río Sanpa), 05°19'N, 61°03'W, riverbank, 900–1000 m, 20 Apr. 1988, *R. Liesner 23487* (MICH); Chimantá Massif, central Section, swampy depression in wet savanna along E branch of headwaters of Río Tirica, 12 Feb. 1955, *J. Steyermark & J. J. Wurdack 761* (NY—2 sheets, VEN); Laguna al oeste del Río Cuchivero, en las proximidades de este, 27 Dec. 1976, *B. Trujillo 14358* (MY–Maracay).

Plants probably belonging to *E. steyermarkii* are: VENEZUELA. **Bolívar:** Gran Sabana, San Ignacio de Yuruaní, morichal, 05°00'N, 61°10'W, 850 m, 4 May 1988, *R. Liesner 24208* (CIIDIR, MICH) [but achenes 0.6–0.8 mm, pale brown, puncticulate]; vicinity of road campamento 150 at km 150 in valley of savanna of Río Uarama below Uarama-tepui, NE of Luepa, 1220 m, Apr. 1960, *J. Steyermark & S. Nilsson 606* (NY, VEN) [but rigid, deeply sulcate culms].

The species is named after Julian Steyermark, in honor of his many important contributions to the botany of Latin America.

Eleocharis venezuelensis S. González & Reznicek, sp. nov. (Subgen. *Eleocharis*, sect. *Eleocharis*, ser. *Tenuissimae*). TYPE: Venezuela. Apure: Dtto. Pedro Camejo, Parque Nacional Santos Luzardo, sect. 2, Fundo "La Guacharaca," 30 km SE de margen derecha del Río Capanaparo, aprox. 6°42'N, 67°32'W, 50 m, 31 Mar. 1989, *G. Aymard, N. Cuello & R. Schargei 7405* (holotype, MO).

Eleocharis retroflexae affinis sed culmis robustioris, spiculis (4.5–)5.2–9 mm longis, (1.5–)2–2.7 mm latis, glumis (2.6–)3.2–4.3 mm longis, acheniis (1.4–)1.5–1.7 mm longis, 0.7–0.9 mm latis, maturitate nigris, setis robustioris differt.

Perennial (sometimes annual?), densely caespitose, often profusely proliferous and appearing to be repeatedly branched; culms 5–12 cm long (much larger in aquatic phases), 0.3–0.5(–0.8) mm wide, dark green, sometimes very minutely white-puncticulate, sulcate, erect and rigid, or floating; sheaths scarious, brown or purple at the base, membranous, hyaline and inflated at the acute or rounded apex. Spikelets (4.5–)5.2–9 mm long, (1.5–)2–2.7 mm wide, oblong to lanceolate, flattened, ± acute, 7–16-flowered, often sterile and proliferous; glumes subdistichous, (2.6–)3.2–4.3 mm long, 1.2–1.8 mm wide, membranous, oblong to long-elliptic, prominently keeled, obtuse to acute, with a broad green to stramineous midvein and brownish to purple sides, the margin and apex broadly hyaline, the lowest glume ± ½ the length of the spikelet, the midvein closely and finely nerved, appearing to be a continuation of the culm. Achene (1.4–)1.5–1.7 mm long, 0.7–0.9 mm wide, trigonous, obovoid to ± urceolate, truncate at the apex, narrowed to the base, pericarp yellowish to shiny dark gray or black, the dark layer easily falling off, leaving a yellowish to light brown wall, cancellate, each side with about 7–14 longitudinal rows of ± circular pits; rostrum 0.4–0.5 mm long, high-pyramidal, acuminate, broad at the base and usually deeply 3-lobed and slightly decurrent on the angles of the achene, light brownish; hypogynous bristles 4–6 or absent, shorter or slightly longer than the achene, flattened at the lower half, white to light brown colored, finely toothed. Style trifid. Stamens 3, anthers 1.8–2.3 mm long, the connective short prolonged.

Distribution. Known from the states of Apure and Guárico, as an aquatic or subaquatic on sandy river banks and around lagoons, between 50 and 100 m. Fruiting known in March and December. The aquatic, proliferous plants are often sterile.

This species has been identified as, and is related to, *Eleocharis retroflexa*. However, *E. venezuelensis* has more rigid and coarse culms (in the terrestrial forms); larger spikelets, glumes, and achenes; the lowest glume with several close and fine nerves along the midvein; achenes with a brown to shiny black coat (easily fallen), and ornamentation less deeply cancellate as compared with that of *E. retroflexa*. The North American *E. vivipara*, also with dark, cancellate achenes, has polystichous spikelets and shorter achenes with the rostrum not decurrent. From *E. subfoliata*, *E. venezuelensis* differs mainly in the much larger glumes, larger and relatively more deeply cancellate achenes, and broader decurrent rostrum.

Paratypes. VENEZUELA. **Apure:** Dtto. Pedro Camejo, Caño La Cochina de La Pica crossing, between the Río Cinaruco and the Río Capanaparo, aprox. 6°43′N, 67°48′W, 70 m, 2 Mar. 1979, *G. Davidse & A. C. González 15988* (MO). **Guárico:** Dtto. Infante, Parque Nacional Aguaro-Guariquito, Morichal San Ramón, ca. 9°40′–9°44′N, y 67°52′–67°56′W, 100 m, Dec. 1981, *F. Delascio, R. Montes & G. Davidse 11416* (MO).

Eleocharis sp.

The *Eleocharis retroflexa* complex is much in need of a taxonomical and nomenclatural revision, and it seems unwise to describe yet another poorly known species in the group. However, some floating plants belonging to the *E. retroflexa* complex show a "*Websteria*-like" branching pattern not recorded previously in *Eleocharis*. This species has, in *Stergios, Gutierrez & Stergios 11279* (MO), dimorphic culms, the fertile culms (0.1–0.3 mm wide) growing among whorls of abundant, capillary culms, successively giving place to secondary whorls, in up to five orders of branching. In *E. retroflexa* and other species with proliferous spikelets, branching is seen because of the proliferous habit, but the culms are not evidently dimorphic. In addition, *E. retroflexa* differs from the species here discussed in having obovoid to urceolate achenes truncate at the apex (vs. elliptic or long obovoid achenes narrowed to the apex), and high (vs. low) pyramidal rostrums. The rostrum type of this species is similar to that in *E. glauca*, which can be distinguished by its clearly polystichous, shorter glumes, shorter achenes (0.8–0.85 mm), and long stolons connecting the fascicles of culms.

Another collection, apparently of the same species, *Trujillo & Pulido 15123* (MY–Maracay), growing as an emergent aquatic, lacks the successive verticils of culms, but its culms are evidently and repeatedly branched up to 2.5 cm above the base, with some of the secondary culms slenderer.

Specimens examined. VENEZUELA. **Amazonas:** Dtto. Atures, 20 km de Pto. Ayacucho, carretera hacia El Burro, lajas de piedra asociadas con arroyo de manantial, 160–180 m, Sep.–Oct. 1987, *B. Stergios, E. Gutierrez & P. Stergios 11279* (MO); alrededores de El Sipapo, ± 28 km despues del cruce desde la carretera Puerto Ayacucho–Simariapo, 100 m, 22 Mar. 1979, *B. Trujillo & J. Pulido 15123* (MY–Maracay).

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Pitcairnia calcicola (Bromeliaceae), a New Species from the Tropical Dry Forest of Costa Rica

Jason R. Grant
Department of Plant Biology, University of Maryland, College Park, Maryland 20742-5815, U.S.A.

J. Francisco Morales
Departamento de Botánica, Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Apartado Postal 22-3100, Costa Rica

ABSTRACT. *Pitcairnia calcicola* is described as a narrow endemic of the low limestone hills in the tropical dry forest of central Guanacaste Province, Costa Rica. It belongs to *Pitcairnia* subg. *Pitcairnia,* and appears to be most closely related to *P. flagellaris* L. B. Smith of Guatemala.

Pitcairnia calcicola J. R. Grant & J. F. Morales, sp. nov. TYPE: Costa Rica. Guanacaste: Parque Nacional Barra Honda, Sendero Las Cavernas, bosque secundario en la cima y falda sur del Cerro Barra Honda, 10°09′52″N, 85°21′45″W, 420 m, 8 Sep. 1993, *Morales 1659b, Reyes, & Lepiz* (holotype, INB; isotypes, CR, MO, US). Figure 1.

A *Pitcairnia flagellari,* cui affinis, sed foliis longioribus et latissimus, scapus lepidotis, bracteis scapigeris internodia longioribus, pedicellis brevior, sepalis longioribus, et petalisque sin appendicibus differt.

Plants acaulescent, terrestrial, epilithic on limestone outcrops (calciphilic), stoloniferous, 120–170 cm tall in flower. Leaves grass-green, dimorphic, persistent, spinose, not petiolate; outer leaves reduced to short spinose-serrate spines, 7–18 mm long, the sheaths ovate, 2.5–4.0 cm long, 3.0–4.5 cm wide, slightly inflating the base of the plant, the blades linear-long, 4.5–14.0 cm long, 2–4 mm wide; inner leaves foliaceous, the sheaths scarcely defined as they merge into the blades without differentiation, the blades narrow, linear-long, 50–125 cm long, 8–10 mm wide at base, 14–18 mm wide at the middle, and 18–25 mm wide at their broadest above the middle, acuminate, narrowing toward the apex; spines usually antrorse (rarely retrorse), 0.25–1.0 mm long, roughly spaced every 2 mm on the outer leaves and sheaths of the inner leaves, sparse and usually absent on the blades of the inner leaves. Scape reddish, erect, thinly white to greenish white flocculose, 41–57 cm long; scape bracts grass-green, linear-triangular, filiform, 25–36 cm long, 7–9 mm wide at base, 2–3 mm wide at the middle and 0.50–1.0 mm wide at the apex, lepidote. Inflorescence paniculate, diffuse, bipinnate to tripinnate, 45–135 cm tall, lepidote, the rachis reddish; primary bracts (those bracts that subtend branches) linear-long, acuminate, erect to spreading, never decurrent, 18–79 mm long, 2–5 mm wide, grass-green, lepidote, decreasing in length toward the apex of the inflorescence, those of the lower branches exceeding the length of the sterile portion of the branch it subtends, while shorter when subtending the branches near the apex of the inflorescence; primary branches 2–6 in number, 18.5–26.5 cm long, lepidote; secondary branches 8–10 cm long. Flowers pedicellate, trigonal. Floral bracts (those bracts that subtend pedicels) triangular and pungent to ovate and acute, lepidote, shorter than the pedicels, 5–17 mm long, 2.5–3.5 mm wide, decreasing in length toward the apex of the inflorescence. Pedicels slender, 5–16 mm long, 0.75 mm wide, longer than their subtending floral bract, lepidote, reddish. Sepals bright red, narrowly triangular in outline, acuminate, firm, pungent, lepidote, 33–36 mm long, 5–6 mm wide at base, 3–4 mm wide at the middle, and less than 1 mm wide at the apex. The adaxial sepal and petal pairs are arranged on the upper side of the flower, while the abaxial sepal and petal are on the lower side of the

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Figure 1. *Pitcairnia calcicola* J. R. Grant & J. F. Morales. A, B from the holotype, C–G from the paratypes. —A. Lower habit. —B. Upper portion of inflorescence. —C. Entire habit. —D. Lateral view of flower showing the upper position of the abaxial petal and sepal pairs, and the lower position of the adaxial petal and sepal. —E. Lateral internal

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view of flower showing the position of the pistil and stamens. —F. Capsule tightly bound within the firmly dried calyx (one sepal removed to show the carpels). —G. Bicaudate seed.

flower. Petals bright red, linear-obovate, apically obtuse, glabrous, unappendaged, 46–52 mm long, 2.0–3.5 mm wide at base, 4–5 mm wide at the middle, and 6–8 mm wide at their broadest toward the apex, exceeding the sepals, stamens, and pistil. Stamens included, 45–49 mm long, shorter than the pistil; filaments slender, 37–41 mm long, 0.25 mm wide; anthers linear, 7–8 mm long, 0.5 mm wide, basifixed. Pistil included, 46–48 mm long, longer than the stamens; ovary 3-carpeled, 3-loculed, ovate, superior, 6–7 mm long, 2–3 mm wide at anthesis; style 37–40 mm long, 0.5 mm wide; stigma 2.0 mm long, 1.0 mm wide, with the conduplicate-spiral type morphology (i.e., the three lobes twist spirally). Capsules ovate, trigonal, septicidal, 8–18 mm long, 5–7 mm wide, tightly bound within the firmly dried calyx and lined by the dried petals, stamens, and pistil to form a "shaker-like" capsule-calyx from which the seeds are dispersed, light to dark brown at maturity, dehiscing along an inward-facing suture; carpels three, 2.5–3.0 mm wide. Only when the carpels open resulting in the spreading of the sepals may seeds may fall out. Seeds bicaudate, "s" shaped, 3.0–4.1 mm long in total length; embryo reniform to obovate on its side and linear-thin from above, burnt-orange to rust in color, 0.9–1.2 mm long, 0.25–0.35 mm wide, and 0.10–0.18 mm wide from above; endostome extending linearly from diagonally opposite ends of the embryo, each 1.0–1.5 mm long, 0.05–0.10 mm wide, ivory-white to buff in color.

Paratypes. COSTA RICA. **Guanacaste:** Parque Nacional Palo Verde, Area Conservación Tempisque, Estación Palo Verde, Sendero Cactus, 10°20′00″N, 85°21′10″W, 100 m, 12 Dec. 1990, *Chavarria 191* (CR, INB, MO); Peninsula de Nicoya, 10 km S of Santa Cruz near Vista al Mar, 17 July 1992, *Grant 92-02008 & Rundell* (CR, SEL, US); Parque Nacional Palo Verde, Area Conservación Tempisque, Estación Palo Verde, Sendero Cactus, 10°20′00″N, 85°21′10″W, 100 m, 11 Jan. 1994, *Grant 94-02307 & Rundell* (CR, US); Parque Nacional Palo Verde, Valle del Tempisque, Sendero Guayacan, 10°21′00″N, 85°21′00″W, 10 m, 8 Sep. 1994, *Chavarria 1034* (CR, INB, MO); Parque Nacional Barra Honda, Sendero Las Cavernas, bosque secundario en la cima y falda sur del Cerro Barra Honda, 10°09′44″N, 85°21′31″W, 390 m, 1 Oct. 1994, *Lepiz, Fernandez & Reyes 556* (CR, INB, SEL, US).

TAXONOMY

Pitcairnia calcicola belongs to *Pitcairnia* subg. *Pitcairnia* because of its bicaudate seeds. It appears to be most closely related to *P. flagellaris* L. B. Smith of Guatemala, from which it differs in its longer, wider leaves, lepidote scape, longer scape bract internodes, shorter pedicels, longer sepals, and petals without appendages. The new species also shows similarities to several other bright red-flowered species with paniculate inflorescences including *P. angustifolia* Solander of the Greater and Lesser Antilles, *P. integrifolia* Kew-Gawler of Trinidad and Venezuela, *P. ruderalis* L. B. Smith of Peru, and superficially to *P. valerii* Standley of Costa Rica and Panama.

Of the species of *Pitcairnia* in Costa Rica, *P. calcicola* appears in gross morphology to mimic *P. valerii* through its similar bright red flowers and paniculate inflorescence. However, *Pitcairnia valerii* belongs to a different species complex: it is a larger plant with a huge inflorescence (140–260 cm tall); it has entire, narrowly lanceolate leaves and smaller flowers; and it is found in premontane rainforests and cloud forests. These two species do not appear to be related, but rather exhibit convergent characteristics in order to attract a similar group of pollinators, likely hummingbirds.

Fruiting material of the red-petaled *Pitcairnia calcicola* may be confused with two other species found in Costa Rica, the yellow-petaled *P. halophila* L. B. Smith and white-petaled *P. megasepala* Baker. They may be distinguished from one another by the length of their sepals: 23–29 mm long in *P. halophila*, 30–35 mm long in *Pitcairnia calcicola*, and 35–40 mm long in *P. megasepala*.

PHENOLOGY

Pitcairnia calcicola flowers from late August through mid-September during the rainy season. By December and January, the plants have finished flowering and die back to stolons that remain viable until the rains of April and May stimulate sprouting. The seeds are distributed mainly by wind or by adherence to small animals.

HABITAT

Plants are terrestrial on exposed limestone hills in the lower Tempisque basin of the tropical dry forest of central Guanacaste Province, Costa Rica. The hills on which the plants occur are 100–200 m in elevation and generally lack soil. The surface rock consists of a "hard, porous Eocene limestone" that when exposed on the ridges and upper slopes becomes sharp and deeply creviced (Hartshorn in Janzen, 1983: 129). This is a transition zone between the tropical dry forest typical of northern Guanacaste and the premontane wet forest of the southern Nicoya Peninsula. It has a mean annual biotemperature of 23–24°C, and 1500–1900 mm of rainfall annually (Rodriguez & Estrada, 1994). The area supports a rich ecosystem with a larger number of species than northern Guanacaste, which is the driest region of the country. The bromeliad flora of the tropical dry forest of Guanacaste is a type that extends south from Mexico along the Pacific Coast. With few exceptions, they are primarily xeric species unknown to mesic and wet Costa Rica.

DISTRIBUTION

Pitcairnia calcicola is a narrow endemic of the limestone hills in the tropical dry forest of central Guanacaste Province, Costa Rica. Although it has only been collected once outside the Parque Nacional Palo Verde and Parque Nacional Barra Honda, it is likely to be found in adjacent areas of similar-type geology and vegetation.

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New Combinations in North American Alismatidae

Robert R. Haynes
Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama 35487-0344, U.S.A.

C. Barre Hellquist
Department of Biology, North Adams State College, North Adams, Massachusetts 01247, U.S.A.

ABSTRACT. Subspecies is the only infraspecific rank included in the Alismatidae in the *Flora of North America.* All new combinations for taxa in North America are proposed herein for use in this Flora: *Potamogeton pusillus* subsp. *tenuissimus, P. pusillus* subsp. *gemmiparus, P. foliosus* subsp. *fibrillosus, Sagittaria graminea* subsp. *chapmanii, S. graminea* subsp. *weatherbiana, Najas guadalupensis* subsp. *olivacea, N. guadalupensis* subsp. *floridana,* and *N. guadalupensis* subsp. *muenscheri.*

The family treatments for the Alismatidae in the *Flora of North America* include only one infraspecific category, that being subspecies. We have long recognized only one infraspecific category. In previous publications, however, Haynes (1974, 1979) considered this infraspecific category to be at the rank of variety. "Variety" was chosen mostly because the botanist with whom he was associated used that rank more often than that of subspecies. Haynes indicated in both publications cited above that he considered varieties (or infraspecific categories) to be morphogeographic subdivisions of a species. That concept has not changed, only the rank at which the taxa are accepted. It is our opinion that more and more systematists accept only one infraspecific rank (although the Botanical *Code* allows for more), and that rank is becoming more often subspecies. We now, therefore, use subspecies exclusively.

Infraspecific taxa in the Alismatidae have previously been recognized at the varietal and subspecific levels. Utilizing one infraspecific category necessitates a new combination for any taxon that has previously been recognized at the varietal level and for which no subspecific name is available. Such taxa are being accepted in *Potamogeton* (Potamogetonaceae), *Sagittaria* (Alismataceae), and *Najas* (Najadaceae). All necessary combinations are proposed below for use in the *Flora of North America.*

Potamogeton pusillus L. subsp. **tenuissimus** (F. K. Mertens & W. D. J. Koch) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Potamogeton pusillus* L. var. *tenuissimus* F. K. Mertens & W. D. J. Koch, in Röhlings, Deutschl. Fl. 1: 857. 1823. TYPE: not located.

Potamogeton pusillus L. subsp. **gemmiparus** (Robbins) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Potamogeton pusillus* L. var. *gemmiparus* Robbins, in A. Gray, Manual, 5th ed. 489. 1867. *Potamogeton gemmiparus* (Robbins) Morong, Bot. Gaz. (Crawfordsville) 5: 51. 1880. TYPE: U.S.A. Massachusetts: valley of the Blackstone, *Robbins s.n.* (lectotype, selected by Haynes (1974), NY; isolectotypes, GH, NY, PH, US).

Potamogeton foliosus Rafinesque subsp. **fibrillosus** (Fernald) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Potamogeton fibrillosus* Fernald, Mem. Amer. Acad. Arts 17: 51. 1932. *Potamogeton foliosus* Rafinesque var. *fibrillosus* (Fernald) R. R. Haynes & J. L. Reveal, Rhodora 75: 76. 1973. TYPE: U.S.A. Oregon: margin of Harney Valley, "P" Ranch, 22 June 1901, *W. C. Cusick 2598* (holotype, GH; isotypes, F, K, MO, NY, UC, US).

Sagittaria graminea A. Michaux subsp. **chapmanii** (J. G. Smith) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Sagittaria graminea* L. var. *chapmanii* J. G. Smith, Annual Rep. Missouri Bot. Gard. 6: 52. 1895. *Sagittaria chapmanii* (J. G. Smith) Mohr, Bull. Torrey Club 24: 20. 1897. TYPE: U.S.A. Florida: in a creek on road to Marianna, 3 or 4 mi. from Ochesee, 1862, *Chapman s.n.* (lectotype, selected here, NY).

Bogin (1955), in his revision of *Sagittaria,* cited *Chapman s.n.,* 1862, as the holotype. That specimen cannot be the *holotype* since collections made by Mohr in 1880 and 1884 "in the vicinity of Mo-

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bile, Alabama" are also included in the protologue. We believe that since the variety was named to commemorate Chapman, one of his collections should be chosen as the lectotype if it was cited in the protologue and maintains current usage. *Chapman s.n.*, 1862, at NY satisfies both criteria.

Sagittaria graminea A. Michaux subsp. **weatherbiana** (Fernald) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Sagittaria weatherbiana* Fernald, Rhodora 37: 387. 1935. *Sagittaria graminea* A. Michaux var. *weatherbiana* (Fernald) C. Bogin, Mem. New York Bot. Gard. 9: 209. 1955. TYPE: U.S.A. Virginia: Norfolk Co., gum swamp N of Land of Promise, 7 May 1935, *Fernald & Griscom 4297* (holotype, GH).

Najas guadalupensis (Sprengel) Magnus subsp. **olivacea** (Rosendahl & Butters) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Najas olivacea* Rosendahl & Butters, Rhodora 37: 347. 1935. *Najas guadalupensis* (Sprengel) Magnus var. *olivacea* (Rosendahl & Butters) R. R. Haynes, Sida 8: 43. 1979. TYPE: U.S.A. Minnesota: Kandiyohi Co.: NE bay of Norway Lake, 6 Sep. 1933, *C. O. Rosendahl & F. K. Butters 6446* (lectotype, selected by Haynes (1979), MIN).

Najas guadalupensis (Sprengel) Magnus subsp. **floridana** (R. R. Haynes & W. A. Wentz) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Najas guadalupensis* (Sprengel) Magnus var. *floridana* R. R. Haynes & W. A. Wentz, Sida 5: 262. 1974. TYPE: U.S.A. Florida: Dade Co., St. Rt. 94 off U.S. 41 at edge of Everglades National Park, ca. 40 mi. W of Miami, 5 Apr. 1972, *W. A. Wentz 670* (holotype, US; isotypes, GH, MICH, OS).

Najas guadalupensis (Sprengel) Magnus subsp. **muenscheri** (Clausen) R. R. Haynes & C. B. Hellquist, comb. et stat. nov. Basionym: *Najas muenscheri* Clausen, Rhodora 39: 59. 1937. *Najas guadalupensis* (Sprengel) Magnus var. *muenscheri* (Clausen) R. R. Haynes, Sida 8: 45. 1979. TYPE: U.S.A. New York: Greene Co., tidal mudflats of Hudson River, Imbocht Bay, 3 Sep. 1936, *W. C. Muenscher & O. F. Curtis, Jr. 5495* (holotype, BH, isotype, GH).

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Haynes, R. R. 1979. Revision of North and Central American *Najas* (Najadaceae). Sida 8: 34–56.

Additional Notes on the Scrophulariaceae of China

Hong De-yuan
Laboratory of Systematic and Evolutionary Botany, Institute of Botany,
Chinese Academy of Sciences,
Xiangshan, Beijing 100093, People's Republic of China

ABSTRACT. Two species, *Pterygiella suffruticosa* Hong and *Scrophularia lhasaensis* Hong, and one subspecies, *S. chasmophila* W. W. Smith subsp. *xizangensis* Hong, are described as new from southwestern China. In addition, four new combinations are proposed in the genera *Triphysaria* and *Mazus: T. chinensis* (Hong) Hong, *M. pumilus* (Burman f.) van Steenis var. *wangii* (Li) Chin, *Mazus pumilus* (Burman f.) van Steenis var. *delavayi* (Bonati) Chin, and *Mazus pumilus* (Burman f.) van Steenis var. *macrocalyx* (Bonati) Chin.

The following new taxa and combinations are proposed to make the names available for the forthcoming account of the Scrophulariaceae in volume 18 of the *Flora of China.*

Pterygiella suffruticosa Hong, sp. nov. TYPE: China. SW Sichuan: Muli, Ninglang, Chongtianhe, 2000 m, 27 Sep. 1983, *Qinghai-Xizang Expedition 14400* (holotype, PE; isotype, PE). Figure 1.

A ceteris speciebus differt habitu fruticoso et caulibus teretibus.

Shrubs, ca. 1 m tall. Stems terete, gray, 5–7 mm thick; shoots densely pilose. Leaves opposite, sessile, linear-elliptic, 3–5 × 0.3–1 cm, densely puberulent on both surfaces, base cuneate, margin entire, apex acute. Spikes terminal; lower bracts similar to upper leaves in shape and size, gradually decreasing in size upward. Pedicels up to 3 mm long, pilose. Calyx 1.3–1.5 cm long, puberulent, cleft to middle, slightly 2-lipped; lobes subulate-deltoid. Corolla yellow or pale pink, 1.4–1.6 cm long; upper lip galeate, entire; lower lip 3-lobed, middle lobe acute, lateral ones rounded, lanose in 2 vertical patches. Pistil hairy; ovary ellipsoid; style ca. 8 mm long.

Pterygiella Oliver, which is endemic to China, consists of five species, all of which are annuals, though *P. bartschioides* Handel-Mazzetti is also a biennial. This new species, *P. suffruticosa,* is readily distinguished from all by its shrubby habit.

Paratypes. CHINA. **Yunnan:** E of Lijiang, banks of the Yangtze River, *Rock 10469* (A); Mengtze, in ravine, 1400 m, *Henry 9141* (A).

Scrophularia lhasaensis Hong, sp. nov. TYPE: China. Xizang (Tibet): Lhasa, hills W of Lhasa and beyond Trisum, 4500 m, on rocks, 1 Sep. 1942, *F. Ludlow & G. Sherriff 9053* (holotype, A).

Scrophulariae chasmophilae W. W. Smith affinis, sed a qua foliis majoribus, 1.7–4.5 cm longis, 1–2.7 cm latis, integris, corolla minore, ca. 10.5 mm longa, lobis postici labii angustis, 2 mm latis, non imbricatis.

Caespitose perennials, less than 15 cm tall, glandular with multicellular hairs throughout except for corolla, stamens, and pistil. Rhizomes ca. 9 mm thick. Stems several, with 1 or 2 pairs of scaly leaves in lower part, branched in upper part. Leaves opposite; petiole 2–3 mm long or upper leaves sessile; leaf blade ovate to ovate-orbicular, 1.7–4.5 × 1–2.7 cm, base rounded or nearly truncate, margin entire or rarely scarcely serrate, apex obtuse or acute. Cymes 2, terminal, forming an inflorescence of 4 flowers; peduncle ca. 1.2 cm long; bracts linear. Pedicel 2–3 mm long. Calyx ca. 5 mm long, glandular-pilose, cleft nearly to base; lobes linear-oblong, obtuse at apex, ca. 1.8 mm wide. Corolla greenish yellow, ca. 10.5 mm long, urceolate, glabrous on both sides; upper lip ca. 3.8 mm long, ca. 2.3 mm longer than lower lip; lobes ca. 2 mm wide, not overlapping; lower lip ca. 2 mm long. Stamens slightly exceeding corolla tube in height, glabrous; staminode clavate. Pistil including the style ca. 8.5 mm long, glabrous, ovary gradually attenuate at apex into style.

Scrophularia lhasaensis is most closely related to *S. chasmophila* W. W. Smith and *S. przewalskii* Batal. From these, it differs in having larger leaves 1.7–4.5 cm long and 1–2.7 cm wide, entire or subentire leaf margins, smaller corollas ca. 10.5 mm long, and narrower (ca. 2 mm), nonoverlapping lobes of upper corolla lips.

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Figure 1. *Pterygiella suffruticosa* Hong. —1. Upper part of plant. —2. Node showing indumentum. —3. Flower. —4. Opened calyx. —5. Opened corolla. —6. Stamen. —7. Pistil. —8. Cross section of ovary. Scale: 1 cm in 1 and 2; 5 mm in 3–7; 1 mm in 8. Drawn by Zhang Tai-li.

Scrophularia chasmophila W. W. Smith subsp. **xizangensis** Hong, subsp. nov. TYPE: China. SE Xizang: Nyingchi (Kongbo, Deyuan La), among rocks, 4300 m, 5 June 1947, *F. Ludlow, G. Sherriff & H. H. Elliot 15153* (holotype, A).

A subsp. *chasmophila* differt corolla majore, 1.8–2.2 cm longa, foliis majoribus, 1.3–2.7 longis, 1–2.2 mm latis, manifeste serratis et staminodio obovato.

Perennials up to 15 cm tall. Roots several, 2–3 mm diam., up to 60 cm long. Stems glabrous, with several pairs of scaly leaves. Leaves in 2 or 3 pairs, rhomboid, ovate-orbicular or fan-shaped, 1.3–2.7 × 1–2.2 cm, pilose with multicellular hairs on both surfaces, base rounded or truncate, margin coarsely dentate, apex acute or rounded. Cymes 1–3-flowered, terminal on main stem and upper branches; peduncle glabrous, less than 5 mm long. Pedicel glabrous, less than 5 mm long, sometimes with 2 bracteoles. Calyx ca. 6 mm long, glandular pilose; lobes ovate-lanceolate, apex acute. Corolla yellow, 1.8–2.2 cm long, glandular outside, tube tubular; upper lip ca. 6.5 mm longer than lower lip, ca. 8.5 mm wide; lobes slightly overlapping, lateral lobes of lower lip wider and shorter than middle one, middle lobe ca. 2 mm long. Stamens included; staminode obovate. Ovary ca. 2 mm long; style ca. 1.4 cm long.

Scrophularia chasmophila subsp. *chasmophila* differs from subspecies *xizangensis* in having smaller corollas up to 1.5 cm long, smaller leaves up to 1.8 cm long, inconspicuously and sparsely serrate leaf margins, and clavate staminodes. In contrast, subspecies *xizangensis* has corollas 1.8–2.2 cm long, leaves 1.3–2.7 cm long with coarsely dentate margins, and obovate staminodes. Furthermore, subspecies *xizangensis* is restricted to Xizang, whereas subspecies *chasmophila* is distributed in northwestern Yunnan and southwestern Sichuan. The two subspecies are separated by three gorges, the Yarlung Zangbo River, the Nujiang (Salween) River, and the Lancang (Mekong) River. The differences between them are rather sharp, and the new taxon may deserve specific rank.

Paratypes. CHINA. **Xizang:** Nyingchi (Kongbo, Nyima La), 3800 m, deep shade among boulders in damp situations, *Ludlow, Sherriff & Taylor 5142* (A), Ba La, Pasum Chu, 4500 m, scree at foot of glacier, *Ludlow, Sherriff & Elliot 13996* (A), Lusha Chu, 3800 m, *Ludlow, Sherriff & Taylor 4769* (A).

Triphysaria chinensis (Hong) Hong, comb. nov. Basionym: *Orthocarpus chinensis* Hong, in Tsoong & H. P. Yang, Fl. Reipubl. Popularis Sin. 67(2): 405. 1979. TYPE: China. Hubei: Xinshan, 10 Sep. 1926, *Chen Yung s.n.* (holotype, N).

There is so far no convincing evidence that the Chinese material belongs to any American species of the genus *Triphysaria.* Therefore, I prefer to maintain the species.

Mazus pumilus (Burman f.) van Steenis var. **wangii** (Li) Chin, comb. nov. Basionym: *Mazus wangii* Li, Brittonia 8: 37. 1954. TYPE: China. Yunnan: Fo-Hai (Menghai), July 1936, 2500 m, *C. W. Wang 76071* (A).

Mazus pumilus (Burman f.) van Steenis var. **delavayi** (Bonati) Chin, comb. nov. Basionym: *Mazus delavayi* Bonati, Bull. Herb. Boissier, ser. 2. 8: 530. 1908. TYPE: China. Yunnan: a-Pin-tzé, 1885, *Delavay 1518* (P).

Mazus pumilus (Burman f.) van Steenis var. **macrocalyx** (Bonati) Chin, comb. nov. Basionym: *Mazus macrocalyx* Bonati, Bull. Herb. Boissier, ser. 2. 8: 529. 1908. TYPE: China. Yunnan: *Ducloux s.n.* (P).

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Studies in the Capparidaceae XVIII. A New Giant-Fruited *Capparis* (*C. muco*) from Eastern Venezuela

Hugh H. Iltis
Department of Botany, University of Wisconsin, 430 Lincoln Drive, Madison, Wisconsin 53706, U.S.A.

Luis J. Cumana C., and Rosario E. Delgado M.
Herbario IRBR, Departamento de Biología, Universidad de Oriente, A.P. 245, Cumaná 6101, Sucre, Venezuela

Gerardo C. Aymard
Herbario, UNELLEZ-Guanare, Mesa de Cavacas 3323, Portuguesa, Venezuela
Current address: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Capparis* (subg. *Calyptrocalyx*) *muco,* an arborescent species from dry tropical semideciduous and deciduous forests northeast and south of Barcelona, Anzoátegui, in northern Venezuela and several islands in Lago de Guri, Bolívar, in eastern Venezuela, is newly described and differentiated by a dense, soft, thin and slender, loosely stellate-echinate leaf pubescence [consisting of simply constructed, sessile, 2-rayed, stellate hairs (1.0–1.4 mm diam.) grading to echinate and complex multirayed, multiangulate "candelabra" or "palmoid" hairs on multiseriate stalks] from the related but tightly stellate-echinate *C. leprieurii-C. maroniensis* complex of the Guianas, in which the hairs are minute (0.2–0.3 mm diam.) and distantly dispersed. The large, more or less spherical fruits of "Muco" contain pulp that is eaten by both monkeys and people. Illustrations and a distribution map are provided.

RESUMEN. Se describe *Capparis* (subg. *Calyptrocalyx*) *muco,* una especie arborescente de los bosques secos tropicales deciduos y semideciduos del noreste y sur de Barcelona, Anzoátegui al norte de Venezuela y de algunas islas del Lago de Guri, Bolívar al este de Venezuela. Esta nueva especie se distingue en hojas poseer con una pubescencia laxa de pelos estrellado-equinados suaves y delgados [formada por pelos simples, sesiles, con dos rayos, estrellados (1.0–1.4 mm de diám.) graduando a pelos más complejos equinados, multiradiados, multiangulados "candelabro" o en forma de palma sobre un estipite multiseriado] en comparación con sus afines *C. leprieurii-C. maroniensis* del complejo de Las Guayanas, donde los pelos estrellado-equinados estan adpresos, los que son muy pequeños (0.2–0.3 mm de diám.) y muy dispersos. Los frutos grandes subesféricos del "Muco" son comestibles. Se incluyen ilustraciones y un mapa de distribución.

THE TAXONOMIC HISTORY OF *CAPPARIS MUCO,* A TALE OF UNCOMMON COOPERATION

According to an old African folktale, "It takes a whole village to raise a child." By the same token, it sometimes takes a whole network of systematists to discover a new species. So it was with the elusive *Capparis muco,* the subject of this paper.

The discovery of this rare species was long in coming and deserves special recounting. Two sterile collections of what seem to be juvenile shoots (stump sprouts?) with exceptionally large, somewhat falcate leaves were the first to be collected, namely by H. M. Curran and M. Haman for the Gray Herbarium of Harvard University, both under number *1197,* but one from Bachaco, on July 1, 1917, the other from Guanta, simply stating 1917. While the latter is a well-known coastal town ca. 15 km NNE of Barcelona in the Estado Anzoátegui, Venezuela, we have not been able to locate "Bachaco," either in the field near Guanta or on any map. Local informants have never heard of it and the Harvard herbaria are unable to locate the collectors' notebooks. Nevertheless, since both specimens carry the same collection number and look as if coming from the same tree, we must assume they were both collected somewhere near Guanta. Labeled as "*Capparis macrophylla,*" which they are not, the specimens, lacking both flowers and fruit,

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could not be placed by Iltis in the 1950s even to genus within the Capparidaceae.

During the 1960s, Iltis let it be known that he was willing to identify any and all New World Capparidaceae collections. As a consequence, Leandro Aristeguieta of the Caracas Herbarium sent him in June of 1969 various specimens of Capparidaceae for identification, including one quite mysterious plant from Curataquiche. This specimen, collected in flower in March 1969, was soon equated with the 1917 collections of Curran and Haman, but nevertheless the identity of the taxon remained a puzzle. Shortly thereafter, Aristeguieta went back to Curataquiche and soon forwarded a fine mature fruit from there, big as an orange and full of large seeds, which just deepened the mystery. Considering that it was indehiscent and had a very short gynophore, and that the flowers had ca. 20 short stamens, the material suggested an undescribed *Morisonia.* The lively correspondence that followed resulted in a few more collections from the same location, but no more insights into its taxonomy.

Curataquiche, as it turned out, is a small village 22 km south of Barcelona, where the plant, locally called "Muco," was reported to be not uncommon in the dry deciduous forests and woodlands, but seems to occur, in fact, at most sporadically.

Then in January 1991 an opportunity arose for Iltis to go to Venezuela and, imposing on the wonderful hospitality of Carmen Benítez de Rojas, plant taxonomist in Maracay, and Thirza Ruiz, the Venezuelan *Cleome* authority, to spend three weeks hunting Capparidaceae in their company. The climax of this highly focused and mostly successful enterprise was to occur near Cumana, a capparidaceous paradise, when, with the generous cooperation of Maestra Rosario Delgado and her associate, the wood anatomist of Capparidaceae, Luis Cumana, of the Universidad de Oriente Herbarium, we all traveled together one day to Curataquiche determined to recollect the mysterious Muco. To make a long story short, everybody there seemed to know Muco, but nobody was willing or able to show us one. Was it perhaps because of its desirable edible fruit that no one wanted to share its whereabouts? Or was it because, in fact, Muco has become indeed very rare in this beat-up landscape that once had seen much better days? The one tree that was reported to grow right *in* the village, in someone's garden, and one that several people were willing to talk about, had only recently been reduced to a stump to make room for a house, suggesting perhaps that Muco was once upon a time locally semi-cultivated or at least protected. Tantalizing to be so close, yet so far, it was all in all a most frustrating wild-goose chase.

Once back in Madison, Wisconsin, and many letters later, Iltis received a package with a mature fruit and a magnificent set of flowering specimens of Muco (now the type collection) from Luis Cumana and Rosario Delgado, who after revisiting Curataquiche twice without any luck, had finally hunted the species down at a different village called El Mucal de Perepecual, 8 km ESE of San Bernardino (where Peter Loefling collected plants for Linnaeus after 18 January 1754). Here this species is apparently so common that the area itself is named for the tree, Muco, as elsewhere south of Barcelona, being its common name, an epithet we now formally apply to our newly described species. But even in "El Mucal," it took Cumana and Delgado two trips to finally capture specimens of the species in flower! Finally, Cumana and his students collected *C. muco* within San Bernardino itself, in December 1995 in fruit, and in April 1996 in flower, interestingly among the ruins of colonial buildings right next to the church on the main square, and in the patios of houses nearby, growing next to *Crateva tapia* L., another capparid that is sometimes eaten, both species suggesting (perhaps even pre-Columbian?) semi-cultivation, what with Muco here, as elsewhere in northern Venezuela, reported as edible by the human population. Thus, without these extraordinary efforts, we would, to this day, still not have been able to recognize this plant as the unique, and potentially useful, taxon that it is.

During all this time, however, flowering specimens *were* in hand, but from the freshly flooded artificial Lago de Guri, 300 km southeast of Barcelona, in the state of Bolívar, the first of these collected in 1981 by A. Gonzalez and Ronald Liesner (an extraordinarily capable collector for the Missouri Botanical Garden, and a former Iltis student at the University of Wisconsin), but promptly misidentified by Iltis as *C. maroniensis,* while in 1989 some excellent specimens were made near there by Gerardo Aymard, a field botanist with the Projecto de Primatología Ecológica de la Guyana Venezolana of the late Warren Kinzey, Suzanne Walker, and Marilyn Norconk, who reported that the young seeds of *C. muco* and later the sweet pulp of its fruits were a major food source for the White-faced Saki monkeys (*Pithecia pithecia*) (Kinzey et al., 1989; Norconk, 1996; Norconk & Kinzey, 1993). Soon thereafter, Aymard obliged Iltis's request by collecting a magnificent fruit, nearly identical to those from near Barcelona. Still, at this point, all Guri and now all Barcelona material continued to be labeled first as a new *Morisonia,* and then *C. maroniensis*, because the leaves and flowers seemed to match the few available specimens, as did the large fruit, judging only from its published description, what with not a single fruit of that taxon available in any of the American or Venezuelan herbaria. During all this time, there was little focus on studying pubescence beyond looking for stellate hairs, for the leaves of most collections of *Capparis* subg. *Calyptrocalyx* soon become varnished and totally glabrous.

Thus, it was not until 1995 that a detailed epidermal examination of young leaves finally showed the northern Venezuelan specimens to be in agreement with those found at Lago de Guri in their unique, dense, soft pubescence, which, on the one hand, was quite unlike that of the *C. leprieurii-maroniensis* complex, but on the other hand, suggested a fairly close relationship to *C. nectarea* Vellozo of eastern Brazil.

Let no one say that old-fashioned, morphological taxonomy is not without its joys and grand surprises, even in the molecular age of the 1990s!

International collaboration between local field botanists in the tropics and far away monographers in the old herbaria way up North has remained a much treasured theme of systematic botany, today as it has for 200 years, based on mutual cooperation mutually agreed upon, and mutually beneficial to scientific understanding, empowering the spirits of all concerned (Vazquez et al., 1995). But more important than that, it is on the *local* participation, the *local* expertise, that so much taxonomic research depends. In fact, ultimately, the very survival of tropical biota is directly tied to *local* involvement; if science is international, so is extinction (Iltis & Kolterman, 1983). But exploration and collecting need not be restricted to virgin rainforests, for, as we have seen, even in long- and well-settled, and thoroughly disturbed humanized landscapes such as near Barcelona or Cumaná, the town where Humboldt and Bonpland first landed in South America, in July 1799, to collect Capparidaceae (nearly a dozen species!) and a few other things besides, one may discover, often teetering on the brink of extinction, botanical treasures that cry out for protection, and, if that is not possible, at the very least deserve to be brought into cultivation, as surely *Capparis muco* does (Iltis, 1988).

In the face of the worldwide twin demons of human population growth and blind faith in perpetual economic growth and development (sustainable or otherwise), the themes of biologists concerned with the disappearance of life's diversity must continue to be: explore, collect, study, and, especially, *preserve*—truly a case of now or never, for even tomorrow may be too late. And if now we all do work together, we *all* shall benefit (Lovejoy, 1979; Prance, 1995).

The fieldwork of the Venezuelan collaborators, freely offered and enthusiastically implemented, was as essential a part of this exploration into *Capparis* taxonomy as it was a gratifying and invaluable empowering of the scientific spirit that sustains us all, and deserves recognition. The present paper is but a small yet significant result of this cooperation, and the co-authorship a most highly deserved, if seldom given, appreciation.

CAPPARIS SUBGENUS *CALYPTROCALYX* AND *C. MUCO*

Capparis subg. *Calyptrocalyx* Eichler (1863: 269, 278) [sect. *Calyptrocalyx* (Eichler) Pax & Hoffmann, 1936; *Neocalyptrocalyx* Hutchinson, 1967] comprises six species of shrubs to large forest trees and one species that is a liana, all with variously stellate, stellate-echinate, stellate-subpeltate to stalked multiangulate pubescence. These may be listed as follows (Iltis, unpublished):

Section *Mesocapparis* (Eichler) Pax & Hoffmann, in Engler & Prantl, Nat. Pflanzenfam. (ed. 2) 17b: 136, 1936, *pro parte.*

1. *Capparis lineata* Dombey ex Persoon, in DC., Prodr. 1: 257. 1824 (lectotype of section).

Section *Calyptrocalyx* (Eichler) Pax & Hoffmann in Engler & Prantl, 17b: 138, 1936.

2. *Capparis muco* Iltis et al., sp. nov., 1996.
3. *Capparis nectarea* Vellozo, Flora Fluminensis V: tab. 107. 1825 [1829] (type of subgenus and section).
    - 3a. *C. nectarea* subsp. *nectarea.*
    - 3b. *C. nectarea* subsp. *eichleriana* (Urban) Iltis, stat. nov. (*C. eichleriana* Urban, Linnaea 43: 265, 1880–1882).
4. *Capparis grandipetala* Maguire & Steyermark, in Mem. N.Y. Bot. Gard. 51: 115–117. 1989.
5. *Capparis leprieurii* Briquet, in Ann. Cons. et Jard. Bot. Genève 17: 393–394. 1914.
6. *Capparis maroniensis* Benoist, in Bull. Mus. Hist. Nat. Paris 25: 296. 1919. *C. surinamensis* J. C. Went, in Rec. Trav. Bot. Néerl. 30: 164. 1933; emend. in Med. Bot. Mus. et Herb. Utrecht 5: 2–3.
7. *Capparis* nom. provis. *nervifolia* Iltis, sp. nov. (*J. M. Pires 3695*, IAN, WIS!).

All these species are native to northern, eastern, and Amazonian South America, and are characterized by usually large, thick-walled, nearly sessile to short-gynophored, spherical or oblongoid fruits and large seeds. In particular, the subgenus has a

2-seriate calyx composed of four sepals in two decussate pairs. The outer, much larger, and hemispheric sepals are valvate-connate and completely enclose the whole of the flower in a seamless spherical bud, but then separate and recurve, together with the narrower, inner free pair, some time before anthesis to allow the corolla to open. This separation and recurving is often straightforward and symmetrical, with all four sepals reflexing individually, but occasionally incomplete, so that one may find the two outer sepals stuck together and, reflexed only to one side of the flower, joined into something like a calyptra (= cap), this then evidently the inspiration for Eichler's poorly chosen subgeneric name.

Already Eichler (1863), in his monumental treatment of the Capparidaceae for Martius's *Flora Brasiliensis,* found the taxonomy of *C. nectarea,* the one, solitary species of his subgenus *Calyptrocalyx,* to be difficult because of grossly inadequate and insufficient collections. Thus, although he (Eichler, 1863: 178) does cite a sterile(?) *Sello* collection (in B) from Rio de Janeiro, but must have had, presumably, a flowering one as well to serve as a model for his illustration (tab. 65, fig. III), his description by his own admission was based mostly on Vellozo's dramatic drawing (Fl. Flum. Ic. V, tab. 107, 1825) and text (p. 230, fide Eichler), with neither he nor Vellozo certainly ever having seen or described the large, lemon-shaped, subspherical to broadly oblongoid, edible *C. nectarea* fruits. In fact, one of his key characters for distinguishing his subgenus VII *Calyptrocalyx* from his subgenus VI *Mesocapparis* (which contains two unrelated species, one of which, *C. lineata,* a liana, is herewith placed next to its somewhat distant relatives into *Calyptrocalyx*) was the shape of the mature fruit, which, Eichler surmised quite mistakenly, "judging from the immature ovary" ("*ut ex ovarii indole judicandum*"), must be "*siliquiformis,*" that is, bean-shaped!

Even today, we work under similar difficulties. First of all, some of the species are large, tropical moist forest canopy trees, and few botanists, except experienced and fearless tree climbers, can collect such specimens. Not only that, but the flowers of some species open at night, only to readily fall apart at the slightest touch the next morning. Thus, Carol Gracie tells us how, early one day, she and Scott Mori (both from The New York Botanical Garden) were trying to collect *Capparis leprieurii* at a nature preserve near Saül, French Guiana. In order to gather a flowering branch, Scott had to climb to the top of a 40-m-tall tree with French telephone pole climbers, and then bring the treasure carefully down to earth tightly clamped in his teeth, whereupon (and soon after a quick picture-taking session by Carol) the corolla promptly disintegrated. On the other hand, *C. muco* appears to be a day bloomer (10 A.M., fide Aymard), and the persistence of the petals in herbarium specimens supports that notion.

Secondly, the massive indehiscent, internally fleshy, edible fruits of almost all the species of *Calyptrocalyx,* from the size of a ping-pong ball (*C. lineata*) to some as large as a good-sized orange or even a small grapefruit (*C. muco*), are very rarely collected, perhaps in part because of problems with drying, but more likely because they are very rarely produced. Being plants of a seasonal climate, they are hardly ever found associated with flowers. We still do not have fruits of most populations or even of two or three distinct species, perhaps also because in some species they are edible and fall victim to people, or else to monkeys. Thus, of the 17 collections of *Capparis leprieurii* from the nature preserve near Saül, only four were in flower, the rest were sterile, and none were in fruit.

Finally, both flowers and fruits of different taxa can be quite similar and have driven one of us to complete distraction, trying to make taxonomic sense out of what appears to be a much too inclusive, but seemingly indivisible, variability.

While the problem of distinguishing the large- and few-flowered *C. leprieurii* from the smaller- and many-flowered *C. maroniensis* in the Guianas has not yet been completely resolved, a recent insight made it quite clear that the somewhat smaller- and many-flowered, sequentially blooming trees of northern and eastern Venezuela, though very similar in inflorescence structure, can readily be segregated on the basis of a quite distinctive leaf pubescence. Thus, in the two species mentioned above, and examining *fully expanded but still pubescent* leaves, the pubescence consists of minute, distinct, individual stellate-echinate hairs, only 0.2–0.3 mm in diameter, evenly but distantly dispersed (scattered) with much glabrous space between each, which on closer examination (40×) are more or less appressed and circular, echinate or stellate-subpeltate, with ca. 20–30 or more very short arms radiating mostly horizontally but some also in all directions from an irregularly hemispheric center called the umbo (see Roe, 1971, for hair nomenclature). On the other hand, plants of northern and eastern Venezuela (*C. muco*) have, especially on the underside of their young, fully expanded, yet still pubescent leaves, a longer (1–1.5 mm), soft, evenly and more or less densely and continuously distributed, somewhat more persistent, buff-colored pubescence that on closer examination (30–50×) proves to be a complex mixture of several distinctive stellate hair types, the rather low number of long and slender rays (branches or arms) giving an appearance of "looseness." These include (1) "tufts" of 2 to ca. 5, nearly 1 mm long, thin, single-celled rays (hair branches) arising from a single, more or less sessile to more or less raised base, these on both leaf surfaces (see Roe, 1971: 502, fig. 4, 504, fig. 10); (2) hairs with 2 to 4 or more slender, more or less horizontal to ascending, "Texas long-horn cattle" style, lateral rays as much as 1.4 mm from tip to tip, diverging from a short, multicellular (multiseriate) stalked base (see Roe, 1971: 504, fig. 11); these, finally, grading in many variations to (3) multiangulate hairs with up to 15 or more widely divergent, single-celled, slender rays inserted on or near the top of a 1–1.5-mm-tall multicellular multiseriate stem, resulting in "palmoid" or "Hydra-like" compound structures of considerable complexity (cf. Roe, 1971: 504, fig. 12).

In addition to the pubescence, the flowers (smaller than those of *C. leprieurii* but only a little larger than those of *C. maroniensis*) and the enormous round fruit make *C. muco* an amply differentiated taxon.

In subgenus *Calyptrocalyx,* only *C. nectarea,* restricted to the Serra do Mar from Rio de Janeiro to Pernambuco, and an isolated population of what appears to be the same, or a closely related, species far to the north of it on the other side of the Amazonas River in Edo. Amapa, Brazil, has a pubescence and a fruit somewhat similar to those of *C. muco,* and therefore may well be considered its closest relative. But in *C. nectarea* the pubescence is generally more sparse and openly dispersed, the center of the multiangulate hairs with somewhat of an echinate umbo, and is mostly of a less complex architecture than one finds in *C. muco.*

While such heavy reliance on pubescence as a taxonomic character may seem trivial and insufficient to some, one can point to other genera, such as *Solanum* sect. *Brevantherum* (Roe, 1967, 1971, 1972; Seithe, 1962), *Clethra* (L. M. González, pers. comm.), *Lesquerella* (Rollins & Shaw, 1973: 23–27), or *Croton* (Webster et al., 1996), as well as *Capparis* (Vesque, 1882a, b, 1887), where pubescence has proven to be a conservative, reliable, decisive and eminently useful character. In subgenus *Calyptrocalyx,* it has proven to be indispensable. And yet, here again, nature has thrown us taxonomists a "foul ball." Almost all the taxa, no matter how pubescent their leaves when young, soon end up glabrous and varnished, making definitive species identification of many of the collections, except by geographic inference, quite impossible.

Finally, by adding still another giant-fruited species to the northern South American *Capparis* flora, *C. muco* joins the related *C. nectarea* and *C. maroniensis,* but also the unrelated *C. pulcherrima* Jacquin, *C. stenosepala* Urban, *Belencita nemorosa* (Jacquin) Dugand, and *Morisonia* spp., in raising the question whether these plants developed such giant, indehiscent fruits with large, hard seeds in response to dispersal by a now extinct Pleistocene megafauna (Janzen & Martin, 1982). But that tantalizing question will have to be dealt with another time.

Capparis (subg. *Calyptrocalyx*) **muco** H. H. Iltis, L. Cumaná, R. Delgado & G. Aymard, sp. nov. TYPE: Venezuela. Anzoátegui: Distrito Bolívar, El Mucal de Perepecual, cerca de Campo Alegre, aproximadamente 7 km de San Bernardino, alt. 80 m, 13 mar. 1993 (full flower!), *L. Cumana C., P. Vivenes & R. E. Delgado M. 5415* (holotype, WIS; isotypes, BM, CAY, COL, F, G, GH, INPA, IRBR, K, MER, MO, MY, MYF, NY, P, PORT, RB, S, SP, TEX, TFAV, TRIN, U, US, VEN). Figures 1, 2.

Arbor ad 7–16(–20) m alta. Species aspectu foliorum, racemum corymbosum (3-ad 12-florum), et florum *Cappari leprieurii* et *Cappari maroniensi* similis, sed foliis juvenilibus adaxialiter glabrescentibus, abaxialiter ± dense piloso-stellatis, et floribus 22–28 mm diam. divergens.

Trees with dense foliage, 7–16(–20) m tall, to 40 cm DBH, generally softly buff or rusty stellate pubescent on all young growth and especially underside of leaves (see below). Leaves alternate, "leafing" out and membranaceous at flowering time, becoming thinly coriaceous, varnished and shiny, narrowly to broadly elliptic or oblanceolate-elliptic to oblong or obovate-elliptic, the apex sharply acuminate to rounded and minutely apiculate, the base narrowly to broadly cuneate to obtuse or rounded and (rarely) slightly retuse (subcordate), those of the flowering branches mostly 8–19 cm long, 4–8 cm wide, the 6–9 main lateral nerves on each side curved upward, the angle between opposing nerves 90° to 130°, both nerves and midrib ± prominently raised on the leaf underside (juvenile "sprout" leaves larger, to 26 × 12 cm, somewhat falcate, and with up to 11 nerves per side); petioles 6–15 mm, weakly if at all pulvinate. Leaf pubescence distinctive, of long, ascending, and slender-armed, loosely stellate, crinkly white to rust-colored, soft pilose hairs or hair-branches, the upper surface uniformly and loosely covered with few-rayed hairs ± individually discernible (30×), the lower surface with a dense, soft tangle of several types (Roe, 1971), mostly with 2- to 5-rayed, slender, 0.4–0.7 mm long, stellate or multiangulate hairs with strongly

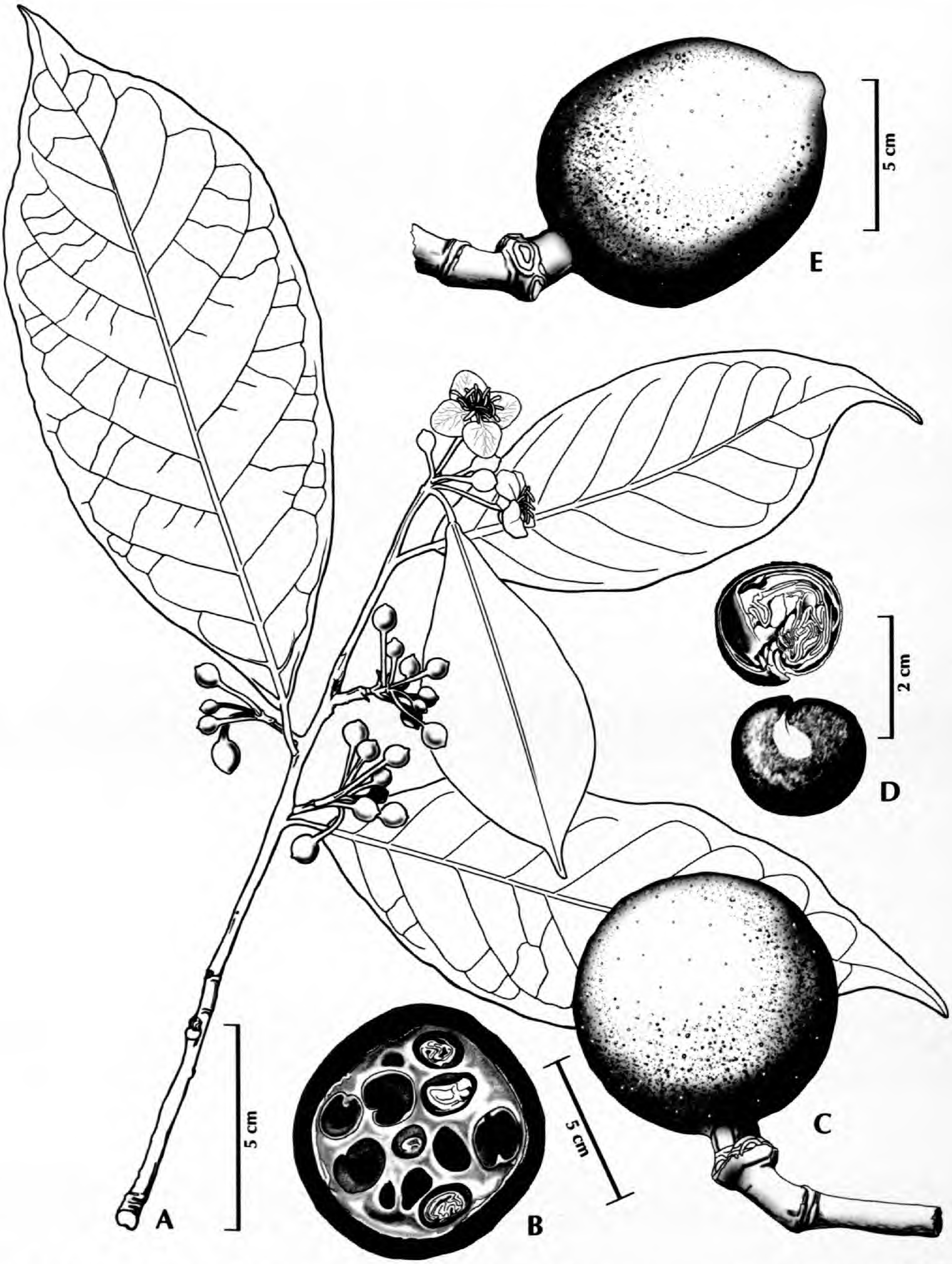

Figure 1. *Capparis muco* Iltis et al. —A. Flowering branch from El Mucal, the type collection (*Cumana et al. 5415*). —B, C. Fruit from Lago Guri (*Aymard et al. 7594*). —D, E. Seeds and fruit from Curataquiche (*Aristeguieta et al. 7158*). All drawings by Kandis Elliot.

ascending arms forming a "V" from a sessile base, or with 2–4 laterally undulating horizontal rays (like the horns of "Texas longhorn" cattle: tip to tip ca. 0.9–1.4 mm), grading to multiangulate hairs with 3–6 or more arms strongly diverging or ascending from a short multiseriate stem, grading finally to complex, palmoid or Hydra-like, multiangular or even somewhat echinate hairs with 15 or more arms radiating in all directions from the top of a multicellular, multiseriate stem, the stemmed

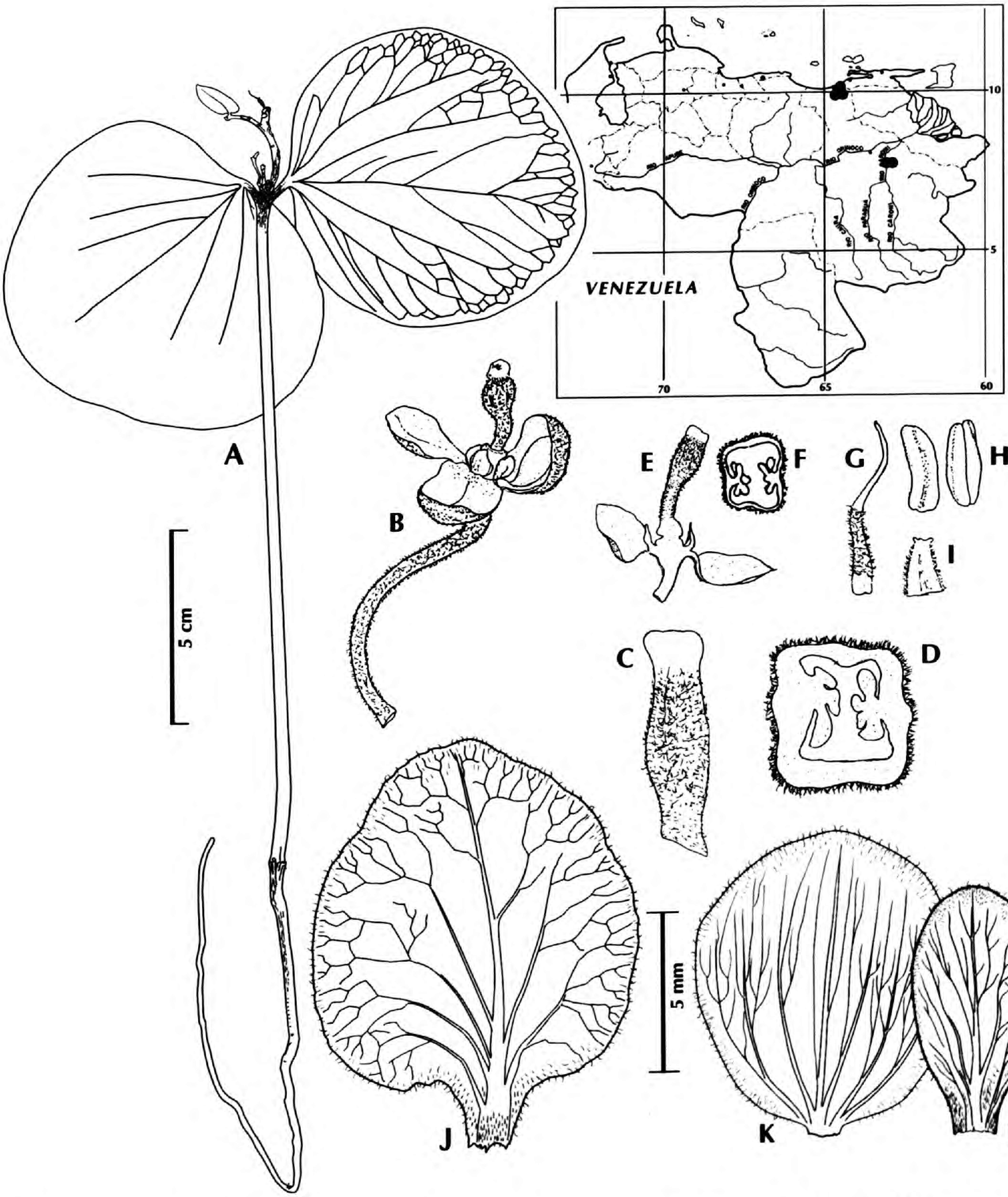

Figure 2. *Capparis muco* Iltis et al. (all from *Cumana et al. 5415*). —A. Seedling. —B. Flower with 1 sepal and 3 petals removed, showing 2 flat nectariferous scales. —C–F. Side view and cross section of pistils. —G. Staminal filament. —H. Anther. —I. Nectariferous scale. —J. Petal. —K. Outer sepal. —L. Inner sepal. Drawings A, and J–L by Kandis Elliot, B–I by Luis Cumana. Map shows distribution of the two meta-populations.

hairs lacking or rare on the upper surface, common on the lower, the leaves soon glabrescent, especially above.

Inflorescences solitary (though sometimes 2 or more in close proximity), mostly corymbose axillary racemes, few to many on a shoot of the previous season, several- to 12-flowered, the flowering sequential within each raceme with only 1 or 2 open flowers at any one time, but these accompanied by 2 to 10 buds of all sizes, their slender pedicels densely crowded near the ends of 2–3(–13)-cm-long peduncles ("spurs") of new growth (these are axillary, but in fact often actually terminal by continuing last year's 1–3-cm-long axillary growth), the peduncle (axis, new branchlet) naked except for minute bracts, or bearing 1–3 leaves with a flower solitary in each leaf axil; new growth terminating a shoot of the previous season to 20 cm long, often also bearing axillary in addition to terminal inflorescences. Pedicels (6–)12–15(–23) mm long, the lower flowers on a branchlet sometimes subtended by full-grown leaves, the upper by minute (ca. 2 mm), petioled, caducous bracts (clavate, the blade never unfolding), these as well as the leaves subtended by minute, paired, stellate-echinate pubescent to essentially glabrous, sharp-pointed, 1 mm long, linear-triangular, caducous "horns" (stipules). Flower buds spherical-apiculate, densely short-stellate, ca. 6–8 mm long at beginning of calyx anthesis when outer sepals separate. Calyx of 4 sepals in 2 decussate dimorphic series, the larger, outer valvate sepal pair hemispheric-gibbous, 7–9 mm long, 5–8 mm wide, densely stellate without, subglabrous within, enclosing the inner in a seamless bud, the inner sepal pair free, oblong and narrower, 6–8 × 3–4 mm, stellate with stellate-ciliate margin, all separating quite some time before corolla opens, and, eventually, becoming strongly recurved. Nectary scales 4, inserted inside of the sepals between the petal bases, ± triangular, ca. 1.5–2 mm long, 0.5–2.2 mm wide at base, glabrous within but fringed with dense tufts of 5- to 8-rayed, stiffly echinate white hairs, densely stellate without. Flowers creamy white, fragrant, the corolla "rotate" (resembling a 4-petaled malpighioid flower), ± actinomorphic, flat and cruciform, 20–24(–26) mm across, the petals (in bud) sinistrose-contorted (looking on from the outside), broadly ovate to obovate or orbicular, rounded to truncate and somewhat auriculate at base where abruptly contracted to a short down-turned claw, 9–13 × 8–9 mm (northern Venezuela) to ca. 11–14(–17) × 9–13 mm (in Lago de Guri, the flowers to 36 mm across), palmately veined, somewhat wavy-margined, the inner surface glabrous at very base but with few short, white hairs toward the apex, the outer surface ± densely stellate and with simple, twisted, white hairs grading to brownish, stellate hairs at apex and margin. Stamens 16–18, short, essentially equal, fertile and mostly included, the filaments 6–8(–10) mm (northern Venezuela), 6–14 mm (Lago de Guri) long, densely white stellate-tufted on lower half, glabrous distally, the anthers 2–3 mm long. Ovary ovoid-oblongoid to subspherical, 3–5 × 2–4 mm, not constricted below the broad, flat, glabrous, centrally retuse stigma, ± quadrangular, with 4 main longitudinal ribs, densely pubescent, unilocular, the 2 placentae parietal; gynophore densely stellate, (3–)6–9 mm long; androgynophore ca. 1.5 mm, shorter than the nectary scales.

Mature fruit gigantic, subspherical to ovoid and somewhat umbonate, (8 × 6–)10 × 8–12 × 10 cm (or reputed to be even larger, "as big as a grapefruit"—M. A. Norkong, pers. comm.), the thick, woody-crustaceous rind 7–9 mm thick, green to yellowish when ripe, glabrous, indehiscent, but fracturing when falling from a tree (with a little help from the monkeys, no doubt); gynophore massive, 3–9 mm long, to 11 mm thick, as is the pedicel, 22–30 mm long, 8 mm thick. Seeds several to 20, suborbicular to reniform, flattened, very large, 28–31 × 22–26 × 11–16 mm, embedded in an edible, orange pulp, in northern Venezuela much attacked by insect pests; embryo white, the cotyledons much convoluted and profoundly folded one into the other. Seedlings with a 10–20-cm-long primary root and an erect, 14–19-cm-long glabrous hypocotyl (stem) bearing large, leafy, emergent cotyledons, these, when fully unfolded, perfectly round, palmately-pinnately veined, 8–10 cm in diameter, on very short petioles, glabrous, but with the young leaves of the emerging plumule stellate.

Capparis muco is endozoochorous, the immature young seeds being eaten by monkeys (*Pithecia pithecia*, white-faced Saki) (fide M. A. Norconk, pers. comm.; *Aymard, Kinzey & Walker 7594*) as well as, later, the orange pulp, by people (fide *Curran & Haman 1197*; *Cumana & Delgado 4912*, who report the fruit to be aromatic). The common name in northern Venezuela is "Muco."

Distribution and ecology. In highly seasonal, dry, tropical deciduous to semi-deciduous forests and gallery forests ("*bosque tropófilo macrotérmico*" of Huber, 1986; see also Norconk, in press; Parolin, 1993; Aymard, in prep.) on sandy soil with much leaf litter, highly local and rare, but locally well known (see below); at Lago de Guri with average annual rainfall 1100 mm and average yearly temperature 26.9°C, at elevation of 10–240 m; flowering from March into April (sometimes through May), fruiting from late May into September (December), with the leaves deciduous in late February.

Capparis muco is known from two meta-populations (Fig. 2), one to the northeast and south of Barcelona in the arid coastal belt of northeastern Venezuela, the other from islands in Lago de Guri south of the dam on the Rio Caroní in central eastern Venezuela, these separated by almost 300 km. The Lago de Guri location has been described in detail by Norconk (1996), Norconk and Kinzey (1993), Parolin (1993), Kinzey et al. (1989), and others. *Capparis muco* was once collected in 1917 at Guanta, northeast of Barcelona, but has not, in that industrialized area, been relocated since, even though xeric forests are still abundant on the hillsides there.

The three other locations, some 20 to 22 km by air more or less south of Barcelona deserve special comment. Curataquiche is a small village just west of the main highway from Barcelona to San Mateo (at Km 40). El Mucal de Perepecual is presumably the minute settlement of El Mucal (Dirección de Cartographía Nacional Venezuela, the topographic Hoya 7245 SAN MATEO, 1:10,000, 1963, 9°56′45″ N, 64°40′00″W), 10.5 km due W of Curataquiche, 2 km SE of Campo Alegre, 8 km ESE of San Bernardino and 22 km S of Barcelona. San Bernardino is a small village, nestled in a small range of hills that reach 500 m, south by southwest of Barcelona. Only 18 km apart from east to west, all of these three *C. muco* locations are in the headwaters and drainage of Rio Aragua, in rather low to somewhat hilly country at an elevation of 80 to 300(500?) m.

In both the northern and southern meta-populations xerophytic Capparidaceae are common. At the type locality *C. muco* grows along streams in dry forest with *Morisonia americana* L. and *Steriphoma ellipticum* (DC.) Sprengel, while in the nearby xerophytic forest one finds *C. odoratissima* Jacquin, *C. flexuosa* (L.) L., and *Morisonia americana.* At Lago de Guri, associated species include *C. frondosa* Jacquin, *C. osmantha* Diels, and *C. flexuosa.* The meta-populations are not quite identical, with the northern population tending to have thinner, larger, more pointed leaves, with a less dense and more buff or straw-colored pubescence, rather than a rusty brown one as in some collections from Lago de Guri; the inflorescences have more flowers (5–12 rather than mostly 3–6), on shorter peduncles; and the corollas are a little smaller (ca. 22–26 mm across, rather than 24–36 mm). Nevertheless, judging from the span of variability in related taxa, and considering the limited number of specimens that would lead to sampling error, the differences are not great enough to be recognized taxonomically at the present time.

Although the gigantic fruits and seeds are similar to those illustrated for *Capparis maroniensis* by van Roosmalen (1985: 69), and the flowers are only slightly larger, the unique, soft pubescence consistently occurring in two, geographically quite separate populations supports segregation as a well-differentiated species.

Paratypes. VENEZUELA. **Est. Anzoátegui:** Distrito Bolívar, "Muco," arbol de flores cremosas, fragantes, Curataquiche, mar. 1969 (fl), *Aristeguieta & Zabala 7010* (VEN, WIS); arbol 7–8 m, follaje perennifolio, fruto seco indehiscente, Hacienda Curataquiche, 6 July 1969 (y. and old fr., seedlings), *Cárdenas de Guevara 967* (MY, photo WIS), same tree as *7010* (see above) and same collection as *Aristeguieta, Liogier & Cárdenas de Guevara 7158* (VEN, WIS); "Muco," frutos comestibles, aromáticos, las semillas son destruidas por predadores, especie poco frequente, abunda en una zona llamada "El Mucal," El Mucal de Perepecual, cerca de Campo Alegre, 9 Sep. 1991 (y. fr. "no flowers this time of the year," seedlings), *Cumana & Delgado 4912* (WIS, topotype); galerias en quebradas rocosas, Perepecual, cerca de Campo Alegre, 13 mar. 1993 (fl.), *L. Cumana, P. Vivenes & R. Delgado 5445* (IRBR, WIS); plaza central cerca de ruinas coloniales y iglesia, San Bernardino, 22 Dec. 1995 (fr), *Cumana 6277* (IRBR, WIS); patios de casas, San Bernardino, 2 Apr. 1996 (fl), *Cumana 6293* (IRBR, WIS); Cambura, via San Bernardino, 1 Apr. 1996 (fl), *Cumana 6291* (IRBR, WIS); Distrito Sotillo, Guanta, 1917 (sterile), *Curran & Haman 1197* (GH, US); Bachaco [presumably near Guanta], "tree 12 inches diam. 50 ft. high. edible fruit," 1 July 1917 (sterile), *Curran & Haman 1197* (GH, NY, US, fragm. WIS). **Est. Bolívar:** 15 m tree, fls. white, forest, Represa Guri, islands 6 to 18 Km S of dam, 220–240 m, 7°38′N, 62°58′W, 2 Apr. 1981 (fl), *Liesner & Gonzalez 11145* (US, VEN, WIS); Municipio Piar, arbol 16 m, fls. blancas, fr. verdes, *Pithecia pithecia* se come los frutos, bosques medio semideciduos sobre afloramientos de cuarcitas ferrugíneas, con predominio de *Maytenus, Peltogyne floribunda, Piptadenia leucoxylon, Trichilia lepidota leucastera,* Isla en lago de Guri (Sector Las Carolinas), 15 km al E de la Presa R. Leoni, 270 m, 7°40′N, 62°51′W, 23–28 May 1989 (fl., almost mature fr.), *Aymard, Kinzey & Miller 7594* (MY, PORT, VEN, WIS), 13 Mar. 1993 (flowers), *Aymard s.n.* (WIS). [These are from "Round Island," 7°45′ N, 62°52′W, according to Parolin, 1993: 140].

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A New Species of *Calathea* (Marantaceae) from Veracruz, Mexico

Maite Lascurain
Instituto de Ecología, A.C., Apartado Postal 63, 91000 Xalapa, Veracruz, Mexico

ABSTRACT. A new species, *Calathea misantlensis*, is described and illustrated. Its closest affinities are with *C. coccinea* Standley & Steyermark from Chiapas and Oaxaca, Mexico, and Guatemala, but it differs from that species in inflorescence morphology.

RESUMEN. Una nueva especie, *Calathea misantlensis*, se describe e ilustra. Sus afinidades más cercanas son con *C. coccinea* Standley & Steyermark de Chiapas y Oaxaca (Mexico) y Guatemala, pero difiere de esta especie en la morfología de la inflorescencia.

Calathea is a New World genus of about 300 species, most of them tropical. While examining specimens for a study of the Marantaceae of Veracruz, six *Calathea* species were identified as occurring in this state. A few herbarium specimens were tentatively identified as *C. coccinea*. However, observations from field studies and from plants growing at the botanical garden at Francisco Javier Clavijero del Instituto de Ecología, A.C., Xalapa, Veracruz, led me to conclude that they are actually a new species.

Calathea misantlensis Lascurain, sp. nov. TYPE: Mexico. Veracruz: Mpio. Yecuatla, la Zeta, arriba de Luz Bella, 1200 m, 19°49'N, 96°49'W, 4 June 1991, *C. Gutiérrez 4215* (holotype, XAL).

Planta acaulis, rhizomatosa. Folia corrugata, ovata vel amplissime ovata, tenuia, cum acumine, basi rotundata. Spica ovoidea, capitata, compacta, pedunculo subglabro. Bracteae spiraliter dispositae, ovatae, apiculatae, basi obtusae vel rotundatae. Corollae lobis ovatis vel ellipticis, rubris. Staminodium callosum obovatum, cucullatum, rubrum. Capsula obovoidea.

Rhizomatous acaulescent deciduous herbs, 1–1.5 m high. Leaves borne in a basal rosette, new shoots developing from rhizomes. Petiole glabrous to pubescent, ca. 34 cm long. Pulvinus delicate, elliptic in cross section, abaxial surface glabrous, adaxial surface with several longitudinal dark pubescent lines, light yellow, 1.4–4 cm long. Sheath auriculate, delicate, translucent, glabrous, 18.5–34 cm long. Cataphylls membranaceous when live, glabrous to pubescent, 5–18 cm long and probably longer. Lamina corrugate, ovate to widely ovate, delicate, smooth, membranaceous, abaxial surface glabrous, adaxial surface glabrous to pubescent, apex lightly apiculate, base obtuse to rounded, midrib pubescent, darker than the rest, 29.5–47 cm long, 21–27 cm wide. Inflorescences simple, terminal, capitate, ovate to widely ovate, 3.5–7 cm long, 2.5–6.5 cm wide, occasionally with two inflorescences per shoot, one pedunculate and the other sessile, the second one developing in the middle of the peduncle, with one bract, this acuminate, clasping, membranous, red- and green-spotted, longer than the pair of flowers that protect or cover it, 5 cm long, 3 cm wide; occasionally developing in the basal portion of the peduncle with one pair of red flowers, with one bract. Peduncle dark brown to red, succulent, subglabrous, to 63 cm long. Bracts closely set, 15–30, spirally arranged, lanceolate to ovate, red to green or yellow, 2–5.5 cm long, ca. 1–1.3 cm wide, the basal ones 3.3 cm long, 1.5–2 cm wide, membranaceous or fibrous, apex acute to acuminate, base truncate, abaxial surface pubescent, adaxial surface glabrous, each bract subtending two pairs of flowers, the lowermost margins corrugate. Prophyll bicarinate, carina with villous margins, apex sericeous, 1.3–1.5 cm long, 0.5–1 cm wide. Interphyll membranaceous, glabrous, apex obcordate, 1.1 cm long, 0.8 cm wide. Bracteoles lanceolate, flat in cross section, 1–2 per cymule, membranaceous, glabrous, somewhat fibrous and strong when dry, 1.4 cm long, 1.6 cm wide. Flowers sessile, red, closed and open. Corolla tube with the internal side of throat hirsute in the median part, 1.2–3.8 cm long, ca. 0.5 cm wide. Lobes ovate to elliptic, red, almost equal, 1.2–3.2 cm long, 0.3–0.8 cm wide. Sepals glabrous, equal, persistent in fruit, papyraceous when dry, translucent when live, membranous when live, lanceolate to linear, base white, terminal part red, 1.3–2.7 cm long, 0.2–0.4 cm wide. Outer staminode 1.3 cm long, 0.7 cm wide, sometimes absent. Callose staminode obovate, bilobate, base red, 0.7–1 cm long, callus white. Cucullate staminode, base pilose, 0.7–0.9 cm long and 0.4–0.6 cm wide, appendix red. Style white, thin, translucent. Stigma white, curved. Ovary glabrous, 0.2 cm long. Capsule obovate, 0.7

NOVON 6: 385–388. 1996.

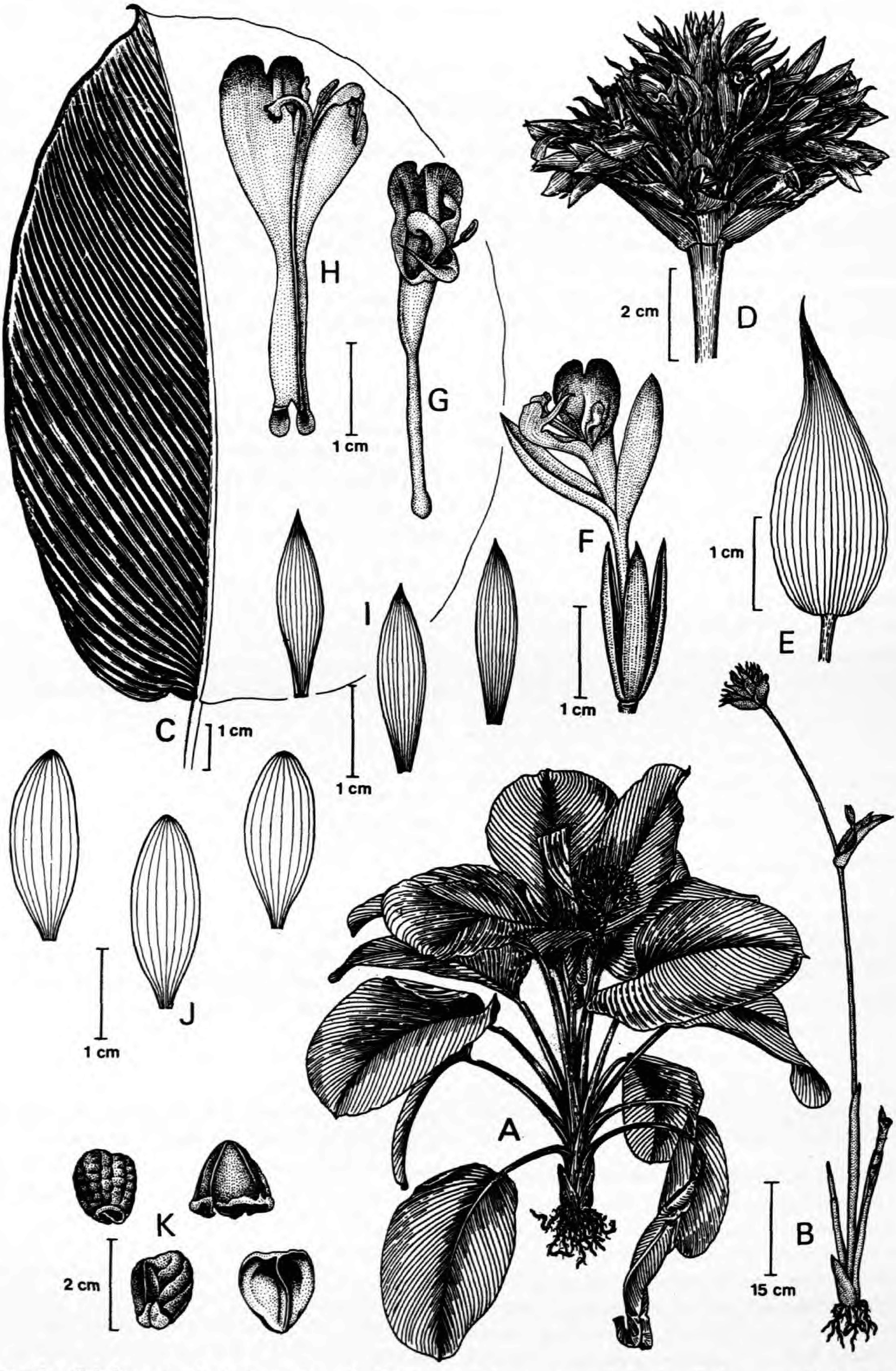

Figure 1. *Calathea misantlensis* Lascurain. —A. Habit. —B. Inflorescence. —C. Leaf. —D. Close-up of inflorescence. —E. Basal bract. —F. Flower. —G. Staminodes, stamen, and style. —H. Longitudinal section of staminodes, stamen, and style. —I. Sepals. —J. Corolla lobes; corolla tube has been extended and the three lobes were removed. —K. Seed.

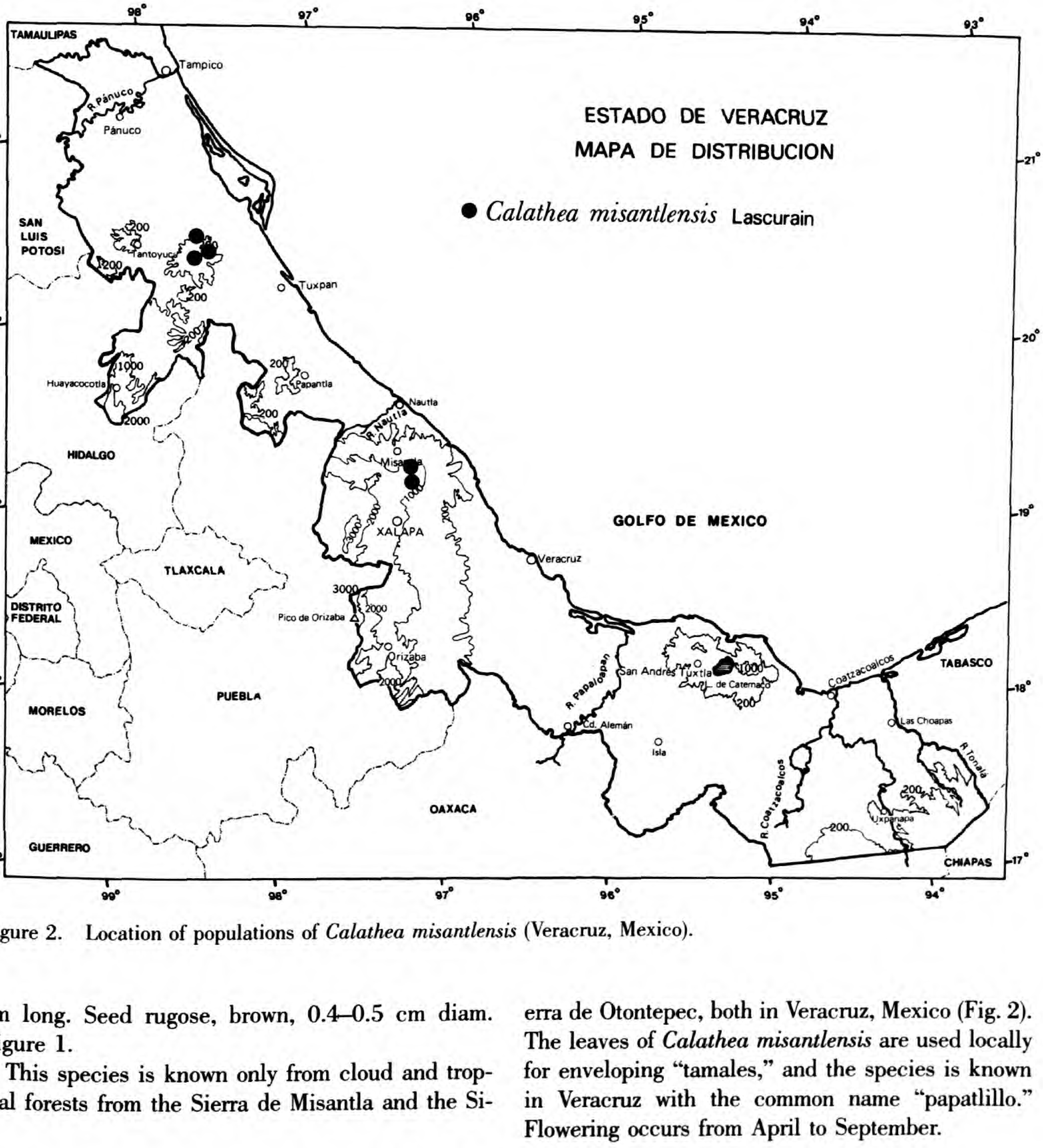

Figure 2. Location of populations of *Calathea misantlensis* (Veracruz, Mexico).

cm long. Seed rugose, brown, 0.4–0.5 cm diam. Figure 1.

This species is known only from cloud and tropical forests from the Sierra de Misantla and the Sierra de Otontepec, both in Veracruz, Mexico (Fig. 2). The leaves of *Calathea misantlensis* are used locally for enveloping "tamales," and the species is known in Veracruz with the common name "papatlillo." Flowering occurs from April to September.

Table 1. A comparison of morphological features between *Calathea coccinea* and *C. misantlensis.*

Feature	*C. coccinea*	*C. misantlensis*
bracts	separated	closely set
bract length (cm)	1.2–1.6	2–3.3(–5.5)
bract width (cm)	0.6–1.2	1–1.3(–2)
bract shape	oval	lanceolate to ovate
inflorescence shape	elliptical	ovate to widely ovate
inflorescence length (cm)	5.5–7	3.5–7
inflorescence width (cm)	2–5.5	2.5–6.5

DISCUSSION

The new species is distinguished by the bracts closely set, 2–3.3(–5.5) cm long and 1–1.3(–2) cm wide, lanceolate to ovate with the tip acute to pronouncedly acuminate. The inflorescence is ovate to widely ovate, compact, capitate; some individuals rarely exhibit a sessile inflorescence with a pair of flowers, one of which is cleistogamous. All the specimens examined exhibit inflorescences and leaves simultaneously. *Calathea coccinea,* described by Standley and Steyermark (1944), has bracts separated by 5 mm or less; the bracts are 1.2–1.6 cm long and 0.6–1.2 cm wide; and the inflorescence is lax, elliptical. The known herbarium specimens of

C. coccinea rarely exhibit leaves. For a side-by-side comparison of the two species, see Table 1.

At the Sierra de Misantla, *Calathea misantlensis* grows in mixed stands of temperate cloud forests with tropical forests, at an elevation of 1100–1650 m. The dominant species in these forests are *Quercus affinis* Scheidweiler, *Liquidambar macrophylla* Oersted, and *Cyathea fulva* (M. Martens & Galeotti) Fée. Populations of *C. misantlensis* are more abundant on the plateau of the Sierra de Otontepec. Here, the vegetation consists of cloud forests dominated by *Quercus acutifolia* Née, *Nectandra* spp., and *Ilex* spp.

The accelerated disappearance of its habitat, due to agricultural expansion and livestock grazing, has caused the fragmentation of populations of *C. misantlensis*, which therefore are threatened.

Paratype. MEXICO. **Veracruz:** Mpio. Misantla, Cañada del Huérfano, 6 km al NW de Santa Rita, 1650 m, 3 Apr. 1982, *R. Fernández N. 1086–e* (ENCB).

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Coleogeton (Potamogetonaceae), a New Genus of Pondweeds

Donald H. Les
Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3042, U.S.A.

Robert R. Haynes
Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama 35487-0344, U.S.A.

ABSTRACT. *Potamogeton* subg. *Coleogeton* is elevated to generic level. A combination of morphological and anatomical features readily distinguishes the new genus *Coleogeton* from both *Groenlandia* and *Potamogeton*, the two other genera recognized in the Potamogetonaceae. All new combinations for taxa that occur in North America are proposed for use in the *Flora of North America*. These new combinations include *Coleogeton striatus*, *C. pectinatus*, *C. filiformis*, *C. filiformis* subsp. *alpinus*, *C. filiformis* subsp. *occidentalis*, and *C. vaginatus*.

Coleogeton (Reichenbach) D. H. Les & R. R. Haynes, stat. nov. Based on: *Potamogeton* L. [subg.] *Coleogeton* Reichenbach, Icones fl. Germ. et Helv. VII. 10. 1845. TYPE: *Coleogeton pectinatus* (L.) D. H. Les & R. R. Haynes (basionym: *Potamogeton pectinatus* L.).

Aquatic herbs propagated by seeds, tubers, or rhizomes; stems terete, nodes without oil glands; turions absent. Leaves submersed, alternate, opaque, sessile, linear, canaliculate, turgid, subulate to obtuse at apex, acute at base, margins entire, veins 1–5; stipules tubular, sheathing stem and young inflorescences connate or convolute, adnate to base of blades for ⅔ or more of stipule length. Inflorescence a capitate or cylindrical spike with 1–20 whorls of flowers, compact or moniliform, with 2–4 flowers in each whorl, submersed; peduncles flexible. Flowers with perianth of 4 free, rounded, short-clawed segments; androecium of 4 stamens, filaments adnate to the perianth claw, anthers 2-locular; gynoecium of 4 carpels. Fruit abaxially rounded, turgid, beaked; embryo with less than one full coil. Chromosome number: $x = 13$.

Two genera, *Potamogeton* L. and *Groenlandia* J. Gay, in addition to *Coleogeton* comprise the Potamogetonaceae. Traditional taxonomic treatments of the Potamogetonaceae have virtually always recognized the distinctness of *Coleogeton* species by consistently segregating them as either a separate subgenus (e.g., *Coleogeton*; Raunkiær, 1896) or at least section (e.g., *Coleophylli*; Ascherson & Graebner, 1907). Vegetatively, *Coleogeton* resembles *Potamogeton* by its alternate leaves, and differs from *Groenlandia*, which has opposite leaves. The stipules of *Coleogeton* are adnate to the blade for at least two-thirds the length of the stipule. The few species of *Potamogeton* with fused stipules are adnate less than half the length of the stipule, mostly less than 4 mm. Submersed leaves of both *Potamogeton* and *Groenlandia* are translucent, flat, and without grooves or channels, whereas those of *Coleogeton* are opaque, channeled, and turgid.

Coleogeton can further be separated from *Potamogeton* and *Groenlandia* by its flexible peduncle and elongate stigmatic papillae. Hagström (1916) ascribed the latter feature as a mechanism that prevents hybridization between *Coleogeton* and *Potamogeton* species. Thus, even Hagström, who recognized a multitude of *Potamogeton* hybrids, could produce no evidence of hybridization between these genera. Preston (1995) recently affirmed that no hybrids are known to occur between *Potamogeton* and *Coleogeton*. Peduncles of both *Potamogeton* and *Groenlandia* also possess a hypodermis, which is usually absent in *Coleogeton* (Tomlinson, 1982). The flexible peduncle of *Coleogeton* results from an evident endodermis of "U-cells" (Ogden, 1974), which is lacking in both *Potamogeton* and *Groenlandia*. The peduncle bends at the water surface, keeping the spike in the water. Pollination in *Coleogeton* is apparently autogamous and can involve flowers that occur either underwater or at the water surface (Guo & Cook, 1989). The absence of an endodermis in *Potamogeton* and *Groenlandia* results in a stiff pe-

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duncle that protrudes above the water surface and pushes the spike into the air to facilitate aerial pollination. Both *Potamogeton* and *Coleogeton* differ from *Groenlandia* by having curved embryos but not the highly coiled cotyledons of the latter, a feature that also occurs in *Zannichellia* L. (Tomlinson, 1982).

Pollen ultrastructural features further distinguish the three genera of Potamogetonaceae. *Coleogeton* and *Groenlandia* each possess a pollen type that is different from any of those found in *Potamogeton* (Sorsa, 1988). The pollen morphology of *Groenlandia* is intermediate between *Coleogeton* and certain subsections of *Potamogeton* (Sorsa, 1988).

All members of *Coleogeton* for which chromosome counts have been published possess the chromosome number of $2n = 78$; however, this group exhibits an impressive aneuploid range including counts of $2n = 42, 66, 70, 71$, and every number from $2n = 73–88$ (Les & Philbrick, 1993). *Coleogeton* has an essentially cosmopolitan distribution, mostly due to the widespread occurrence of *Coleogeton pectinatus* (L.) D. H. Les & R. R. Haynes (St. John, 1916, as *Potamogeton pectinatus*).

1. **Coleogeton striatus** (Ruíz & Pavón) D. H. Les & R. R. Haynes, comb. nov. Basionym: *Potamogeton striatus* Ruíz & Pavón, Fl. Peruv 1: 70. 1798. SYNTYPES: "Habitat in aquis vivis Chancay, et Limae Provinciarum; abunde in Lurin lacubus et paludibus." TYPE: Peru. Lima: Chancay near Torreblanca, 24 July 1778, *H. Ruíz & J. Pavón s.n.* (lectotype, selected here, MA; isolectotype, P).

Potamogeton pectinatus L. var. (?) *latifolius* J. W. Robbins, in S. Watson, Bot. King's Explor. 338. 1871. Syn. nov. *Potamogeton latifolius* (J. W. Robbins) Morong, Mem. Torr. Bot. Club 3: 52. 1893. TYPE: U.S.A. Nevada: Humboldt River below Humboldt Lake, *W. W. Bailey 1142* (holotype, GH).

2. **Coleogeton pectinatus** (L.) D. H. Les & R. R. Haynes, comb. nov. Basionym: *Potamogeton pectinatus* L., Sp. Pl. 1: 127. 1753. TYPE: Austria. *Celsius 29* (lectotype, designated by Haynes (1986), UPS, Burser Herb. X: 124).

3. **Coleogeton filiformis** (Persoon) D. H. Les & R. R. Haynes, comb. nov. Basionym: *Potamogeton filiformis* Persoon, Syn. Pl. 1: 152. 1805. TYPE: Denmark. Sjælland: frequent in lakes, *C. F. Schumacher s.n.* (holotype, P? not seen).

3a. Coleogeton filiformis (Persoon) D. H. Les & R. R. Haynes subsp. **alpinus** (Blytt) D. H. Les & R. R. Haynes, comb. et stat. nov. Basionym: *Potamogeton marinus* f. *alpinus* Blytt, Norges Flora 1: 370. 1861. *Potamogeton filiformis* Persoon var. ß *alpinus* (Blytt) Ascherson & P. Graebner, Synop. mitteleurop. Fl. I: 353. 1897. SYNTYPES: Norway. Dovre: Johnsvandet near Trondheim, in Lake Vola, *M. N. Blytt s.n.* (syntype, O not seen); Dovre: Hviddalsvandene, *Lindblom s.n.* (syntype, Karlstad?, probably destroyed by fire in 1865); Laurgaard: Selsvand, *N. G. Moe s.n.* (syntype, C not seen); Lomsvand, *N. G. Moe s.n.* (syntype, C not seen).

Potamogeton borealis Rafinesque, Med. Repos., Hexade 2, 5: 354. 1808. Syn. nov. *Potamogeton marinum ?* Michaux, auct. non L., Fl. Bor.-Amer. 1: 102. 1803. *Potamogeton filiformis* Persoon var. *borealis* (Rafinesque) H. St. John, Rhodora 18: 134. 1916. TYPE: Canada. St. Lawrence River, *A. Michaux s.n.* (holotype, P not seen).

Potamogeton marinus L. var. *macounii* Morong ex Macoun, Cat. Can. Pl. 4: 88. 1888. Syn. nov. *Potamogeton filiformis* Persoon var. *macounii* (Morong ex Macoun) Morong, Mem. Torr. Bot. Club 3(2): 50. 1893. TYPE: Canada. Alberta: Old Wives Lakes, and in Crawling Valley, S of the Hand Hills. 22 Aug. 1879, *John Macoun s.n.* (holotype, CAN not seen).

3b. Coleogeton filiformis (Persoon) D. H. Les & R. R. Haynes subsp. **occidentalis** (J. W. Robbins) D. H. Les & R. R. Haynes, comb. et stat. nov. Basionym: *Potamogeton marinus* L. var. (?) *occidentalis* J. W. Robbins, in S. Watson, Bot. King's Explor. 339. 1871. *Potamogeton filiformis* Persoon var. *occidentalis* (J. W. Robbins) Morong, Mem. Torr. Bot. Club 3(2): 51. 1893. *Potamogeton interior* Rydberg, Fl. Colorado p. 13. 1906. TYPE: U.S.A. Nevada: Ruby Lake, *S. Watson 1143* (holotype, US; isotypes, GH, YU not seen).

Additional specimens. U.S.A. **Utah:** Uintas, head of Bear River, *S. Watson 1144* (paratype, US; isoparatypes, GH, YU not seen). **Nevada:** Truckee Pass, *S. Watson 1145* (paratype, US; isoparatypes, GH, YU not seen); brackish waters of the Lower Humboldt, *S. Watson 1146* (paratype, US not seen).

4. **Coleogeton vaginatus** (N. Turczaninow) D. H. Les & R. R. Haynes, comb. nov. Basionym: *Potamogeton vaginatus* N. Turczaninow, Fl. Baicalensi-Dahurica 2: 162. 1856. TYPE: Russia. Siberia: in lacubus subsalsis, prope Selenginenses [subsaline lake near Selenginsk S of Lake Baikal], *N. Turczaninow s.n.* (holotype, L not seen).

Potamogeton moniliformis H. St. John, Rhodora 18: 130. 1916. Syn. nov. TYPE: Canada. Saskatchewan: between Cumberland House and Hudson Bay, Aug., *T. Drummond s.n.* (holotype, GH).

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Una nueva especie de *Tintinnabularia* (Apocynaceae)

J. Francisco Morales
Instituto Nacional de Biodiversidad (INBio), Apto. 22-3100, Sto. Domingo de Heredia,
Costa Rica

RESUMEN. Se describe y se ilustra *Tintinnabularia gratissima* de México. En adición, se incluye una breve sinopsis del género.

ABSTRACT. *Tintinnabularia gratissima* from Mexico is described and illustrated. In addition, a brief synopsis of the genus is given.

El género *Tintinnabularia,* descrito por Woodson (1936), se caracteriza por las hojas glandulares en el haz en la base del nervio central, los lóbulos foliáceos del cáliz, la presencia de domacios en las axilas de los nervios secundarios y la corola con la parte superior cilíndrica a casi campanulada, transversalmente pentagonal.

En el neotrópico se encuentra relacionado con *Allomarkgrafia,* del que se puede separar fácilmente por los lóbulos foliáceos del cáliz y la presencia de domacios en las axilas de los nervios secundarios. Además, *Tintinnabularia* se encuentra únicamente en Guatemala y el sur de México, en contraposición de *Allomarkgrafia,* distribuido desde el sur de Nicaragua hasta la amazonía del Perú.

Los especímenes de *Tintinnabularia* son escazos y pobremente representados en herbarios. Colecciones recientes han demostrado la presencia de otra especie presente en el sur de México, la cual se describe como nueva en el presente trabajo. En adición, se conocen y describen los frutos por primera vez para el género. Una clave para las especies y una sinopsis de la sistemática de ambas se expone a continuación.

CLAVE PARA LAS ESPECIES DE *TINTINNABULARIA*

1a. Lóbulos de la corola inconspicuamente puberulentos por ambas caras, 1–1.1 cm; anteras 6–7 mm, filamentos 1–2 mm; láminas usualmente 4–8 cm de ancho . . . . *T. gratissima*
1b. Lóbulos de la corola densamente tomentulosos en el interior, glabros en el exterior, 4–7 mm; anteras 12–13 mm, filamentos 2.2–3.1 cm; láminas usualmente 1.5–3.5 cm de ancho . . . . *T. mortonii*

Tintinnabularia gratissima J. F. Morales, sp. nov. TIPO. México. Veracruz: El Cerro de Villa Rica, cerca de Mundo Nuevo, 19°48′N, 96°46′W, 1600 m, 7 Mayo 1981 (fl), *G. Castillo, G. Cortez & J. Becerra 1835* (holótipo, INB; isótipo, F; foto, INB ex F). Figura 1.

Liana volubilis foliis laminis ellipticis vel ovatis, 7.5–16 cm longis 3–8 cm latis membranaceis glabris supra costa basi conspicue glanduliferis subtus axillis costae et venarum secondariarum irregulariter foveolatis petiolis 1.3–2 cm longis inflorescentiis 4–5 flores gerentibus sepalis foliaceis 0.7–1 cm longis corollae lobis 1–1.1 cm longis inconspicue puberulis antheris 6–7 mm longis ovario 1–1.5 mm longo nectariis circiter 2 mm longis folliculis moniliformibus 37–39 cm longis glabris seminibus 0.9–1.2 cm longis coma circiter 2.5 cm longa.

Liana, tallo terete o subterete, ramitas tiernas aplanadas antes de cada nudo, glabras o glabradas, lenticelas escazas o ausentes. Láminas 7.5–16 × (3)4–8 cm, elípticas, ovadas a angostamente-elípticas, caudado-acuminadas o largamente acuminadas en el ápice, obtusas en la base, glabras, membranáceas, 2–3 glándulas en la base adaxial, enteras o irregularmente dentadas, nervio central visible en ambas caras, venación secundaria apenas visible en la haz, conspicua en el envés, broquidódroma, venación terciaria conspicuamente reticulada, domacios presentes o ausentes en las axilas de los nervios secundarios en el envés, pecíolo 1.3–2 cm, glandular en las axilas. Inflorescencias cymas umbeliformes, terminales y pendulosas, 4–5 flores, pedúnculo 7 cm, pedicelos 1.6–2.8 cm, glabros, bracteolas escariosas, inconspicuas; sépalos 0.7–1 cm, muy angostamente elípticos, foliáceos, glabros y no imbricados, 2 glándulas en la base interior; corola infundibuliforme, parte basal 4–5 × 2–3 mm, glabro, parte superior 1.9–2.1 × 0.9–1 cm, casi campanulada, glabra, lóbulos 1–1.1 cm × 6–7 mm, ovados, inconspicuamente puberulentos en ambas caras; estambres insertos en la base de la corola, filamentos 1–2 mm, pubescentes, anteras 6–7 mm, truncadas, ápice pubescente, acuminado y filiforme, conniventes y aglutinadas a la cabeza del pistilo, gineceo 1–1.5 mm, glabro, pistilo 8–9 mm, nectarios ca. 2 mm, separados, obtusos y enteros. Folículos 37–39 cm × 2–3 mm, algo monoliformes, lisos; semillas 0.9–1.2 cm, con surcos longitudinales, coma ca. 2.5 cm, marrón.

Distribución y habitat. Se desarrolla en bosques húmedos y ecosistemas alterados, entre los 1400–1600 m. Conocida únicamente en México (Veracruz).

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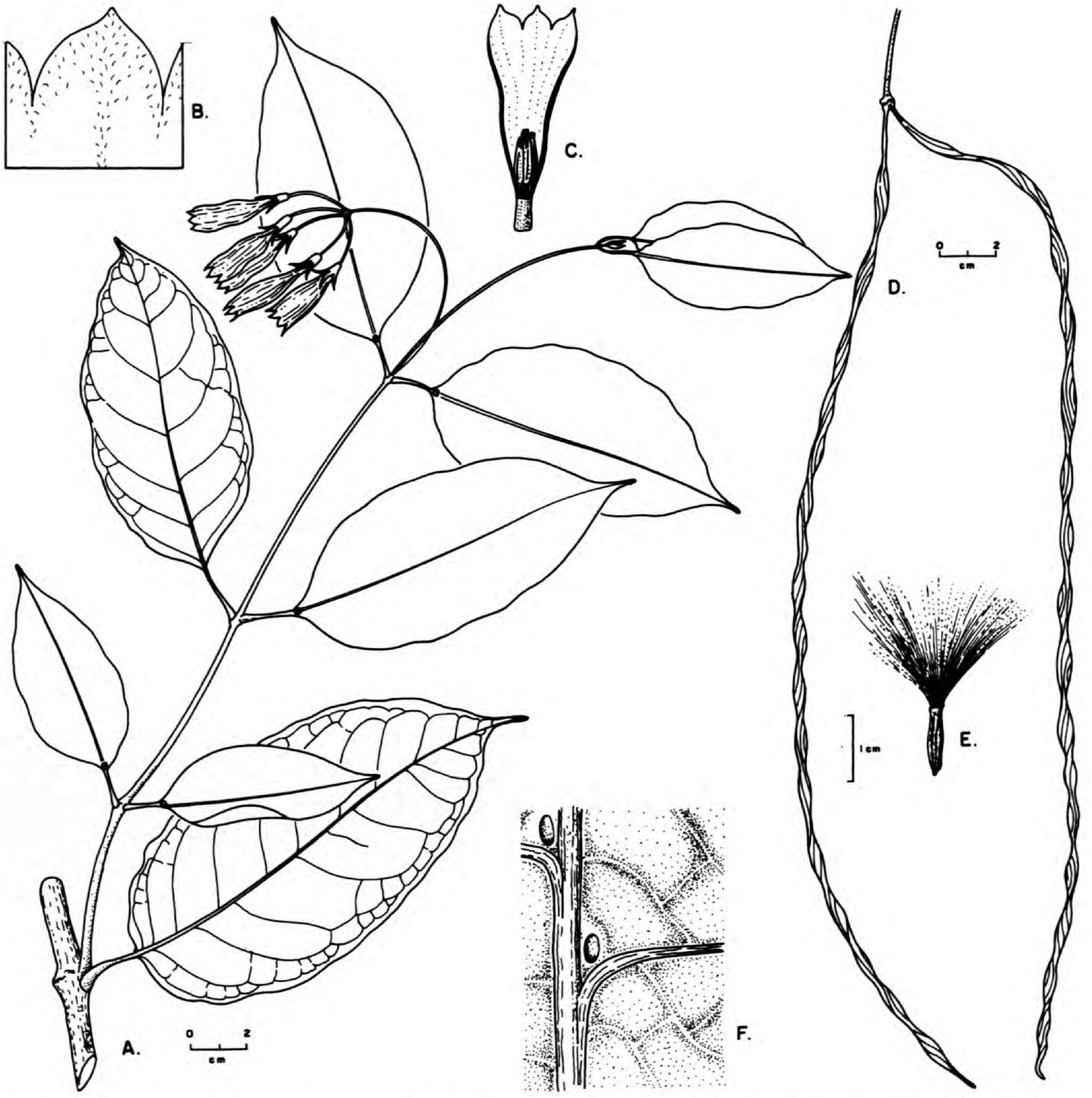

Figura 1. A–E. *Tintinnabularia gratissima* J. F. Morales (Castillo et al. 1835). —A. Hábito. —B. Pubescencia de los lóbulos. —C. Corola abierta, mostrando anteras y filamentos. —D. Fruto. —E. Semilla. —F. Domacios en el envés de la lámina.

Fenología. Se encuentra con flores y frutos entre abril y mayo.

Tintinnabularia gratissima se caracteriza por sus filamentos y anteras cortas, con los lóbulos de la corola inconspicuamente pubérulos y hojas mucho más grandes.

Parátipos. MEXICO. **Veracruz:** Faldas del Cerro El Platanillo, Sierra de Santa Martha, 23 dic. 1978, *J. Calzada 5154* (F, foto INB ex F).

Tintinnabularia mortonii Woodson, Ann. Missouri Bot. Gard. 23: 389, t. 7. 1936. TIPO. Guatemala. Alta Vera Paz: Quebrada Secas, 650 m, 8 June 1920, *Johnson 200,* (holótipo, US; isótipo, F; foto, INB ex F).

Liana, tallo terete o subterete, ramitas tiernas aplanadas o algo tetragonales antes de los nudos, glabradas, lenticelas escazas o ausentes. Láminas 4–12 × 1.5–3.5(4.8) cm, angostamente elípticas a angostamente ovadas, caudado-acuminadas o acuminadas en el ápice, obtusas o cuneadas en la base, glabras, membranáceas o cartáceas, 4–7 glándulas en la base adaxial, enteras o dentadas, nervio central prominente en ambas caras, venación secundaria broquidódroma, apenas visible o inconspicua en la haz, conspicua en el envés, domatios presentes o ausentes en las axilas de los nervios secundarios, pecíolo 0.5–1.8 cm, algunas veces con 1–2 glándulas cerca de la base de la hoja, glandular en las axilas. Inflorescencias cymas umbeliformes o corimbosas, terminales y pendulosas, 3–8 flores, pedúnculo 0.8–6 cm, pedicelo 1.5–3 cm, terete y glabro, bracteolas ca. 1 mm, escariosas; sépalos 0.9–1.6 cm × 2–3 mm, angostamente-ovados a ovados, foliáceos, glabros y no imbricados, 1–2 glándulas en la base interior; corola infundibuliforme, amarilla o amarillo-anaranjada, pentagonal, parte basal 4–9 × 2 mm, glabro, parte superior 2–3.7 × 0.9–1.4 cm, casi campanulada, algunas veces algo abultada en la mitad, glabra, lóbulos 4–7 × 4–6 mm, ovados, erectos, glabros exteriormente, densa y conspicuamente tomentulosos en el interior, la pubescencia blanca o grisácea; estambres insertos en el extremo superior de la corola, con los ápices cerca de la boca, filamentos 2.2–3.1 cm, glabros, anteras 1.2–1.3 cm, sagitadas, ápice acuminado y filiforme, conniventes y aglutinadas a la cabeza del pistilo, aurículas ca. 1 mm, gruesas, gineceo 2–2.5 mm, glabro, pistilo 2.8–3.2 cm, nectarios 2–2.5 cm, separados, obtusos y enteros. Folículos desconocidos.

Distribución y habitat. Esta especie es conocida de Guatemala y el sur de México (Chiapas), donde se desarrolla en bosques y áreas alteradas entre los 650–2600 m.

Fenología. Se encuentra en floración entre enero y mayo.

Vegetativamente puede ser separada fácilmente por sus hojas más angostas y oblongas que *T. gratissima* J. F. Morales, con los lóbulos de la corola densamente tomentulosos.

Especímenes adicionales examinados. MEXICO. **Chiapas:** along road to Pichucalco, Muncipio Solosuchiapa, *Breedlove 34900,* (MO, NY); east of Laguna Tzikaw, Monte Bello National Park, *Breedlove 35191,* (MO); Municipio Pueblo Nuevo Solistahuacán, N of Pueblo Nuevo, *Thomas et al. 3639,* (NY). GUATEMALA. **Alta Verapaz:** large swamp east of Tactic, *Standley 92671,* (F, MO). **Zacapa:** between Cerro de Monos and upper slopes of Monte Virgen, *Steyermark 42856,* (F, MO, NY, US).

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A New Species of *Mollinedia* (Monimiaceae) from Costa Rica

J. Francisco Morales and Quirico Jiménez M.

Instituto Nacional de Biodiversidad (INBio), Apto. 22-3100, Sto. Domingo de Heredia, Costa Rica

ABSTRACT. A new species of *Mollinedia* from Costa Rica, *M. macrophylla* J. F. Morales & Q. Jiménez, is described and illustrated.

Mollinedia Ruíz & Pavón (subfamily Mollinedioideae) is a dioecious genus of ca. 90 species of shrubs and small trees restricted to moist and wet forest of the Neotropics. It was monographed by Perkins (1900), and the most recent taxonomic revision was the thesis of Piexoto (1987).

While revising collections of *Mollinedia* Ruíz & Pavón in preparation for the *Manual de las Plantas de Costa Rica,* a different species with larger leaves not corresponding to any previously described taxon was found in the Braulio Carrillo National Park. We conclude it represents a new species, and we describe it here.

Mollinedia macrophylla J. F. Morales & Q. Jiménez, sp. nov. TYPE. Costa Rica. Limón: Parque Nacional Braulio Carrillo, bosque primario en el sendero Las Palmas, estación Quebrada Gonzalez, 19°57′10″N, 84°08′50″W, 500 m, 18 mayo 1993 (fl), *Morales et al. 1500* (holotype, INB; isotypes, CR, F, K, MO, NY). Figure 1.

Species foliis grandissimis, 28–42 × 21–28.5 cm, a congeneribus diversa.

Dioecious shrub 2–5 m tall, sometimes somewhat scandent, the branchlets puberulent, smooth or scarcely striate. Leaves 28–42 × 21–28.5 cm, ovate to elliptic, membranaceous, glabrous above, very sparsely puberulent below, the margin serrulate, short acuminate to acute at the apex, obtuse to rounded basally, the venation impressed above, prominent, puberulent and conspicuous below; petioles 2–3 cm × 4–5 mm, rugose, puberulent. Staminate inflorescences 1–6 in the leaf axils, in 2–3-flowered cymes, 3–6 cm long, puberulent, cream hairs, peduncles 0.3–1.5 cm long, pedicels 2–7 mm long, bracts ca. 2 mm long, ovate, acute, scarious. Flowers 0.9–1.1 cm diam. at anthesis, campanulate, puberulent; tepals 4, the outer pair 4–5 mm long, 5–6 mm broad, obtuse, the inner pair slightly smaller, with an apical laciniate appendage; stamens ca. 150, 2–3 mm long, the anthers hippocrepiform, sessile or subsessile. Carpellate inflorescence 2–5-flowered, in the axil of the leaf, puberulent, peduncles 2–7 mm long, pedicels 0.8–2.3 cm long, bracts ca. 2 mm long, ovate, acute, scarious; flowers 7–8 mm diam., turbinate, tepals 2–3 mm long, caducous, the carpels ca. 1 mm long, 31–40, cylindrical, puberulent, style ca. 0.5 mm long, clavate. Fruiting receptacle 1.7–2.1 cm broad, discoid, reflexed, sparsely puberulent on both surfaces; fruiting carpels 1.4–1.7 × 0.9–1.1 cm, ellipsoid, 2–5 (7), carnose, glabrous, the seed slightly smaller, 1.3–1.5 cm long, mottled with purple, glabrous.

Mollinedia macrophylla is known only from the tropical rainforest of the northeastern slopes of the Cordillera Volcánica Central, in the Braulio Carrillo National Park, near Horquetas of Sarapiquí, at elevations of 300–650 m. Flowering from May to June.

Mollinedia macrophylla differs from all the previously known species of *Mollinedia* in Mesoamerica by its very large leaves. It is somewhat related to *Mollinedia butleriana* Standley from Honduras, but *M. macrophylla* differs from that species by its larger leaves, sparser pubescence, and larger fruiting carpels. Most of the species in the genus have smaller leaves (Piexoto, 1987; Perkins, 1900).

Paratype. COSTA RICA. **Heredia:** Parque Nacional Braulio Carrillo, Sendero Las Palmas, 16 May 1993, *Rivera s.n.* (CR, F, INB, MO).

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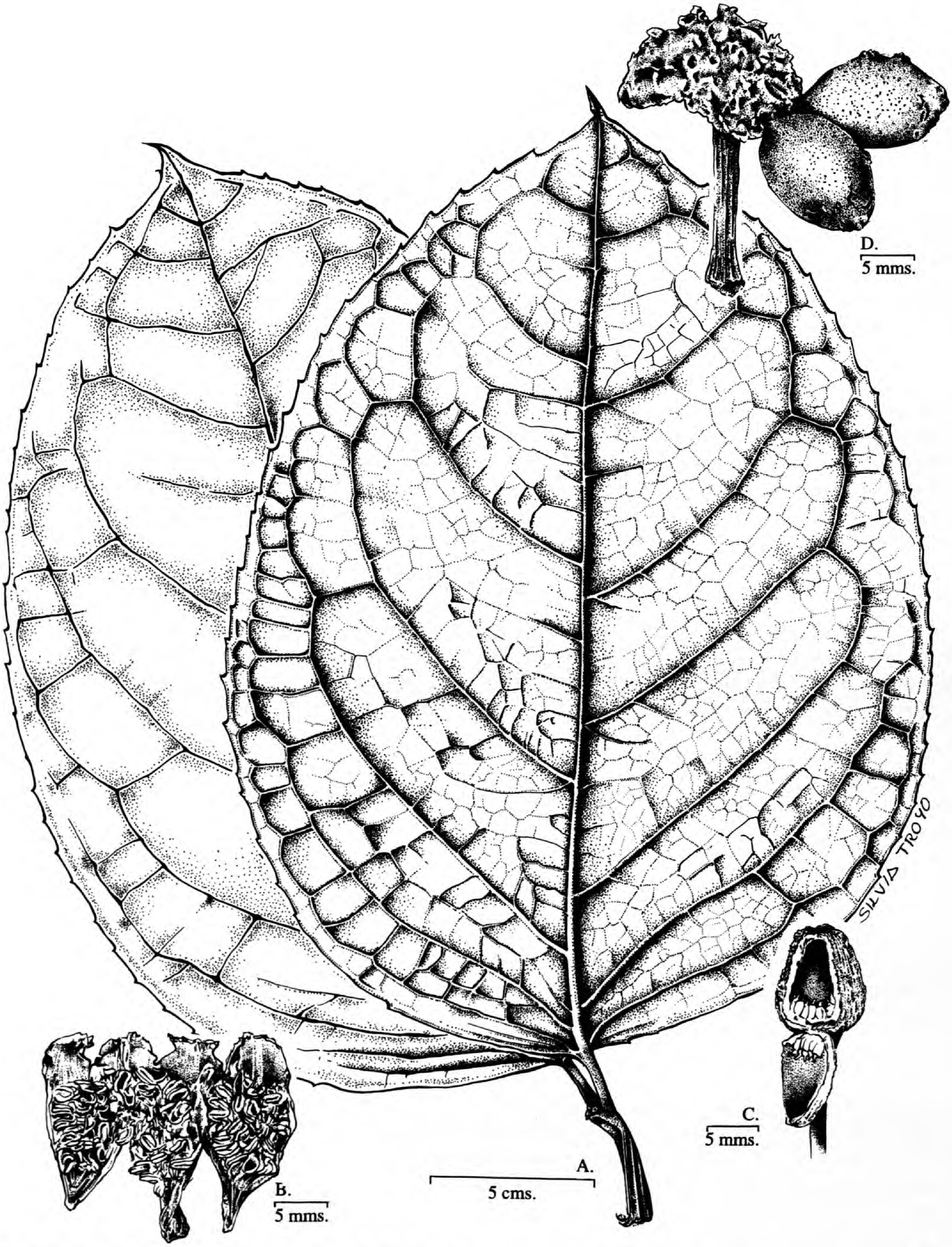

Figure 1. A–D. *Mollinedia macrophylla* J. F. Morales & Q. Jiménez (*Morales et al. 1500*). —A. Habit. —B. Staminate flower expanded and stamens. —C. Pistillate flower and carpels. —D. Receptacle and fruiting carpels.

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New Infrageneric Taxa and Combinations in *Chenopodium* L. (Chenopodiaceae)

Sergei L. Mosyakin
N. G. Kholodny Institute of Botany, 2 Tereshchenkivska Str., Kiev, 252601 Ukraine

Steven E. Clemants
Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, New York 11225-1099, U.S.A.

ABSTRACT. Five new subsections and five new combinations of subsectional rank are validated within *Chenopodium* subg. *Blitum* (L.) Hiitonen and *Chenopodium* L. subg. *Chenopodium.* In subgenus *Blitum* these are: *Chenopodium* subsect. *Foliosa* Kowal ex Mosyakin & Clemants; and *Chenopodium* subsect. *Capitata* Kowal ex Mosyakin & Clemants. In subgenus *Chenopodium* the new subsections are: *Chenopodium* subsect. *Polysperma* Kowal ex Mosyakin & Clemants; *Chenopodium* subsect. *Undata* Aellen & Iljin ex Mosyakin & Clemants; and *Chenopodium* subsect. *Standleyana* Mosyakin & Clemants. The new combinations in subgenus *Chenopodium* are: *Chenopodium* subsect. *Urbica* (Standley) Mosyakin & Clemants; *Chenopodium* subsect. *Leptophylla* (Standley) Clemants & Mosyakin; *Chenopodium* subsect. *Fremontiana* (Standley) Clemants & Mosyakin; *Chenopodium* subsect. *Favosa* (Aellen) Mosyakin & Clemants; and *Chenopodium* subsect. *Cicatricosa* (Aellen) Mosyakin & Clemants. Delimitation of some other infrageneric taxa is discussed.

The genus *Chenopodium* L. (Chenopodiaceae) may be subdivided into three natural subgenera: *Chenopodium* subg. *Ambrosia* A. J. Scott, subg. *Blitum* (L.) Hiitonen, and subg. *Chenopodium.*

There has been a fair amount of debate about the proper type for *Chenopodium.* Britton and Brown (1913) were the first to select a lectotype (*C. rubrum* L.), but Hitchcock and Green (1929) adopted *C. album* L. as the lectotype. This later choice has been accepted in recent literature (Jarvis et al., 1993; Greuter et al., 1993; for additional arguments see Uotila, 1993; Mosyakin, 1993), and is thus followed in this paper as well.

The infrageneric taxonomy of the genus has been extensively discussed in several publications (Standley, 1916; Aellen & Iljin, 1936; Kowal, 1953; Aellen, 1960; Scott, 1978). However, in preparing treatments of *Chenopodium* for forthcoming volumes of the *Flora Europae Orientalis* (Mosyakin), the *Flora of North America,* and the *Flora of Japan* (Clemants) it has become evident that new infrageneric taxa and combinations should be validated within *Chenopodium* subg. *Blitum* and *Chenopodium* subg. *Chenopodium.*

Chenopodium subg. **Blitum** (L.) Hiitonen, Suomen Kasvio: 307. 1933. TYPE: *Blitum capitatum* L. (= *Chenopodium capitatum* (L.) Ambrosi (lectotype of the genus *Blitum* L., selected by Britton & Brown, 1913).

If *Chenopodium rubrum* were considered the lectotype of *Chenopodium,* then this would have to be called *Chenopodium* subg. *Chenopodium.* However, if the genus *Blitum* is recognized, this lectotypification of *Chenopodium* by *C. rubrum* may cause serious disruption in the nomenclature of the majority of species currently placed in *Chenopodium.*

Ignatov (1988) redundantly made the same combination at the subgeneric level.

Chenopodium [sect. *Blitum* (L.) Hooker fil.] subsect. **Foliosa** Kowal ex Mosyakin & Clemants, subsect. nov. *Chenopodium* sect. *Eublitum* (Moquin-Tandon) Aellen subsect. *Foliosa* Kowal, Monogr. Bot. (Warszawa) 1: 113. 1953 (invalid name: Polish description); Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 577. 1961 (invalid name: German description). TYPE: *C. foliosum* Ascherson (= *Blitum virgatum* L.).

Perianthii segmenta in fructus tempore succulenta (rarius exsucca). Semen margine canaliculatum vel obtusatum. Inflorescentia plerumque foliosa.

Perianth segments succulent at maturity, forming characteristic berry-like clusters (rarely non-succulent). Seeds with canaliculate or obtuse margins. Inflorescence normally leafy (flowering clusters with subtending leaves/bracts almost to the top).

This subsection includes the *C. foliosum* aggregate: *C. foliosum* s. str., *C. exsuccum* (Loscos) Uotila, *C. litwinowii* (Paulsen) Uotila (= *C. korshinskyi*

Litvinov). All members of this subsection are native to the Old World: mostly mountainous regions of Eurasia; however, *C. foliosum* at present occasionally occurs almost worldwide as an escaped, naturalized, or casual alien.

Chenopodium [sect. *Blitum* (L.) Hooker fil.] subsect. **Capitata** Kowal ex Mosyakin & Clemants, subsect. nov. *Chenopodium* sect. *Eublitum* (Moquin-Tandon) Aellen subsect. *Capitata* Kowal, Monogr. Bot. (Warszawa) 1: 113. 1953 (invalid name: Polish description); Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 577. 1961 (invalid name: German description). TYPE: *C. capitatum* (L.) Ambrosi (= *Blitum capitatum* L.).

Perianthii segmenta in fructus tempore succulenta (rarius exsucca). Semen acute marginatum vel carinato-marginatum. Inflorescentia plerumque aphylla vel subaphylla.

Perianth segments succulent at maturity, forming characteristic berry-like clusters (rarely non-succulent). Seeds with acute or keeled margins. Inflorescence normally leafless (flowering clusters without subtending leaves or bracts, or with a few bracts only near the base).

Members of this subsection (*C. capitatum* aggregate: *C. capitatum* s. str., *C. overi* Aellen) are New World in origin; *C. capitatum* has been cultivated (especially in Europe), and sporadically occurs as an escaped or casual alien in many countries.

Chenopodium subg. **Chenopodium**

Note. If *C. rubrum* were considered the lectotype for *Chenopodium* (Britton & Brown, 1913), then this subgenus would be in need of a new name or combination.

Chenopodium sect. **Grossefoveata** Aellen & Iljin ex Mosyakin, Ukrayins'k. Bot. Zhurn. 50(5): 75. 1993. *Chenopodium* sect. *Chenopodia* ser. *Grossefoveata* Aellen & Iljin, Fl. SSSR 6: 55. 1936 (invalid name: Russian description). *Chenopodium* sect. *Chenopodium* subsect. *Grossefoveata* Aellen, in Aellen & Just, Amer. Midl. Naturalist 30: 75. 1943 (invalid name: English description); Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 577. 1961 (invalid name: German description). TYPE: *C. hybridum* L.

Synonym:

Chenopodium III. *Hybrida* Standley, North Amer. Fl. 21(1): 13. 1916 (name of uncertain rank).

The senior author believes that this section consists of one species with three rather distinct subspecies: *C. hybridum* subsp. *hybridum* (Europe and western Asia; an alien in many other regions); an as-yet-unpublished subspecies (East Asia, with some exclaves in Central Asia and southern Siberia); and *C. hybridum* subsp. *gigantospermum* (Aellen) Hultén (= *C. simplex* (Torrey) Rafinesque; *C. gigantospermum* Aellen; native to North America). Additional morphological justification may be found in Baranov (1964). However, in recent North American literature *C. simplex* is usually recognized as a separate species.

Standley (1916) never mentioned a particular rank for his infrageneric groups of *Chenopodium.* The sectional status of these names is not evident from the context of his work, or from the form and usage of the names. Standley also ignored all previous infrageneric subdivisions within *Chenopodium* and *Atriplex* L. The number of infrageneric groups described by Standley for North American representatives of these two genera (17 for *Chenopodium* and 29 for *Atriplex*) is unusual for traditional sections. In other treatments published in the "North American Flora" series almost simultaneously with the treatment of Chenopodiaceae, such infrageneric names are sometimes referred to simply as "groups" (e.g., Rydberg, 1908). Aellen, who certainly was very familiar with the treatments in "North American Flora," never mentioned in all modifications of his system for *Chenopodium* any of Standley's infrageneric entities, evidently regarding them as informal groups. Under Article 35 of the *Code* (Greuter et al., 1994) they should be regarded as validly published names of uncertain rank (and, subsequently, inoperative in questions of priority), and they may be used as basionyms for new combinations. However, in order to ensure validity of our new taxa and combinations, we provide the formal Latin descriptions for all presumably disputable names.

Chenopodium sect. **Chenopodium**

Synonyms:

Chenopodium sect. *Leprophyllum* Dumortier, Florula Belgica: 21. 1826.
Chenopodium sect. *Chenopodia* C. A. Meyer in Ledebour, Fl. Altaica 1: 403. 1829; Aellen & Iljin, Fl. SSSR, 6: 54. 1936.
Chenopodium sect. *Chenopodiastrum* Moquin-Tandon in A. De Candolle, Prodr. 13, 2: 61. 1849.

Chenopodium [sect. *Chenopodium*] subsect. **Polysperma** Kowal ex Mosyakin & Clemants, subsect. nov. *Chenopodium* sect. *Chenopodia* C. A. Meyer subsect. *Polysperma* Kowal, Monogr. Bot. (Warszawa) 1: 114. 1953 (invalid name: Polish description); Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 577. 1961 (invalid name: German description). TYPE: *C. polyspermum* L.

Synonym:

Chenopodium II. *Polysperma* Standley, North Amer. Fl. 21(1): 13. 1916 (name of uncertain rank).

Planta glabra, non farinosa. Folia ovalia vel oblongo-ovalia, integra vel rarissime basi subhastata. Testa nitida, subtilissime punctata.

Plant normally glabrous, not farinose. Leaves ovate or oblong-ovate, entire or rarely subhastate (with two indistinct lobes near the base). Testa shiny, minutely punctate.

The sole member of this subsection, *C. polyspermum*, is a distinctive species with at least two (or three?) distinct varieties. It differs from all other members of section *Chenopodium* in the total (or almost total) absence of vesicular hairs on the leaves, stems or flowers, and in the testa sculpture. In spite of being very different from *C. hybridum* morphologically, *C. polyspermum* may hybridize with this species, forming a hybrid known as *C. ×perhybridum* Ponert (1966). Aellen and Iljin (1936) placed *C. polyspermum*, together with *C. murale* L., in the series *Undata* Aellen & Iljin; however, in our opinion, these species are not closely related (see discussion below).

Chenopodium [sect. *Chenopodium*] subsect. **Urbica** (Standley) Mosyakin & Clemants, comb. nov. Basionym: *Chenopodium* I. *Urbica* Standley, North Amer. Fl. 21(1): 11. 1916 (name of uncertain rank). TYPE: *C. urbicum* L.

Folia deltoidea vel rhomboidea, margine denticulata vel rarius subintegra. Inflorescentia spicata, plerumque stricta et erecta. Semen margine obtusatum. Testa nitida, subglabra vel minutissime reticulata.

Leaves deltoid or rhombic, normally dentate or denticulate at margins (rarely almost entire). Inflorescence spicate, normally straight and erect. Seeds with obtuse margin. Testa shiny, almost smooth or indistinctly reticulate.

The sole member of this subsection, *C. urbicum*, differs from other members of *Chenopodium* sect. *Chenopodium* in the broadly deltoid (or rhombic-deltiod) leaves, seed margin rounded, and peculiar inflorescence with its branches in most cases almost appressed to the main stem. This subsection shows affinity (especially in the testa sculpture) to the next one (below). These two subsections differ particularly in the seed margin (rounded in subsection *Urbica*, acute in subsection *Undata*) and inflorescence (normally lax in *C. murale* s.l.). Strangely enough, in all versions of Aellen's system *C. urbicum* was placed in *Chenopodium* series (or subsect.) *Lejosperma* Aellen & Iljin.

Standley (1916) included in his *Urbica*-group *C. murale* L. and *C. mexicanum* Moquin-Tandon. We believe that these two species are not closely related to *C. urbicum*.

Chenopodium [sect. *Chenopodium*] subsect. **Undata** Aellen & Iljin ex Mosyakin & Clemants, subsect. nov. *Chenopodium* sect. *Chenopodia* C. A. Meyer series *Undata* Aellen & Iljin, Fl. SSSR 6: 54. 1936 (invalid name: Russian description). *Chenopodium* [sect. *Chenopodium*] subsect. *Undata* Aellen, in Aellen & Just, Amer. Midl. Naturalist 30: 75. 1943 (invalid name: English description); Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 577. 1961 (invalid name: German description). TYPE: *C. murale* L.

Pericarpium minute punctulato-verrucosum. Inflorescentia cymosa vel cymoso-paniculata, plerumque laxa. Semen acute carinato-marginatum, subtiliter granulatum vel punctulatum.

Pericarp minutely verrucose-punctate. Inflorescence cymose or cymose-paniculate, normally lax. Seeds with acute or keeled margin; testa minutely punctate.

This subsection consists of *C. murale* s. str. and some taxa closely related to this species (e.g., *C. fasciculosum* Aellen). Members of this subsection differ from other species of *Chenopodium* sect. *Chenopodium* in the acute (sharply to bluntly keeled) seed margins, and testa marked with minute pits. This subsection seems to be closely allied to the preceding.

Chenopodium [sect. *Chenopodium*] subsect. **Leptophylla** (Standley) Clemants & Mosyakin, comb. nov. Basionym: *Chenopodium* IV. *Leptophylla* Standley, North Amer. Fl. 21(1): 14. 1916 (name of uncertain rank). TYPE: *C. leptophyllum* Nuttall ex S. Watson.

Synonym:

Chenopodium V. *Cycloidia* Standley, North Amer. Fl. 21(1): 16. 1916 (name of uncertain rank).

Folia linearia vel lineari-lanceolata, angusta; apice acuminata vel acuta, margine integerrima vel basi subhastata; uninervia vel plerumque trinervia (rarissime multinervia); saepissime griseo-farinosa vel olivaceo-virescentia. Testa subglabra.

Leaves linear or linear-lanceolate, narrow, acute or acuminate at apex; margins entire or hastately lobed at base; in most cases with only one (central) vein, or with additional one (rarely more) pair of lateral veins; mostly gray-farinose, or olive green. Testa smooth or nearly so.

This subsection brings together all the narrow-leaved *Chenopodium* species that form a close-knit, difficult group in the western United States and Canada (*C. leptophyllum* Nuttall ex S. Watson, *C. pratericola* Rydberg, *C. desiccatum* A. Nelson, *C. foggii* Wahl, *C. hians* Standley, *C. subglabrum* (S. Watson) A. Nelson, *C. cycloides* A. Nelson, *C. pallescens* Standley; possibly also *C. albescens* Small). There is some overlap with other subsections. Particularly, *C. albescens* appears to form an intermediate with *Chenopodium* subsect. *Chenopodium*, and *C. atrovirens* Rydberg forms a transition from this subsection to the next one (*Chenopodium* subsect. *Fremontiana*). More detailed discussion of the relationships within this group may be found in Crawford (1975) and La Duke and Crawford (1979). Species of this subsection were usually included by Aellen and his co-authors (Aellen, 1960; Aellen & Just, 1943; Aellen & Iljin, 1936) in the section *Chenopodia* C. A. Meyer series *Leiosperma* Aellen & Iljin (invalid name: see discussion below).

Chenopodium [sect. *Chenopodium*] subsect. **Fremontiana** (Standley) Clemants & Mosyakin, comb. nov. Basionym: *Chenopodium* VII. *Fremontiana* Standley, North Amer. Fl. 21(1): 18. 1916 (name of uncertain rank). TYPE: *C. fremontii* S. Watson.

Folia basalia et media saepissime trilobata; rarius subrotundata vel rotundato-ovalia, margine subintegra, plerumque non denticulata; plurimum tam longa quam lata. Testa glabra vel rarius minutissime striata. Odor subnullus.

Lower and medium cauline leaves normally ± trilobate, or sometimes almost rotundate or rotundate-ovate; margins almost entire (with the exception of basal lobes, when present), in most cases as long as wide or nearly so. Testa smooth or rarely indistinctly striate. Plants without rank odor (this last statement is necessary for distinguishing members of this subsection from *C. watsonii* s.l. and *C. vulvaria* and allied species).

This subsection includes the following species: *C. fremontii* S. Watson s.l. (including *C. pringlei* Standley), *C. atrovirens* Rydberg, *C. incanum* (S. Watson) A. A. Heller, *C. incognitum* Wahl, *C. nevadense* Standley, *C. glabrescens* (Aellen) Wahl, and *C. flabellifolium* Standley. They had previously been placed by Aellen (1960) and Aellen and Just (1943) mostly in *Chenopodium* subsect. *Lejosperma* (an invalid name). However, they appear to form a good and natural group allied to *Chenopodium* subsect. *Chenopodium* and *Chenopodium* subsect. *Favosa* (see discussion under the latter) and are geographically restricted mostly to the southwestern part of North America, and Central America (however, some South American taxa centered around *C. petiolare* Kunth possibly also belong here or, most probably, form their own group more distantly related to our subsection). These species all have more or less trilobate leaves, a rather glabrous pericarp, and smooth (or nearly smooth) testa.

Chenopodium [sect. *Chenopodium*] subsect. **Favosa** (Aellen) Mosyakin & Clemants, comb. nov. Basionym: *Chenopodium* series *Favosa* Aellen, Feddes Repert. 69: 69. 1964. *Chenopodium* subsect. *Cellulata* Aellen series *Favosa* ("*Foveosa*") Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3, 2: 577. 1961 (invalid name: German description). TYPE: *C. ficifolium* Smith (lectotype, selected here).

Synonym:

Chenopodium sect. *Chenopodia* C. A. Meyer series *Cellulata* Aellen & Iljin, Fl. SSSR 6: 68. 1936 (invalid name: Russian description). *Chenopodium* subsect. *Cellulata* Aellen in Aellen & Just, Amer. Midl. Naturalist 30: 69. 1943 (invalid name: English description).

This subsection includes the following species: *C. ficifolium* Smith (including *C. blomianum* Aellen), *C. berlandieri* Moquin-Tandon s.l. (including *C. zschackei* J. Murr), *C. macrocalycium* Aellen, *C. bushianum* Aellen, *C. quinoa* Willdenow, *C. hircinum* Schrader, *C. watsonii* A. Nelson s.l. (an aggregate including also *C. palmeri* Standley, *C. arizonicum* Standley, and *C. neomexicanum* Standley). Some other species probably belonging to this group (mostly South American ones, e.g., *C. philippianum* Aellen) are in need of further taxonomic study. This is also true for a North American group, *C. watsonii* sensu lato, since it, evidently being related to *C. berlandieri*, at the same time closely approaches morphologically some forms of the *C. fremontii* aggregate, and possibly may be included together with the latter in *Chenopodium* subsect. *Fremontiana*. See Wilson (1976), La Duke and

Crawford (1979), and Walters (1985, 1988) for discussions of relationships within this group and relationships to representatives of other subsections (in particular, with the preceding subsection).

Chenopodium [sect. *Chenopodium*] subsect. **Cicatricosa** (Aellen) Mosyakin & Clemants, comb. nov. Basionym: *Chenopodium* series *Cicatricosa* Aellen, Feddes Repert. 69: 69. 1964. *Chenopodium* subsect. *Cellulata* Aellen series *Cicatricosa* Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 577. 1961 (invalid name: German description). TYPE: *C. acerifolium* Andrzejowski (lectotype, selected here).

This group consists of the following species: *C. acerifolium* Andrzejowski (including *C. klinggraeffii* (Abromeit) Aellen), *C. suecicum* J. Murr s.l. (including some Eurasian and possibly North American hexaploid forms of this mostly diploid species), *C. karoi* (J. Murr) Aellen, and *C. jenissejense* Aellen & Iljin.

Almost all representatives of this subsection (except *C. suecicum*) are predominantly non-weedy species of alluvial, riparian, and other similar marginal habitats, occurring mostly in temperate and northern Eurasia. They differ from representatives of *Chenopodium* subsect. *Chenopodium* in having less smooth, in most cases indistinctly foveolate or foveolate-striate testa. However, they are morphologically connected to both *Chenopodium* subsect. *Chenopodium* and *Chenopodium* subsect. *Favosa* (by *C. suecicum* and *C. karoi*, respectively). An excellent but somewhat outdated discussion of the relationships between species of this subsection and *C. ficifolium* may be found in Aellen (1929). The group is extremely interesting from the phytogeographical point of view, and is in need of a more detailed taxonomic study.

Chenopodium [sect. *Chenopodium*] subsect. **Standleyana** Mosyakin & Clemants, subsect. nov. TYPE: *C. standleyanum* Aellen.

Synonym:

Chenopodium VI. *Bosciana* Standley, North Amer. Fl. 21(1): 16. 1916 (name of uncertain rank).

Plantae gracile erectae, plerumque ramosae; inflorescentia gracilissima moniliformia. Laminae foliorum tenues, plerumque trilobatae vel subintegrae. Semina non manifeste picta vel minutissime foveolata.

Plants mostly gentle, erect, branched. Inflorescence moniliform, with small loosely disposed glomerules (often having flowers in various stages of development). Leaf blades normally thin, trilobate or occasionally almost entire. Seed testa almost glabrous or indistinctly minutely pitted.

The following species are included in this subsection: *C. bryoniifolium* Bunge (= *C. koraiense* Nakai s. str.; *C. atripliciforme* J. Murr s. str.), *C. gracilispicum* Kung (*C. koraiense* auct. p.p.), ? *C. badachschanicum* Tzvelev (*C. atripliciforme* J. Murr, p. p.), *C. standleyanum* Aellen (*C. boscianum* auct.), *C. missouriense* Aellen emend. Dvořák (1987).

We prefer not to use the name *Bosciana*, since *C. boscianum* Moquin-Tandon seems to be a synonym (or infraspecific entity) of *C. berlandieri* s.l., and was commonly misapplied for a species now known as *C. standleyanum*. Moreover, Standley (1916) included in this group such species as *C. carnosulum* Moquin-Tandon, *C. nevadense* Standley, and *C. albescens* Small, which, in our opinion, do not belong here.

We accept the species *C. missouriense* in the narrow sense, as it was delimited and lectotypified by Dvořák (1987), since most of the specimens in North American herbaria determined as *C. missouriense* in fact represent various forms of *C. strictum* and (less commonly) *C. album*. The placement of *C. badachschanicum* is rather tentative: this little-known Asian species also shows some similarity with the *C. karoi* aggregate.

We include here species with rather smooth testa (similar to *Chenopodium* subsect. *Chenopodium*), but it is necessary to note that they are closely connected to some species of the preceding subsection (especially to *C. karoi* and *C. suecicum*) by evident morphological transition, since minute characters of testa sculpture may vary considerably (from deeply and prominently sculptured to almost glabrous) within groups of closely related taxa, which is evident from the example of *C. hybridum* sensu lato. Representatives of this subsection (as well as of the preceding one) are also mostly non-weedy species of alluvial and disturbed semi-natural habitats (river banks, forest margins, eroded slopes, etc.).

Chenopodium [sect. *Chenopodium*] subsect. **Chenopodium**. TYPE: *C. album* L. (lectotype of the genus).

Synonyms:

Chenopodium IX. *Alba* Standley, North Amer. Fl. 21(1): 21. 1916 (name of uncertain rank).

Chenopodium sect. *Chenopodia* C. A. Meyer series *Lejosperma* Aellen & Iljin, Fl. SSSR 6: 59. 1936 (invalid name: Russian description). *Chenopodium* sect. *Chenopodium* subsect. *Leiosperma* Aellen in Aellen &

Just, Amer. Midl. Naturalist 30: 61. 1943 (invalid name: English description); Aellen in Hegi, Illustr. Fl. Mitteleur., ed. 2, 3/2: 578. 1961 (invalid name: German description).

This subsection includes *C. album* L. sensu latissimo, *C. strictum* Roth s.l., *C. opulifolium* Schrader ex A. P. De Candolle and some other species, mostly those segregated from the above taxa. *Chenopodium vulvaria* L. and several similar Eurasian taxa (e.g., *C. sosnowskii* Kapeller, *C. pamiricum* Iljin, *C. nidorosum* Otschiauri, *C. iljinii* Goloskokov) may be included here provisionally; however, they also demonstrate an evident similarity with the *C. acerifolium–C. karoi* complex, and possibly after additional study they should be separated into their own subsection.

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Compositae of the Guayana Highland—XI. *Tuberculocarpus* gen. nov. and Some Other Ecliptinae (Heliantheae)

John F. Pruski

United States National Herbarium, Department of Botany, MRC-166, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. A new genus from Venezuela, *Tuberculocarpus,* is described and illustrated, and the combination *T. ruber* is made. *Thelechitonia* and *Complaya* are placed in synonymy of the formerly unispecific *Sphagneticola,* and a lectotype is chosen for the generitype *S. ulei* and for *Verbesina calendulacea. Sphagneticola* includes cultivated *Wedelia trilobata,* and the combinations *S. brachycarpa, S. calendulacea, S. gracilis,* and *S. trilobata* are made. *Wulffia* is a taxonomic synonym of *Tilesia,* and combinations in *Tilesia* are proposed for the three species and one variety formerly placed in *Wulffia: Tilesia baccata, T. macrocephala, T. rubens,* and *T. baccata* var. *discoidea.* The basionym of the most widespread species of *Tilesia* (*Coreopsis baccata*) has previously been attributed to Linnaeus filius, but was published earlier by Linnaeus. *Elaphandra moriana* from French Guiana is described, and the combination *Elaphandra lehmannii* is made. *Oyedaea wurdackii* is described from Venezuela and is illustrated, and the combination *Oyedaea tepuiana* is proposed. The combination *Verbesina ligulata* is provided, and *V. guianensis* is lectotypified and is an earlier name for *V. schomburgkii. Elaphandra sucrensis* is reduced to synonymy of *E. verbesinoides, E. lucidula* is reduced to *E. ulei, Oyedaea blakeana* is reduced to *O. scaberrima,* and *Wulffia trujilloi* is reduced to *Tilesia macrocephala.*

The Ecliptinae Lessing (including Verbesininae Bentham) of the Heliantheae (Compositae) are difficult taxonomically, both at the generic and specific levels. The traditional generic and subtribal classifications of this group by Bentham (1873) and Hoffmann (1890–1894) have been much revised in the recent past. The classification used here is that of Robinson (1981), but recent modifications by Robinson (1984a, 1992, and literature cited therein) and Strother (1991, and literature cited therein) are accepted. Features most commonly employed in classifications include anther, style, cypsela, and pappus characters, and fertility of the ray florets. Karis and Ryding (1994) used the name Verbesininae for much of the Ecliptinae.

The following novelties and adjustments involve taxa primarily from the Guayana Highland of northeastern South America. These novelties are proposed prior to the appearance of many of them in the *Compositae of the Guayana Highland,* the *Guide to the Vascular Plants of Central French Guiana,* the *Flora of St. John, U.S.V.I.,* and the *Flora of the Venezuelan Guayana.* A map (Fig. 1) is given for the six Guayana Highland endemics proposed or transferred here. The genera treated herein are restricted to the New World, with the exception of *Sphagneticola* O. Hoffmann. Generic restructuring proposed here includes reduction of *Complaya* Strother and *Thelechitonia* Cuatrecasas to synonymy of *Sphagneticola,* which necessitates the transfer of the species of *Wedelia trilobata* (L.) Hitchcock group to *Sphagneticola;* the reduction of *Wulffia* Necker ex Cassini to synonymy of *Tilesia* G. Meyer, including the transfer of *Wulffia baccata* (L.) Kuntze to *Tilesia;* and the description of *Tuberculocarpus* Pruski, a generic segregate of the *Aspilia* Thouars-*Wedelia* Jacquin alliance.

ELAPHANDRA

Strother (1991) recently proposed the segregate *Elaphandra* from the *Aspilia-Wedelia* alliance. The limits of formerly unispecific *Elaphandra* were expanded by Robinson (1992; 1994) to include 11 additional species (only 10 of which are recognized here), many of which were suggested by Strother (1991; in sched.) as belonging to *Elaphandra.* The combination proposed here and the description of *Elaphandra moriana* Pruski raises to 13 the number of species in the genus.

The species of *Elaphandra* have sterile ray florets (when present) and would previously have fit into the concept of *Aspilia,* now a synonym of *Wedelia. Elaphandra* was not reported (nor was *Aspilia*) in the Guianas by Funk (1991), and *E. moriana* is the first species of the genus known in the Guyana Highland. The type of *E. moriana* was listed by Cremers and Hoff (1995) as *W. fruticosa* Jacquin, which is unknown in French Guiana. *Elaphandra* is diagnosed by eglandular leaves, by rays sterile

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when present (one species is discoid), by ovate eglandular anther appendages, these commonly abaxially black though sometimes tan within or distally, by erect or laxly recurved (not strongly coiled) papillose style branches, by rostrate (necked) cypselas that have a reduced or aristate pappus, and by lack of obvious carpopodia and elaiosomes.

Elaphandra lehmannii (Hieronymus) Pruski, comb. nov. Basionym: *Aspilia lehmannii* Hieronymus, Bot. Jahrb. Syst. 28: 605. 1901. *Wedelia lehmannii* (Hieronymus) B. L. Turner, Phytologia 72: 393. 1992. SYNTYPES: Colombia. Risaralda: in silvis prope Arrayanal ad fluvium Río Risaralda, 1400–1800 m, 24 Oct. 1883, *Lehmann 3282* (B destroyed [photograph, NY, US]); locality not indicated, *Triana 1363* (not seen) and *Triana 1365* (not seen). Lectotypification is deferred, because not all syntypes were studied.

Distribution. Andean Colombia and presumably extending southward into Ecuador.

This species is one of four placed in *Elaphandra* Group I of Robinson (1992), and possibly includes the very similar *Aspilia patentipilis* S. F. Blake. Specimens in US determined by Blake as *A. patentipilis* tend to have hairier stems, fewer capitula, these with very long outer phyllaries, and longer peduncles. If these distinctions are consistently found in future collections, then a combination in *Elaphandra* may be needed for *A. patentipilis*. It seems best to view *E. lehmannii* in a broad sense, presently including *A. patentipilis*. Furthermore, *E. quinquinervis* (S. F. Blake) H. Robinson, which has 5-veined leaves, is very closely related to *E. lehmannii* and may not prove to be distinct. If the two above species are placed in synonymy of *E. lehmannii* the distribution of *E. lehmannii* would range from the eastern to the western cordilleras of Colombia and southward into Ecuador.

Elaphandra moriana Pruski, sp. nov. TYPE: French Guiana. Inselberg granitique à l'extrémité nordouest des Monts de la Trinité, 4 Aug. 1981, *J. de Granville 4741* (holotype, US; isotype, US). Figure 1.

Suffrutex scandens; *caules* strigosi; *folia* simplicia opposita petiolata, lamina 4–12 × 0.8–5.2 cm chartacea eglandulosa; *capitulescentia* cymosa vel monocephala; *capitula* radiata paleacea, flosculis 30–34; *phyllaria* strigosa herbacea basi scariosa; *flosculi radiati* 5 vel 6 steriles, corolla luteola 5.5–6.5 mm longa; *flosculi disci* 24–29 hermaphroditi, corolla luteola ca. 4.2 mm longa; *antherae* nigrae, appendicibus apicalibus stramineis eglandulosis; *achaenia* rostrata nigra, aristis 2–4 fragilibus caducis 1.5–3.2 mm longis.

Scandent shrub to 2 m tall; *stems* weak, subterete, strigose, the internodes 2.5–7(–11) cm long, usually much shorter than the subtending leaves. *Leaves* simple, opposite, petiolate; *petioles* 0.5–1.5 cm long, strigose-hispidulous, thin, not obviously canaliculate; *blades* elliptic-lanceolate to elliptic, 4–12 × 0.8–5.2 cm, chartaceous, weakly triplinerved from well above base, basally cuneate or sometimes attenuate, the margins serrulate, apically acute to acuminate, the surfaces eglandular, without black dots, the adaxial surfaces green, scabrous, the abaxial surfaces pale green, hispidulous, especially so on larger veins. *Capitulescences* cymose or sometimes monocephalous, terminal or axillary from the most distal node, of 1–3 long-pedunculate capitula held slightly above the subtending leaves; *peduncles* erect, 2–5 cm long, densely hispid-strigose. *Capitula* radiate, 30–34-flowered; *involucres* campanulate, 6–9 × 6–8 mm; *phyllaries* 10–13, in ca. 2 series, imbricate, subequal, herbaceous or inner ones scarious at base, oblong, 5–9 × 2–2.5 mm, strigose, not black-streaked, the apices broadly acute to rounded; *receptacles* flat, 2.5–3 mm diam., paleate, the pales conduplicate, 5–6.5 × 1–1.4 mm, glabrous, stramineous, the apices acuminate. *Ray florets* (immature) 5 or 6, sterile, lacking styles; *corollas* yellow, 5.5–6.5 mm long, the tubes ca. 1 mm long, glabrous, the limbs 4.5–5.5 × 2.5–3 mm, eglandular, shortly bilobed at the apices, 6–8-veined with 2 veins larger than the others, these abaxially puberulent distally. *Disk florets* 24–29, bisexual; *corollas* actinomorphic, yellow, not black-streaked, tubular-funnelform, ca. 4.2 mm long, the tubes ca. 1.1 mm long, glabrous, the throats ca. 2.4 mm long, glabrous, the lobes 0.7–0.9 mm long, long-triangular, weakly puberulent; *anthers* weakly exserted, ca. 2.3 mm long, the thecae black, the apical appendages ovate, black at base, tan distally, eglandular, the filaments 1.2 mm long; *style branches* ca. 1.5 mm long, papillose, slightly spreading, with paired stigmatic lines, the apices narrowed. *Ray ovaries* sterile, 2.8–3 mm long, obconic, 3-angled, ciliate on the ribs, 3-aristate, the aristae 1.8–2.4 mm long, subequal to unequal. *Disk cypselas* 4–4.2 × 1.5–2 mm, obovate, slightly compressed, black, weakly puberulent on necks and shoulders, lacking elaiosomes and carpopodia; *pappus* 2–4-aristate, the aristae subequal to unequal, 1.5–3.2 mm long, fragile and easily knocked off, arising from a low fimbriate crown ca. 0.6 mm tall.

Distribution and ecology. This species is known only from the type collection made on a granitic inselberg (laja) in the northwestern sector of Monts de la Trinité in French Guiana. It was collected in flower in August.

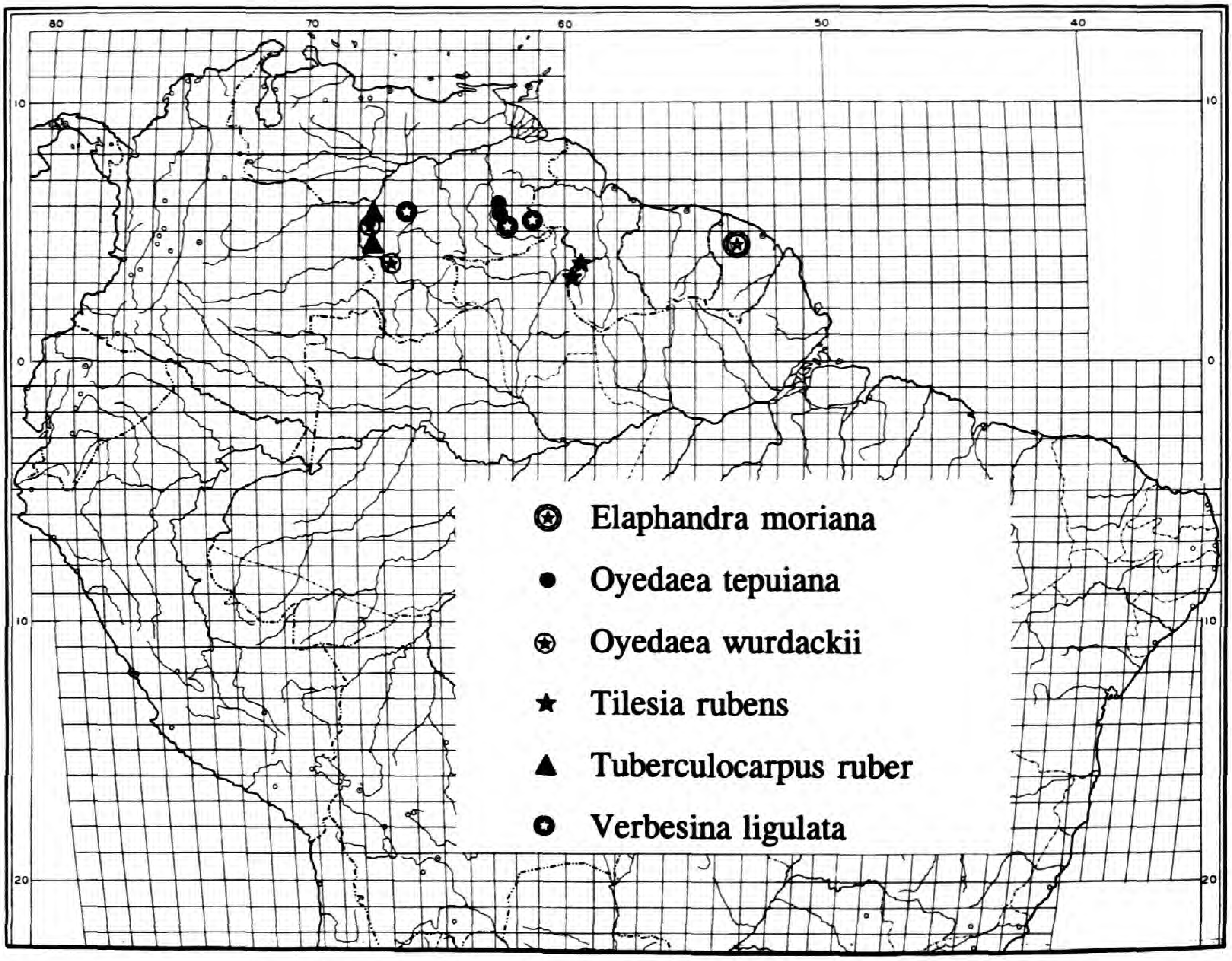

Figure 1. Distributions of *Elaphandra moriana* Pruski, *Oyedaea tepuiana* (V. Badillo) Pruski, *Oyedaea wurdackii* Pruski, *Tilesia rubens* (Alexander) Pruski, *Tuberculocarpus ruber* (Aristeguieta) Pruski, and *Verbesina ligulata* (Maguire & Wurdack) Pruski.

This is the first *Elaphandra* known in the Guayana Highland. *Elaphandra verbesinoides* and *E. ulei* are the nearest geographical relatives. They differ from *E. moriana* by membranous leaves that are black-dotted, and by black-streaked phyllaries or corollas, which place them in Group II of Robinson (1992). *Elaphandra moriana* has chartaceous non-black-dotted leaves, radiate capitula, non-hispid pales that are apically acuminate, and non-black-streaked phyllaries and corollas, which place it as the fourth species referable to Group I of Robinson (1992). It differs from the three Andean species of this group by smaller capitula, a well-developed aristate pappus, and distally tan anther appendages.

I am happy to name this new species for Scott Mori, Director of the Institute of Systematic Botany of The New York Botanical Garden. Scott pointed my eyes eastward in the Guayana Highland through his fine collections made for his forthcoming *Guide to the Vascular Plants of Central French Guiana*. *Elaphandra moriana* is named in conjunction with my treatment of the Compositae in this flora.

Elaphandra verbesinoides (DC.) H. Robinson, Phytologia 72: 148. 1992. *Gymnopsis verbesinoides* DC., Prodr. 5: 561. 1836. *Aspilia verbesinoides* (DC.) S. F. Blake, Proc. Biol. Soc. Wash. 34: 120. 1921. TYPE: Trinidad. Without date, *J. Lockart s.n.* (holotype, G-DC not seen [photograph, US; IDC microfiche 800. 941.III.6]; isotypes, GH not seen [photograph, US], K not seen).

Aspilia sucrensis Aristeguieta, Acta Bot. Venez. 1(2): 80. 1966. Syn. nov. *Elaphandra sucrensis* (Aristeguieta) V. Badillo, Revista Fac. Agron. (Maracay) 45: 95. 1994 [1995]. TYPE: Venezuela. Sucre: Península de Paria, Cerro Patao, norte de Puerto de Hierro, nordeste de Güiria, fila seca en la cumbre, 875 m, 25–26 July 1962, *Steyermark & Agostini 91337* (holotype, VEN; isotypes, NY, US—2).

Distribution. Venezuela (Sucre) and Trinidad.

Elaphandra sucrensis is added to the synonymy of *E. verbesinoides* given by Robinson (1992). *Elaphandra verbesinoides* is closely related to Amazonian (Bolivian and Brazilian) *E. ulei* [*E. lucidula* (S. F. Blake) H. Robinson, syn. nov.], the latter differing by shorter petioles, often by more rounded leaf bases, and by fewer capitula, these frequently on longer peduncles. It is possible that *E. verbesinoides* or the related *E. ulei* will eventually be found in the Venezuelan Guayana or the Guianas. *Elaphandra verbesinoides* and *E. ulei* belong to *Elaphandra* Group II of Robinson (1992), which contains four species characterized by black-spotted leaves and black-streaked phyllaries or corollas.

OYEDAEA

Oyedaea DC. is largely Andean and contains about 15 species, 6 in Venezuela, and 3 of these in the Guayana Highland. The Brazilian species once referred to *Oyedaea* were transferred by Robinson (1984b) to *Dimerostemma* Cassini, which includes not only the 11 species treated by Robinson, but also the invalid *D. oblonga* (Baker) Barroso, not keyed by Robinson. *Oyedaea* and *Dimerostemma* have sterile ray florets and winged disk cypselas, but *Dimerostemma* differs from *Oyedaea* by its distinctly foliar outer series of phyllaries and coiled style branches. *Oyedaea* is further distinguished by its disk cypselas with two slender awns and an apical neck.

Oyedaea is expanded here to include *Zexmenia tepuiana* V. Badillo and a newly described species, both endemic to the Venezuelan Guayana. Additional collections are needed to accurately place *O. verbesinoides* var. *hypomalaca* Steyermark. This taxon should not be recognized as a variety of *O. verbesinoides,* but rather included in the synonymy of *O. maculata* S. F. Blake (also of northeastern Venezuela), or, alternatively, elevated to the species level. The key to the Venezuelan taxa of *Oyedaea* given by Aristeguieta (1964) is modified here to include the new synonymy and two novelties.

KEY TO THE VENEZUELAN TAXA OF *OYEDAEA*

1a. Leaves strongly triplinerved from above base.
2a. Corollas white; Amazonas . . *O. wurdackii* Pruski
2b. Corollas yellow.
3a. Involucres 10–14 mm tall; phyllaries strigose, outer ones lanceolate; ray limbs 15–20 × 4–6 mm; widespread in the Caribbean coastal ranges, less frequent in the Andes, also Trinidad, Colombia, Panama, and Costa Rica (includes *O. verbesinoides* var. *glabior* Steyermark, syn. nov.) . . . . *O. verbesinoides* DC. var. *verbesinoides*
3b. Involucres 5–6.5(–10) mm tall; phyllaries puberulent, outer ones obpyriform; ray limbs ca. 10 × 3 mm; Bolívar . . . . *O. tepuiana* (V. Badillo) Pruski
1b. Leaves ± pinnately veined.
4a. Inner phyllaries rounded at the apices; Lara and Trujillo . . . . *O. obovata* S. F. Blake
4b. Inner phyllaries apically acute.
5a. Leaves tomentose abaxially; Monagas . . . . *O. verbesinoides* var. *hypomalaca* Steyermark
5b. Leaves puberulent abaxially.
6a. Ray limbs 10–13 × 2–4.5 mm; Amazonas and Bolívar (includes *O. blakeana* Steyermark, syn. nov.) . . . . *O. scaberrima* (Bentham) S. F. Blake
6b. Ray limbs 18–20 × 5–5.5 mm; Anzoategui and Sucre . . . . *O. maculata* S. F. Blake

Oyedaea tepuiana (V. Badillo) Pruski, comb. nov. Basionym: *Zexmenia tepuiana* V. Badillo, Ernstia 30: 1. 1985. TYPE: Venezuela. Bolívar: Dtto. Piar, Karún-tepui, 17 km E of Canaima, 6°14′N, 62°43′W, 1050 m, 31 Aug. 1983, *Prance & Huber 28382* (holotype, MY; isotypes, K, MO, MYF not seen, NY, VEN). Figure 1.

Distribution. This species is endemic to Auyán-tepui, Cerro Venado, and Kurún-tepui in Bolívar, Venezuela, from 1050 to 1360 m elevation, but should be looked for in neighboring Brazil and Guyana.

This species has sterile ray florets typical of *Oyedaea* and is misplaced in the sister genus *Zexmenia* La Llave, which has pistillate ray florets.

Oyedaea wurdackii Pruski, sp. nov. TYPE: Venezuela. Amazonas: Dpto. Atures, carretera Pto. Ayacucho hacia Samariapo, km 27, 6 km al sur Tobogán de la Selva, 5°24′N, 67°37′W, 28 Sep. 1993, *A. Gröger 1125* (holotype, VEN; isotype, US). Figures 1, 2A–F, 3.

Flosculis radiatis sterilibus necnon disci achaeniis compressis alatis biaristatis cum genere *Oyedaea* perfecte congrua, sed a congeneribus omnibus corollis (tam disci quam radiatis) albis (nec luteis) diversa.

Shrubs 0.5–3 m tall; *stems* subterete or subhexagonal, strigose, the internodes 1–6 cm long, shorter to very much shorter than the subtending leaves. *Leaves* simple, opposite, petiolate; *petioles* 5–10 mm long, strigose, stout and much broadened at base, those of the same node often connected by a narrow rim; *blades* elliptic-lanceolate, 4.5–13 × 1.2–5.6 cm, chartaceous, triplinerved from well above base, basally cuneate to attenuate, the margins serrulate to serrate, apically narrowly acute to attenuate, the surfaces eglandular, the adaxial surfaces green, scabrous, the abaxial surfaces pale green, strigose, especially so on larger veins, also with scattered moniliform hairs. *Capitulescences* cymose, open, terminal or axillary from the distal nodes, of 9–15 capitula held above the subtending leaves, at anthesis somewhat congested, rounded, ca. 5–9 cm tall and broad, in fruit sometimes more open; *peduncles* 0.5–3.5 cm long, hispid

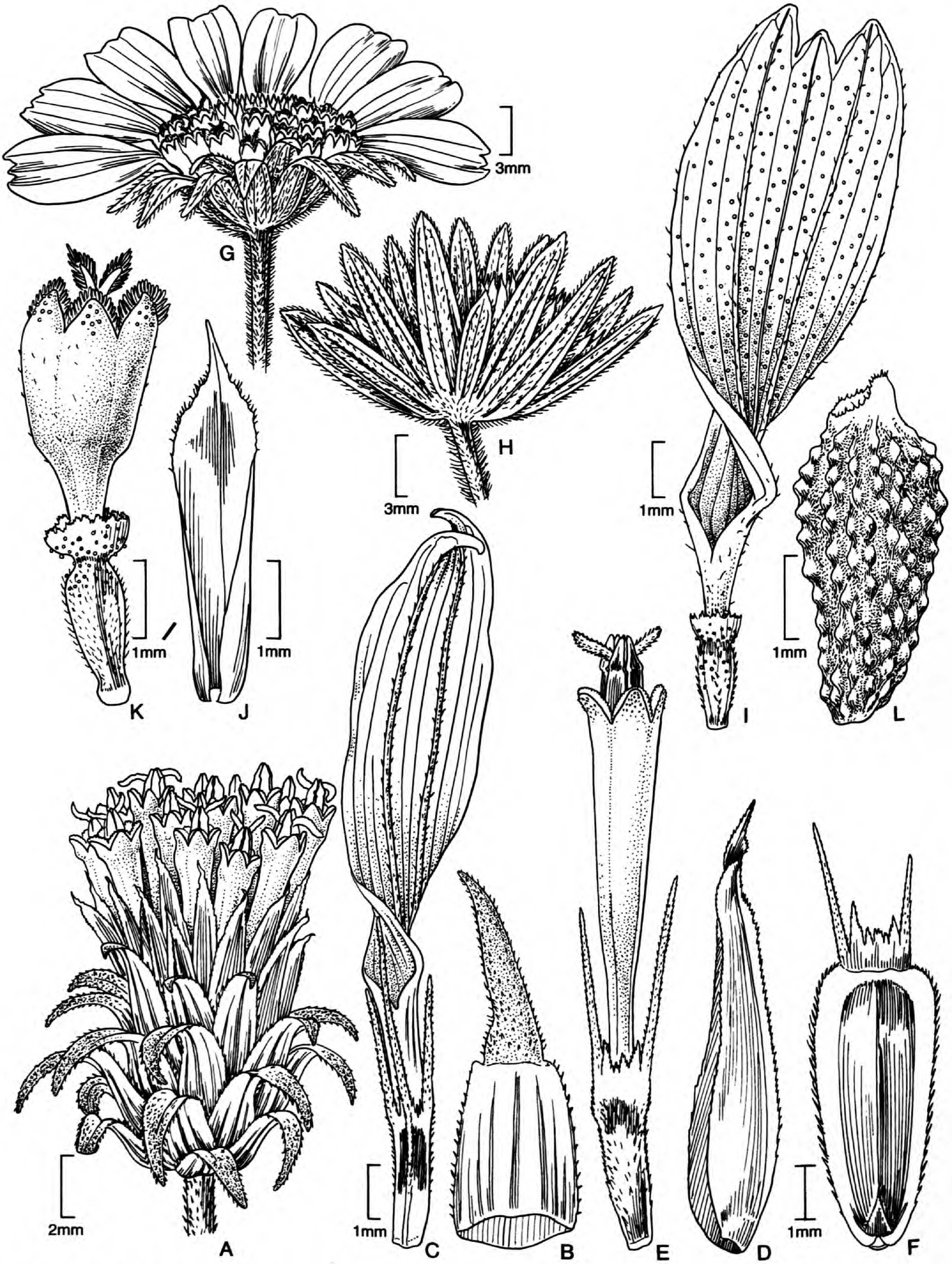

Figure 2. A–F. *Oyedaea wurdackii* Pruski. —A. Capitulum with ray corollas removed. —B. Phyllary. —C. Ray floret. —D. Pale. —E. Disk floret. —F. Disk cypsela. G–L. *Tuberculocarpus ruber* (Aristeguieta) Pruski. —G. Capitulum with front ray corollas removed. —H. Involucre. —I. Ray floret. —J. Pale. —K. Disk floret. —L. Disk cypsela. A–C *from Gröger 625* (US); D–F from *Maguire et al. 30583* (NY); G, I–K from *Gentry & Berry 14567* (NY, US); H from *Davidse & Huber 15381* (US); L from *Huber 3787* (NY).

Figure 3. *Oyedaea wurdackii* Pruski (type collection *Gröger 1125*). Photo taken by Andreas Gröger in Amazonas, Venezuela.

to strigose. *Capitula* radiate, 35–53-flowered; *involucres* narrowly campanulate, 7–10 × 5–10 mm; *phyllaries* ca. 18, in ca. 3 series, imbricate, graduate, lanceolate, 6–10 × 1.5–3 mm, rigid, broad and scarious at base, the apices herbaceous, strigose, narrowly attenuate to cuspidate, commonly reflexed; *receptacles* flat, ca. 5 mm diam., paleate, the pales conduplicate, often keeled near apices, to 10 × 1.4 mm, firm, scarious basally, the apices subherbaceous, sometimes suffused with purple, stiffly attenuate. *Ray florets* ca. 10, sterile, lacking styles; *corollas* white, 10.5–12.3 × 2–2.5 mm, the tubes 1.2–1.8 mm long, glabrous, the limbs 9.3–10.5 × 3–4 mm, shortly 2- or 3-lobed at apices, ca. 7-veined with 2 veins larger than the others, abaxially puberulent. *Disk florets* 25–43, bisexual; *corollas* actinomorphic, white, tubular-funnelform, 7.5–8.3 mm long, the tubes 2–2.2 mm long, glabrous, the throats 5.1–5.3 mm long, glabrous, the lobes 0.7–0.8 mm long, triangular, puberulent-papillose within, sometimes weakly puberulent on outer surfaces; *anthers* slightly to much-exserted, ca. 3 mm long, the thecae black, the apical appendages elongate, black, eglandular, the connectives black when young to cream-colored, the filaments 2.5–3.5 mm long; *style branches* ca. 1 mm long, papillose, laxly recurved, with paired stigmatic lines, the apices narrowed. *Ray ovaries* sterile, 2.5–3.5 mm long, obconic, 3-awned, the awns 1.5–3(–4.5) mm long, subequal to unequal. *Disk cypselas* compressed, winged, 5–6 × 1.5–2.5 mm, the body black, weakly puberulent, the wings ciliate, cream-colored, ca. 0.5 mm broad at maturity; *pappus* stoutly 2-awned, the awns scabridulous, subequal to unequal, 2–3.3 mm long, these exserted from the involucre and often reaching to the top of the pales, the squamellae between the awns ca. 5, to 1 mm long.

Distribution and ecology. This species is known only from Amazonas, Venezuela, at elevations from 100 m to under 1000 m (J. Wurdack, pers. comm.), at the escarpment base and slope of the northwestern part of Cerro Yapacana, in secondary growth on recently burned granitic lajas of Cerro Caldero and Cerro Danto, and in secondary areas at Tobogán de la Selva near Coromoto. It is known to flower in January, September, and December. The species is to be expected from adjacent regions of Bolívar, Venezuela, and Vichada, Colombia.

This new species matches yellow-flowered *Oyedaea* as circumscribed by Blake (1921) except in (white) corolla color. All other oyedaeas have yellow corollas. The triplinerved leaves and open capitulescence of *O. wurdackii* most closely resemble those of *O. tepuiana.*

I am pleased to name this *Oyedaea* after one of its discoverers, my friend and colleague John Julius Wurdack. John is a co-discoverer of Cerro de la Neblina and one of the foremost authorities on the plants of Guayana. In the 1950s as a staff member of The New York Botanical Garden he published or co-published 6 new genera and 36 new species of Compositae from Guayana, thus the dedication of this new composite to him is appropriate and well-deserved.

Paratypes. VENEZUELA. **Amazonas:** Dpto. Atures, Río Sipapo, 5 km de su desembocadura al Río Orinoco, Cerro Caldero, 5°01′N, 67°46′W, 17 May 1992 (late fruit), *A. Gröger & J. Barcroft 413* (US, VEN); Dpto. Atures, carretera Pto. Ayacucho hacia Samariapo, km 19, Cerro Danto al lado oriental de la carretera, 5°30′N, 67°35′W, 11 Dec. 1992, *A. Gröger 625* (US, VEN); NW slopes of Cerro Yapacana, 1 Jan. 1951, *B. Maguire, R. Cowan & J. Wurdack 30583* (NY); Cerro Yapacana, base of NW escarpment, 2 Jan. 1951, *B. Maguire, R. Cowan & J. Wurdack 30638* (NY).

SPHAGNETICOLA

In the course of routine work for neotropical floristic treatments I saw a photograph of a plant seemingly the same species as the widely known *Wedelia trilobata* (L.) Hitchcock. This photograph, however, was labeled as a phototype of *Sphagneticola ulei* O. Hoffmann, a name with which I was unfamiliar. Robinson's (1981) observation that the black anthers and the cypselas with a fimbriate coroniform pappus found in unispecific *Sphagneticola* O. Hoffmann "indicate a probable place in the Ecliptinae" and the placing of *W. trilobata* in a new genus (*Complaya*) by Strother (1991) furthered my interest. I have now seen type material of *S. ulei,* which indeed proves to be conspecific with the widespread plant known in cultivation in the tropics and subtropics of both hemispheres as *W. trilobata* (n.v. Wedelia, Creeping ox-eye, Wild marigold, etc.). *Sphagneticola* is not only squarely positioned within Ecliptinae sensu Robinson (1981), but it is a generic name (earlier than *Complaya* and *Thelechitonia*) for *W. trilobata*; thus the combination *S. trilobata* (L.) Pruski is proposed.

Sphagneticola trilobata differs from most wedelias by being a stoloniferous herb rooting at the nodes with stems elongating sympodially, thereby laterally displacing the terminal capitula; by abaxially glandular ray limbs; by black ovate anther appendages; and by tuberculate cypselas without well-developed carpopodia and without elaiosomes or pappus awns. It and two other species were recently treated at the generic rank (as *Complaya*) by Strother (1991). A fourth species of this group was treated by Cuatrecasas (1954) as *Thelechitonia muricata* Cuatrecasas. Angel Cabrera noted that *Thelechitonia muricata* is conspecific with *W. brachycarpa* Baker (J. Cuatrecasas, pers. comm.), and the name *Thelechitonia* was treated as a synonym of *Wedelia* by Robinson (1981). Robinson and Cuatrecasas (1992), prompted by Strother's publication of *Complaya,* resurrected *Thelechitonia* and treated *Complaya* as a generic synonym of *Thelechitonia.* They expanded *Thelechitonia* to include four species.

The types of *Sphagneticola ulei* and *Wedelia trilobata* are conspecific, and the earlier generic name must be used for this group of four species. I provide an updated generic synonymy and four new combinations in *Sphagneticola.* The generic and specific circumscriptions of Strother (1991) and Robinson and Cuatrecasas (1992) are followed. An earlier epithet (blocked in *Wedelia,* but available here) is used for the paleotropical plant most widely known as *W. chinensis* (Osbeck) Merrill.

Sphagneticola O. Hoffmann, Notizbl. Königl. Bot. Gart. Berlin 3: 36. 1900. TYPE: *Sphagneticola ulei* O. Hoffmann [= *Sphagneticola trilobata* (L.) Pruski].

Wedelia sect. *Stemmodon* Grisebach, Fl. Brit. W. I. 371. 1861. TYPE: not designated, but including only *Wedelia carnosa* Richard, nom. illeg. [≡ *Sphagneticola trilobata* (L.) Pruski] and *Wedelia gracilis* Richard [≡ *Sphagneticola gracilis* (Richard) Pruski].

Thelechitonia Cuatrecasas, Bull. Soc. Bot. France 101: 242. 1954. Syn. nov. TYPE: *Thelechitonia muricata* Cuatrecasas [= *Sphagneticola brachycarpa* (Baker) Pruski].

Complaya Strother, Syst. Bot. Monogr. 33: 10. 1991. TYPE: *Silphium trilobatum* L. [≡ *Sphagneticola trilobata* (L.) Pruski].

Sphagneticola contains four species that are common at lower elevations throughout much of the tropics and subtropics (though not known to occur in Africa), often near waterways or along coasts: *S. trilobata, S. brachycarpa* (Baker) Pruski, *S. calendulacea* (L.) Pruski, and *S. gracilis* (Richard) Pruski. Two species, *S. trilobata* and *S. brachycarpa,* are known in the Guayana Highland of northeastern South America. Two species, *S. calendulacea* and *S. trilobata,* are used medicinally, and *S. trilobata* is also known to cause contact dermatitis (Lovell, 1993; pers. obs.).

Sphagneticola brachycarpa (Baker) Pruski, comb. nov. Basionym: *Wedelia brachycarpa* Baker, in C. Martius, Fl. Bras. 6(3): 181. 1884. *Seruneum brachycarpum* (Baker) Kuntze, Revis. Gen. Pl. 1: 365. 1891, nom. illeg. (*Seruneum* Rumphius ex Kuntze, 1891, includes the type of *Wedelia* Jacquin, 1760.) *Stemmodontia brachycarpa* (Baker) Morong, Ann. New York Acad. Sci. 7: 147. 1893. *Thelechitonia brachycarpa* (Baker) H. Robinson & Cuatrecasas, Phytologia 72: 142. 1992. TYPE: Paraguay. Along the margins of Río Paraguay near Assumption, 28 Apr. 1874, *Balansa 855* (holotype, K not seen [photograph and fragment, US]; isotype, G not seen [photograph, US]).

?*Wedelia paludosa* DC. var. *villosa* Baker, in C. Martius, Fl. Bras. 6(3): 181. 1884. *Wedelia brasiliensis* (Sprengel) S. F. Blake var. *villosa* (Baker) S. F. Blake, J. Wash. Acad. Sci. 21: 332. 1954. TYPE: Guyana. Ad fluv. Essequibo et Rupununi, s.d., *Appun 2508* (holotype, K not seen nor found).

Thelechitonia muricata Cuatrecasas, Bull. Soc. Bot. France 101: 242. 1954. TYPE: Colombia. Meta: Río Casanare, Esmeralda, 130 m, 19 Oct. 1938, *Cuatrecasas 3902* (holotype, F not seen [photograph, US]; isotype, US).

Distribution. Venezuela (Guayana and in the Llanos), Colombia, Guyana, Peru, Brazil, Bolivia, Paraguay, and Argentina.

The leaves of this species are unlobed, and the plants are more erect than the two other New World species. Many specimens of this species have been determined previously as *W. brasiliensis* (Sprengel) S. F. Blake (a synonym of *S. trilobata*). Strother (1991) noted that such specimens "may represent a. . .species of *Complaya.*"

Sphagneticola calendulacea (L.) Pruski, comb. nov. Basionym: *Verbesina calendulacea* L., Sp. Pl. 902. 1753. *Jaegeria calendulacea* (L.) Sprengel, Syst. Veg. 3: 590. 1826. *Wedelia calendulacea* (L.) Lessing, Syn. Compos. 222. 1832, non Persoon 1807. *Seruneum calendulaceum* (L.) Kuntze, Revis. Gen. Pl. 1: 365. 1891, nom. illeg. (*Seruneum* Rumphius ex Kuntze, 1891, includes the type of *Wedelia* Jacquin, 1760.) TYPE: "Zeylona:" s.d., *Hermann* [lectotype, chosen here, *Herb. Hermann, no. 311, vol. 1, fol. 73* (BM not seen [photograph, US]); possible isolectotypes, *Herb. Hermann, no. 311, vol. 2, fol. 16* (BM not seen [photograph, US]), *Herb. Hermann, no. 311, vol. 3, fol. 21* (BM not seen [photograph, US]), *Herb. Hermann, no. 311, vol. 4, fol. 43* (BM not seen [photograph, US]), *Collectio plantarum Zeylanicum. . .p. 65 (bottom center)* (Bibliothèque de l'Institut de France [photograph, US])]. Grierson (1980) listed "TYPE: Herb. Herman [sic] (BM)"; however, I have seen photographs of four Hermann specimens of this species scattered between four of the five volumes of the Hermann collection. Thus, the statement by Grierson is not specific enough for formal lectotypification (C. Jarvis, pers. comm.). The Hermann specimen on p. 65 of the Burman herbarium folio in the Bibliothèque de l'Institut de France was presumably the basis for tab. 22, fig. 1, in Burman, Thes. Zeylan. 52. 1737 [1736], cited in the protologue by Linnaeus (see Lourteig, 1966: 28), but because it is unlikely that Linnaeus saw this sheet it is not chosen as the lectotype. LINN 1021.6 not seen (IDC microfiche 177. 610.III.6) is marked in Linnaeus's hand "calendulacea 9" (Savage, 1945), referring this sheet to the ninth species of *Verbesina* in *Species Plantarum,* 1753. However, LINN 1021.6 is also labeled "chin[a]" (Savage, 1945), which does not agree with the data given by Linnaeus in the protologue. Thus, LINN 1021.6 was not chosen as the lectotype, nor is it listed here as a possible isolectotype.

Solidago chinense Osbeck, Dagb. Ostind. Resa 241. 1757. Syn. nov. *Wedelia chinensis* (Osbeck) Merrill, Philipp. J. Sci. 12: 111. 1917. *Complaya chinensis* (Osbeck) Strother, Syst. Bot. Monogr. 33: 14. 1991. *Thelechitonia chinensis* (Osbeck) H. Robinson & Cuatrecasas, Phytologia 72: 142. 1992. TYPE: China. Kwangtung: Dane's Island, near Whampoa, 20 Oct. 1751, *Osbeck s.n.* (holotype, LINN? not seen or S? not seen).

Distribution. China including Taiwan, India, Indo-China, Japan, Malaysia, the Philippines, and Sri Lanka (Li, 1978).

I examined the photographs of the four Hermann specimens of *Verbesina calendulacea* L. in BM (one of which is here designated as the lectotype), the photograph of the Hermann specimen in the Bibliothèque de l'Institut de France, and the protologue, and agree with Merrill's (1917) observation that *Solidago chinensis* Osbeck and *V. calendulacea* are conspecific. The Linnaean epithet was blocked in *Wedelia* by *W. calendulacea* Persoon, thus Merrill proposed the combination *W. chinensis,* which for much of this century has been the name used for this plant. The epithet "*calendulacea*" was available for this species in both *Complaya* and *Thelechitonia,* but was not used. This species was suggested by Fosberg (1993) as perhaps being better placed in *Wollastonia* DC. than in *Wedelia,* but is not properly placed in either genus.

Nicolson et al. (1988) listed opposite-leaved *Verbesina calendulacea* L. and *Solidago chinensis* Osbeck as synonyms of "*Wedelia chinensis* (L.) Merrill," a combination not made by Merrill. The "*Wedelia chinensis* (L.) Merrill," in the sense of Nicolson et al. (1988) is based on *Verbesina chinensis* L. [≡ *Anisopappus chinensis* (L.) Hooker f. & Arnott], a species with alternate leaves of tribe Inuleae. Nicolson et al. (1988) interpreted opposite-leaved *Solidago chinensis* Osbeck as either a "nom. illeg. or comb. nov.?" based on alternate-leaved *Verbesina chinensis* L., whereas I follow Merrill (1917) and treat *Solidago chinensis* as a different taxon based on a different type described by Osbeck.

Sphagneticola gracilis (Richard) Pruski, comb. nov. Basionym: *Wedelia gracilis* Richard, in Persoon, Syn. Pl. 2: 490. 1807. *Seruneum gracile* (Richard) Kuntze, Revis. Gen. Pl. 1: 365. 1891, nom. illeg. (*Seruneum* Rumphius ex Kuntze, 1891, includes the type of *Wedelia* Jacquin, 1760.) *Complaya gracilis* (Richard) Strother, Syst. Bot. Monogr. 33: 14. 1991. *Thelechitonia gracilis* (Richard) H. Robinson & Cuatrecasas, Phytologia 72: 142. 1992. SYNTYPES: Antigua and Santo Domingo, s.d., presumably Richard collections in P (not seen). The original Richard collection from Antigua was doubtfully referred to the species by Schulz (1911: 99–100), thus defining "the type locality as Santo Domingo" (Howard, 1989). I am unaware, however, whether a lectotype (sheet) designation has been made. Specimens from both localities cited in the protologue match this species as circumscribed here, and lectotype designation is deferred until material in P is seen.

Distribution. Greater Antilles, Antigua, Barbuda, Guadeloupe, Martinique, St. Barthélemy, and St. Martin (Howard, 1989).

This West Indian endemic is closely related to *S. trilobata* but differs by smaller leaves, capitula, and cypselas.

Sphagneticola trilobata (L.) Pruski, comb. nov. Basionym: *Silphium trilobatum* L., Syst. Nat., ed. 10: 1233. 1759. *Wedelia carnosa* Richard, in Persoon, Syn. Pl. 2: 490. 1807, nom. illeg. *Seruneum trilobatum* (L.) Kuntze, Revis. Gen. Pl. 1: 365. 1891, nom. illeg. (*Seruneum* Rumphius ex Kuntze, 1891, includes the type of *Wedelia* Jacquin, 1760.) *Wedelia trilobata* (L.) A. Hitchcock, Annual Rep. Missouri Bot. Gard. 4: 99. 1893. *Stemmodontia trilobata* (L.) Small, Fl. S.E. U.S. 1262, 1340. 1903. *Complaya trilobata* (L.) Strother, Syst. Bot. Monogr. 33: 14. 1991. *Thelechitonia trilobata* (L.) H. Robinson & Cuatrecasas, Phytologia 72: 142. 1992. TYPE: Tab. 107, fig. 2, in Plumier, Pl. Amer. 1757 (lectotype, designated by Howard, 1989).

Buphthalmum strigosum Sprengel, Neue Entd. 2: 140. 1821. *Acmella brasiliensis* Sprengel, Syst. Veg. 3: 592. 1826, nom. superfl. *Wedelia brasiliensis* (Sprengel) S. F. Blake, Contr. U.S. Natl. Herb. 26: 250. 1930, comb. illeg. TYPE: Brazil. s.d., *Sello s.n.* (holotype, P not seen)

Wedelia paludosa DC., Prodr. 5: 538. 1836. TYPE: Brazil. s.d., *Lund 611* (holotype, G-DC not seen [photograph, US; IDC microfiche 800. 935.I.3]).

Sphagneticola ulei O. Hoffmann, Notizbl. Königl. Bot. Gart. Berlin 3: 36. 1900. Syn. nov. TYPE: Brazil. Rio de Janeiro: in Sümpfen der Restinga der Gavea, Sep. 1899, *Ule 3914pp* (holotype, B destroyed, photographs in NY, US; lectotype, designated here from isotype, HBG). [Another sheet is also labeled *Ule 3914* (HBG), but was collected in Apr. 1895 at Jacarépaguá and is not type material.]

Distribution. Wedelia is widespread in Guayana (where it occurs from 119 to 900 m elevation) and in the rest of the Neotropics from Mexico and the West Indies south to Argentina; widely cultivated out-of-doors as an ornamental and naturalized in eastern Australia, Malaysia, Pacific islands, and warmer regions of the New World. It is grown in at least four U.S. states: California (in Berkeley fide J. Strother, pers. comm.), Florida (well known in south Florida; recently reported in Tallahassee (Anderson, 1995), near its northernmost limit), Hawaii, and Louisiana. The species has been noted in Louisiana by Odenwald and Turner (1978), but was not vouchered by them. It was not mentioned as cultivated in New Orleans by Seidenberg (1993), although it is used as an ornamental there (Melinda Taylor, pers. comm.; pers. obs.). *Sphagneticola trilobata* is here newly documented for Louisiana by the following out-of-doors collections from Baton Rouge, Lafayette, and New Orleans: *Harris 774* (LSU), *Pruski et al. 3711* (NO, NY), *Pruski 3724* (US), *Pruski 3742* (K, LSU, MO, NO, US), *Thomas 22247* (NLU), *Thomas & Allen 74948* (NLU), *Urbatsch 5155* (LSU).

This species has variable leaf morphology. Thick-leaved forms, often cultivated, were previously referred to *W. carnosa,* whereas longer, more narrow-leaved forms were determined as either *W. brasiliensis* or *W. paludosa.* A complete list of synonyms is given in Schulz (1911).

TILESIA

During preparation of floristic treatments of neotropical Compositae, *Wulffia* Necker ex Cassini (not *Wolffia* Horkel ex Schleiden, 1844, Lemnaceae) was noted as a taxonomic synonym of *Tilesia.* Accordingly, *Wulffia* is reduced to the synonymy of *Tilesia,* and the three species and one variety of *Wulffia* are transferred to *Tilesia.*

Tilesia capitata G. Meyer was described as a new genus and species in *Primitiae Florae Essequeboensis* (Meyer, 1818). *Tilesia capitata* is the same as the species subsequently called either *Wulffia baccata* (L.) Kuntze or *W. stenoglossa* (Cassini) DC. Although the epithet "*baccata*" has priority, the name most widely used in Brazil and Venezuela is *W. stenoglossa* (Cassini) DC. due largely to use by Baker (1884) and Aristeguieta (1964).

Five years after Meyer's flora, Cassini (1823) treated *Coreopsis baccata* (the basionym of *Wulffia baccata*) as equal to the mononomial *Wulffia* of Necker (Elem. Bot. 1: 35. 1790). Also, Cassini noted that the unpublished genus and species *Chylodia sarmentosa* Richard was possibly near or the same as *Wulffia,* and to avoid confusion with *Chilodia* R. Brown (1810), he suggested *Chatiakella* as a replacement generic name for Richard's *Chylodia.* Cassini was uncertain about the ultimate disposition of these names and treated them as potential synonyms. He said if these three genera were indeed synonymous they should be united under the oldest available name, which he took to be *Wulffia* Necker. Indeed, in Cassini's time names of Necker were accepted. Unfortunately, Necker's names are mononomials and now new names in his *Elementa Botanica* (1790) are "not to be treated" as genera (Art. 20.4 (b) Ex. 11, Greuter et al., 1988), and this work is listed in Appendix V (Opera Utique Oppressa) in Greuter et al. (1994).

Tilesia (1818) and *Wulffia* Necker ex Cassini (1823) were equated by Schultz-Bipontinus (1848) and Bentham (1873: 367) under *Wulffia,* the later genus. I do not wish to continue this misusage. Thus, I herein propose transfers of three species and one variety from *Wulffia* to the earlier *Tilesia.*

Lastly, literature search reveals a misattribution of the authorship of *Coreopsis baccata* by Jackson (1893–1895) in *Index Kewensis* to Linnaeus filius, where it appears in *Supplementum Plantarum* (Linnaeus filius, 1782). Additionally, Jackson noted that *Coreopsis baccata* also appears in Linnaeus's Amoen. Acad. as species no. 111 (Dalberg collection no. 15) on p. 262, 1785. However, it is noted here that *Coreopsis baccata* was earlier published by Linnaeus (though not indexed as such by Jackson, 1893–1895) in *Plantae Surinamenses* (Linnaeus 1775: 14) as an unnumbered taxon (Dalberg collection no. 15) and this name is cited below in the transfer of that taxon to *Tilesia.*

Tilesia G. Meyer, Prim. Fl. Esseq. 251. 1818. TYPE: *Tilesia capitata* G. Meyer [= *Tilesia baccata* (L.) Pruski var. *baccata*].

Wulffia Necker, Elem. Bot. 1: 35. 1790, nom. illeg.; ex Cassini, in F. Cuvier, Dict. Sci. Nat. ed. 2, 29: 491. 1823. Syn. nov. TYPE: *Coreopsis baccata* L. [≡ *Tilesia baccata* (L.) Pruski var. *baccata*].

Chatiakella Cassini, in F. Cuvier, Dict. Sci. Nat. ed. 2, 29: 491. 1823. TYPE: *Chylodia sarmentosa* Richard ex Cassini [= *Tilesia baccata* (L.) Pruski var. *baccata*].

Chylodia Richard ex Cassini, in F. Cuvier, Dict. Sci. Nat. ed. 2, 29: 491. 1823, non *Chilodia* R. Brown, 1810. TYPE: *Chylodia sarmentosa* Richard ex Cassini [= *Tilesia baccata* (L.) Pruski var. *baccata*].

Tilesia is restricted to the Neotropics and contains a somewhat wide-ranging species with two varieties and two uncommon species. Two species (*T. baccata* var. *baccata* and *T. rubens*) occur in Guayana; one of them (*T. rubens*) is a Guayana Highland endemic. Full synonymies are given for three of the four taxa, but for *Tilesia baccata* var. *baccata* only pertinent and regional synonymy is given. *Tilesia* is partly characterized by eglandular leaves, rays sterile (when present), strongly striate pales, and baccate fruits lacking pappus. *Wedelia ambigens* S. F. Blake resembles *Tilesia* by strongly striate pales and epappose cypselas. *Wedelia ambigens,* however, has leaves glandular abaxially and fertile ray florets, and therefore is retained in *Wedelia.*

Tilesia baccata (L.) Pruski, comb. nov. Basionym: *Coreopsis baccata* L., Pl. Surinam. 14. 1775; L. f., Suppl. 380. 1782; L., Amoen. Acad. 262. 1785. *Pascalia baccata* (L.) Sprengel, Syst. Veg. 3: 602. 1827. *Wulffia baccata* (L.) Kuntze, Revis. Gen. Pl. 1: 373. 1891. TYPE: Surinam. S.d., *Dalberg 15* (holotype, LINN 1026.7 not seen [IDC microfiche 177. 614.I.6]).

Tilesia capitata G. Meyer, Prim. Fl. Esseq. 254. 1818. *Meyera capitata* (G. Meyer) Sprengel, Syst. Veg. 3: 601. 1826. *Wulffia capitata* (G. Meyer) Schultz-Bipontinus, Linnaea 21: 246. 1848, as "*Wulfia.*" TYPE: Guyana. Essequibo, s.d., *Meyer 177* (holotype, GOET).

Helianthus? sarmentosus Richard, Actes Soc. Hist. Nat. Paris 1: 112 (as "105"). 1792. TYPE: French Guiana. Cayenne, s.d., *Leblond s.n.* (holotype, G not seen; possible isotype, G-DC not seen [IDC microfiche 800. 942.I.7]).

Verbesina oppositiflora Poiret, in Lamarck, Encycl. 8: 460. 1808. TYPE: French Guiana. Ile de Cayenne, s.d., *Martin s.n.* (holotype, herb. Desfontaines [FI?] not seen; isotype, G-DC not seen (IDC microfiche 800. 942.I.6). The type status of a second specimen in G-DC not seen (IDC microfiche 800. 942.I.4) determined as *Verbesina oppositiflora* is uncertain. The type status of a specimen from the Martin herb. in G-DC not seen (IDC microfiche 800. 942.I.8) determined as "*Chiatakella*" *platyglossa* is also uncertain.

Helianthus membranifolius Poiret, in Lamarck, Encycl., Suppl. 3: 18. 1813 [as "*Verbesina membranifolia*" Poiret, in DC., Prodr. 5: 563, 619. 1836, orth. var.]. *Wulffia membranifolius* [(Poiret) DC.], Prodr. 5: 619. 1836, comb. illeg. provis. TYPE: French Guiana. Ile de Cayenne, s.d., *sin coll.* (holotype, herb. Desfontaines [FI?] not seen; isotype, P not seen [photograph, US]).

Gymnoloma maculata Ker Gawler, in Edwards, Bot. Reg. 8: t. 662. 1822. *Wulffia maculata* (Kew Gawler) DC., Prodr. 5: 563. 1836. TYPE: Cultivated at Chelsea, England, from material collected in Brazil (holotype, K not seen).

Chylodia sarmentosa Richard ex Cassini, in F. Cuvier, Dict. Sci. Nat. ed. 2, 29: 490. 1823. SYNTYPES: sin loc., nos. 232 and 604 in herb. Surian (P not seen).

Chatiakella platyglossa Cassini, in F. Cuvier, Dict. Sci. Nat., ed. 2, 46: 402. 1827. *Wulffia platyglossa* (Cassini) DC., Prodr. 5: 563. 1836. TYPE: French Guiana. S.d., *Poiteau s.n.* (holotype, K [herb. Gay] not seen [photograph, US]). The type status of a specimen from the Martin herb. in G-DC not seen (IDC microfiche 800. 942.I.8) determined as "*Chiatakella*" *platyglossa* is uncertain.

Chatiakella stenoglossa Cassini, in F. Cuvier, Dict. Sci. Nat., ed. 2, 46: 403. 1827. *Wulffia stenoglossa* (Cassini) DC., Prodr. 5: 563. 1836. TYPE: sin loc., *herb. Surian s.n.* (holotype, P not seen).

Aspilia bolivarana V. Badillo, Ernstia 23: 14. 1984. Syn. nov. TYPE: Venezuela. Amazonas: en bosque al lado de la pista de Santa Bárbara del Orinoco, 25 May 1975, *Berry 698* (holotype, VEN; isotype, MYF [photograph, NY, US]).

Distribution. Central America, the West Indies, and tropical South America.

This is the sole yellow-flowered, radiate species of *Tilesia.* It occurs near or along waterways or forest margins and is often collected, although its occurrence is only sporadic.

Tilesia baccata var. **discoidea** (S. F. Blake) Pruski, comb. nov. Basionym: *Wulffia baccata* var. *discoidea* S. F. Blake, J. Wash. Acad. Sci. 28: 491. 1938. TYPE: Ecuador. Napo: near Tena, 400 m, 5 Apr. 1935, *Mexia 7170* (holotype, US).

Wulffia scandens DC., Prodr., 5: 564. 1836. Syn. nov. TYPE: Peru. 1832, *Poeppig pl. exs n. 24. diar. 1663.* (holotype, G-DC not seen [photograph, US; IDC microfiche 800. 942.II.8]).

Distribution. Ecuador, northern Peru, western Brazil, and possibly Colombia.

This variety is recognized by yellow-flowered, discoid capitula. The distinctiveness of this variety was pointed out to me by Harold Robinson, who recognizes it in his forthcoming Heliantheae treatment in the *Flora of Ecuador* series.

Tilesia macrocephala (H. Robinson) Pruski, comb. nov. Basionym: *Wulffia macrocephala* H. Robinson, Phytologia 56: 259. 1984. TYPE: Ecuador. Pastaza: Lorocachi, Pica a Lagatococha a 1 hora siguiendo margen derecha del Río Curaray, sector sur del campamento militar, 1°39'S, 75°59'W, 200 m, 1 June 1980, *Jaramillo, Coello & Freire 31746* (holotype, US).

Wulffia trujilloi V. Badillo, Ernstia, ser. 2, 3: 127. 1994. Syn. nov. TYPE: Venezuela. Yaracuy: Pitiguao, camino Cocorote-Aroa, 1600 m, 26 Feb. [on isotype] or Oct. [in protologue] 1950, *Trujillo & Fernández 918* (holotype, MY not seen; isotype, MY).

Distribution. Colombia, Ecuador, and Andean Venezuela.

This radiate species is characterized by large capitula, foliar outer phyllaries, and reddish corollas. Venezuelan *Wulffia trujilloi* does not differ significantly in reproductive or vegetative features from *T. macrocephala* and is here reduced to synonymy.

Tilesia rubens (Alexander) Pruski, comb. nov. Basionym: *Wulffia rubens* Alexander, Lloydia 2: 217. 1939. TYPE: Guyana. NW slopes of Kanuku Mountains, in drainage of Moku-moku Creek (Takutu tributary), 200–300 m, 5 Apr. 1938, *Smith 3456* (holotype, NY; isotype, US). Figure 1.

Distribution. This species is endemic to the Kanuku Mountains and the Northern Rupununi Savanna in the Guayana Highland of Guyana, where it occurs from 107 to 300 m elevation.

This radiate species also has reddish flowers, but is recognized by small capitula, non-foliar outer phyllaries, and narrow leaves.

TUBERCULOCARPUS

At the generic level a significant recent modification was the reduction of the traditionally recognized *Aspilia* into the synonymy of *Wedelia* by Robinson (1992). The subsequent transfer of most neotropical species of *Aspilia* (including Venezuelan *A. rubra* Aristeguieta) to *Wedelia* by Turner (1992), who did not see material (type and/or nontype) for all species transferred (B. Turner, pers. comm.), did not solve the problem. For example, *W. rubra* (Aristeguieta) B. L. Turner is not a *Wedelia*.

Aspilia rubra differs from the neotropical species traditionally referred to *Aspilia* by bright orangish red ray corollas with abaxially glandular limbs and by tuberculate disk cypselas, and from species traditionally referred to *Wedelia* by sterile ray florets in addition to the tuberculate disk cypselas. Because of bright orangish red ray corollas and tuberculate disk fruits *A. rubra* is anomalous and cannot be satisfactorily placed in any existing genus. It is designated here as the type of a new, unispecific genus, *Tuberculocarpus.*

Genera of the Ecliptinae from Guayana with species that may have tuberculate fruits include *Acmella* Richard, *Baltimora* L., *Eclipta* L., *Eleutheranthera* Poiteau ex Bosc, *Sphagneticola, Synedrella* Gaertner, *Verbesina* L., and now *Tuberculocarpus.* Of these, only *Tuberculocarpus* consistently has sterile ray florets. *Verbesina* rarely has sterile rays and the second, less common species of *Eleutheranthera* has sterile rays. The other Guayanan genera with tuberculate fruits all have pistillate ray florets (when present), and are thus readily distinguished from *Tuberculocarpus.* Furthermore, *Acmella, Synedrella,* and *Verbesina* have flattened cypselas, thereby differing from the other five genera. Among the remaining five genera *Baltimora* is unique in having an open diffuse capitulescence and capitula with the disk florets functionally staminate; *Eclipta* differs by filiform pales and quickly deciduous corollas; *Eleutheranthera* by loosely fused anthers and in the common species by lacking ray florets; *Sphagneticola* by creeping habit with stems rooting at the nodes; and *Tuberculocarpus* by bright orangish red ray corollas.

Tuberculocarpus Pruski, gen. nov. TYPE: *Aspilia rubra* Aristeguieta [≡ *Tuberculocarpus ruber* (Aristeguieta) Pruski].

Herbacea perennis vel fruticosa pauciramosa pubescens; *folia* simplicia opposita brevipetiolata, lamina lanceolata 5–16.5 × 0.4–3(–5.5) cm supra strigosa subtus strigosa et glandulosa; *capitulescentia* terminalis saepius monocephala, pedunculis erectis 8 cm usque longis; *capitula* radiata paleacea, flosculis 50–86; *flosculi radiati* 10–16 steriles, corolla aurantiaco-rubra, glandulosa et puberula; *flosculi disci* 40–70, lobis puberulis et pauciglandulosis; *styli rami* apice papillosi; *antherae* nigrae, appendicibus apicalibus glandulosis; *achaenia* valde tuberculata, corona apicali breviori ca. 0.5 mm alta, aristis nullis.

Perennial herbs to subshrubs 0.3–2 m tall; *stems* erect or leaning, few-branched, subterete, pubescent on young growth, glabrescent below. *Leaves* simple, opposite, short-petiolate; *petioles* 2–4 mm long, strigose; *blades* lanceolate, 5–16.5 × 0.4–3(–5.5) cm, chartaceous, pinnately veined, basally cuneate, sometimes narrowly so, the margins entire or occasionally weakly and remotely denticulate, apically narrowly acuminate, the adaxial surfaces strigose, trichomes leaning toward apices of blades, the abaxial surfaces with trichomes as above, also glandular. *Capitulescences* terminal, monocephalous or occasionally with another capitulum (rarely with 2 additional capitula) from most distal node; *peduncles* erect, non-leafy, pubescent, 2–8 cm long. *Capitula* radiate, 50–86-flowered; *involucres* campanulate to hemispherical, (7–)10–15 mm tall and broad; *phyllaries* ca. 15, in 2 series, subequal or nearly so, herbaceous, weakly imbricate, lanceolate, narrowly acute or acuminate, (7–)10–15 × 2–3.5 mm, pubescent, also sometimes weakly glandular, weakly 3-striate or the veins obscure; *receptacles* flat or convex, paleate, the pales elliptic-lanceolate, ca. 5 mm long, stiff, conduplicate, glabrous and tan proximally, strigose and reddish distally, the apices often abruptly mucronate, the mucro often callous-tipped. *Ray florets* 10–16, sterile, lacking styles; *corollas* orangish red, the tubes 1–1.5 mm long, weakly puberulent, the limbs exserted from the involucre, 11–13 × 3–4 mm, ca. 10-veined, the abaxial surfaces glandular and often also puberulent on the veins, the apices 3-lobed. *Disk florets* 40–70, bisexual; *corollas* yellowish orange, 3–4 mm long, the tubes 0.6–0.7 mm long, the throats narrowly campanulate, ca. 2 mm long, the lobes 0.4–0.6 mm long, deltoid, strongly pilose within or marginally, weakly glandular and with a few hairs on the outer surfaces; *anthers* weakly exserted, ca. 1.8 mm long, the thecae black, the apical appendages ovate, ca. 0.2 mm long, black or occasionally tan near connectives, glandular; *styles*

Figure 4. *Tuberculocarpus ruber* (Aristeguieta) Pruski (*Steyermark et al. 131525*). Photo taken by Bruno Manara at Tobogán de la Selva near Puerto Ayacucho, Amazonas, Venezuela.

yellow, weakly exserted, the branches ca. 1 mm long, spreading to reflexed but not coiled, with paired stigmatic lines, apically acute, papillose, especially so at the apices. *Cypselas* obovoid, somewhat compressed and with small wings, shoulders, and an apical neck, the body 4–4.5 mm long, each face sometimes with paired longitudinal ridges, black, tuberculate at maturity, weakly puberulent at apices, the carpopodia small, non-sculptured, elaiosomes absent; *pappus* coroniform, ca. 0.5 mm tall, on top of the neck of the cypsela, aristae absent.

Tuberculocarpus ruber (Aristeguieta) Pruski, comb. nov. Basionym: *Aspilia rubra* Aristeguieta, Mem. New York Bot. Gard. 9: 369. 1957. *Wedelia rubra* (Aristeguieta) B. L. Turner, Phytologia 72: 394. 1992. TYPE: Venezuela. Amazonas: occasional on savanna edge between Puerto Ayacucho and Samariapo, 100–120 m, 11 Nov. 1953, *Maguire, Wurdack & Bunting 36147* (holotype, NY; isotype, US). Figures 1, 2G–L, 4.

Distribution and ecology. This taxon is endemic to Amazonas, Venezuela (near Coromoto, Puerto Ayacucho, Rincones de Chacorro, and Ríos Cataniapo and Coromoto), where it occurs in savannas, around *Mauritia* palm swamps, riverine forests, fields, roadsides, and grassy areas on granitic lajas. *Tuberculocarpus ruber* is known from 37 to 150 m elevation; and it flowers in April–July, September, and November–January. The species is to be expected from adjacent regions of Bolívar, Venezuela, and Vichada, Colombia.

VERBESINA

Five of the approximately 300 species of the New World genus *Verbesina* are known in Guayana, one non-endemic with pinnatifid leaves (*V. columbiana* B. L. Robinson) and four endemic species with entire leaves. Endemic *V. ligulata* was described as a subspecies of *V. schomburgkii* Baker, but is raised here to species level.

Robinson and Greenman (1899) and Blake (1925) recognized both *Verbesina guianensis* and *V. schomburgkii*. These authors did not see the two syntypes of *V. guianensis*, and this species was not lectotypified by them. Steyermark (Steyermark et al, 1953: 676–677) recognized only one of the two species. He used the name *Verbesina schomburgkii*

Schultz-Bipontinus ex Klatt (31 May 1884), and placed *V. guianensis* Baker (1 May 1884) into synonymy. Steyermark used the Schultz-Bipontinus name because it first appeared in the literature in 1849 (in Rich. Schomburgk, Reis. Br. Guiana 3: 1078. 1848 [1849]), albeit then solely as a nomen. This disposition was followed by Aristeguieta (1964). However, the name having priority is *Verbesina guianensis,* and *V. schomburgkii* is here placed in synonymy.

Verbesina guianensis Baker, in C. Martius, Fl. Bras. 6(3): 211. 1 May 1884. TYPE: Guyana. Pacaraima Mountains, s.d., *Rob. Schomburgk, ser. I, add. 194.S* (lectotype, designated here, K [photograph, GH; photograph and fragment, US]).

Verbesina schomburgkii Schultz-Bipontinus, in Rich. Schomburgk, Reis. Br. Guiana 3: 1078. 1848 [1849], nom. nud.; ex Klatt, Leopoldina 20: 94. 31 May 1884. Syn. nov. TYPE: Venezuela. Bolívar: Mount Roraima, Nov. 1842, *Rich. Schomburgk 993* (holotype, B destroyed [photograph, GH, NY, US; fragments and tracing, GH]).

Distribution. This species is known only from Bolívar, Venezuela, and Guyana, but is to be expected in adjacent Brazil.

This discoid species is characterized by oblong leaves and weakly flaring disk corolla tubes.

Verbesina ligulata (Maguire & Wurdack) Pruski, comb. nov. Basionym: *Verbesina schomburgkii* Schultz-Bipontinus subsp. *ligulata* Maguire & Wurdack, Mem. New York Bot. Gard. 9: 369. 1957. TYPE: Venezuela. Amazonas: Cerro Yutaje, Caño Yutaje, 1500 m, 17–19 Feb. 1953, *Maguire & Maguire 35283* (holotype, NY; isotypes, GH, US). Figure 1.

Distribution. This species is endemic to the Venezuelan Guayana, where it occurs in Bolívar (Gran Sabana, Ilú-tepui, Macizo del Chimantá) and Amazonas (Cerro Yutajé, Río Coro west of Cerro Yutajé), from (800–)1200 to 2150 m elevation.

This species is most closely related to discoid *V. guianensis,* and to radiate *V. angusta* Maguire, Steyermark & Wurdack (Bolívar, Venezuela), *V. pilosa* Maguire & Wurdack (Bolívar, Venezuela), and *V. tatei* S. F. Blake (Sucre, Venezuela). It is recognized by radiate capitula with distinctly graduated, 3-seriate involucres, by pilose, generally elliptic leaves, and by stout, strongly flaring disk corolla tubes. Collections with radiate capitula from the Chimantá Massif, Bolívar, Venezuela, have nearly glabrous, oblong leaves and thin, weakly flaring disk corolla tubes. These collections seem intermediate between *V. guianensis* and *V. ligulata,* and are not satisfactorily placed.

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Carex roraimensis (Cyperaceae) Revisited

A. A. Reznicek

University of Michigan Herbarium, North University Building, Ann Arbor, Michigan 48109, U.S.A.

ABSTRACT. Study of plants referred to *Carex roraimensis* disclosed that three geographically isolated species were represented. *Carex roraimensis* itself, confined to Mt. Roraima and the Chimantá Massif, with retuse, obtuse, or acute pistillate scales shorter than the perigynia, short-beaked perigynia, and prolonged sheath apices, and two new species described here: *Carex marahuacana,* from Cerro Marahuaca, with longer-beaked perigynia, acuminate pistillate scales shorter than the perigynia, and sheath apices not prolonged beyond the base of the leaf blade; and *C. neblinensis,* from Cerro de la Neblina with long-beaked perigynia, acuminate pistillate scales as long as the perigynia, and prolonged sheath apices.

Review of *Carex* materials from the Venezuelan Guayana disclosed several undescribed species, and two of these are related to *Carex roraimensis* Steyermark. They are described below to make their names available for the treatment of the genus for the *Flora of the Venezuelan Guayana.*

Until now, all collections of *Carex* sect. *Ovales* from the tepuis in the Venezuelan Guayana were thought to be *Carex roraimensis* Steyermark. This species is a member of the *Carex bonplandii* Kunth complex, characterized by narrow perigynia with only narrow, blunt wings, but differs in its pale, hyaline to stramineous or greenish (when fresh) pistillate and staminate scales (resembling those of *Carex longii* Mackenzie), consistent presence of elongate inflorescence bracts subtending the lowermost spikes, and strong tendency to have the culms smooth or nearly so on the angles.

Carex roraimensis was described from Mt. Roraima and has been collected there a number of times, as well as nearby on the Chimantá Massif. Similar-looking plants referred to *C. roraimensis* have also recently been collected on Cerro de la Neblina and on Cerro Marahuaca. Specimens from these three areas do indeed look quite alike and seem to be close relatives. However, the Roraima-Chimantá, Cerro de la Neblina, and Cerro Marahuaca each have consistent, distinctive morphological features, and it seems clear that the three have to be treated as distinct species in spite of their quite similar appearance.

For the sake of completeness and because much new material has accumulated since the description by Steyermark, a comprehensive description and exsiccatae list for *Carex roraimensis* are provided to accompany those of the other two species, *C. marahuacana* and *C. neblinensis.*

Major differences between these three species are summarized in the key below.

1. Pistillate scales retuse, obtuse, or acute; perigynium beaks 1–1.4(–1.6) mm long . . . . *C. roraimensis*
1. Pistillate scales acuminate to acuminate-awned; perigynium beaks (1.4–)1.5–2.2 mm long 2
    2. Pistillate scales 3.7–4.8 mm long; perigynia 3.8–4.8 mm long, tapering to a narrowly triangular beak; upper sheaths prolonged ca. 0.6–1.8 mm beyond base of blade . . . . *C. neblinensis*
    2. Pistillate scales 2.7–3.6 mm long; perigynia 3.3–4.1 mm long, abruptly tapering to a ± parallel-sided beak; upper leaf sheaths not prolonged beyond base of blade . . *C. marahuacana*

Carex marahuacana Reznicek sp. nov. TYPE: Venezuela. Amazonas: Dept. Atabapo, Cerro Marahuaca, summit on undulating plateau with islands of shrubs and Marahuacaea with stream branch leading to Salto de Monos and SE edge to Caño Iguapo, S and SE of summit Camp, 3°37′N, 65°23′W, 2520–2650 m, 26–27 Feb. 1985, *Steyermark & Holst 130755* (holotype, MO). Figure 1G–I.

Plantae laxe cespitosae; culmi fertiles 15–55 cm alti; vaginae basales pallidae brunneae. Folia 4–6; laminae 4–45 cm longae, 1.5–3.3 mm latae; vaginae ca. 4–12 cm longae, ventraliter hyalinae, non prolongatae. Inflorescentiae 1–3 cm longae, erectae; spicae 5–7, gynaecandrae, ovoideae, 4.5–8.5 mm longae, 2.5–5.5 mm latae, basi staminata 0.5–1.5 mm longa. Squamae pistillatae 2.7–3.6 mm longae, triangulari-ovatae, acuminatae, hyalinae, pallide stramineae. Perigynia 3.3–4.1 mm longa, 1.2–1.4(–1.7) mm lata, ascendentia, corpibus obovatis, in rostrum serrulatum (1.4–)1.6–2 mm longum abrupte contracta. Achenium 1.6–1.9 mm longum, 1–1.4 mm latum, ovatum. Stigmata 2.

Loosely caespitose in small clumps; fertile culms ca. 15–55 cm tall, erect, ± obtusely trigonous, smooth except for scattered prickles on the angles; bladeless basal sheaths pale brown. Leaves 4–6, on

NOVON 6: 419–422. 1996.

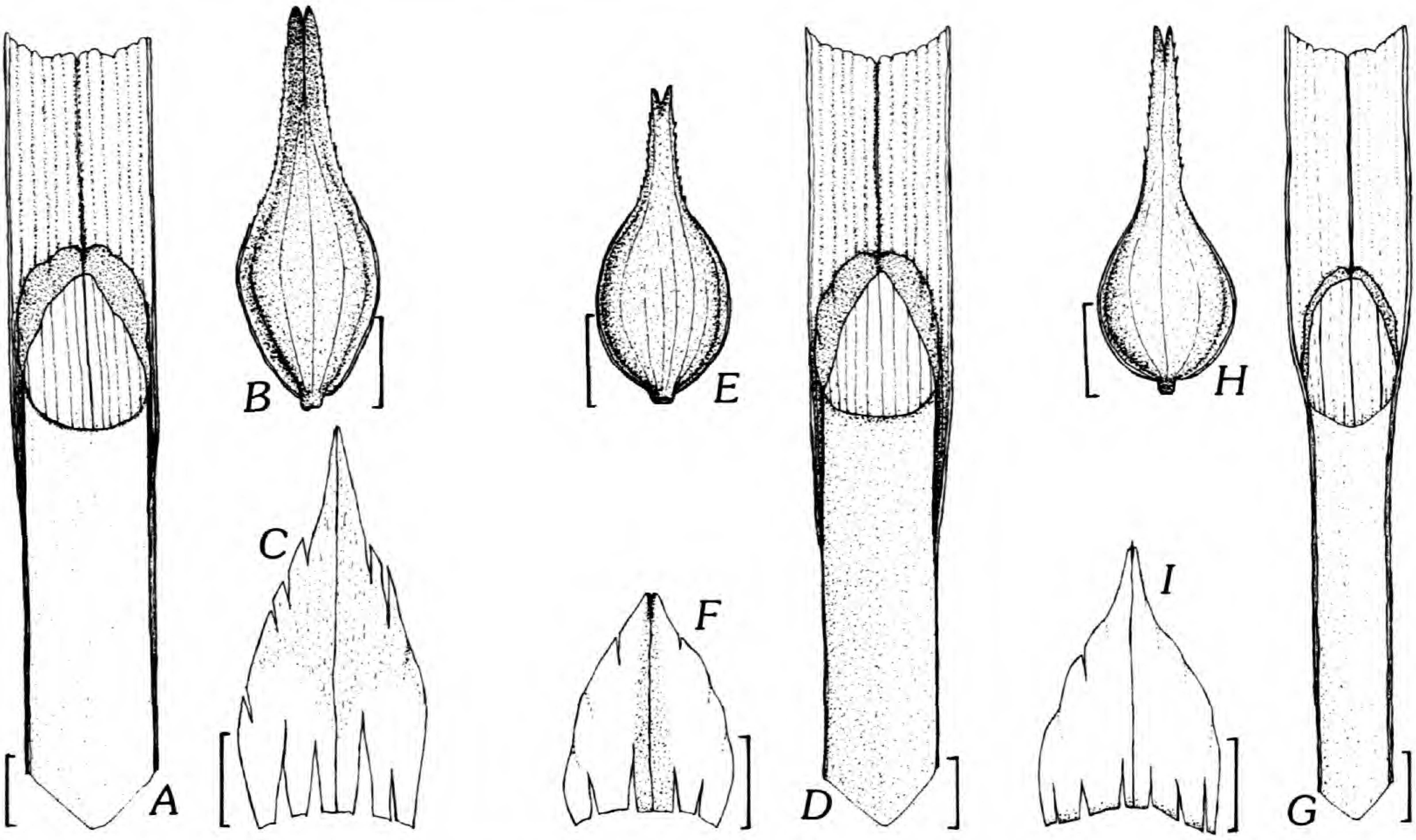

Figure 1. A–C, *Carex neblinensis* Reznicek. —A. Sheath apex. —B. Perigynium. —C. Pistillate scale. (From *Steyermark 103755.*) D–F, *Carex roraimensis* Steyermark. —D. Sheath apex. —E. Perigynium. —F. Pistillate scale. (From *Steyermark et al. 128379.*) G–I, *Carex marahuacana* Reznicek. —G. Sheath apex. —H. Perigynium. —I. Pistillate scale. (From *Steyermark et al. 126035.*) Scale bars = 1 mm.

lower ⅓–⅕ of the culm; blades 4–45 cm long, 1.5–3.3 mm wide, plicate to involute, papillose above, smooth below, the margins antrorsely scabrous; leaf sheaths ca. 4–12 cm long, tightly enveloping culms, glabrous, green to pale brown or grayish brown; the inner band of sheaths glabrous, pale brown, hyaline, not prolonged above leaf base, the apex concave; ligules 0.5–1.7 mm long, rounded, the free portion entire, ± thickened and brown, up to 0.3 mm long. Inflorescences 1–3 cm long, 5–8 mm wide, stiffly erect, spikes approximate, the lowest two spikes 1.2–5.5 mm distant, spikes single at nodes, sessile, lowermost bracts ± setaceous, usually longer than the inflorescence, (1.6–)2.2–15 cm long and up to ca. 1.1 mm wide, conspicuous, sheathless, the upper bracts much reduced; spikes 5–7, gynaecandrous, ovoid, 4.5–8.5 mm long, pistillate portion ca. 3.8–7 mm long, ca. 2.5–5.5 mm wide, ca. 5–18-flowered, staminate portion 0.5–1.5 mm long, 1–3-flowered. Pistillate scales 2.7–3.6 mm long, 1.6–2.1 mm wide, triangular-ovate, acuminate to acuminate-awned, hyaline, pale stramineous with a green to stramineous center, 1-nerved. Staminate scales ca. 3–4.6 mm long, ca. 1.4–1.7 mm wide, narrowly ovate, acute to acuminate, hyaline, pale stramineous with a green to stramineous center, 1-nerved. Perigynia 3.3–4.1 mm long, 1.2–1.4(–1.7) mm wide, (2.2–)2.4–2.9 times as long as wide, ascending, planoconvex with ovate bodies 1.7–2.4 mm long, widest 0.7–0.9 mm above base, narrowly blunt-edged, smooth, abruptly contracted into a beak, greenish to stramineous, glabrous, sessile, adaxial side ± faintly 3–6-nerved over achene, abaxial side ± faintly 11–15-nerved over achene; beaks (1.4–)1.6–2 mm long, 0.6–1 times as long as the perigynium body, flattened, narrow, ± parallel-sided, serrulate-margined nearly to apex, the apex bidentate with teeth up to 0.5 mm long. Achenes 1.6–1.9 mm long, 1–1.4 mm wide, 1.1–1.8 times as long as wide, biconvex, ovate, pale brown, short-stipitate, apiculum very short; style straight; stigmas 2. Stamens 3, anthers ca. 1.4–1.8 mm long.

Streambanks and open, wet areas, 2500–2650 m; endemic to Cerro Marahuaca.

Though very similar in overall aspect to many other species of *Carex* section *Ovales,* and especially to *C. roraimensis* and *C. neblinensis,* the peculiar, virtually parallel-sided perigynium beak (Fig. 1H) is unique to this species. Unlike either *C. roraimensis* or *C. neblinensis,* the leaf sheaths in this species are not prolonged beyond the base of the leaf blade.

Paratypes. VENEZUELA. **Amazonas:** Dept. Atabapo, Cerro Marahuaca, HUHA, Cumbre antiplanicie no arbolada más o menos plana, con piedras expuestas, río abajo, 3°40'N, 65°30'W, 2580 m, 31 Jan. 1982, *Steyermark et al. 125931* (VEN); Dept. Atabapo, Cerro Marahuaca, FHUIF, Cumbre, zona pantanosa no arbolada en la antiplanicie, río arriba, 3°35'N, 65°20'W, 2480–2500 m, 2 Feb. 1982, *Steyermark et al. 126035* (NY); Dept. Atabapo, Cerro Marahuaca, Cumbre, parte central de la Meseta Sur-Este, al lado de una grieta, a lo largo de la Quebrada Yekuana, afluente del río Negro, 3°40'30"N, 65°26'30"W, 2560 m, 10–12 Oct. 1983, *Steyermark 129539* (VEN).

Carex neblinensis Reznicek, sp. nov. TYPE: Brazil. Cerro de la Neblina, Planicie de Zuloaga, Río Titirico, 10–15 Oct. 1970, *Steyermark 103755* (holotype, NY). Figure 1A–C.

Plantae laxe cespitosae; culmi fertiles 20–90 cm alti; vaginae basales pallidae brunneae. Folia 3–5; laminae 3–40 cm longae, 1.5–3 mm latae; vaginae ca. 4–15 cm longae, ventraliter hyalinae, pallide brunneae, 0.6–1.8 mm prolongatae. Inflorescentiae 1.4–3.4 cm longae, erectae; spicae (2–)3–7, gynaecandrae, anguste obovoideae, 6–9 mm longae, 3–4.5 mm latae, basi staminata 0.5–2 mm longa. Squamae pistillatae 3.7–4.8 mm longae, lanceolatae vel anguste triangulari-ovatae, acuminatae, stramineae. Perigynia 3.8–4.8 mm longa, 1.2–1.5 mm lata, adpressa, corpibus ellipticis, in rostrum serrulatum 1.5–2.2 mm longum contracta. Achenium 1.7–2.1 mm longum, 1–1.2 mm latum, ovatum. Stigmata 2.

Loosely caespitose in small clumps; fertile culms ca. 20–90 cm tall, erect, ± obtusely trigonous, with scattered to dense prickles on the angles; bladeless basal sheaths pale brown. Leaves 3–5, on lower ¼–⅖ of the culm; blades 3–40 cm long, 1.5–3 mm wide, plicate to involute, smooth, the margins and midrib antrorsely scabrous distally; leaf sheaths ca. 4–15 cm long, tightly enveloping culms, glabrous, green to pale brown or grayish brown; the inner band of sheaths glabrous, pale brown, hyaline, prolonged 0.6–1.8 mm above leaf base, the apex concave; ligules ca. 1.6–3.5 mm long, rounded, the free portion entire, hyaline, whitish to pale brown, up to 0.8 mm long. Inflorescences 1.4–3.4 cm long, 6–9 mm wide, stiffly erect, spikes approximate, the lowest two spikes 1.9–9 mm distant, spikes single at nodes, sessile, lowermost bracts ± setaceous, usually longer than the inflorescence, ca. 2–8 cm long and up to ca. 1.4 mm wide, conspicuous, sheathless, the upper bracts much reduced; spikes (2–)3–7, gynaecandrous, narrowly obovoid, 6–9 mm long, pistillate portion ca. 5–7 mm long, ca. 3–4.5 mm wide, ca. 5–10-flowered, staminate portion ca. 0.5–2 mm long, 2–6-flowered. Pistillate scales 3.7–4.8 mm long, 1.4–2 mm wide, lanceolate to narrowly triangular-ovate, acuminate, stramineous with a green to brown center and hyaline margins, 1-nerved. Staminate scales ca. 4–4.8 mm long, ca. 1.4–1.7 mm wide, narrowly ovate, acuminate, stramineous with a green center and hyaline margins, 1-nerved. Perigynia 3.8–4.8 mm long, 1.2–1.5 mm wide, 2.8–3.5 times as long as wide, ± appressed, planoconvex with elliptic bodies 2.1–3 mm long, widest 1.1–1.7 mm above base, narrowly blunt-edged, smooth, tapering into a beak, greenish to stramineous, glabrous, sessile, adaxial side distinctly 3–7-nerved over achene, abaxial side distinctly 7–11-nerved over achene; beaks 1.5–2.2 mm long, 0.5–0.9 times as long as the perigynium body, flattened, narrowly triangular, serrulate-margined nearly to apex, the apex bidentate with teeth up to 0.3 mm long. Achenes 1.7–2.1 mm long, 1–1.2 mm wide, 1.6–1.8 times as long as wide, biconvex, ovate, pale brown, short-stipitate, apiculum very short; style straight; stigmas 2. Stamens 3, anthers ca. 1.6–1.7 mm long.

Swampy savannas, wet woodlands, and open, wet areas, 2100–2400 m; Cerro de la Neblina.

Carex neblinensis has longer perigynia than either *C. marahuacana* or *C. roraimensis,* but they are largely concealed by the equally long pistillate scales. As in *C. roraimensis,* the sheaths are prolonged beyond the base of the leaf blade.

Paratypes. BRAZIL. Sierra da Neblina, trail to Pico Phelps, 2 Dec. 1965, *Maguire et al. 60457* (NY); VENEZUELA. **Amazonas:** Dept. Rio Negro, Cerro de la Neblina, Camp II, 2.5–3.5 km NE of Pico Phelps (= Neblina), 00°50'00" to 12"N, 65°58'48"W, 2085–2100 m, 17–22 Feb. 1984, *Funk 6268* (VEN); *Funk 6297* (VEN).

Carex roraimensis Steyermark, Fieldiana, Bot. 28(1): 67. 1951. TYPE: Venezuela. Bolívar: summit of Mount Roraima, on southern half of the summit between Summit camp, Great Central Rift, Central Swamp, and pond at southern end, 2700–2740 m, 28 Sep. 1944, *Steyermark 58870* (holotype, F, photo MICH; isotype NY). Figure 1D–F.

Loosely caespitose in small clumps; fertile culms ca. 20–85 cm tall, erect, ± obtusely trigonous, with scattered to dense prickles on the angles, especially just below the inflorescence; bladeless basal sheaths pale brown. Leaves 4–6, on lower ¼–⅖ of the culm; blades 2–35 cm long, 1.5–3.5 mm wide, ± flat to involute, papillose above, smooth below, the margins and midrib antrorsely scabrous distally; leaf sheaths ca. 2–10 cm long, tightly enveloping culms, glabrous, green to pale brown or grayish brown; the inner band of sheaths glabrous, pale brown, hyaline, prolonged 0.4–3.5(–6.5) mm above leaf base, the apex truncate to concave; ligules ca. 1.5–7 mm long, rounded, the free portion entire, hyaline and whitish to brown, up to 0.6 mm long. Inflorescences 1.4–3.8 cm long, 5–13 mm wide, stiffly erect, spikes ± approximate, the lowest two spikes 2.2–11 mm distant, spikes single at nodes, sessile, lowermost bracts ± setaceous, usually longer than the inflorescence, ca. 1.2–5 cm long and up to ca. 1.1 mm wide, conspicuous, sheathless, the upper bracts much reduced; spikes (3–)4–9, gynaecandrous, obovoid, 5.5–10.5 mm long, pistillate portion ca. 5–7.5 mm long, ca. 3.5–5.5 mm wide, ca. 5–20-flowered, staminate portion ca. 0.5–3 mm long, ca. 2–8-flowered. Pistillate scales 2.2–3.3 mm long, 1.4–2 mm wide, broadly ovate, retuse, obtuse, or acute, hyaline with a greenish to stramineous center, 1-nerved. Staminate scales ca. 2.8–3.7 mm long, ca. 1.5–1.8 mm wide, ovate, emarginate and short-awned, retuse, or acute, greenish to stramineous with hyaline margins, 1-nerved. Perigynia 3.2–4.1 mm long, 1.1–1.5(–1.8) mm wide, (2.1–) 2.3–2.7(–3) times as long as wide, ascending to spreading, ± planoconvex with elliptic bodies 2–2.8 mm long, widest 1.1–1.7 mm above base, narrowly blunt-edged, smooth, tapering into a beak, greenish to stramineous, glabrous, sessile, adaxial side distinctly 3–8-nerved over achene, abaxial side distinctly 7–11-nerved over achene; beaks 1–1.4(–1.6) mm long, 0.4–0.7 times as long as the perigynium body, flattened, narrowly triangular, serrulate-margined nearly to apex, the apex bidentate with teeth up to 0.2 mm long. Achenes 1.7–2 mm long, 1–1.2 mm wide, 1.5–2 times as long as wide, biconvex, ovate-elliptic, pale brown, short-stipitate, apiculum very short; style straight; stigmas 2. Stamens 3, anthers ca. 1.7–2.1 mm long.

Open, wet areas and open, swampy savannas, 1850–2740 m; endemic to Mt. Roraima and the Chimantá Massif.

Paratypes. BRAZIL. **Roraima:** an Bächen auf dem Gipfel, Jan. 1910, *Ule 8536* (K). GUYANA/BRAZIL. **Mt. Roraima:** summit, 26 Nov. 1927, *Tate 433* (NY). VENEZUELA. **Bolívar:** Chimantá Massif, Central Section, near lower Cumbre Camp, 1863 m, 2 Feb. 1955, *Steyermark & Wurdack 355* (MICH); Chimantá Massif, Central Section, swamp along E branch of headwaters of Rio Tirica, 2120 m, 12 Feb. 1955, *Steyermark & Wurdack 799* (F, NY); Chimantá Massif, Central Section, open swampy savanna along W branch of headwaters of Rio Tirica above Upper Falls, 2090 m, 17 Feb. 1955, *Steyermark & Wurdack 914* (F, MICH); Distrito Piar, Macizo del Chimantá, Altiplanicie en la base meridional de los farallones superiores del Apacará-tepui, sector norte del Macizo, 5°20′N, 62°12′W, 2200 m, 30 Jan.–1 Feb. 1983, *Huber & Steyermark 7028* (VEN); Distrito Piar, Macizo del Chimantá, Altiplanicie en la base meridional de los farallones superiores del Apacará-tepui, sector norte del Macizo, 5°20′N, 62°12′W, 2200 m, Jan.–1 Feb. 1983, *Steyermark et al. 128379* (MO, NY); Roraima Tepuy, Sector Noreste, Lago Gladys, 5°15′36″N, 60°15′W, 2700 m, 3–5 April 1989, *F. Delascio C. 13938* (VEN).

Ule 8536 was referred by Kükenthal (1921) to *Carex bonplandii*, but as Steyermark (1951) surmised, it is *C. roraimensis*. *Steyermark & Wurdack 355* is peculiar in that some spikes also have a few staminate flowers at the apex.

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Carex porrecta (Cyperaceae), a Distinctive New Species from Northern South America and Costa Rica

A. A. Reznicek
University of Michigan Herbarium, North University Building, Ann Arbor, Michigan 48109, U.S.A.

Konraed Camelbeke
Department of Morphology, Systematics, and Ecology, Laboratory of Botany, State University Gent, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium

ABSTRACT. *Carex porrecta* is a relatively widespread but evidently rare species unique among New World representatives of *Carex* subg. *Indocarex* in having strongly outcurved perigynia with very long, spreading beaks and a conspicuous, thick rhizome. This species occurs in humid montane forests, often associated with ravines, rock outcrops, and steep slopes at about 1600–2600 m.

Carex subg. *Indocarex* has about 15–20 known species in the Neotropics, although it has never been the subject of a thorough study. This distinctive plant was recognized independently by both of us as quite distinct from the common *C. polystachya* (Hermann, 1974), to which specimens were referred (if identified), and we here describe it as new.

Carex porrecta Reznicek & Camelbeke, sp. nov. TYPE: Ecuador. Imbabura: km 64–65 Otavalo-Selva Alegre, 0°15′N, 78°34′W, 1600 m, 13 Mar. 1988, *Lægaard & Renvoize 70823* (holotype, AAU; isotypes, QCA, QCNE). Figure 1.

Plantae laxe cespitosae vel solitariae; culmi (35–)55–125 cm alti; vaginae basales brunneae, glabrae. Folia 8–14, plerumque basalia; laminae (15–)35–60 cm longae, (3–)6–13 mm latae; vaginae 4–12.5 cm longae, glabrae; ligulae (2–)6–22 mm longae. Inflorescentiae ca. (20–)35–75 cm longae; paniculae ca. 6–14, ascendentes vel nutantes, 4.5–12 cm longae; bracteae infimae laminis ca. (18–)28–55 cm longis, ca. (2.4–)3.5–13 mm latis et vaginis ca. (2.5–)3.5–6.5 cm longis. Perigynia (3.3–)4–4.5(–5.2) mm longa, 0.6–1.2 mm lata, patentia, valde extrorsus curvata, trigona, straminea vel olivacea, glabra, in rostrum contracta; rostra (1.5–)1.7–2.8 mm longa. Achenium ca. 1.6–2.3 mm longum, ca. 0.7–1 mm latum. Styli marcescentes; stigmata 3. Antherae 3, ca. 1.2–1.9 mm longae.

Plants loosely caespitose or solitary, somewhat elongate rhizomes up to 12 cm or more long and 3–5 mm thick; roots brown; culms (35–)55–125 cm tall, trigonous, smooth, with glabrous, brown, ± fibrous basal sheaths. Leaves 8–14, mostly basal; blades ca. (15–)35–60 cm long, (3–)6–13 mm wide, the widest leaves 9–13 mm wide, plicate, glabrous, antrorsely scabrous distally on the upper surface and especially the margins and slightly on the midrib adaxially; leaf sheaths 4–12.5 cm long, ± loosely enveloping culm, glabrous, green or the outermost pale reddish brown; inner band of sheaths glabrous, green, becoming stramineous to reddish near apex, veined, the apex deeply concave; ligules (2–)6–22 mm long, long-acute to obtuse (on the uppermost leaves), the free portion 0.5–1 mm long, stramineous to reddish brown, membranous and often slightly fringed. Vegetative shoots unknown. Inflorescences ca. (20–)35–75 cm long, panicles ca. 6–14, with the uppermost panicles overlapping and the lowest 2 panicles ca. 13–21 cm distant, panicles 1 or 2 at the nodes, ascending to nodding on thin, strongly flattened, smooth to ± scabrous peduncles; lowest panicles with peduncle ca. 7–18 cm long, the uppermost lateral panicles essentially sessile; lowermost bract with blade ca. (18–)28–55 cm long and ca. (2.4–)3.5–13 mm wide with sheath ca. (2.5–)3.5–6.5 cm long, the uppermost bracts much reduced. Panicles pyramidal, the lower 4.5–12 cm long, 1.5–6 cm wide, with 4–16 primary branches, the lower 1–10 branches again often compound with 1–10 secondary branches 6–20 mm long, and the secondary branches sometimes with 1–3 tertiary branches up to 8 mm long, the upper panicles much reduced; primary branches ascending, 8–55 mm long, subtended by an urceolate, pubescent cladoprophyll. Ultimate spikes 4.5–16 mm long; pistillate portion 3–16 mm long, ca. 4.5–9.5 mm wide, with (2–)4–15 perigynia, staminate portion (1.5–)3.5–5.5(–7.5) mm long, 0.6–1.4 mm wide, ca. 3–10-flowered. Pistillate scales (2–)2.5–3.8(–4.5) mm long, 0.8–1.5 mm wide, ovate, acute to acuminate, in the lowermost spikes usually with

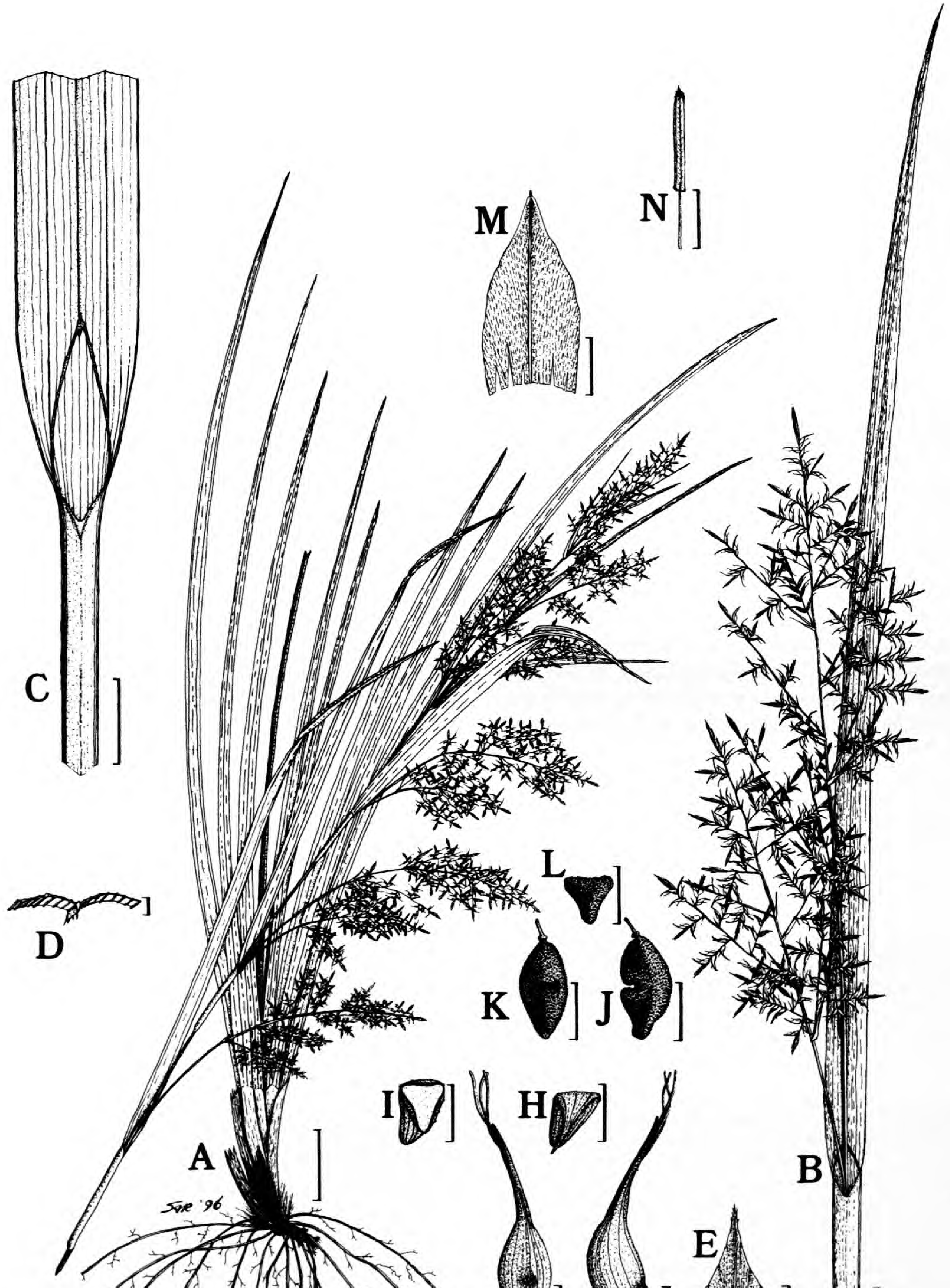

Figure 1. *Carex porrecta* Reznicek & Camelbeke. —A. Habit. —B. Portion of inflorescence. —C. Sheath and ligule. —D. Leaf, transverse section. —E. Pistillate scale. —F. Perigynium, side view. —G. Perigynium, front view. —H.

a scabrous awn up to 3 mm long, glabrous or sometimes with a few, short, appressed hairs abaxially, reddish brown to dark brown with a green center, usually with just 1 main vein. Staminate scales (2.9–)3.3–4(–4.3) mm long, ca. 0.8–1.4 mm wide, lanceolate to narrowly ovate, acute to acuminate, awnless, glabrous, golden or reddish brown to brown, 1-veined. Perigynia (3.3–)4–4.5(–5.2) mm long, 0.6–1.2 mm wide, spreading and strongly outcurved, trigonous with ± flat, lanceolate to narrowly ovate sides, the sides sometimes distended by the mature achene, stramineous to olive green to brown, glabrous, sessile, 10–21-nerved, the nerves often golden brown to brown, contracted into a beak; beaks (1.5–)1.7–2.8 mm long, stramineous to reddish brown near the apex, smooth, the apex hyaline, membranaceous, strongly oblique to irregularly bidentate with teeth up to 1.2 mm long. Achenes ca. 1.6–2.3 mm long, ca. 0.7–1 mm wide, trigonous with flat to concave, often asymmetric, narrowly elliptic sides, tightly enveloped by the perigynia, dark brown, finely papillose, sessile, often strongly and irregularly indented on one or two sides. Styles withering; stigmas 3. Stamens 3, anthers ca. 1.2–1.9 mm long, yellow, twisted, filaments white, up to 4 mm long.

Carex porrecta apparently occurs sparingly from Ecuador north to Costa Rica in humid forests at 1600–2600 m elevation (the label on *Cerón 1149* gives a greater altitudinal range of 1800–3356 m). Specific habitats on specimens include: "very humid rock shelves" and "on boulder along stream," and the species apparently occurs mostly on steep banks and in ravines and steep valleys. Fruiting specimens have been collected in April, March, July, and September.

The epithet is derived from the Latin *porrectus*: extended, stretched outward and forward, in reference to the elongate, outcurved beak that is such a conspicuous feature of this species.

Both the prominently indented achenes and the long, outcurved, smooth beak of *Carex porrecta* are unique in subgenus *Indocarex* in the Neotropics, and this species appears to have no close relatives. There are some Old World species, such as *C. filicina* Nees or *C. raphidocarpa* Nees, among others (Kükenthal, 1909), that also have smooth, long beaks. However, these all differ in many other characters, and *C. porrecta* does not appear to have a close relationship with any Old World *Carex*.

Paratypes. COSTA RICA. **Limón:** Cordillera de Talamanca, Atlantic slope, Canyon of the Río Siní, 1800–1900 m, 9°13′N, 82°59′W, 15 Sep. 1984, *Davidse & Herrera 29166* (MO). VENEZUELA. **Bolívar:** Mount Roraima, ascent of ledge along SW-facing side, from beginning of sandstone bluffs to summit, 2255–2620 m, 27 Sep. 1944, *Steyermark 58743* (F). COLOMBIA. **Cauca:** between Q. Curuyaco and Santa Rosa, along Rio Caquata, 1840–1700 m, 23 Jul. 1944, *Core 1035* (NY). ECUADOR. **Pichincha:** Old road Quito–Santo Domingo, between San Juan and Chiriboga, 0°16′S, 78°41′W, 2500 m, 22 Mar. 1979, *Holm-Nielsen 16070* (AAU); road Quito–Nono–Pacto, between Nono and Tandayapa, 2400 m, 0°2′S, 78°37′W, 24 Mar. 1979, *Holm-Nielsen 16123* (AAU); on road Nono-Nanegalito, app. 5 km below Sierra, 2400 m, 0°2′S, 78°38′W, 13 Mar. 1984, *Lægaard 51828* (AAU); road to Lulumbamba, vicinity of Pan de Azúcar, 00°05′N, 78°30′W, 1800–3356 m, 11 Apr. 1987, *Cerón 1149* (QCNE).

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Perigynium, top view. —I. Perigynium, transverse section. —J. Achene, side view. —K. Achene, front view. —L. Achene, top view. —M. Staminate scale. —N. Anther. Scale bar = 5 cm in A, 2 cm in B, 5 mm in C, and 1 mm in D–N. Drawn by Susan A. Reznicek from *Davidse & Herrera 29166* (MO).

A New Species and Combinations in Malagasy *Chrysophyllum* L. (Sapotaceae)

George E. Schatz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Laurent Gautier
Conservatoire et Jardin Botanique de la Ville de Genève, Case Postale 60,
CH-1292 Chambesy/GE, Switzerland

ABSTRACT. The Malagasy taxa of Sapotaceae formerly placed in the genera *Austrogambeya, Donella,* and *Gambeya* are provided with new combinations in the genus *Chrysophyllum.* A new species of *Chrysophyllum* from Madagascar is described with leaf venation intermediate between *Austrogambeya* and *Gambeya,* and *Donella,* and thus further confirms the merging of these genera with *Chrysophyllum.*

RÉSUMÉ. Nous proposons des nouvelles combinaisons dans le genre *Chrysophyllum* (Sapotaceae) pour les taxons malgaches précédemment placés dans les genres *Austrogambeya, Donella,* et *Gambeya.* Une nouvelle espèce de *Chrysophyllum* de Madagascar est décrite. Sa nervation est intermédiaire entre celle des *Austrogambeya* et *Gambeya* et celle de *Donella* et confirme le regroupement de ces genres sous *Chrysophyllum.*

The division of *Chrysophyllum* L. into segregate genera, proposed initially by Pierre (1890–1891) and Baillon (1892), and adopted and expanded later by Aubréville (1961, 1974), is based upon vegetative characters, especially on leaf venation, and to a lesser extent wood anatomy. However, flowers, fruits, and seeds provide no evidence to support such a division. As Aubréville (1974) himself stated: "Les fleurs des espèces de *Donella* ne se distinguent pratiquement pas les unes des autres, ni même de celles des *Gambeya.* Il en est de même des fruits et des graines chez les espèces malgaches."

In agreement with the recent generic monograph of Sapotaceae by Pennington (1991), we prefer to return to a generic concept closer to that of Engler (1904), who considered the vegetative differences relevant only at the sectional level. Therefore, we propose the following new combinations in *Chrysophyllum* to accommodate the Malagasy species previously described by Lecomte and Aubréville in the genera *Austrogambeya* Aubréville & Pellegrin, *Donella* Pierre ex Baillon, and *Gambeya* Pierre.

Furthermore, an undescribed large tree from basaltic formations in the northeastern rainforests of Madagascar exhibits leaf venation intermediate between *Austrogambeya* and *Gambeya,* and *Donella,* and thus provides further evidence for merging those genera with *Chrysophyllum.* At the specific level, recent collections have shown that some of the taxa recognized by Aubréville (1974) cannot be maintained. Therefore, the following new synonymy is also proposed.

SYNOPSIS OF *CHRYSOPHYLLUM* L. IN THE *FLORE DE MADAGASCAR ET DES COMORES* AREA

Chrysophyllum ambrense (Aubréville) G. E. Schatz & L. Gautier, comb. nov. Basionym: *Donella ambrensis* Aubréville, Fl. Madag. 164: 118, pl. 27: 3–4. 1974. TYPE: Madagascar. Antsiranana: Centre (Nord): Montagne d'Ambre, *Service Forestier 11277* (holotype, P).

Chrysophyllum analalavense (Aubréville) G. E. Schatz & L. Gautier, comb. nov. Basionym: *Donella analalavensis* Aubréville, Fl. Madag. 164: 117, pl. 27: 7–8. 1974. TYPE: Madagascar. Mahajanga: environs d'Analalava, *Perrier de la Bâthie 12309* (holotype, P).

Chrysophyllum boivinianum (Pierre) Baehni, Boissiera 11: 76. 1965.

Gambeya boiviniana Pierre var. *lavanchiana* Aubréville, syn. nov., Fl. Madag. 164: 110. 1974. TYPE: Comores. Anjouan, *Lavanchie s.n.* (holotype, P).

Chrysophyllum capuronii G. E. Schatz & L. Gautier, sp. nov. TYPE: Madagascar. Toamasina: Nosy Mangabe Special Reserve, a 520 ha island in the Bay of Antongil, 5 km S of Maroantsetra, 15°30′S, 49°46′E, 0–330 m, 9 Jan. 1989 (fr), *G. E. Schatz & J. S. Miller 2555* (holotype, MO; isotypes, K, P, PRE, TAN). Figure 1.

Ab aliis Malagasis speciebus *Chrysophylli* foliis anguste

Figure 1. *Chrysophyllum capuronii* G. E. Schatz & L. Gautier, sp. nov. Photograph of type specimen at MO (*G. E. Schatz & J. S. Miller 2555*).

ellipticis ad anguste oblonga, omnino glabris, basibus asymmetricis cuneatis ad obtusas, marginibus undulatis, apicibus acuminatis, nervis secondariis 8–12 utrinque, tertiariis reticulatis differt.

Tree to 30 m tall exuding very thick, caustic white latex from branches and especially fruits. Petioles slightly canaliculate, 0.9–1.6 cm long, glabrous; leaf blades narrowly elliptic to narrowly oblong, 7–14.5(–20.5) × 2.5–4.5(–6.5) cm, membranaceous to chartaceous, glabrous, glossy, bases asymmetrical, cuneate to acute to obtuse and somewhat decurrent along petiole, margins undulate, apices acuminate with an acumen 1–3 cm long, midribs flattened to slightly concave toward the base adaxially, distinctly elevated below, venation weakly brochidodromous with 8–12 major secondary veins on each side plus occasional minor intersecondaries, these elevated both adaxially and abaxially, tertiary venation reticulate, slightly elevated both adaxially and abaxially. Flowers unknown. Fruits five-seeded berries, spheroid, 3.5–4.5 cm diam., greenish yellow at maturity, mesocarp orange-red, pedicels 0.5–0.8 cm long, 0.3–0.4 cm diam., seeds 2 cm long, 1.4 cm wide, 0.7 cm thick, light brown, shiny.

Paratypes. MADAGASCAR. **Antsiranana**: Table basaltique d'Ambanitazana, près d'Andrapengy (au N d'Antalaha), 11 Apr. 1967 (st), *Service Forestier (Capuron) 27738bis* (P). **Toamasina**: Nosy Mangabe, Apr. 1990 (st), *B. Carlson 197* (MO).

Chrysophyllum delphinense (Aubréville) G. E. Schatz & L. Gautier, comb. nov. Basionym: *Donella delphinensis* Aubréville, Fl. Madag. 164: 120, pl. 27: 1–2. 1974. TYPE: Madagascar. Toliara: forêt de Mandena, *Service Forestier 7850* (holotype, P).

Chrysophyllum fenerivense (Aubréville) G. E. Schatz & L. Gautier. comb. nov. Basionym: *Donella fenerivensis* Aubréville, Fl. Madag. 164: 116, pl. 26: 8–9. 1974. TYPE: Madagascar. Toamasina: Tampolo, *Service Forestier 13072* (holotype, P).

Chrysophyllum guerelianum (Aubréville) G. E. Schatz & L. Gautier, comb. nov. Basionym: *Austrogambeya guereliana* Aubréville, Fl. Madag. 164: 122, pl. 28. 1974. TYPE: Madagascar. Antsiranana: Ouest: Montagne des Français, *Service Forestier 12794* (holotype, P).

Chrysophyllum lanceolatum (Blume) A. DC., Prodr. 8: 162. 1844.

Donella lanceolata (Blume) Aubréville var. *malagassica* Aubréville, Fl. Madag. 164: 117, pl. 27: 5–6. 1974. Syn. nov. TYPE: Madagascar. Toamasina: environs de la baie d'Antongil, entre Anema et Amboditavolo, *Service Forestier 8954* (holotype, P).

Chrysophyllum masoalense (Aubréville) G. E. Schatz & L. Gautier, comb. nov. Basionym: *Donella masoalensis* Aubréville, Fl. Madag. 164: 112, pl. 26: 6–7. 1974. TYPE: Madagascar. Fianarantsoa: vallée de Namorona près de Ranomafana, *Service Forestier 8833* (holotype, P).

Chrysophyllum perrieri (Lecomte) G. E. Schatz & L. Gautier, comb. nov. Basionym: *Donella perrieri* Lecomte, Bull. Mus. Natl. Hist. Nat. 34: 355. 1928. TYPE: Madagascar. Toamasina: Betampona près d'Ambodiriana, ouest de Tamatave, *Perrier de la Bâthie 17413* (holotype, P).

Donella perrieri Lecomte var. *pubescens* Aubréville, Fl. Madag. 164: 114. 1974. Syn. nov. TYPE: Madagascar. Toamasina: Tampolo, N Fénérive, *Service Forestier 8635* (holotype, P).

Donella perrieri Lecomte var. *sambiranensis* Lecomte, Bull. Mus. Natl. Hist. Nat. 34: 355. 1928. Syn. nov.

Donella sambiranensis (Lecomte) Aubréville, Fl. Madag. 164: 115, pl. 26: 5. 1974. Syn. nov. TYPE: Madagascar. Antsiranana: bassin du Sambirano, *Perrier de la Bâthie 15432* (holotype, P).

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Contributions to South American Caesalpiniaceae. I. Two New Species of *Jacqueshuberia* from the Venezuelan Guayana

Basil Stergios
BioCentro, UNELLEZ, Mesa de Cavacas, Edo. Portuguesa 3323, Venezuela

Paul E. Berry
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Study of Caesalpiniaceae collections from the Venezuelan Guayana has revealed the first known occurrences of *Jacqueshuberia* in the region, with two new species, *J. splendens* from Cerro Aracamuni in southern Amazonas state and *J. pustulata* from the Río Autana watershed in northern Amazonas state.

RESUMEN. El estudio de colecciones de Caesalpiniaceae de la Guayana venezolana ha resultado en el primer reporte del género *Jacqueshuberia* de la región, con dos especies nuevas, *J. splendens* de Cerro Aracamuni, al sur del Estado Amazonas, y *J. pustulata* de la cuenca del río Autana al norte del Estado Amazonas.

The most recently described of the five previously known species of *Jacqueshuberia, J. brevipes* Barneby (1990), was described from Guyana and was the first report of this genus outside of the Amazon basin (Silva & Graham, 1980). Due to Venezuela's proximity to Guyana, it was to be expected that the genus would eventually be found there. The highly restricted distributions of all known species in the genus, as well as the paucity of collections, were well summarized by Barneby (1990), as was the genus's botanical history since it was first described by Ducke (1922) from Brazilian Amazonia.

Both new species described herein are known from single collections from Amazonas state in Venezuela. *Jacqueshuberia splendens* is presently known from rocky slopes of Cerro Aracamuni at 800 m elevation in southern Amazonas state, whereas *J. pustulata* is restricted to northern Amazonas in the headwaters of Autana River at 110–120 m elevation. Both species share a low growth habit (4–5 m) and local distributions among shrubby or patchy, low, streamside forests.

Jacqueshuberia pustulata Stergios & P. E. Berry, sp. nov. TYPE: Venezuela. Amazonas: Municipio Atures, caño Cabeza de Manteco, afluente del río Autana en Salto Manteco, 5°52'N, 67°27'W, 110–120 m, 10 Nov. 1984, *E. Melgueiro & F. Gudnchez 5* (holotype, TFAV; isotypes, MO, PORT). Figure 1.

Arbor 5-metralis, foliis 35–40 cm longis, 24–28-pinnatis; pinnis 50–70-jugatis, rachi angulato, lateraliter acuto, internodiis dense paleaceo-pubescentibus; foliolis rugose reticulatis, supra distincte pustulatis, 10–11 mm longis, 1–2 mm latis; calycis tubo viridi-olivaceo, petalis cucullatis luteis, 6 mm longis, 3 mm latis.

Small tree up to 5 m tall; branchlets notably 5-sulcate, 8–10 mm thick, reddish brown tomentulose along the rounded ridges but nearly glabrous within the grooves. Stipules paripinnate, coppery paleaceous-tomentulose along midrib, 2.5–3 cm long with 16–20 pairs of leaflet-like lobes; stipule lobes linear-lanceolate, somewhat cymbiform, 8–9 × 1–1.2 mm, minutely appressed-pilulose, especially near the base, midrib and 6–8 pairs of straight-ascending lateral nerves distinctly raised on both surfaces, lateral nerve pairs becoming somewhat subcontiguous toward the apex. Leaf 35–40 cm long, 3.5–4 mm thick along lower half, attenuating toward the apex, stalk minute-pilulose; rachis adaxially canaliculate and angled with a pointed ridge along the entire length; petiole 4–4.5 cm; interpinnal segments 0.8 cm, densely paleaceous-tomentulose along lateral ridge extending from the pinnal nodes; pinnae 24–28-paired, pairs remaining opposite along entire leaf length, 7–10 cm long, the shorter pinnae occurring toward the base and apex of the leaf, interfoliate segments 1 mm; leaflets 50–70-jugate, opposite along rachis, 10–11 × 1–2 mm, somewhat falcate-naviculiform with a rounded apex, inequilateral and generally applanate at the base, glabrous, stiff-herbaceous in texture, rugose-reticulate on both surfaces but primarily on the lower and notably pustulate on the upper, midvein readily visible on lower surface but

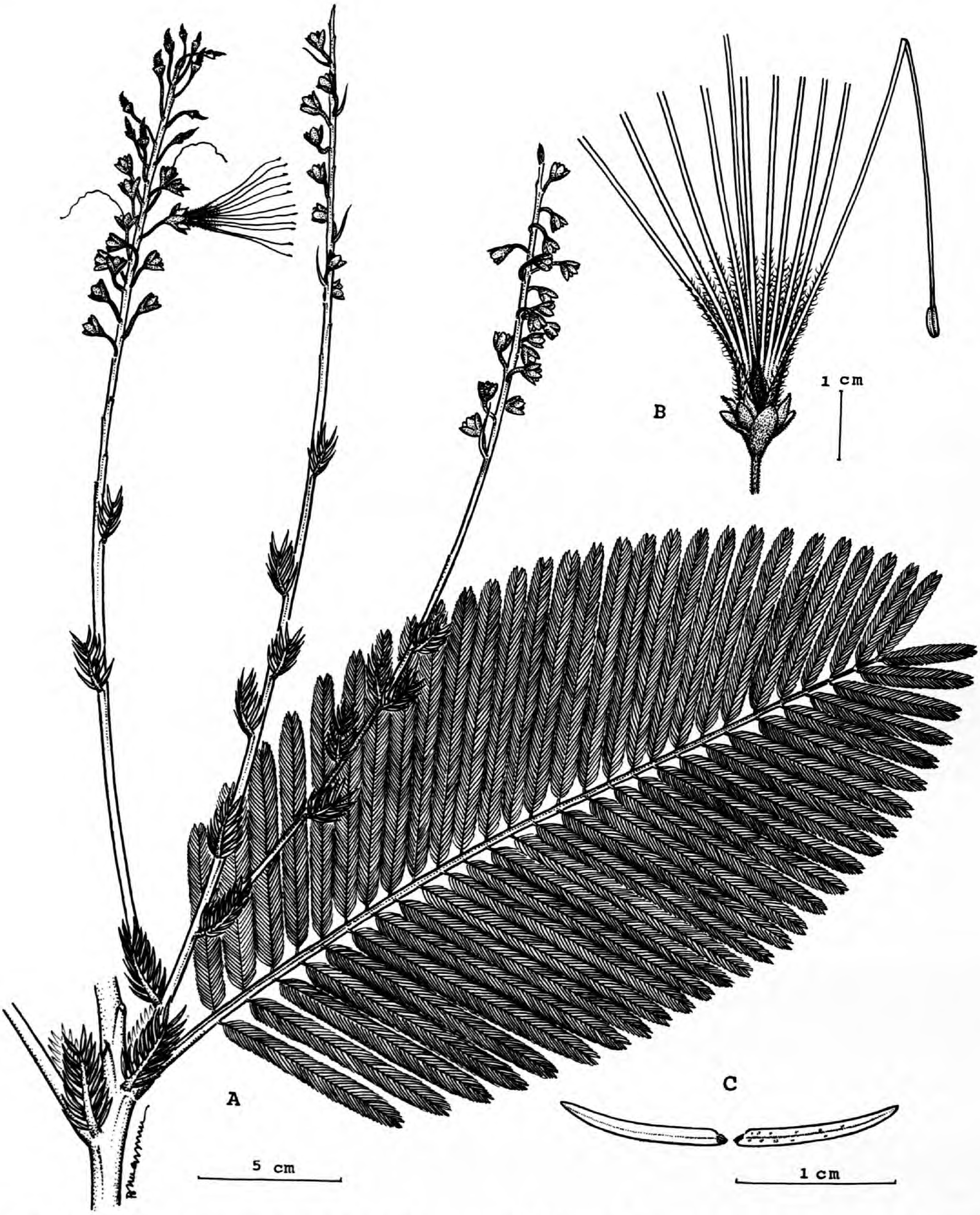

Figure 1. *Jacqueshuberia pustulata* Stergios & P. E. Berry. —A. Habit. —B. Flower showing only lower part of stamens. —C. Leaflets. Based on *Melgueiro & Guánchez 5.*

barely so on the upper, lateral veins not discernible. Inflorescence a terminal, 1–3-branched panicle of racemes, 35–40 cm long, efoliate, minutely tomentulose-puberulent, flowers loosely distributed along apical half of panicle branches, 1–1.8 cm between them at mid-point along raceme; pedicels 1.7–2 cm long, erect tomentose-puberulent, cernuous to nutant closer to base of flowers; bracts paripinnately foliar, 8-jugate, 2 cm long and very similar in appearance to the foliar stipules. Flowers mostly drooping near the apex of the pedicels; floral bracts obtuse, 5 × 3.5–4 mm, reflexed-cucullate, partly appressed-tomentulose without, glabrous within, margins minutely but entirely ciliolulate, caducous; hypanthium olive drab, cupular, 4 × 4 mm, reddish to copper-brown and erect-tomentulose; sepals broadly ovate, 6.5–7 × 6 mm (at base), blotchily tomentulose without, glabrous within; petals yellow, cucullate, 6 × 3 mm, caducous; staminal tube 7–11 mm long, copiously reddish lanate-villose; stamens 10, equal, but filaments tend to be fused in pairs at unequal levels near top of tube, the free portion 2.5–4.5 cm long, glabrous; anthers 4 × 1–1.5 mm, glabrous, rounded at the apex; ovary sessile, 5–6 × 1.5 mm, densely cinnamon-tomentose; style 2.5–2.8 cm long, glabrous; ovules 15. Pods not seen on specimens studied.

Distribution and ecology. In low, open forest near a waterfall along black-water streams, in the headwaters of the Río Autana in northern Venezuelan Amazonas state, at 110–120 m elevation. The tree is frequented by very aggressive ants.

By virtue of the large number of pinnae and the nitid condition of the leaflets, *Jacqueshuberia pustulata* appears to be most closely related to *J. brevipes* and *J. splendens.* It differs from *J. brevipes* in the larger leaves and more numerous but smaller pinnae (50–70 vs. 35–48 pairs) that are linear and rugose-reticulate. *Jacqueshuberia pustulata* also has longer pedicels and a larger hypanthium than *J. brevipes.* The stipule lobes of *J. pustulata* are smaller than those of *J. brevipes* (8–9 × 1 mm vs. 20 × 4 mm). Mature trees of *J. pustulata* are found at low altitudes (110–120 m) in low, open, riverine forests and are only about 5 m tall, whereas *J. brevipes* are ca. 20-m-tall, montane forest trees on sandstone.

Jacqueshuberia pustulata differs from *J. splendens* in its larger leaves and greater number of leaflets per pinna. The leaf rachis is angled with a pointed ridge rather than rounded along the leaf as in *J. splendens,* and the internodes are densely paleaceous-pubescent, as opposed to nearly glabrous. The leaflets of *J. pustulata* are thinner, slightly longer, more falcate, and more rugose-pustulate than those of *J. splendens.* The stipule lobes of *J. pustulata* are also larger than those of *J. splendens,* which are only 4–5 mm × 0.8 mm. The inflorescence of *J. splendens* is a short, axillary, and generally unbranched raceme, while that of *J. pustulata* is a terminal panicle 35–40 cm long. The petals and staminal tube of *J. splendens* are larger and more showy than those of *J. pustulata*; both these species have yellow petals, however, a character known elsewhere in the genus only in *J. quinquangulata* Ducke.

Jacqueshuberia splendens Stergios & P. E. Berry, sp. nov. TYPE: Venezuela. Amazonas: Municipio Río Negro, arbustales, roca abierta y bosque denso en la vertiente oriental del Macizo Aracamuni, 1°32′N, 65°48′W, aprox. 800 m, Feb. 1981, *O. Huber & E. Medina 5929* (holotype, US; isotype, VEN). Figure 2.

Arbuscula 4-metralis, ramis patentibus; pinnis 49–53-jugatis; foliolis nitentibus, crasse coriaceis, costa venisque obsoletis; stipularum lobis parvis, minus quam 5 mm longis; floribus luteis, magnis, conspicuis, petalis 8–10 mm longis, 4–5 mm latis, tubo stamineo 15–17 mm longo.

Small tree about 4 m tall with a spreading crown; terminal branchlets 5-sulcate, sparsely reddish brown, erect-puberulent to glabrous, surface somewhat verrucate-striate over and among the longitudinal grooves. Stipules paripinnate, reddish brown, short, erect-puberulent, 1 cm long, 5–6-jugate; lobes very minutely, ± appressed-puberulent, 4–5 × 0.8–1 mm, mucronate at apex, coriaceous; midrib distinct on lower surface, raised and dark-colored, invisible on upper surface. Leaf 14–27 cm long, compoundly bipinnate, 2.5 mm thick at base of petiole, attenuating to 1 mm thick at leaf apex; rachis rounded-canaliculate adaxially; petiole 2.5 cm long; interpinnal segments 8–11 mm long, minutely ferrugineous-tomentulose; pinnae 15–18-paired, opposite, 5.5–8 cm long, the longer pinnae at leaf midpoint; leaflets 49–53-jugate, opposite along rachis, mature leaflets glabrous and notably lustrous, younger leaflets and those of apical pinnae often loosely pilose at or near the apex, with a minute tuft of hairs right at the tip, thick-coriaceous, with rounded margins and a concave center-depression on the upper surface, ± smooth and notably globulate on both surfaces, 8–9 × 1.5 mm, obliquely inequilateral, somewhat falcate, apex acute; venation not visible, except midrib faintly on lower surface. Inflorescence an axillary raceme or panicle 11–15 cm long, minutely puberulent or nearly glabrous, flowers 15–20 per raceme, clustered near tips, verticillate, 3–4 pedicels arising from approximately the same point; pedicels 8–12 mm long, red-brown, tomentulose, generally straight-ascending; bracts minutely foliar, 7–8 mm long, 4–5-jugate, minutely puberulent; bracteal lobes 4–5 × 0.5 mm. Hypanthium light green, cupular-campanulate, 3.5 mm long × 4.5–5 mm wide at the top, reddish brown puberulent to nearly glabrous; sepals broadly ovate, 6 × 5 mm, lightly puberulent on outer surface, sometimes minutely ciliolulate on apical margins; petals showy, intense pale yellow, 8–10 × 4–5 mm, persistent, somewhat cucullate; staminal tube 15–17 mm long, lightly la-

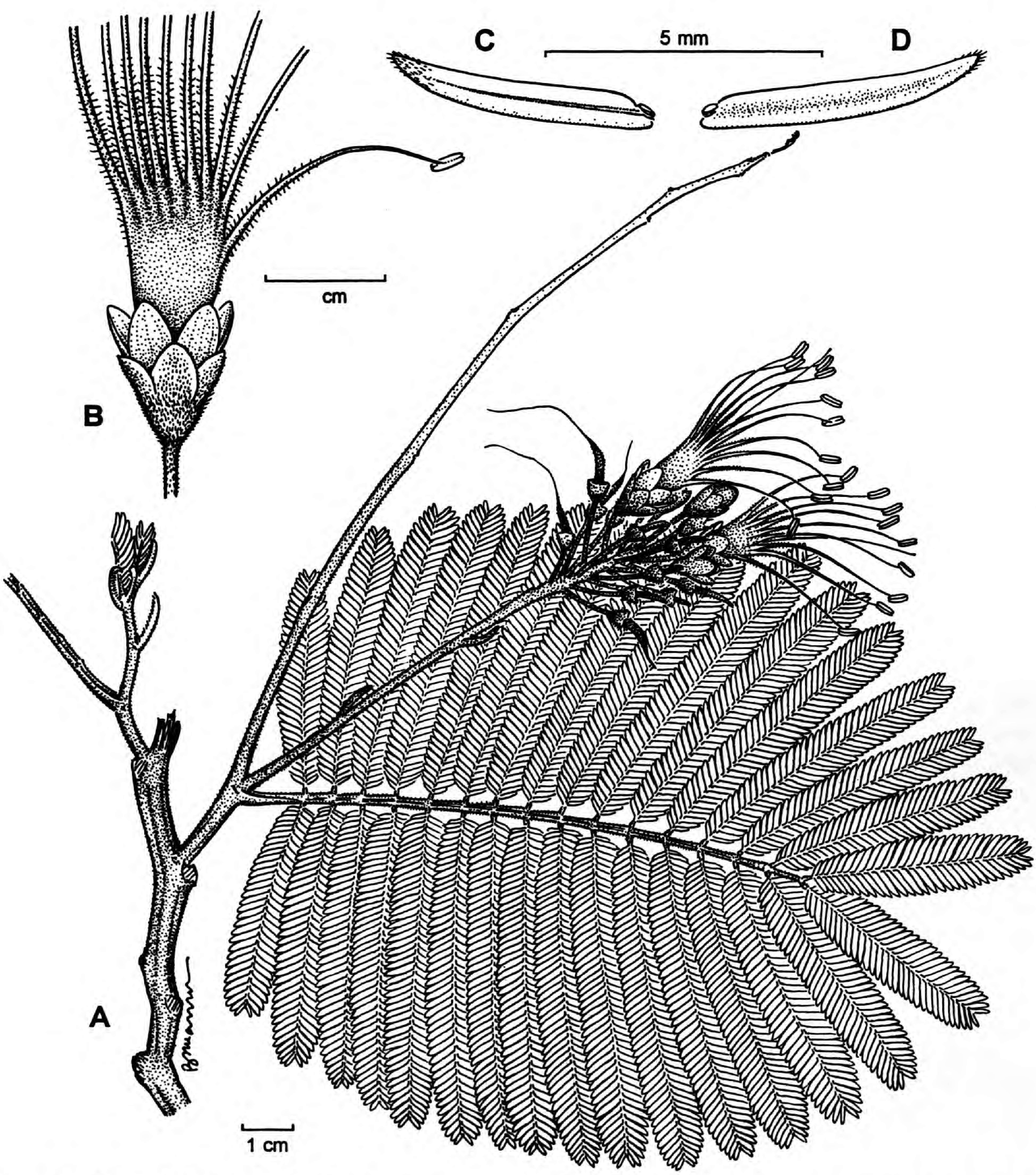

Figure 2. *Jacqueshuberia splendens* Stergios & P. E. Berry. —A. Habit. —B. Flower showing only the lower part of stamens. —C. Underside of leaflet. —D. Upper side of leaflet. Based on *Huber & Medina 5929.*

nate-villose around the base of the filaments, practically glabrous toward the base of the tube; stamens 10, the distal 2 originating lower down on the tube than the other 8, the free portion 20–25 mm long, with some scattered, villous hairs to about halfway toward the apex, then becoming glabrous; anthers bright yellow, 3.5 × 1.5 mm, apically truncate; ovary cinnamon-tomentulose, 6–7 mm long, stipe 2.5 mm; style 22–26 mm long, glabrous; ovules 20–21. Pods not seen.

Distribution and ecology. Frequent along edge of stream in open, rocky shrubland and adjacent low forest on the eastern slopes of Cerro Aracamuni, a sandstone mountain ("tepui") in southern Venezuelan Amazonas state, at about 800 m elevation.

Jacqueshuberia splendens can be distinguished by the glossy sheen of the foliage and by the coriaceous, smooth leaflets with only the lower surface midrib visible. It is also characterized by its bright yellow flowers grouped toward the apex of the raceme on straight-ascending pedicels. Also notable is the insertion of two of the filaments lower down on the staminal tube.

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Contributions to South American Caesalpiniaceae. II. A Taxonomic Update of *Campsiandra* (Caesalpinieae)

Basil Stergios
BioCentro, UNELLEZ, Mesa de Cavacas, Edo. Portuguesa, Venezuela 3323

ABSTRACT. The little-known tropical South American genus *Campsiandra* (Caesalpiniaceae), distributed throughout the Amazon basin and to the north into the Orinoco basin of Venezuela and the Esequibo–Carantijn basins of Guyana and Surinam, has been under revisionary study by the author since 1982. Intensive field exploration, especially in the Venezuelan Guayana, and herbarium work, including examination of all type specimens and their duplicates, have enabled the definition of 14 new species: *Campsiandra aymardii, C. casiquiarensis, C. chigo-montero, C. curaara, C. emonensis, C. ferruginea, C. gomez-alvareziana, C. guayanensis, C. implexicaulis, C. nutans, C. pasibensis, C. steyermarkiana, C. taphornii,* and *C. velutina*; 3 varieties: *C. gomez-alvareziana* var. *pusilliflora, C. macrocarpa* var. *alveolata,* and *C. macrocarpa* var. *grandifolia*; 2 taxa at new statuses: *C. angustifolia* var. *rosea* and *C. comosa* var. *surinamensis*; and the reinstatement of *C. laurifolia* Bentham to species level. A lectotype is designated from the syntypes of *C. comosa* Bentham. Relationships among related species are discussed, and a key is provided to distinguish the known taxa.

RESUMEN. El género tropical suramericano poco conocido *Campsiandra* (Caesalpiniaceae), distribuido de manera inconstante y con cierto endemismo a través de la cuenca amazónica, y hacia el norte en las cuencas del Orinoco de Venezuela y la Essequibo–Carantijn de Guyana y Surinam, ha sido objeto de estudios de revisión taxonómica por el autor desde 1982. La exploración intensiva de campo, sobre todo en la Guayana venezolana y trabajo de herbario, al incluir todas las muestras tipos, durante este lapso ha permitido la definición de 14 especies nuevas: *Campsiandra aymardii, C. casiquiarensis, C. chigo-montero, C. curaara, C. emonensis, C. ferruginea, C. gomez-alvareziana, C. guayanensis, C. implexicaulis, C. nutans, C. pasibensis, C. steyermarkiana, C. taphornii,* and *C. velutina*; 3 variedades: *C. gomez-alvareziana* var. *pusilliflora, C. macrocarpa* var. *alveolata,* and *C. macrocarpa* var. *grandifolia*; 2 estados nuevos: *C. angustifolia* var. *rosea* and *C. comosa* var. *surinamensis*; y la redefinición a nivel de especie de *C. laurifolia* Bentham. Se designa el lectótipo de los síntipos de *C. comosa* Bentham. Se discuten las relaciones entre las especies relacionadas, y se presenta una clave descriptiva con fines de distinguir entre los taxa reconocidos.

Richard Cowan's (1953, 1958) preliminary studies with *Campsiandra,* in which he had to contend with a limited number of herbarium specimens available and the absence of most of the type collections, nevertheless enabled him to define in an organized manner the then-known taxa (2 species and 1 variety: *C. comosa* Bentham, *C. angustifolia* Spruce ex Bentham, *C. comosa* var. *laurifolia* (Bentham) Cowan), and to describe a new species, *C. macrocarpa* Cowan. Since Cowan's (1958) work, the genus has remained in relative obscurity. Meanwhile, collections have been accumulating through various botanical explorations in the Amazon basin countries, principally Brazil. Most of these specimens have remained incorrectly or poorly identified.

A renewed interest in *Campsiandra* was created by efforts at the UNELLEZ in Guanare, Venezuela, to determine details of the use of its seeds by native Amerindians to make a crude flour for food. This attribute was first observed by Humboldt (1834) during his voyage to the Orinoco at the turn of the 19th century, and later noted by the European naturalist A. Ernst, who resided in Venezuela during the late 1800s (Bruni Celi, 1986). After having obtained a sample of the flour in 1872, Ernst wrote in a letter to Kew in 1886, "I had a kind of little tart made here in my house; but I must confess that I found its taste rather indifferent and somewhat mouldy." Today, only the Pumé Amerindian group of the Capanaparo–Cinaruco river complex in Apure State, Venezuela, still rely to a great degree on these "chiga" (pronounced: *chee-gah*) tree (*C. implexicaulis,* sp. nov., and the much less dominant *C. angustifolia*) seeds for part of their diet (Stergios, 1993).

In addition to the ethnobotanical aspect, work was also begun on taxonomic and distributional studies, since field quests in search of *Campsian-*

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dra along the Orinoco tributaries and into remote Amazonia soon revealed that a distinct species diversity within the genus did indeed exist, and that this diversity was related to such natural habitat conditions as black- versus white-water, and riverine versus high bank or alluvial plain environments. Also, as in other Amazonian Caesalpiniaceae, a high degree of endemism is evident, especially among the black-water species. After more than 13 years of pursuit and study, backed by extensive field observations and collections and the availability of a complete array of type specimen material, it is possible to define and describe here the following new species and varieties. In addition, a new combination and status novum are presented, namely, *C. angustifolia* var. *rosea* (Poeppig) Stergios and *C. comosa* var. *surinamensis* (Kleinhans) Stergios, and *C. laurifolia* is reinstated to species level.

KEY TO THE SPECIES OF *CAMPSIANDRA*

1\. Leaflets with some form of minute, readily observable pubescence, at least on lower surface, chartaceous, coriaceous to cartilaginous; stamens 15–17; flowers actinomorphic, persistent, showy; low to medium-sized riparian or swamp-forest trees, 8–10(–15) m tall, with rounded, rather low-set crowns . . 2

1\. Leaflets glabrous, lustrous on both surfaces, generally notably coriaceous; stamens 10–13(14–15 in *C. comosa*); flowers regular to zygomorphic, either inconspicuous and often caducous in rather small, compact, top-crown inflorescences on erect trees 20–35 m tall on alluvial plains, or else conspicuous and persistent on non-flooded high-bank, riparian trees 10–15 m tall 18

2(1). Leaflets appressed-puberulent, tomentose to arcuate pubescent, ± chartaceous with straight margins; calyx tube 2–6 × 2–4 mm; petals 6–9 × 3–6.5 mm; white-water and mixed-water, riparian and seasonally flooded habitats 3

2\. Leaflets erect-puberulent or velutinous, erect-pilose or uncinate pubescent, or with perpendicular, fine hairs flexed at the tip, notably coriaceous with somewhat to pronounced revolute margins; calyx tube 8–12 × 4–8 mm; petals 6–7 mm to 2 cm long, showy; generally in black-water riparian and swamp-forest habitats 11

3(2). Upper surface of leaflets glabrous and lustrous, lower surface appressed-puberulent and without a dull, waxy coating; anthers dorsally glabrous; wood whitish or cream-colored when dried (*C. angustifolia*) 4

3\. Upper and lower leaflet surfaces appressed- or arcuate-puberulent, lower surface with or without some degree of a dull, waxy coating; anthers pilose on upper surface; wood pinkish when dried 5

4(3). Leaflets narrowly oblong-elliptic to lanceolate, 9–14 × 2.5(–3) cm; flowers small, calyx tube 2.5(–3) × 2(–2.5) mm, petals 6–7 × 3 mm, margins minutely ciliate-puberulent near apex less than ½-distance to base; pistil frequently aborting with a short, nonexserted style . . . . *C. angustifolia* var. *angustifolia*

4\. Leaflets narrowly oblong, 7–9 × 2–2.5 cm, sometimes appressed-puberulent on upper midvein near base of leaflet; flowers larger, calyx tube 5 × 4 mm, petals 10–11 × 6–6.5 mm, margins notably ciliate-puberulent nearly to the base; pistil almost always fertile . . . . 1. *C. angustifolia* var. *rosea*

5(3). Flowers notably small, calyx tube 2.5–3 × 2.5 mm, petals 7–7.5 × 3–4.5 mm, sepals valvate or separated by minute sinuses at the base at anthesis; petiole wing terminating 2.5–3 cm below first pair of leaflets . . . . 14. *C. laurifolia*

5\. Flowers larger than the above, calyx tube 5–7 × 2(4–5) mm, petals 0.8–1.4 cm × 4–6 mm, sepals distinctly imbricate at the base at anthesis; petiole wing extending up to first pair of leaflets 6

6(5). Leaflets completely nitid below or dull waxy coating restricted to near midvein, apex ± retuse-mucronate; lower midvein rounded to ovate, not ridged 7

6\. Leaflets with a dull, waxy coating on undersurface, apex rounded to minutely apiculate-mucronate; lower midvein distinctly trigonous with a raised, narrowing ridge 9

7(6). Sepals only sparsely appressed-puberulent on outer surface with a distinct, broad, glabrous band around apical margin, broadly ovate, 3.5 × 3.5 mm; calyx tube 4.5 mm wide at the top (base of sepals); leaflets oblong to oblong-elliptic, 10–12 × 3–4 cm, mostly sparsely appressed-puberulent on a smooth upper surface with only secondary veins somewhat visible; mid and secondary veins same color as leaflet or lighter in color; petals 12–14 × 8–9 mm; pedicels 1–1.5 cm long; riparian trees with multiple, overhanging trunks . . . . 13. *C. implexicaulis*

7\. Sepals completely and densely appressed-puberulent or velutinous-tomentose on outer surface, ovate, 3 × 2.5–3.5 mm; calyx tube 3–3.5 mm broad at base of lobes; leaflets broadly oblong-elliptic to more narrowly oblong, 14–16 × 3.5–5 cm, moderately to densely pubescent on upper surface with veinlets notably visible in dried specimens; midvein on lower surface tinged dark red-purple and distinct from leaflet color in dried specimens; petals less than 1 cm long, 4–6 mm wide; pedicels 5–10 mm long; swamp forest or embankment trees with generally erect trunks 8

8(7). Leaflets broadly oblong-elliptic, 14–16 × 4–5.5 cm, somewhat coriaceous, arcuate-puberulent above, copiously succulent-ferrugineous-puberulent below; venation on lower leaflet surface areolate-reticulate, patchworked with scattered, ferrugineous-orange blotches; pulvinus thickly rugose-pluriangulate, 7 × 4–5 mm; sepals broadly ovate, 3 × 3 mm wide, auriculately imbricate at base;

calyx tube and pedicels densely ferrugineous-tomentose; pods large, more than 40 cm long; epidermal dots on lower leaflet surface not readily visible . . . . 9. *C. ferruginea*

8. Leaflets narrowly oblong, 15–16 × 3.5–4 cm, somewhat falcate and inaequilateral, chartaceous, appressed-pubescent above and puberulent below; venation on lower leaflet surface favoso-reticulate; pulvinus warty-rugose, 4 × 3 mm; sepals ovate, 3 × 2.5 mm, straight-imbricate at base; calyx tube and pedicels only sparsely appressed-puberulent; pods less than 30 cm long; epidermal dots on lower leaflet surface prominent, sometimes dark-colored . . . . 21. *C. taphornii*

9(6). Calyx tube cupular, rounded, as long as wide (4 × 4 mm); pedicel articulation right at base of calyx tube; leaflets (11–)13–15, narrowly elliptic, 12–14 × 2.5–3.5 cm, somewhat coriaceous, villous-tomentose below, more whitish-pilosulous above; maturing pods greenish rose-pink . . . . 8. *C. emonensis*

9. Calyx tube cupular-campanulate to tubular, longer than wide; pedicel articulation 1.5–3 mm below base of calyx tube; leaflets 9(–11) or fewer, more broadly elliptic to oblong-lanceolate, (14–)15–20 × 2–5 cm, chartaceous, appressed-pubescent at least on lower surface; maturing pods light to yellow-green 10

10(9). Leaflets oblong-lanceolate, 13–14 × 2–3 cm, only sparsely appressed-puberulent on upper surface with scattered, disoriented, whitish hairs; tertiary venation broadly and smoothly areolate above; pedicels caducous-prone, drooping, 1.4–2.5 cm long; calyx tube cupular-campanulate, 4–5 × 3–4 mm; petal margins only sparsely ciliolate; stamens tortuous, filaments notably bulbous at the base, 2.5–3.5 cm long; leaves 12–22 cm long . . . . 18. *C. nutans*

10. Leaflets 14–20 × 4.5–5 cm, noticeably appressed-puberulent above with brownish hairs mostly oriented away from midvein toward the margins; venation rugose-reticulate on upper surface with tertiary and quarternary veinlets prominent and cobwebby; pedicels 6–8 mm long, mostly straight-ascending, persistent; calyx tube tubular, 6–7 × 2 mm; petal margins copiously ciliate-pubescent; stamens showy and mostly straight, 5.5–6.5 cm long, filaments not bulbous at the base; leaves 19–24 cm long . . 2. *C. aymardii*

11(2). Calyx tube 10–12 × 5–8 mm; petals 1.8–2 cm × 6–8 mm; leaflets oblong-elliptic, notably coriaceous with distinctly revolute margins, strongly veined (*C. macrocarpa*) . . . 12

11. Calyx tube 4–10 × 3–6 mm; petals less than 1.5–1.8 cm long; leaflets more narrowly oblong or oblong-lanceolate, thick chartaceous to moderately coriaceous, margins mostly flat or straight, not notably revolute 14

12(11). Leaves at least 25–30 cm long; leaflets 17–19 × 5–6 cm, narrowly retuse-mucronate; pods 9–12 cm wide . . . . 17. *C. macrocarpa* var. *grandifolia*

12. Leaves 10–17 cm long; leaflets 8–13 × 2–4 cm, widely obtuse-mucronate; pods less than 8 cm wide 13

13(12). Leaflets strongly coriaceous, distinctly shiny, both surfaces but primarily the lower one prominently alveolate by readily visible quinary veinlets, the lower surface without a dull, waxy coating, epidermal dots prominent; margins abruptly and uniformly revolute; apex long obtuse-mucronate, tip 16–18 mm . . . . 16. *C. macrocarpa* var. *alveolata*

13. Leaflets moderately coriaceous, the upper surfaces moderately reticulate, the lower one with venation less prominent, the quarternary veinlets forming broad areoles, the lower surface dull, with a reddish, waxy epidermal coating, epidermal dots hidden; margins moderately and unevenly revolute; apex short obtuse-mucronate, tip 8–10 mm . . . . 15. *C. macrocarpa* var. *macrocarpa*

14(11). Upper surface of leaflets drooping or uncinate, scattered, long-pilose pubescent, or with scattered, inclined and tortuous, whitish hairs; calyx tube moderately to densely appressed-tomentose; anthers pilose on both surfaces 15

14. Upper surface of leaflets uniformly short and erect-puberulent or tomentose, the hairs rather cinnamon-colored; calyx tube with erect hairs perpendicular to tube; anthers dorsally glabrous 16

15(14). Leaflets oblong-lanceolate, 15–20 × 3–4 cm, drooping or hanging from the branch as though wilted; upper surface drooping or uncinate-pilose pubescent; pedicels more than 2 cm long; calyx tube only sparsely puberulent; anthers loosely but evenly pilose over entire ventral surface; stigma bulging below widened tip; perianth persistent during development of young fruit; mature pods 40–50 cm long . . . . 7. *C. curaara*

15. Leaflets oblong-elliptic, less than 15 cm long, horizontal rather than drooping on branch; upper surface with irregularly scattered, inclined or tortuous hairs or nearly glabrous; pedicels less than 1 cm long; calyx tube thickly cinnamon-tomentose; anthers pilose on one side of filament insertion only, glabrous on other side; stigma straight funnel-shaped below tip; perianth usually caducous after anthesis; mature pods 23–28 cm long . . . . 12. *C. guayanensis*

16(14). Lower surface of leaflets lustrous, dull, waxy coating not evident; midvein distinctly rose-red in dried specimens; calyx tube cuneate or shortly angustate at the base, pedicel articulation erect with the axis; sepals densely tomentose throughout, glabrous apical band not evident; fruits notably straight, less than 4.5 cm wide . . . . *C. wurdackiana* ined.

16. Lower surface of leaflets with distinct waxy epidermal coating; midvein same color as leaflet or lighter in color in dried specimens; calyx tube notably oblique at the base, the pedicel articulating at an angle from the perpendicular; sepals sometimes with a glabrous band along at least a part of the outer apical

margin; pods somewhat falcate, 5–9 cm wide 17

17(16). Leaf rachis 23–25 cm long; leaflets 16–20 × 6–7 cm, coriaceous and felt-like to the touch, broadly subopposite, 5–10 mm between leaflets of a pair; panicle racemes stoutly 3–5-branched; calyx tube 8–10 mm long; petals 15–18 × 7–8 mm; pedicels articulating 2 mm below base of calyx tube; pods 30–32 × 5–5.5 cm . . . . 22. *C. velutina*

17. Leaf rachis 12–15 cm; leaflets 8–12 × 2–3 cm, ± chartaceous and smooth to the touch, practically opposite, 1–2 mm distance between leaflets of a pair; panicle racemes only occasionally short-branched or not at all; calyx tube 4–4.5 mm long; petals 8–10 × 6 mm; pedicels articulating right at base of calyx tube; pods 35–40 × 7–9 cm . . . . 19. *C. pasibensis*

18(1). Flowers zygomorphic, lower 2 petals recurved, upper 3 hooded or revolute; stamens usually 10, octodynamous; tall, alluvial plain canopy trees 20–35 m tall, usually not flowering every year, and then only for a week or less 19

18. Flowers actinomorphic; petals all recurved, straight and hooded at apex or rotate; stamens 11–13 or 15, regular, equal; varzea and riparian trees, 15–20 m tall, flowering yearly for periods of 2 weeks or more 20

19(18). Panicle open and spreading, lateral branches 7–12 cm long; flowers moderately small, calyx tube tubular, 4–5 × 2.5 mm, petals oblong-cuneate, narrowing gradually to the base, 10 × 5 mm; leaflets oblong-lanceolate, 10–12 × 3–4 cm . . . . 10. *C. gomez-alvareziana* var. *gomez-alvareziana*

19. Panicle smaller, more contracted, lateral branches 1.5–2 cm long; flowers notably smaller, calyx tube cupular, 2 × 2.5 mm, petals elliptic, shortly attenuate, 7 × 4.5 mm; leaflets oblong-elliptic, 10–12 × 4–4.5 cm . . 11. *C. gomez-alvareziana* var. *pusilliflora*

20(18). Flowers numerous, small, densely compacted into a ± reniform, head-like, thick panicle, about 7 × 9 cm; petals uniformly recurved, thick-carnose, 9–10 × 3.5–4 mm; stamens thin, tortuous; leaflets very firm, coriaceous-cartilaginous, keeled when fresh . . . . 20. *C. steyermarkiana*

20. Flowers larger, in open, showy, ovate-elliptical panicles 12–14 cm long, 14–17 cm wide, lateral branches easily visible, not hidden by dense flowers; petals straight-ascending or rotate, not recurved, 8–12(–13) × 3.5–5(–6) mm, membranous except for some thickening at the center; stamens generally straight, not tortuous; leaflets less coriaceous, applanate 21

21(20). Flowers rotate at anthesis; mature petals blotched with a rose color, 8 × 3.5 mm; calyx tube 2.5 × 2 mm; sepals 2 × 1.5 mm; upper surface of leaflets prominently venulose . . . . 3. *C. casiquiarensis*

21. Flowers cupular at anthesis; mature petals white, 12–13 × 5–6 mm; calyx tube 3–5 × 2–4.5 mm; sepals 2.5–3.5 × 1.5–3 mm; upper surface of leaflets generally smooth except for midvein, mostly only secondary veins somewhat notable 22

22(21). Stamens 15; pedicels 12–16 mm long; calyx tube 4.5–5 × 4–4.5 mm, very sparsely puberulent to nearly glabrous; sepals ovate-obtuse to ovate-triangular, 3.5 × 3 mm; petioles short-winged, applanate distally with thickened margins, not revolute, glabrous; pod 30–34 × 5–6 cm . . . . 5. *C. comosa*

22. Stamens 11–12(–13); pedicels 7–8 mm long; calyx tube 3–3.5 × 2–2.5 mm, more notably puberulent; sepals ovate-acute, 2.5–3 × 1.5 mm, more puberulent than the tube; petioles revolute-winged distally, notably puberulent; pod 22–25 × 5–5.5 cm . . 4. *C. chigo-montero*

1. Campsiandra angustifolia Spruce ex Bentham var. **rosea** (Poeppig & Endlicher) Stergios, stat. nov. Basionym: *Campsiandra rosea* Poeppig & Endlicher, Nov. Gen. et Sp. Pl. III 62, t. r. 68. 1845. TYPE: Crescit vulgatissima in litore lacus Egensis in Brasilia boreali, Sep. 1832, *E. Poeppig 2505* (holotype, NY; isotype, W).

Originally described by Poeppig and Endlicher from a flooded lake shore in northern Brazilian Amazonia in 1845, *C. rosea* was later treated as a synonym of *C. laurifolia* by Bentham (Mart. Fl. Bras. 15(2): 54, 1870). Even Poeppig was unsure of its status in his original paper, and it was not mentioned by Cowan (1953) in his treatment of *Campsiandra.* Upon study of the two type specimens and other recent collections from the Venezuelan Guayana, *C. rosea* can now be considered a variety of *C. angustifolia,* primarily because of the consistently nitid, glabrous condition of the upper surface of the leaflets, and the lack of a dull, waxy epidermal coating on the lower surface. The anthers are glabrous dorsally as in *C. angustifolia,* and the wood is whitish or cream-colored when dried rather than pinkish, as in *C. laurifolia. Campsiandra angustifolia* var. *rosea* can be distinguished from the type variety by the much smaller, more narrowly oblong leaflets, with some whitish appressed puberulence along the upper midvein, rather than being totally glabrous. The flowers are larger (also unlike *C. laurifolia*), and more like those of *C. implexicaulis* described in this paper. The petals are ciliolulate nearly to the base rather than just around the apical tip, and the pistil is almost always fertile, rather than non-exserted and frequently aborting as in the type variety.

Specimens examined. BRAZIL. **Amazonia:** *Poeppig 2505* (NY, W). VENEZUELA. **Amazonas:** Río Casiquiare, entre la boca y Piedra Guachapita, Nov. 1984, *B. Stergios & G. Aymard 7656* (PORT); Río Pasiba, cerca de la desembocadura con el río Casiquiare, dic. 1984, *B. Ster-*

gios & G. Aymard 7669 & 7688 (PORT); Riberas del río Orinoco, Depto. Atures, Mar. 1986, *C. B. de Rojas et al. 3505* (MY, PORT); Raudal Atures, río Orinoco at Puerto Ayacucho, Apr. 1984, *A. Gentry & B. Stein 46265* (MO, PORT); Río Casiquiare, entre la boca del Pasimoni y El Porvenir, dic. 1984, *B. Stergios & G. Aymard 7618* (PORT); Boca del río Pasiba, con el Casiquiare, Feb. 1989, *B. Stergios, K. Kubitzki, G. Aymard & E. Melguiero 13232* (K, NY, PORT, TFAV, VEN). **Bolívar:** Río Caroní, en el desembocadura del río Claro, Mar. 1988, *D. Taphorn DCT-88-22* (PORT, TFAV).

2. **Campsiandra aymardii** Stergios, sp. nov. TYPE: Venezuela. Amazonas: Depto. Rio Negro, río Emoni (tributary of the lower Siapa), entre Piedra San Antonio y Caño Bocón, 2°10'N, 66°18'W, ca. 150–200 m, Jan. 1987, *B. Stergios & G. Aymard 9979* (holotype, PORT; isotypes, K, MO, NY, US, VEN).

Arbor frutescens, 5–7-metralis; foliolis elongatis, 14(–15)–20 cm longis, 4.5–5 cm latis, oblongo-lanceolatis, supra adpresse brunneo-puberulentis, pilis ad marginem versis; venis primariis rugose reticulatis, venis tertariis quarternariisque conspicuis; calycis tubo cylindrico, 6–7 mm longo, 2 mm lato; petalorum marginibus copiose ciliatis; staminibus rectis, prominentibus, 5.5–6.5 cm longis. Habitat in silvis ripariis secus flumina aquae subnigrae, vel in arenosis prope silvas inundatas.

Shrubby *tree* 5–7 m tall; terminal branchlets minutely whitish-puberulent or glabrous, estipulate. *Leaves* imparipinnate, usually 11-foliolate, 19–24 cm long, minutely whitish-puberulent to glabrous, petiole proper 6–7 cm long, short-revolutely winged up to first pair of leaflets, wings 1 mm wide, rachis shallow-sulcate for its entire length, deepening near and through the nodes; petiolules transversely rugose, minutely puberulent, 2 mm long. *Leaflets* somewhat membranous, easily flexible, opposite near base of leaf, slightly subopposite toward apex, oblong-lanceolate, 14(–15)–20 × 4.5–5 cm, appressed-puberulent on upper surface, with brownish hairs mostly oriented away from midvein toward the margins, uniformly ferrugineous, appressed-puberulent below, apex obtuse-acuminate, tip rounded, base obtuse, lower surface with a dull, waxy coating; venation rugose-reticulate on upper surface with tertiary and quarternary veinlets prominent and arachnoid, midvein on lower surface distinctly trigonous with a raised, narrowing ridge, same color as leaflet blade, secondary veins and veinlets somewhat raised; *inflorescence* a terminal, open and showy panicle of racemes, 16–19 cm broad across the apex, 13–15 cm deep, minutely ferrugineous-puberulent throughout, pedicels straight, 6–8 mm long, with the articulation 1.5–3 mm below base of calyx tube, bracts early-caducous. *Flowers* showy, moderately sized, 1.5–2 cm long at anthesis, bracts caducous, obtuse, 0.5 mm long; calyx tube tubular, 6–7 × 2 mm, uniformly and minutely ferrugineous, appressed, lanate-tomentulose; sepals minutely appressed-tomentulose without except for a glabrous band around the apex, obtuse, 2.5 × 2 mm, imbricate at the base; petals white, extended-cucullate, 5.5 × 7 mm; stamens deep red, showy, filaments straight and extended 5.5–6.5 cm long; anthers sparsely pilose above or glabrous, copiously long-pilose below, 1.8–2 mm long; style glabrous, somewhat narrowly flattened, 5.2–5.4 cm long; stigma praemorsely truncate; ovary glabrous, flattened, 7 mm × 0.8 mm at widest part, stipe 4–5 mm long; ovules 11–13, discoid. Young *pod* flattened, slightly falcate, 21–23 × 5–6 cm.

Distribution and ecology. Endemic to the middle-lower Emoni River, a semi-black-water ("tea"-colored) tributary of the lower Siapa River drainage in southern Venezuelan Amazonia. Low, somewhat spreading, shrubby trees on river-edge sandbars. Known only from type locality.

Campsiandra aymardii can be distinguished primarily by the rather large, herbaceous, oblong-lanceolate leaflets with a distinct rugose-reticulate venation on the upper surface, coupled with a rather narrow, tubular calyx and notably long, extended style and stamen filaments. This species is most closely related to the *C. emonensis–C. nutans* group, also described here, because of the presence of a dull, waxy coating on the undersurface of the leaflets, a rounded to minutely apiculate-mucronate apex, and a distinctly trigonous lower midvein with a raised, narrowing ridge. *Campsiandra aymardii* is similar to the more distant *C. laurifolia,* which has appressed pubescence on both surfaces of the leaflets and anthers with dorsally pilose hairs. It differs from *C. laurifolia* principally by its larger flowers, basally imbricate sepals, and the longer extension of the petiole wing. This species is dedicated to my colleague and long-time field companion, Gerardo Aymard, who has been instrumental in calling attention to, and defining, many new botanical discoveries for South America.

Paratypes. VENEZUELA. Emoni River in southern Amazonia, entre piedra San Antonio y caño Bocón, Jan. 1987, *B. Stergios & G. Aymard 9954* (GUYN, K, NY (fr), PORT (fr), TFAV, US, VEN), Oct. 1986, *B. Stergios & P. Stergios 9661* (NY, PORT, TFAV, VEN), Jan. 1987, *B. Stergios & G. Aymard 9919* (PORT, TFAV).

3. **Campsiandra casiquiarensis** Stergios, sp. nov. TYPE: Venezuela. Amazonas: Límite entre Deptos. Rio Negro y Casiquiare, Casiquiare River at the mouth of Caño Curamoni, 2°40'N, 66°10'W, 130 m, Oct. 1987, *B. Stergios & P. Stergios 11334* (holotype, PORT; isotypes, BM, GUYN, K, LE, MO, NY, PORT, TFAV, US).

Arbor 12–15-metralis; foliolis complanatis, glabris, nitentibus, supra prominenter venulosis; floribus sub anthesi rotatis, petalis membranaceis, ex laete-dense roseis, 8 mm longis, 3.5 mm latis, calycis tubo 2.5 mm longo, 2 mm lato, lobis 2 mm longis, 1.5 mm latis.

Habitat endemica secus flumina aquae nigrae in Amazonia venezuelana.

Erect *tree* 12–15 m tall; branchlets with longitudinally ribbed-rugose bark, glabrous. *Leaves* imparipinnate, 9–11-foliolate, the leaflets increasingly subopposite from base to apex, lower pair directly opposite, 11–13 cm long near the inflorescences, petiole minutely appressed-puberulent, 2.5–3.5 cm long, narrowly winged, the wings on the lower half involute-perpendicular, then turning abruptly revolute on the distal half; rachis only slightly adaxially canaliculate, very minutely whitish-puberulent to glabrous, red-black in color when dried; petiolules transversely rugose, glabrous, 3 × 1.5 mm. *Leaflets* generally coriaceous, flat, oblong, obtuse-mucronate with rounded tip, glabrous and nitid, mid-rachis leaflets 9.5–11.5 × 3–3.5 cm, slightly larger at leaf apex; upper surface smooth to venulose-reticulate, midvein sunken, dark red in color when dried, lower surface more notably raised-venulate, the quarternary veinlets forming closed areoles. *Inflorescence* a somewhat irregularly shaped, leaved, terminal, racemed panicle of small, densely clustered flowers, minutely ferrugineous-tomentulose; pedicels mostly straight-ascending, 6–7 mm long. *Flowers* actinomorphic, somewhat inconspicuous, about 7 mm long in anthesis; bracts minute, obtuse, tomentulose, 0.5 mm long, caducous; calyx tube swollen-cupular, 2.5 × 2 mm, sparsely appressed-puberulent; sepals obtuse-cucullate, more densely tomentulose than the tube, glabrous within, 2 × 1.5 mm; petals rotate at anthesis, tinted and blotched with a deep rose color, 8 × 3.5 mm, margin almost entirely ciliolate; stamens mostly 11, filaments straight, 2.5–2.8 cm long; anthers dorsally glabrous, pilosulose below, 0.8–1 mm × 0.5 mm; ovary applanate, 7 × 1 mm, glabrous; stipe 4–5 mm long; style 2.4–2.5 cm long; ovules 10–11, discoid. *Pod* flattened, somewhat undulate, falcate, 31–34 × 6–7 cm.

Distribution and ecology. Restricted to the upper Casiquiare River, in particular near or at the mouths of black-water tributaries (caño Curamoni) in southern Venezuelan Amazonia. Riparian blackwater swamp forests, near the mixed-water Casiquiare River main flow. Presently known only from the type locality. Common name: *chigo montero de rebalse.*

Campsiandra casiquiarensis is distinguished by the semi-coriaceous, oblong, ventrally venulous leaflets coupled with the very small, rotate, rose-blotched flowers and short-tubular, center-bulged calyx tube. This species belongs to a group consisting of four rather tall, straight, and robust species: *C. casiquiarensis, C. chigo-montero, C. gomez-alvareziana,* and *C. steyermarkiana,* all with generally lustrous, glabrous, coriaceous leaflets, 10–13 stamens, and very small, often caducous flowers. Among these, *C. casiquiarensis* is most akin to *C. steyermarkiana* and *C. chigo-montero* as swamp-forest, riparian trees, with actinomorphic, generally persistent flowers and 11–13 stamens. *Campsiandra steyermarkiana* and *C. chigo-montero* are more consistently flowering and for longer periods of time. *Campsiandra casiquiarensis* differs from *C. steyermarkiana* in the applanate, less coriaceous leaflets, larger flowers in more open, ovate-elliptical panicles, thinner, extended petals and relatively straight filaments. It differs from *C. chigo-montero* in the rotate, rose-colored petals, smaller calyx and more notably venulate condition of the upper leaflet surface. Collectively, the forementioned group of four species are rather distantly related to *C. comosa* (localized in Guyana and Surinam) in the generally glabrous, more or less coriaceous condition of the leaflets; the group differs markedly in the much smaller flowers, irregular in the case of *C. gomez-alvareziana,* fewer stamens (10 and octadynamous for *C. gomez-alvareziana*), and smaller leaflets.

Paratypes. VENEZUELA. **Amazonas:** Same tree as holotype, but fruiting, Feb. 1989, *B. Stergios, K. Kubitzki, G. Aymard & E. Melguiero 13224* (K, PORT, VEN); selvas pluviales ribereñas del Alto Casiquiare entre el caño Dorotamoni y la boca del río Pamoni, Sep. 1987, *B. Stergios & P. Stergios 11335* (BM, GUYN, K, LE, MO, NY, PORT, US, VEN).

4. Campsiandra chigo-montero Stergios, sp. nov. TYPE: Venezuela. Amazonas: Límite entre Deptos. Casiquiare y Río Negro, Río Casiquiare, entre El Mango y El Porvenir, 2°0′N, 66°30′W, 150 m, Sep. 1986, *B. Stergios, P. Stergios & P. Cardozo 9374* (holotype, PORT; isotypes, BM, K, LE, MO, NY, INPA, GUYN, TFAV, US, VEN). Figure 1A.

Arbor erecta, 8–12-metralis, ramis nutantibus; foliolis coriaceis glabris, nitentibus; paniculis conspicuis, floribus cupulosis persistentibus confertis; petalis albis, 12–13 mm longis, 5–6 mm latis, actinomorphis; staminibus 11–12(–13), erectis.

Habitat secus flumina aquae clarae.

Straight, erect *tree* 8–12 m tall; crowns ovoid-oblong and drooping; terminal branchlets rusty-brown in color, mostly glabrous, but occasionally

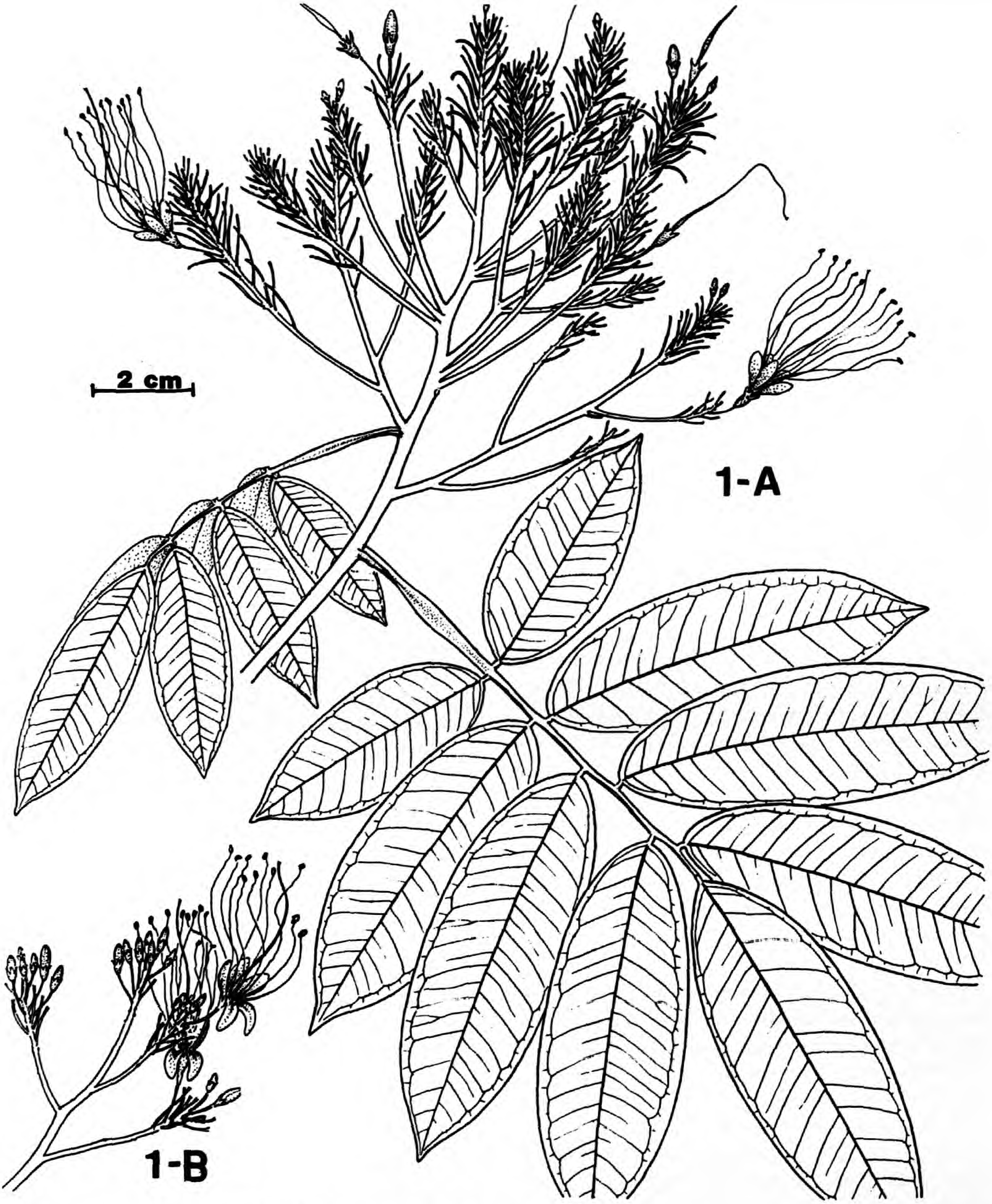

Figure 1. —A. *Campsiandra chigo-montero* Stergios, habit and flower. —B. *Campsiandra gomez-alvareziana* Stergios var. *gomez-alvareziana*, flowers.

with scattered, minute, whitish puberulence, more so on the youngest branches, mostly smooth, but with some occasional longitudinal striations. *Leaves* imparipinnate, usually 9-foliolate, but occasionally 11-foliolate further back from the branch-tips, leaflets closely then more openly (7 mm) subopposite along rachis, 11–14 cm long near the inflorescences, only minutely whitish appressed-puberulent to glabrescent; petiole 3.5–4 cm long, involute-revolutely winged as in *C. casiquiarensis*; rachis canaliculate to sulcate adaxially, becoming almost flattened toward the petiole; petiolules transversely rugose, tomentulose, 2.5 mm long, 1.5–1.8 mm wide. *Leaflets* mostly elliptic, oblong-elliptic, obtuse-mucronate, minutely pointed-apiculate, 8.5–10.5(–11) × 3.5–4 cm, glabrous and nitid, coriaceous, mostly smooth to globulate on upper surface, upper midvein only slightly sunken and same color as blade, lower suface openly and shallowy favoso-reticulate with raised secondary and quarternary veins branching from a prominent midvein. *Inflorescence* a terminal, rather densely flowered, usually showy panicle of racemes, minutely rusty-tomentulous-puberulent, efoliate; pedicels rather densely aggregated near the apical portion of raceme, 7–8 mm long, usually ± straight-ascending, but sometimes the lower ones nodding near the tip. *Flowers* actinomorphic, persistent, somewhat showy, 1–1.3 cm long at anthesis; bracts oblong-lanceolate, acuminate, cucullate, 1.5 × 0.8 mm, appressed-tomentulose without, glabrous within; calyx tube tubular-campanulate, 3–3.5 × 2.5 mm, uniformly minute-puberulent; sepals ovate-acute but with a rounded apex, 2.5–3 × 1.5 mm, appressed-tomentulose, without, but with a rather distinct, dark red glabrous band around apical margin; petals white, cupular, ascending, 12–13 × 5–6 mm, margins very minutely ciliolulate to glabrescent; stamens 11–12(–13), equal, filaments ± straight at anthesis, 2.0–2.2 cm long; anthers glabrous above, pilosulose below, 1.5 × 0.8 mm; ovary 8–10 × 1.5 mm, compressed with rounded margins and concave, longitudinal furrows on both surfaces; stipe 3–3.5 mm long; style glabrous, 2.4–2.5 cm long; stigma flat-truncate; ovules 10–11, discoid. *Pod* applanate with wavy margins, falcate, 22–25 × 5–5.5 cm.

Distribution and ecology. Primarily white-water, riparian embankment habitats, suspended some height above the river's edge. Rather cosmopolitan in the Casiquiare, Siapa, and upper Orinoco watersheds of Venezuelan Amazonia; also in Brazilian Amazonia and Bolivia (río Abuná). Common names: Venezuela: *chigo montero*; Brazil: *capurana de varzea*; *acapuraná.*

Campsiandra chigo-montero is similar to *C. steyermarkiana* and *C. casiquiarensis* because of the small, actinomorphic flowers that are produced every year for periods of two weeks or more, and the regular, equal, 11–13 stamens. Within this group of species, *C. chigo-montero* can be most closely associated with *C. casiquiarensis* with the larger flowers in larger, more open panicles; nonrecurved, more membranous petals; straighter stamens at anthesis; and less coriaceous, more applanate leaflets. *Campsiandra chigo-montero* can be readily distinguished from other related species as already discussed for *C. casiquiarensis.* It also prefers a riparian but higher embankment habitat, rather than the more inundated swamp-forest habitats of *C. casiquiarensis* and *C. steyermarkiana.* Indeed, its common name *chigo-montero* makes reference to this embankment habitat.

Paratypes. BOLIVIA. Río Abuná, July 1992, *L. Vargas 1052* (NY). BRAZIL. **Roraima:** São Luiz do Anauá, km 330, carretera Manaus–Caracaraí, ago. 1987, *Cid Ferreira 9104* (INPA, NY, PORT); Rio Trombetas a montante de Cach. Porteira, ago. 1986, *Cid Ferreira et al. 7966* (INPA, NY, PORT). **Pará:** Rio Tapajós, Santarém, Dec. 1978, *R. Vilbena s.n.* (U); Lago Jacundá, dez. 1991, *L. Ferreira 9* (NY); Santarém, banks of Tapajos, Nov.–Mar., 1849–50 *Spruce 304* (K, TCD); Rio Perauari, cuenca Rio Maués, July 1983, *J. Zarucchi 3035* (K); Rio Madeira, near Tres Casas, Sep.–Oct. 1934, *B. Krukoff 6366* (K); Rio Solimôes, Palmares, Oct. 1936, *B. Krukoff 8436* (K, U); Rio Mapueira arriba del rio Trombetas, May 1974, *D. Campbell P22394* (K); Rio Curuquetê, July 1971, *Prance et al. 14266, 14613* (U); Rio Cururu, May 1977, *N. Rosa 1917* (U); Rio Madeira, Oct. 1923, *J. Kuhlmann 17814* (U). VENEZUELA. Río Orinoco, just below Caño Yapacana, June 1959, *J. Wurdack & L. Adderley 43029* (MO, NY); Caño Tiramoni, tributario del Alto Casiquiare, Feb. 1989, *B. Stergios, K. Kubitzki & G. Aymard 13168* (K, NY, PORT, TFAV, US, VEN); Río Siapa, entre la boca y el Caño Duapo, Sep.–Oct. 1986, *B. Stergios & P. Stergios 9416, 9483* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN); Río Casiquiare, media-vuelta arriba de Piedra Guachapita, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11302* (BM, GUYN, K, LE, MO, MY, NY, PORT, TFAV, US, VEN); Caño Curamoni, tributary of the Upper Casiquiare, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11343* (BM, K, GUYN, MO, NY, PORT, TFAV, US, VEN).

5. **Campsiandra comosa** Bentham, J. Bot. Hook. II. 93. 1840. TYPE: British Guiana. Banks of the Esequibo, sometime between 1837 and 1839, *R. H. Schomburgk 296* (lectotype, selected here, K; isolectotypes, BM, NY, TCD, US, W).

Syntype. Esequibo, 1836, *R. H. Schomburgk 13* (BM, K). Creole name Apicaro; Arowak Ulari Wallaba.

In Bentham's original description of *C. comosa,* he cited two collections by R. H. Schomburgk from British Guiana, Nos. 13 and 296. According to this description, which is general and rather brief, certain details can be interpreted as having been seen from either of the two collections, although some slight but interesting differences exist between them. The overall nature of his description, and what seems most reasonable to define as *C. comosa* Bentham, can better be seen among the specimens of *Schomburgk 296*: the generally fewer leaflets that are glabrous, nitid, and coriaceous and the "thick" (cupulate?) calyx tube. Also, there exist at least six known specimens. Based on these advantages, it seems appropriate to designate this collection as the lectotype of *C. comosa* Bentham var. *comosa.*

However, it must be pointed out that *Schomburgk 13* has a more complete inflorescence, an accompanying pod, and the information on the label was what was cited by Bentham in his publication.

Additional representative specimens examined. BRITISH GUIANA [GUYANA]. 1841, *R. M. Schomburgk 198* (BM); Cauje(?) River, Apr. 1884, *Jenman 1856* (U); Orealla Corontyne River, July 1880, *Jenman 1819* (K), Dec. 1909, *C. Anderson 403* (K); Mazaruni River, Sep. 1880, *G. Jenman 1856?* (K); Demarara River, May 1887, *G. Jenman 3915* (K); Br. Guiana [Guyana] (s.n., s.d.), *Appun. 878* (K); Esequibo River, Sep. 1929, *Sandwith 220* (U); Whymarushi riverside, June 1924, *A. Persaud 31* (K); Demarara River, S of Georgetown, Oct. 1935, *Br. Guiana For. Dept. 2456* (K); Alisili, Demarara River, Aug. 1919, *Hohenkerk 809* (K); Esequibo River by Yakaramare Creek, June 1943, *Br. Guiana [Guyana] For. Dept. 41348* (K); Kuriji Falls, Esequibo River, Aug. 1952, *Br. Guiana [Guyana] For. Dept., JB-17* (U); Mahaicoury River, Mar. 1934, *For. Dept. 364* (K); Esequibo River, between Bartica and Moraballi, July 1960, *A. Watson 22* (K); Captain Creek, Mahaicony River, May 1967, *D. Davis 202* (K); Upper Abay River, Oct. 1981, *B. ter Welle & H. Green 5431* (U); Canje River, W of Digitima Creek, Dec. 1986, *J. Pipoly 9598* (U); Upper Demarara-Berbice, Esequibo, below Kurupukari, Sep. 1990, *T. Mc Dowell 3266* (U); Esequibo River at Karapukari, Potaso-Sipuruni, Apr. 1992, *B. Hoffman 1319* (U).

6. **Campsiandra comosa** Bentham var. **surinamensis** (Kleinhans) Stergios, stat. nov. Basionym: *Campsiandra surinamensis* Kleinhans, Rec. Trav. Bot. Neerl. 22: 406–408. 1925. TYPE: Surinam. Corantijnfluss am Kaboerie Kreek, Nov. 1916, *Stahel & Gonggrijp 2948* (holotype, U; isotype, U).

Campsiandra surinamensis Kleinhans apparently represents a segment of a population of this genus endemic to the Guianas, and in particular, to the south in Surinam. Although *C. surinamensis* was originally described as a species, it was cited by Cowan (1953) as a synonym of *C. comosa* Bentham without comment, and Surinam collections, including the type, were apparently not available for examination at the time. Upon careful study of collections since then, it seems correct to consider *C. surinamensis* a variety of *C. comosa.* Of the collections of *Campsiandra* from the entire Guyana region available to me for study, those from Guyana can be matched with what is now defined as *C. comosa* Bentham var. *comosa,* and a few specimens from parts of the Esequibo can be determined as *C. comosa* var. *surinamensis.* However, collections from Surinam are all comparable to *C. comosa* var. *surinamensis,* which can be distinguished from the type variety by the following key:

1. Leaflets notably coriaceous, areolate-venulate on undersurface to the quinary veinlets; calyx tube tubular-campanulate, 5 × 4 mm; sepals obtuse-triangular, 3.5 × 3 mm, 1 mm wide near apex, cucullate-cymbiform, thickened toward the center; petals oblong-cuneate, obtuse, 11–12 × 5 mm, somewhat thickened, succulent; anthers 1.5–2 mm long; ovary depressed down the center on both sides; pod 8–9 cm wide . . . . *C. comosa* var. *surinamensis*

1′. Leaflets somewhat less coriaceous, more flexible, wider, less notably areolate-venulate on undersurface, quinary veinlets not readily distinguishable; calyx tube cupulate, 4–5 × 4.5 mm; sepals widely obtuse, 2 mm wide near the apex, flattened, not noticably thickened toward the center; petals ovate-obtuse, 9–10 × 5.5–6 mm, membranous; anthers 1 mm long; ovary mostly flat on both sides; pod smaller, 5–6 cm wide . . . . *C. comosa* var. *comosa*

Additional specimens examined. SURINAM. Corantijne, June 1916, *J. Gonggrijp 2280* (U); Opeiland in de Carantijne in de buurt van Wakay, Nov. 1954, *Lindeman 6669* (U, US, VEN). GUYANA. Kurupukari Falls, Esequibo River, no date, *C. Anderson, 403-A* (NY); Moraballi Creek, Lower Esequibo, July 1960, *A. Watson 22* (NY).

7. **Campsiandra curaara** Stergios, sp. nov. TYPE: Venezuela. Amazonas: Raudal Cabarua del Río Casiquiare, entre la boca del Atamoni y 1 km aguas abajo de la Piedra Esterita, abr. 1958, *B. Stergios, G. Aymard & L. Nico 8304* (holotype, PORT; isotypes, K, NY, PORT, TFAV, US).

Arbor 15–20 metralis; foliolis oblongo-lanceolatis, nutantibus, 15–20 cm longis, 3–4 cm latis, supra uncatopilosis; pedicellis ultra 2 cm longis; calycis tubo sparse pulverulento; leguminibus elongatis, 40–50 cm longis.

Habitat in arenis ripariis secus flumina aquae subnegrae in Amazonia venezuelana.

Robust *tree* 15–20 m tall; terminal branchlets with longitudinal, blackish, pointed ribs, bark gray-brown and flaky in between, minutely cinnamon puberulent. *Leaves* imparipinnate, usually 9-foliolate, but occasionally 11-foliolate; the leaflets only slightly (1–3 mm) subopposite along the rachis; petiole 4.5–5 cm long, chartaceously undulate-winged, wings involute for ⅔ the distance, revolute for the rest, dorsally concave, minutely puberulent; rachis dorsally canaliculate with rounded ridges, whitish, erect-puberulent; petiolules finely transversely rugose, interrupted by two longitudinal grooves, one on each side of the petiolule, 4 × 1.5 mm, finely erect-puberulent. *Leaflets* oblong-lanceolate, 15–20 × 3–4 cm, herbaceous to chartaceous, drooping or hanging from the rachis as though wilted, apex obtuse-mucronate, the tip rounded, the base equilateral, obtuse; upper surface smooth to finely reticulately veined, drooping or uncinate-pilose pubescent; lower surface nitid (without waxy epidermal coating), copiously erect, ferrugineous-puberulent, veins not prominent except for the midrib. *Inflorescence* an open, loose, terminal panicle, with 1–2-cm distances between racemes, ferrugineously erect-puberulent; racemes stout, extending nearly perpendicular to the main axis, 8–9 cm long; pedicels straight and directed outward at a 45° angle from the raceme, notably stout, terete, 2.4–3.3 cm long, 1.5–2.5 mm thick, articulating 1 mm below base of calyx tube. *Flowers* somewhat showy, up to 2 cm long at anthesis; bracts early-caducous and not seen; calyx tube tubular-campanulate, 7–8 × 4.5–5 mm, somewhat oblique, bulging along one side, sparsely semierect-puberulent; sepals broadly ovate, roundly obtuse, auriculately imbricate at the base, 4 mm × 4 mm, more notably puberulent than the tube, and the hairs adpressed; petals white, sometimes tinged pink along the center nerves, transversely ovate, 12 × 8 mm, rounded-obtuse and slightly cucullate, margins very minutely ciliolulate, and then only near the apex; stamens 14–15, filaments thin, taeniform right to the base, but attenuating somewhat to the apex, 4.3–4.4 mm long; anthers oblong, 2.5 × 1 mm, loosely pilose, more so on ventral side; ovary compressed, fusiform with rounded margins, flat and smooth, 10 × 2 mm; stipe terete, 8–9 mm long; style taeniform, 5.3–5.5 cm long; stigma campanulately truncate, 1 mm long, 0.5 mm wide at the apex, slightly bulging below the tip; ovules 9, compressed, somewhat hippocrepiform. *Pod* compressed, slightly falcate, 40–50 × 6.5–7 cm, nitid, transversely and smoothly forked-rugose; apex obtuse, faintly mammiform.

Distribution and ecology. Endemic and only occasional in sandy embankment, sandbar, riparian habitats of mixed and semi-black water tributaries of southern Venezuelan Amazonia; 125–170 m.

Campsiandra curaara stands out for the unusual and noticeable drooping growth habit of the leaflets and the robust nature of the tree, an uncommon characteristic for sandy-beach or low-embankment habitats. This species can also be distinguished by the chartaceous nature of the oblong-lanceolate leaflets with uncinate-pilose hairs on the upper surface. These characters, in addition to the flat leaflet margins and much smaller flowers, are instrumental in distinguishing *C. curaara* from *C. macrocarpa* Cowan. In addition, *C. macrocarpa* is almost entirely restricted to black-water, swamp-forest habitats. *Campsiandra curaara* can be further distinguished by the stout and openly spreading nature of the racemes on the panicle and the notably large and stout pedicels; the persistant perianth; the bulging, campanulate stigma; and the notably large pods. Both *C. curaara* and *C. macrocarpa* belong to a clearly defined group of species (the others to be described in this paper) all of which have some form of erect pubescence on the leaflets and parts of the inflorescence. *Campsiandra curaara* can be distinguished from the most closely related species, *C. guayanensis*, by the smaller, more elliptic and coriaceous leaflets with erect-inclined, scattered hairs rather than uncinate, much shorter, more slender pedicels, more thickly tomentose calyx tube, caducous perianth, and smaller pods. The epithet *curaara* is the Yanomamö Indian word for the *Campsiandra* tree. The plant is commonly known among the natives as "chigo duvio."

Paratypes. VENEZUELA. **Amazonas:** Raudal Cabarua del Medio Río Casiquiare, aprox. 1 km aguas abajo de Piedra Esterita, Feb.–Mar. 1986, *B. Stergios & G. Aymard 9102* (same tree as holotype: MO, NY PORT, US, VEN), Sep. 1986, *B. Stergios et al. 9387* (same tree as holotype: PORT), ene. 1987, *B. Stergios et al. 9841* (same tree as holotype: BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN); Medio Río Casiquare, frente a El Porvenir, Feb.–Mar. 1986, *B. Stergios & G. Aymard 7623* (K, NY, PORT); Bajo río Emoni, entre la Laguna y tres vueltas más arriba, Feb.–Mar. 1986, *B. Stergios & G. Aymard 9275* (NY, PORT, TFAV, VEN).

8. **Campsiandra emonensis** Stergios, sp. nov. TYPE: Venezuela. Amazonas: Río Emoni, afluente del río Siapa, ½-día en bongo abajo del caño Bocón, aprox. 2°10′N, 66°17′W, 150 m, ene. 1987, *B. Stergios & G. Aymard 9989* (holotype, PORT; isotypes, K, NY, PORT, VEN).

Arbor 6–10-metralis; foliolis (11–)13(–15), anguste ellipticis, 12–14 cm longis, 2.5–3.5 cm latis, subcoriaceis, subtus villoso-tomentosis, supra pilosioribus; calycis tubo cupulato, rotundato, 4 mm longo, 4 mm lato, pedicelli articulatione exacte ad basin tubi; legumine inmaturo viridi-roseo.

Habitat in silvis ripariis secus flumina aquae nigrae vel in arenosis prope selvas leviter inundatas.

Small to medium-sized *tree* 6–10 m tall, with an irregularly spreading, meandering crown, the lowermost branches often drooping over to nearly touch the ground; branchlets matted-tomentulose, slightly longitudinally pluri-sulcate around the stem. *Leaves* imparipinnate, mostly 13(–15)-foliolate, but sometimes 11-foliolate with leaflets opposite or subtly subopposite but then by only 1 mm or less, 19–24 cm long near the inflorescences, lightly ferrugineous-puberulent; petiole 5.5–7.5 cm long, flattened dorsally and rather inconspicuously chartaceous-winged; rachis flattened dorsally with not-too-prominent lateral ridges or nearly rounded, attenuating notably toward the apex; petiolules broadly transversely rugose, glabrous, 3 × 1.5 mm. *Leaflets* narrowly elliptic, 12–14 × 2.5–3.5 cm, somewhat coriaceous, attenuate at the base, apex obtuse-mucronate, the tip usually rounded, appressed villous-tomentose on lower surface with a dull, waxy coating, more whitish-pilosulous above or nearly glabrous; lower mid-vein trigonous with a raised, narrowing ridge, lightly venulous-reticulate above or nearly smooth, with only secondary veins somewhat evident. *Inflorescence* a rather loose, oblong, terminal panicle of racemes, densely rusty-brown puberulent, sometimes containing several scattered, sessile leaflets; pedicels straight-ascending, 11–13 mm long, articulation right at base of calyx tube or nearly so. *Flowers* usually showy, up to 2 cm long at anthesis; bracts very minute and deciduous, ± globose, 0.4 × 0.25 mm, woolly-tomentose; calyx tube cupular, ± rounded, as long as wide, 4 × 4 mm, sparsely appressed-puberulent; sepals rather broadly obtuse-cucullate, 2 mm long, 2 mm wide at the imbricate base, rather densely coffee-brown, ascending-tomentose without, glabrous within; petals white, ascending-cucullate, 1.3–1.4 cm × 5 mm, margins ciliolulate only around the apex, glabrous along the sides; stamens 15, filaments delicately filiform, intricate-undulate, 4.8–5 cm long; anthers glabrous above, appressed-tomentose below, 2 × 1 mm; ovary applanate, 8–10 × 1.5 mm, fusiform with rounded edges; stipe 8–9 mm long; style 5 cm long; stigma flat-truncate; ovules 9, discoid. *Pod* compressed-falcate, somewhat wavy-margined, 27–31 × 6–7 cm.

Distribution and ecology. Sandy, riparian white-sand beaches, usually bordering low swamp forests. Known only from a limited distribution within black- or semi-black-water tributaries in southern Amazonia of Venezuela.

Among the taxa with appressed pubescence prevalent on both surfaces of the leaflets, *C. emonensis* can be grouped with two other closely related species described in this paper, *C. nutans* and *C. aymardii*, by characters discussed above with *C. aymardii.* This species can be distinguished from the other two principally by the smaller, more narrowly elliptic and coriaceous leaflets with a more prevalent tomentose-pubescence on lower surface; and by a more cupular, rounded calyx tube with the pedicel articulation right at or near the base of the tube. The fruits are generally both longer and wider, and are notably greenish rose-colored when maturing. *Campsiandra emonensis* shares both general habitat and growth habit charateristics with *C. aymardii*; although also quite localized, *C. emonensis* seems to have a wider distribution in Amazonian black-water watersheds. *Campsiandra nutans,* on the other hand, is a notably taller tree on low-land alluvial plains, more distant from the river-edge, and with a wider distribution into Brazil.

Paratypes. VENEZUELA. **Amazonas:** Lower Emoni River, three river-turns up-stream from the "laguna," Feb.–Mar. 1986, *B. Stergios & G. Aymard 9267* (NY, PORT); Lower Emoni River, tributary of the Siapa, Feb.–Mar. 1986 (fr), *B. Stergios & G. Aymard 9244* (NY, PORT, VEN), *9240* (BM, K, MO, NY, PORT, TFAV, US, VEN), *9241* (GUYN, PORT, TFAV, VEN), *9244* (PORT, VEN); Río Emoni, 5 vueltas arriba de la Laguna, 2°10′N, 66°17′W, Oct. 1986, *B. Stergios et al. 9647* (NY, PORT, VEN), *9658* (K, NY, PORT, TFAV, US, VEN); Río Emoni, 5 vueltas abajo del caño Bocón, ene. 1987, *B. Stergios & G. Aymard 9981* (K, MO, NY, PORT, VEN); Río Curamoni, afluente del alto Casiquiare, Feb. 1989 (fr), *B. Stergios, K. Kubitzki & G. Aymard 13214* (K, MO, NY, PORT, TFAV, US, VEN), *13222* (BM, GUYN, NY, PORT, TFAV, VEN).

9. **Campsiandra ferruginea** Stergios, sp. nov. TYPE: Venezuela. Amazonas: Río Pasimoni, entre Piedra Aracapoa y Pueblo Viejo, 1°45′N, 66°45′W, Oct. 1986, *B. Stergios et al. 9561* (holotype, PORT; isotypes, K, MO, NY, PORT, TFAV, US, VEN).

Arbor 6–8-metralis; foliolis late oblongis, subcoriaceis, supra arcuate puberulentulis, subtus succulenter ferrugineo-puberulentis; in pagina inferiore venulis areolate reticulatis, maculis ferrugineo-croceis conspersis; sepalis late ovatis, 3 mm longis, 3 mm latis, basi auriculate imbricatis; legumine elongato, plus quam 40 cm longo.

Habitat endemica in silvis ripariis secus flumina aquae nigrae.

Somewhat low, spreading riparian *tree* 6–8 m tall; branchlets smooth to longitudinally rounded-undulate, dark red-brown in color, nitid but minutely ferrugineous-puberulent in the depressions, rather stout and robust, 5–6 mm diam. near the inflorescences. *Leaves* imparipinnate, 11–13-foliolate, leaflets opposite to subopposite, when so, then 5–7 mm distance between them; notably rusty, appressed, woolly-tomentulose on the petiole, puberulent on the rachis; petiole 5.5–7 cm long, broadly flattened dorsally with an obvious, stout, wing that is notably involute the entire distance to the first node, or turning suddenly revolute the last 5–10 mm beforehand; pulvinus well developed, pluriangulate, transversely rugose 7 × 4–5 mm; rachis deeply sulcate with the borders pointedly ridged; petiolules thickly rugose transversely, 3 × 1.5 mm, minutely puberulent. *Leaflets* broadly oblong-elliptic, 14–16 × 4–5.5 cm, somewhat coriaceous, obtuse-rounded at the base, apex broadly obtuse-mucronate, the tip slightly retuse; arcuate-puberulent on upper surface, copiously succulent-ferrugineous, appressed-arcuate puberulent below and nitid, hairs on both surfaces lying in different, disoriented directions; margins notably revolute, stiff to the touch; venation on lower leaflet surface distinctly areolate-reticulate, patchworked with scattered, ferrugineous-orange blotches, midvein rounded to ovate; upper surface much more finely but still areolate-reticulate, notably lustrous beneath the minute hairs. *Inflorescence* on collection available with only unopened flower buds, a few of which are near anthesis. Inflorescence a terminal panicle of short racemes, originating at the base of the terminal leaf, minutely puberulent near the base of the stalk, densely tomentulose up into the branching racemes; pedicels of buds near anthesis erect-ascending, 5–7 mm long. *Flowers (described from mature buds prior to anthesis).* Bracts acuminate-cymbiform with involute margins, appressed-puberulent without, 3 mm long, 1.5 mm wide near the base, early-caducous; calyx tube tubular-campanulate, 6–7 × 3.5–4 mm, densely ferrugineous-tomentose; sepals broadly carnose, broadly ovate, copiously and entirely tomentulose, 3 × 3 mm, auriculate-imbricate at the base, rounded at the apex; petals broadly elliptic, cucullate, 8 × 6 mm, longitudinally thickened at the center; margins minutely ciliolulate around the apex, but entire toward the base; stamens *(in immature bud)* 16, filaments somewhat applanate right from the base, 1–1.5 cm long; anthers widely oblong, 2.5 × 1 mm, very sparsely pilose; ovary applanate, narrowly elliptic-fusiform with rounded margins, 6–7 × 1 mm; stipe thickened, 1.5–2 × 1 mm; style thick-carnose, terete, 1.4–1.5 cm long, 0.5 mm thick; stigma praemorsely truncate; ovules 8, discoid. *Pod* large and only slightly falcate, 43 × 7–8 cm, applanate but with somewhat wavy margins, smoothly or rounded transversely rugose on both surfaces, both margins thickened and rounded.

Distribution and ecology. This species is of rare occurrence in black-water, riparian-igapó habitats of southern Venezuelan Amazonia, and so far only known from two localities.

Among the appressed-pubescent group of species, *C. ferruginea* can be associated with *C. taphornii* and *C. implexicaulis* (also described in this paper), by the nitid or nearly so under-surface of the leaflets without the dull, waxy coating and retuse-mucronate apical tip; and by the rounded-ovate lower midrib. Of these, it can be most closely related to *C. taphornii* by the completely covered, velutinous-tomentose or puberulent sepals, generally smaller flowers (see the key), larger and more elliptic leaflets, dark red-purple lower midvein, shorter pedicels, and swamp-forest-embankment habitat with single, generally erect trunks. *Campsiandra ferruginea* can readily be distinguished from the related species by the more coriaceous, notably revolute and ferrugineously blotched, broadly oblong-elliptic leaflets with the distinct areolate-reticulate venation, and arcuate-puberulent upper surface; the broadly ovate, auricular, imbricate sepals; and the large pods that are more than 40 cm long. Precise information about the size and form of mature flowers during anthesis is not available. However, the presence of mature flower buds nearly ready to open provided the basic information for the description.

Paratype. VENEZUELA. **Amazonas:** Caño Yagua, al este del cerro Yapacana, Depto. Atabapo, May 1981, *F. Guánchez 1238* (PORT, TFAV).

10. Campsiandra gomez-alvareziana Stergios, sp. nov. TYPE: Venezuela. Amazonas: Bajo Río Siapa, frente a la Laguna Yucuta, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11311* (holotype, PORT; isotypes, BM, GUYN, HGB, K, LE, MO, NY, PORT, TFAV, US, VEN). Figure 1B.

Arbor procera, 20–35-metralis, dense frondosa; foliolis coriaceis glabris nitentibus; venis in pagina inferiore vulgo distincte prominentibus et reticulatis; floribus parvis, irregularibus, inconspicuis, duobus petalis inferioribus recurvatis, tribus superioribus revolutis; staminibus octodynamis.

Habitat in silvis planis eminentibus, longe a rivis.

Majestic *tree* 20–35 m tall with compact crowns that many times protrude upper canopy layer, trunks robust, up to about 50–75 DBH, somewhat speading to buttressed at the base; a rusty-red-brown resin (sample included with *Stergios & Aymard 7329*, PORT) accumulates on the outside of the bark from a reddish brown sap; branchlets lightly longitudinally rugose, rusty appressed-puberulent. *Leaves* imparipinnate, usually 9-foliolate, rarely 11, the leaflets very nearly opposite or occasionally subopposite, but not for more than 1–3 mm, 8.5–13 cm long; petiole narrowly dorsally winged, sometimes the wings turning revolute about halfway along petiole, 3.5–4.5 cm long; rachis ± canaliculate dorsally or flattened, minutely whitish-puberulent; petiolules transversely rugose, minutely puberulent, 2.5 × 2.5 mm. *Leaflets* notably coriaceous, glabrous, nitid, oblong-lanceolate, obtuse-mucronate with a rounded tip, 10–12 × 3–4 cm, notably alveolate-reticulate on undersurface with the quinary veinlets distinct, upper surface mostly smooth, occasionally only secondary venation visible, mid-nerve somewhat sunken. *Inflorescence* a rather open, somewhat spreading terminal panicle of ferrugineous-tomentulose racemes, the lateral branches 7–12 cm long; racemes openly distributed down the panicle, 2–4.5 cm long, outwardly straight-ascending, the distal portion with a rather loose array of small, somewhat caducous or aborting flowers; pedicels mostly erect-ascending, sometimes nodding in different directions, 13–14 mm long. *Flowers* zygomorphic, rather small, about 1 cm long at anthesis; bracteoles early caducous, minute, acute-triangular, 1.5 × 0.5 mm, golden-brown tomentulose without; calyx tube tubular, 4–5 × 2.5 mm, irregularly appressed-puberulent; sepals parabolic-lanceolate, 2.5–3 × 1 mm, appressed-tomentulose without, but with a narrow, glabrous band around apical margin; petals oblong-cuneate, narrowing gradually to the base, two lower ones recurved, the upper three cucullate-revolute, 10 × 5 mm, margin minutely ciliolate; stamens 10, octodynamous, or sometimes 11, with two much shorter than the others, the shorter filaments inferiorly located; filaments straight and ribbon-like at anthesis, 3–3.2 cm long; anthers 1.5 × 0.8 mm, glabrous above, wavy-pilose below; ovary applanate with rounded margins, 5 × 1 mm, stipe 4 mm long; style straight-extended, 2.8–3 cm long; stigma apically umbonate-truncate; ovules 7–8, discoid. *Pod* compressed, notably undulate, notably falcate-cyclical, 18–23 cm long, but 30–45 cm following the center axis, 6.5–8 cm wide. *Seeds* transversely broadly elliptical to reniform, compressed, discoid, circularly winged, 5–5.5 cm across; wings papery, 5–8 mm wide.

Distribution and ecology. A scattered, occasional distribution on the little or non-inundated alluvial plains of the Casiquiare and Siapa river basins and their tributaries of the Venezuelan Amazonia; south into Amazonian Brazil and the Vaupés of eastern Colombia. *Campsiandra gomez-alvareziana* is a more tierra-firme species with a large, robust, nearly buttressed trunk, and a high, protruding crown. The inconspicuous, caducous flowers in inflorescences hidden among the top of the crown, coupled with an infrequent flowering period, kept this species from botanical scrutiny until the present study. The flowers are readily consumed by a still-unidentified, small, tree-top monkey called *mono covió* in native baré. Also, they are visited by a species of bat, but it is unknown whether the bats eat the flowers, or are merely pollinators. This species was first called to my attention by the local natives, descendants of the nearly extinct Baré Indian group of the Upper Río Negro, in 1984, while I was studying the riverside *Campsiandra* along the Casiquiare. The first collections were only sterile (*Stergios & Aymard 4197*, July 1982; *7402*, Nov. 1984). But finally, the apparently very brief flowering period was in sight. *Stergios, Aymard & Nico 9357*, in mid-September 1986, yielded very young inflorescence sprouts; and finally, during the first week of October 1987 (*Stergios & Stergios 1305, 11311*), the first flowers were successfully collected. By the next week, all were gone, with only sparse fruiting observed. Common name: *chiga tierra-firme.*

Campsiandra gomez-alvareziana can be readily distinguished from the other species with glabrous leaflets by the inconspicuous inflorescences restricted to the top part of the canopy; the small, caducous-prone, zygomorphic flowers with the two lower petals recurved; the octodynamous stamens; the coriaceous leaflets with quinary-areolate inferior venation; and the tall, robust growth habit on alluvial plains, some distance away from the river's edge. Of the other species in this group, it can be most closely associated with *C. steyermarkiana* with the smaller flowers, mostly coriaceous and nitid leaflets, and tall, robust growth habit. This unique species is dedicated to a good friend and colleague, Felipe Gómez Alvarez, first president of the UNELLEZ, and Minister of Agriculture of Venezuela, who initiated and eagerly supported the various aspects of research with *Campsiandra.*

Paratypes. BRAZIL. Rio Ituxi, cerca boca del rio Curuquetê, July 1971, *G. Prance et al. 14003* (K). VENEZUELA. **Amazonas:** Piedra Guachapita, río Casiquiare, July 1982, *B. Stergios & G. Aymard 4197* (PORT, VEN), Nov. 1984, *B. Stergios & G. Aymard 7329, 7402* (PORT, VEN), Sep. 1986, *B. Stergios & P. Stergios 9357* (K, NY, PORT, US, VEN), Oct. 1986, *B. Stergios & P. Stergios 9666* (GUYN, K, NY, PORT, TFAV, US, VEN), Oct. 1986, *B. Stergios & P. Stergios 9697* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN), Sep.–Oct. 1987, *B. Stergios & P. Stergios 11305* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN); Laguna Catárapo, río Casiquiare, Apr. 1985, *B. Stergios & G. Aymard 8095* (NY, PORT, VEN, TFAV), Oct. 1986, *B. Stergios & P. Stergios 9569* (K, MO, NY, PORT, TFAV, US, VEN); Río Casiquiare a altura de El Merey, Oct. 1986, *B. Stergios & P. Stergios 9571* (BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN); Río Emoni, Mar. 1986, *B. Stergios & G. Aymard 9262* (NY, PORT, VEN); Río Chimoni, afluente del bajo Siapa, Apr. 1985, *B. Stergios et al. 8176* (GUYN, K, NY, PORT, TFAV, US, VEN); Río Casiquiare, media-vuelta arriba de Piedra Guachapita, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11303* (BM, GUYN, HBG, K, LE, MO, NY, PORT, TFAV, US, VEN); Río Casiquiare entre Wirionawe y Isla Coromoto, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11308* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN); Río Siapa, aguas abajo del caño Duapo, Oct. 1986, *B. Stergios et al. 9482* (BM, GUYN, HBG, K, LE, MO, NY, PORT, TFAV, US, VEN); Río Siapa, entre la Laguna Yucuta y boca del Emoni, Oct. 1986, *B. Stergios et al. 9659* (K, NY, PORT, TFAV, US, VEN); Río Siapa, media vuelta abajo del Caño Duapo, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11309 & 11310* (BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN); Río Siapa, en los alrededores de la Laguna Yucuta, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11312 & 11313* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN).

11. Campsiandra gomez-alvareziana var. **pusilliflora** Stergios, var. nov. TYPE: Venezuela. Amazonas: Selvas pluviales del Caño Atamoni (cuenca del medio Casiquiare), Depto. Rio Negro, 2°10′N, 66°26′W, 120–150 m, Oct. 1986, *B. Stergios, H. Martínez & O. Martínez 9562* (holotype, PORT; isotypes, BM, K, GUYN, LE, MO, NY, PORT, TFAV, US, VEN).

Arbor 15–20-metralis; foliolis oblongo-ellipticis, 10–12 cm longis, 4–4.5 cm latis; panicula florali parva compactaque ramis 1.5–2 cm longis; floribus minimis, calycis tubo cupulato, 2 mm longo, 2.5 mm lato, petalis ellipticis, breviter attenuatis, 7 mm longis, 4.5 mm latis.

Habitat in silvis planis temporarie inundatis, saepius propter flumina.

Swamp-forest tree 15–20 m tall, ± uniform-trunked rather than spreading at the base. Leaves usually 9-foliolate, 10–14 cm long, the narrowly winged petioles 3.5–4.5 cm long; leaflets oblong-elliptic, 10–12 × 4–4.5 cm, dark red-brown-black in color when dried. Inflorescence a rather small, dense-flowered, elliptic panicle 8–9 × 7–8 cm; lateral branches short, contracted, 1.5–2 cm long; pedicels ascending, 8–9 mm long. Flowers zygomorphic, small, 7.5–8 mm long at anthesis; calyx tube cupular, wider than long, 2 × 2.5 mm; petals elliptic, short-attenuate, 7 × 4.5 mm, the lower two recurved; stamens 10, rarely 11, octodynamous; filaments 2.5–3 cm long; ovary 5 mm long; stigma 1.5–3 cm long. Pods only somewhat falcate, small, 18–20 × 6–7 cm.

Distribution and ecology. Apparently restricted to black-water, seasonally flooded alluvial plain forests. So far, known only from the type collection in southern Venezuelan Amazonia, and río Apaporis, tributary of the Vaupés in Amazonas of Colombia.

Campsiandra gomez-alvareziana var. *pusilliflora* can be distinguished from the type variety by the more oblong-elliptic leaflets, which tend to stain a dark red-brown-black when dried; a smaller, rounder, dense-flowered panicle with shorter, more contracted lateral branching; notably smaller flowers with a more cupular calyx tube, 2 × 2.5 mm; and elliptic, short-attenuate petals, 7 × 4.5 mm. Pods are smaller and wider, 18–20 × 6–7 cm, and only somewhat falcate. These alluvial plain trees are of smaller stature than the type variety, from 15 to 20 m tall.

Paratypes. COLOMBIA. **Vaupés:** Río Apaporis, entre ríos Pacoa y Kamanarí, Sorotama, ago. 1951, *Schultes & Cabrera 13724* (K). VENEZUELA. **Amazonas:** Caño Atamoni, afluente del medio-Casiquiare, abr. 1985, *B. Stergios & G. Aymard 8294* (K, NY, PORT), Sep.–Oct. 1987, *B. Stergios & P. Stergios 11320* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN).

12. Campsiandra guayanensis Stergios, sp. nov. TYPE: Venezuela. Amazonas: Piedra La Esterita, entre Raudal Cabarua y boca del Atamoni del medio río Casiquiare, 2°8′N, 66°29′W, Sep. 1986, *B. Stergios, P. Stergios & P. Cardozo 9465* (holotype, PORT; isotypes, K, NY, PORT).

Arbuscula 4–7-metralis; foliolis supra pilis irregulariter tortis conspersis, vel subglabris, oblongo-ellipticis, minus quam 15 cm longis; pedicellis brevibus, minus quam 1 mm longis; calycis tubo dense laete brunneo-tomentoso; leguminibus 23–28 cm longis.

Habitat in silvis ripariis rupestribus, saltuosis, secus flumina aquae nigrae vel subnigrae.

Small to medium-sized *tree* 4–7 m tall; branchlets somewhat thickened, 6–7 mm wide near the inflorescence, corky and rusty-brown in color, but with intermittent longitudinal brownish black, somewhat rugose bands. *Leaves* imparipinnate, 9–13-foliolate, the leaflets opposite or only obliquely subopposite, 18–20 cm long near the inflorescence, sparsely and unevenly, minutely erect-puberulent; petiole somewhat thickened, semiterete, 4–5 mm wide and slightly longitudinally rugose on dorsal plane, narrowing abruptly to the rachis at the first pair of leaflets, wings usually entirely involute, but spreading out halfway to the rachis, then curling in again for the rest of the way; rachis canaliculate dorsally with rather pronounced ridges, somewhat intermittently and longitudinally protuberant around the remainder; petiolules somewhat retrorsely deflexed, evenly transversely rugose, 3 × 1.5 mm, sparsely erect-puberulent. *Leaflets* oblong-elliptic, 12–14 × 4.5–5.5 cm, thickly herbaceous to somewhat coriaceous, basally obtuse to nearly rounded, flattened; apex obtuse and short, retuse-mucronate; upper surface with irregularly scattered, semierect, inclined or tortuous minute hairs, or nearly glabrous, nitid and smooth, veinlets appearing reticulate-rugose with the aid of magnification, midvein flattened and somewhat darker in color in dried specimens; undersurface rather copiously cinnamon-tomentulose, midvein notably raised and somewhat triangular, the secondary venation rounded and much less prominent, the intervenulous surface with a distinct waxy epidermal coating. *Inflorescence* a small, terminal racemed panicle, somewhat hidden by the surrounding leaves, 7–12 cm long, velvety and ferrugineous, appressed-tomentose; racemes sometimes alternately branched, 3–5 cm long, the branches 2–3 cm long; pedicels ± straight, or slightly vermiform, 0.8–1 cm long or less, articulating at or nearly at the base of the calyx tube. *Flowers* 1.5 cm long at anthesis, the perianth caducous after anthesis; bracts early caducous, cymbiform, 1.5 mm long, about 0.5 mm wide, woolly-tomentose without, glabrous within; calyx tube cupular-campanulate, 5–6 × 5 mm, copiously cinnamon-tomentulose; sepals rounded-parabolic, cucullate, 3.5 × 3.5 mm, imbricate at the base, cinnamon-tomentulose as the tube; petals cucullate, 15–16 × 7 mm, veins basal-reticulate, notably salient on outer surface, dark-colored in dried specimen, margin ciliolulate around the apex to halfway to the base, then glabrous; stamens 14, filaments applanate to taeniform right from the base, attenuate somewhat toward the apex, 4.5–4.7 cm long; anthers bearded-pilose ventrally, but distally only, basally glabrous, sparsely and occasionally pilose above, 2 × 1.25 mm; ovary 9–11 × 1.5 mm, compressed, fusiform, slightly grooved down the center on both sides; stipe compressed, 9–11 mm long; style 4.8–5 cm long, flattened to taeniform but rounding toward the apex; stigma infundibuliform, truncate, nearly 0.5 mm wide at the tip; ovules 9, compressed, somewhat turbinate. *Pod* flattened, falcate, with undulate inner margin, 23–28 × 6–7 cm, surfaces subtly or smoothly rugose-globulate.

Distribution and ecology. Adapted primarily to somewhat rocky, uneven, flood-prone river edges in black or semiblack (tea-colored) waters. Infrequently distributed in southern Venezuela throughout the Guayana area, in tributaries of the lower Caura River and upper Atabapo River tributaries of the Orinoco River watershed. Also found in black-water tributaries of the Casiquiare River basin and the lower Siapa (Emoni River) of the Río Negro watershed.

Campsiandra guayanensis appears to be somewhat more variable than some of the other species described in this paper, but for now seems to stand out as a reasonably well defined species. Although it can be placed with the black-water, erect-pubescent *C. macrocarpa* group, as discussed under *C. curaara*, *C. guayanensis* can be distinguished by the unusual pilose condition of the ventral side of the anthers, confined to only one side of the filament; the more oblong-elliptic leaflets with erect-inclined, scattered hairs on the upper surface; shortened pedicels; and the thickly cinnamon-tomentulose calyx. This species appears most closely related to *C. curaara* but is fairly easily separated by the form and habit of the leaflets, the non-persistent perianth, the straight-sided stigma, and other characters discussed earlier.

Paratypes. VENEZUELA. **Amazonas:** Piedra La Esterita del medio Casiquiare, Oct. 1986, *B. Stergios et al. 9563* (same tree as holotype: K, NY, PORT, TFAV); Río Emoni, entre la laguna y 3 vueltas hacia arriba, Feb.–Mar. 1986, *B. Stergios & G. Aymard 9264* (NY, PORT, VEN); Medio río Emoni, abajo del caño Bocón, ene. 1987, *B. Stergios et al. 9982* (PORT, TFAV, VEN); Río Emoni, entre la laguna y 5 vueltas más arriba, Oct. 1986, *B. Stergios et al. 9651* (BM, GUYN, HBG, K, MO, NY, PORT, TFAV, US, VEN); Río Pasimoni, entre Piedra Lajacaribe y Piedra Chiricoa, abr. 1985, *B. Stergios, G. Aymard & L. Nico 8350* (PORT, TFAV, VEN) and *8351* (GUYN, PORT, TFAV); Río Casiquiare, a altura de Apatátji, abajo de Paso del Diablo, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11315* (BM, GUYN, K, MO, NY, PORT, US, VEN); Río Curamoni, afluente del medio-alto Casiquiare, Nov.–Oct. 1987, *B. Stergios & P. Stergios 11384* (GUYN, K, MO, NY, PORT, TFAV, US, VEN); Río Casiquiare, entre Caño Mamón y Capihuara, Feb. 1989, *B. Stergios, K. Kubitzki, G. Aymard & E. Melgueiro 13198* (GUYN, HBG, K, NY, PORT, TFAV, US, VEN); Río Atacavi, a altura del caserío Paloma, Nov. 1989, *Jorge Velazco 1029* (GUYN, NY, PORT, VEN). **Bolívar:** Río Urbani, afluente del Río Caura, ene. 1986, *D. Taphorn DCT-86-27* (GUYN, NY, PORT, VEN); Río Urbani, afluente del río Caura, Feb. 1986, *B. Stergios et al. 8841* (PORT).

13. Campsiandra implexicaulis Stergios, sp. nov. TYPE: Venezuela. Apure: Los Cañitos, carretera San Juan de Payara–Cunaviche, aprox. 12 km al sur del río Arauca, Dtto. Pedro Camejo, dic. 1985, *B. Stergios 8796* (holotype, PORT; isotypes, K, MO, NY, US, VEN). Figure 2.

Arbor 8–12-metralis, forma tipica multiplicibus intermixtis caulibus super aquam impendentibus, vel *Rhizophorae* habitu crescentibus; foliolis oblongis ad oblongo-elliptica, 10–12 cm longis, 3–4 cm latis, supra levibus vel sparse adpresse puberulentis, subtus nitentibus nulla cera epidermica praesente; calycis tubo in loborum basi 5–6 mm lato; sepalis consperse adpresse puberulentis, conspicue marginatis; petalis 12–14 mm longis, 8–9 mm latis.

Habitat secus flumina aquae nigrae vel in silvis ripariis temporarie inundatis.

Medium-sized *tree* 8–12 m tall, with spreading, lunate-appearing to transverse-elliptic crowns, the main branches often leaning over, nearly to the ground; trunks usually multiple, often intertwisting and tending to bend or incline out over the water from the river edge, or form dense, *Rhizophora*-like growth habits; branchlets longitudinally suberous-rugose, with alternating bands of coffee-brown and dark red-brown coloring when dried, glabrescent. *Leaves* imparipinnate, 9(–7)-foliolate, opposite, or rarely subtly subopposite and then separated by 1 mm, 10–15 cm long on the terminal branchlets, scattered pilosulous with whitish, translucent hairs

Figure 2. *Campsiandra implexicaulis* Stergios, flowering branch.

or mostly glabrescent, somewhat patchy-pulverulent with a whitish, resinous-appearing exudate; petiole 3–4 cm long, applanate dorsally and flat-winged one-third of the distance from the base, then revolute for the remainder to the first pair of leaflets; rachis dorsally sulcate with somewhat rounded ridges and blotchy, whitish cream puberulent; petiolules transversely corrugate-rugose, sparsely whitish-puberulent to glabrescent, 3 × 1.5 mm. ***Leaflets*** oblong to oblong-elliptic, 10–12 × 3–4 cm, rounded at the base, the apex bluntly obtuse-mucronate to broadly mammiform, the tip subtly retuse, thin and herbaceous; upper surface notably smooth and furvous, only midvein and sometimes the secondary nerves evident, sparsely but uniformly whitish appressed-puberulent, the hairs all acroscopic and outward toward the margins; lower surface opaque but without a waxy epidermal coating, smoothly favoso-reticulate, only the midvein strongly evident and rounded, same color as the leaflet blade, uniformly light-cinnamon appressed-puberulent; margins flat, subtly undulate. *Inflorescence* an open, showy, copious-flowered terminal panicle of racemes, coffee-cream-colored appressed-puberulent; racemes alternating, 1–2 cm apart, 6–10 cm long, solitary or sometimes bifurcating near the middle; pedicels twice-flexuous, 12–15 mm long, articulation 2 mm below base of calyx tube. *Flowers* showy, nearly 2 cm long at anthesis; bracts cochleariform-spathuliform, 2 mm long, 0.75 mm wide narrowing to 0.5 mm near the base, coffee-cream-colored tomentulose without, glabrous within, early caducous; calyx tube tubular-campanulate, 5–6 mm long, 4.5 mm wide at base of sepals, aequilateral, minutely appressed-puberulent to very nearly glabrous; sepals broadly ovate, rounded-obtuse, 3.5 × 3.5 mm, appressed-puberulent near the center with a rather broad, notable glabrous band around the outside apical-margin; petals white, sometimes tinged lightly rose-colored when young or in bud, only slightly cucullate, spathuliform, 12–14 × 8–9 mm, copiously pilose-ciliolate along the margin, the transparent hairs reaching up to 0.5 mm long; stamens 15, filaments terete right to the base, basally 0.5 mm wide, attenuating to the apex, 4.2–4.5 cm long; anthers oblong-elliptic, 1.75 × 1.5 mm, scattered-pilose above, densely pilose below; ovary applanate with rounded margins, inaequilaterally fusiform, 6–8 × 2 mm; stipe terete, 9–10 mm long, 1 mm wide; style flattened, ribbon-like, 5.3–5.5 cm long; stigma truncate; ovules 9, irregularly discoid to more pisiform. *Pod* flattened to compressed, ± falcate, 19–27 × 5–6 cm, distal end rounded-apiculate, nitid and smoothly undulate on both surfaces, transversely venulose; margins thickened and broadly wavy. *Seeds* transversely elliptic to reniform, compressed, 4 × 5 cm, testa chartaceous, dark red-brown, extending out into a circular, spongy wing about 7 mm wide, which enables the seed to float on the surface of the water.

Distribution and ecology. Low, swampy riparian habitats along the larger-bodied, usually white-water to tea-colored rivers and lagoons. A frequent, rather cosmopolitan distribution in the northern Venezuelan Guayana, principally from the mid-Orinoco River on downstream through northern Amazonia (Atabapo, Atures) into Bolívar and on into Delta Amacuro, and associated large-bodied tributaries near their drainage into the Orinoco from both the north (Apure, Guárico, Anzoátegui, and Monagas States), and the south (Guayana Shield). *Campsiandra implexicaulis* is particularly frequent along the principal rivers of Apure State in southern Venezuela, south of the Arauca and Apure Rivers, and represents, to date, the northernmost distribution for the genus (see TYPE citation). Along the Capanaparo River, it is the main species employed by the Pumé indians for making "chiga" flour (Stergios, 1993; in this publication, the *Campsiandra, Stergios 15671,* was referred to as *C. caulintrincata,* ined., but is here published as a paratype of *C. implexicaulis.* The former name proposed will not be used). Representing the most common and cosmopolitan species of this genus in southern Venezuela, it has been the most collected, and many specimens have originally been determined as *C. comosa* var. *laurifolia.*

Paratypes. BRAZIL. **Pará:** Rio Trombetas, June 1974, *D. Campbell et al. P22509* (K, INPA). VENEZUELA. **Apure:** Costa norte del río Capanaparo, Hato Sta. Elena, ene. 1964, *M. Ramia et al. 2854* (MY); Río Capanaparo, San José de Capanaparo, June 1992, *B. Stergios 15671* (see BioLlania 9: 71–90, 1993) (BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN); Caño Los Cañitos, al sur del río Arauca, mayo 1982, *B. Stergios 3959, 3960* (PORT, VEN); Caño Guayabal, Buena Vista del río Meta, ene. 1982, *B. Stergios 3244* (PORT, VEN); Río Apure, 3 km al sur de Pesquero, abr. 1977, *G. Davidse & A. González 12259* (U, VEN). **Bolívar:** Río Caroní, cerca de San Felix, Nov. 1960, *Steyermark 87818* (NY, U, VEN); Río Claro, afluente del río Charoní, Mar. 1988, *D. Taphorn DCT 88-22* (PORT); Río Cuchivero, June 1940, *L. Williams 13307* (K); Río Sipao, carretera Caicara–Maripa, Feb. 1886, *B. Stergios et al. 8840* (GUYN, K, NY, PORT); Río Cuchivero, carretera Caicara–Maripa, Feb. 1986, *B. Stergios et al. 8855* (K, NY, PORT, VEN). **Delta Amacuro:** Río Orocoima, Mun. Antonio Díaz, Feb. 1987, *A. Fernández 3738* (PORT, VEN). **Amazonas:** Río Orinoco, S. tip of Isla Ratón, Nov. 1965, *F. Breteler 4810* (U); Río Ventuari, entre Morrocoy y San Juan de Manipiari, Mar. 1973, *G. Agostini 1515* (U, VEN); Raudal Atures, near Pto. Ayacucho, Nov. 1953, *B. Maguire et al. 36133* (NY, VEN); Río Cataniapo, 200 m hacia la vía a El Gavilan, cerca de Pto. Ayacucho, abr. 1985, *B. Stergios et al. 7997* (PORT, TFAV); Río Orinoco, 18 km de La Esmeralda, feb. 1990, *G. Aymard & L. Delgado 8237* (PORT, VEN).

14. Campsiandra laurifolia Bentham, J. Bot. Hook. II. 94. 1840; in Mart. Fl. Bras. XV. II. 54. 1870. TYPE: Río Negro in Brazilian Amazonia, 1837, *L. Riedel 83* (holotype, K; isotype, LE (no other duplicates known to exist)).

In the light of detailed studies and field observations of the different populations of *Campsiandra* so far defined throughout northern South America since Cowan's (1953) preliminary evaluation, it can be plausibly ascertained that Bentham's original *C. laurifolia* should continue to be considered as a valid species. Even though only two collections of the genus were available to Bentham at the time, they were, according to his descriptions and the type specimen, reliably distinct. Also, it is important to note that they were from distinct regions and watersheds, the black-water Amazon basin, and the Atlantic-drainage Esequibo of Guyana. Cowan had more collections available to him, especially from Brazil, but it is unclear from his treatment whether he had the opportunity to evaluate the type collections. It can be presumed that among the material available to him, *C. laurifolia* was represented, among other now recognizable taxa of the genus, and that his view was wide and preliminary. At present, it is more pertinent to relate *C. laurifolia* to other, more akin populations from Brazil and southern Venezuela than to the more isolated *C. comosa* populations of the Guyanas (Guyana and Surinam). *Campsiandra laurifolia* differs quite clearly from *C. comosa* in the more narrowly oblong rather than more elliptical leaflets, which are notably chartaceous-herbaceous and appressed-puberulent on both surfaces. The glabrous-coriaceous vs. chartaceous-appressed-pubescent situation in the leaflets has taken on a definite importance for *Campsiandra,* as can be demonstrated in the key. In 1953, the genus was still too poorly collected and with practically no field data, to give proper weight to this and other diagnostic aspects. The flowers of *C. laurifolia* are much smaller than those of *C. comosa,* and in fact are among the smallest within the chartaceous-appressed-pubscent species group, comparable to those of *C. angustifolia.* The sepals are more narrowly obtuse, herbaceous rather than succulently thickened at the center, more flattened, and valvate to sinuate at the base instead of imbricate. The calyx tube and sepals are densely puberulent throughout rather than nearly glabrous.

Selected specimens examined. BRAZIL. Rio Amazonas near Manaus, Aug. 1923, *J. Kuhlmann & A. Ducke 17815* (U). **Pará:** Paraná do Ricardo, Aug. 1934, *B. Krukoff 5897-a* (K, U); vicinity of Santarém, Nov.–Mar. 1849–50, *R. Spruce s.n.* (K); Rio Capim, June 1897, *J. Huber 810* (K); Brasilia, Borba s.d. *Riedel s.n.* (K); Rio Negro, São Gabriel, Dec.–Jan. 1930–31, *E. Holt & E. Blake 607* (K); Rio Negro, Sta. Isabel, June 1937, *A. Ducke 510* (K); Rio Mapuera, Nov. 1985, *L. Cuelho et al. 147* (NY); S bank of Rio Negro, near Manáus, Nov. 1966, *Prance et al. 3022* (U); Rio Negro, Ponta Negra, Dec. 1968, *Prance et al. 9087* (K); Rio Ituxi, cerca Boa do Curuquetí, July 1966, *Prance et al. 14131* (K, U); Rio Madeira, Terr. Rondônia, June 1968, *Prance et al. 5287* (K, U); Lago do Janauacá, S of Solimôes, Aug. 1973, *C. C. Berg et al. P19792* (K, U); Rio Negro, cerca de Tarumá, Oct. 1966, *Prance et al. 2640* (K, U); Maués, frente de fábrica Guaraná, abr. 1974, *D. Campbell et al. P21987* (U); Rio Negro, between mouths of the Caurés and Barcelos, Oct. 1971, *Prance et al. 15126* (U); Rio Purús, Lago Preto, June 1971, *Prance et al. 13743* (K, U); Rio Negro, entre Isla Jacaré y Airâo, Oct. 1971, *Prance et al. 15102* (U); Lago Tefé, cuenca rio Solimôes, July 1973, *E. Lleras et al. P16678* (U); Lago Marraha, Rio Purus, May 1975, *Prance et al. 23402* (U); Rio Negro, above mouth of rio Branco, Oct. 1978, *Madison et al. 68* (K); Lago Tefé, rio Solimôes, Oct. 1982, *I. Amaral et al. 5* (K); Rio Jaciparaná, July 1979, *C. Calderón et al. 2812* (K). COLOMBIA. **Guainía:** San Felipe Neri, Nov. 1948, *J. Molina & F. Barkley 18* (K); Río Apaporis, entre ríos Pacoa y Kananarí, Aug. 1951, *R. Schultes & I. Cabrera 13551* (K, U), June 1951, *R. Schultes & I. Cabrera 12656* (K). **Vaupés:** Río Apaporis, Soratama, above Kananarrí, Jan. 1952, *R. Schultes & I. Cabrera 14996* (K); Río Negro, alrededores de San Felipe Neri, Oct. 1952, *R. Schultes et al. 18033* (K). VENEZUELA. Salto Danto, Río Cuao, Nov. 1948, *B. Maguire et al. 27338* (K); near Esmeralda, Alto Orinoco, 1942, *L. Williams 13120* (K); Caño Mosquito, Río Ventuari, Feb. 1976, *M. Colchester 2247* (K); Isla Ratón, Río Orinoco, Nov. 1965, *F. Bretler 4810* (K); Río Negro, entre San Carlos de Río Negro y boca del Casiquiare, Nov. 1984, *B. Stergios & G. Aymard 7277, 7290, 7296* (PORT); Río Casiquiare, Nov. 1984, *B. Stergios & G. Aymard 7309, 7374* (PORT); Río Emoni, ene. 1987, *B. Stergios & G. Aymard 9981* (PORT); Río Pamoni, Oct. 1987, *B. Stergios & P. Stergios 11341, 11403* (PORT).

15. **Campsiandra macrocarpa** Cowan var. **macrocarpa**, Mem. New York Bot. Gard. 10 (1): 147. 1958.

Campsiandra macrocarpa Cowan was the first species of this genus described since Bentham described *C. angustifolia* in 1870, and the last to be recorded until this present paper. Although *C. macrocarpa* was originally described with only fruiting material available, it still remains a good and distinctive species. Since 1958, a good number of representative flowering collections have been made of *C. macrocarpa,* and it seems appropriate to include here a brief description of the flowering aspect, which has never before been published: *Inflorescence* a rather robust, somewhat loosely spreading, rather shortened terminal panicle of racemes, 10–15 cm long from the last leaf, 10–14 cm wide at anthesis; racemes 4–6, rarely branched, 4–6 cm long, uniformly cinnamon-tomentulose; pedicels usually 1.5–3 cm long, the longest furthest from the raceme apex, more erect-puberulent, straight or somewhat flexuous, articulating 1–1.5 mm below the base of the calyx tube. *Flowers* large and showy, 2–2.5 cm long and about 2 cm wide at the top of the corolla at anthesis, persistent on the panicle; bracts acute-parabolic, 3 × 1 mm, tan-brown tomentulose without, more puberulent within; calyx tube tubular-campanulate, 10–12 × 6–8 mm, lightly but uniformly appressed-puberulent; sepals broadly ovate, rounded-obtuse, auriculate-imbricate at the base, 4 × 4 mm, more densely puberulent without than the calyx tube, glabrous within; petals somewhat cucullate with inflexed margins, spatulate-obovate, 1.7 cm long, 7–8 mm wide, margins notably ciliolulate, especially around the apex; stamens 14–15, filaments terete near the base becoming somewhat compressed distally, 4.5–5 cm long; anthers oblong, 2.5–3 × 1.5 mm, pilose on both surfaces, but sparsely so dorsally; ovary fusiform, compressed but remaining thickened, 10 × 2 mm, the borders rounded, slightly grooved longitudinally down the center; stipe compressed, 10–11 mm long; style terete-attenuate, 3.5 cm long; stigma infundibuliform, truncate, 0.75 mm long, 1 mm wide at the top; ovules 9, compressed-pisiform.

Representative collections examined (flowering specimens only). VENEZUELA. **Amazonas:** Río Yatúa, entre Piedra Catipán y Ípaca, dic. 1984, *B. Stergios & G. Aymard 7520* (BM, K, MO, NY, PORT, TFAV, VEN); Río Yatúa, above Piedra Arauicaua, Oct. 1957, *B. Maguire et al. 41932* (NY, US, VEN); Río Pasimoni, entre la boca y Piedra Aracapoa, Oct. 1986, *B. Stergios et al. 9534* (NY, PORT); Caño Curamoni del alto Casiquiare, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11342* (see under var. *alveolata* for herbaria); Río Baría, entre La Laguna y Laja Bajájö, *B. Stergios et al. 16315* (see under var. *alveolata* for herbaria).

16. **Campsiandra macrocarpa** Cowan var. **alveolata** Stergios, var. nov. TYPE: Venezuela. Amazonas: Río Yatúa, above Piedra Acauicaua, Oct. 1957, *B. Maguire et al. 41932* (holotype, VEN; isotypes, K, NY, US, W). Figure 3.

Foliolis firmiter coriaceis, subtus nitentibus, prominenter punctatis, cera epidermica absente, margine firmiter revolutis usque ad apicem mucronatum, 16–18 mm longum; venulis quinariis prominentibus, scrobiculatis.

Spindly, riverside and swamp-forest tree 12–15 m tall; trunk mostly erect, solitary. Leaves 10–17 cm long with 11–13 nearly opposite leaflets. Leaflets widely obtuse-mucronate, 8–13 × 2–4 cm, strongly coriaceous, distinctly nitid, shiny, waxy epidermal layer lacking, especially on lower surface, revealing the presence of epidermal dots, erect or sometimes somewhat uncinate-puberulent; margins abruptly and distinctly revolute throughout; apex long obtuse-mucronate, the tip 16–18 mm long; lower surface notably alveolate by readily visible quinary veinlets. Panicles and flowers generally as previously described for *C. macrocarpa* Cowan var. *marcocarpa.* Pods are within the scope of those described by Cowan (1958).

Distribution and ecology. Endemic to swamp forests of black-water tributaries of the Casiquiare basin in southern Venezuelan Amazonia. Infrequent. So far only recorded from the Yatúa and Baría Rivers, of the Pasimoni River headwaters.

Campsiandra macrocarpa var. *alveolata* can be distinguished from the type variety principally by the strongly coriaceous leaflets with abruptly and uniformly revolute margins, and the longer, obtuse-mucronate tip, 16–18 mm long. Both surfaces of the leaflets are distinctly nitid and, primarily the lower one, prominently alveolate by means of readily visible quinary veinlets; the lower surface without a dull, waxy coating, and the epidermal dots prominent.

Paratypes. VENEZUELA. **Amazonas:** Río Yatúa, entre la boca y Piedra Catipán, Sep. 1984, *B. Stergios & G. Aymard 7499* (PORT); swamp-forest along edge of Pacimoni, Feb. 1856, *Spruce 2466* (K, oldest known collection); Río Pasimoni, entre la boca y laguna Buridajao. abr. 1985, *B. Stergios, G. Aymard & L. Nico 8337* (PORT, VEN); Río Baría, entre la Laguna Yuruví y la Laja Bajájö, aprox. 25 vueltas aguas arriba de la boca, Nov. 1994, *B. Stergios et al. 16315* (BM, GUYN, HBG, MO, NY, PORT, TFAV, US, VEN); Río Pasimoni, en la boca del Río Yatúa, Nov. 1994, *B. Stergios et al. 16297* (K, MO, NY, PORT, TFAV, US, VEN); Río Pasimoni, a altura de la segunda laguna, Nov. 1994, *B. Stergios et al. 16225* (K, MO, NY, PORT, TFAV, US, VEN).

17. **Campsiandra macrocarpa** Cowan var. **grandifolia** Stergios, var. nov. TYPE: Venezuela. Amazonas: Caño Curamoni, afluente del alto Casiquiare, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11342* (holotype, PORT; isotypes, BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN).

Foliis elongatis, 25–30 cm vel ultra longis; foliolis 17–19 cm longis, 5–6 cm latis, anguste retuse mucronatis; leguminibus 9–12 cm latis.

Low, spreading swamp-forest tree 10–12 m tall. Leaves large, 25–30 cm long; petioles stout, thick, 4–6 mm wide across adaxially flattened surface, 7–8 cm long, distinctly canaliculate-revolutely winged; leaflets usually 15, the pairs nearly opposite, notably large, 17–19 × 5–6 cm, narrowly retuse-mucronate, tips 12–14 mm long, nitid, copiously erect to uncinate-puberulent on lower surface, only sparsely so on upper surface. Panicles and flowers generally as for *C. macrocarpa* var. *macrocarpa.* Pods large and notably broad, 36–40 × 9–12 cm.

Distribution and ecology. A low, rather speading riparian swamp-forest tree. So far, this variety can only be reported from the ultra-black water Curamoni, Pasimoni and Baría rivers, all tributaries of the Casiquiare River basin in the southern Venezuelan Amazonia.

Campsiandra macrocarpa var. *grandifolia* is distinguished from the other two varieties principally by the notably and consistently large leaves, 25–30 cm or more long, and the large leaflets 17–19 × 5–6 cm which are narrowly retuse-mucronate

Figure 3. *Campsiandra macrocarpa* Cowan var. *alveolata* Stergios, flowering branch and detail of leaf surface.

rather than more widely obtuse-mucronate. The pod is larger than the other two varieties, 9–12 cm wide.

Paratypes. VENEZUELA. **Amazonas:** Río Pasimoni, entre la boca y Piedra Aracapoa, Oct. 1986, *B. Stergios et al. 9534* (BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN); Caño Curamoni, afluente del Alto Casiquiare, Feb. 1989, *B. Stergios et al. 13225* (K, NY, PORT, TFAV, US, VEN); Río Baría, entre Laguna Yuruví y la Laguna Bajájö, aprox. 25 vueltas aguas arriba de la boca, Nov. 1994, *B. Stergios et al. 16314 & 16227* (K, MO, NY, PORT, TFAV, US, VEN), *B. Stergios et al. 16329* (NY, PORT, TFAV).

18. Campsiandra nutans Stergios, sp. nov. TYPE: Venezuela. Amazonas: Depto. Río Negro, Río Casiquiare, frente a El Porvenir, 1°57′N, 66°32′W, 150 m, Dec. 1984, *B. Stergios & G. Aymard 7626* (holotype, PORT; isotypes, BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN).

Arbor procera, 12–25-metralis; foliolis supra sparse adpresse puberulentis, pilis canescentibus multifariam versis; venis tertiariis supra late leviterque areolatis; pedicellis patentibus, 1.4–2.5 cm longis; petalis margine sparse ciliolatis; staminibus contortis.

Habitat in ripis prominentibus occasione oblata inundatis, interdum in rupestribus.

Rather tall *tree* 12–25 m high; branchlets shortened, thickened, longitudinally rugose, glabrous or nearly so, with grayish-colored bark, lighter in color than the accompanying leaf-petioles and inflorescence branches. *Leaves* imparipinnate, mostly 9–11-foliolate with leaflets opposite or nearly so, 12–22 cm long near the inflorescences, blotchy and closely appressed-puberulent or nearly glabrous; petiole 3–4.5 cm long, dorsally sulcate and involute-revolutely winged, glabrous or sparsely appressed-puberulent; rachis glabrous or nearly so, dorsally sulcate with rather pointed ridges; petiolules glabrous, transversely rugose, 3 × 1.5 mm. *Leaflets* oblong-lanceolate, 13–14 × 2–3 cm, chartaceous or somewhat thinly coriaceous, sparsely appressed-puberulent on upper surface with scattered, disoriented, whitish hairs, otherwise nitid, apex rounded, obtuse-mucronate, base obtuse; lower surface rusty-appressed puberulent; midvein above flattened, somewhat sunken, notably darker in color than the blade in dried specimen, tertiary venation broadly and smoothly areolate; midvein below ± trigonous, distinctly raised, lesser veins also raised and broadly areolate; a dull, waxy epidermal coating evident on lower surface. *Inflorescence* a rather short, terminal, or more often lateral panicle of racemes, arising somewhat cauline from the thinner branchlets and ± hidden among the most nearly terminal leaves, notably rusty-puberulent, especially on the racemes, 7–9 cm long, 11–12 cm wide at anthesis; pedicels varying in length, 2–2.5 cm toward the back of the raceme, 1.4–1.8 cm near the tip, notably recurved to varying degrees, then caducous at anthesis before fruit formation, articulation 2.5–3 mm below base of calyx tube. *Flowers* 1.5 cm long and openly scattered among the relatively bare racemes at anthesis; bracts obtuse, cucullate-acuminate, 1.5 × 0.75 mm, appressed-puberulent without, glabrous within; calyx tube cupular-campanulate, 4–5 × 3–4 mm, sparsely and minutely puberulent; sepals acute-obtuse, 3 × 2.5 mm, imbricate at the base, slightly more puberulent than the tube; petals white, ascending-cucullate, 13 × 6.5 mm, ciliolulate around the apical margin, margins entire nearer the base of the petals; stamens 15, filaments tortuous, 2.5–3.5 cm long, bulbous at the base; anthers 1.2 × 1 mm, tomentose below, sparsely pilose above; ovary concave-fusiform, 7–8 × 1.5 mm, the margins rounded; stipe 5–5.5 mm long; style 3.6–3.7 cm long; stigma short-truncate; ovules 8, discoid. *Pod* applanate, ± falcate, transversely rugose-reticulate on the surfaces 22–24 × 6–7 cm; light yellow-green in color when maturing.

Distribution and ecology. Riparian banks and alluvial plains more distant from the river-edge that are not frequently flooded; and occasionally rupestrine among river-edge boulder formations. Not common, but apparently with a non-localized distribution. In Venezuela, it can be found infrequently along the middle Casiquiare in Amazonia and in the Orinoco basin in the riverine rainforests of the lower Caura. More frequently recorded for Brazilian Amazonia (Cururú, Madeira, Rio Negro, and Santarém).

Campsiandra nutans is most closely related to *C. emonensis* and *C. aymardii* with the dull, waxy coating on the undersurface of the leaflets, the rounded, mostly obtuse-mucronate apex, and the trigonous lower midvein with the raised and narrowing ridge; it is similar to *C. aymardii* in the longer, campanulate to tubular calyx tube, fewer, more broadly elliptic to oblong-lanceolate, more chartaceous leaflets, the lower position of the pedicel articulation, and the yellowish green color of the young fruits. *Campsiandra nutans* can be readily distinguished from its more related species by the shorter stamens with the filaments bulbous at the base; the caducous-prone, drooping pedicels; the whitish, disoriented puberulence on the upper leaflet surface; the shorter, more cauline inflorescences; shorter leaves; and taller growth habit on embankments, alluvial plains, or rocky shores.

Paratypes. BRAZIL. **Pará:** Santarém, *Spruce s.n.* (K);

Rio Cururú, alto Tapajós, Feb. 1974, *W. Anderson 10858B* (K); Rio Madeira, Capaira, road Jaciparaná–Porto Velho, June 1968, *Prance et al. 5328* (K); Baixo rio Negro, frente a Manaus, Nov. 1966, *Prance et al. 3022* (K); In varzea, road Humaitá–Porto Velho, Nov. 1966, *Prance et al. 5498* (K). VENEZUELA. **Amazonas:** Río Casiquiare en la Isla de la Paloma, abr. 1985, *B. Stergios et al. 8052, 9007* (same tree: fruiting) (K, NY, PORT, TFAV, US, VEN); Río Casiquiare, en los alrededores de la isla Sta. Rosa, Oct. 1986, *B. Stergios et al. 9481* (K, NY, PORT, TFAV, VEN); Río Casiquiare, entre Buena Vista y Duruquene, 2°15'N, 66°28'W, Oct. 1986, *B. Stergios et al. 9619* (BM, K, MO, PORT, TFAV, US, VEN); Río Casiquiare entre El Merey y Piedra Guachapita, 1°58'N, 66°55'W, Oct. 1986, *B. Stergios et al. 9663 & 9664* (*9663*: K, MO, NY, PORT, TFAV, VEN; *9664*: BM, GUYN, PORT, US); Río Casiquiare en la boca del río Pamoni, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11341* (BM, K, NY, PORT, TFAV, US, VEN); Río Casiquiare en el ribero de la playa Máuari, Feb. 1989, *B. Stergios, K. Kubitzki, G. Aymard & E. Melguiero 13153* (PORT, VEN). **Bolívar:** Río Caura, a altura de Las Trincheras, 7°0'N, 64°51'W, 70 m, Mar. 1989, *A. Fernández 5112* (BM, GUYN, K, LE, MO, NY, PORT, TFAV, US, VEN).

19. Campsiandra pasibensis Stergios, sp. nov. TYPE: Venezuela. Amazonas: Río Pasiba, entre 300 m de la boca y la Laguna de Pasiba, afluente del medio-alto Casiquiare, Dec. 1984, *B. Stergios & G. Aymard 7687* (holotype, PORT; isotypes, BM, K, GUYN, HBG, LE, MO, NY, PORT, TFAV, US, VEN).

Arbuscula exilis 6–8-metralis; foliolis laevibus, oblongo-lanceolatis, 8–12 cm longis, 2–3 cm latis, chartaceis, candicantibus, supra erecte puberulentis, suboppositis; floribus parvis, calycis tubo 4–4.5 mm longo, 2.5–3 mm lato; leguminibus 35–40 cm longis, 7–9 cm latis.

Habitat endemica in ripariis "igapó," Guayana amazonica.

Low, igapó *tree* 6–8 m tall with a slender, rather spindly trunk; branchlets somewhat slender, 4–5 mm thick near the inflorescence, multiple and shallow-grooved around the stem, alternating in color, darker within the grooves and lighter on the rounded ridges, minutely and rather sparsely erect-puberulent. *Leaves* imparipinnate, 12–15 cm long, usually 11-foliolate, but occasionally 9-foliolate with leaflets mostly opposite, but sometimes obliquely subopposite by a distance of 1–2 mm, short and mostly erect-tomentulose; petiole 4–5 cm long, distinctly involute-winged for about ¾ of the distance to the rachis, then short-revolute for the remainder, the wing becoming wider and more notable at this point, velvety, erect, grayish brown tomentulose; rachis dorsally involute-sulcate, the ridges closing in toward the center, sometimes almost closing off the groove, erect, whitish, fuzzy-tomentulose; petiolules transversely rugose, 3.5 × 1.5 mm, grayish-erect tomentulose, contrasting in color from the surrounding rachis and leaflet, the same pubescence persisting onto the annexing rachis node. *Leaflets* oblong, narrowly oblong to oblong-lanceolate, 8–12 × 2–3 cm, quite chartaceous with flat margins, narrowly obtuse-mucronate, the tips rounded or very minutely retuse, the base obtuse-acute, rather darkly reddish brown when dried; upper surface smooth, very minutely venulate under magnification but the veins not raised, midvein sunken below the surface of the leaflet, short, erect, whitish cinnamon puberulent; lower surface reticulate-venulous, the secondary and midveins the most prominent, the others rather obscure, not forming distinct areoles, short, erect, cinnamon-tomentulose; a dull, waxy epidermal coating present on lower surface. *Inflorescence* a terminal, narrow and rather small, racemed panicle, exserted from the rather retrorse terminal leaves and thus more visible, 12–14 cm long, 6–7 cm wide at anthesis, densely cinnamon-tomentulose; racemes somewhat closely aggregated near the apex of the panicle, sometimes short-branched, 3–5 cm long and nearly erect-ascending; pedicels 12–14 mm long, thin, almost wire-like, falcate to sigmoid, seldom totally straight, erect, whisker-like, cinnamon-puberulent, articulate right at the base of the calyx tube. *Flowers* rather small, 1.5 cm long at anthesis, notably congested near the apex of the racemes in a somewhat pauciflorous panicle; bracts early deciduous, parabolic-cymbiform, 3 × 1 mm, cinnamon-tomentulose without, sparsely cinnamon-pilose within; calyx tube tubular-campanulate, 4–4.5 × 2.5–3 mm, notably oblique at the base, erect, setaceous, cinnamon-puberulent throughout; sepals broadly ovate, rounded-obtuse, 3 × 3 mm, slightly cucullate, auriculate-imbricate at the base, erect, cinnamon-puberulent on outer surface as for the tube; petals white, obovate-cuneate, 8–10 × 6 mm, notably ciliolulate around apical margin, then glabrous down the sides, only slightly cucullate; stamens 15–16, filaments terete at and near the base, but becoming compressed distally, with intermittent blister-like swellings, 4.3–4.4 cm long; anthers oblong, 3 × 1 mm, long-pilose below, glabrous above; ovary fusiform, compressed, 6–7 × 1.5 mm, borders rounded and slightly thickened, somewhat depressed longitudinally on both surfaces; stipe compressed, 6–7 mm long; style 4.8–5 cm long, compressed, but becoming terete just below the stigma; stigma discoid, horizontally truncate, 0.5 mm wide; ovules 7–8, compressed, hippocrepiform. *Pod* notably large, 35–40 × 7–9 cm, falcate, flattened, rounded at the distal end and subtly mammiform; both surfaces nitid, smoothly rugose-globulate and transversely venulose.

Distribution and ecology. Restricted to blackwater, swamp-forest (igapó) habitats. Endemic to black-water tributaries of the mid-upper Casiquiare drainage, the Pasimoni River watershed, and the Emoni River of the lower Siapa River drainage in the southern Venezuelan Amazonia.

Campsiandra pasibensis can be distinguished by the very chartaceous, flat-margined, oblong-lanceolate leaflets with short-erect, whitish puberulence on upper surface; the smaller flowers in narrow, protruding inflorescences, emerging from reflexed, terminal leaves. The calyx tube and sepals are erect, setaceous-puberulent, with bristly, succulent, cinnamon-colored hairlets, rather than appressed-puberulent. The pods are wider than the other species of the erect-puberulent group. This species is mostly related to *C. velutina,* also described in this paper, by the straight, erect nature of the leaflet pubescence, the waxy, epidermal coating on the undersurface of the leaflets, and the relatively wide pods. *Campsiandra pasibensis* differs, however, by the smaller, much more chartaceous leaflets, much smaller flowers with the pedicel articulation right at the base of the calyx tube, the nearly opposite leaflets on the rachis, and the much wider pods. *Campsiandra pasibensis* is named in honor of the very picturesque and biologically important, blackwater Laguna de Pasiba, in the Pasiba River of the upper Casiquiare drainage, where this species is found.

Paratypes. VENEZUELA. **Amazonas:** Bajo Río Emoni, afluente del Río Siapa, Feb. 1986, *B. Stergios & G. Aymard 9242* (K, NY, PORT, TFAV, VEN); Río Pasimoni, entre Piedra Aracapoa y Pueblo Viejo, afluente del Río Casiquiare, Oct. 1986, *B. Stergios et al. 9554* (K, NY, PORT, TFAV, US, VEN); Caño Curamoni, afluente del Alto Casiquiare, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11348* (K, NY, PORT, TFAV, VEN).

20. Campsiandra steyermarkiana Stergios, sp. nov. TYPE: Venezuela. Amazonas: Selvas ribereñas de rebalse del río Casiquiare, entre Caño San Miguel y Piedra Capihuara, límite entre Deptos. Rio Negro y Casiquiare, 120–150 m, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11325* (holotype, PORT; isotypes, BM, GUYN, HBG, K, LE, MO, NY, PORT, TFAV, US, VEN).

Arbor procera, 25–30-metralis; foliolis coriaceo-cartilagineis, glabris, nitentibus, carinatis; paniculis floralibus densis, reniformibus, capitulosis; floribus parvis, petalis regulariter retrorsis, firmiter carnosis, 9–10 mm longis, 3.5–4 mm latis; staminibus tenuibus tortuosisque.

Habitat endemica in silvis ripariis inundatis prope flumina aquae clarae.

Tall, straight *tree* 25–30 m high with rather large, solitary trunk; branchlets minutely whitish-puberulent or glabrescent, lined longitudinally with 3–4 rows of corky ridges, creating a somewhat canaliculate appearance, nitid in between. *Leaves* imparipinnate, almost always 11-foliolate, the leaflets from 1 mm to 5 mm-subopposite, the greatest gap nearer the leaf apex, 13–16 cm long; petiole narrowly involute and then revolute on ventral surface, applanate between wings, 3–3.5 cm long; rachis notably canaliculate along entire length, with pointed ridges; petiolules transversely rugose, glabrescent, 3 mm long. *Leaflets* coriaceous-cartilaginous, rather stiff in general consistency, glabrescent when younger with minutely, scattered hairs then becoming glabrous, lustrous and nitid, a dark, shiny green in color when fresh, notably carinate, elliptic to oblong-elliptic, 10.5–11.5 × 4–4.5 cm, apex obtuse, notably mucronate and briefly rounded-apiculate with a mammiform tip, smooth on upper surface with a slightly raised and rounded midvein, sharply reticulate below with a very prominently raised, rounded midrib. *Inflorescence* a very densely flowered, compact, thick, head-like, reniform, terminal, racemed panicle, about 7 cm long and 9 cm wide, the panicle branchlets hidden by the dense flowers, densely and compactly ferrugineous appressed-tomentulose; pedicels straight-ascending or somewhat recurved, 5–7 mm long. *Flowers* actinomorphic, persistent, small and compacted at anthesis on short raceme-branchlets, 8–9 mm long at anthesis; bracteoles persistent to late-caducous, ovate, short-acuminate, 1.5 × 0.8 mm, cucullate, tomentulose without, nitid and dark-red colored within; calyx tube cupular-campanulate, 3.5–4 × 2.5 mm, rather densely appressed-tomentulose; sepals acute-triangular, 2.5 × 2 mm, same pubescence as tube, but completely and more densely so; petals white, uniformly recurved and rather thick-carnose, 9–10 × 3.5–4 mm, margins very minutely ciliolate to entire; stamens 12–13, filaments delicately thin, tortuous at anthesis, 2.5–2.7 cm long; anthers 1.5 × 0.7 mm, glabrous above, densely pilosulous below; ovary 9–11 × 2.5–3 mm, compressed with thickened, raised longitudinal margins; stipe 4.5–5 mm; style 1.9–2.2 cm, stigma slightly praemorsely truncate; ovules 7–9, discoid. *Pod* not seen.

Distribution and ecology. So far restricted to turbid, primarily white-water, riparian, and varzea habitats characteristic of the upper Casiquiare (Capihuara) and the Pamoni River tributary in southern Venezuelan Amazonia; 120–150 m; tall varzean trees (25–30 m) with single, large trunks. Common name: *chigo montero de rebalse.*

Campsiandra steyermarkiana can be distinguished among other riparian *Campsiandra* by its tall, erect, and robust growth habit; glossy, dark green, carinate leaflets, and the numerous, small flowers grouped into dense, head-like, reniform, terminal panicles. It can be distinguished from *C. gomez-alvareziana,* which is also an erect, tall, canopy tree with small flowers, by the actinomorphic, persistent flowers with more than 10 regular stamens, and growth habits confined to varzean swamp forests. *Campsiandra steyermarkiana* is most closely related to both *C. casiquiarensis* and *C. chigo-montero,* but can readily be distinguished by the fleshy, recurved petals, delicate, tortuous stamens, thick, reniform-like panicle, and the glossy, carinate leaflets with a rounded, nipple-like mucronate apex-tip. This distinctive member of the genus is dedicated to our long-time friend and colleague, the late Julian A. Steyermark, who both pioneered and revolutionized our knowledge and understanding of the Venezuelan flora.

Paratypes. VENEZUELA. **Amazonas:** Río Casiquiare entre Capihuara y Caño Curamoni, Oct. 1987, *B. Stergios & P. Stergios 11332* (BM, GUYN, K, MO, NY, PORT, TFAV, US, VEN); Río Pamoni, 2°48'N, 65°57'W, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11418* (GUYN, K, NY, PORT, TFAV, US, VEN); Río Casiquiare, entre Solano y Piedra Guachapita. 1°58'N, 66°55'W, Sep.–Oct. 1987, *B. Stergios & P. Stergios 11298* (GUYN, K, NY, PORT, TFAV, US, VEN).

21. Campsiandra taphornii Stergios, sp. nov. TYPE: Venezuela. Bolívar: Río Claro, al este de los tanques, 7°55'N, 63°06'W, Mar. 1988, *D. Taphorn DCT-88-3B* (holotype, PORT; isotypes, K, NY, PORT, GUYN, VEN).

Arbor 7–15-metralis; foliolis anguste oblongis, inaequaliter falcatis; venis subtus scrobiculato-reticulatis, interdum punctis obscuris permixtis; sepalis ovatis, 3 mm longis, 2.5 mm latis, basi recte imbricatis.

Habitat in silvis ripariis secus flumina aquae nigrae vel subnigrae.

Tree 7–15 m tall; branchlets ellipsoid, rusty appressed-puberulent, longitudinally smooth warty-rugose with ca. 4 more-pronounced, dark-colored, longitudinally directed, rounded, vein-like protuberances somewhat evenly arranged around the stem. *Leaves* imparipinnate, 9(–11)-foliolate, leaflets opposite to subtly subopposite, minutely puberulent or tomentulose; pulvinus warty-rugose, 4 × 3 mm, rather inconspicuous; petiole 3.5–4 cm long, notably ferrugineous-tomentulose, dorsally erect to inclined-winged near the base, then wings turn abruptly revolute up to the first pair of leaflets; rachis more minutely puberulent to nearly glabrous, dorsally sulcate; petiolules rather finely, transversely rugose, 2.5–1.5 mm. *Leaflets* narrowly oblong, 15–16 × 3.5–4 cm, somewhat falcate, chartaceous, frequently inaequilaterally cuneate at the base, apex obtuse to acute-mucronate, the tip usually slightly retuse, sparsely puberulent on upper surface, copiously rusty, appressed-puberulent below, thinning out on the older leaflets, notably caespitose-tomentulose at the base (and top of petiolule); margins applanate; lower surface with scattered, dark-colored, epidermal glandular-like dots; venation favoso-reticulate on both surfaces, but smoother above, more pronounced below, midvein dark-red-colored, more notably so on lower surface and ± rounded. *Inflorescence* a terminal panicle of openly distributed, rather long racemes, main axis ferrugineous-tomentulose; racemes 7–10.5 cm long, puberulent to glabrescent on the lower portion, terminal portion ferrugineous-tomentulose; pedicels sparsely and minutely puberulent, 1.5–2 cm long, mostly straight-ascending, but sometimes slightly cornuiform at the tip, usually articulating 1.5–2 mm below base of calyx tube, two-thirds or more caducous before or at anthesis, leaving a small cluster of more persistent flowers near the tip of each raceme. *Flowers* about 1.5 cm long at full anthesis; bracts fleshy, acuminate-cymbiform and broadly ovate, golden brown lanose-tomentose without, 2 mm long, 1 mm at widest part; calyx tube tubular-campanulate, 5–6 mm long, 3.5–4 mm wide at base of lobes, mostly inaequilaterally bulged near the base, sparsely appressed-puberulent to glabrescent; sepals ovate, obtuse, somewhat cucullate, straight-imbricate at the base, 3 × 2.5 mm, more notably and totally golden brown, appressed-puberulent; petals cucullate, 9 × 5–6 mm, suddenly short-angustate at the base, the margins becoming membranously translucent and rounded-auriculate near the base, the narrowed, basal portion 2 mm long, the margins ciliolulate except for the narrowed basal portion; stamens 15, filaments terete, 4–4.2 cm long, 0.75 mm at the base but attenuating notably into delicate filaments about halfway to the tip; anthers barbate-pilose dorsally, ventrally villous, 2 × 1 mm; ovary applanate-fusiform with rounded margins, 8–9 × 2 mm; stipe about 7 mm long; style 5.3–5.5 cm long, terete; stigma infundibuliform, 1 × 1 mm; ovules 8, discoid. *Pods* applanate, ± smooth on both surfaces, 21–22 × 5–5.5 cm; margins slightly thickened and wavy; distal end short-cuspidate.

Distribution and ecology. Occasional in riparian semi-black or tea-colored-water habitats. Usually rocky, white-sandy streams and small tributaries of the larger, turbid, white-water rivers that drain into the lower Orinoco River along the extent of the northern boundary of the Venezuelan Guayana Shield between Bolívar State and the states of Apure, Guárico, and Anzoátegui to the north and west. Other similar, varzean habitats along the Orinoco River drainage from the confluence of the Guaviare-Atabapo rivers along the Colombian-Venezuelan border in northern Amazonia, north to Puerto Ayacucho can also be documented.

Campsiandra taphornii can be distinguished by the narrowly oblong, inaequilateral, falcate, chartaceous leaflets, usually nitid below with favosoreticulate venation and notable, usually dark-colored, glandular-like epidermal dots; and the glabrescent, inaequilaterally bulged calyx tube with basally straight-imbricate sepals. *Campsiandra taphornii* is most closely related to *C. ferruginea* and *C. implexicaulis* discussed previously in this paper. This group of appressed-pubescent species, unlike the *C. emonensis-C. nutans-C. aymardii* group, can be further differentiated from *C. laurifolia* in general by the nitid undersurface of the leaflets with the absence of a distinct, dull, waxy epidermal coating. Other distinctions of both of these groups from *C. laurifolia* were pointed out earlier while discussing *C. aymardii. Campsiandra taphornii* is dedicated to my long-time colleague and ardent biological explorer, Donald C. Taphorn, founder and curator of what is now Venezuela's most important freshwater fish collection at the BioCentro Museum, UNELLEZ, Guanare, Venezuela.

Paratypes. VENEZUELA. **Anzoátegui:** Laguna Mamo, cerca del Orinoco, abr. 1987, *Colonnello 1106* (CAR). **Apure:** Caño La Pica, Fundo Coco de Mono, camino Capanaparo–Cinaruco, ene. 1987, *B. Stergios, P. Stergios & D. Taphorn 9730* (NY, PORT, VEN). **Bolívar:** Dtto. Heres, Laguna Lara, después del caserío El Bongo, abr. 1989, *E. Sanoja et al. 2764* (PORT). **Amazonas:** Río Cataniapo, Depto. Atures, ½-km arriba del puente Cataniapo, cerca de Puerto Ayacucho, Feb. 1986, *B. Stergios & G. Aymard 8935* (PORT-unicate), Feb. 1986, *B. Stergios et al. 8944* (PORT); Atabapo, en isla en la confluencia de los ríos Guaviare y Atabapo, ene. 1988, *B. Stergios et al. 11439, 11441* (GUYN, K, NY, PORT, TFAV, VEN). **Guárico:** Laguna de Atarrillado, mid Aguaro River, Jan. 1995, *D. Rodríguez n/n* (PORT, K, MO, NY).

22. Campsiandra velutina Stergios, sp. nov. TYPE: Venezuela. Amazonas: Depto. Atures, riberas del río Cataniapo, 150 m aguas arriba del puente sobre el río Cataniapo, 9 km al sur de Puerto Ayacucho, Feb. 1987, *E. Melguiero & E. Medina 724* (holotype, PORT; isotypes, PORT, TFAV).

Arbor erecta, valida, 8–12-metralis; foliolos 16–20 cm longis, 6–7 cm latis, papyraceis, late subopposititis, illis cuiusque jugi 0.5–1 cm remotis; calycis tubo 8–10 mm longo; petalis 1.5–1.8 cm longis, 7–8 mm latis, conspicuis.

Habitat endemica in ripariis secus flumina aquae subnigrae.

Erect, medium-sized, robust-appearing *tree,* 8–12 m tall; branchlets near inflorescence glabrescent, 5-shallow-canaliculate longitudinally symmetric around the stem, the sunken canals blackened and alternating with slightly raised, rugose-appearing, hepatic-brown colored, longitudinal bands. *Leaves* imparipinnate, usually 11-foliolate, large and robust, 23–26 cm long near the inflorescences, the leaflets notably subopposite, 5–10 mm gap between leaflets of a pair along the rachis, minutely cinnamon-arcuate or semierect-puberulent; petiole 5–6 cm long, densely cinnamon-tomentulose, flattened dorsally, 5 mm wide, with raised ridges slanting outward then turning into tightly revolute wings up to the first pair of leaflets; rachis 23–25 cm long, notably dorsally sulcate, densely erect to arcuate-puberulent so as to be velvety to the touch; petiolules short and thickened, 3 × 3 mm, arched backwards toward the axis, subtly transversely rugose and cinnamon-puberulent. *Leaflets* broadly oblong and large, 16–20 × 6–7 cm, thickly and pliably coriaceous, felt-like to the touch, undulous across the entire blade, the margins flat, the apex obtuse-mucronate, the tip rounded, the base obtuse; rather densely erect-puberulent on both surfaces, with light-brownish, cream-colored hairs; nerves reticulately venulous on both surfaces, notable for being lighter in color than the leaflet blade, but also distinctly raised on lower surface. *Inflorescence* a terminal panicle of multiple-branched racemes, showy primarily because of the larger flowers, but much shorter than the terminal leaflets and somewhat hidden by them, 14–17 cm long, 8–12 cm wide at anthesis, densely erect cinnamon-pubescent; racemes rather thick and stout, 6–8 cm long, 3–5-branched, the branches 2–6 cm long; pedicels flexuous to arching, 1–1.5 cm long, caducous before anthesis on the lower half to third of the fertile part of the rachis, articulating 2 mm below the base of the calyx tube. *Flowers* showy at anthesis, 2–2.5 cm long, 2 cm wide at the top of the open corolla, but many are caducous while still in bud, leaving a rather thinned-out flowering panicle at anthesis; bracts 2.5–3 × 1.5 mm, broadly ovate-cymbiform, cinnamon-woolly-tomentose without, occasionally and sparsely pilose within; calyx tube tubular, 8–10 × 4 mm, ± oblique at the base, somewhat thinly but uniformly cinnamon-erect-pubescent; sepals broadly ovate, auriculate-imbricate at the base or somewhat cordiform, 4 × 4 mm, thickened at the center to form a protruding bulge giving them a naviculiform or sharply cucullate appearance, uniformly short and straight-erect-pubescent; petals 15–18 × 7–8 mm, cucullate-spatulate, the margins notably and entirely ciliolate, some of the cilia reaching 0.5 mm long; stamens 14–15, filaments terete from the base then becoming slightly compressed toward the apex, filiform, tortuous, 4.5–4.8 cm long; anthers elliptical, 1.5 × 1 mm, pilose on ventral surface, dorsally glabrous; ovary fusiform, compressed but remaining somewhat thickened, 8–9 × 1.5 mm, slightly depressed longitudinally in the center, the borders rounded; stipe compressed, 12–13 mm long; style 4–4.2 cm long, terete, penicilliform; stigma minute, abruptly truncate; ovules 8, compressed, hippocrepiform. *Pod* flattened, slightly falcate, 30–32 × 5–5.5 cm, obtuse-apiculate at distal end, somewhat obliquely cuneate at the base, the surfaces nitid, smoothly and subtly transversely rugose, somewhat globulate.

Distribution and ecology. Endemic to the semi-black-water riparian habitat of the Cataniapo River in northern Venezuelan Amazonia.

Campsiandra velutina is much easier to distinguish than some of the other species described as more or less endemic to the Venezuelan Guayana. It stands out because of the large, thick, undulate, leather-like leaflets with a dense, velvety, short-erect pubescence and dull, waxy epidermal coating and the larger, more showy flowers on mostly bare, stoutly branched panicled racemes. *Campsiandra velutina* is perhaps most akin to *C. macrocarpa* in the larger flowers and easy to distinguish areolate-reticulate leaflet venation, but the flowers of *C. macrocarpa* are larger still, and the leaflets are much smaller and more cartilaginous-coriaceous with distinctly revolute margins; and the pods of *C. macrocarpa* are generally larger. *Campsiandra velutina* can be more closely associated with *C. pasibensis* and *C. wurdackiana* (sp. nov., BioLlania, Edición Especial N°6, 1996, in press) by the short, erect, cinnamon-puberulence of the leaflets and calyx tube and dorsally glabrous anthers. The flowers are notably larger than the other two species, as are the leaflets. The comparative relationships among this group of species is summarized in the synoptic key presented in this paper.

Paratype. VENEZUELA. **Amazonas:** Lower Río Cataniapo, ½-km arriba del puente Cataniapo, cerca de Puerto Ayacucho, Feb. 1986, *B. Stergios & G. Aymard 8930* (BM, GUYN, HBG, K, MO, NY, PORT, TFAV, US, VEN).

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Ocotea ikonyokpe, a New Species of Lauraceae from Cameroon

Henk van der Werff
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. A recent collection of a lauraceous tree sent to me for identification represents an undescribed species of *Ocotea*. It is here described as *O. ikonyokpe* and is contrasted with the other African species of that genus.

Ocotea is a large genus of Lauraceae consisting of about 300 species in the Neotropics, 7 species in Africa, and about 30 species in Madagascar. The African species are distributed from the Canary Islands (with one endemic species, *O. foetens* (Aiton) Baillon), one species in West Tropical Africa, and four species in the mountains of East Africa, extending to South Africa. Many of the American species have unisexual flowers, while all African and Malagasy species have bisexual flowers. Species with opposite or subopposite leaves are more common in Africa and Madagascar than in the Americas. The placement of the African, Malagasy, and American species in one genus has never been seriously questioned.

Recently, an undescribed species of *Ocotea* was collected in Cameroon; a description follows here.

Ocotea ikonyokpe van der Werff, sp. nov. TYPE: Cameroon. Southwest Province: Rumpi Hills Forest Reserve, 1.5 km W of Madie River Ford, *D. Thomas 10456* (holotype, MO; isotypes, K, SCA, Y). Figure 1.

Ocoteae michelsonii affinis, sed foliis subtriplinervibus, subtus glaucis, gemmis pubescentibus et ramulis sparse pubescentibus recedit.

Tree, to 40 m tall. Twigs terete, dark brown, sparsely pubescent, the hairs white, erect, flexuous. Terminal buds densely white pubescent. Leaves initially opposite, becoming subopposite on older twigs, thinly chartaceous, 10–17 × 3–6 cm, elliptic, base acute, apex acute or acuminate, glabrous on both surfaces, lower surface glaucous; lateral veins 7–10, the basal pair more strongly developed than the more distal ones, and leaving the midvein under a more acute angle, midrib and lateral veins immersed on upper surface, and slightly raised on lower surface, higher order veins forming a fine reticulation, slightly raised but clearly visible under a dissecting microscope, without free veinlets. Petioles 6–13 mm long, sparsely pubescent when young, becoming glabrous with age. Inflorescences axillary, 6–12 cm long, sparsely pubescent at base, more densely so toward the flowers, paniculate-cymose. Flowers pale yellow, bisexual, tepals 6, equal, pubescent outside, sparsely pubescent inside, ca. 3 mm long, broadly elliptic, stamens 9, 4-celled, the cells arranged in 2 rows, outer 6 stamens with introrse-lateral cells, inner 3 with extrorse-lateral cells, outer stamens ± pubescent, inner ones nearly glabrous, all stamens ca. 3 mm long in alcohol-preserved flowers; filaments of inner stamens with 2 sessile, ellipsoid glands near the base; staminodia 3, ca. 1.2 mm long, widened in the upper half, largely hidden by the inner stamens; pistil glabrous, 3 mm long, the ovary small, swollen; receptacle shallow, glabrous inside. Fruit unknown.

Ocotea ikonyokpe can be readily recognized by its glabrous, (sub)opposite leaves, which are glaucous below and subtripliveined. Only one other species of *Ocotea, O. gabonensis* Fouilloy, is known from Tropical West Africa. The latter species has alternate, stiffer leaves and glabrous (or nearly so) terminal buds; its flowers and inflorescences are nearly glabrous. The few available collections of *O. gabonensis* indicate it is a small tree (three recent collections all give 6 m as the height of the plant), while *O. ikonyokpe* is a 40-m-tall tree.

Ocotea angustitepala (Krause) Robyns & Wilczek was described from Cameroon, but was recently recognized as a cultivated *Nectandra patens* (Swartz) Grisebach, a species native to the West Indies (Rohwer, 1989). Therefore, *O. ikonyokpe* is the only *Ocotea* species known from Cameroon, although *O. gabonensis* may well also occur in that country.

There are an additional five *Ocotea* species known from Tropical East and southern Africa, all montane species reported from above 1500 m. The southern African *O. bullata* (Burchell) E. Meyer can be easily recognized by the large and conspicuous domatia on its leaves. Two species, *O. michelsonii* Robyns & Wilczek and *O. usambarensis* Engler, have opposite leaves; *O. michelsonii* differs in having glabrous twigs, glabrescent buds, and pinnately veined leaves, while *O. usambarensis* differs

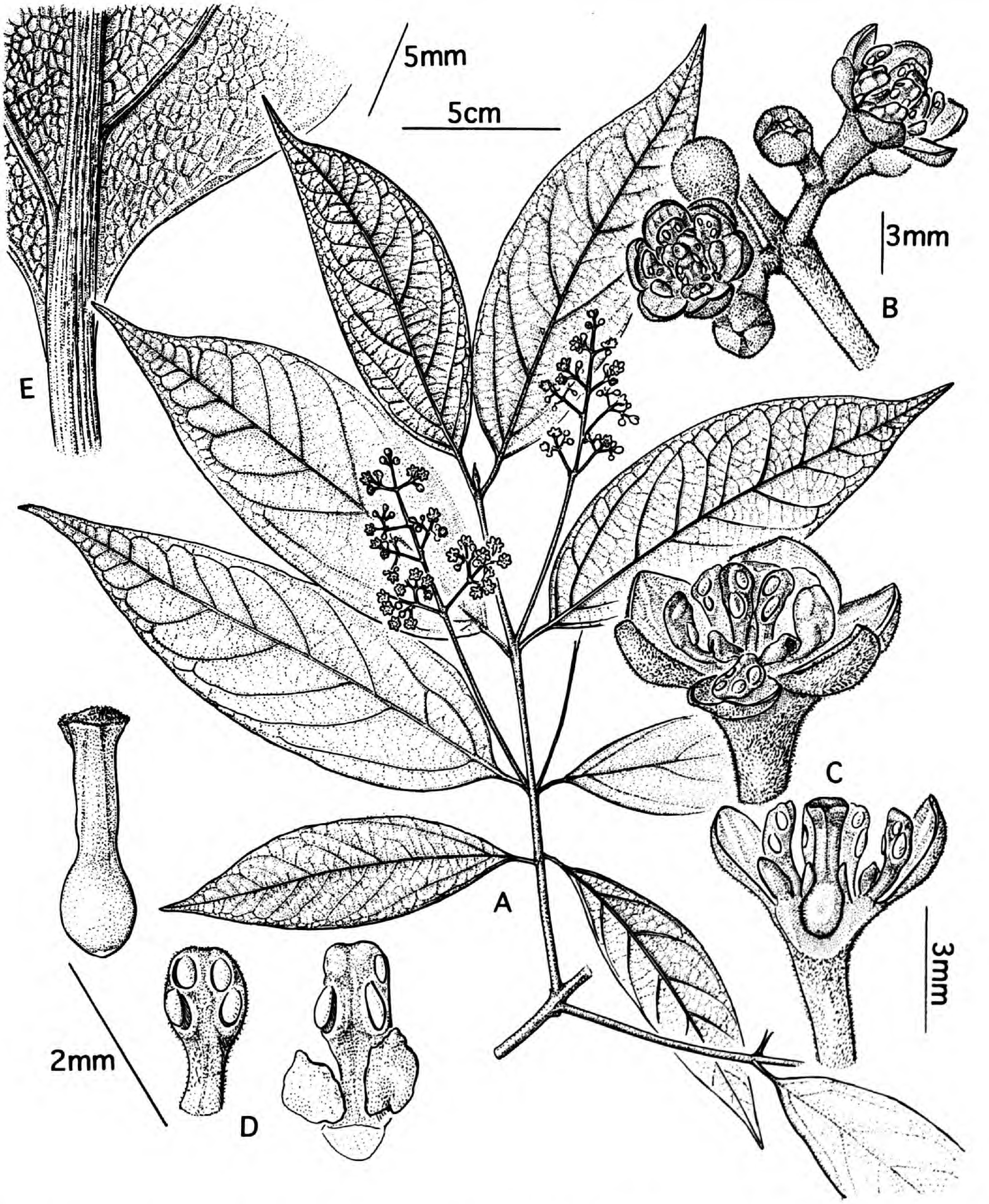

Figure 1. *Ocotea ikonyokpe* van der Werff. —A. Habit. —B. Detail of inflorescence. —C. Detail of flowers. —D. Stamens and pistil. —E. Detail of leaf.

in its pubescent leaves. *Ocotea kenyensis* (Chiovenda) Robyns & Wilczek (synonym: *O. viridis* Kostermans) has alternate leaves, just as *O. gabonensis*, and morphological differences between these two species are not obvious. The last species, *O. argylei* Robyns, is apparently only known from the type collection with small fruits; it is compared with *O. kenyensis* in the discussion following its description and I therefore assume it has alternate leaves. The published key to the tropical African species of *Ocotea* (Fouilloy, 1974) is not very helpful in their identification; more good collections are probably needed before the problems can be solved. However, *O. ikonyopke* resembles only *O. michelsonii*, and the differences between the two seem quite pronounced.

The specific epithet is derived from the common name of this species in the Iroko language, and the species is locally an important source of timber.

Acknowledgments. I thank Duncan Thomas for bringing the specimens to my attention and the Curator of K for sending me duplicates of the type collection. John Myers provided the illustration.

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Studies in Malagasy Lauraceae II: New Taxa

Henk van der Werff
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Eight new species of Lauraceae from Madagascar belonging to the genera *Beilschmiedia*, *Ocotea*, and *Potameia* are described and illustrated: *Beilschmiedia moratii*, *Ocotea grayi*, *O. longipedicellata*, *O. malcomberi*, *O. oligantha*, *O. sambiranensis*, *O. tsaratanensis*, and *Potameia micrantha.*

As a result of studies of older collections at P and of recent collections, eight new species of Lauraceae from Madagascar have been recognized. They are described and illustrated in this contribution. New treatments of the genera *Beilschmiedia*, *Ocotea*, and *Potameia* are near completion and will be part of an updated treatment of Lauraceae for the *Flore de Madagascar et des Comores.*

Beilschmiedia is represented in Madagascar by about ten species, all endemic. Two of those were first described in monotypic genera (*Thouvenotia* Danguy; *Bernieria* Baillon) but were placed by Kostermans (1939) with a few other species in *Apollonias.* Subsequently, Kostermans (1952) transferred these species to *Beilschmiedia*, a definite improvement, and published three additional species in 1957.

The Malagasy species are still poorly known, as flowers and/or fruits have not yet been collected of all published species. Nevertheless, two species groups can be recognized. One group has subopposite, glabrous leaves; tepals fused in a short floral tube, which is dehiscent in old flowers and leaves a circular scar at the base of the young fruit; and black young branches. The other group has alternate, usually pubescent leaves; tepals persisting in the fruiting stage, although they eventually become damaged and fall; and does not have black young branches that contrast with the gray older twigs.

The new species of *Beilschmiedia* described here belongs in the first group and differs from the other species in leaf and inflorescence characters.

Beilschmiedia moratii van der Werff, sp. nov. TYPE: Madagascar. Massif de Tsaratanana, basin of the Maevarano, between 1750 and 2000 m, *SF (Capuron) 24985* (fl) (holotype, MO; isotype, P not seen). Figure 1.

Ex affinitate *Beilschmiediae oppositae* et *B. sary*; a *B. opposita* reticulatione elevata et foliis base obtusis vel rotundatis, a *B. sary* foliis minoribus, basi obtusis vel rotundatis, et inflorescentia puberula recedit.

Tree, to 15 m tall. Twigs terete, glabrous, the young ones black, older twigs with gray, corky bark. Terminal buds glabrous. Leaves subopposite, coriaceous, 2.5–4 × 1.5–3 cm, broadly elliptic, shiny, base and tip obtuse to rounded, the margin often incurved, glabrous on both surfaces, lateral veins 4–7 on each side, but poorly differentiated from the tertiary venation, midrib weakly raised on both surfaces, lateral veins and lax reticulation prominently raised. Petioles 4–7 mm long, glabrous. Inflorescences axillary, paniculate, to 3.5 cm long, puberulous, especially toward the tip of inflorescence, the hairs wrinkled, ± erect, the flowers often with a glabrous bract with ciliate margin at their base, this ca. 2 mm long. Flowers depressed globose, a floral tube scarcely present, 3–4 mm wide and ca. 2 mm tall. Tepals 6, equal, sparsely puberulous, broadly elliptic to ovate, the margin thinner than the central part, the inner surface glabrous, the base fused, tepals dehiscing in old flowers and leaving a circular scar at base of the very young fruit. Stamens 9, 2-celled, the outer 6 broadly ovate, ca. 2 mm long, pubescent along margin, the cells large, introrse, filament very short, connective prolonged beyond the cells; inner 3 narrowly triangular, densely pubescent, 1.5–2 mm long, the cells lateral, 2 large, globose glands present at base of filaments, base of filaments of Whorls III and IV fused into a narrow, pubescent ring; staminodia of Whorl IV small, triangular, pubescent. Pistil glabrous, ovary turbinate, gradually narrowed into the short style. Fruit roundish, 3–3.5 cm diam.

Beilschmiedia moratii is known from the Massif de Tsaratanana and the summit of Anjanaharibe; the two flowering collections were made in November. This species is closely related to *B. opposita* and *B. sary.* The three species share subopposite leaves, black young twigs, and bases of the tepals united in a short floral tube, which is dehiscent in old flowers, leaving a circular scar at the base of the young fruit. *Beilschmiedia moratii* differs from *B. sary* in its smaller leaves with obtuse to rounded base and its puberulous inflorescences and flowers; from *B. opposita* it differs in its raised reticulation

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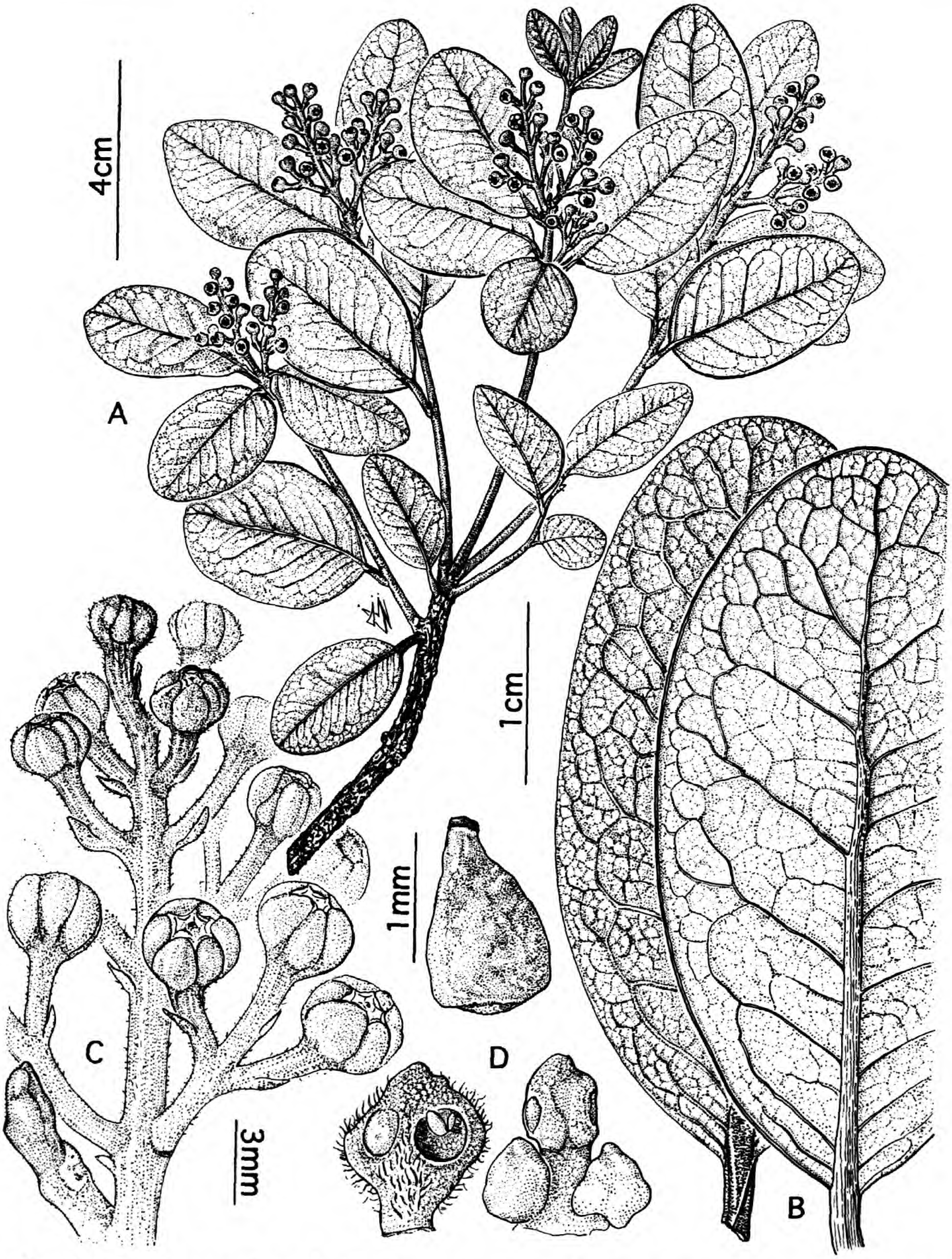

Figure 1. *Beilschmiedia moratii* van der Werff. —A. Habit. —B. Leaves showing venation pattern. —C. Inflorescence. —D. Pistil and stamens.

of the leaves, obtuse to rounded leaf base, and erect hairs on the inflorescence. Stamens of Whorl III are fertile in *B. moratii* (or have at least well developed locelli), whereas these are probably staminodial in *B. sary* and *B. opposita*.

This species is named after P. Morat, Director of the Laboratoire de Phanérogamie of the Muséum National d'Histoire Naturelle in Paris, who collected this species and who has greatly stimulated studies of the flora of Madagascar.

Paratypes. MADAGASCAR. Tsaratanana, 2100 m elev., *Morat 2284* (P); Antsiranana, summit of Anjanaharibe-Sud., *Lewis et al. 1350* (MO, P, TAN).

Ocotea is represented on Madagascar by 30–35 species. It is readily recognized because it is, on

Madagascar, the only genus with four-celled stamens and a fruit seated in a cupule. Several species have very pronounced pit-domatia; domatia are not found in the other genera occurring on Madagascar. Although most species are now well understood, one complex consisting of species with glabrous leaves, without domatia and without inrolled leaf bases, needs to be resolved. Several names apply to this complex and it is unlikely that additional new species need to be recognized.

Ocotea grayi van der Werff, sp. nov. TYPE: Madagascar. Toliara, Réserve Intégrale #11 (Andohahela), *van der Werff et al. 12732* (holotype, MO; isotypes, B, G, GH, K, L, LE, MO, NY, P, PRE, QRS, TAN). Figure 2.

Ocoteae trichophlebiae affinis, sed foliis triplinervibus, domatiis ornatis, inflorescentiis et foliis majoribus recedit.

Tree, to 25 m tall. Twigs ± terete, yellow-brown tomentellous when young, the indument wearing off with age. Terminal buds tomentellous. Leaves alternate, tripliveined, chartaceous, 9–19 × 4–9 cm, elliptic or broadly elliptic, base acute or obtuse, apex acute or acuminate, lateral veins 3–5, the basal pair more strongly developed than the distal ones, upper leaf surface pubescent when young, soon becoming glabrous, sometimes with remnants of indument on midrib and lateral veins, midrib, lateral veins, and tertiary venation immersed; lower surface with a sparse to dense indument, hairs erect, ± curled, indument denser along major veins and midrib, midrib, lateral veins, and tertiary venation clearly raised; domatia present, consisting of shallow pockets covered by a dense tuft of hairs. Petioles 0.8–1.5 cm long, with similar indument as twigs. Inflorescences (densely) pubescent, paniculate, axillary, to 12 cm long. Flowers creamy white or pale yellow. Tepals 6, pubescent on both surfaces, ca. 2 mm long. Stamens 9, 4-celled, 1 mm long, filaments pubescent; anthers glabrous, glands present at base of inner stamens, staminodia 3, stipitiform, pubescent. Ovary and inside of receptacle glabrous. Cupule deeply cup-shaped, to 2.5 cm wide, 1.5 cm high, fruit roundish, ca. 2 cm diam.

Ecology. Forests on eastern slopes, from Brickaville south to Ft. Dauphin, inland to Ranomafana and Fianarantsoa, up to 1000 m elevation.

Flowers: August–November (mostly September–October); fruits throughout the year.

Ocotea grayi is characterized by the presence of domatia, tripliveined leaves, erect indument on lower leaf surface, and its rather long inflorescences. Most collections placed in this species were previously identified as *Ocotea trichophlebia.* This latter species differs from *O. grayi* in its pinnately veined leaves, lack of domatia, and smaller leaves and inflorescences. *Ocotea trichophlebia* also occurs at higher elevations than *O. grayi.*

This species is dedicated to Bruce Gray, an excellent collector of Lauraceae and whose company I enjoyed on several field trips.

Common names. Varongirwimbakoka, Varongy, Varongy fotsy, Varongi mainty.

Paratypes. MADAGASCAR. Moramanga, route d'Anosibe, *Cours 888* (P); Befotaka *Cours 5333* (MO, P); Befotaka, *Decary 4737* (P); Vondrozo, *Decary 5231* (P); Vondrozo, *Decary 5424* (P). Bassin de la Manampanihy, *Humbert 6061* (P); Haute Vallée du Mandrare, *Humbert 6673* (P); Ranomafana National Park, *Malcomber et al. 1610* (MO, P, TAN); road Ft. Dauphin-Ranomafana, *McPherson & Rabevohitra 14975* (MO, P, TAN). Bas Namorona, *Perrier de la Bathie 6694*(P); Bas Namorona, *Perrier de la Bathie 11837* (P); Bassin inférieure du Mangoro, *Perrier de la Bathie 18235* (P); Bassin du Namorona, *Perrier de la Bathie 4486* (P). Réserves Naturelles: Tamatave, *RN 3196* (P); Behara, *RN 3433* (P). Service Forestière: Fianarantsoa, *SF 3182* (P); Benara, *SF 3787* (P); Ambila-Lemaitso, *SF 4896* (P); Folongoina, *SF 5227* (P); Ranomafana, *SF 5608* (P); Vohipeno, *SF 6379* (P); Mananjary, *SF 6688* (P); Nampohone, N of Ft. Dauphin, *SF 6970 Capuron* (P); Analolava, *SF 7103* (P); Fort Carnot, *SF 9678* (P); Fort Carnot, *SF 10990* (P); Manakara, *SF 19212* (MO, P); Fort Carnot, *SF 19298* (MO, P); Fort Carnot, *SF 19794* (MO, P); Manakara, *SF 6542* (P); Andohahela, *van der Werff et al. 12745* (MO, P, QRS, TAN).

Ocotea longipedicellata van der Werff, sp. nov. TYPE: Madagascar. Canton Sahatavy, District Vavatenina, *RN (Rakotondramisa) 11386* (holotype, P). Figure 3.

Inter species madagascarienses pedicellis longis, gracilibus et foliis, ramulis gemmisque terminalibus glabris distinguenda.

Shrub. Twigs terete, slender, glabrous. Terminal buds glabrous. Leaves alternate, chartaceous, elliptic or narrowly elliptic, 6–11 × 2–3.5 cm, glabrous on both surfaces, the base acute, tip acuminate, upper surface smooth, ± shiny, lateral veins 7–9, immersed or nearly so on upper surface, weakly raised on lower surface. Petioles glabrous, 6–10 mm long, flattened above. Inflorescences in axils of deciduous bracts at the tips of the twigs, glabrous, paniculate-cymose, 5–8 cm long, laxly flowered. Pedicels slender 1–1.5 cm long. Flowers glabrous on outside, the tepals spreading. Tepals 6, equal, 2–2.5 mm long, the inner surface with a few hairs near the base; stamens 9, 4-celled, the cells arranged in 2 rows, ca. 1.3 mm long, filaments about as long as anthers, inner 3 stamens with 2 glands at the base of the

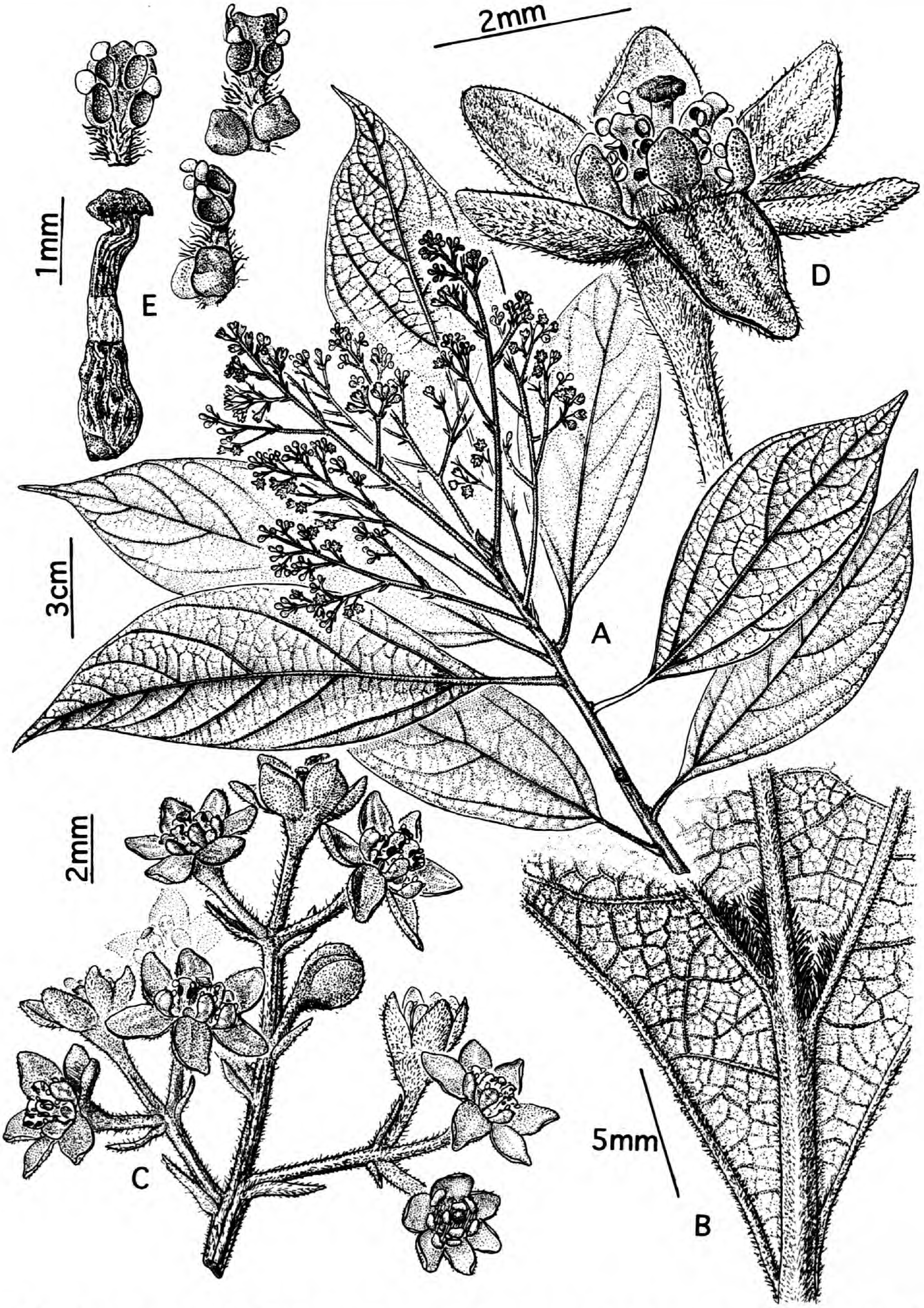

Figure 2. *Ocotea grayi* van der Werff. —A. Habit. —B. Detail of lower leaf surface, showing domatia. —C. Part of inflorescence. —D. Flower. —E. Pistil and stamens.

filaments, pistil ca. 2 mm long, glabrous, ovary gradually narrowed into the style; receptacle deep, glabrous inside. Cupule cup-shaped, with entire margin, 1.5 cm wide, 0.8 cm high, pedicel scarcely thickened; fruit ellipsoid, 2 × 1.5 cm.

Flowers: October–December.

This species is readily recognized by its glabrous condition, acuminate leaves, and the slender inflorescences with long-pedicelled flowers. These long pedicels are unique among *Ocotea* species in Mad-

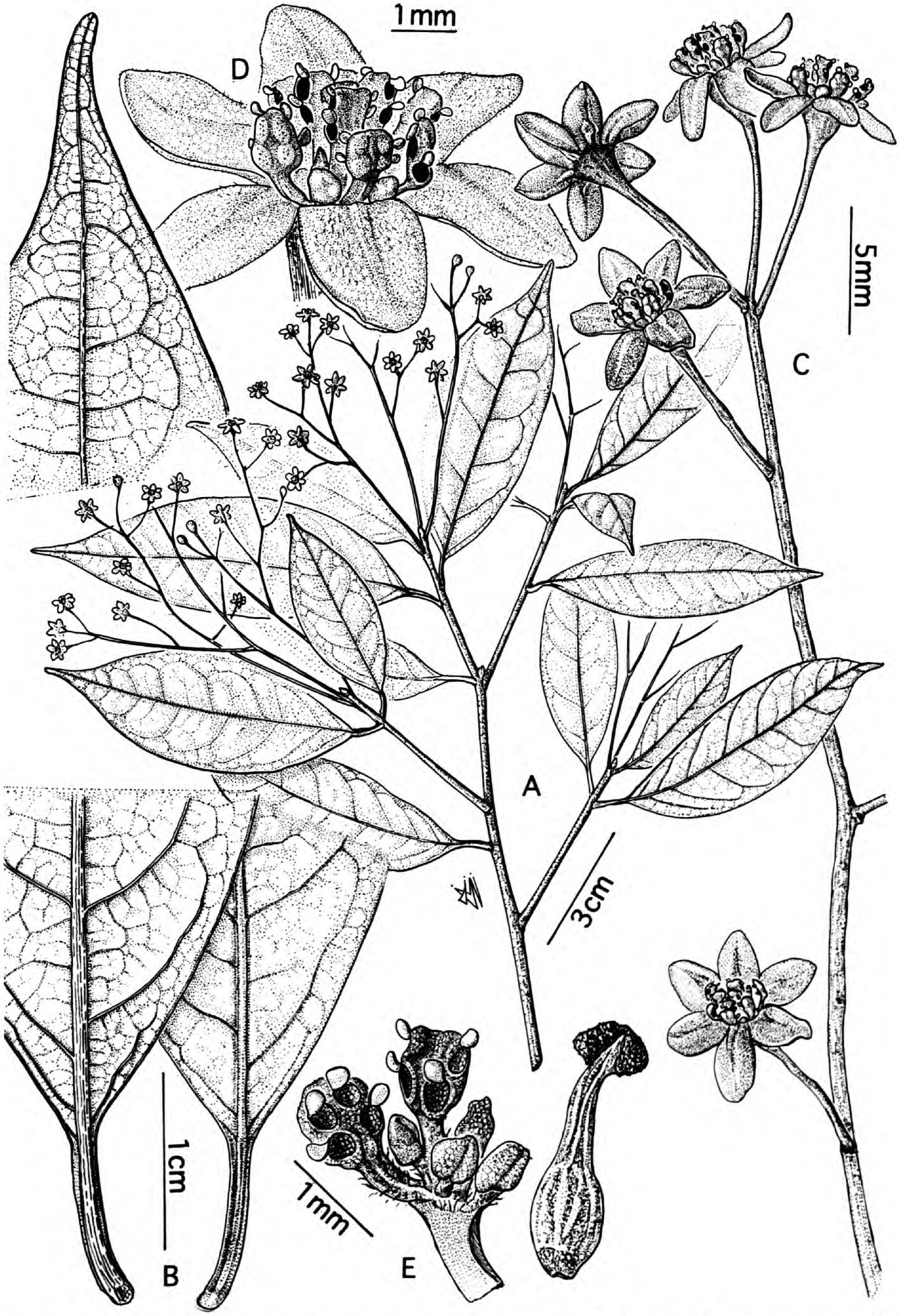

Figure 3. *Ocotea longipedicellata* van der Werff. —A. Habit. —B. Detail of leaves. —C. Inflorescence. —D. Flower. —E. Pistil and stamens on part of the receptacle.

agascar and are the main reason I describe this species, known from only two collections.

Paratype. MADAGASCAR. Province Toamasina, Réserve Naturelle Intégrale 3, Zahamena, *Randrianjanaka 8* (MO).

Ocotea malcomberi van der Werff, sp. nov. TYPE: Madagascar. Toliara, Réserve Intégrale #11 (Andohahela), *van der Werff et al. 12756* (holotype, MO; isotypes, B, BR, G, GH, K, L, LE, NY, P, QRS, TAN, TNS, US). Figure 4.

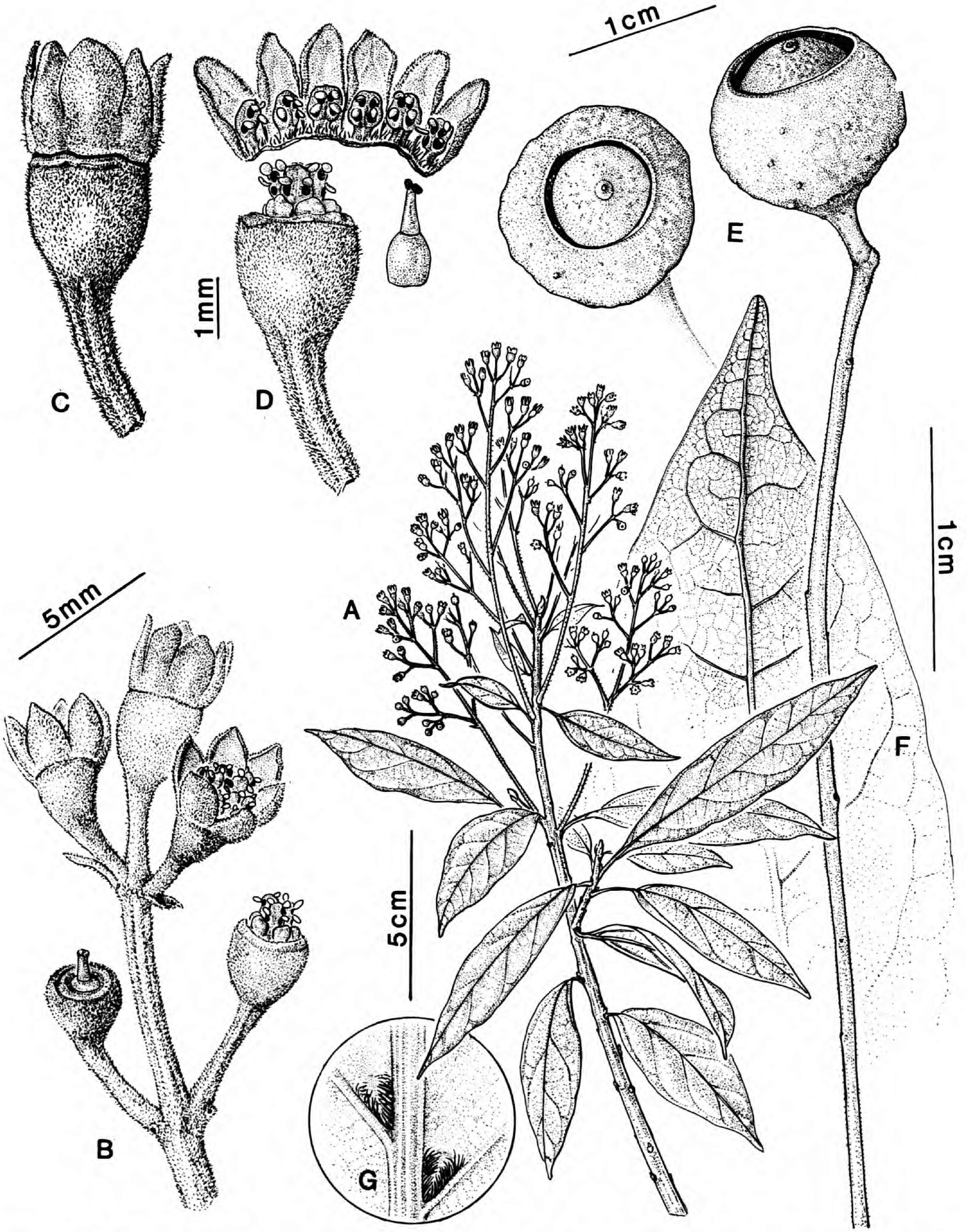

Figure 4. *Ocotea malcomberi* van der Werff. —A. Habit. —B. Part of inflorescence. —C. Old flowers showing abscission line of tepals. —D. Old flower showing inner stamens and united tepals with outer stamens. —E. Fruits. —F. Detail of leaf.

Ocotea trichanthae similis sed inflorescentibus longioribus, minus pubescentibus et domatiis inconspicuis recedit.

Trees, 20 m tall. Twigs terete or slightly angular, when young covered with a very fine, gray indument, the hairs very short and individually scarcely visible, becoming glabrous with age. Terminal buds light brown-tomentellous. Leaves alternate, chartaceous, 6–10 × 2.5–5 cm, (broadly) elliptic, base and apex acute, upper surface shiny, glabrous, lower surface dull, glabrous, but very young leaves pubescent, venation immersed on upper surface, midrib and lateral veins slightly raised on lower surface, lateral veins 4–6, domatia present, consisting of mostly shallow pockets with a fringe of hairs or entirely covered by hairs. Petioles 0.8–1.3 cm long, glabrous or minutely puberulous, usually darker colored than the twigs. Inflorescences 5–13 cm long, in axils of deciduous bracts near the apices of twigs or along short, leafless shoots, but rarely in axils of normal leaves, paniculate, gray-pubescent. Flowers pale yellow or white. Tepals 6, pubescent both surfaces, ca. 1.3 mm long, connected at their base and in old flowers falling off as a ring, together with the stamens. Stamens 9, 4-celled, the outer 6 0.8 mm long, the filaments very short or almost absent, anthers dorsally with some hairs; inner 3 stamens ca. 1.1 mm long, with 2 glands attached near the base, staminodia 3, stipitiform, pubescent. Receptacle deep, glabrous inside, ovary and style each 1 mm long, with a few hairs on upper part of ovary and along style or glabrous. Cupule deeply cup-shaped, 2 cm wide, 1.4 cm high, fruit ellipsoid, 2.2 × 1.6 cm.

This species is restricted to the southeast corner of Madagascar (Andohahela, Col du Maningotry, Ifarantsa) between 300 and 600 m elevation. A few collections, including the type, were made along roads, suggesting this species tolerates disturbed habitats quite well.

Flowers: August–October; fruits: January, September, November.

Ocotea malcomberi has been confused with *O. trichantha* but differs in its longer inflorescences (usually longer than the surrounding leaves), shallow and inconspicuous domatia (sometimes domatia are only present in a few leaves), and by the shorter, sparser indument of the inflorescences (surface is usually clearly visible). The petioles of *O. malcomberi* are not infrequently darker than the twigs, a condition that is very rare in *O. trichantha. Ocotea malcomberi* is only known from the southeast of Madagascar, while *O. trichantha* has been reported from the southwest part (Massif d'Analavelona, Isalo). Both species have their inflorescences in axils of deciduous bracts, an uncommon character of Malagasy *Ocoteas*. Another uncommon character are the basally connate tepals, which fall off as a unit in older flowers.

This species is named after Simon Malcomber, an excellent collector of Malagasy plants.

Common names. Varongy fotsy, Varong mavokely.

Paratypes. MADAGASCAR. Andohahela Reserve, *McPherson 14422* (MO, P, TAN); Col de Maningotry, *McWhirter 230* (K, P); Col du Maningotry, *Rabevohitra 2242* (MO). Réserves Naturelles: Bahara, *RN7457* (P). Service Forestière: Col du Maningotry, *SF (Capuron) 8509* (P); Ivorona-Ifarantsa, *SF 15625* (MO, P); Ifarantsa, *SF 15630* (P); Col du Maningotry, *SF (Capuron) 28346* (MO, P); Col de Maningotry, Ifarantsa, sans collecteur, *3-R-57* (P).

Ocotea oligantha van der Werff, sp. nov. TYPE: Madagascar. Centre. Massif de Vohibe-Antoatra, au S-SE d'Ambositra entre 1600 et 1869 m d'alt. *SF (Capuron) 23856* (holotype, MO; isotype, P). Figure 5.

Inter species madagascarienses gemmis terminalibus inflorescentiisque glabris et foliis glabris, domatiis magnis ornatis, recedit.

Small tree. Twigs terete, glabrous or with some scattered hairs. Terminal buds glabrous. Leaves alternate, subcoriaceous, 3.5–6 × 2–3.5 cm, broadly elliptic or elliptic, glabrous on both surfaces, venation immersed on both surfaces, base obtuse, acute or rounded, tip acute, lateral veins 3–4, domatia present, consisting of deep pits, mostly in axils of lateral veins, but sometimes also along lateral veins. Petioles glabrous, 0.4–0.8 cm long. Inflorescences in axils of deciduous bracts or normal leaves, glabrous, 2–3 cm long, with 7 or fewer flowers. Tepals 6, glabrous outside, sparsely pubescent inside, 2–2.5 mm long. Stamens 9, 4-celled, glabrous or with few hairs at base of filament, glands of inner stamens attached above base of filament, staminodia 3, glabrous. Ovary and inside of receptacle glabrous. Fruits unknown.

This species is only known from the type collection made in the Massif du Vohibe-Antoatra, S-SE of Ambositra, between 1600 and 1870 m altitude.

Flowers: December.

Ocotea oligantha belongs to a small group of montane species with small leaves and pit-domatia. Characteristic for this species is the combination of glabrous terminal buds, glabrous flowers, pinnately veined leaves with domatia not solely in axils of the basal lateral veins, and glabrous, few-flowered inflorescences. Although the terminal buds are glabrous, the young twigs immediately below the buds are somewhat pubescent; as a rule, Lauraceae with glabrous terminal buds also have glabrous twigs.

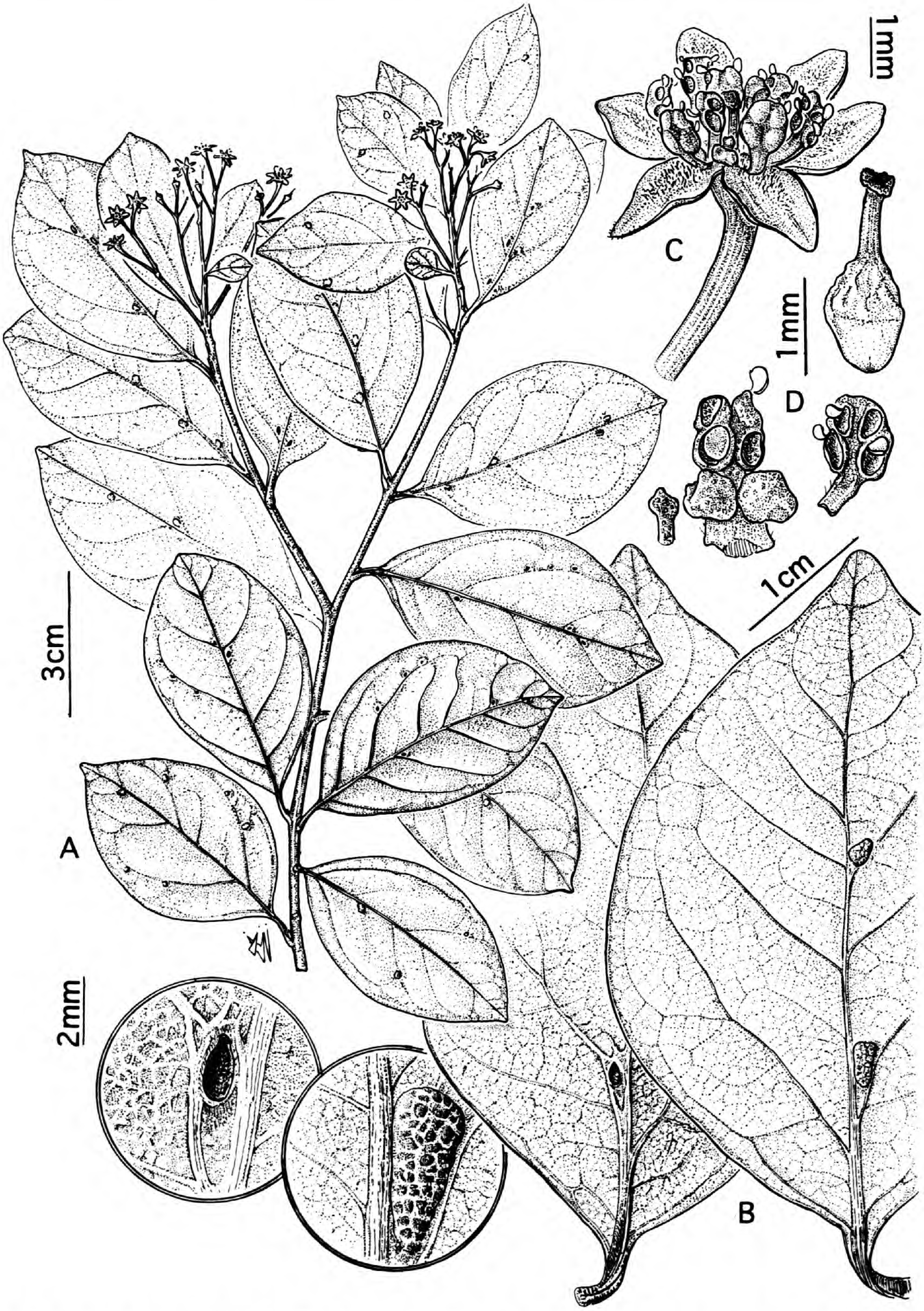

Figure 5. *Ocotea oligantha* van der Werff. —A. Habit. —B. Leaves showing domatia on upper and lower surface. —C. Flower. —D. Pistil and stamens.

Ocotea sambiranensis van der Werff, sp. nov. TYPE: Madagascar. Prov. Antsiranana, Massif du Manongarivo, above the village of Ambodisakoana, *van der Werff & McPherson 13502* (holotype, MO; isotypes, GH, K, L, LE, P, PRE, TAN). Figure 6.

Ob statum glabrum et folios sine domatiis *Ocoteam longipedicellatam* et *O. madagascariensem* tangit, ab *Ocotea longipedicellata* pedicellis brevioribus, ab *O. madagascariense* foliis acutis recedit.

Small tree, 5–6 m tall. Twigs terete or angular, glabrous. Terminal buds glabrous. Leaves alternate,

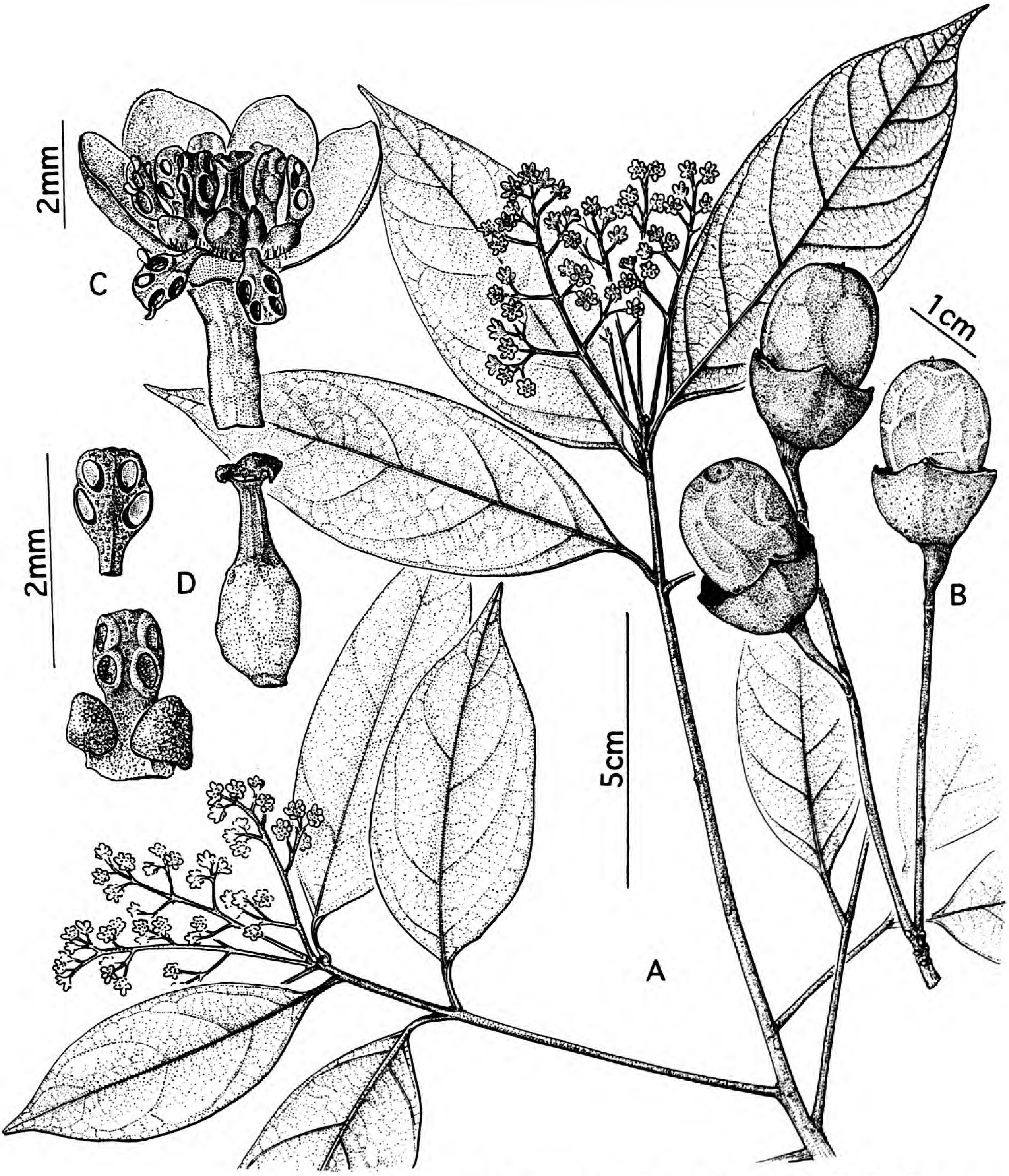

Figure 6. *Ocotea sambiranensis* van der Werff. —A. Habit. —B. Fruits. —C. Flower. —D. Pistil and stamens.

(narrowly) elliptic or slightly ovate, 8–16 × 3–7 cm, glabrous, firmly chartaceous, base acute or rarely obtuse, apex finely acute or acuminate, lateral veins weakly developed, in the distal half of laminae difficult to separate from tertiary veins, 7–11 on each side, secondary and tertiary venation raised on lower leaf surface and sometimes less so on upper leaf surface; domatia absent. Petioles glabrous, canaliculate, 7–13 mm long. Inflorescences in axils of cataphylls, usually grouped at tips of branches or infrequently along short shoots, glabrous, 3–7 cm long, the smaller ones racemose, the larger ones with the lower branchlet racemose or cymose. Pedicels 3–6 mm long. Flowers white, fragrant, tepals ± spreading at anthesis, 6–7 mm diam. Tepals 6, equal, ca. 2 mm long, glabrous outside, minutely puberulous inside, but with some longer hairs near the base, stamens 9, 4-celled, the outer 6 ca. 2 mm long, the filaments broad, a little shorter than the anthers, glabrous, anther cells introrse, arranged in 2 rows; inner 3 stamens ca. 2 mm long, lower 2 anther cells extrorse, upper 2 lateral, filaments at base with 2 elliptic glands, staminodes very small, pubescent; pistil glabrous, 3 mm long, ovary gradually narrowed in the style, stigma large, receptacle deep, glabrous inside. Fruit ellipsoid, 2.5–3 × 1.5 cm, cupule deeply cup-shaped, 2 cm wide, with 6 lobes or teeth.

All collections of *O. sambiranensis* come from the Manongarivo Massif, east of Ankaramy, and were made in rather dry, evergreen forest on the summit of the massif. It was not found in the forest on the slopes. It is a small, understory tree.

Flowers and fruits: October.

Ocotea sambiranensis is one of the few *Ocotea* species that is vegetatively glabrous. The other glabrous species are *O. madagascariensis,* which differs in having obtuse leaf apices, and *O. longipedicellata,* which differs in having much longer pedicels and the scarcely raised or immersed reticulation of the leaves.

Paratypes. MADAGASCAR. Antsiranana, Manongarivo Massif, above village of Ambodisakoana, elev. 1100 m, *van der Werff & McPherson 13472* (MO, P, TAN), *van der Werff & McPherson 13490, 13501, 13523* (MO, P, TAN); Antsiranana, Réserve Spéciale Manongarivo, Bekolosy, *Malcomber & Rakotomalala 2604* (MO, P, TAN).

Ocotea tsaratananensis van der Werff, sp. nov. TYPE: Madagascar. Massif du Tsaratanana, sylve à lichens sur la crête entre les hautes bassins de la Maeverano et du Sambirano, aux bords de l'Andohanisambirano, vers 2450 m, *SF (Capuron) 27010* (holotype, MO; isotype, P). Figure 7.

A congeneribus foliis parvis, domatiis magnis praeditis et indumento dense tomentello ramulorum juniorum, inflorescentiarum et gemmarum terminalium distinguenda.

Tree, to 10 m (said to reach 15–20 m in valleys). Twigs angular, brown tomentellous when young, glabrescent with age, with conspicuous scars from fallen leaves or bracts. Terminal buds densely tomentellous. Leaves alternate, coriaceous, 3–5.5 × 2–2.5 cm, (broadly) elliptic, base acute, obtuse or rounded, tip obtuse or acute, glabrous on both surfaces or with a few hairs along midrib on lower surface, midrib and lateral veins immersed on both surfaces, reticulation weakly raised on both surfaces, lateral veins 3–4; domatia present, consisting of deep pits in axils of basal lateral veins, sometimes smaller pit-domatia present in axils of distal veins, margin of domatia glabrous. Petioles 0.7–1.0 cm long, with similar indument as twigs or, on older twigs, darker in color than the twigs. Inflorescences to 5 cm long, densely pubescent, mostly in axils of deciduous bracts. Tepals 6, pubescent at base, becoming glabrous toward the tip, inner surface glabrous or nearly so, ca. 2 mm long. Stamens 9, 4-celled, glabrous or with a few hairs near base of filaments, ca. 1.5 mm long, staminodia 3, stipitiform, pubescent. Cupule flat, ca. 1.1 cm diam., pedicel strongly swollen, 0.8 cm long; fruit roundish, 1.6 × 1.4 cm, almost completely exserted.

This species is known from two collections, both made on the upper slopes of the Massif de Tsaratanana, at 2300–2500 m elevation.

Flowers and fruits: November.

Ocotea tsaratananensis differs from the other montane, small-leaved *Ocotea* species with pit-domatia in its tomentellous terminal buds, young twigs, and inflorescences. The other species in this group are either glabrous or have some appressed pubescence, but never the erect, dense pubescence of *O. tsaratananensis.* The large number of scars from fallen leaves and bracts are also striking and suggest this is a slow-growing species. It is likely that on trees growing in more sheltered places, this character is less pronounced.

Paratype. MADAGASCAR. Massif du Tsaratanana, *SF (Capuron) 27051* (MO).

Potameia is a genus endemic to Madagascar and it includes about 20 species. It is one of the few genera of Lauraceae with dimerous flowers; other dimerous genera are the neotropical *Chlorocardium* and Asian *Syndiclis* (although the latter also includes trimerous species). Most species of *Potameia* have four two-celled stamens, but in two species there is a reduction to four one-celled stamens. In the new species described below the reduction has proceeded even further: it has only two one-celled stamens. The reduction is accompanied by a decrease in flower size; the flowers of this new species are, with a diameter of less than 1 mm, the smallest in the family.

Potameia micrantha van der Werff, sp. nov. TYPE: Madagascar. Prov. Toamasina, Masoala Peninsula, near village of Ambanizana, south trail, elev. 25–200 m, *van der Werff et al. 12777* (holotype, MO; isotypes, B, BR, G, GH, K, L, LE, NY, P, PRE, QRS, TAN, TNS, US). Figure 8.

A congeneribus staminibus duobus antherisque 1-locellatis recedit.

Tree, to 20 m tall. Twigs terete, light brown-tomentellous, with age (dark) brown-tomentellous and glabrescent, 2–3 mm diam. 5 cm below the tip, the branching pattern resembling that of *Combretum.* Terminal buds densely tomentellous. Leaves alternate, ± clustered near the tips of the branches, chartaceous, (broadly) elliptic, 9–14 × 3–6 cm,

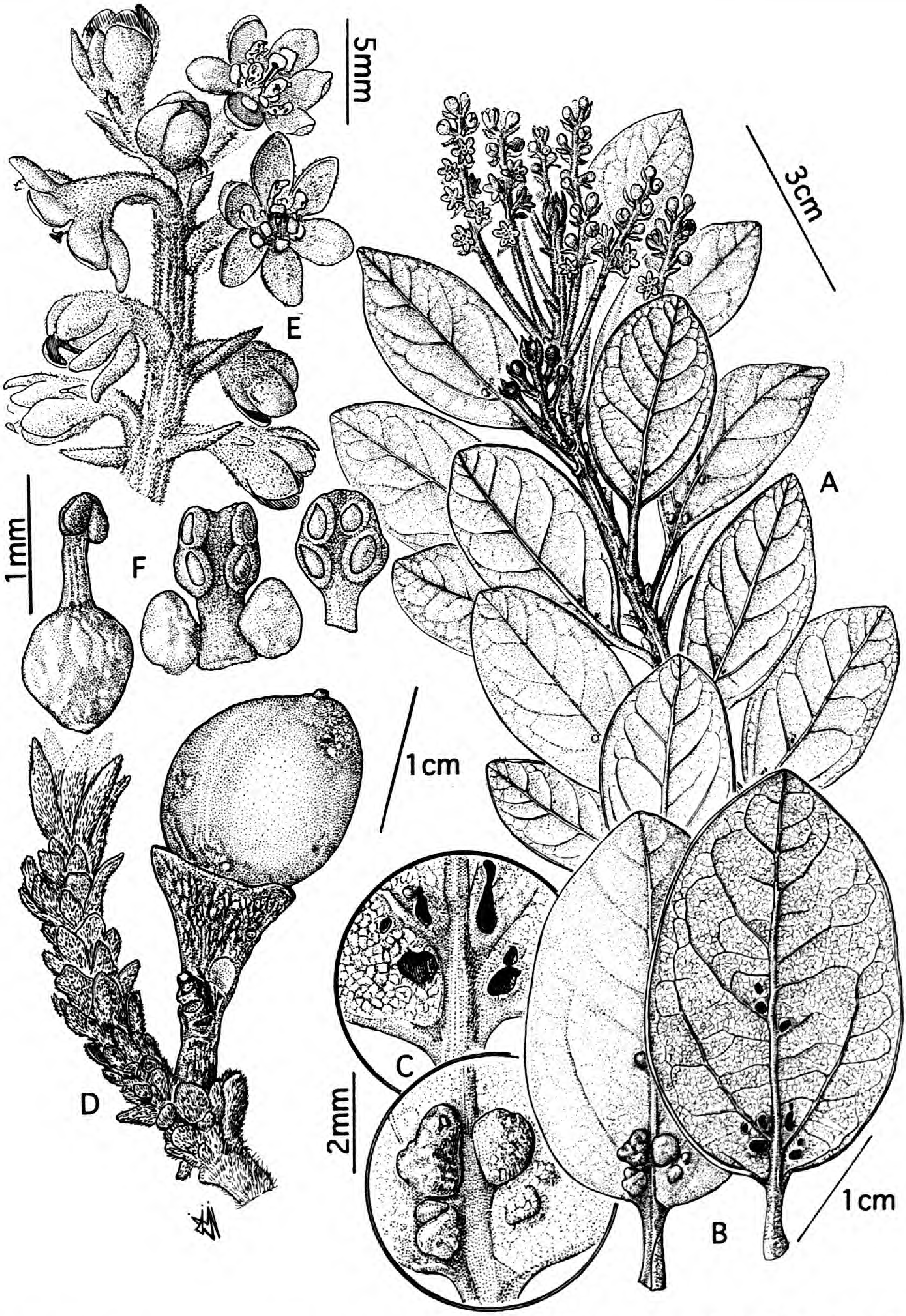

Figure 7. *Ocotea tsaratananensis* van der Werff. —A. Habit. —B. Upper and lower leaf surfaces showing venation and domatia. —C. Details of leaves showing domatia. —D. Fruit with young shoot, showing bracts. —E. Part of inflorescences. —F. Pistil and stamens.

base acute or obtuse, apex acute, rarely obtuse, upper surface glabrous except for the pubescent basal part of midrib, lower surface with scattered erect hairs, the main lateral veins and midrib brown tomentellous; venation ± immersed on upper surface, midrib and main lateral veins clearly raised on lower surface, tertiary venation slightly raised; lateral veins 7–11 on each side. Petioles 7–10 mm long, densely tomentellous. Inflorescences axillary, paniculate, to 7 cm long, many-flowered, the main

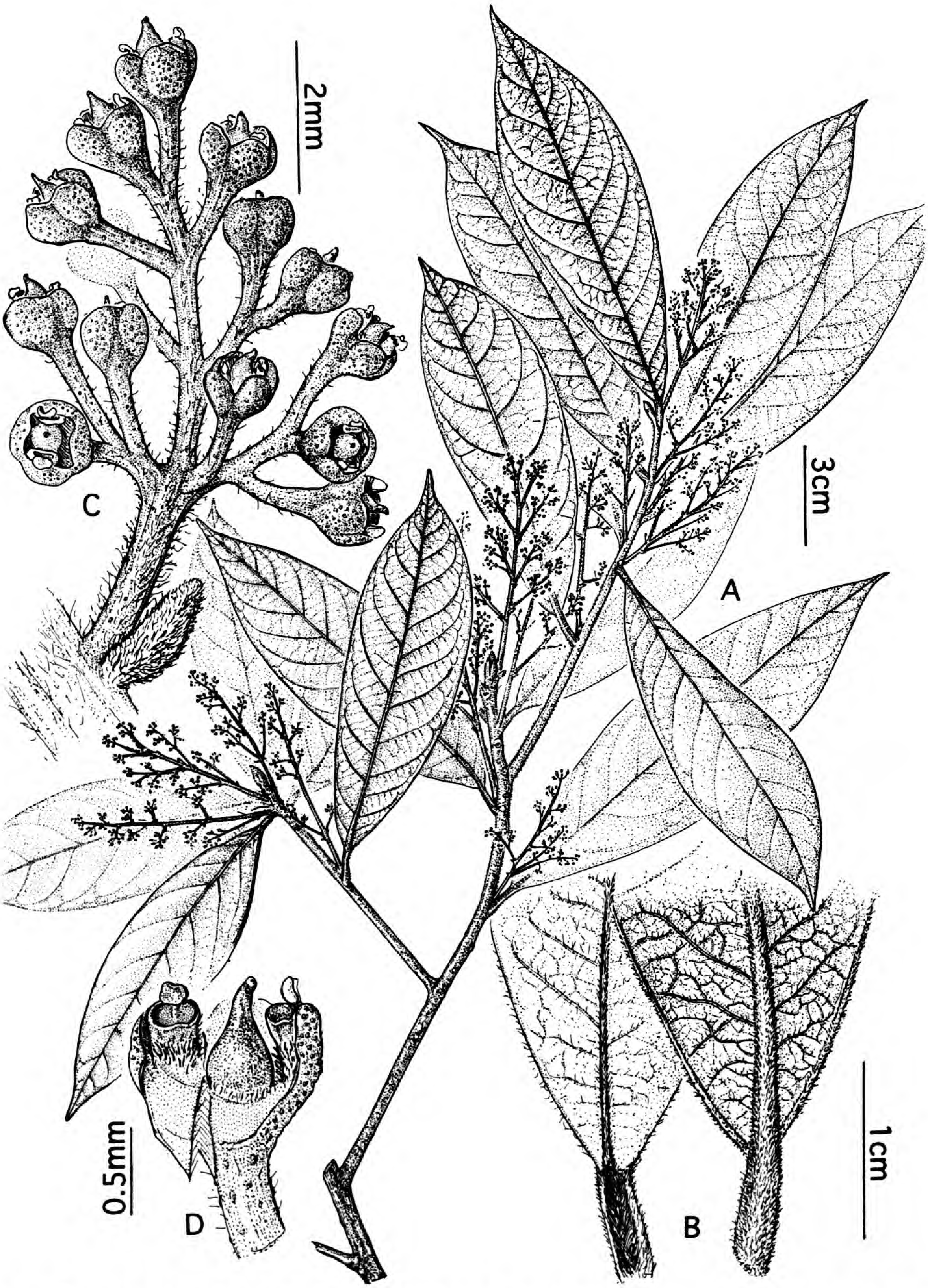

Figure 8. *Potameia micrantha* van der Werff. —A. Habit. —B. Leaf bases, showing venation and indument. —C. Detail of inflorescence. —D. Dissected flower.

axis tomentellous, but indument becoming sparser on minor axes, flowers glabrous; bracts along main axis densely tomentellous; smaller bracts strongly ciliate, otherwise glabrous; pedicels 0.6–0.8 mm long, but becoming larger in young fruit, glabrous. Flowers glabrous, 0.6–0.8 mm diam.; tepals 4, equal, minute; stamens 2, 1-celled, the cell introrse-apical; 2 staminodia represented by tufts of hair at the base of the tepals; glands not seen; ovary glabrous, ovoid; receptacle cup-shaped. Fruits (narrowly) ellipsoid, 3.5 × 1.3 cm.

Flowering: October–November.

Vegetatively, *Potameia micrantha* is characterized by the erect indument of the lower leaf surface and the acute leaves. The only other species with a similar indument is *P. velutina*, but this species has obovate leaves with a rounded apex. Also, the indument of *P. velutina* is shorter than that of *P. micrantha*. The flowers of *P. micrantha*, with only two fertile, one-celled stamens, are unique in the genus and even in the family. *Potameia micrantha* has been collected several times at low elevations on the Masoala Peninsula, at one place growing ± 100 m inland from the beach. *Potameia* has, in general, small flowers; *P. micrantha* has the smallest flowers I have seen in Lauraceae and fully deserves its epithet.

Paratypes. MADAGASCAR. Prov. Toamasina, Masoala Peninsula near village of Ambanizana, *van der Werff et al. 12797* (MO, P, QRS); Prov. Toamasina, Nosy Mangabe, *van der Werff et al. 12836* (MO, P, QRS); Prov. Toamasina, Nosy Mangabe, *Schatz & Miller 2499* (MO).

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Notes on Costa Rican Lauraceae with the Description of Several New Species

Henk van der Werff
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Among recent collections from Costa Rica were several undescribed species. Two new species of *Pleurothyrium*, *P. guindonii* and *P. oblongum*, are described, recent collections of poorly known species of that genus are listed, and a key to the Costa Rican species of *Pleurothyrium* is presented. These additions bring the number of *Pleurothyrium* species known from Costa Rica to eight. Two new species of *Ocotea*, *O. rufescens* and *O. multiflora*, are also described and their affinities are discussed, at least as far as known. *Nectandra salvadorensis* Lundell is transferred to *Ocotea*. A reexamination of type specimens has led to a different concept of *Ocotea tonduzii* Standley and *O. pittieri* (Mez) van der Werff. Most specimens formerly placed in *O. pittieri* are now included in the new species *O. praetermissa*. The correct name for specimens placed in *O. tonduzii* can only be determined after a study of the *O. insularis* complex.

Pleurothyrium guindonii van der Werff, sp. nov. TYPE: Costa Rica. Guanacaste: Cantón de Tilarán, 4–5 km NW of Monteverde, tree, 25 m, in pasture, *Haber, Guindon & Brenes 11089* (holotype, MO; isotypes, BM, CR, F, L, MEXU, NY, P, PMA, QRS, S, US, USJ). Figure 1.

Pleurothyrio immerso van der Werff simile, sed foliis apice obtusis, base angustatis, floribus majoribus et foliis supra punctis glandulosis destitutis recedit.

Trees, to 25 m. Twigs angular, appressed pubescent, the pubescence completely covering the young twigs, older twigs becoming glabrous and corky. Terminal buds densely appressed gray-pubescent. Leaves alternate, elliptic or obovate, 5–11 × 2–4.5 cm, the base attenuate or acute, apex obtuse or very shortly acuminate, the upper surface glabrous and not gland-dotted, lower surface glabrous or with some appressed hairs, especially along the midrib; lateral veins 5–7, immersed on both surfaces, arching upwards near margin, but not loop-connected, tertiary venation immersed, not obvious. Petioles 6–9 mm long, with a similar indument as twigs. Inflorescences in axils of deciduous bracts, 2.5–6 cm long, gray or brown pubescent, racemose or paniculate. Flowers greenish, 8–10 mm diam. Tepals 6, equal in size and shape, spreading to reflexed at anthesis, 3–4 mm long, outer surface puberulent, inner surface glabrous near the base, becoming papillose toward the tip, especially on the inner three tepals; stamens 9, 4-celled, anthers of the outer six stamens bent inward, those of the inner three stamens bent outward, the anther cells lateral; glands strongly enlarged, forming a wall surrounding the stamens, but usually not completely fused, the individual glands still recognizable; pistil glabrous, ovary globose, 2 mm long, style ca. 1 mm long; receptacle (sparsely) pubescent inside. Cupule deeply cup-shaped, with a few coarse lenticels, 1.5 cm high, usually split in three lobes, frequently dried glands and stamens present at rim of cupule; pedicel swollen in fruit; fruit ellipsoid, 3.5 × 1.7 cm.

Flowering: April.

Pleurothyrium guindonii can only be confused with *P. immersum* van der Werff. Both species have small leaves and rather short inflorescences, though they differ in several details. *Pleurothyrium guindonii* has obovate leaves with an attenuate-acute base and obtuse apex, the upper surface is not gland-dotted, the flowers are 8–10 mm diam., the inner surface of tepals is papillose toward the apex, and the ovary is glabrous, while *P. immersum* has elliptic leaves with an acute base and a distinctly acuminate apex, the upper surface is gland-dotted, the flowers are ca. 5 mm diam., the inner surface of the tepals is uniformly pubescent, and the ovary is also pubescent.

It is a pleasure to name this species after Carlos Guindon, who has made excellent collections of Lauraceae in the Monteverde Biological Reserve.

Paratypes. COSTA RICA. **Alajuela:** Cantón de San Ramón, Estación Río San Lorenzo, *Campos 63* (MO), Estación Río San Lorencito, *Morales et al. 1400* (MO).

Pleurothyrium oblongum van der Werff, sp. nov. TYPE: Costa Rica. Cantón de Limón: San Rafael de Pandora, *Estrada 445* (holotype, INB; isotype, MO).

Inter congeneribus centrali-americanis foliis glabris, magnis venatione brochidodroma recedit.

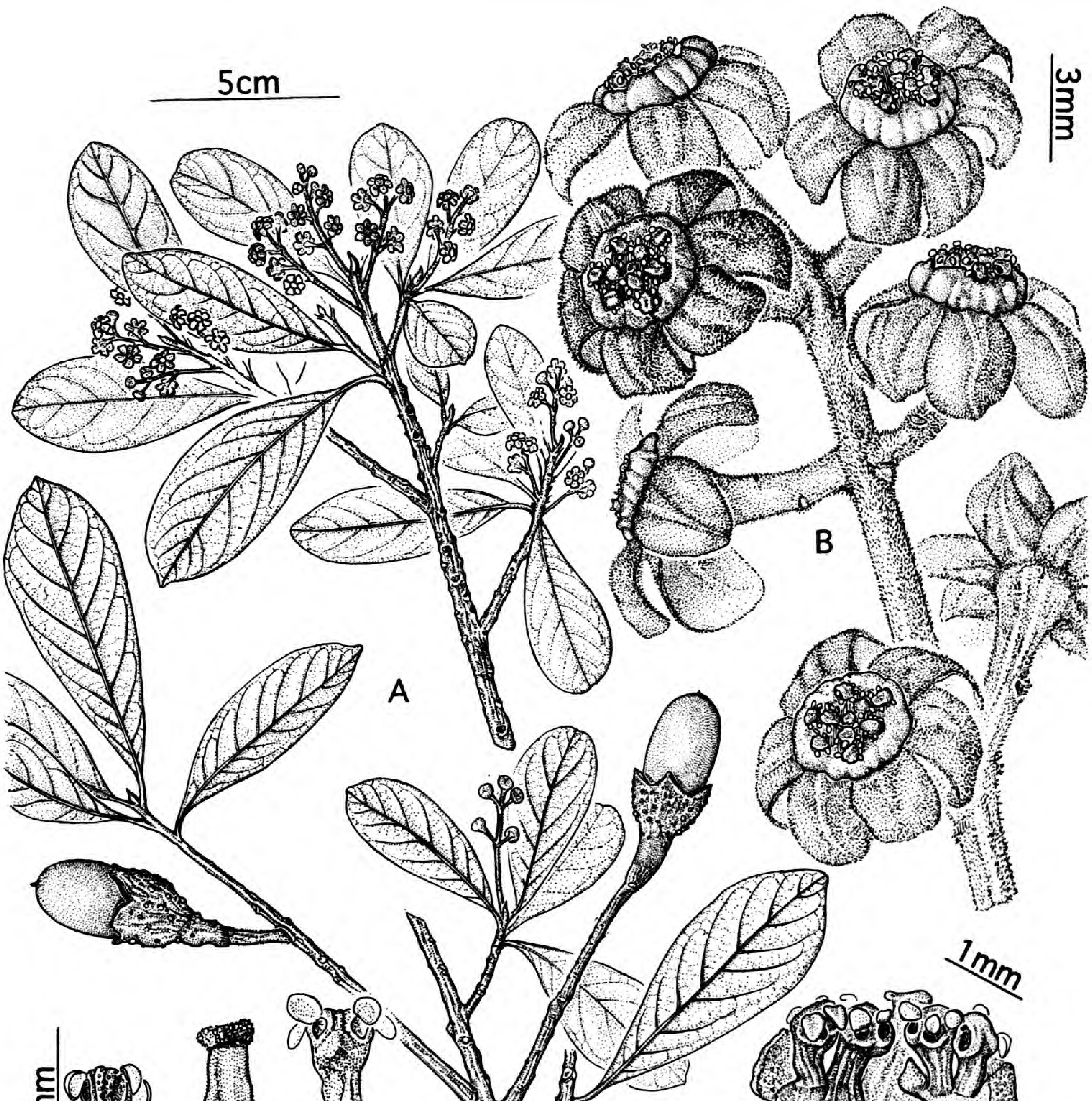

Figure 1. *Pleurothyrium guindonii* van der Werff. —A. Habit of flowering and fruiting twig. —B. Detail of inflorescence. —C. Flower in cross section. —D. Stamens and pistil.

Small tree, to 8 m tall. Twigs terete or slightly angular, glabrous or sparsely appressed pubescent, 7 mm diam. ca. 5 cm below the apex. Terminal buds appressed pubescent. Leaves alternate, chartaceous, 20–45 × 8–16 cm, oblong, or elliptic-oblong, glabrous on both surfaces, base rounded to obtuse, apex acuminate, acumen ca. 1 cm long, lateral veins ca. 20 (10–17 in Panamanian collection), near the margin united with a distinct marginal vein. Petioles 15–25 mm long, ca. 4 mm thick, glabrous. Inflorescence (detached) 12 cm long, very laxly branched, paniculate-cymose, minutely puberulous, more densely so toward the flowers, pedicels minutely puberulous, ca. 5 mm long. Flowers green, tepals 6, ca. 3 mm long, half-erect at anthesis, outer three tepals densely puberulous outside, inner three with a small puberulous triangular patch near the base, otherwise glabrous, all tepals glabrous or nearly so on inner surface; stamens 9, all 4-celled, outer 6 stamens with anther bent inward and the locelli dorsal-lateral; filaments slender, as long as anthers, inner 3 stamens with the locelli extrorse-lateral; glands strongly enlarged, surrounding the stamens, but not fused, 3 staminodia present, minute, threadlike, as long as the glands; pistil 1.5 mm long, style short, 0.3 mm long, ovary gray-puberulous, except at very base, receptacle glabrous inside. Fruits ellipsoid, 2.5 × 1.5 cm, cupule shallowly cup-shaped, 1.5–2 cm wide, 1 cm high, with a few warty protuberances.

Flowers and fruits: August.

Pleurothyrium oblongum can be readily recognized by its large (20–45 cm long), glabrous, oblong leaves with a strongly developed marginal vein. It resembles somewhat *P. hexaglandulosum* van der Werff, but the latter has obovate leaves and short (to 5 mm long) petioles. *Pleurothyrium oblongum* was included in Burger and van der Werff (1990) as *Pleurothyrium* sp. A and was listed under the imperfectly known species in van der Werff (1993); it was then only known from the fruiting Proctor Cooper collection. *Pleurothyrium oblongum* is known from three collections in the Caribbean lowlands near the Panamanian–Costa Rican border.

Paratypes. COSTA RICA. **Limón:** near Puerto Vargas, *Holdridge 6336* (USJ). PANAMA. **Bocas del Toro:** Almirante, *Proctor Cooper* 539 (F, NY, US).

Because only four species of *Pleurothyrium* were included in the recent treatment of Lauraceae for Costa Rica (Burger & van der Werff, 1990) and only five species were included in the key to species in the recent revision of *Pleurothyrium* (van der Werff, 1993), a key to the eight species of *Pleurothyrium* currently known from Costa Rica is provided below.

1a. Lower leaf surface covered by a brown-tomentose or tomentellous indument, the leaf surface not visible . . . . *P. palmanum*
1b. Lower leaf surface not completely covered by an indument, and always (partly) visible 2
2a. Lower leaf surface with erect hairs, the indument denser and tomentose along the midrib; twigs ferruginous-tomentellous . . . . *P. pauciflorum*
2b. Lower leaf surface glabrous or with some appressed hairs; twigs appressed pubescent or, in *P. golfodulcense*, ± gray-tomentellous 3
3a. Leaf base rounded to rounded-cordate; submarginal vein strongly developed, thus venation brochidodromous; leaves 20–45 cm long 4
3b. Leaf base angustate, acute, or rarely obtuse; submarginal vein lacking or weakly developed; leaves generally less than 20 cm long 5
4a. Leaves obovate; petioles to 5 mm long . . . . *P. hexaglandulosum*
4b. Leaves oblong; petioles 15–25 mm long . . . . *P. oblongum*
5a. Tepals erect at anthesis; glands of stamens enlarged, but not forming a wall surrounding the stamens; anthers held above the glands . . . . *P. trianae*
5b. Tepals spreading or reflexed at anthesis; glands forming a wall enclosing the stamens; anthers about as tall as the glandular mass 6
6a. Bracts of inflorescence present at anthesis; leaves 10–20 cm long . . . . *P. golfodulcense*
6b. Bracts of inflorescence absent at anthesis; leaves less than 11 cm long 7
7a. Upper leaf surface gland-dotted; leaves elliptic, the tip acuminate; tepals uniformly pubescent on inner surface . . . . *P. immersum*
7b. Upper leaf surface not gland-dotted; leaves ± obovate, the tip obtuse or very shortly acuminate; inside of tepals glabrous in lower half, papillose in upper half . . . . *P. guindonii*

Several of the Costa Rican species were known from only a few collections and of those, recent collections and their distribution are cited below.

Pleurothyrium golfodulcense Burger & Zamora: recent collections are *Herrera 4870, Chavarría 519, Marín 235, 397, 417, Zamora 1752, Thomsen 796, González 16,* and *Quesada 412.*

Pleurothyrium hexaglandulosum van der Werff: no new collections.

Pleurothyrium immersum van der Werff: *Marín 313,* from the Cantón de Osa, is the second collection.

Pleurothyrium palmanum (Mez & Donn. Smith) Rohwer: recent collections are *Bello 1277, 4015, 4050, 5214,* from Monteverde, and *Aguilar 1146* and *1173,* from Limón, Cantón de Talamanca, Alto Lari. *Bello 1277* was a 30-m tree. *Aguilar 1173* and *Guindon 3, 27,* and *42,* from Puntarenas, Cordillera de Tilarán, Sta. Elena, are the first fruiting collections. The cupule is shallowly bowl-shaped, with coarse warts on the outside, 1.8 cm diam., ca. 1 cm tall; fruit broadly ellipsoid, 2 × 1.5 cm. The recent collections have leaves to 15 cm long, and it seems likely that the type has unusually large leaves.

Pleurothyrium pauciflorum van der Werff & Hammel: three recent collections, *Herrera 4895* and *5006,* and *Aguilar 3131,* all from the Cantón de Osa. *Herrera 4895* was flowering in January, *Herrera 5006* in December, and *Aguilar 3131* in February.

Pleurothyrium trianae (Mez) Rohwer: two recent collections are *Hammel 18068* and *18257,* both from the Cantón de Osa. The collections from the Osa Peninsula are unusual in having inrolled leaf bases. Collections of this species from elsewhere (in Costa Rica, for example, *Zamora 1363* from Alajuela) do not have inrolled leaf bases. In other characters the collections from the Cantón de Osa fit well in *P. trianae.*

Ocotea rufescens van der Werff, sp. nov. TYPE: Costa Rica. Prov. Limón: Cantón de Talamanca, Bratsi, Alto Lari, *Aguilar & Schmidt 1077* (holotype, MO; isotypes, BM, F, INB). Figure 2.

Ocoteae pharomachrosorum Gómez-Laurito affinis sed indumento rufescenti-tomentello paginae inferioris foliorum bene distincta.

Tree, to 25 m. Twigs terete or ridged, densely reddish brown tomentellous, the indument covering the surface completely. Terminal bud densely brown-tomentellous. Leaves alternate, chartaceous, 9–16 × 3.5–6 cm, elliptic or ovate-elliptic, apex acute or slightly acuminate, base acute or obtuse, upper surface shiny, glabrous, except for some curled hairs along midrib and basal lateral veins, lower surface densely reddish brown tomentellous, the surface completely covered, lateral veins 4–6, arching upwards near the margin, but not or scarcely loop-connected, these veins and reticulation slightly raised on upper surface, lateral and tertiary veins slightly raised on lower surface; petioles densely tomentellous, 1–2 cm long. Inflorescences in axils of bracts, rarely in axils of leaves, sometimes clustered near tip of branches, usually once cymosely branched. Flowers creamy-white, basally tomentellous, the tepals becoming glabrous toward the tip. Tepals 6, equal, the outer 3 glabrous inside, the inner 3 papillose inside, all with a slightly papillose margin, elliptic 2 mm long, spreading in older flowers; stamens 9, all 4-celled, the outer 6 with cells introrse and arranged in 2 rows, each with a small sterile tip, ca. 1 mm long, the filaments very short, inner 3 with cells extrorse lateral and 2 glands at the base of the filaments, ca. 1 mm long; staminodia 3, very small; top of the receptacle with a ring of hairs at insertion of stamens and tepals; receptacle deep, glabrous inside; pistil glabrous, ovary globose, as long as the style. Cupule small, shallowly bowl-shaped, ca. 8 mm wide; fruit ellipsoid, ca. 2 mm long.

Flowering: March.
Altitudinal range: 450–1400 m.

Paratypes. COSTA RICA. **Limón:** Talamanca, Bratsi, Alto Lari, *Aguilar & Schmidt 1134* (CR, INB, MO, USJ), *Herrera 5279* (CR, INB, MO).

Ocotea rufescens is the only *Ocotea* species in Costa Rica and Panama (where it is likely to occur as well) with a dense reddish brown tomentellous indument on twig and lower leaf surface. It is most closely related to *O. pharomachrosorum* Gómez-Laurito; the two species share characters such as the glabrous or papillose inner surface of the tepals, outer anthers with a sterile apical tip, raised reticulation on the upper leaf surface, dense indument on twig and lower leaf surface, the sometimes unequal leaf bases, and the tepals becoming glabrous toward their tips. *Nectandra salvadorensis* Lundell also has a raised reticulation on the upper leaf surface, dense indument on the lower leaf surface, glabrous or slightly papillose surface of tepals, and sometimes a small sterile tip of the outer stamens. Its inflorescences are not as densely pubescent as in the Costa Rican species, and hence its glabrescent tepals are not as obvious. Two other *Ocotea* species in Central America have the lower leaf surface completely covered with a tomentose or tomentellous indument, and a key to the species is provided below. Species with an appressed or sericeous indument are not included in the key.

1a. Petioles distinct, at least 1 cm long; leaf blades without vernation lines 2
1b. Petioles lacking, inrolled leaf bases decurrent to the base of the apparent petiole; vernation lines clearly visible on lower leaf surface . . . . *O. calophylla* Mez
2a. Leaf base distinctly inrolled . . . . . *O. salvinii* Mez
2b. Leaf base plane, not inrolled 3
3a. Lower leaf surface and twigs gray tomentellous . . . . *O. pharomachrosorum*
3b. Lower leaf surface (reddish) brown tomentellous 4
4a. Inner surface of tepals densely pubescent, the indument completely covering the surface, at least in the basal half of the tepals; tomentellous indument of inflorescence and leaves mostly erect . . . . *Ocotea* sp. (Honduras)
4b. Inner surface of tepals glabrous or with some scattered hairs; tomentellous indument of inflorescence and leaves erect or ± appressed 5
5a. Twigs initially tomentellous, but soon glabrescent; indument on leaves and inflorescences ± appressed . . . . *O. salvadorensis*
5b. Indument on twigs persistent; leaves and inflorescences with predominantly erect tomentellous indument . . . . *O. rufescens*

Included in the key is an undescribed species related to *O. salvadorensis* from cloud forests in Honduras.

A new combination is needed for the use of *Ocotea salvadorensis.* Rohwer (1986) provisionally included this species in *Ocotea* but did not make the new combination. It cannot be placed in *Phoebe* or *Cinnamomum* because its tepals are spreading at anthesis, and it lacks domatia and tripliveined leaves.

Figure 2. *Ocotea rufescens* van der Werff. —A. Habit. —B. Detail of inflorescence. —C. Flower in cross section. —D. Fruit. —E. Stamens. —F. Leaf bases showing venation and indument.

Ocotea salvadorensis (Lundell) van der Werff, comb. nov. Basionym: *Nectandra salvadorensis* Lundell, Wrightia 4: 105. 1969. *Phoebe salvadorensis* (Lundell) Lundell, Wrightia 5: 344. 1977. TYPE: El Salvador. Dept. Santa Ana: cloud forest near summit of Cerro Monte Cristo, *P. H. Allen 7173* (holotype, LL; isotypes, GH, NY).

Ocotea salvinii Mez has been included in *Phoebe* or *Cinnamomum* as well, for instance by Rohwer (1986). His opinion was solely based on the type, which has only immature flowers. Recent collections from Chiapas have flowers and fruits and indicate the species belongs in *Ocotea.*

Ocotea multiflora van der Werff, sp. nov. TYPE: Costa Rica. Puntarenas: Reserva Forestal Golfo Dulce, *Aguilar 791* (holotype, MO; isotypes, BM, CR, INB, MEXU).

A congeneribus centrali-americanis foliis multinervibus floribusque parvis recedit.

Tree, to 45 m tall. Twig slender, angular, glabrous or nearly so, lenticellate. Terminal buds slender, white appressed pubescent. Leaves alternate, chartaceous, 6–9 × 1.5–3 cm, (narrowly) elliptic, the base inrolled, cuneate and slightly decurrent on the petiole, the apex bluntly acute, gland dots readily visible on the lower leaf surface of flowering specimens, less visible in fruiting stage, upper leaf surface glabrous, lower surface glabrous or with some appressed hairs, especially along midrib, when young; lateral veins 12–17, these, midrib, and tertiary venation weakly raised on lower surface, immersed on upper surface; domatia absent. Petioles poorly differentiated from the leaf base, 4–7 mm long, glabrous or with a few appressed hairs. Inflorescences in axils of leaves, 6–10 cm long, paniculately cymose, many-flowered, the basal 3–5 cm unbranched, almost glabrous at the base, but toward the flowers progressively more puberulous, the hairs short, ± spreading, bracts lacking at anthesis. Flowers white, tepals 6, equal, ± erect at anthesis, pubescent on both surfaces, the hairs ± erect, ca. 1 mm long; stamens 9, 4-celled, the outer with introrse cells, anthers sessile or nearly so, 0.8–1.0 mm long, dorsally with some erect, curled hairs, inner 3 stamens with extrorse cells, 1 mm long, filament distinct, ca. 0.2 mm long, filament and base of anther with some long, erect hairs, 2 globose glands present at the base of the filaments; staminodia 3, threadlike, 0.6 mm long, pubescent; pistil glabrous, 2 mm long, style ca. 0.5 mm long; receptacle deep, glabrous inside, constricted near apex, flower inside densely pubescent at insertion of stamens and tepals. Fruits ellipsoid, 2 × 1.2 cm, pedicel swollen in fruiting stage, cupule small, plate-like, the margin entire and single.

Phenology. Flowers: December–February; fruits: April–May.

Ocotea multiflora is known from ten collections, all made on the Osa Peninsula. Of those, I have not seen *Burger 12377,* but this collection is the same species as *Burger et al. 12376,* a sterile juvenile tree. Vegetatively, *O. multiflora* is characterized by its rather small, elliptic leaves with many lateral veins and a slightly decurrent leaf base, and its slender, appressed pubescent terminal buds. It has, for *Ocotea,* very small flowers and a deep receptacle, which is not common among Central American species of *Ocotea.* I cannot suggest a close relative of *O. multiflora.* The fact that it grows into a very tall tree (on three collections it is described as 45 m tall) and has small flowers explains why it has not been collected and described earlier. It is included in the *Flora Costaricensis* (Burger & van der Werff, 1990) as *Ocotea* sp. B.

A very unusual feature of the two fruiting collections is that the fruit is seated obliquely on the small cupule. Young, immature fruits have the normal, symmetrical position in respect to the cupule. I checked a few of the obliquely seated fruits, but found no signs of disease or insect damage; the cotyledons were normally formed and showed no signs of damage. Thus, it may well be that the fruits take an oblique position in respect to the cupule during maturation, but if so, this would be the first example of such a fruit position I have seen among Lauraceae.

Paratypes. COSTA RICA. **Puntarenas:** Parque Nacional Corcovado, *Kernan & Phillips 906* (CR, MO, USJ); *Kernan & Phillips 1145* (CR, MO, USJ); *Aguilar 3021* (CR, INB, MO); *Aguilar 3135* (CR, INB, MO); Puntarenas, Osa Peninsula, Reserva Forestal Golfo Dulce, *Hammel & Robles 16725* (CR, F, MO); *Aguilar 2969* (CR, INB, MO); *Burger et al. 12376* (MO); Cantón de Osa, Aguabuena, *Herrera 4845* (CR, MO).

OCOTEA TONDUZII STANDLEY

Because the name *Ocotea tonduzii* has been applied to several species, I will briefly review its history and try to clear the confusion surrounding this name.

Ocotea tonduzii Standley is a new name for *O. cuneata* Mez, non (Grisebach) Gómez, and has two syntypes, *Tonduz 1739* and *2142,* both in BR and which I have seen. Allen (1945) included in *O. tonduzii* a syntype of *O. ira* Mez & Pittier (*Tonduz 10415,* BR), and because the syntypes of *O. ton-*

duzii were not available to her, she used the name *O. tonduzii* in the sense of *O. ira*. Rohwer (1986) studied the syntypes of *O. tonduzii* and recognized it as a valid species, distinct from *O. ira*. Burger and van der Werff (1990) regarded *O. tonduzii* and *O. ira* as closely related and included them in their concept of *O. insularis* (Meissner) Mez, and thus largely accepted the concept of Allen. I have recently studied the syntypes of *O. tonduzii* and agree with Rohwer's concept of recognizing *O. tonduzii* as a distinct species. Diagnostic for *O. tonduzii* are the densely ferruginous-tomentellous flowers, the long terminal buds that are basally glabrous and appressed pubescent in the distal half, and the glabrous leaves with raised venation on both surfaces. Although *O. tonduzii* resembles *O. ira* in leaf shape, the latter lacks the raised venation, has smaller, pubescent terminal buds, and lacks a ferruginous indument on the flowers. The cupule of *O. tonduzii* is shallowly cup-shaped, 6–8 mm diam., and the green (probably immature) fruits are ellipsoid and ca. 1 cm long.

Specimens belonging to *O. tonduzii* have been cited as follows: Allen (1945) placed *Skutch 3755* in *O. skutchii* Allen; it is a paratype of, but is not conspecific with, *O. skutchii*. Five collections that I place in *O. tonduzii* were all cited in Burger and van der Werff as *O. endresiana* Mez, including an unrecognized syntype (*Pittier 1739*) in CR. I have not seen the type of *O. endresiana*, but according to the original description, *O. endresiana* has glabrous flowers and is thus distinct from *O. tonduzii*.

All names incorrectly associated with *Ocotea tonduzii* (*O. endresiana*, *O. insularis*, *O. ira*, and *O. skutchii*) belong to the *Ocotea insularis* group. The question of how many species should be recognized in this group and the proper placement of the specimens incorrectly included in *O. tonduzii* requires further study. An inconspicuous, but apparently reliable character for all species of this group is the presence of a small tuft of short, white hairs at the point where the filament of the third whorl of stamens widens into the anther, but only on the side facing the pistil. Such tufts of hair are lacking in *O. tonduzii*.

Ocotea tonduzii is rarely collected. Apart from the syntypes, I have seen three collections from the vicinity of Vara Blanca (*Skutch 3755*, *Wilbur 21726*, and *Hammel & Grayum 14086*), one from the Río Zurqui (*Grayum & Sleeper 6141*), and a sterile collection from Monteverde (*Wheelwright 165*). It occurs between 1500 and 2000 m; flowering collections were made in July and August.

Ocotea praetermissa van der Werff, sp. nov. TYPE: Costa Rica. Prov. Cartago: SW slope of Volcán Irazu, 2600 m, *Burger et al. 12065* (holotype, MO; isotype, F).

Ex affinitate *O. helicterifoliae* (Meisner) Hemsley et specierum affinium foliis parvis, puberulis, domatiis praeditis inflorescentiis floribusque (sub)glabris distinguenda.

Shrubs to medium-sized trees, to 15 m tall. Twigs terete, densely tomentellous when young, becoming glabrous with age. Terminal bud densely pubescent. Leaves alternate, chartaceous, elliptic or obovate-elliptic, 3–10 × 1.5–4 cm long, base acute or infrequently obtuse, apex acute or obtuse, lateral veins 3–6, venation immersed or weakly raised on upper surface, prominently raised on lower surface, upper surface glabrous or nearly so, lower surface (sparsely) pubescent, the hairs predominantly erect, the indument denser on the main veins, axillary tufts of hairs frequently present. Petioles 5–12 mm long, with a similar indument as the twigs. Inflorescences axillary, to 12 cm long, glabrous or with some scattered hairs, racemose (when short) to paniculate. Flowers yellowish, glabrous, 5–7 mm diam. Tepals 6, 2–2.5 mm long, equal, on the inner surface with some hairs near the base and the distal part (especially near the margin) papillose; stamens 9, all 4-celled, the outer 6 with introrse cells, the inner 3 with the lower pair extrorse and upper pair lateral; filaments of inner stamens with 2 glands near the base; staminodia usually present, 3; pistil glabrous, with a conspicuous, often lobed stigma. Fruit ellipsoid, 2.5 × 1.8 cm, cupule a very shallow cup, ca. 1.3 cm diam.

Phenology. Flowering specimens have been collected in February, March, May, June, and September.

Ecology. This species occurs in cloud forest, mostly between 2000 and 3200 m, but occasionally at lower altitudes. *Haber 10668* was collected on an exposed ridge at only 900 m.

Ocotea praetermissa corresponds with the concept of *O. pittieri* (Mez) van der Werff in Burger and van der Werff (1990). Rohwer (1991) concluded, after studying the type, that the name *O. pittieri* had been misapplied and that *O. pittieri* sensu typi is very closely related to *O. brenesii* Standley or synonymous with it. The most obvious difference between *O. praetermissa* and *O. pittieri* is that the latter lacks the erect pubescence on the lower leaf surface. *Ocotea praetermissa* also has narrower leaves than *O. brenesii*.

Ocotea praetermissa belongs to the *O. helicterifolia group*. Characteristic for this group are the erect indument on twigs and leaves, tepals with papillose apex and/or margin, and bisexual flowers. Several species in this group have relatively large staminodes and have been described in *Phoebe;* others were described in *Ocotea* and *Nectandra.* Species in this group are not well understood and are in need of a modern treatment.

Paratypes. COSTA RICA. **Puntarenas:** *Davidse et al. 28547* (MO), 28551 (MO), *Haber 10668* (MO), *Hammel & Neprokoeff 15056* (MO). **Alajuela:** *Austin Smith H679* (MO); *Bello 2839* (MO). **Cartago:** *Carlson 3585* (MO), *Bernardi 10626* (MO), *Almeda 3762* (MO), *Morales et al. 436* (MO), *Taylor 4460* (MO), *Williams & Molina 13888* (MO). **Heredia:** *Rivera 32, 131,* and *260* (all MO), *Varela 60* (MO). **Limón:** *Davidse et al. 28627, 28809,* and *28922* (all MO). PANAMA. **Bocas del Toro:** *Antonio 1602* (MO). **Chiriquí:** *Hammel et al. 7013* (MO).

The following collections differ somewhat from my concept of *Ocotea praetermissa* and may belong to different species: *Tucker 1001* (San Salvador): inflorescences and pedicels shorter than in *Ocotea praetermissa,* but likely to be that species. *Aranda 2247, 1261, 1265,* and *1317; van Hagen 2022, 2031,* and *2070* (Panama): inflorescences densely pubescent and rather short. This may well be an undescribed species. *Haber 4526, 4637,* and *4671* also have pubescent, few-flowered inflorescences like the Aranda and van Hagen collections from Panama.

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A New Species of *Ocotea* (Lauraceae) from the Serra do Espinhaço, Brazil

Sachiko Yasuda

Graduate School of Human and Environmental Studies, Kyoto University, Kyoto, 606-01, Japan
Current address: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Ocotea oppositifolia*, from the Serra do Espinhaço, Bahia-Minas Gerais, Brazil, is described as new. It can be distinguished from the other neotropical species in the genus by the combination of its opposite leaves, pit domatia, and double-rimmed cupules.

Ocotea, with more than 300 species, is one of the larger genera of Lauraceae and is known from the Neotropics, Madagascar, and tropical Africa. It is the largest genus of Lauraceae in the Neotropics, distributed from Mexico to Argentina. According to van der Werff (1991), the genus is extremely variable and sometimes thought to be a catchall for lesser known neotropical laurels. The species of this genus are characterized by the paniculate or racemose inflorescences, six equal tepals, nine stamens, anthers with four pollen sacs arranged in two rows, two small, globose glands at the base of each innermost stamen, and fruits with flat or cup-shaped cupules. Nearly all the neotropical species of this genus have alternate or clustered leaves. However, some collections from Brazil were recently discovered to have opposite leaves. Some of these are treated as *Ocotea sp.* in van der Werff (1995). Besides the opposite leaves, the specimens have pit domatia and double-rimmed cupules, and the combination of those characters distinguishes them from all the other neotropical *Ocotea* species.

Ocotea oppositifolia S. Yasuda, sp. nov. TYPE: Brazil. Bahia: Seabra, in a forest disturbed in some areas, with woody lianas, 900 m alt., 13 Feb. 1987 (fl), *J. R. Pirani et al. 2000* (holotype, MO). Figure 1.

Species haec ab aliis speciebus neotropicis differt foliis oppositis et domatiis foveatis et cupulis diplomarginatis.

Small tree or shrub, 2–6(–12) m tall. Twigs terete, with a few appressed hairs, soon glabrescent. Terminal bud with appressed hairs. Leaves opposite, elliptic, 6–13 × 2–5 cm, the base and apex acute, firmly chartaceous, glabrous, glossy above, pinnately veined; lateral veins 8–12 pairs, the midrib, lateral veins, and reticulation immersed on both surfaces, or slightly raised below; pit domatia sometimes present in the axils of the secondary veins near the base, with straight hairs along the edges. Petioles 0.5–1 cm long, flat above. Inflorescences in the axils of the leaves or rarely around bracts, racemose, rarely paniculate, 3–6 cm long, with some appressed hairs. Pedicels pubescent, to 5 mm long, with an ovate-elliptic bract ca. 2.5 mm long at the base. Flowers bisexual, creamy or green, aromatic, 3–4 mm long including the slightly narrowed base. Tepals 6, equal, ovate, 2.0–3.0 × 1.5–2.2 mm, the outer surface with some appressed hairs or nearly glabrous, the inner surface with erect hairs, the inner surface of the inner tepals more densely so. Stamens 9, all 4-celled and the cells arranged in two rows, the anther 0.7–0.9 mm long, papillose on the apex, the filament 0.3–0.4 mm long, pubescent; outer 6 stamens with introrse cells, inner 3 stamens with extrorse cells, each of the inner stamens with 2 glands attached near the base. Staminodia 3, ca. 0.7 mm long, sagittate or stipitiform, pubescent. Ovary globose, ca. 0.7 mm diam., glabrous; style ca. 1.2 mm long, glabrous. Infructescences with few fruits, glabrous, rarely sparsely pubescent, 4–6 cm long. Fruits ellipsoid to ovoid, 2–2.5 cm long, ca. 1.4 cm wide (when dried), glabrous. Cupules olive-green, cup-shaped, ca. 2 cm wide, ca. 1.5 cm deep, glabrous, the outside smooth or slightly ridged, double-rimmed, the outer rim erect, slightly longer than the inner rim.

Ocotea oppositifolia is known from the Serra do Espinhaço, at about 1000 m in elevation. According to Harley (1995), the vegetation of this region is categorized as cerrado or campo rupestre: cerrado is a seasonal savanna woodland formation with medium to low trees and shrubs, characteristic of a huge area of southeast, central, and parts of western Brazil; campo rupestre is a unique vegetation of the upper levels of the Serra do Espinhaço, where outcrops of usually highly acidic rocks in-

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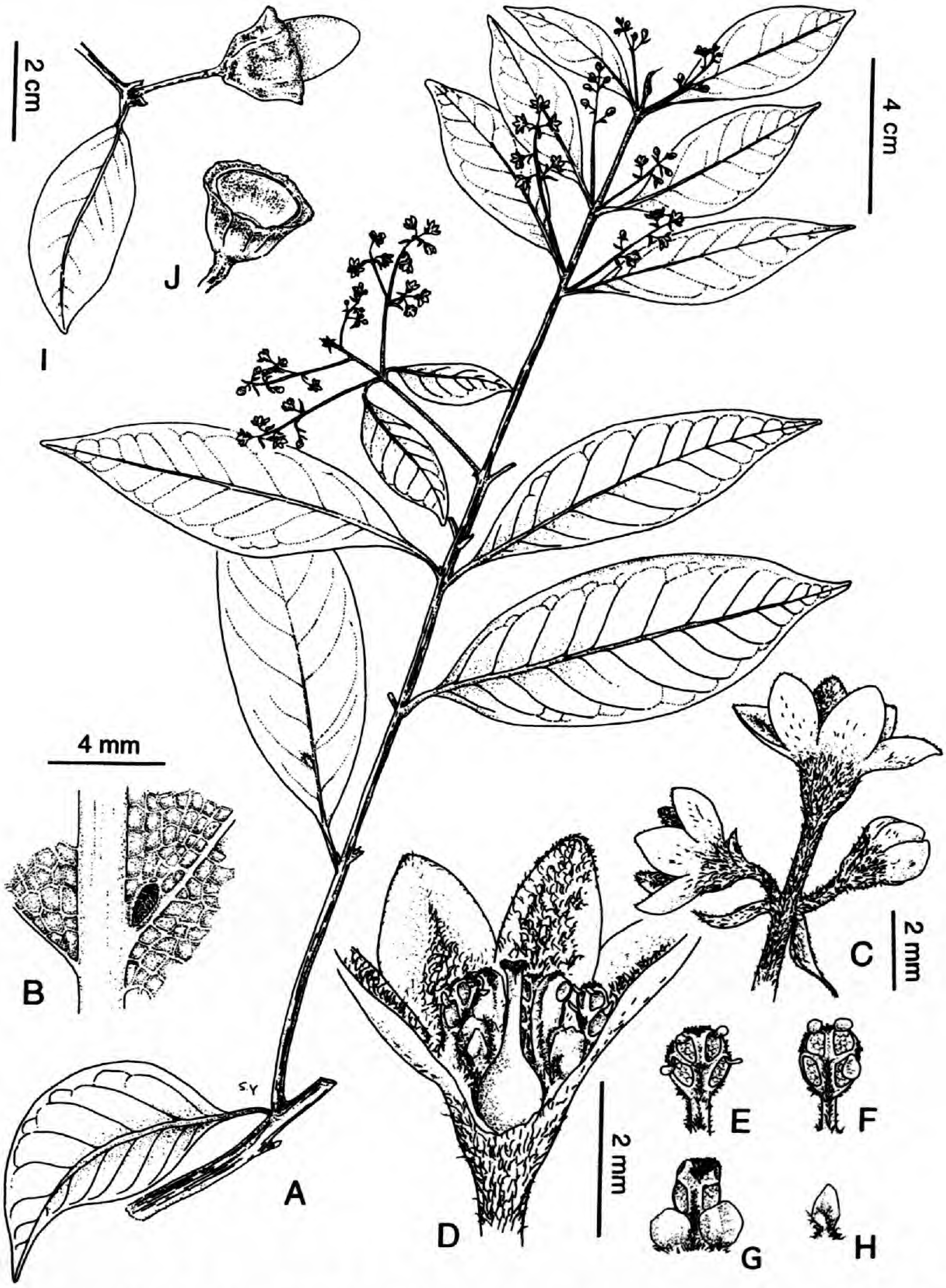

Figure 1. *Ocotea oppositifolia* S. Yasuda. —A. Branchlet with inflorescences. —B. Detail of lower surface of leaf. —C. Detail of inflorescence terminal divisions. —D. Open flower. —E. Adaxial view of a first whorl stamen. —F. Adaxial view of a second whorl stamen. —G. Abaxial view of a third whorl stamen. —H. Abaxial view of a staminode. —I. Branchlet with fruit. —J. Cupule.

hibit forest formation, and the mountain ridges with their saxicolous flora are intersected by humid valleys, providing a complex mosaic of vegetation types with a variety of microclimates.

Ocotea oppositifolia is closely related to the *O. indecora* group of Rohwer (1986), which also grow as shrubs or trees, have racemose inflorescences, bisexual flowers, and cup-shaped cupules. In addition, some species of the *O. indecora* group tend to have subopposite leaves. The *O. indecora* group is still poorly known, the delimitation of species presenting some difficulties (Rohwer, 1986), but one can distinguish *O. oppositifolia* from almost all the other species in this group by its habitat (most of the other species are from wet forests), pit domatia (the domatia of the other species, if present, do not modify the tissue of the leaves), and double-rimmed cupules (most of the other species have single-rimmed cupules). An exception, *O. complicata* (Meissner) Mez, occurs in caatingas and has double-rimmed cupules according to Rohwer (1986); this species differs from *O. oppositifolia* by its alternate leaves and the absence of domatia. Besides the aforementioned characters, the inflorescences of the *O. indecora* group tend to be clustered only on the terminal buds or on the leafless short shoots, whereas those of *O. oppositifolia* are mostly in the axils of the leaves (without a short shoot) and very rarely on the terminal buds. The leaves of some species in this group also tend to be clustered near the tops of the twigs, but those of *O. oppositifolia* are distributed evenly along the twigs. Although it is not included in the *O. indecora* group by Rohwer (1986), *O. catharinensis* Mez likely belongs in this group, having subopposite leaves, racemose inflorescences, and bisexual flowers. This species differs from *O. oppositifolia* by its non-pitted domatia, inflorescences clustered on the terminal buds or leafless short shoots, and single-rimmed cupules.

Besides the *Ocotea indecora* group, a species possibly close to *O. oppositifolia* is *O. porosa* (Nees & C. Martius) L. Barroso, which has pit domatia and axillary inflorescences with pubescence less dense near the tepals. The domatia of *O. porosa* are pitted like a slit, unlike the ones of *O. oppositifolia* with a small, round pit, and the cupules of *O. porosa* are flat and have a single margin. Additionally, *O. porosa* is from wet forests. Van der Werff (1995) suggested a relationship between the collections belonging to this new species and *O. scrobiculifera* Vattimo-Gil, but according to the description (Vattimo, 1977), *O. scrobiculifera* has ferruginous-tomentellous twigs, unlike the subglabrous twigs of *O. oppositifolia.*

In the neotropical *Ocotea, O. beyrichii* (Nees) Mez and *O. eichleri* Mez also have opposite or subopposite leaves, but one can distinguish them from *O. oppositifolia* by the absence of domatia. There are some species in *Licaria* that also have opposite leaves and/or double-rimmed cupules, but the collections of this genus only with fruits can be distinguished from *O. oppositifolia* by the absence of domatia. Regarding the double-rimmed cupules, there are about seven species with the same character in Brazil. However, the outer rims of most of those species are thickened and spread outward with persistent tepals, whereas the ones of *O. oppositifolia* are not thickened but erect without persistent tepals. Additionally, those seven species have alternate leaves.

Paratypes. BRAZIL. **Bahia:** Serras dos Lençois, 700–1000 m alt., 26 May 1980 (fr), *Harley et al. 22633* (MO); Água Quente, 1140 m alt., 17 Dec. 1988 (fr), *Harley et al. 27546* (MO); Abaíra (Abeira?), 1050 m alt., 27 Dec. 1988 (fr), *Harley et al. 27828* (MO); Município de Mucugê, 1000 m alt., 22 Dec. 1979 (fl), *Mori & Benton 13145* (NY). **Minas Gerais:** Grão-Mogol, ca. 1000–1050 m alt., 4 Nov. 1987 (fr), *Assis et al. s.n. (CFCR 11504)* (MO), 1050 m alt., 27 May 1988 (fr), *Barreto et al. s.n. (CFCR 11990)* (MO), ca. 1000 m alt., 28 May 1988 (fr), *Barreto et al. s.n. (CFCR 12064)* (MO), ca. 1000 m alt., 5 Nov. 1987 (fr), *Pirani et al. s.n. (CFCR 11539)* (MO); Diamantina-Biribiri, ca. 1000 m alt., 31 Jan. 1981 (fr), *Giulietti et al. s.n. (SPF 21969)* (MO); ca. 5 km N of Grão-Mogol, 1000 m alt., 18 Feb. 1969 (fr), *Irwin et al. 23482* (MO).

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