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Cover: *Guapira guasarensis* Aymard (See page 20, Fig. 2).
Drawn by Bruno Manara† (VEN).

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(Continued on page ii)

(Continued from page i)

PRADOSIA GOLFODULCENSIS (SAPOTACEAE) UNA NUEVA ESPECIE DEL PACÍFICO CENTRAL Y SUR DE COSTA RICA

Reinaldo Aguilar Fernández,[1] Daniel Santamaría-Aguilar,[2,3,4] y Alexandre K. Monro[5]

Resumen. Se describe e ilustra una nueva especie de *Pradosia* para Costa Rica, *P. golfodulcensis*. El epíteto específico hace referencia a una región en el Pacífico sur de Costa Rica, lugar de donde provienen la mayoría de ejemplares de este nuevo árbol. La nueva especie presenta afinidades morfológicas con cuatro especies de América del Sur: *P. glaziovii*, *P. granulosa*, *P. subverticillata* y *P. verticillata*. También se compara con *P. grisebachii*, este nombre sustituye a *P. atroviolacea*, nombre previamente utilizado para la única especie del género conocida de América Central (Nicaragua, Costa Rica y Panamá).

Palabras clave: Chrysophylloideae, Ericales, Golfo Dulce, Mesoamérica, Península de Osa, Tarrazú

Abstract. A new species of *Pradosia* is described and illustrated from Costa Rica, *P. golfodulcensis*. The specific epithet refers to a region in the south Pacific of Costa Rica, from where most of the specimens of this new tree originate. The new species shows morphological affinities with four South American species: *P. glaziovii*, *P. granulosa*, *P. subverticillata,* and *P. verticillata*. It is also compared with *P. grisebachii,* name that substitutes *P. atroviolacea* that was previously used for the only species of the genus known from Central America (Nicaragua, Costa Rica, and Panama).

Entre 1990–2001 la familia Sapotaceae comprendía 54 géneros y ca. 1.100 especies con distribución Pantropical (Pennington, 1990; Govaerts et al., 2001). Sin embargo, en los últimos años la utilización de marcadores moleculares, han llevado a la restitución de géneros que Pennington había colocado en sinonimia y a cambios significativos en la circunscripción de otros géneros, de manera que ahora se reconocen en la familia entre 65 y 70 géneros (Swenson et al., 2020). Pennington (1990), elaboró la revisión de la familia para la serie Flora Neotropica y documento 12 géneros y aproximadamente 400 especies. Desde entonces, cerca de 44 especies han sido descritas para esta región en los géneros *Chromolucuma* Ducke (3 spp.), *Chrysophyllum* L. (7 spp.), *Ecclinusa* Mart. (1 sp.), *Elaeoluma* Baill. (1 sp.), *Pouteria* Aubl. (28 spp.), *Pradosia* Liais (3 spp.) y una especie de *Sideroxylon* L. (IPNI, 2022).

Sapotaceae es un importante componente florístico de los bosques tropicales en términos de número de especies e individuos (ter Steege et al. 2013). Esto no es una excepción para la región de Golfo Dulce, ubicada en el Pacífico sur de Costa Rica. En esta pequeña región, que alberga los últimos bosques húmedos tropicales de tierras bajas a lo largo de la costa del Pacífico en América Central (Weissenhofer et al., 2008), uno de los integrantes arbóreos más destacados en estos bosques son de esta familia, ya que cuenta con los nueve géneros documentados para el país y cerca de 41 especies de las 69 que alberga toda Costa Rica (Hietz, 2008; Huber et al., 2008; Morales, 2015; Cornejo et al., 2021; ver Apéndice 1).

Pradosia contiene 23 especies, principalmente distribuidas en América del Sur, con dos especies (incluida la aquí descrita) en los bosques húmedos de América Central (Nicaragua, Costa Rica y Panamá; ver Pennington y Knapp, 2009; Morales, 2015; Terra-Araujo et al., 2015; Terra-Araujo et al., 2016). Las especies de *Pradosia* son por lo general pequeños o grandes árboles, aunque *Pradosia brevipes* (Pierre) T. D. Penn. es un arbusto que crece en regiones áridas de Bolivia, Brasil y Paraguay (Viscarra et al., 2014; Terra-Araujo et al., 2016). Las hojas de *Pradosia* son por lo general opuestas a verticiladas, las flores tienen corolas desde blanco, verde hasta rojo-vino, son bisexuales, se pueden encontrar sobre las ramas o el tronco [p. ej., *P. lactescens* (Vell.) Radlk., *P. lahoziana* Terra-Araújo, *P. ptychandra* (Eyma) T. D. Penn], frecuentemente 5-meras y sin estaminodios; el fruto es drupáceo (Terra-Araujo et al. 2016; De Faria et al., 2017). Para más detalles de la morfología de este género y clave de identificación, ver Pennington (1990) y en especial Terra-Araujo et al. (2016).

Pradosia golfodulcensis Aguilar & D. Santam. *sp. nov*. TIPO: COSTA RICA. Puntarenas: Golfito, Reserva Forestal Golfo Dulce, serranías de Golfito, Villa Briceño, La Gamba, orillas de la Estación Biológica La Gamba, 08°42'10"N, 083°12'20"W, 70 m, 29 Julio 1997 (fr. inm.), *N. Zamora & R. Aguilar 2605* (Holotipo: MO; Isotipos: K). Fig. 1–4.

Pradosia golfodulcensis is morphologically similar to *Pradosia glaziovii* (Pierre) T. D. Penn. in its inner bark non-sweet tasting, petiols without scales, and similar leaves

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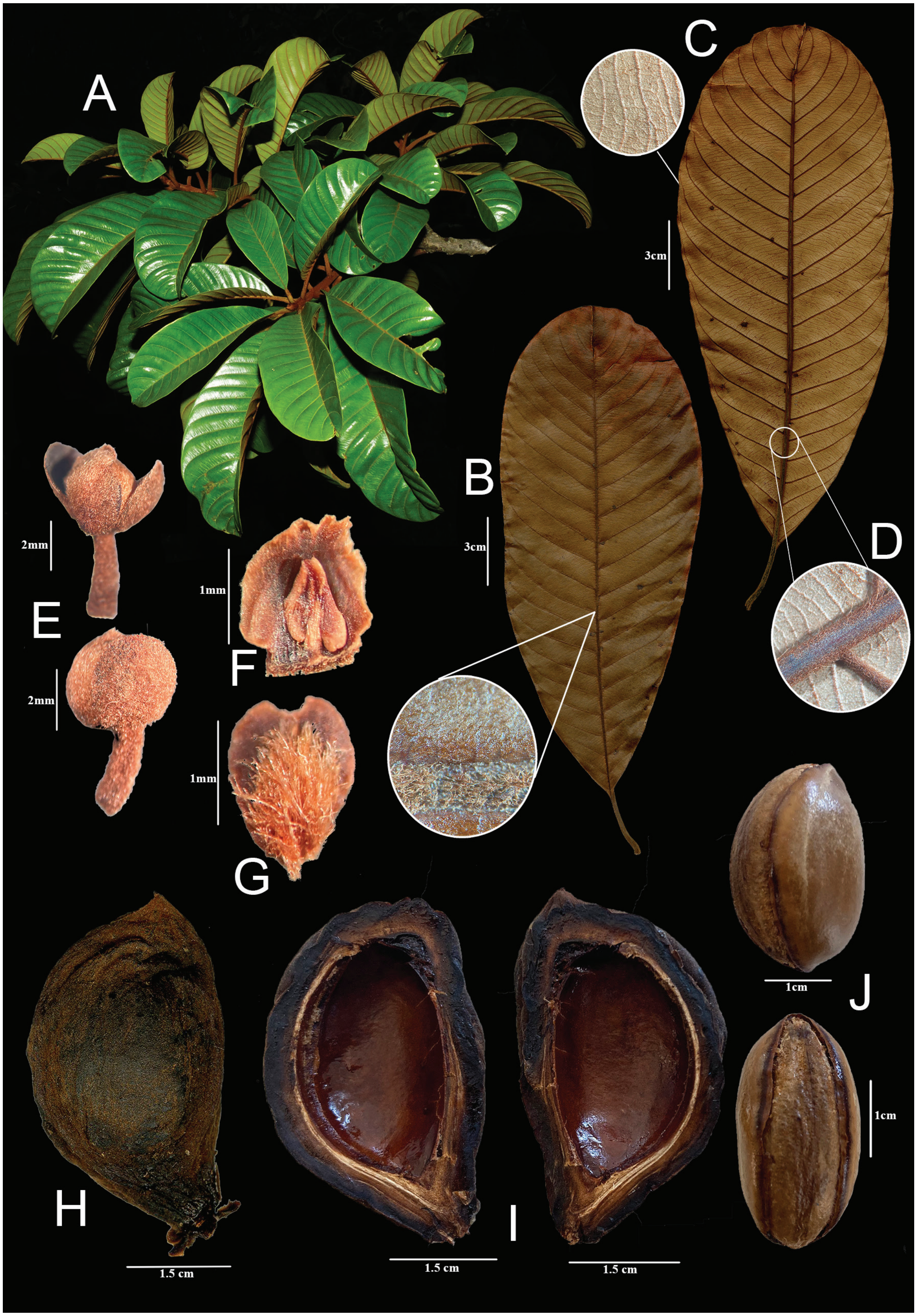

FIGURA 1. *Pradosia golfodulcensis*. **A**, rama mostrando el haz de las láminas foliares; **B**, haz de una lámina foliar y detalle de la vena central y su indumento; **C**, envés de una lámina foliar y detalle de las venas terciarias; **D**, detalle de la vena central por el envés y tricomas; **E**, botones florales; **F**, cara adaxial de la corola y estambre; **G**, cara abaxial de la corola; **H**, Fruto; **I**, Parte interna del fruto; **J**, Semilla. A sin testigo de herbario; B–D de *N. Zamora & R. Aguilar 2605* (MO); E de *L. Acosta et al. 1478* (MO); H–J de *N. Zamora et al. 2624* (MO).

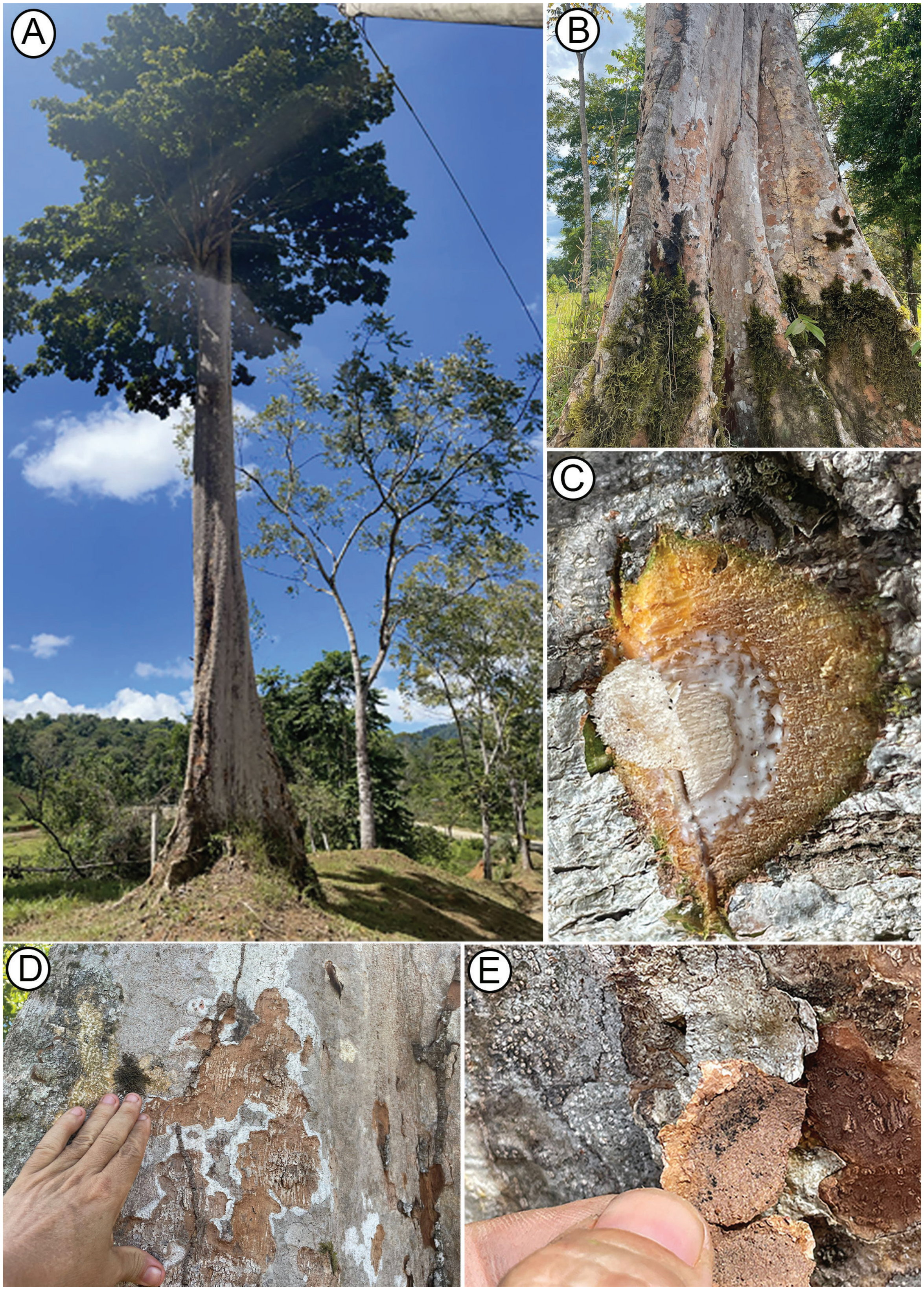

FIGURA 2. *Pradosia golfodulcensis*. **A**, hábito; **B**, contrafuertes; **C**, savia en el tronco; **D**, corteza; **E**, corteza exfoliando. Fotos por Reinaldo Aguilar, sin testigo de herbario, fotografía tomada en Puntarenas, Osa, camino a Rancho Quemado, frente a la entrada de Baneguitas (08°40'42.76"N, 083°31'40.92"W).

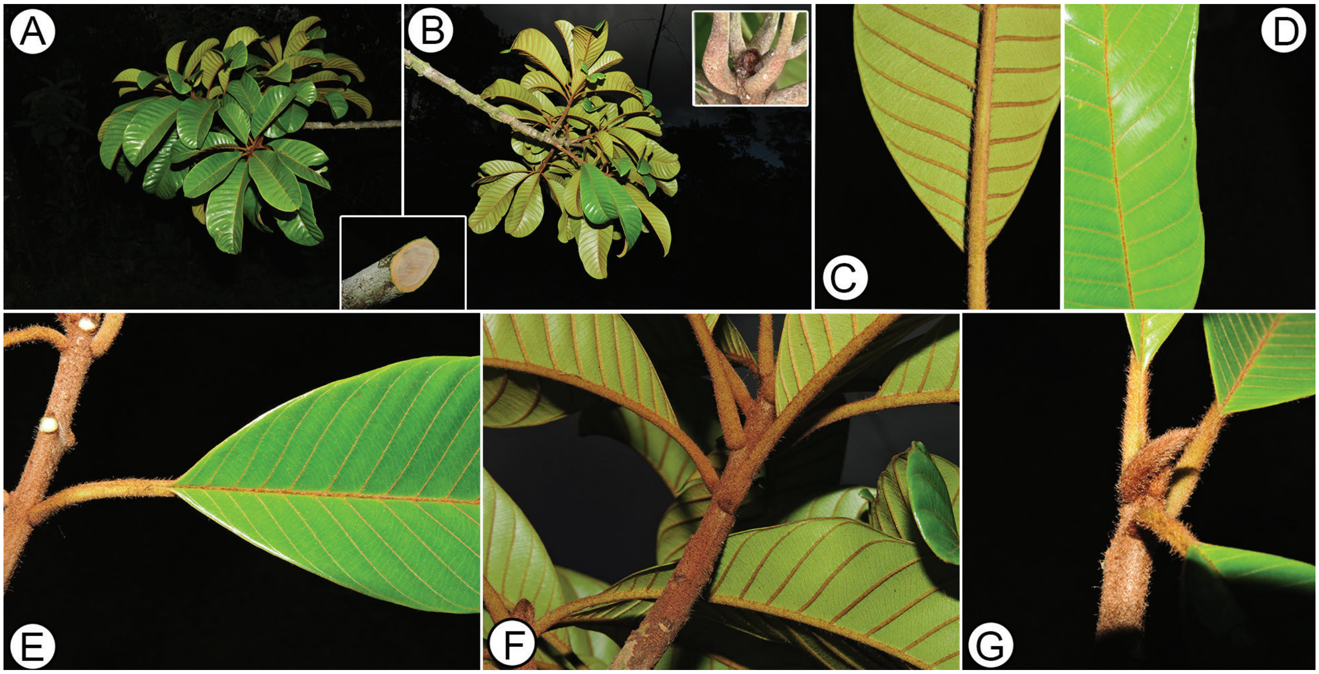

Figura 3. *Pradosia golfodulcensis*. **A**, haz de las láminas foliares y corte de una rama (en recuadro); **B**, envés de las láminas foliares y parte apical de las ramitas y base del pecíolo (en recuadro); **C**, base de la lámina por el envés y venas laterales; **D**, margen de la lámina foliar; **E**, pecíolo, también notar los tricomas sobre las venas; **F**, ramita. **G**, parte apical de la ramita. Fotos por Reinaldo Aguilar, sin testigo de herbario, fotografía tomada en Puntarenas, Osa, camino a Rancho Quemado, frente a la entrada de Baneguitas (08°40'42.76"N, 083°31'40.92"W).

(shape and size), tertiary veins are numerous and well marked, and eucamptodromous venation, but differs by the cream or greenish cream corolla (vs. reddish), and fruits with smooth surface (vs. muricate).

Árbol 14–45 m de alto × 35–60 cm de diámetro, la corteza externa blanquecina-grisácea, lisa o exfoliándose en pequeñas placas, sin sabor sabor dulce; corteza interna amarillenta a blanquecina, con exudado blanco y escaso. *Ramitas* teretes, la corteza estriada, cubierta con tricomas ferrugíneos, la yema apical cubierta por una densa pubescencia de tricomas ferrugíneos de 0.5–2 mm de largo, los brazos de los tricomas desiguales. *Hojas* alternas o pocas veces subopuestas, agrupadas de forma espiral en el ápice de las ramitas; pecíolo 1.1–3.5 xx 0.19–0.24 cm, algunas veces engrosados en la base, ligeramente acanalado adaxialmente, en toda su longitud o arriba de la mitad distal, redondeados abaxialmente, densamente pubescente, los *tricomas* hasta 2 mm de largo, ferrugíneos, cuando secos y los tricomas son removidos la superficie es negra, estipelas ausentes; lámina 9.1–24 × 4–9.9 cm, obovado elíptica a obovado, el haz glabro (excepto sobre la vena central y las laterales), el envés esparcidamente pubescente (la pubescencia más densa sobre las venas) los tricomas incoloros o incoloros y con algunas partes ferrugíneas, sésiles o corto estipitados, los brazos del tricoma más o menos similares en longitud; venación eucamptódroma; vena central por el haz plana o muy levemente hundida, pubescente, por el envés elevada, redondeada, cubierta con tricomas ferrugíneos, hasta 1.5 mm de largo, los tricomas más largos con brazos marcadamente desiguales; venas laterales 11–23 por lado, planas o muy leve acanaladas por el haz, pubescentes, los tricomas pardo claro a blanquecinos, por el envés elevados, los tricomas ferrugíneos, sésiles o corto estipitados; venas terciarias finas, numerosas, sinuosas, bien marcadas; base aguda a angostamente cuneada; ápice obtuso a cortamente acuminado; margen entero, plano o muy inconspicuamente revoluto. *Inflorescencia* en botón floral en fascículos de 3–5 flores, a lo largo de las ramas por debajo de las hojas. *Flores* solamente vistas en botón floral, perianto 5-meras, en un verticilo, crema (*L. Acosta et al. 1478*) o crema verdoso (*R. Aguilar et al. 5396*); botón floral ca. 0.5 mm de ancho; pedicelo ca. 3–4 [6–8] mm de largo, densamente pubescente; sépalos ca. 4 [4.5–5] × 3–4 mm (5–6 × 3.5–5 mm en frutos inmaduros), ovados a suborbiculares, densamente pubescentes por afuera, los tricomas pardos, glabros por dentro, el ápice obtuso; corola 2.1–2.5 [6.5–7] × 1.6–1.9 mm, abaxialmente pubescente en la mitad proximal, pero glabros hacía los márgenes, los tricomas pardos, adaxialmente glabros, el tubo [3–3.3 mm de largo], los lóbulos [3.3–3.8 mm de largo]; estambres 5, antepétalos, adnados a la base de corola; filamentos 0.1–0.5 mm de largo, glabros; anteras 1–1.3 mm de largo, sagitadas, glabras; ovario 1.7–1.8 × 0.8–1.6 mm, la pared ca. 0.3 mm de grueso, angostamente ovado, densamente cubierto por tricomas pardos a ferrugíneos, los tricomas hasta ca. 1 mm largo; estilo capitado (0.5–0.8 mm de largo en frutos inmaduros), glabro; estaminodios ausentes. *Fruto* ca. 4.7 cm de largo (cuando seco), amarillos (*N. Zamora et al. 2624*), obovado, la superficie lisa, esparcidamente pubescentes (densamente en frutos inmaduros), los tricomas ferrugíneos; mesocarpo ca. 3–4 mm de grueso (en un fruto luego de ser

FIGURA 4. Distribución geográfica de *Pradosia golfodulcensis*. Mapa elaborado con SimpleMappr (Shorthouse, 2010).

hidratado; *L. Acosta et al. 1478*), endocarpo ca. 0.7 mm de grueso; pedicelo ca. 1.3 × 0.4 cm; semilla 1 (o 2; *N. Zamora et al. 2624*), 2.8 × 1.8 cm y 1.4 cm de grueso, la superficie beige, lisa, ligeramente brillante, el margen cerca a la cicatriz pardo oscuro, la cicatriz ca. 0.9 cm de ancho (en la parte media).

Características distintivas: *Pradosia golfodulcensis* se reconoce por la combinación de hojas alternas, agrupadas en el ápice de las ramas, la lámina tiene la venación eucamptódroma, la vena central por el haz es plano o ligeramente sulcada, las venas laterales conspicuas y las terciarias finas y numerosas en el envés; los pecíolos carecen de estipelas. Las flores se encuentra sobre las ramas, la corola es crema o crema verdosa, con la cara externa de la corola pubescente (glabra en los márgenes); así como los tricomas ferrugíneos y largos, que cubre diferentes partes vegetativas (ramitas, venas de las láminas foliares) y reproductivas (perianto, ovario y frutos).

En el campo esta especie se reconoce por su tronco recto, con contrafuertes de hasta 2 m de altura. La savia es blanca y por general escasa. Las hojas con la venación destacada y la pubescencia ferrugínea ayudan a distinguir esta especie de cualquier otra Sapotaceae en la Península de Osa (Fig. 2, 3).

Etimología: El epíteto específico hace referencia a la región de Golfo Dulce, lugar de donde provienen la mayoría de ejemplares de esta nueva especie.

Distribución y hábitat: *Pradosia golfodulcensis* es una especie endémica de Costa Rica. Según especímenes en colecciones se encuentra restringida a la vertiente Pacífica, en la región de Tarrazú, provincia de San José (500–600 m de elevación), y la región de Golfo Dulce, provincia de Puntarenas (70–400 m de elevación) (Fig. 4). Ejemplares de herbario y observaciones en el campo indican que se encuentra en bosque primario y orillas de caminos. En la Península de Osa crece sobre suelo rojo y arcilloso.

Fenología: Especímenes de *Pradosia golfodulcensis* fueron recolectados con botones florales y flores en abril y mayo; mientras los frutos en diferentes estados de maduración en junio, julio y setiembre.

Pradosia golfodulcensis morfológicamente es similar a *P. glaziovii* (Pierre) T. D. Penn., *P. granulosa* Pires & T. D. Penn., *P. subverticillata* Ducke todas restringidas a Brasil y *P. verticillata* Ducke de Brasil y Guyana Francesa (Terra-Araujo et al., 2016). Estás especies tienen similaridad morfológica en la forma de las láminas foliares (p. ej. obovadas elíptica), el rango de tamaño (9–31 × 3–11 cm), la venación eucamptódroma, los nervios laterales por lo general conspicuos, mientras los terciarios son numerosas, bien marcados, los pecíolos sin estipelas; y las flores con la corola pubescente en la cara externa. Sin embargo, estas especies se pueden distinguir por las características anotadas en el Cuadro 1.

Por otra parte, *Pradosia grisebachii* (Pierre) T. D. Penn (siguiendo el concepto de Terra-Araujo et al. 2016) es la única especie de *Pradosia* hasta el presente conocida para América Central (Nicaragua, Costa Rica, Panamá). Este taxón fue tratado como *P. atroviolacea* Ducke, en Pennington & Knapp (2009) y Morales (2015), posteriormente relegada a sinónimo de la primera (Terra-Araujo et al. 2016). Sin embargo, ésta se distingue por la presencia de un par de estipelas sobre el pecíolo (vs. sin estipelas), el pecíolo y el envés de la lámina foliar son glabros o escasamente pubescente con tricomas amarillentos (vs. pecíolo y envés especialmente sobre los nervios, pubescente y con tricomas ferrugíneos). Comparar con las Fig. 3 y 5.

Evaluación del estado de conservación: Documentamos seis colecciones de cuatro localidades, tres de las cuales están asociadas con la región de Golfo Dulce y la cuarta con Cerro Diamante. Los datos de las localidades nos permiten evaluar la especie bajo el criterio B de la Lista Roja de la UICN (2012) utilizando GeoCat (Bachman et al., 2011). La Extensión de Ocurrencia (EOO) basado en estas recolecciones es de 2.152 km^2, que está por debajo del umbral de 20.000 km^2 para la categoría En Peligro (EN). El **Área de** Ocupación (AOO) correspondiente es de 16 km^2, con un ancho de celda de 2 km como recomienda la UICN (2012). Esto también está por debajo del umbral para

Cuadro 1. Comparación de *Pradosia golfodulcensis,* con aquellas especies morfológicamente similares. Los datos presentados provienen de Terra-Araujo et al. 2016.

	P. GOLFODULCENSIS	*P. GLAZIOVII*	*P. GRANULOSA*	*P. SUBVERTICILLATA*	*P. VERTICILLATA*
Filotaxia y tamaño de la lámina	Alternas o pocas veces subopuestas, agrupadas de forma espiral en el ápice de las ramitas, 9.1–24 × 4–9.9 cm	Alternas o verticiladas, agrupadas en el ápice de las ramas, 9–24 × 4–11 cm	Subverticiladas, 8–22 × 5–8 cm	Alternas o subverticiladas, agrupadas en el ápice de las ramitas, 10–21 × 3–8 cm	Verticiladas, agrupadas en el ápice de las ramitas, 13–31 × 4–11 cm
Indumento en el envés de la lámina	Pubescente, especialmente sobre las venas	Puberulento	Glabro, o si pubescente el indumento sobre las venas	Glabro	Pubescente, especialmente sobre las venas
Vena media por el haz de la lámina	Plana o muy levemente hundida	Hundida	Hundida	Hundida	Hundida
Longitud del pecíolo e indumento	1.1–3.5 cm, densamente pubescente	1.2–1.9 cm, pubescente	0.9–2 cm, tomentoso o glabrescente	2–3.2 cm, tomentuloso	1.0–4.1 cm, pubescente
Longitud de la corola y color	2.1–2.5 [6.5–7] mm, crema o crema verdosa	5–6.5 mm, rojiza	4.5–5.5 mm, rojo-vino	5.5–6.5 mm, verdosa	4–4.6 mm, rojiza
Longitud del fruto y superficie	ca. 4.7 cm, lisa	3.5–5 cm, muricada	3–4.5 cm, muricada	3.5–4 cm, lisa	3.5–4.5 cm, lisa
Hábito, color y sabor de la corteza externa	Árbol 14--45 m de altura, blanquecina-grisácea, lisa o exfoliándose en pequeñas placas, sin sabor dulce	Árbol hasta 30 m de altura, pardo grisácea, lisa, sin sabor dulce	Árbol pequeño 4–6 m de altura, pardo grisácea, áspera, sin sabor dulce	Árbol hasta 4 m, pero puede alcanzar los 20 m de altura; corteza grisácea lisa, dulce	Árbol hasta 15 m, pero puede alcanzar los 20 m de altura, verdosa, lisa, exfoliándose, sin sabor dulce

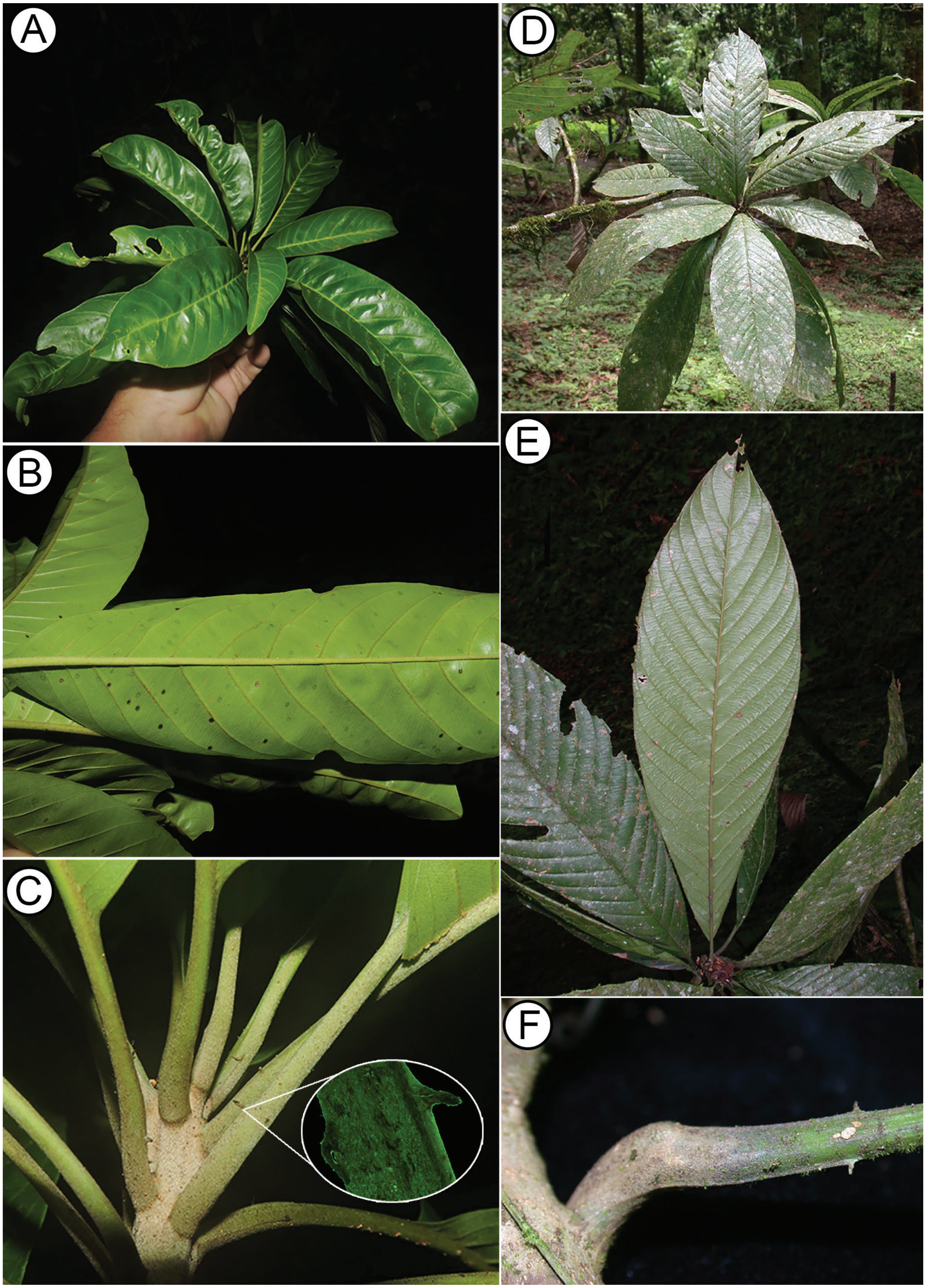

FIGURA 5. Comparación de *Pradosia grisebachii* en la vertiente del Pacífico (A–C) y la del Caribe (D–F). **A**, ramita mostrando el haz de las láminas foliares; **B**, envés de las láminas foliares; **C**, estipelas sobre el pecíolo, con un acercamiento de ellas en recuadro; **D**, ramita mostrando el haz de las láminas foliares; **E**, envés de una lámina foliar (nótese la venas laterales); **F**, estipelas sobre el pecíolo. Fotos por Reinaldo Aguilar (A–C) y Orlando Vargas/Flórula Digital de La Selva.

EN (<500 km^2). Utilizando Global Forest Watch (2022), estimamos que aproximadamente el 80% del EOO se encuentra dentro de áreas protegidas (corredores biológicos, reservas forestales o áreas silvestres protegidas) del Parque Nacional Corcovado, la Reserva Forestal Golfo Dulce, el Parque Nacional Piedras Blancas y el Refugio Nacional de Vida Silvestre de Golfito. El mapa interactivo de Global Forest Watch (2014) también sugiere que entre 2001 y 2015, <5% del EOO fue deforestado, lo que sugiere una amenaza activa, pero baja, de deforestación (Criterio B, subcriterio C). Si bien el AOO es <500 km^2, solo se aplica un subcriterio (B), por lo que *Pradosia golfodulcensis* no puede considerarse En Peligro. Por lo tanto, evaluamos esta especie como Vulnerable (**VU**) en base a la EOO y la amenaza activa aunque baja de la deforestación/agricultura que podría conducir a un riesgo de extinción en el futuro.

Pradosia golfodulcensis fue tratada como *Pradosia* sp. A, en el Manual de Plantas de Costa Rica (Morales, 2015). El testigo ahí citado (*Aguilar & González 5396*; INB [ahora CR], MO), un árbol 20 m de alto y 30 cm de DAP, con flores crema verdoso, y recolectado en Las Torres, Golfito, Puntarenas (500 m de elevación) no pudo ser ubicado por nosotros. Por tal razón, suponemos que las medidas de las flores ahí presentada es basada en ese ejemplar, las cuales difieren notablemente del único ejemplar con botones florales que pudimos estudiar (*L. Acosta et al. 1478,* MO) y que es el utilizado para elaborar nuestra descripci*ón*. Por tal razón, las medidas entre corchetes [ ], corresponden a las brindadas por Morales (2015).

Finalmente, consideramos que las poblaciones costarricenses de la vertiente Caribe (p. ej. La Selva; *O. Vargas 1872*, LSCR; fr. *O. Vargas 1310,* est.*;* LSCR) y del Pacífico (p. ej. Manuel Antonio, Península de Osa; *P. Harmon 114*, CR; fr.) de *Pradosia,* y como se menciono anteriormente son referidas a *P. grisebachii* (Terra-Araujo et al. 2016) merecen estudios adicionales cuando más ejemplares con flores y frutos se encuentren disponibles. Según nuestras observaciones, difieren notablemente en varias características morfológicas de las láminas foliares tales como: la forma, número de venas laterales, y la arquitectura de las venas terciarias, ver por ejemplo Fig. 5.

Ejemplares adicionales examinados: Costa Rica. Puntarenas: Golfito, Reserva Forestal Golfo Dulce, Península de Osa, alrededores de Estación Agujas, 08°32'05"N, 083°25'36"W, 300 m, 24 Mayo 2000 (bot. fl.), *L. Acosta et al. 1478* (MO); Osa Peninsula, along road to Bahia Drake north of Corcovado National Park, 08°40'47"N, 083°31'39"W, 70 m, 21 Marzo 2006 (est.), *A. A. Anderberg et al. 52* (MO, S [S06-13150, n.v.]); Reserva Forestal Golfo Dulce, Península de Osa, camino a Rancho Quemada, 08°41'00"N, 083°32'30"W, 100–200 m, 21 Marzo 2006 (est.), *D. Santamaría & Curso de Sapotaceae 3969* (CR); Parque Nacional Corcovado, Península de Osa, Puerto Jiménez, Río Agujas, Estación Agujas, orillas de la estación, 08°32'00"N, 083°26'00"W, 300–400 m, 24 Setiembre 1997 (fr.), *N. Zamora et al. 2624* (K, MO). San José: Tarrazú, estribaciones del Cerro Diamante, 09°32'30"N, 084°01'20"W, 500–600 m, 23 Junio 1998 (fr.), *A. Estrada et al. 1627* (CR).

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Apéndice i.

Lista de las especies de Sapotaceae en la Península de Osa

La delimitación de La Península de Osa es la propuesta por Cornejo et al. (2012). La lista en general sigue la taxonomía de Morales (2015). Al lado del género se indica el número de especies en Costa Rica, seguido por el número de especies en la Península de Osa. Cuando se encuentran disponibles se brinda el nombre vernáculo (N.v.). Especies anotas con *son endémicas de Costa Rica, mientras otras con **son endémicas de Costa Rica y la Península de Osa.

Sapotaceae

***Chromolucuma* 1/1**

C. cespedesiiformis J. F. Morales. (Fig. 6A).

***Chrysophyllum* 4/9**

C. argenteum Jacq. **N.v.**: caimito cimarrón, caimito de montaña, caimito silvestre. (Fig. 6B).

C. cainito L. **N.v.**: caimito. (Fig. 6C).

C. moralesianum Aguilar, D. Santam. & J. M. Chaves.** (Fig. 6D).

C. sierpense Aguilar, D. Santam. & J. M. Chaves.**

***Elaeoluma* 1/1**

E. glabrescens (Mart. & Eichler) Aubrev. **N.v.**: carey, níspero negro. (Fig. 6E).

***Manilkara* 4/2**

M. staminodella Gilly. (Fig. 6F).

M. zapota (L.) Royen. **N.v.**: níspero. (Fig. 6G).

***Micropholis* 3/4**

M. crotonoides (Pierre) Pierre. **N.v.**: zapotillo. (Fig. 7A).

M. melinoniana Pierre. **N.v.**: manzana de monte, mariabé. (Fig. 7B).

M. venulosa (Mart. & Eichler) Pierre. (Fig. 7C).

***Pouteria* 21/38**

Adicionalmente Morales (2015), menciona que en la Península de Osa, se encuentra cinco identidades tratadas por él como: *Pouteria* sp. C, E, G, H, I.

P. amygdalicarpa (Pittier) T. D. Penn. **N.v.**: Níspero colorado, níspero de monte, níspero zapote, sapotillo, zapotillo.

P. bulliformis Q. Jiménez & T. D. Penn. (Fig. 7D).

P. caimito (Ruiz & Pav.) Radlk. (Fig. 7E).

P. campechiana (Kunth) Baehni. **N.v.**: canistel, zapotillo.

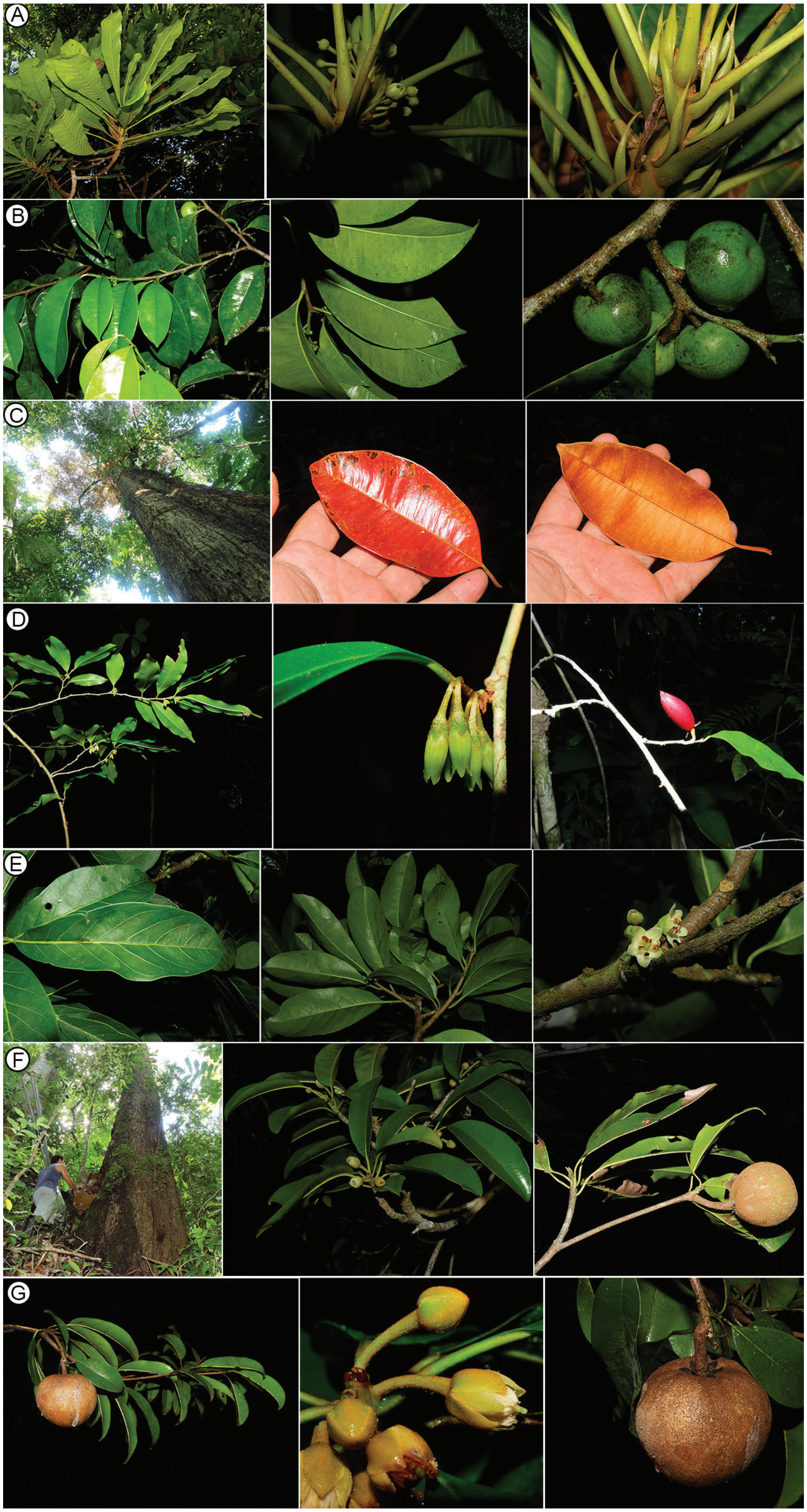

FIGURA 6. **A**, *Chromolucuma cespedesiiformis*. **B**, *Chrysophyllum argenteum*. **C**, *Chrysophyllum caimito*. **D**, *Chrysophyllum moralesianum*. **E**, *Elaeoluma glabrescens*. **F**, *Manilkara staminodella*. **G**, *Manilkara zapota*. Fotos por Reinaldo Aguilar.

FIGURA 7. **A**, *Micropholis crotonoides*. **B**, *Micropholis melinoniana*. **C**, *Micropholis venulosa*. **D**, *Pouteria bulliformis*. **E**, *Pouteria caimito*. **F**, *Pouteria chiricana*. **G**, *Pouteria durlandii*. Fotos por de Reinaldo Aguilar.

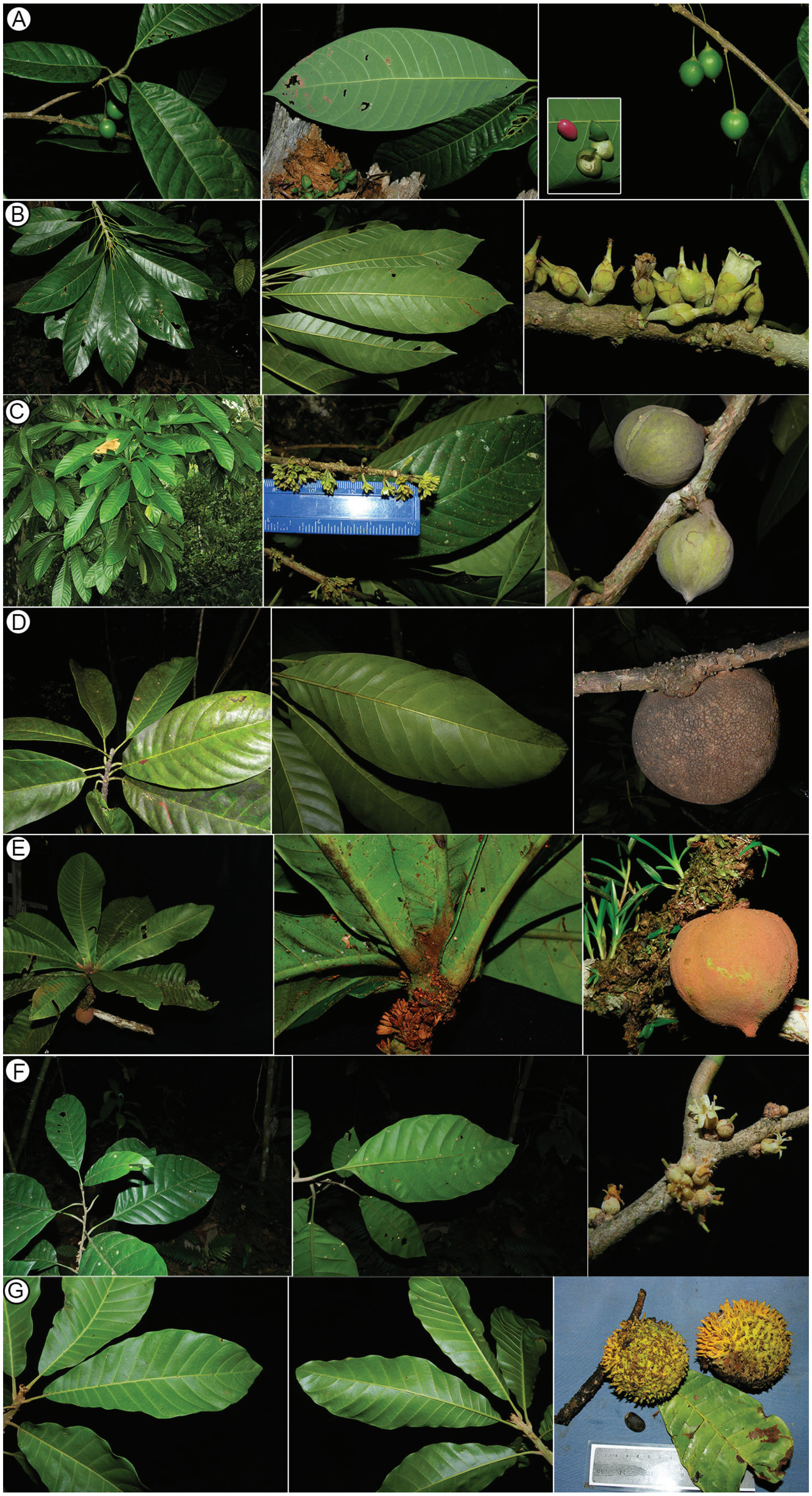

Figura 8. **A**, *Pouteria filiformis*. **B**, *Pouteria fossicola*. **C**, *Pouteria glomerata*. **D**, *laevigata*. **E**, *P. lecythidicarpa*. **F**, *Pouteria subrotata*. **G**, *Pouteria torta*. Fotos por de Reinaldo Aguilar.

***Pouteria* 21/38 cont.**

P. chiricana (Standl.) Baehni. (Fig. 7F).

P. cuspidata (A. DC.) Baehni.

P. durlandii (Standl.) Baehni. (Fig. 7G).

P. filiformis T. D. Penn. **Nota**. Aunque esta especie fue mencionada como endémica de Costa Rica (Morales, 2015), imágenes fueron observadas de un ejemplar recolectado en Panamá (http://herbario.up.ac.pa/Herbario/). De tal forma su ámbito de distribución se extiende a Panamá. (Fig. 8A).

P. filipes Eyma.

P. fossicola Cronquist. **N.v.**: zapote. (Fig. 8B).

P. foveolata T. D. Penn.

P. glomerata (Miq.) Radlk. (Fig. 8C).

P. juruana K. Krause.

P. laevigata (Mart.) Radlk. (Fig. 8D).

P. lecythidicarpa P. E. Sánchez & Poveda* (Fig. 8E).

P. leptopedicellata Pilz.

P. reticulata (Engl.) Eyma. **N.v.**: carey, níspero zapote, níspero zapotillo.

P. spicata J. F. Morales.*

P. subrotata Cronquist (Fig. 8F).

P. torta (Mart.) Radlk. **N.v.**: Níspero mamoncillo, zapote de monte, zapotillo. (Fig. 8G).

P. triplarifolia Standl. & P. H. Allen ex T. D. Penn.* **N.v.**: zapote, zapote colorado. (Fig. 9A).

***Pradosia* 2/2**

P. golfodulcensis Aguilar & D. Santam.*

P. aff. grisebachii (Pierre) T. D. Penn. (Fig. 5A–C).

***Sarcaulus* 2/1**

S. brasiliensis (A. DC.) Eyma. Tratado por Morales 2015, como *Sarcaulus* sp. B. Sin embargo, aquí los referimos como *S. brasiliensis* hasta que la taxonomía no sea clarificada. (Fig. 9B).

***Sideroxylon* 7/1**

S. capiri (A. DC.) Pittier. **N.v.**: caracolillo, níspero de monte, tempisque.

FIGURA 9. **A**, *Pouteria triplarifolia*. **B**, *Sarcaulus brasiliensis*. Fotos por de Reinaldo Aguilar.

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TWO NEW SPECIES OF *GUAPIRA* (NYCTAGINACEAE) FROM MONTANE HUMID FORESTS IN NORTHWESTERN VENEZUELA

GERARDO A. AYMARD-CORREDOR[1]

Abstract. *Guapira fundacionensis* from montane forests over the "Aguardiente" sandstone formation, "La Fundación" region, Andes of Táchira State, and *Guapira guasarensis* from "río Guasare"**,** on foothills and montane forests located in eastern side of Sierra de Perijá, Zulia state, both in Venezuela, are described, illustrated, and their morphological relationships with allied species are discussed. Both species have similarities with *G. opposita*, however they differ by having branches, petioles and perianth densely ferrugineous tomentose, by leaf shape and texture, peduncle size, and flowers subtended by three bracteoles. In a geographical and taxonomical context, *G. guianensis* and *G. pacurero* are regarded here as diferent from *G. eggersiana* and *G. opposita*, while *Guapira ayacuchae* is considered a synonym of *G. cuspidata*, *G. olfersiana* of *G. opposita*, whereas *G. davidsei* is regarded as a recognizable species. An updated key to the 20 Venezuelan species of *Guapira* is presented, and phytogeographical information about the La "Fundación" is provided. *Guapira fundacionensis* and *G. guasarensis* are remarkable species, the first by its two stigmas and the latter for bearing five glands at the top of the ovary in an otherwise predominantly one stigma genus, without glands at the top of the ovary.

Keywords: Flora of Venezuela, wet forests, *Guapira*, sandstone outcrops

Resumen. *Guapira fundacionensis* sobre afloramientos de areniscas de la formación Aguardiente, La Fundación, estado Táchira, Andes de Venezuela y *Guapira guasarensis*, de bosques del piedemonte y montanos del río Guasare, del lado este de la Sierra de Perijá, estado Zulia son descritas, ilustradas y sus relaciones morfológicas con la especie afín son discutidas. Ambas especies poseen similaridades con *G. opposita*, sin embargo, difieren en la pubescencia densamente ferruginosa en las ramas, pecíolos y perianto, en la forma y textura de las hojas, tamaño del pedúnculo y las flores subtendidas por 3 bractéolas. En un contexto geográfico y taxonómico, *G. guianensis* y *G. pacurero* son tratadas como especies diferentes de *G. eggersiana* y de *G. opposita*. Por otra parte, *G. ayacuchae* es considerada un sinónimo de *G. cuspidata*, *G. olfersiana* de *G. opposita* y *G. davidsei* es reconocida como una especie válida. Se presenta una clave actualizada para diferenciar las 20 especies del género *Guapira* presentes en Venezuela e información acerca la fitogeografía del sector La Fundación. *Guapira fundacionensis* y *G. guasarensis* son especies notables, la primera por sus dos estigmas y la segunda por poseer 5 glándulas en el ápice del ovario, en un género donde predomina un solo estigma y ovario sin glándulas.

Palabras clave: afloramientos de arenisca, bosques húmedos, *Guapira*, Flora de Venezuela

Guapira Aubl. (1775: 308) together with *Neea* Ruíz & Pav. (1794: 52) are the most diverse and representative genera of Nyctaginaceae (Pisonieae) (Bittrich and Kühn, 1993; Douglas and Spellenberg, 2010; Rossetto et al., 2019, Rossetto and Caraballo-Ortiz, 2020*)*. *Guapira* has a Neotropical distribution and ranges from southern Florida (i.g., *G. discolor* (Spreng.) Little), central to southern Mexico through Central America, the Caribbean, Colombia, Venezuela, the Guianas, Ecuador, Peru, Brazil, Bolivia and Paraguay (Damascena and Coelho, 2009 Onwards; Ulloa Ulloa et al., 2018 Onwards) and comprises ca. 70 species (Lundell, 1968: Ulloa Ulloa et al., 2018 Onwards; World Checklist of Vascular Plants; kew.org).

Guapira is most diverse throughout the lowland vegetation of humid to seasonally dry forests and savannas; some endemic taxa are found in Brazilian Atlantic forest and Cerrado vegetation (Furlan and Guilietti, 2014; Chagas and Costa-Lima, 2020: Rossetto and Ferraz, 2020) and in the Antilles (Little Jr., 1968; Ulloa Ulloa et al., 2018 Onwards). Several species are found over rocky slopes and oligotrophic soils derived from the Precambrian crystalline basement of the Guayana Shield (e.g., *G. bolivarensis* Steyerm., *G. neblinensis* Maguire & Steyerm. and, drained by black waters rivers (e.g., *G. sancarlosiana* Steyerm.), on scrub ("bana" or "campina") and low Amazonian forests known as "caatinga Amazonica" or "campinarana" on white-sand soils (Steyermark and Aymard, 2003; Aymard et al., 2009).

Guapira is closely related to *Neea*: both genera have unarmed stems and branches, the leaves are commonly opposite, sometimes verticillate, rarely alternate, flowers unisexual (sometimes bisexual in *N. floribunda* Poepp. & Endl. *sensu* Defilipps and Maina, 2003) with a dioecious condition, and fleshy anthocarps. These two genera have been treated conventionally as distinct taxa, basically separated based on the shape of the staminate perianth and the stamen position in the staminate perianth, which is exserted in *Guapira* and inserted in *Neea*. Burger (1983) was the first to recommend that both genera should be united under *Guapira*. Molecular evidence indicates that these genera form a single lineage (Douglas and Manos, 2007; Rossetto et al., 2019), and that the character "exserted stamens" is homoplasic (Rossetto et al., 2019). However, Chagas and Costa Lima (2020) pointed out that these studies were based on a small sample of species (20%), and the resulting data still do not represent a robust phylogenetic support to demonstrate that these entities should be merged. Nevertheless, so far, *Guapira* and *Neea* can be morphologically distinguished by the state characters presented in Table 1.

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Table 1. Comparison of diagnostic morphological characters of *Guapira* and *Neea*

Character	*Guapira*	*Neea*
Inflorescence	cymes; distal branches bearing groups of 2–3(–5) flowers at the end of flowered cymules	Cymes or panicles; sometimes cauliflorous or ramiflorous; distal branches compound by multifloral cymules
Perianth buds	Clavate, rounded or obtuse at apex	Elliptic or oblong, long-acuminate at apex
Staminate flower	Perianth obconic-campanulate, infundibuliform o funnel-shaped, rarely urceolate; elongate, stamens exserted	Perianth usually urceolate, sometimes tubular to ellipsoid or infundibuliform, globose or elongate; stamens included
Pistillate flower`	Perianth tubular or urceolate, not contracted at apex; stigma exserted, penicellate-fimbriate	Perianth tubular, contracted at apex; stigma included, rarely shortly exserted, rounded or penicellate
Pistil	Borne on a shortly stalk or stipe	Sessile or narrowed at the base
Anthocarps	Soft and fleshy, oblong-ellipsoid, drupaceous, rarely globose; crowned by a united portion of perianth; longitudinally sulcate when dry, black or purple	Firm, globose or ellipsoid, usually crowned by a free portion of perianth, not sulcate when dry, yellow, orange or purple

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

The present contribution increases to 20 the number of species known of *Guapira* from Venezuela, ten of them are endemic; the two new taxa are the first records of the genus for the Venezuelan Andes. In this geographical and taxonomical context, *G. guianensis* Aubl. and *G. pacurero* (Kunth) Little are treat here as diferent from *G. eggersiana* (Heimerl) Lundell and *G. opposita* (Vell.) Reitz as well. *G. ayacuchae* Steyerm. is considering a synonymy of *G. cuspidata* (Heimerl) Lundell, *G. olfersiana* (Link, Klotzsch & Otto) Lundell of *G. opposita* (Vell.) Reitz. and *G. davidsei* Steyerm. is recognized as validate species, different of *G. ferruginea* (Klotsch ex Choisy) Lundell.

Material and Methods

This work is based on morphological (using a dissecting stereomicroscope) and herbarium studies in COL, GH, MO, NY, PORT, and VEN (herbarium codes after Thiers, 2019). The world checklist of vascular plants (WCVP) was consulted: this dataset is a comprehensive list of scientifically described plant species, compiled over four decades, from peer-reviewed literature, authoritative scientific databases, herbaria and observations, then reviewed by experts (Govaerts et al., 2021). Historical taxonomic literature on *Guapira* and *Neea* were examined using Biodiversity Heritage Library website (http://www.biodiversitylibrary.org). Current bibliography were scrutinized, mainly the treatments of Nyctaginaceae of northwestern South America (Standley, 1931), Flora of the Lesser Antilles (Kellogg, 1988), Flora of the Guianas (DeFilipps and Maina, 2003), the Flora of the Venezuelan Guayana (Steyermark, 1987; Steyermark and Aymard, 2003), the Flora of Ecuador (Harling, 2010) and Flora of Brazil (Furlan and Giulietti, 2014). Also, the checklist: *Nuevo Catálogo de la Flora Vascular de Venezuela* (Aymard, 2008) was reviewed. Type specimens of *Guapira* and *Neea* species involved in this study were examined using on-line images from JSTOR Global Plants (https://plants.jstor.org/). In addition, International Plant Names Index (https://www.ipni.org/) and Tropicos (http://legacy.tropicos.org/Home.aspx) were also consulted to update the current nomenclature and geographical information.

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

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

TAXONOMY

Guapira fundacionensis Aymard, *sp. nov.*
TYPE: VENEZUELA. Táchira: 10 km E of La Fundación, around Represa La Dorada, 07°47'N, 71°46'W, 700–1000 m, 10–13 March 1981 (fl and fr), *R. Liesner & A. González 10465* (Holotype: VEN, Isotypes: MO, PORT). Fig. 1.

Guapira fundacionensis is similar to *G. opposita*, but morphologically it differs from the latter in having branches and petioles densely ferrugineous pubescent, leaves ovate, membranaceous, base acute; peduncle 3 cm long, axes, densely adpressed ferrugineous pubescent, without glandular trichomes; flowers subtended by 3 bracteoles, triangular; pistillate perianth ferruginous outside and ovary bearing five glands at the top.

Small *tree* 4–10 m tall, branchlets adpressed ferrugineous pubescent, glabrescent when mature. *Leaves* opposite, black-brown when drying, blades 10–15 × 3–5 cm membranaceous, ovate, acuminate at the apex, acute at the base, glabrous at both sides, the midvein sparsely to dense adpressed ferrugineous pubescent bellow, apex acuminate, base acute, margin entire, lateral nerves 5–8 each side, raised bellow, impressed above, brochidodromous, arcuated and convergent towards margin and linking ca. 3 mm to the margin, tertiary venation scarcely evident at both sides; petiole 0.5–2 cm long, striate, pubescence same as the branchlets. *Pistillate inflorescence* terminal cymes, 3–5 × 2–3 cm, dichotomously branched with three primary axes, densely adpressed ferrugineous pubescent. The peduncle ca. 3 cm long, ca. 2 mm diam., striate, pubescence same as the axes, with four primary branches, ca.1.25 cm long, bearing groups of 2–3(–5) flowers at the end of these axes. *Pistillate perianth* subtended by three bracteoles, lanceolate, ca. 1 mm long, pedicels 0–1mm long, pubescence same as peduncle outside. Perianth 4–5 × ca. 1.5 mm, tubular, pubescence same as peduncle outside, glabrous inside, ovary sessile, subconic, ca. 1.5 mm long, glabrous, bearing 5 glands at the top, style 2–3 mm long, stigma ca. 2 mm long, frimbriate, into 5 divisions, staminodes 5, ca. 1 mm long, glabrous. *Staminate inflorescences* not seen. *Young anthocarps* globose, sessile, 3–4 x 2–3 mm, sparsely pilose at the base, glabrescent at the top, rostrum ca. 0.5 mm long, adpressed pubescent outside.

Phenology: this new species has been collected with flowers and young fruits in March.

Etymology: the epithet *fundacionensis* is coined after the “La Fundación”, a high biodiversity locality in the Western portion of the Cordillera de Mérida, Táchira state, Venezuela.

Distribution and ecology: Known only from primary wet forests near “La Fundación” between 700–1000 m.

The type locality of *Guapira fundacionensis*, La Fundación, is located in the western portion of “Cordillera de Mérida”, on sandstone outcrops belonging to the “Formación Aguardiente” (Notestein et al., 1944; Salvador, 1961a, b). The vegetation of this area is relatively well known because of the collections made by R. Liesner, J. A. Steyermark and collaborators. These botanists observed that the vegetation associated with these sandstone outcrops includes several endemic species as well as many taxa that are present only in the Guayana Shield highlands on table-like mountains known as “Tepuis”, as well in the Amazon and Orinoquia basins floras (Riina, 1996; Aymard and Campbell, 2007, 2008). This entire highland region is called Pantepui, it is rich in endemic species and unique habitats (Riina et al., 2019). This natural region is located on oligotrophic soils derived from the Precambrian crystalline basement and sandstone rocks belong to the Roraima group on the Guayana Shield (Gibbs and Barrow, 1993).

No descriptive analysis of vegetation types from the sandstone rocks and sandy substrates of the Venezuelan Andes has been undertaken so far. The entire Tertiary was characterized by tectonic events and changes in climate and sea level (Hooghiemstra and van der Hammen, 2004). The Western Cordillera is the most recently upraised (Kroonenberg et al., 1990) of the northern Andes complex, and paleobotanical and geomorphological data indicate that its final uplift was completed around 4–3 mya (Gregory-Wodzicki, 2000). The progressive physical separation of the Andes from the other natural regions resulted in the present Andean flora: a mosaic of endemics, and elements from the Guayana, Amazonia, south-temperate, and northtemperate floras (van der Hammen and Cleef 1984; van der Hammen, 2000; van der Hammen and Hoogghiemstra 2000; Hooghiemtra et al., 2006). Gansser (1974) pointed out that the table montains near the Andean orogeny are topped by sandsones of Upper Cretaceous age (ca. 22 mya). According to him, these formations are lithologically similar to the pre-Cambrian sandstones on the Guayana Shield (besides it oldest age: 1,700–1,800 mya). Currently, no continuous outcrops connect the Guiana Shield with the Andes range, although many conspicuous table montains such the La Mesa de Yambí, Mapiripán, Serranía de La Lindosa and further west, La Macarena range, maybe represent reliable places to link the Guayana Shield and the Andes (Gansser, 1974). Furthermore, few studies have examined whether taxa occurring in the Andes considered to be Amazonia-Guayana relicts do indeed have a lowland origin, and whether present day disjunctions are a result of vicariance or dispersal. Studies on two families with high species diversity in both the Guayana region and the Andes, (Bromeliaceae [Givnish et al. 2004] and Gentianaceae, Helieae [Gould and Struwe, 2004]) suggest different histories leading to the modern distributions: evolution of the group in the lowlands and dispersal to the Andes (Givnish et al., 2004), or Andean origins with subsequent radiation (Gould and Struwe, 2004).

A broader biogeographic question regarding the affinities of floras occurring on sandstone habitats located far away each other with a very different geological history. Nevertheless, using tropical dry forest as example, Pennington et al. (2009) established a plausible approach relating floras of separate places that appearing on similar habitats, explaining it through the vicariance of habitats. In this sense, the high degree of conservation of phylogenetic niches suggests the probability of dispersal of a tropical dry

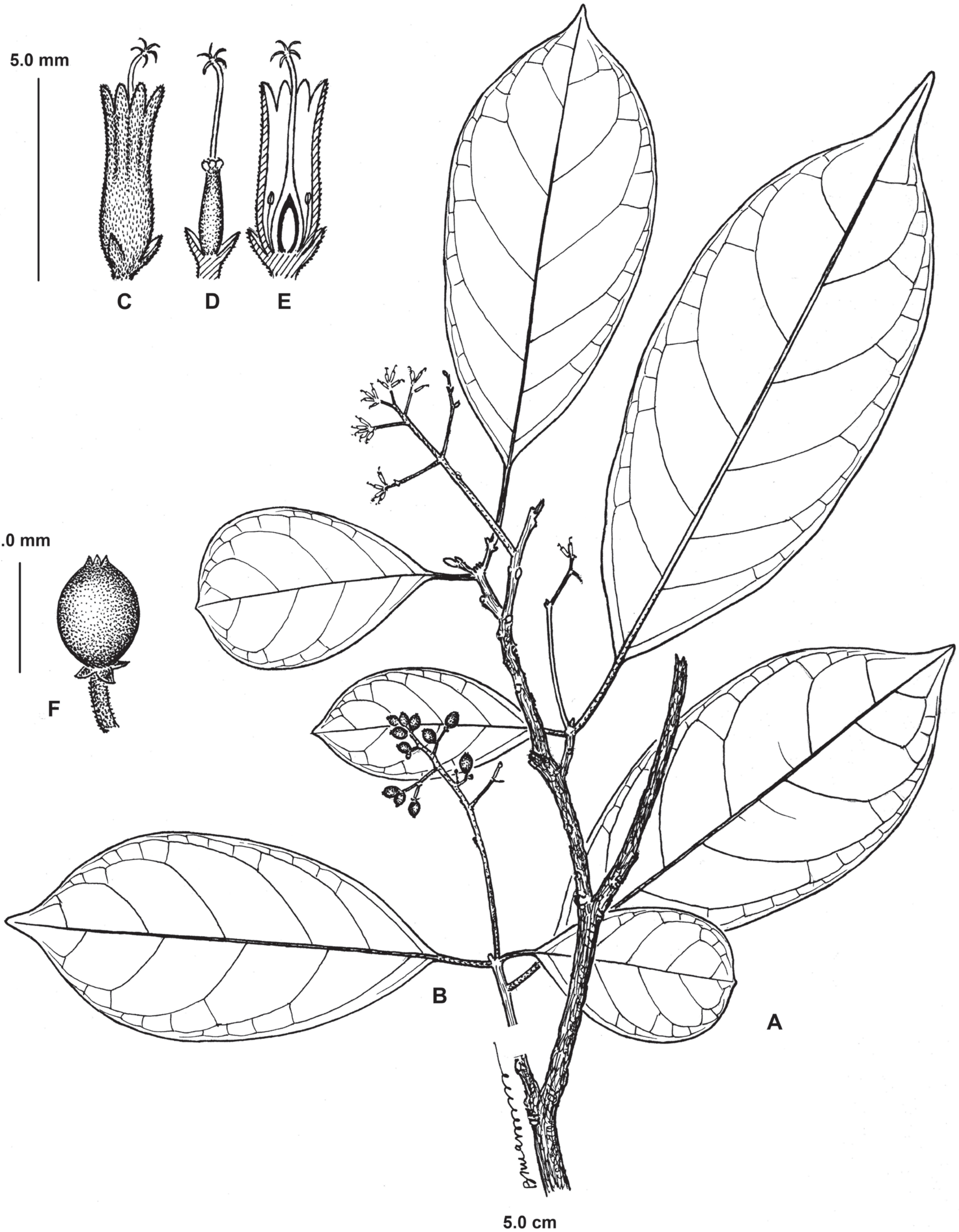

FIGURE 1. *Guapira fundacionensis* Aymard. **A–B**, branches showing the pistillate inflorescence and young fruits; **C**, frontal view of the pistillate perianth showing the stigma; **D**, pistillate flower without perianth showing the glands at the top of apex; **E**, inside the pistillate perianth in longitudinal section showing the gynecium and the staminodes; **F**, young anthocarp. Drawn by Bruno Manara† based on the holotype.

forest lineage to another larger distant area of tropical dry forest is higher than the probability that species of adjacent biomes will incorporate or develop the adaptations necessary to colonize its near areas of tropical dry forest. A similar argument could be applied to floras over sandstone outcrops located in different natural regions. See also Melton et al. (2022), who studied disjunct genera in eastern Asia (EA) and eastern North America (ENA), in the context of climatic niches, and found that "...niche-neutral processes and niche conservatism may affect the distribution of disjunct species."

Future floristic and genomics research should make comparative surveys of the Andean floras occupying habitats over sandstone derived from both the Guayana and Amazon regions.

Conservation status. Currently, this species is only known from the type collection. However, under IUCN (2017) guidelines fewer localities constitute deficient data (DD) to determine its conservation status. Nevertheless, it should be regarded as Critically Endangered (CR) based on the criterion B1ab(iii)+2ab(iii), due to the lower number of known localities and to it smaller estimated Area of Occupancy, with just 4,000 km², an estimated Extent of Occurrence of 0 km² (IUCN, 2017), and the continuous deforestation and degradation of the ecosystems of the "La Fundación" area in the last five decades.

By its glabrous lower leaf surface, or essentially so, the midrib or veins with scattered microscopic tomentum and peduncle and pedicels with dense ferruginous or red tomentum, this new species is morphologically similar to *Guapira opposita*. However, *G. fundacionensis* differs from the latter species by its branches and petioles densely ferrugineous pubescent (vs. glabrous), leaves ovate, membranaceous (vs. elliptic to broad-elliptic, chartaceous to subcoriaceous), base acute (vs. attenuate); peduncle 3 cm long, axes, densely adpressed ferrugineous pubescent, without glandular trichomes (vs.ca. 1.5, dense red with glandular trichomes); flowers subtended by 3 bracteoles, triangular (vs. 2–5, linear to lanceolate); pistillate perianth ferruginous outside (vs. red-puberulous) and ovary bearing five glands at the top (vs. without glands). The latter morphological feature represents an unique character that does not occur in any species of the genus.

Guapira guasarensis Aymard, *sp. nov.*
TYPE: VENEZUELA. Zulia. Mara. NW slopes of Cerro Negro, between Hacienda Santa Clara and Hacienda Tonchal, 5.5 km SW of Rancho 505, S of río Guasare, 10°55'N, 72°27'W, 500–620 m, 29 May 1980 (fl and fr), *J. A. Steyermark, G. Davidse* & *A. Stoddart 122761* (Holotype: VEN, Isotype: MO). Fig. 2.

Guapira guasarensis is similar to *G. opposita*, but morphologically it differs from the latter in having branches and petioles densely ferrugineous tomentose, leaves obovate-elliptic to elliptic, membranaceous, base acute; peduncle 6–9 cm long; flowers subtended by 3 bracteoles; pistillate perianth ferruginous outside and two stigmas.

Small to medium *tree* 10–20 m tall, branchlets striate, appressed ferrugineous pubescent, glabrescent when mature. *Leaves* opposite, black when drying, blades 8–20 × 4–10 cm, membranaceous, obovate-elliptic to elliptic, glabrous at both sides, apex acuminate, acumen 0.5–1 cm long, base acute, margins entire, lateral nerves 10–16 each side, raised below, impressed above, brochidodromous, arcuated and convergent towards margin and linking ca. 5 mm to the margin, tertiary venation evident at both sides; petiole 1.5–4 cm long, striate, pubescence same as the branchlets. *Pistillate inflorescence* 2–6 × 3–8 cm, terminal cymes, erect, peduncle 6–9 cm long, 2–3 mm diam., striate, densely appressed ferrugineous pubescent, with two bracts at the base, subopposite, lanceolate, ca. 2.5 mm long, pubescence same as peduncle. The peduncle with four primary branches, 4–4.5 × 0.2–0.4 cm, bearing groups of 2–3(–4) flowers at the end of these axes. *Pistillate perianth* subtended by three bracteoles, ca. 1 mm long, triangular, pubescence outside same as peduncle, glabrous inside; pedicels ca. 1mm long, pubescence same as peduncle; perianth ca. 4 × 1.5 mm, tubular-urceolate, pubescence outside same as peduncle, glabrous inside, ovary ca. 2 mm long, ellipsoid, glabrous, style 2–3 mm long, stigmas 2, 4–5 mm long, deeply frimbriate, into 10 divisions, staminodes 5, 1–2 mm long, glabrous. *Staminate inflorescences,* not seen. *Anthocarps* 7–12 × 2–4 mm, ellipsoid, 8-costate, pubescence same as perianth, pilosule to glabrescent when mature, rostrum ca. 0.5 mm long, densely ferrugineous pubescent at the base.

Phenology: this new species has been collected with flowers and young fruits in May.

Etymology: the epithet *guasarensis* is coined after the "Río Guasare", with which the "Río Socuy" formed the "Río Limón, the latter is most important affluent of "Bahía de El Tablazo," an estuary located in west side of Venezuelan Gulf.

Distribution and ecology: the species is hitherto known to occur in primary or secondary wet montane forest at 400–1000 m elevation, located in the NE portion of "Sierra de Perijá," Zulia state. The "Sierra de Perijá" is the northernmost projection mountain range of the Andean Cordillera Oriental of Colombia, formed a natural boundary between Colombia and Venezuela. It is has a distinct orogenic history from the adjacent ranges of northern South America (Montes et al., 2010), This natural region is well known by its interesting biogeographical types of vegetation (Rangel and Arellano, 2007; 2009), several endemics (e.g., *Albizia buntingii* Barneby & J.W. Grimes–Leguminosae, *Begonia perijaensis* Jara–Begoniaceae, *Espeletia perijaensis* Cuatr.–Asteraceae, *Gustavia tejerae* R. Kunth–Lecythidaceae, and *Linochilus perijaensis* (S. Díaz & G.P. Méndez) Saldivia & O.M. Vargas–Asteraceae), rare taxa (e.g., *Copifera venezuelana* Harms & Pittier–Leguminosae, and *Ocotea gentryi* van der Werff–Lauraceae), as well as the presence of Amazonian and Guayana elements (e.g., *Iryanthera hostmannii* (Benth.) Warb. *I. juruensis* Warb–Myristicaceae, *Ouratea ferruginea* Engl.–Ochnaceae, *Pouteria gongrijpii* Eyma–Sapotaceae, and *Xylopia amazonica* R.E. Fr.— Annonaceae).

Additional specimens examined: VENEZUELA. Zulia: Mara. Caño Izquierda, tributary of río Guasare, W of Rancho

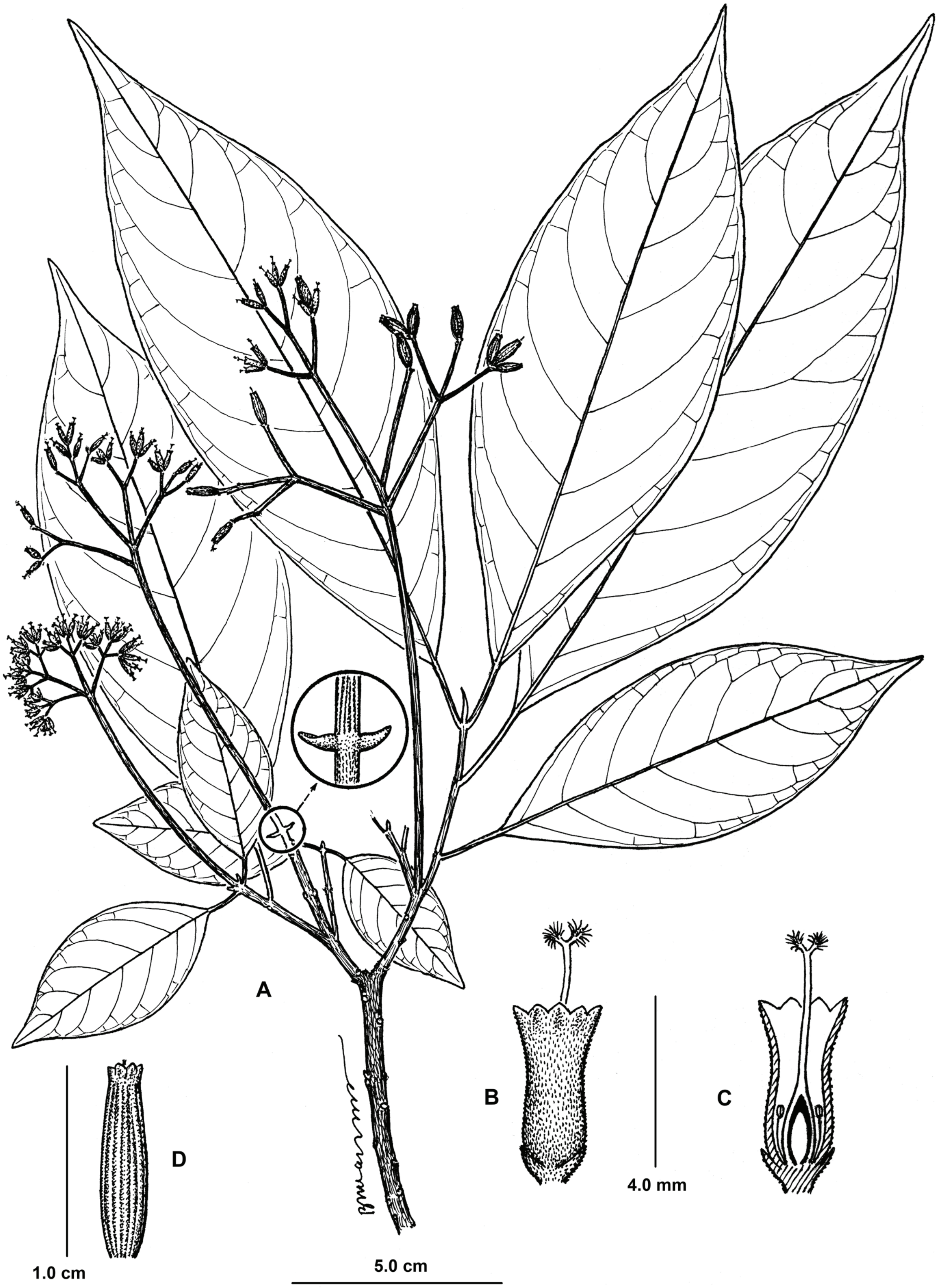

FIGURE 2. *Guapira guasarensis* Aymard. **A**, habit showing the branch of pistillate plant and basal bracts located on primary branches; **B**, frontal view of the pistillate perianth showing the two stigmas; **C**, inside the pistillate perianth in longitudinal section showing the gynecium and the staminodes; **D**, young anthocarp. Drawn by Bruno Manara† based on the holotype.

55, 4 km W of Campamento Carichuano (Corpozulia), 11°01'N, 72°18'W, 600–1000 m, 03 May 1980 (fr), *J. A. Steyermark, G. Davidse* & *A. Stoddart 123230* (MO, VEN). Zulia. Mara. NW slopes of Cerro Negro, between Hacienda Santa Clara and Hacienda Tonchal, 5.5 km SW of Rancho 505, S of río Guasare, 10°55'N, 72°27'W, 500–620 m, 29 May 1980 (fr), *J. A. Steyermark, G. Davidse* & *A. Stoddart 122771* (MO, VEN).

Conservation status. Currently, this species is only known from the type and two additional collections, and it is reported here as rare species. However, under IUCN (2017) guidelines fewer localities constitute deficient data (DD) to determine its conservation status. Nevertheless, it should be regarded as Critically Endangered (CR) based on the criterion B1ab(iii)+2ab(iii), due to the lower number of known localities and to it smaller estimated Area of Occupancy, with just 8,000 km^2, an estimated Extent of Occurrence of 0.000 km^2 (IUCN, 2017), and the continuous deforestation and degradation of the ecosystems of the “Sierra de Perijá.” These areas have been highly deforested during the last six decades. This deforestation increases rapidly and without regulation, with significantly greater patch sizes due the emergence of illegal land uses in both side of the “Sierra de Perijá.” This degradation unfortunately will accelerate land cover change in the coming years (for reviews see: Pacheco-Angulo et al., 2014; Quiroga-Angel et al., 2022). Although conservation status assessments can still be carried out for species with such low numbers of collections (Rivers et al., 2011), it may be hard to determine whether an appearance of rarity in a species is due to the lack of data or to its actual rarity.

In addition, the region where *G. guasarensis* was found is out of the Venezuelan national park system, particularly “Sierra de Perijá” National Park, which only includes the southwestern portion of the “Sierra de Perijá” range mountains.

Given its lower surface of leaves glabrous or essentially so, the midrib or veins with scattered microscopic tomentum and peduncle and pedicels with dense ferruginous or red tomentum, it new species appear to be closely allied to *Guapira opposita*. However, this new species different from de latter by its branches and petioles densely ferrugineous tomentose (vs. glabrous), leaves membranaceous, obovate-elliptic to elliptic (vs. chartaceous to subcoriaceous, elliptic to broadly elliptic), base acute (vs. attenuate); peduncle 6–9 cm long (vs. ca. 1.5); flowers subtended by 3 bracteoles (vs. 2–5, linear to lanceolate); pistillate perianth ferruginous outside (vs. red-puberulous) and two stigmas (vs. one stigma). The latter morphological feature represents an unique character that does not occur in any species of the genus.

KEY TO THE SPECIES OF *GUAPIRA* IN VENEZUELA

Modified from Steyermark and Aymard (2003); species indicated with an asterisk (*) are endemic to Venezuela

1a. Leaves 25–35 × > 15 cm; fruits 2–2.5 cm long. . . . . *G. sipapoana* (Amazonas)

1b. Leaves 0.1–18 × 0.5–13 cm; fruits < 1.5 cm long. 2

2a. Inflorescence globose or sub-hemispheric, head-like; densely flowered, flowers sessile 3

2b. Inflorescence elongate cymes, variously branched, the flowers usually pedicellate, or if sessile, the leaves rounded or obtuse at apex and 1.8 cm wide or less 4

3a. Leaves oblong-elliptic to rounded, 2–5.5 cm long, densely ferrugineous pubescent on the lower surface; staminate flowers 3–3.5 mm long, without glandular trichomes outside . . . . *G. ferruginea** (Aragua, Bolívar, Carabobo, Delta Amacuro, Falcón, Guárico, Lara, Miranda, Portuguesa, Yaracuy)

3b. Leaves lanceolate-elliptic or oblong-elliptic, 6–13 cm long, minutely subappressed puberulent on the lower surface; staminate flowers 4–5 mm long, with glandular trichomes outside . . . . *G. davidsei** (Delta Amacuro)

4a. Lower and/or upper surface of leaves, or lower midrib, densely pubescent or pilosulous with lax, spreading, or divaricate hairs. 5

4b. Lower surface of leaves (including lower midrib, itself sometimes pubescent), glabrous, but if pubescent, it appressed pubescent 7

5a. Branchlets pilose with spreading gray trichomes; lower and/or upper surface of leaves, or lower midrib, densely pubescent; petiole 3–5 cm long; peduncle 1.5–2.5 cm long . . . . *G. pubescens** (Apure, Cojedes, Miranda, Guárico, Portuguesa)

5b. Branchlets with a densely ferrugineous tomentum; lower and/or upper surface of leaves, or lower midrib pilosulous with lax, spreading, or divaricate hairs 6

6a. Peduncle 7–9.5 cm long; petiole and young stems densely pubescent with spreading hairs 0.2–0.5 mm long . . . . *G. marcano-bertii** (Bolívar, Delta Amacuro)

6b. Peduncle (1–)3.5–5 cm long; petiole and young stems with hairs < 0.1 mm long . . . . *G. rusbyana** (Bolívar, Delta Amacuro, Vargas)

7a. Lower surface of leaves, midrib and veins with a minute tomentum of non spreading hairs or densely pubescent 8

7b. Lower surface of leaves glabrous or essentially so, the midrib or veins with scattered microscopic tomentum 9

8a. Leaves coriaceous, lower surface covered completely by dense rufo-ferruginous tomentum, the tertiary venation on both surfaces very conspicuous or elevated . . . . *G. sancarlosiana* (Amazonas)

8b. Leaves chartaceous to subcoriaceous, lower surface sparsely rufous-tomentose to glabrescent, but never covered with dense rufo-ferruginous tomentum; tertiary venation either not evident, inconspicuous, or not elevated. . . . . *G. cuspidata* (Amazonas, Apure, Bolívar, Delta Amacuro, Monagas, Sucre)

9a. Peduncle and pedicels with dense ferruginous or red tomentum 10

9b. Peduncle and pedicels glabrous or sparsely pubescent 13

10a. Branches and petioles glabrous; leaves chartaceous to subcoriaceous, base attenuate; peduncle ca. 1.5 cm long; flowers subtended by 2–5 bracteoles, linear to lanceolate; pistillate perianth red-puberulous outside. . . . . *G. opposita* (Apure, Barinas, Distrito Capital, Falcón, Guárico, Miranda, Nueva Esparta, Sucre, Yaracuy, Zulia)

10b. Branches and petioles densely ferrugineous tomentose, leaves membranaceous or coriaceous, base acute to cuneate; peduncle 1.7–9 cm long; flowers subtended by 3 bracteoles, triangular; pistillate perianth ferruginous outside 11

Key to the species of *Guapira* in Venezuela cont.

Modified from Steyermark and Aymard (2003); species indicated with an asterisk (*) are endemic to Venezuela

11a. Leaves elliptic-ovate or lance-ovate, coriaceous, base cuneate; peduncle 1.7–4 cm long; perianth ca. 7 mm .... *G. amacurensis** (Bolívar, Delta Amacuro)

11b. Leaves ovate, obovate-elliptic to elliptic, membranaceous, base acute; peduncle 3–9 cm long; pistillate perianth 4–5 mm 12

12a. Leaves obovate-elliptic to elliptic, lateral nerves 10-16; peduncle 6–9 cm long; pistillate perianth tubular-urceolate, ovary without glands at the top, stigmas 2; anthocarps ellipsoid........ *G. guasarensis** (Zulia)

12b. Leaves ovate, lateral nerves 5–8; peduncle ca. 3 cm long; pistillate perianth tubular, ovary bearing 5 glands at the top, stigmas 1; anthocarps globose .... *G. fundacionensis** (Táchira)

13a. Peduncle and/or axes of inflorescence sparsely to moderately puberulent........ 14

13b. Peduncle and/or axes of inflorescence glabrous 16

14a. Leaves often broadest above the middle, conspicuously venose, shiny; lateral veins conspicuous, 9–11 on each side, subelevated or impressed on both sides, conspicuously anastomosing with the tertiary veinlets, ascending to an angle of 45° or more; tertiary veinlets forming a prominent network .... *G. fragrans* (Amazonas, Apure, Aragua, Bolívar, Carabobo, Delta Amacuro, Falcón, Lara, Nueva Esparta, Portuguesa, Táchira, Yaracuy, Zulia)

14b. Leaves often broadest near the middle, not venose, opaque; lateral veins inconspicuous, 5 or 6 on each side, impressed, divaricately spreading at an angle of 15–30°; tertiary veinlets obsolete or inconspicuous........ 15

15a. Leaves 2–4 cm broad, elliptic, elliptic-lanceolate, rarely oblanceolate, base cuneate to rounded; petioles ca. 1.5–2 cm long; inflorescences axes glabrous .... *G. eggersiana* (Anzoátegui, Aragua, Bolívar, Delta Amacuro, Miranda, Monagas, Nueva Esparta, Sucre)

15b. Leaves 5–7 cm broad, elliptic to obovate, base acute; petioles 2–3 cm long; inflorescences axes pubescent........ *G. guianensis* (Anzoátegui, Aragua, Bolívar, Delta Amacuro, Miranda, Sucre)

16a. Tertiary veinlets prominent and finely reticulate on both sides of leaf blades 17

16b. Tertiary veinlets inconspicuous and subreticulate........ 19

17a. Leaves 1–4 × 0.5–2.5 cm; apex rounded or manifestly obtuse; petiole 0.1–0.5 cm long; staminate inflorescence penducle not longer than 3 cm .... *G. microphylla* (Anzoátegui, Apure, Aragua, Bolívar, Carabobo, Falcón, Miranda, Nueva Esparta, Sucre, Táchira)

17b. Leaves 6–18 × 3–8 cm; apex acute to long acuminate; petiole 0.8–2 cm long; staminate inflorescence penducle 4–8 cm long........ 18

18a. Branches with ferruginous-glandular trichomes; leaves elliptic to ovate, dark dotted on the lower surface, black-greenish when dry; pistillate perianth 3–3.5 long, tubular, anthocarp fusiform .... *G. bolivarensis* (Bolívar)

18b. Branches glabrous or sparsely gray puberulent; leaves elliptic-oblong to ovate-elliptic, without dark dotted on the lower surface, bright yellowish to brown when dry; pistillate perianth ca. 2 mm long; obconic, anthocarp oblong .... *G. pacurero* (Anzoátegui, Aragua, Carabobo, Dependencias Federales, Distrito Capital, Falcón, Guárico, Lara, Mérida, Miranda, Nueva Esparta, Sucre, Zulia)

19a. Leaves oblanceolate to elliptic-lanceolate; staminate perianth cylindric-tubular, 1.8–2 mm wide; stamens 8........ *G. glabriflora** (Amazonas)

19b. Leaves ovate or elliptic-ovate; staminate perianth ± funnel-shaped, 3.2 mm wide; stamens 10 .... *G. neblinensis** (Amazonas)

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LECTOTYPIFICATION OF SOME EARLY COLLECTED SPECIES OF *QUERCUS* (FAGACEAE) IN CALIFORNIA AND MEXICO

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Abstract. Lectotypes are designated for the following species of *Quercus* (Fagaceae) and associated synonymous taxa collected in Mexico, and what was later to become California, during the historic five-year Malaspina Expedition around the world: *Quercus agrifolia*, *Q. castanea*, *Q. diversifolia*, *Q. elliptica*, *Q. lobata*, *Q. lutea*, *Q. magnoliifolia and Q. rugosa* as well as *Q. kelloggii* and *Q. tinctoria* var. *californica* collected by early collectors in California.

Keywords: Bigelow, California, Frémont, lectotype, Mexico, Neé, Newberry, *Quercus*

Three of the common and early named species of *Quercus* L. (Fagaceae) in California, *Q. agrifolia* Neé, *Q. lobata* Neé, and *Q. kelloggii* Newb., do not have a holotype or lectotype associated with their names, although there is no doubt about their identity. Both *Q. agrifolia* and *Q. lobata* are the earliest names for species of *Quercus* collected in Mexico, and in what was later to become California, published by Luis Neé (1801). Because some of the earliest named Mexican oaks are also involved, we are also including here all names in the Neé publication that still need lectotypification.

Luis Neé was a French-born Spanish botanist who lived from the 1700s into the 1800s. Muller & McVaugh (1972) estimated that he was born about 1760 or before. Madulid (1989) reported that he died on 3 October 1807. Other sources give his dates of birth and death as 1734–1803 (https://thebiography.us/en/nee-louis) or 1734–1807 (https://plants.jstor.org). His main claim to fame was that he was a prolific collector of plant specimens who accompanied the Malaspina Expedition on a five-year scientific expedition of exploration (1789–1794) conducted by the government of Spain involving two ships, the Atrevida and Descubierta. The expedition, commanded by Alessandro Malaspina and José de Bustamante y Guerra, left Spain and explored south-eastern and western South America, western Mexico, western North America as far north as Alaska, across the Pacific to the Philippines, and south to New Zealand and Australia before returning to Spain (Madulid, 1989; David et al., 2001–2004). Although Neé made extensive botanical collections (Fernández and Alonso, 2016), the main botanical work resulting from the expedition was his publication on oaks (Neé, 1801). His name, spelled Née in the title of the publication, may have been a typographic error as he signed his name Neé, with the accent on the second 'e.' Most of the new species of oaks he published are Mexican, but he also described two of the common species of oaks, *Quercus agrifolia* and *Q. lobata*, in what at the time was part of Mexico but is now California. Based on the itinerary of the expedition to the west coast of Mexico and North America (Madulid, 1989: 39–40), all of the oaks were collected between March and December 1791. Another California oak, *Q. kelloggii*, was gathered by a number of early collectors during exploratory scientific expeditions in California both when California was part of Mexico and later when the United States expanded to its current continental boundaries. Several of the mid-19th century expeditions were conducted in anticipation of building railways to tie the whole country together by rail.

Neé (1801) did not cite specific specimens in his descriptions, but he did indicate where they were collected. William Trelease, who wrote the monumental and seminal work, *The American Oaks* (Trelease, 1924), never examined Neé's collections in the herbarium of the Real Jardín Botánico in Madrid (MA), Spain, although he did have access to drawings of most of Neé's species made for J.M.C. Lange at C, which Trelease photographed, or in the case of *Q. lobata*, redrew a leaf, and included photographs of the drawings as plates in his monograph (Trelease, 1924: pl. 65a *Q. macrophylla* Neé; pl. 72a *Q. magnoliifolia* Neé; pl. 73a *Q. lutea* Neé; pl. 101a *Q. rugosa* Neé; pl. 119a *Q. microphylla* Neé; pl. 168, fig. *Q. lobata* (leaf 1); pl. 252a *Q. splendens* Neé; pl. 301a *Q. salicifolia* Neé; pl. 358a *Q. castanea* Neé; pl. 359a *Q. elliptica* Neé; and pl. 390a *Q. acutifolia* Neé). In almost every case it is possible to determine the specimen at MA from which each drawing was made, and although Trelease used the phrase "sketch of the type" this is not effective lectotypification. It is rather surprising that Trelease did not visit MA, as he visited many of the other important herbaria in Europe just before World War I. Cornelius H. Muller, also an important oak taxonomist, did visit MA in 1950, 1958, and 1964 (Muller and McVaugh, 1972) and, as was Muller's habit, he removed fragments (now at UCSB) from some of Neé's specimens of *Quercus*. Several of the species of *Quercus* described by Neé, including *Q. circinata* Neé, *Q. macrophylla*, *Q. microphylla* and *Q. salicifolia*, were effectively lectotypified by Muller and McVaugh (1972). In the case of *Q. magnoliifolia*, Muller and McVaugh wrote "The type of *Q. magnoliaefolia* [*sic*] (sheet no. 25969) represents the species as understood

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by Trelease." The problem is that the MA sheet 25969 is not original material, as required by Article 9.4 of the current International Code of Botanical Nomenclature (Turland et al., 2018), because Neé did not consider the specimen to be *Q. magnoliifolia* but possibly a variety of *Q. nigra* L. as is evident from the determination on the label written in Neé's hand. Dennis E. Breedlove, as part of his planned revision of Latin American oaks, studied the Neé oak types in MA in 1985 and annotated those that he proposed to designate as lectotypes, but he never published the lectotypifications before his death in 2012. In recent years, two species, *Q. acutifolia* (Nixon and Berrie, 2017) and *Q. candicans* Neé (Valencia-A. et al., 2018), have been lectotypified based on specimens that Breedlove had annotated as lectotypes. Another ten species described by Neé that Breedlove marked as lectotypes have not yet been lectotypified. All of the lectotypes and isolectotypes are listed as such in the publication of Neé's collections by Fernández and Alonso (2016), but because they lack the phrase "designated here" as required by Article 7.11 of the current International Code of Botanical Nomenclature (Turland et al., 2018) none of the entries for those collections constitute valid lectotypification.

Of the two recently lectotypified names of Neé's oaks, one is particularly interesting. It turns out that the Neé specimens labeled *Quercus candicans* now at MA as well as the single leaf removed from MA by Muller (now at UCSB), are actually a species of *Roldana* La Llave in the Asteraceae (Valencia-A. et al., 2018). It is rather remarkable that this misidentification had not been noticed earlier. Trelease (1924) perpetuated the misidentification because he based his understanding of the species on Neé's descriptions and what subsequent authors, such as A. de Candolle (1864) and Liebmann (1869), had interpreted as *Q. candicans*. A. de Candolle (1864) remarked that the Neé specimens he saw at MA were strange for *Quercus* because of the sharp teeth along the edge of the lobes and the pubescence like that of *Populus alba* L. when he wrote "*Mihi videtur a Querco aliena, propter dentes mucronatos secus margines loborum et pubescentiam modo Populi albae*." When Muller studied the Neé specimens at MA, he did not realize that Neé's specimens of *Q. candicans* were not an oak. Muller and McVaugh (1972) wrote; "The type consists of six detached juvenile leaves, obviously the species called *Q. candicans* by Trelease." When Muller visited MA in 1958 he reported in his notes, now at UCSB, that the number of leaves were then only five; and when Breedlove studied the same specimens there were only four leaves remaining with at least one of the missing leaves now at UCSB. Breedlove annotated one of the two type specimens of '*Q. candicans*' at MA as the lectotype and the other as the isolectotype, but he also did not recognize that the specimens were not a species of *Quercus*. The formal lectotypification was made by Valencia-A. et al. (2018), who also determined that the two specimens at MA plus the fragment at UCSB were *Roldana lineolata* (DC.) H. Rob. & Brettell. and made the combination *R. candicans* (Neé) Villasenor, S. Valencia & Coombes, which is the name that must be used for this species of *Roldana*. As pointed out by Valancia-A. et al. (2018), the Mexican oak that has been called *Q. candicans*, now must go by the next oldest available name, *Q. calophylla* Schltdl. & Cham. Although there is no doubt that the extant Neé collections of '*Q. candicans*' at MA and the leaf at UCSB are *R. candicans*, it is quite possible that the original specimens collected by Neé were in fact an oak and that there was a mix-up of specimens at some point. The reason for this uncertainty is that in Neé's description as translated into English (Neé 1805) states that it was "A middle-sized tree with a straight trunk, and branches forming a compact head." The *Roldana* to which the extant five leaves belong is a shrub about 2–3 m tall. At BM and G there are specimens of an oak labelled *Q. candicans* that were sold by Pavón in the 1820s (Muller and McVaugh, 1972) that could possibly be the actual specimens collected and described by Neé, but it is likely impossible to prove that they are part of the original material of Neé's *Q. candicans*. Of the remaining ten species of *Quercus* described by Neé that Breedlove marked as lectotypes or isolectotypes eight are still recognized species including species from both Mexico and California.

The story of how *Quercus kelloggii* was named is a bit complicated and involves a number of early collectors in California. What was ultimately named *Q. kelloggii* appears in the part of Bentham's *Plantae Hartwegianae* that covers Hartweg's collections from California between 1846 and 1847 (Bentham 1849: 294–342). According to Stafleu and Cowan (1976: 176) the whole publication was published between about January 1849 and March 1857. Within the section covering the California collections, the entries have two numbering systems. The first is a sequential taxonomic number assigned by Bentham followed by a number in parenthesis from Hartweg's journal as published in *The Journal of the Horticultural Society of London* between 1846 and 1848. The *Quercus* entry in question appears on page 337 in Bentham's *Plantae Hartwegianae* treatment as "1966 (139). *QUERCUS rubra*, Linn. (*fide* Liebmann)." The locality is given as "*In planitiebus circa Sonoma*" which translates as "In lowlands around Sonoma." Hartweg's (1847: 190) journal gives more information; "The face of country about Sonoma and San Miguel is perfectly level towards the bay, and capable of great agricultural improvements. Several species of oaks (*Quercus*, Nos. 139, 140, and 141) thrive well in the fine black vegetable mould [*sic*], and are disposed in large irregular clumps, giving the country the appearance of an immense park, enlivened by numerous herds of elks and antelopes." Collection number 139 was later named *Q. kelloggii*, number 140 is *Q. douglasii* Hook. & Arn., and number 141 is *Q. lobata*. Although Sonoma is the present day locality of the town of Sonoma, San Miguel was the name of Rancho San Miguel in present day Sonoma County that no longer exists. From Hartweg's journal those collections would have been made in mid-September of 1846 although the date 1848, which has to be incorrect, appears on the label of some specimens of this collection. Liebmann's determination of *Q. rubra* was evidently the reason that Bentham did not publish *Hartweg 1966* (139) as a new species, although he had already named the specimen in the Bentham Herbarium (K000832289) as "*Quercus sonomensis* Benth." The determination by Liebmann was not on the Hartweg collection but rather on a Frémont collection (number 500) dated 1846 in the Hooker Herbarium at K (K000832288); this specimen has the typical Liebmann determination slip in his hand. Apparently, Liebmann did not study any of the collections in the Bentham Herbarium, which is evident from the fact that only specimens in the Hooker Herbarium were cited in his major work on Mexican oaks (Liebmann, 1854). Because it was not until 1854 that the Bentham Herbarium was given to Kew, it is likely that Liebmann, who did not date his determination slips, had examined only the Hooker Herbarium and at a date before 1853. The Bentham Herbarium also had a duplicate of *Frémont 500* which is now at NY (NY00253629) and is discussed further below. Bentham would have known that the Hartweg and Frémont collections were the same species, and clearly the reference by Bentham of *Q. rubra* "fide Liebmann" is in reference to Frémont 500 seen by Liebmann in the Hooker Herbarium at Kew. The publication date of page 337 in Bentham's *Plantae Hartwegianae* is probably mid-February 1857 (Stafleu and Cowan, 1976: 176) which indicates that Torrey, who was working on the same species of oaks, but with other specimens, would have been unaware of Bentham's writing until sometime after that date.

At the same time that Bentham was completing *Plantae Hartwegianae*, Torrey was working on the *Report on the botany of the expedition* published in volume 5 number 4 of *Reports of explorations and surveys: to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, made under the direction of the Secretary of War* which is abbreviated in its different volumes as *Pacif. Railr. Rep*. (Torrey, 1857). This particular volume and number covered the route near the thirty-fifth parallel, explored under the command of A.W. Whipple in 1853 and 1854 and was published between August and September of 1857 (Stafleu and Cowan, 1986: 407) although Torrey dated his introduction to the botanical section as January 12, 1857. The botanical collections of the expedition were made by J. M. Bigelow. In the introduction to the botanical part the volume Torrey wrote that "The greater part of the botanical collections made by Bigelow, in the Pacific Railroad Survey, under the charge of Captain Whipple, were submitted to me for examination in accordance with the instructions of the War Department." When Torrey named *Quercus tinctoria* W. Bartram var. *californica* Torr., he not only had the Bigelow collection (NY01470684 collected in "Napa Valley" in 1854), but also four additional earlier collections that were in the Torrey Herbarium, now at NY. Those specimens included examples of the same oak collected during "Frémont's Expedition to California, 1845–47" from the Sacramento Valley (NY00253624 collected 8 Apr 1845 from "Sacramento bottom, above Coro Creek"; NY00253628 collected 14 Jun but without a year from "Near N. Branch of the American Fork"….[illegible due to label damage] and likely better stated as near the branch of the North Fork American River). Two additional sheets of this entity that appear to be duplicates of a collection made by C.C. Parry in 1850 (NY00253625 and NY00253626) were collected in the "Mountains east of San Diego" as part of the Southern California and Mexican Boundary Survey under the direction of W. H. Emory). It is clear that Torrey relied on the collection localities of all five of those specimens when he wrote that this variety occurs in the "Hillsides, Napa Valley. This is a common tree in California. It occurs throughout the valley of the Sacramento, and as far south as San Diego" (Torrey, 1857: 138). Torrey used the collection localities of all of those specimens when he noted the distribution in the protologue. In the first sentence Torrey was referring to the Bigelow collection and in the second and third sentences he was referring to the Frémont and Parry collections. Because he did not cite specific collections all five of those sheets, including the Bigelow collection which we are here designating as the lectotype, are original material as defined by Article 9.4 of the current International Code of Botanical Nomenclature (Turland et al., 2018). It is also important to note that Torrey wrote, and in his hand, "*Quercus tinctoria* var. *californica*" on the label of all five specimens. Torrey thought that *Q. tinctoria* var. *californica* might actually be a distinct species and wrote "We have not been able to point out characters sufficient to distinguish it specifically from *Q. tinctoria* of the Atlantic States, and yet it is probably a distinct species."

The NY00253628 specimen, original material of *Quercus tinctoria* var. *californica,* is an important collection to delve into in more depth. The specimen label has only the day and month but not the year except for the printed label indicting that it was part of "Frémont's Expedition to California, 1845–7." It is possible to make inferences based on additional information from several Frémont collections at GH, K, and NY. A specimen of *Frémont 500* at NY dated 1846 (NY00253629) with duplicates at the other two herbaria as GH00344994 and GH00343026 at Harvard and K000832288 at Kew (ex Hooker Herbarium, which is the specimen mentioned earlier). There is no precise collection locality on the four specimens except that they are from California. However, *Frémont 511* (NY00186315), which is the type collection of *Philadelphus fremontii* Rydb. (Hydrangeaceae), was collected on 14 Jun 1846 along the "North branch of the American River." This is the same day and month as well as the same locality as the NY00253628 specimen of *Q. tinctoria* var. *californica* and supplies the year of 1846 to this specimen as well as linking the four collections of *Frémont 500* to the NY specimens thus making them all original material. It is clear that NY00253628, NY00253629, GH00344994, GH00343026, and K000832288 are all part of the same collection made on 14 Jun 1846 of which the first one is original material seen by Torrey. All of these specimens are also morphologically and phenologically identical.

The NY00253629 specimen was sent to NY from K (Bentham Herbarium) and was most likely received at NY at a later date as it does not have the name *Quercus tinctoria* var. *californica* in Torrey's hand as do the other original material. On the labels, "Torrey 1850," in Bentham's hand, is the date Bentham received the specimens from Torrey.

This is evident from the letter Bentham sent to Torrey on 25 May 1850 in which Bentham thanked Torrey for "your most valuable parcels containing to my great delight an excellent set of Col. Frémont's California plants" (https://www.biodiversitylibrary.org/item/220607#page/21/mode/1up). Also on the label, and with a different pen there are the words "sp. nov" which may have been added by Bentham at the time he was working on the same species collected by Hartweg, which is discussed above. At some point this specimen was sent back to NY from K as it has the *Herbarium Benthamianum* date stamp of 1854, which all K specimens from the Bentham Herbarium had at the time the Bentham Herbarium was given to Kew.

A year after Torrey published *Quercus tinctoria* var. *californica*, J. S. Newberry published the main part of the botanical report in another of the *Pacif. Rail. Rep*. series (Newberry, 1859: 28–29, 89, Fig. 6). In this publication, Newberry published *Quercus kelloggii* and cited *Q. tinctoria* var. *californica* as a synonym. He indicated that he considered it to be neither *Q. tinctoria* nor *Q. coccinea* Münchh., although it was similar to both. Newberry raised Torrey's variety to the rank of species and gave it a new specific epithet to honor Albert Kellogg, who was the first resident California botanist, one of the founding members of the California Academy of Sciences, and its first Curator of Botany. Like Torrey, Newberry did not cite specimens, but he writes "This oak is found in different parts of California, but, apparently, does not extend northward beyond the Oregon line. I have specimens collected both south and north of San Francisco, in the coast mountains, and we found it occurring in considerable numbers between Fort Reading and Lassen's butte, on the western slope of the Sierra Nevada in northern California." We now know that the species extends into Oregon and into northern Baja California, Mexico. Most of Newberry's collections are at US (Stafleu and Cowan, 1981: 733), but there are no Newberry collections of *Q. kelloggii* at US or NY. In any event, because we consider *Q. kelloggii* to be a new name for *Q. tinctoria* var. *californica*, the lectotype of *Q. tinctoria* var. *californica* must also be the lectotype for *Q. kelloggii*. In 1859, a year after the publication of *Q. kelloggii*, J. G. Cooper (1859: 261) published the combination *Q. californica* (Torr.) J. G. Cooper, an illegitimate name because Cooper cited the older name of *Q. kelloggii* in synonymy. Bentham's herbarium name of "*Q. sonomensis* Benth." was published five years later by A. de Candolle (1864: 62) who wrote "Q. sonomensis (Benth, fide Kotschy in h. Boiss.)," apparently unaware that the species had already been published as *Q. kelloggii*. The holotype of *Q. sonomensis* (Benth.) A.DC, although perhaps originally in the G-BOIS herbarium, is now in the G-DC herbarium. The following is the synonymy and lectotypification of the taxa discussed in this article.

Quercus agrifolia Neé, Anales Ci. Nat. 3: 271 (1801). TYPE: U.S.A. California: 1791, *J. Robredo & M. Esquerra s.n.* (Lectotype [designated here]: MA25959 [as image]; Isolectotypes: UCSB000038 [fragment of lectotype, MA25959], MA232908 [as image], UCSB000039 [fragment of MA232908]).

The collection locality on the MA labels is between Monterey and Nootka, without exact locality. Because *Q. agrifolia* does not occur north of California, the collections were most likely made when the ships stopped at Monterey, California, between September 13 and 25 of 1791 (David et al., 2001–2004). The type collection from California has been attributed to Neé because he described the species, but he actually never collected oaks in California. According to Madulid (1989), the botanist Thaddeus Haenke (1761–1816) joined the expedition in Valparaíso, Chile, after having missed the first part of the expedition by not arriving in Cadiz in time for the departure from Spain. It was Haenke who traveled with the two ships north from Acapulco to the west coast of North America during 1791 while Neé collected in Mexico where he gathered the specimens of *Quercus* that he later described from there. Neé rejoined the ships on their return to Acapulco before their voyage across the Pacific in December 1791. Neé actually attributes the collections to Robredo and Esquerra where he writes (in translation of his original publication) "I cannot give the height of this species, of which I have only seen branches collected at Monterey and Nootka, by the marine officer, Don Joseph Robredo, and Don Manuel Esquerra, paymaster of the corvette Atrevida" (Neé 1805).

Quercus castanea Neé, Anales Ci. Nat. 3: 276 (1801). TYPE: MEXICO: Hidalgo, 1791, *L. Neé s.n.* (Lectotype [designated here]: MA25950 [as image]; Isolectotypes: UCSB000189 [fragment of lectotype, p.p. as to larger leaf], MA210518 [as image]).

Quercus diversifolia Neé, Anales Ci. Nat. 3: 270 (1801). TYPE: MEXICO: Guerrero, 1791, *L. Neé s.n.* (Lectotype [designated here]: MA26468 [as image]; Isolectotype: UCSB000576 [fragment of lectotype, MA26468]).

Quercus elliptica Neé, Anales Ci. Nat. 3: 278 (1801). TYPE: MEXICO: Hidalgo, 1791, *L. Neé s.n.* (Lectotype [designated here]: MA25956 [as image]; Isolectotypes: UCSB000210 [fragment of lectotype, MA25956], MA232907 [as image], UCSB000211 [fragment of MA232907]).

Quercus kelloggii Newb., Pacif. Railr. Rep. 6(3): chapter 2, 28, 89, fig. 6 (1858). TYPE: U.S.A., California, Napa Valley. *J. M. Bigelow s.n.*, 1854 (Lectotype [designated here]: NY01470684 [as image]; isolectotype: GH00106400 [as image]).

Heterotypic synonyms: *Quercus californica* (Torrey) J.G. Cooper, Smithson. Rep. 1858: 261. (1859). *Nom. illeg.*

Quercus sonomensis Benth. ex A.DC., Prodr. 60(2.1): 62 (1864). TYPE: U.S.A. California: in lowlands around Sonoma, September 1846, *T. Hartweg 1966* (139), (Holotype: G00719751 [as image]; Isotypes: GH00343027 [as image], K000832289 [as image], NY00248768 [as image], P06852561 [as image]).

Quercus tinctoria W. Bartram var. *californica* Torr., Pacif. Railr. Rep. 4(5): 138. (1857). TYPE: U.S.A. California: Napa Valley, 1854, *J. M. Bigelow s.n.* (Lectotype [designated here]: NY01470684 [as image]; isolectotype GH00106400 [as image]). Original Material: U.S.A. California: near the branch of the North Fork American River, 14 June 1846, *J. C. Frémont 500* (NY00253628 [as *s.n.* 14 June] [as image], GH00344994 [as 500 1846] [as image], GH00343026 [as no collector name 500, 1846] [as image], NY00253629 [as 500, 1846] [as image], K000832288 [as 500, 1846] [as image]); U.S.A. California: mountains east of San Diego, 1850, *C. C. Parry s.n.* {NY00253625 [as image], NY00253626 [as image]}; U.S.A. California: Sacramento bottom, above Coro Creek, 8 April 1846, *J. C. Frémont s.n.* {NY00253624 [as image]}).

Quercus lobata Neé, Anales Ci. Nat. 3: 277 (1801). TYPE: U.S.A. California: 1791, *J. Robredo & M. Esquerra s.n.*, (Lectotype [designated here]: MA26477 [as image]; Isolectotypes: UCSB000239 [fragment of lectotype, MA26477], MA26478 [as image], UCSB000240 [fragment of MA26478]).

The type locality on the specimen label is between Monterey and Nootka to the north of San Blas but with no exact locality. As explained under *Q. agrifolia* the type locality is most likely from the vicinity of Monterey, California.

Quercus magnoliifolia Neé, Anales Ci. Nat. 3: 268 (1801). TYPE: MEXICO. Guerrero: 1791, *L. Neé s.n.* (Lectotype [designated here]: MA233387 [as image]; Isolectotype: MA233386 [as image]).

Quercus lutea Neé, Anales Ci. Nat. 3: 269 (1801). TYPE: MEXICO. Guerrero: 1791, *L. Neé s.n.* (Lectotype [designated here]: MA233384 [as image]; Isolectotype: MA233385 [as image]).

Quercus rugosa Neé, Anales Ci. Nat. 3: 275 (1801). TYPE: MEXICO. Guerrero: 1791, *L. Neé s.n.* (Lectotype [designated here]: MA26471 [as image]; Isolectotypes: UCSB000413 [fragment of lectotype, MA26471], MA232926 [as image], UCSB000412 [fragment of MA232926].

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EPHEDRA MONOSPERMA (EPHEDRACEAE), ANOTHER GYMNOSPERM OF NOTEWORTHY SIZE

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Abstract. Although gymnosperms are well known for their large size, being the largest, tallest and most massive living organisms on earth, an exceptionally diminutive gymnosperm, *Ephedra monosperma* Gmelin ex C. A. Meyer (Ephedraceae), from southwestern China is compared with the much more massive gymnosperms that tend to receive far greater attention and publicity. Photographs of *E. monosperma* and its natural habitat are provided and voucher specimens are cited.

Keywords: *Ephedra*, Ephedraceae, Sichuan Province, southern China, small plants

Gymnosperms are well known for their large size, being the largest, tallest and most massive living organisms on earth. Because of that, they tend to receive a great deal of attention and publicity and are major attractions not only for scientists but also for the curious public. Small gymnosperms, in contrast, are seldom noted and tend to attract little attention. We here report an exceptionally diminutive gymnosperm, *Ephedra monosperma* Gmelin ex C. A. Meyer (Ephedraceae), from southwestern China and compare it with the much more massive gymnosperms that have been the focus of much attention in both popular and scientific media. Photographs of *E. monosperma* and its natural habitat are provided and voucher specimens are cited.

Materials and methods

Mature, fertile individuals of a particularly diminutive species of *Ephedra* were collected during an expedition to southwestern China (Sichuan and Qinghai provinces) in the summer of 2005. Herbarium specimens of the *Ephedra* (voucher specimens cited below) and of the other vascular plants in the area were prepared. The specimens of *Ephedra* were measured with a centimeter rule and their dry weight was determined by use of a postage scale.

Discussion

Gymnosperms are well known for their large size, being the largest, tallest and most massive living organisms on earth. The General Sherman tree, *Sequoiadendron giganteum* (Lindley) J. Buchholz (Cupressaceae; 'giant sequoia'), in Sequoia National Park in the Sierra Nevada of California, at 83.8 meters (274.9 feet) tall, 11.1 meters (36.5 feet) in diameter at its base (anonymous, 2022), and weighing an estimated 1.2 million kilograms (2.7 million pounds) and with a volume of 1486 m^3 (Forest Service, 1990), is arguably the world's largest living organism (but see discussion by Earle, 2021a under 'Big tree' at https://www.conifers.org/cu/Sequoiadendron.php). Individuals of *Sequoia sempervirens* Endlicher (Cupressaceae; 'coastal redwood') are among the tallest plants on earth with many trees reaching 100 meters in height. The tallest, discovered by Chris Atkins and Michael Taylor in August 2000 in the Rockefeller Forest of the Humboldt Redwoods State Park, California, was measured to be 112.7 m in height in July 2004 (Preston, 2006) and 115.85 m in height in 2011 (Earle, 2021b). In Mexico, the tree, *Taxodium mucronatum* Tenore (Cupressaceae; 'El Árbol del Tule'), was reported to have a circumference of 42.0 m (137.8 ft; 14.05 m [46.1 ft] in diameter), in 2005 (Earle, 2021c).

Small trees, especially small gymnosperms, in contrast, are rarely mentioned. Here we report the world's smallest gymnosperm (Fig. 1–5), which we collected at two locations on the border of Qinghai and Sichuan provinces in the Hengduan Mountains of southwestern China in August 2005. The smallest fully-fertile individual among our collections measured a mere 3.5 cm from the soil surface

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to the tip of the longest branch and had a dry weight of 52 grams. The trunk just below the first branch was 1.8 mm in diameter. The entire trunk of all individuals in the area was below ground level. The mature, berry-like cones were bright red. We determined these plants to be *Ephedra monosperma* Gmelin ex C. A. Meyer (Ephedraceae). Hao (1934a), in describing similar small plants from Amnye Maqen in eastern Qinghai as a new species, *E. minima* K. S. Hao, reported the plants to be scattered over the "…nearly naked ground and give a fine display of scarlet fruits (*sic*) somewhat like red pears." Hao (1934b) later corrected the description of the cones, more appropriately, to their resemblance to "red peas." *Ephedra minima* is now placed in synonymy under *E. monosperma*. Our collections were from the upper edge of exposed river banks and adjacent to grazed meadows along two different rivers. Some plants extended slightly into the meadow at both sites.

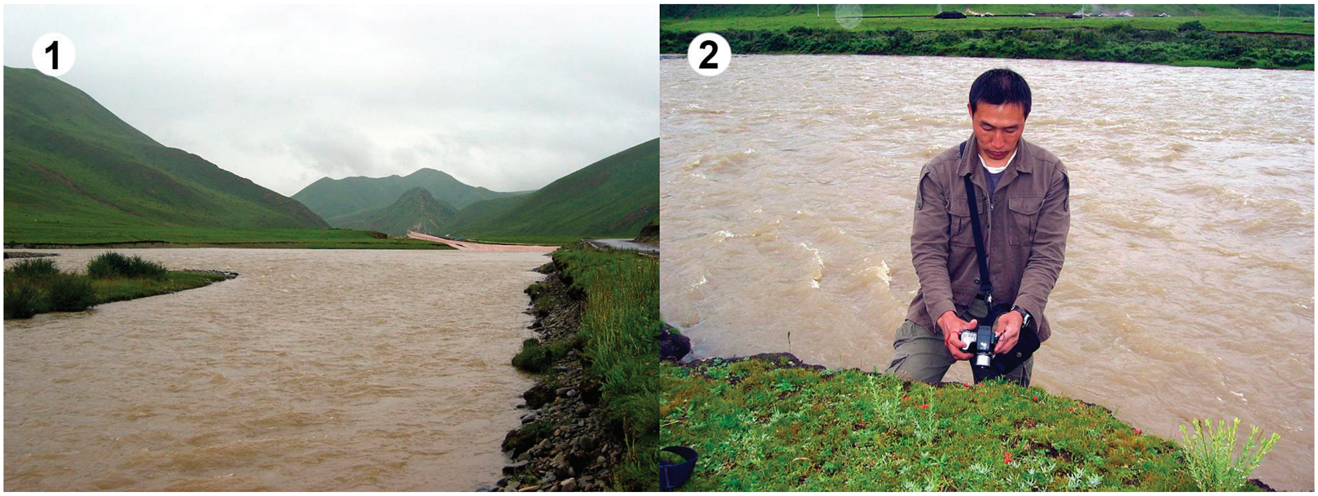

Figure 1–2. **1**, Se Qu (Se River) in Sichuan Province, Sêrtar Xian, between Seda (Sêrtar) and Wengda (Sêrba). 32°9'7"N, 100°25'36"E. Elevation 3770 m. *Ephedra monosperma* S. G. Gmelin ex C. A. Meyer grows at interface between meadow and exposed upper river bank. Photograph by Hang Sun; **2**, Jiahui Chen photographing plants of *Ephedra monosperma* along the Se Qu (Se River), Sichuan Province, Sêrtar Xian, between Seda (Sêrtar) and Wengda (Sêrba). Photograph by Hang Sun.

Voucher Specimens

Voucher specimens of our collections are in the herbaria of the Kunming Institute of Botany (KUN), Kunming, Yunnan, China, the Harvard University Herbaria (A), Cambridge, MA, U.S.A., the Field Museum of Natural History (F), Chicago, IL, U.S.A., and the Kochi Prefectural Botanical Garden (MBK), Kochi, Japan. Collection details are: China, Qinghai Province, Banma Xian (Baima Zong): Nianlong Xiang. Along Duo-ke Qu (Duo-ke River) ca. 65 km by road NW of the city of Seda (Sêrtar), 32˚34'37"N, 100˚32'48"E. Elevation 3670 – 3700 m, 9 Aug 2005, *D. E. Boufford, J. H. Chen, K. Fujikawa, S. L. Kelley, R. H. Ree, H. Sun, J. P. Yue, D. C. Zhang & Y. H. Zhang 34386*; Sichuan Province, Sêrtar Xian: Between Seda (Sêrtar) and Wengda (Sêrba) along the Se Qu (Se River). 32˚9'7"N, 100˚25'36"E. Elevation 3770 m, 11 Aug 2005, *D. E. Boufford, J. H. Chen, K. Fujikawa, S. L. Kelley, R. H. Ree, H. Sun, J. P. Yue, D. C. Zhang & Y. H. Zhang 34602*. A similar collection from China in the Harvard University Herbaria (GH) is from Qinghai Province, Maqén Xian, Dawu: Dawu Xiang, along the Deleni He, S of Maqin (Maqén). 34˚23'56"N, 100˚15'41"E, elevation 3800 m, 3 Aug 1993, *T. N. Ho, B. Bartholomew & M. G. Gilbert 725* (GH).

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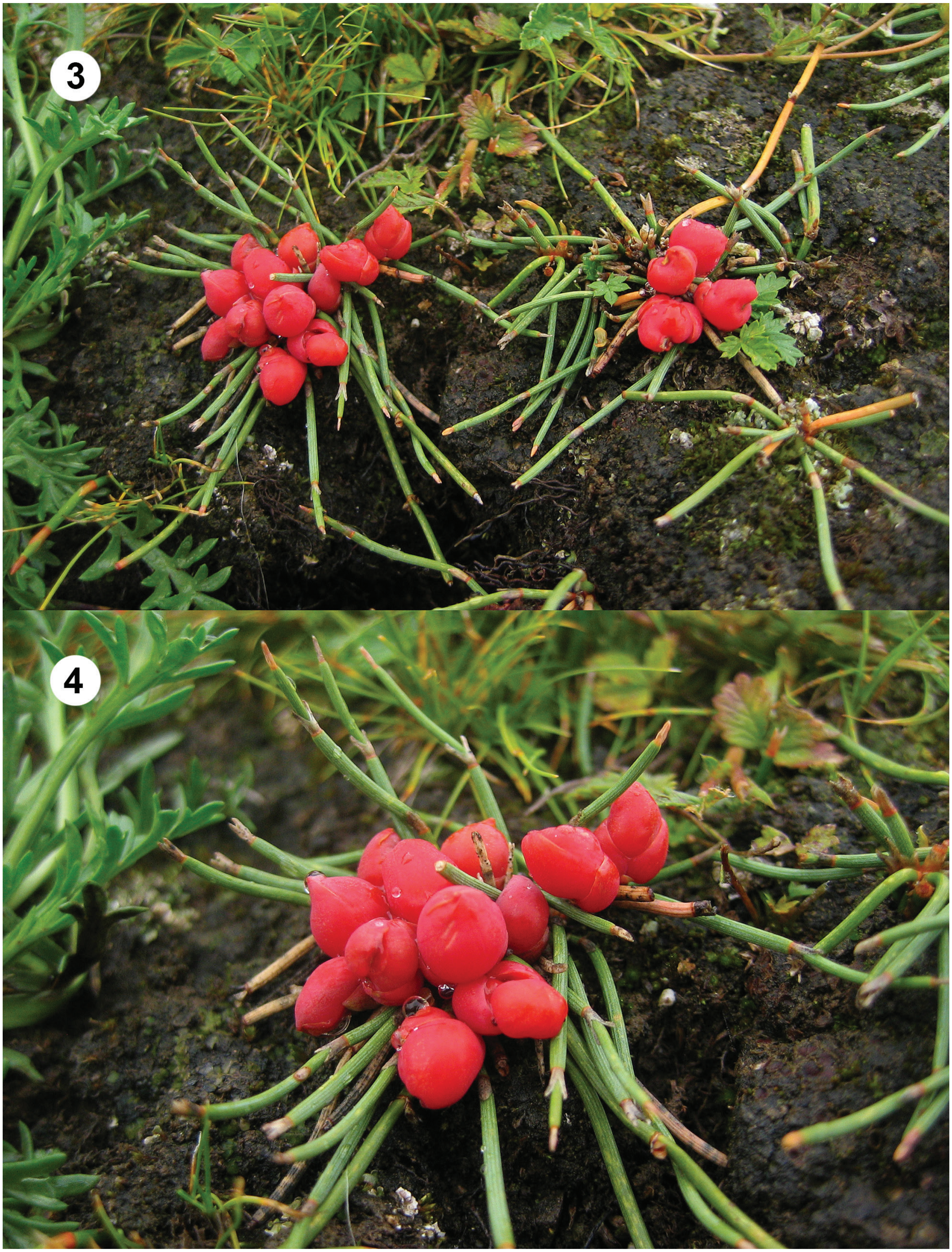

FIGURE 3–4. **3**, *Ephedra monosperma* S. G. Gmelin ex C. A. Meyer with *Kobresia* and *Potentilla* along the Se Qu (Se River), Sichuan Province, Sêrtar Xian, between Seda (Sêrtar) and Wengda (Sêrba). Photograph by Hang Sun; **4**, Close-up of several plants of *Ephedra monosperma* along the Se Qu (Se River), Sichuan Province, Sêrtar Xian, between Seda (Sêrtar) and Wengda (Sêrba). Photograph by Hang Sun.

Plants of China

Ephedraceae
Ephedra monosperma S. G. Gmelin ex C. A. Meyer

Sichuan Province, Sêrtar Xian: Between Seda (Sêrtar) and Wengda (Sêrba) along the Se Qu (Se River). 32°9'7"N, 100°25'36"E; 3770 m. Meadow along river. Upper bank of river at immediate edge of meadow. Cones red.

D. E. Boufford, J. H. Chen, K. Fujikawa, S. L. Kelley, R. H. Ree, H. Sun, J. P. Yue, D. C. Zhang & Y. H. Zhang
34602 11 August 2005

Harvard University Herbaria

FIGURE 5. Herbarium specimen with seven mature individuals of *Ephedra monosperma* S. G. Gmelin & C. A. Meyer. China. Sichuan: Sêrtar (Seda) Xian. Between Seda (Sêrtar) and Wengda (Sêrba) along the Se Qu (Se River). Meadow along river. 32°9'7"N, 100°25'36"E; 3770 m. Upper bank of river at immediate edge of meadow. Cones red. 11 August 2005. *David E. Boufford, Jia-Hui CHEN, Kazumi FUJIKAWA, Susan L. Kelley, Richard H. Ree, Hang SUN, Ji-Pei YUE, Da-Cai ZHANG & Yong-Hong ZHANG 34602* (A).

PRIMER REGISTRO DE *ERIOTHECA MACROPHYLLA* (MALVACEAE) PARA LA FLORA DEL PARAGUAY

Sabrina Soares Figueiredo,[1] Márcio Gleisson Medeiros Gonçalves,[2] Rosa Degen de Arrua,[3]
Ana Paula da Silva Lima[4] y José Iranildo Miranda de Melo[5,6]

Abstract. *Eriotheca* it is one of the three most numerous genera of Bombacoideae (Malvaceae) with approximately 25 species. It is distributed exclusively in South America, where it is predominantly associated with humid environments although it can also be found in areas of the xeric corridor. During the examination of the collections of this subfamily deposited in the Herbarium of the Faculty of Chemical Sciences (FCQ), National University of Asunción (UNA), it was found the first record of the species *Eriotheca macrophylla* for Paraguay, expanding to three the number of species of this genus in the Paraguayan flora.

Keywords: Diversity, Flora, New record, South America

Resumen. *Eriotheca* es uno de los tres géneros más numerosos de Bombacoideae (Malvaceae) con aproximadamente 25 especies. Se distribuye exclusivamente en América del Sur, donde se asocia predominantemente con ambientes húmedos aunque también se puede encontrar en áreas del corredor xérico. Durante el examen de las colecciones de esta subfamilia depositadas en el Herbario FCQ, Facultad de Ciencias Químicas, Universidad Nacional de Asunción (UNA), se encontró el primer registro de la especie *Eriotheca macrophylla* para el Paraguay, ampliando para tres el número de especies del género en la flora paraguaya.

Palabras clave: Diversidad, Flora, Nuevo registro, Sudamérica

Bombacoideae (Malvaceae) se distribuye principalmente en la región Neotropical, con cerca de 18 géneros y 187 especies, siendo constituidas predominantemente por árboles de gran porte (Bayer y Kubitzki, 2003; Duarte et al., 2011; Carvalho-Sobrinho, 2013). Esta subfamilia tiene como principal centro de diversidad las florestas húmedas de la América del Sur, siendo más diversa en Brasil y Colombia (Bayer y Kubitzki, 2003). Sin embargo, especialmente en los últimos diez años, el conocimiento sobre la diversidad taxonómica de Bombacoideae sigue aumentando en la región austral sur-americana a través de nuevos registros de especies como, por ejemplo, el de *Ceiba samauma* (Mart.) K. Schum. para Paraguay por De Egea et al. (2012).

Los representantes de esta subfamilia pueden ser caracterizados morfológicamente principalmente por presentar anteras monotecas y por sus grandes frutos que se abren en valvas presentando kapok de forma abundante que involucra las semillas (De Candolle, 1824; Duarte y Esteves, 2012).

Entre sus géneros, *Eriotheca* Schott & Endl. está entre los tres más representativos en número de especies, con aproximadamente 25 especies asociadas a ambientes secos aunque preferencialmente a ambientes húmedos, creciendo exclusivamente en la América del Sur (Duarte y Esteves, 2012).

Las especies de *Eriotheca* pueden ser reconocidas, principalmente, por la combinación de los siguientes caracteres morfológicos: escamas peltadas en los foliolos, flores pequeñas cuando comparadas a las de los otros géneros de la subfamilia, estambres fusionados hasta cierta altura formando un tubo y luego se presentan libres entre sí (Robyns, 1963).

Con relación a la flora paraguaya, hasta el momento se conocían dos especies de *Eriotheca*: *E. globosa* (Aubl.) A. Robyns y *E. gracilipes* (K. Schum.) A. Robyns (GBIF, 2019). Sin embargo, recientemente durante un análisis "in situ" de las colecciones de Bombacoideae albergadas en el Herbario FCQ, Facultad de Ciencias Químicas, Universidad Nacional de Asunción (FCQ/UNA), se encontró el primer registro de la especie *Eriotheca macrophylla* (K. Schum.) A. Robyns para Paraguay; ampliando a tres el número de especies del género *Eriotheca* en la flora paraguaya. A continuación se describe y se presentan otros datos para la especie.

RESULTADOS Y DISCUSIÓN

Eriotheca macrophylla (K. Schum.) A. Robyns, Bull. Jard. Bot. État. 33 (1/2): 152. 1963. Fig. 1.

Basónimo: *Bombax macrophyllum* K. Schum., Fl. Bras. 12(3): 220. 1886. TIPO: BRAZIL. Bahia: "prope Ilheos", 1831, *B. Luschnath s.n.* (Lectotipo, propuesto por Robyns [1963]: BR [649490]; Isolectotipos: BR [649491, 696067, 696095, 696132]).

Arbusto hasta arbolito de 3–4 m de altura; indumento

La primera Autora agradece a la FAPESq (Fundación de Apoyo a la Investigación del Estado de Paraíba, Brasil) por haber otorgado una beca de maestría (Proceso n. 60418/2018); LaBot (Laboratório de Botánica), Universidade Estadual da Paraíba-UEPB), *Campus* I, por permitir la utilización de sus instalaciones y otras facilidades brindadas; al PPGEC (Programa de Posgrado en Ecología y Conservación-UEPB) por el apoyo financiero otorgado para desarrollar la estancia en Asunción, Paraguay. A la Facultad de Ciencias Químicas, Universidad Nacional de Asunción (FCQ/UNA), por el permiso para examinar las colecciones del Herbario FCQ.

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FIGURA 1. Espécimen de *Eriotheca macrophylla* perteneciente al Herbario FCQ, Facultad de Ciencias Químicas, Universidad Nacional de Asunción, San Lorenzo, Paraguay. **A**, rama reproductiva; **B–C**, botones florales y flores.

constituido por escamas peltadas, lana abundante, ferruginosa. *Hojas* compuestas, digitadas, 4–5 foliolos, pecioladas; *pecíolo* 4–5 cm de longitud, glabro; *foliolos* ca. 6,6 × 2,5 cm, lepidotos, cartáceos, obovados hasta oblongos, ápice emarginado, base decurrente, borde entero o levemente revoluto, haz recubierto de tricomas peltados, envés con o sin tricomas peltados, nervadura principal saliente en ambas superficies, nervaduras secundarías evidentes; *nerviación* craspedódroma. *Botones florales* oblongos, 1,5–1,8 cm de longitud. *Inflorescencia* axilar, 3–7 flores en cada cima. *Flores* 1,8–2,3 cm de longitud, pediceladas; *pedicelo* 1,3–1,5 cm de longitud; *receptáculo* sin nectarios; *cáliz* ca. 0,7 × 0,5 cm, cupuliforme, ápice crenado, externamente recubierto con lana, ferruginosa; *corola* dialipétala, *pétalos* ca. 1,5 × 0,9 cm, obovados, **ápice** redondeado, externamente e internamente recubiertos de tricomas estrellados, dorados; pluriestaminadas, *tubo estaminal* fusionado que se propaga desde la porción mediana hasta la base y después presentando los estambres libres entre sí, *anteras* reniformes; *ovario* con escamas flocosas, ferruginosa. *Cápsula* ca. 3,5 × 1,9 cm, obovada, ápice acuminado, base cuneada. *Semillas* no observadas.

Especímenes examinados: PARAGUAY. Departamento San Pedro: San Pedro: Desvio a Cap. Bado, Estancia Nelly

Isabel, 30 agosto 1994, fr, *Soria N. 6703* (FCQ37214). San Pedro: Rancho ZS, 22 agosto 1994, fl, *Soria N. 6677* (FCQ37234).

Fenología: se ha encuentrado en flor y fruto en Agosto.

Distribución: *E. macrophylla* era considerada endémica del territorio brasileño, restringiéndose a la vegetación del Bosque Atlántico en las regiones Nordeste y Sudeste (Duarte, 2010; Flora do Brasil 2020; Reflora, 2019). En ese trabajo su distribución es ampliada para Paraguay, donde está asociada a los límites del Chaco Húmedo (Ecorregión 2-Región Occidental) con el Bosque Atlántico del Alto Paraná (Ecorregión 2-Región Oriental).

La especie puede ser fácilmente identificada por presentar flores pequeñas cuando comparadas a las de los otros géneros de esta subfamilia, por el color de sus flores, blanco a crema, por la presencia de indumento flocoso y ferruginoso en el cáliz y ovario y por las escamas peltadas en los foliolos.

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A CORRECTED NAME IN NORTH AMERICAN *EPILOBIUM* (ONAGRACEAE)

Peter C. Hoch[1,2] and Kanchi N. Gandhi[3]

Abstract. *Epilobium ravenii* Hoch & Gandhi is proposed here as the new name for the species previously known as *E. foliosum* (Nutt. ex Torr. & A. Gray) Suksd., non *E. foliosum* Heynh.

Keywords: Onagraceae, Nomenclature, *Epilobium foliosum*, *E. ravenii*

Epilobium L., the largest genus in the family Onagraceae, is widely distributed in cool or cold regions of the world with a center of phylogenetic diversity in western North America (Wagner et al., 2007; Hoch, 2021). Most of the estimated 165 species recognized worldwide are perennial; only nine are annual species, and eight of those are endemic/native in western North America. Two of these annuals—*Epilobium foliosum* (Nutt. ex Torr. & A. Gray) Suksdorf and *E. minutum* Lindl.—comprise the well supported monophyletic section *Crossostigma* (Spach) P. H. Raven (Raven, 1976; Baum et al., 1994).

Although *Epilobium foliosum* and *E. minutum* are similar morphologically and occupy overlapping dry, often disturbed habitats from British Columbia and Montana to California and Arizona, rarely to northwestern Mexico (*E. foliosum*), they have different chromosome numbers, $n = 16$ in *E. foliosum* and $n = 13$ in *E. minutum*, both unique in the genus (Seavey et al., 1977), and several consistent morphological differences. Efforts to cross them experimentally fail routinely, and no known natural hybrids have been detected.

Epilobium minutum has been recognized consistently by that name at the specific level for well over a century, whereas *E. foliosum* was originally proposed as a variety of *E. minutum*. Although *E. foliosum* Heynh. (1842), predates the name *E. foliosum* (Nutt. ex Torr. & A. Gray) Suksd. (1900), the earlier name *E. foliosum* Heynh. has heretofore been interpreted as a provisional name and invalid, and therefore, the later Suksdorf name has been in use. However, a careful analysis by Gandhi, with corroboration by W. Greuter, now indicates that *E. foliosum* Heynh. is a valid name and that *E. foliosum* (Nutt. ex Torr. & A. Gray) Suksd. is a later homonym and needs to be replaced with a new name.

According to the analysis by Gandhi and Greuter, within the protologue of *Epilobium foliosum* Heynh., which describes a plant with affinities to *E. tetragonum* L. and/or *E. montanum* L., two species common in Europe, Heynhold expressed some uncertainty ("Ob eigne Art oder nicht, davon habe ich mich nicht genau überzeugen können, da ich die Pflanze am angegebenen Standorte später vergebens suchte"; translation: "I could not fully convince myself whether it is a species of its own or not, because later I could not find the plant again at the locality specified") and preceded his new species with a dagger mark ("†"), explained in the preface to the book as follows: "the plants … marked with a dagger sign are to be regarded as either hybrids or uncertain species". Hoch (2021) and others interpreted this to indicate that the name was provisional, but the last sentence in ICN Article 36.1 (Turland et al., 2018) states that "these provisions do not apply to names published with a question mark or other indication of taxonomic doubt yet accepted by their author." So, the validly published *E. foliosum* Heynhold renders illegitimacy to Suksdorf's later new combination. Since no other epithet has been used at the specific level for the North American plants in question, we provide the following new name.

Epilobium ravenii Hoch & Gandhi, *nom. nov.*
Replaced synonym: *Epilobium minutum* var. *foliosum* Torr. & A. Gray, Fl. N. Amer. (Torr. & A. Gray) 1: 490. 1840.
TYPE: Dry rocks, "Oregon and the Rocky Mountains of California," 1834-1835, *T. Nuttall s.n.*
Homotypic synonym: *Epilobium foliosum* (Nutt. ex Torr. & A. Gray) Suksdorf, Deutsche Bot. Monatsschr. 18: 87. 1900 [non *E. foliosum* Heynh. in Holl & Heynhold, Fl. Sachsen 297-298. 1842]

Eponymy: *Epilobium ravenii* is named in honor of Peter H. Raven, President Emeritus of the Missouri Botanical Garden, for his enormous contributions to our understanding of the plant family Onagraceae, and specifically of *Epilobium*, where among many other contributions he provided the first chromosome count for *E. ravenii*. His work on the family commenced when as a teenager he collected at the Presidio in San Francisco what proved to be the rare and endangered species *Clarkia franciscana* Lewis & P. H. Raven, which in turn led to his dissertation research with Harlan Lewis (1919–2008) at UCLA. Research by Raven and his many students, first at Stanford University and later at Washington University/Missouri Botanical Garden (including the senior author), transformed the classification of Onagraceae and made the family an outstanding model system for the study of plant evolution.

We thank W. Greuter (B) for his advice on interpretation of the International Code of Nomenclature, and P. H. Raven (MO) and W. L. Wagner (US) for comments on and assistance with the text.

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NOTULA ~ ON THE HOLOTYPE OF *CARPOTROCHE CACERESIAE* (ACHARIACEAE)

Alexandre K. Monro[1] and Daniel Santamaría-Aguilar[2]

Kanchi Gandhi pointed out that, when publishing *Carpotroche caceresiae* D. Santam. (Santamaría-Aguilar et al., 2021), we inadvertently cited two series of numbers for the holotype, without indicating that one of them corresponded to the image barcode (5989394), and one corresponded to the accession number at MO (MO5989394); the citations of these two numbers may have created some confusion. We herein clarify that both numbers referred to the same herbarium sheet.

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Thanks to Kanchi N. Gandhi (GH) for bringing this oversight to our attention.

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Page 42 intentionally left blank.

TWO NEW SPECIES OF *EPIDENDRUM* (ORCHIDACEAE: LAELIINAE) FROM THE *SCHISTOCHILUM* GROUP IN THE WESTERN ANDES OF COLOMBIA AND ITS VALUE IN ECOLOGICAL RESTORATION DECISIONS.

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Gustavo Guerra González,[5] and William G. Vargas[5]

Abstract. Two new species of *Epidendrum* from the Western Cordillera of the Colombian Andes are described and illustrated. The new species with red and orange flowers belong to the *Schistochilum* group, *Secundum* subgroup and are similar to *Epidendrum portokalium* and *E. melinanthum* but differ by the color of the flowers and floral details, especially the calli. The new species were found in an open area with mild to severe erosion of the soil with a high clay content and high levels of insolation. The location was purchased with the aim of implementing ecological restoration strategies for its conservation with plans to recover the forest areas and allow connectivity within landscapes. The discoveries made it necessary to change the ecological restoration plans, the results being that it is not necessary to restore forest cover, but rather to maintain the area in its current state, making some changes that allow the conservation of the two new species and associated species.

Keywords: Taxonomy, Andes, Western Cordillera, Neotropics, Systematics, Conservation, Restoration Ecology

Resumen. Se describen e ilustran dos nuevas especies de *Epidendrum* de la Cordillera Occidental de los Andes colombianos. Las especies nuevas de flores rojas y anaranjadas pertenecen al grupo *Schistochilum*, subgrupo *Secundum* y son similares a *Epidendrum portokalium* y *E. melinanthum* pero se distinguen por su el colorido de las flores y los detalles florales y callos. Las nuevas especies se encontraron en un área abierta con erosión leve a severa del suelo, con un alto contenido de arcilla y una alta exposición al sol. Este lugar fue adquirido con el objetivo de implementar estrategias de restauración ecológica para su conservación con la finalidad de recuperar las áreas boscosas y permitir la conectividad dentro del paisaje. Los hallazgos obligaron a cambiar los planes de restauración ecológica, considerando que no es necesario restaurar la cobertura forestal, sino mantener el área en su estado actual, realizando algunos cambios que permitan la conservación de las dos nuevas especies y las especies asociadas.

Palabras claves: Taxonomía, Andes, Cordillera Occidental, Neotrópico, Sistemática, Conservación, Restauración Ecología

Epidendrum L. is one of the most diverse genera within Orchidaceae, distributed from sea level to 4200 m elevation, ranging from the southeastern United States (North Carolina) to northern Argentina, with almost 2400 species described (Hágsater et al., 2016; Ocupa et al., 2021). The genus includes terrestrial, epiphytic, and lithophytic plants occurring in various types of habitats from tropical forest, dunes and scrubs to the Andean paramos (Hágsater and Wrazidlo, 2020).

Epidendrum has been organized into informal groups of species. These groups are aggregated based on vegetative and floral characteristics that allow the easy identification of several species (Ocupa et al., 2021).

The *Schistochilum* Group is recognized by the caespitose habit, the numerous coriaceous leaves, the generally and elongate peduncle to a pluri-racemose inflorescence, the brightly colored flowers generally pollinated by hummingbirds and butterflies, and the caudicles of the pollinarium granulose, the tetrads appearing like a loose pile of roof-tiles, without any spathaceous bracts. The *Secundum* Sub-group is recognized mainly by the non-resupinate flowers with a complex callus (Hágsater, Valenzuela and Cisneros, 2020).

This group of species has historically been confused and combined under the name of *Epidendrum secundum* Jacq., mainly because of the similar flower morphology of non-resupinate flowers with a complicated system of calli (Hágsater and Wrazidlo, 2020). According to Hágsater (1993), the taxon name *Epidendrum secundum* applies only to plants with pink, non-resupinate flowers with a complicated callus restricted to the Antilles.

Here we describe two new species of *Epidendrum* found in an open area of dry soils that was purchased in 2021 with the purpose of being ecologically restored. The initial strategy of restoration was to restore the arboreal vegetation, the quality of the soils, and its connectivity by using intermediate pioneer plant species of rapid growth. This strategy would have allowed the recovery of the connectivity in the location with its reference ecosystem, but introducing rapidly growing species plants would cause the new species to disappear completely, in that the new species is now in its original habitat despite that being a disturbed ecosystem. The discovery of the new species forced changes in the conservation plans, maintaining and conserving the species within the purchased area. Finally, conservation and ecological information are provided as well as the taxonomical comparison between the two species.

The description of the two new species was financed by Celsia, through the project “Environmental Management Plan of the Calima Hydroelectric Power Plant.” We specially thank Ricardo Sierra, president of Celsia, and Marcelo Alvarez, vice president of Generation of the hydraulic generation team and the Calima plant team, for their technical and financial contributions.

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Materials and Methods

Descriptions and illustrations

The descriptions were prepared from living specimens. Specimens were dissected and digital images were taken with a Nikon D750 with a Nikkor 105 mm f/2.8 macro lens. The resulting images were used for diagramming Lankester Composite Digital Plates in Adobe Photoshop® CS6.

Plant material

Epidendrum specimens in the following Herbaria AMES, AMO, B, G, K, NY, CAUP, CUVC and COL (online) were consulted but no additional material was found in these collections to include in the protologues of the new species described herein.

Study area

In 2021, the hydroelectrical company of Celsia, in association with the Corporation Paisajes Rurales, began an ecological restoration pilot project in a property bought as "La Lorena", located in the municipality of Calima El Darién, in the department of Valle del Cauca, in Colombia, 3°52'05.1"N, 76°32'46.4"W (Fig. 1). This property was acquired by the Environmental Corporation of Valle del Cauca (CVC) in 1960 and 1997. The property became part of EPSA company through deed No. 972 of June 6, 2021 at the Candelaria, Valle del Cauca notary, Colombia. Finally, in 2006, it became to be part of Celsia company.

FIGURE 1. Study area of La Lorena where the two new species are found. **A**, Front aerial view in the Calima Lake. **B**, Vertical view showing the entire property purchased by Celsia. **C**, High clay content reaching the shores in the lake. White narrows and circles indicate the position where the two new species were found and the high clay content in La Lorena.

TAXONOMY

Epidendrum calimaense J.S. Moreno & Hágsater. *sp. nov.* TYPE: COLOMBIA, Valle del Cauca: Municipio de Calima El Darién, predio La Lorena, 1732 m, 15 Sept 2020. *A. Zuluaga & J.S. Moreno 5621* (Holotype: CUVC) (Fig. 2–5).

Epidendrum calimaense is most similar to *Epidendrum portokalium* Hágsater & Dodson (2004) which is found along the Amazonian corridor in eastern Ecuador, but the flowers are somewhat smaller, sepals 10–12.2 × 4–5.5 mm (vs. sepals 9–17 × 3.6–5.2 mm), petals are oblong-elliptic, acute (vs. narrowly obovate, apex rounded), and the lip with a distinctly different callus with a pair of spherical calli at its base, mid-callus formed by three unequal tubercules, lateral ones made up of two teeth, middle one made up of three teeth, central lobed and wide, arranged in the shape of a semi-circular crown (vs. callus formed by seven unequal tubercules, none forming a spherical basal body).

Terrestrial, sympodial, caespitose *herb*, to ca. 135 cm tall including inflorescence. *Roots* 0.8–3.2 mm in diameter, basal, terete, fleshy, thin, white. *Stems* 30–58 × 0.3–0.5 cm, simple, cane-like, straight, terete, thin, covered by foliar sheaths, papyraceous, white. *Leaves* 4.5–8.6 × 1.8–2.5 cm, articulate, elliptic, apex rounded, coriaceous, smooth, green, margins entire, aggregate along the apical half of stem. *Spathe* lacking. *Inflorescence* ca. 64–86 cm tall, racemose; peduncle 38–52 cm long, elongate, green, covered by 5–8 tubular bracts 3.0–3.8 cm long, white, scarious when dry, striated, papyraceous, imbricated, acute; rachis 30–35 cm long; producing keikis from sub-apical nodes of peduncle of inflorescence. *Floral bracts* 1–4 mm long, much shorter than ovary, decreasing in size, triangular, acuminate, embracing. *Flowers* ca. 60, successive 16–24 open at any time, non-resupinate, sepals and petals orange, lip orange turning to yellow at disc, callus yellow, column red, apical half yellow, anther green; fragrance none. *Ovary* 17–26 mm long, terete, thin, not inflated, orange tinged green towards base, slightly arched, furrowed. *Sepals* 10–12.2 × 4–5.5 mm, spreading, oblong, apex acute, minutely apiculate, 7-veined, margin entire, spreading; *lateral sepals* oblique, with low dorsal keel. *Petals* 9–11.4 × 3–3.8 mm, spreading, oblong-elliptic, acute, 5-veined, distal margin microscopically dentate, spreading. *Lip* 5.8–6.2 × 10.8–11.2 mm, basally united to column, 3-lobed, base slightly cordate, bicallose, callus massive, a pair of elevated spherical calli on sides at base, central callus lobed and wide, arranged in shape of a semi-circular crown formed by three unequal tubercules, lateral ones made up of two teeth, middle one made up of three teeth; lateral lobes 5.3–5.8 × 3.3–3.8 mm, ovate, distal margins broadly emarginate, slightly reflexed; mid-lobe 4.4–5.4 × 4.8–5.4 mm, basal half an isthmus, apical half sub-triangular, slightly bilobed, lobes divergent, distal margin short-laciniate, sides revolute. *Column* 9.5–10.3 mm long, terete, slightly thickened towards apex, a lateral wing on each side at apex, acute, margin minutely erose, embracing anther, margin minutely papillose, and a pair of finger-like wings curved upwards and attached to the callus. *Clinandrium-hood* reduced; margin irregular dentate. *Anther cap* ovoid, acute, rugose, 4-celled. *Pollinia* 4, narrowly obovate, elongate, laterally compressed, of equal size; caudicles soft and granulose, forming elongate tetrads that appear as a pile of roof tiles; viscarium semi-liquid, transparent. *Rostellum* apical, slit. *Lateral lobes* of stigma very small. *Nectary* deep, penetrating half pedicellate ovary, minutely papillose, papillae arranged in longitudinal rows. *Capsule* oblong-elliptic.

Toponymy: *Epidendrum calimaense* is named after the Calima region in Calima-El Darién, a municipality in Valle del Cauca department of Colombia where the new species was found.

Habitat and ecology: The locations where these two species grow are open sites with mild to severe erosion, moderate to high slopes, high exposure to the sun and in the afternoons to strong moisture-laden winds. The soils are characterized by high clay content, low fertility, low content of organic matter, which promotes a low regeneration capacity of natural covers. These areas were deforested after the construction of the Calima dam in 1961, and their deterioration has intensified over the last 30 years, which is why Celsia bought this area designated to implement an ecological restoration project to recover forest areas and connectivity in the landscape. However, the discovery of *Epidendrum calimaense* and *E. celsiae* made it necessary to change the ecological restoration plans, as preservation of endemic species takes priority over restoring forest cover. The decision was made to maintain the area in its current state, making some changes that allow the conservation of the two new species and its associated diversity. This is an area subject to many pressures and the conservation of the two species of *Epidendrum* requires the establishment of flexible management strategies for the area. The importance of using and comparing detailed floristic characterizations that determined this to be a new endemic species, known only to this location, required the restoration processes be modified; if not modified, the areas would have been covered with forest and these species would have disappeared over time.

Conservation status: *Epidendrum calimaense* and *E. celsiae* are only known from their type locality and both species are protected since the area is protected from external threats. The species classified within the IUCN categories as data deficient (DD) because we lack adequate distribution and population information to make an assessment (IUCN Standards and Petitions Subcommittee 2017; IUCN 2021).

Epidendrum calimaense is recognized by the non-resupinate flowers, the sepals and petals orange, lip disc orange-yellow, callus yellow, column red, apical half yellow, anther green, the sepals 10–12.2 × 4–5.5 mm, oblong, widely acute, the petals 9–11.4 × 3–3.8 mm, spreading, oblong-elliptic, acute, 5-veined, distal margin microscopically dentate, and the lip 5.8–6.2 × 10.8–11.2 mm, united to column, 3-lobed, base slightly cordate, bicallose, callus massive, a pair of elevated spherical calli on sides at base, central callus lobed and wide, arranged in the shape of a semi-circular crown formed by three unequal tubercules, the lateral ones made up of two teeth, middle one made up of three teeth. It is similar to *Epidendrum*

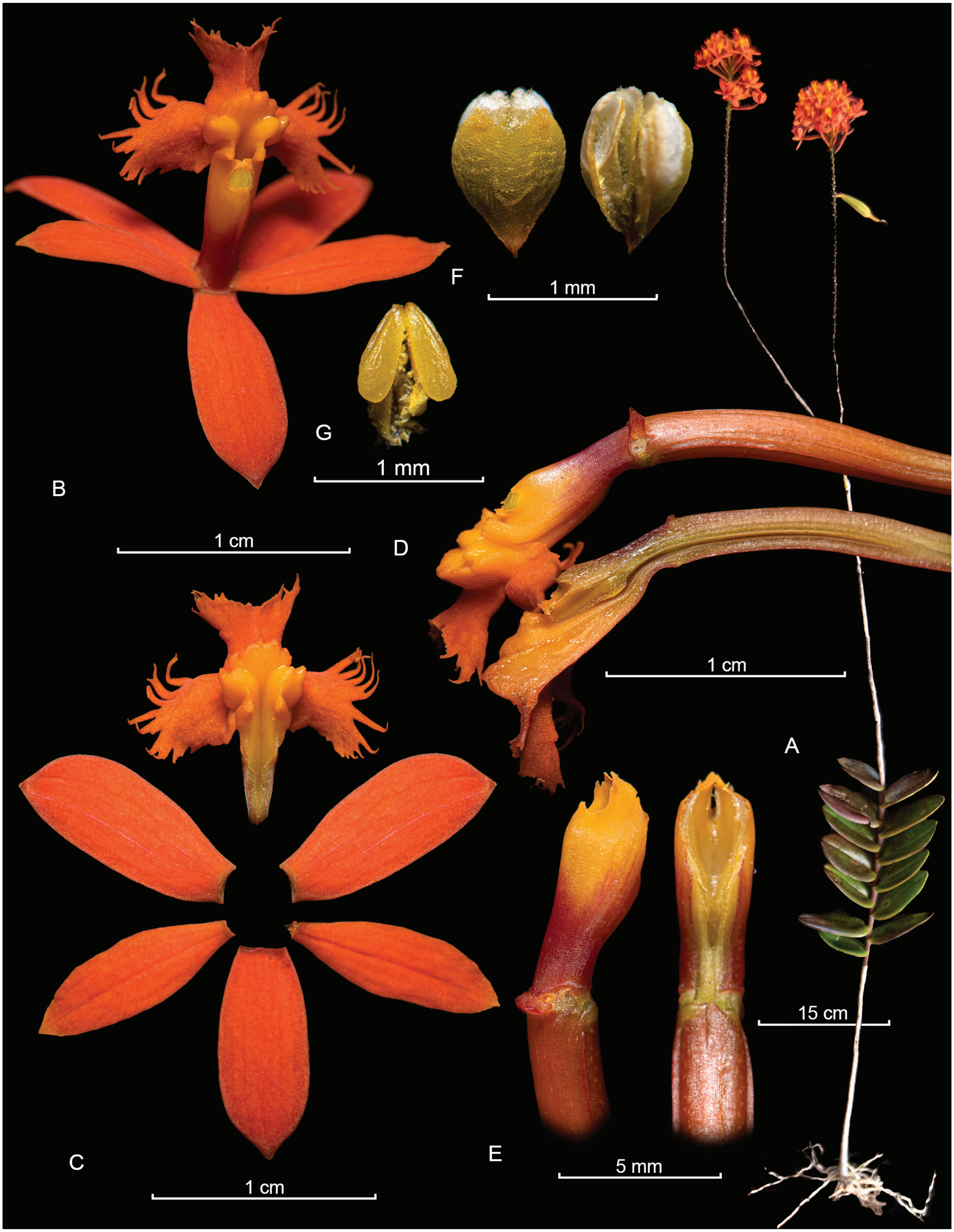

FIGURE 2. LCDP of *Epidendrum calimaense* J.S. Moreno & Hágsater. **A**, Habit; **B**, Flower; **C**, Dissected perianth; **D**, Lip and column lateral view, and transversal section; **E**, Column, ventral and lateral views; **F**, Anther cap; **G**, Pollinarium. LCDP by J. S. Moreno, based on *A. Zuluaga & J. S. Moreno 1504*.

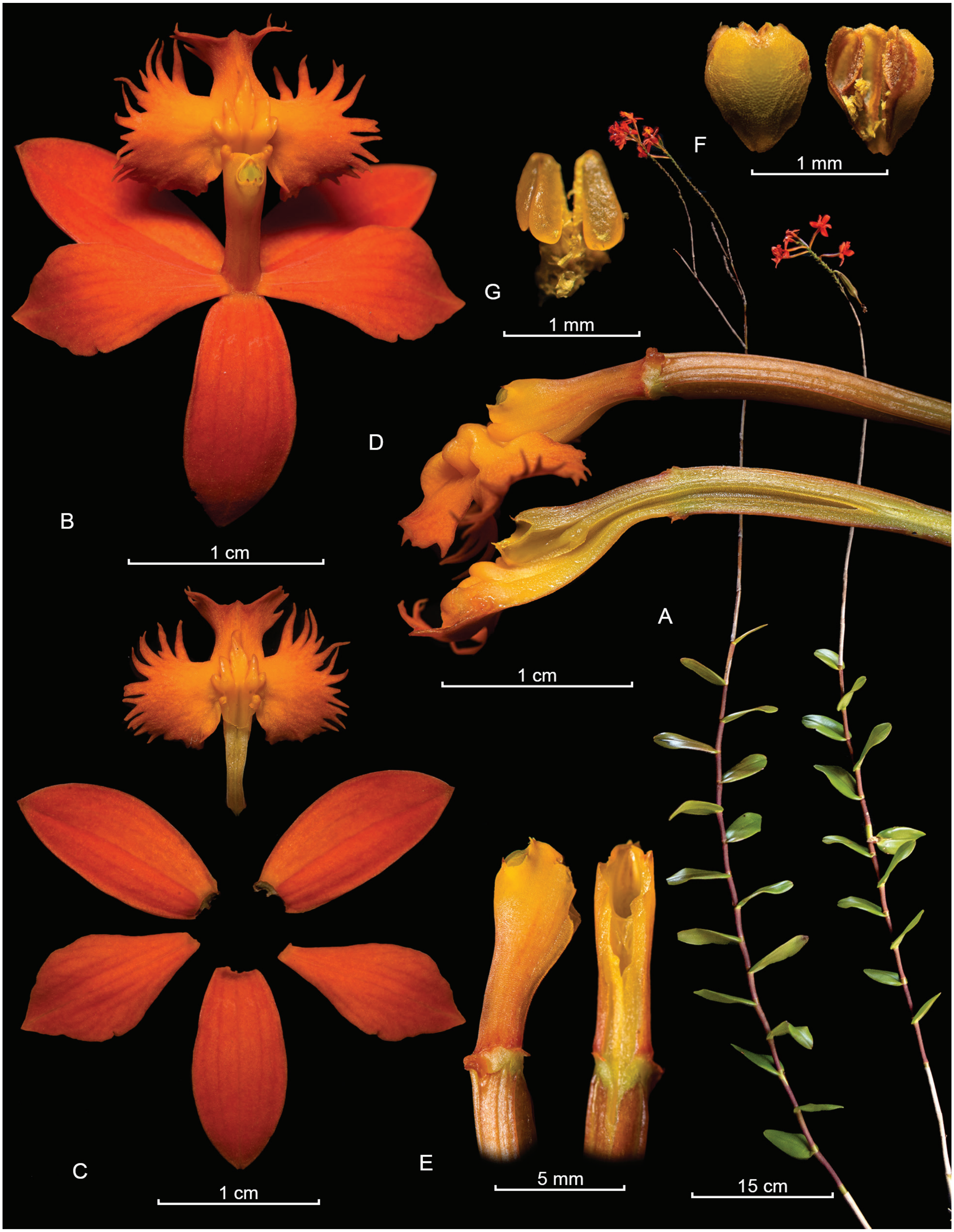

FIGURE 3. LCDP of *Epidendrum celsiae* J.S. Moreno & Hágsater. **A**, Habit; **B**, Flower; **C**, Dissected perianth; **D**, Lip and column lateral view, and transversal section; **E**, Column, ventral and lateral views; **F**, Anther cap; **G**, Pollinarium, based on *A. Zuluaga & J.S. Moreno 1505*.

FIGURE 4. Leaves comparison and stem between between *Epidendrum calimaense* J.S. Moreno & Hágsater and *Epidendrum celsia* J.S.Moreno & Hágsater. **A**, Leaves and stem of *Epidendrum calimaense*; **B**, Leaves and stem of *Epidendrum celsiae*; **C**, Leave shape of *Epidendrum calimaense*; **D**, Leave shape of *Epidendrum celsiae*. Based on *A. Zuluaga & J. S. Moreno 1505 and 1504*.

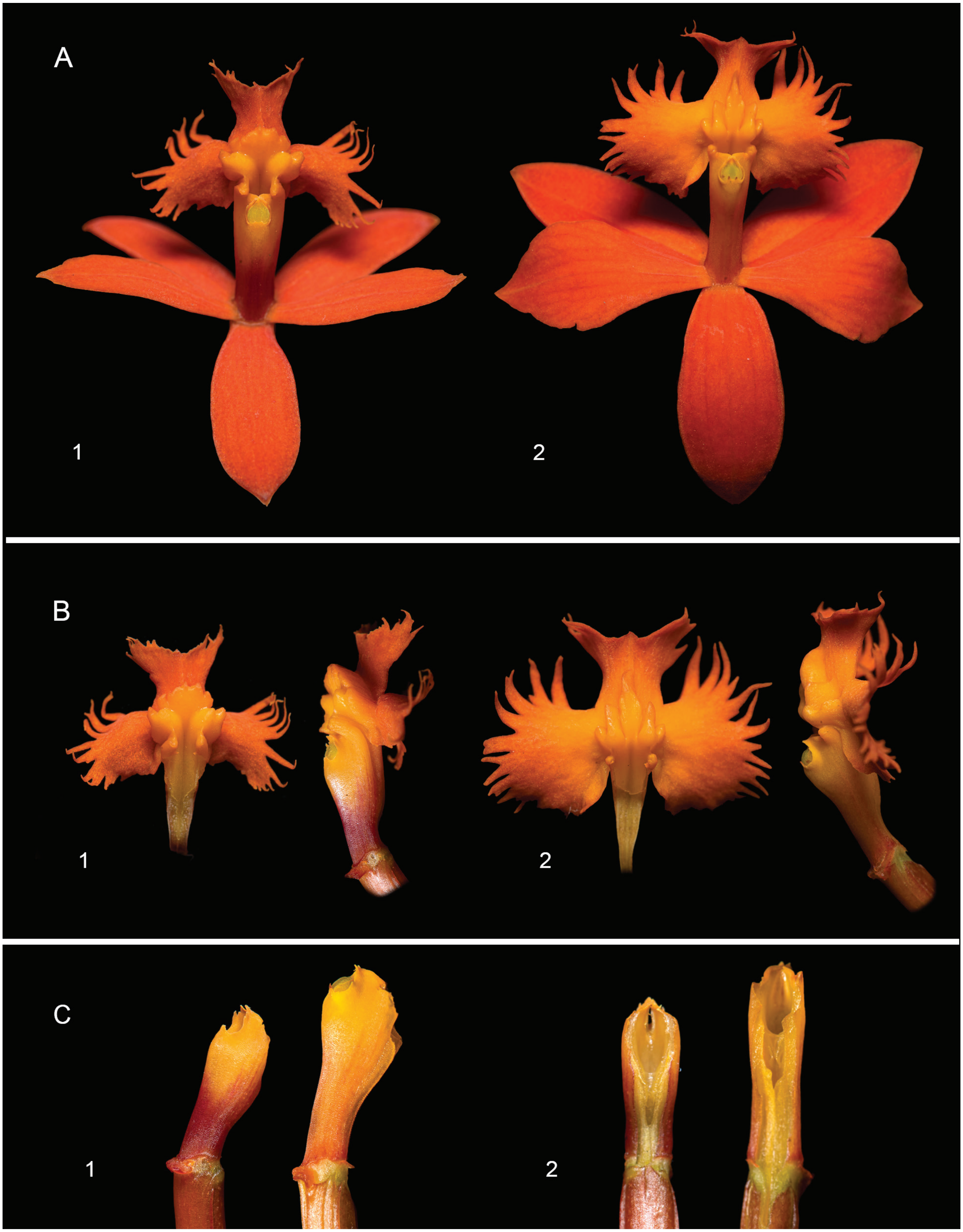

FIGURE 5. Flower comparison between *Epidendrum calimaense* J.S. Moreno & Hágsater (1) and *Epidendrum celsia* J.S. Moreno & Hágsater (2). **A**, Flowers; **B**, Lips, frontal and side views; **C**, Columns, side and ventral views. Based on *A. Zuluaga & J. S. Moreno 1505 and 1504*.

portokalium Hágsater & Dodson (2004), found along the Amazonian corridor in eastern Ecuador, which has larger flowers sepals 9–17 × 3.6–5.2 mm, the petals are narrowly obovate, apex rounded, and the lip with a distinctly different callus formed by seven unequal tubercules, none forming a spherical basal body. In herbarium specimens it can be confused with *Epidendrum melinanthum* Schltr. which was described from the same general area and is widespread in Colombia along the Cordilleras Occidental and Central, but has yellow flowers, the yellow callus turning orange in mature flowers, sepals 7–8 × 3.0–3.5 mm, oblanceolate, acute, the petals 8–9 × 2.5–3.0 mm, elliptic to sub-rhombic, acute, and the callus is formed by two sub-spherical calli at the base, extended beneath by a pair of sub laminar teeth which arch inwards partly embracing a central sub globose mid-callus (see Moreno & Hágsater, 2017).

Epidendrum celsiae J.S. Moreno & Hágsater, *sp. nov.* TYPE: COLOMBIA, Valle del Cauca: municipio de Calima El Darién, predio La Lorena, 1732 m, 15 Sept. 2020. *A. Zuluaga & J.S. Moreno 5622* (Holotype: CUVC) (Fig. 3–5).

Epidendrum celsiae is most similar to *Epidendrum portokalium* Hágsater & Dodson (2004) found along the Amazonian corridor in eastern Ecuador, but the flowers are similar in size, sepals 11.6–13.4 × 5.6–6.4 mm, (vs. sepals 9–17 × 3.6–5.2 mm), petals obtrullate-spatulate, acute, (vs. narrowly obovate, apex rounded), callus formed by three unequal tubercules, lateral ones made up of two teeth, unequal, the outer pair short, united, with the basal part slightly elevated, and mid-tubercule consisting of single elongate and thin, high keel, thickened on each side to about the mid-length (vs. callus formed by seven unequal tubercules).

Terrestrial, sympodial, caespitose *herb*, to ca. 162 cm tall including inflorescence. *Roots* 0.9–3.3 mm in diameter, basal, terete, fleshy, thin, white. *Stems* 70–100 × 0.3–0.7 cm, simple, cane-like, slightly sinuous, terete, thin, covered by foliar sheaths, papyraceous. *Leaves* 4.0–9.2 × 2.2–4.3 cm, articulate, ovate, apex acute, coriaceous, smooth, green, margins entire, distributed throughout stem. *Spathe* lacking. Inflorescence ca. 45–56 cm tall, racemose; peduncle 33–45 cm long, elongate, reddish, covered by 4–8 tubular bracts 3.0–12 cm long, white, scarious when dry, striated, papyraceous, imbricated, acute; rachis 8–21 cm long; producing keikis from sub-apical nodes of peduncle of inflorescence. *Floral bracts* 1.5–5 mm long, much shorter than ovary, decreasing in size, triangular, acuminate, embracing. *Flowers* ca. 40, successive 3–8 open at any time, non-resupinate, sepals and petals fiery orange, lip pale orange-yellow, callus orange-yellow, column yellow, anther green; fragrance none. *Ovary* 19–28 mm long, terete, thin, not inflated, orange, slightly arched, furrowed. *Sepals* 11.6–13.4 × 5.6–6.4 mm, spreading, elliptic, apex acute, minutely apiculate, 5-veined, margin entire, spreading; lateral sepals oblique, with low dorsal keel. *Petals* 11.8–12.6 × 6.7–7.2 mm, spreading, obtrullate-spatulate, acute, 3-veined (lateral veins short branched), distal margin irregularly erose, spreading. *Lip* 8.8–9.5 × 13.8–15.4 mm, united to column, 3-lobed, base cordate, callus massive, callus formed by three unequal tubercules, lateral ones made up of two teeth, unequal, outer pair short, united, with basal part slightly elevated, and mid-tubercule consisting of single elongate and thin, high keel, which is thickened on each side to about middle; lateral lobes 6.3–7.2 × 5.5–6.6 mm, semi-orbicular, margin deeply laciniate, slightly revolute; mid-lobe 4.8–5.3 × 6.8–7.4 mm, basal half an isthmus, apical half slightly bilobed, lobes divergent, sub-quadrate, distal margin laciniate, lateral margins revolute. *Column* 7.8–9.3 mm long, slightly arched upwards at apical half, terete, slightly thickened towards apex, lateral lobe on each side at apex, acute, margin minutely erose, embracing anther, and a pair of very short finger-like wings at base, slightly arched upwards. *Clinandrium-hood* reduced; margin irregular dentate. *Anther cap* ovoid, acute, rugose, 4-celled. *Pollinia* 4, narrowly obovate, elongate, laterally compressed, of equal size; caudicles soft and granulose, forming elongate tetrads that appear as a pile of roof tiles; viscarium semi-liquid, transparent. *Rostellum* apical, slit. *Lateral lobes* of stigma very small. *Nectary* deep, penetrating half pedicellate ovary, minutely papillose, papillae arranged in longitudinal rows. *Capsule* elliptic.

Eponymy: The name honors the energy company CELSIA, the owner who purchased property "La Lorena" for conservation purposes where the new species was found.

Habitat and ecology: See *Epidendrum calimaense*.

Conservation status: See *Epidendrum calimaense*.

Epidendrum celsiae is recognized by the non-resupinate flowers, the sepals and petals fiery orange, lip pale orange-yellow, callus orange-yellow, column yellow, anther green, the sepals 11.6–13.4 × 5.6–6.4 mm, spreading, elliptic, apex acute, minutely apiculate, the petals 11.8–12.6 × 6.7–7.2 mm, spreading, obtrullate-spatulate, acute, and the lip 8.8–9.5 × 13.8–15.4 mm, united to column, 3-lobed, base cordate, callus massive, callus formed by three unequal tubercules, lateral ones made up of two teeth, unequal, the outer pair short, united, with the basal part slightly elevated, and mid-tubercule consisting of single elongate and thin, high keel, which is thickened on each side to about the middle.

The two new species shares similar traits in the habit and flower morphology. Vegetatively, *Epidendrum calimaense* has elliptical leaves with the apex rounded, aggregate along the apical half of the stem, while *Epidendrum celsiae* has ovate leaves with the apex acute, distributed throughout the stem (Fig. 4). The flowers of *Epidendrum celsiae* are larger compared with *E. calimaense*, the lip and callus of *E. calimaense* has the base slightly cordate, bicallose with a pair of elevated spherical calli on sides at base, central callus lobed and wide, arranged in shape of a semi-circular crown formed by three unequal tubercules, lateral ones made up of two teeth, middle one made up of three teeth. In contrast, *Epidendrum celsiae* which could be very similar in appearance has the lip base cordate, with the callus formed by three unequal tubercules, lateral ones made up of two teeth, unequal, outer pair short, united, with basal part slightly elevated, and mid-tubercule consisting of single elongate and thin, high keel, which is thickened on each side to about middle (Fig. 5).

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REVISED TAXONOMY WITH A NEW COMBINATION FOR A MEXICAN SPECIES OF *XANTHISMA* (ASTERACEAE: ASTEREAE)

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Abstract. A new combination *Xanthisma tenuilobum* is proposed for a species endemic to western Chihuahua, Mexico. This revision is necessary in order to take into account the existence of an earlier, validly published name for the species.

Keywords: Asteraceae, *Machaeranthera*, Mexican flora, *Xanthisma*

For much of its history, *Xanthisma* DC. (Asteraceae) has consisted only of the one species, *X. texanum* DC. However, results from analyses of molecular data have supported expanding the genus to include a number of additional species (Morgan and Simpson, 1992; Morgan, 1997, 2003). The most recent treatment of *Xanthisma* (Morgan and Hartman, 2003) included a total of 17 species, most of which had previously been classified in *Haplopappus* Cass. by Hall (1928), and then in *Machaeranthera* Nees by Cronquist and Keck (1957) and Hartman (1990). Whereas *Xanthisma texanum* occurs only in Texas and Oklahoma, the expanded genus is distributed throughout the western U.S. and northern Mexico.

When Morgan and Hartman (2003) published their work on *Xanthisma*, they based the name of one of the species on *Eriocarpum stenolobum* Greene. After being proposed by Greene (1894), this name was subsequently treated as *Haplopappus stenolobus* (Greene) H.M. Hall by Hall (1928), *Machaeranthera stenoloba* (Greene) Shinners by Shinners (1950), and then *Xanthisma stenolobum* (Greene) D.R. Morgan & R.L. Hartman by Morgan and Hartman (2003). *Haplopappus tenuilobus* A. Gray is an older name for this species, having been described eight years earlier than *E. stenolobum* (Gray, 1886). Greene (1894) knew about *H. tenuilobus* but considered it a *nomen nudum*, describing the name as "…..one of those inadmissible hybrid adjectives which Dr. Gray himself condemned….."

We have examined the relevant literature and images of the type specimens and have concluded that the earlier name *Haplopappus tenuilobus* is not a *nomen nudum*, but a validly published name with a complete description and a reference to specimens by collector and collection number. It is therefore necessary to correct the taxonomy of this species with a new combination, as follows.

Xanthisma tenuilobum (A. Gray) D.R. Morgan & Zanoni, *comb. nov.*

Basionym: *Haplopappus tenuilobus* A. Gray, Proc. Amer. Acad. Arts 21:385. 1886 (as "*Aplopappus*"). TYPE: MEXICO. Chihuahua: Mountainous country about 150 miles north of Batopilas, August to November 1885, *E. Palmer 408* (Holotype: GH [00008726; image seen]; Isotypes: NY [00179000; image seen], US [00127888, 00931391; images seen], DOV [0008210; image seen]). Fig. 1.

Heterotypic synonyms: *Eriocarpum stenolobum* Greene, Erythea 2:109. 1894. TYPE: MEXICO. Chihuahua: Sandy flats, Arroyo Aucho, Sierra Madre, 16 Oct 1887, *C. G. Pringle 1303*. (Holotype: NDG [00492; image seen]; Isotypes: NY [00168683, 00179001, 02694101; images seen], US [00127881; image seen], MEXU [01317530; image seen], PH [00003538; image seen], DOV [0009198; image seen], E [00413335; image seen], K [000221424; image seen]).

Haplopappus stenolobus (Greene) H.M. Hall, Publ. Carnegie Inst. Wash. 389:65. 1928.

Machaeranthera stenoloba (Greene) Shinners, Field & Lab. 18:40. 1950.

Xanthisma stenolobum (Greene) D.R. Morgan & R.L. Hartman, Sida Contrib. Bot. 20:1409. 2003.

Xanthisma tenuilobum appears to be uncommon, known only from the Sierra Madre in western Chihuahua, Mexico. It is distinguished by its large showy heads, long-attenuate glandular phyllaries, and deeply pinnatifid to bipinnatifid leaves with narrow linear lobes (Fig. 1; Hartman, 1990). These character states can be seen in images of all the type specimens that we examined except for US00127888 and one of two plants on US00931391. Both plants have had large parts of their main stems removed, and branches from the stem bases have produced smaller heads on which the phyllaries are acute to acuminate rather than long-attenuate. This morphology can also be seen to some degree in DOV0008210 and one of two plants on the *X. tenuilobum* holotype (GH00008726; right side of Fig. 1). Both of these plants have also had much of their main stems removed, with all the heads produced by branches from the stem bases.

We thank the following herbaria for providing images of the type specimens, either by making them available online or through virtual loans: DOV, E, GH, K, MEXU, NDG, NY, and US.

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FIGURE 1. Holotype of *Xanthisma tenuilobum* (A. Gray) D.R. Morgan & Zanoni. Image courtesy of the Gray Herbarium. Original image available at: https://s3.amazonaws.com/huhwebimages/B241FDAC6144421/type/full/8726.jpg

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NOTES ON SOME RECENTLY SYNONYMIZED *FERNANDEZIA* (ORCHIDACEAE: ONCIDIINAE) TAXA

Paul Ormerod[1]

Abstract. Discussion is provided on the recent reduction to synonymy of seven Bolivian and Peruvian taxa of the genus *Fernandezia*.

Keywords: *Fernandezia,* synonymy, Bolivia, Peru

Fernandezia Ruiz & Pav. (Orchidaceae) is a genus of 88 species distributed from Mexico to Bolivia. They are mostly inhabitants of montane (2000–3500 m) forests and can be found growing epiphytically or lithophytically. The plants have a monopodial growth habit, producing axillary inflorescences of few to many, usually small, most often whitish flowers. Only a few taxa have attractive red to orange flowers (e.g. *F. subbiflora* Ruiz & Pav.). Studies based on a large amount of herbarium material by Ormerod (2016) clarified the status and synonymy of two of the red flowered species *F. myrtillus* (Rchb.f.) Garay & Dunsterv. and *F. sanguinea* (Lindl.) Garay & Dunsterv. Further studies of nearly the whole genus by Ormerod (2018) led to the proposal of 45 species, 11 varieties, 3 sections, and 7 new synonyms. Recently Damian, Mitideri and Edquen (2021) proposed that seven taxa described by Ormerod (2018) were all taxonomic synonyms after evaluating these entities based on an examination of fresh material, dried material in CUZ, MO, MOL, UFV, and USM, as well as images of material in AMES, BRIT, F, K, and SEL.

It is the opinion of this author that Damian et al. (2021) overlooked fundamental characters in making their proposals. My dissenting views are given below for each taxon.

Fernandezia breviconnata (Schltr.) M.W. Chase, Phytotaxa 20: 29. 2011.
Basionym: *Pachyphyllum breviconnatum* Schltr., Rep. Sp. Nov. Regni Veg., Beih. 9: 115. 1921. Fig. 1A.
TYPE: PERU. Cusco: Prov. Paucartambo, below Tres Cruces, 3600-3700 m, May 1914, *A. Weberbauer 6976* (Holotype: B, destroyed; Lectotype (designated by Christenson 2008: 285): US, image seen; Isolectotypes: AMES, GH; F, 2 sheets, images seen; MOL, not seen).

Distribution: Peru.

Damian et al. (2021) reduced to the synonymy of this species *F. chaparensis* and the quite dissimilar *F. luerorum*. Study of the type material of *Pachyphyllum breviconnatum* in AMES and GH gave the following characteristics: lateral sepals 7.5 mm long, labellum 7 mm long (claw 3.5 mm long, the ovate-lanceolate blade 3.5 mm long, 2 mm wide), calli distinctly separate, erect, at base of blade, column 3.5 mm long, 1.8 mm wide laterally.

Fernandezia chaparensis Ormerod from Bolivia (*C. Luer, J. Luer, R. Vasquez, T. Mulder, D. Mulder & A. Vogel 128884* [Holotype: K; Fig. 1B]) also has 7.5 mm long lateral sepals, the labellum is 7 mm long, but the claw is only 2.2 mm long, the narrowly oblong blade 4.8 mm long by 1.8 mm wide, its laminate calli are distinctly spreading and joined by a bicallose process, the calli are placed just below the middle of the blade, the column is 3.8 mm long, 2 mm wide laterally. The different proportions of the labellum and the placement and angle of the calli on it indicate that *F. chaparensis* is a species distinct from *F. breviconnata*.

Fernandezia luerorum Ormerod from Bolivia (*C. Luer, J. Luer, E. Besse & R. Vasquez 5616* [Holotype: SEL]) has 7 mm long sepals in which the inner surfaces face upward (vs. inner surfaces parallel in *F. breviconnata* and *F. chaparensis*), the labellum is 6.2 mm long with the claw 3.3 mm long, and the elliptic blade 2.8 mm long by 1.6 mm wide, its fleshy (not laminate) calli form an inverted V-shaped, the column is 2.5 mm long but 3 mm wide laterally (i.e. broader than long). The different proportions of the labellum, form and fleshiness of the calli, and dolabriform column (unique in the genus) clearly show that *F. luerorum* should not be included in *F. breviconnata* or any other taxon for that matter.

Fernandezia gracillima (C. Schweinf.) M.W. Chase, Phytotaxa 20: 30. 2011.
Basionym: *Pachyphyllum gracillimum* C. Schweinf., Amer. Orch. Soc. Bull. 16, No. 10: 564. 1947. Fig. 1C.
TYPE: PERU. Cusco: Prov. Urubamba, Puyupata to Tuncapata, 3200 m, 6 August 1942, *C. Vargas C. 2932* (Holotype: AMES).
Homotypic synonym: *Orchidotypus gracillimus* (C. Schweinf.) Senghas, in Schltr., Die Orchideen ed. 3, I/B, 31: 1923. 1995.

Distribution: Peru.

Damian et al. (2021) reduced to this taxon *F. unduaviae* Ormerod from Bolivia. There is no doubt the two are closely related but examination of the holotype of *Pachyphyllum gracillimum* shows that the lip has a unique shape and dissimilar measurements. The labellum is about 1.6 mm long, with the claw about 0.5–0.6 mm long, the suborbicular blade about 1 mm long and 1 mm wide, and its calli slightly divergent.

I wish to thank herbarium and library staff at Harvard University Herbaria for their help and hospitality during my visits. F, K, MO, NY, SEL, and US kindly loaned materials for study.

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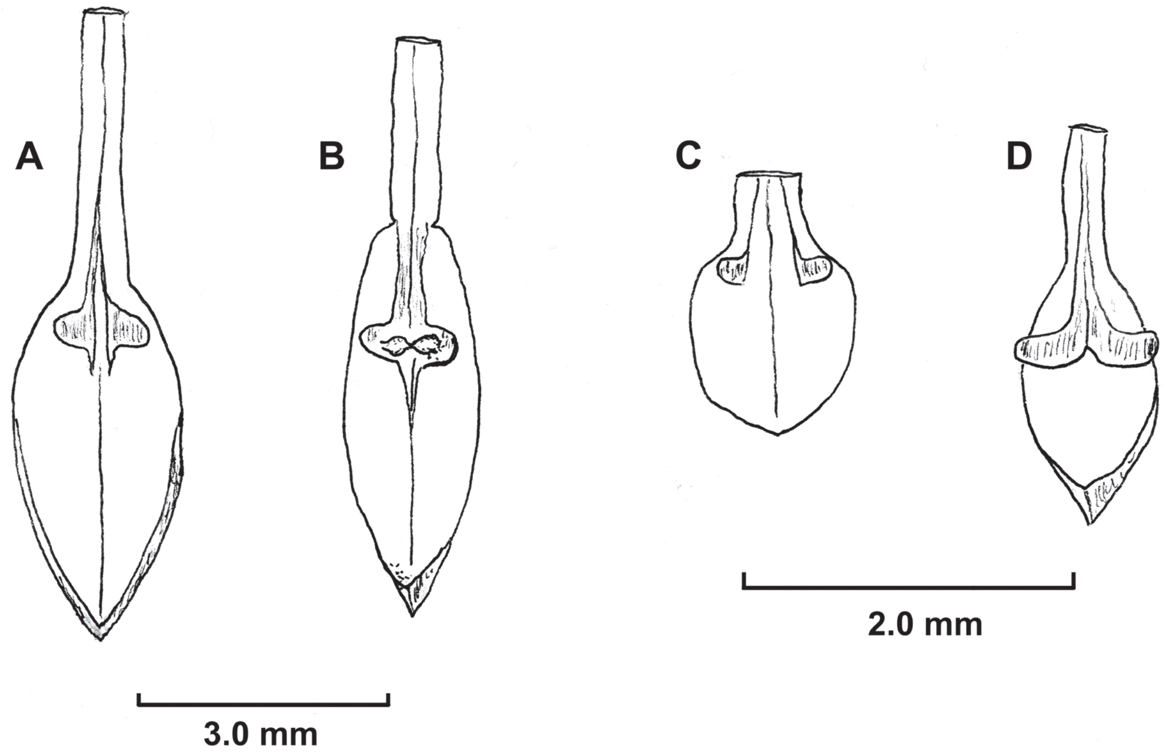

FIGURE 1. Labellum of *Fernandezia* species. **A**, *Fernandezia breviconnata* (Schltr.) M.W. Chase; **B**, *Fernandezia chaparensis* Ormerod; **C**, *Fernandezia gracillima* (C. Schweinf.) M.W. Chase; **D**, *Fernandezia unduaviae* Ormerod. A from isolectotype AMES, B–D from holotypes.

In the Bolivian *F. unduaviae* (*J.C. Solomon 8664* [Holotype: MO; Fig. 1D]) the labellum is about 2.1–2.4 mm long, the claw is 0.80–1.15 mm long, the oblong to elliptic blade is 1.30–1.35 mm long, 0.8–0.9 mm wide, and its calli parallel. It is my view that the Peruvian material studied by Damian et al. (2021) represents *F. unduaviae*. It is also possible that the simultaneously published *F. nunezii* Ormerod from Peru and *F. unduaviae* are taxonomic synonyms.

Fernandezia parvifolia (Lindl.) M.W. Chase, Phytotaxa 20: 30. 2011 as *parviflora*.

Basionym: *Pachyphyllum parviflorum* Lindl., in W.J. Hook., Icon. Plant. 2: t.177. 1837.

TYPE: PERU. Amazonas: Prov. Chachapoyas, without locality, *A. Mathews 1836* (Holotype: K).

Distribution: Peru.

Damian et al. (2021) reduced to this taxon *F. parvifolia* var. *cajamarcae* Ormerod, and strangely *F. nunezii* Ormerod and *F. pastinaca* Ormerod. Reduction of the variety seems to be based on a dislike of varieties as the authors themselves intimated in their discussion.

Fernandezia parvifolia is unique in section *Breviconnatae* Ormerod in having oblong to oblong-obovate leaves, whilst all other members have elliptic leaves that are tapered at each end (i.e., lenticular in outline). This was already noted in Ormerod (2018: 218) under the establishment of *Fernandezia* section *Breviconnatae*. The sepals are 3–4 mm long, the narrowly oblong to ligulate-oblanceolate petals free from the dorsal sepal, and the column is widest in the upper half.

Fernandezia nunezii Ormerod from Peru (*P. Nunez 7805* [Holotype: MO; Isotype: NY]) has leaves lenticular in outline, sepals 2.5–3.0 mm long, the narrowly oblong-rhombic petals joined basally to the dorsal sepal, with the column widest in the basal half. As noted above this taxon and *F. unduaviae* are very similar and may be united at some stage.

Fernandezia pastinaca Ormerod from Bolivia (*F. Calzadilla, I. Vargas, C. Jordan & D. Rocabado 56* [Holotype: MO]) has leaves lenticular in outline, sepals 2.8–3.3 mm long, clawed petals with an elliptic blade that are free from the dorsal sepal, the column is strongly narrowed in the basal half and widest at the middle.

Fernandezia tenuis (Schltr.) M.W. Chase, Phytotaxa 20: 31. 2011.

Basionym: *Pachyphyllum tenue* Schltr., Rep. Sp. Nov. Regni Veg. 9: 116. 1921.

TYPE: PERU. Junin: Chanchamayo Valley, *E. Koehler s.n.* (Holotype: B, destroyed; Lectotype (Christenson 2008: 288): t.131, nr. 512 (in Schltr. 1929).

Homotypic synonym: *Orchidotypus tenuis* (Schltr.) Senghas, in Schltr., Die Orchideen ed. 3, I/B, 31: 1923. 1995.

Distribution: Peru.

Damian et al. (2021) reduced *F. vanderwerffii* Ormerod to this taxon. However the two taxa differ substantially in their leaves, with those of *F. tenuis* being fleshy (*carnosulis* in Schlechter 1921; illustrated Damian et al. 2021: Fig. 1D, H) with upcurved sides whilst those of *F. vanderwerffii* are thin and flat. The smaller labellum calli of the latter were dismissed as unimportant feature by Damian et al. (2021) who did not observe any intermediates in this character. However, the combination of characters of *F. tenuis* (fleshy leaves with upcurved sides, large labellum calli) alongside those of *F. vanderwerffii* (thin, flat leaves, small labellum calli) indicates the two should be treated as sister species.

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ADDITIONAL NOTES ON THE ORCHID FLORA OF MYANMAR AND SOME OTHER ANCILLARY STUDIES

PAUL ORMEROD,[1,2] HUBERT KURZWEIL,[3] AND BA VUONG TRUONG[4]

Abstract. Additional names not accounted for in recent treatments of the orchids of Myanmar are noted, along with some other ancillary studies. Nine new combinations are proposed, *viz. Brachypeza uniflora, Eulophia citrina, E. pulchella, Holcosia pseudotaiwaniana, H. taiwaniana, Phreatia emarginata, P. minuscula, P. perpusilla,* and *Vanda hennisiana*. One new species is also proposed, *viz. Cylindrolobus karenensis*.

Keywords: Myanmar, Asia, orchids, new names, synonymy.

This paper adds to a recent attempt to catalogue the orchid flora of Myanmar (Ormerod, Kurzweil and Watthana, 2021). We also try to deal with some other ancillary issues that were found during the course of our research. The national orchid floras of southeast Asia are going through an exciting period of study boosted by local researchers and enthusiasts who have access to much more fresh material. It is to be hoped their studies will culminate in a much better picture of the southeast Asian flora. Our research efforts here deal mainly with nomenclatural problems, taxonomical confusion, and other historical issues (such as overlooked names).

Brachypeza Garay, Bot. Mus. Leafl. Harv. Uni. 23, 4: 163. 1972.
Type species: *Saccolabium archytas* Ridl.

A genus of Aeridinae with about twelve species distributed from Vietnam to Indonesian Papua. The original concept of the genus centered around short-stemmed plants with soft elliptic leaves, and inflorescences of sequential flowers that bore a relatively long column with a short basal foot. Later, Kocyan and Schuiteman (2014) transferred five species from *Pteroceras* Hassk. to the genus based on molecular analyses.

Brachypeza uniflora (Tixier ex Seidenf.) Ormerod & B.V. Truong, *comb. nov.*
Basionym: *Pteroceras uniflorum* Tixier ex Seidenf., Contr. Orch. Fl. Cambodia, Laos & Vietnam: 97. 1975.
TYPE: VIETNAM. Prenh, near Dalat, 17 October 1924, *F. Evrard 1453* (Holotype: P, image seen).
Homotypic synonyms: *Sarcochilus uniflorus* Gagn., in Lecomte, Fl. Gen. Indo-Chin. 6: 468. 1934 *nom. illeg.* (*non* Schltr. 1913).
Pteroceras semiteretifolium H.A. Pedersen, Nord. J. Bot. 12: 387. 1992 *nom. illeg.*
Brachypeza semiteretifolia (H.A. Pedersen) Kocyan & Schuit., Phytotaxa 161, 1: 64. 2014 *nom. illeg.*
Distribution: Vietnam.

Seidenfaden (1975) inadvertently validated the name *Pteroceras uniflorum* by giving full reference to its basionym, the homonym *Sarcochilus uniflorus* Gagn. The former is the first legitimate name for the species. The later *Pteroceras semiteretifolium* is a superfluous renaming of *P. uniflorum*.

Bulbophyllum Thouars, Hist. Part. Orch. Iles Austral. Afr.: Trois. Tabl. Esp., tt. 93–110. 1822 *nom. cons.*
Lectotype species: *Bulbophyllum nutans* Thouars

This is the second largest genus of Orchidaceae (after *Epidendrum* L., 2400 species) and contains about 2000 accepted species distributed throughout the world, mostly in forests of the warm tropics, but also occurring in mildly temperate forested regions such as parts of Japan. The plants are well-characterized by having one to two (rarely more) apically leaved pseudobulbs, basal inflorescences, and flowers bearing a hinged, usually motile labellum.

Bulbophyllum pumilio C.S.P. Parish & Rchb.f., Trans. Linn. Soc., Bot. 30: 153. 1874. TYPE: MYANMAR. Zingyik, August 1860, *C.S.P. Parish 220* (Lectotype [Seidenf. 1969: 137 as type specimen]: K, image seen; drawing W-R 2265, not seen); Moulmein, *C.S.P. Parish s.n.* (Syntype: W-R 49455, not seen); Kalama Tong, 1860, *C.S.P. Parish s.n.* (Syntype: K, image seen).
Homotypic synonyms: *Cirrhopetalum pumilio* (C.S.P. Parish & Rchb.f.) J.D. Hook., Fl. Brit. Ind. 5: 778. 1890.
Phyllorkis pumilio (C.S.P. Parish & Rchb.f.) O. Kuntze, Rev. Gen. Pl. 2: 677. 1891.
Distribution: Myanmar and Thailand.

In Ormerod et al. (2021) the type was cited as an unnumbered Parish collection in Wien, following without attribution Seidenfaden (1974). We also did not list the type material present in Kew. However, Seidenfaden (1969) effectively lectotypified this species by saying the type specimen (*Parish 220*) was in Kew.

The first author thanks herbarium and library staff at AMES, BM, C, and K for their help and hospitality during his visits. He is also indebted to the late Leslie A. Garay for sharing data on *Geodorum,* and the late Gunnar Seidenfaden for his hospitality in Denmark and for allowing access to material stored at that time at his home. Sathish Kumar kindly provided images of *Geodorum* specimens and drawings stored in CAL.

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Cleisostoma Blume, Bijdr. 8: 362. 1825.
Type species: *Cleisostoma sagittatum* Blume

A genus of monopodial orchids with about 100 species distributed from India and Sri Lanka to Fiji. The species are relatively small-flowered (sepals on average 5–7 mm long) but can have quite complicated floral parts such as the labellum (with both front wall and back wall calli, a septate spur) and pollinarium (with simple to intricate viscidium and stipes). Eighteen species have been recorded from Myanmar but one of these, *C. parishii* (W.J. Hook.) Garay, is now called *Sarcoglyphis parishii* (W.J. Hook.) A.N. Rao (see treatment under that genus).

Cleisostoma discolor Lindl., Edwards's Bot. Reg. 31: misc. 59. 1845. TYPE: "EAST INDIES". *Cult. Messrs. Loddiges s.n.* (Holotype: K-L, image seen).

Homotypic synonym: *Sarcanthus discolor* (Lindl.) J.J. Sm., Bull. Jard. Bot. Buitenz. s. 2, 9: 108. 1912.

Heterotypic synonyms: *Sarcanthus ornithorrhynchus* Rchb.f., Allgem. Gartenz. 24: 219. 1856 *syn. nov.* TYPE: ORIGIN UNKNOWN. *Cult. G. Blass s.n.* (Holotype: W-R 53532, image seen).

Cleisostoma ornithorrhynchum (Rchb.f.) Garay, Bot. Mus. Leafl. Harv. Uni. 23, 4: 173. 1972.

Distribution: India and Bhutan.

This species is characterized by having ligulate leaves with deeply bilobed, triangular tips, flowers with a narrowly conical, partly septate spur, auriculate hypochile sidelobes, a concave, obtuse, upturned labellum epichile, a column with a prominent, laterally twisted rostellum, and a pollinarium with simple oblanceolate stipes. Seidenfaden (1975) united *Sarcanthus termissus* Rchb.f. with *Cleisostoma discolor* but we dispute this synonymy and recognise *C. termissum* (Rchb.f.) Garay as a good species distributed in Vietnam, Cambodia, Thailand, Malaysia, and Indonesia. *Cleisostoma termissum* may be recognised by its often forward-pointing petals with a bold red stripe (vs. patent, unstriped or a very fine line of color), the prominently incurved free tips of the labellum sidelobes, and the curved over pink labellum epichile.

The best image available of the true *C. discolor* appears to be the photographs in Dalstrom et al. (2017). Most internet images called *C. discolor* are of *C. termissum*. Both *C. termissum* and *C. discolor* could be expected to occur in Myanmar.

Cleisostoma racemiferum (Lindl.) Garay, Bot. Mus. Leafl. Harv. Uni. 23, 4: 173. 1972.

Basionym: *Saccolabium racemiferum* Lindl., Gen. Sp. Orch. Pl.: 224. 1833. . TYPE: INDIA. Without locality, *icon N. Wallich 655* (Holotype: K, not seen).

Homotypic synonym: *Sarcanthus racemifer* (Lindl.) Rchb.f., Ann. Bot. Syst. 6: 891. 1863.

Heterotypic synonyms: *Sarcanthus striolatus* Rchb.f., Gard. Chron. n.s. 18: 168. 1882 *syn. nov.* TYPE: "PHILIPPINES". Without locality, June 1882, *Messrs. H. Low & Co. s.n.* (Holotype: W-R, not seen; copy of Reichenbach's sketch: AMES).

Cleisostoma striolatum (Rchb.f.) Garay, Bot. Mus. Leafl. Harv. Uni. 23, 4: 175. 1972.

Distribution: Nepal, India, Bhutan, Myanmar, China, Laos, Vietnam, and Thailand.

In 1882 Reichenbach f. described *Dendrobium ionopus* and *Liparis grossa,* both from material sent from Messrs. Low and said to be from Burma (now Myanmar). However we now know that these plants likely came from the Philippines and that these taxa have never been found in Myanmar. The opposite situation seems to occur in *Sarcanthus striolatus* which was said to be from the Philippines but has never been found there again. Study of the protologue and a copy of Reichenbach's sketches show that *Sarcanthus striolatus* matches all in characters with the earlier *Cleisostoma racemiferum,* therefore we treat them as conspecific. We have seen an image of a Philippine plant attributed to *C. striolatum,* but that belongs to a true Philippine endemic, *C. iloconense* Calaramo et al. The latter taxon may be recognised by its purple, shortly cuspidate (vs. white, ageing to yellow, acute to obtuse) labellum epichile.

Coelogyne Lindl., Coll. Bot. (Lindley): sub t.33. 1821.
Lectotype species: *Coelogyne cristata* Lindl.

This is a genus of about 180–200 species distributed from Sri Lanka and India to Samoa. A number of species make attractive horticultural subjects due to their showy flowers. The plants have one to three leaved pseudobulbs, with terminal inflorescences of small to large, often white, yellow, pinkish, or green flowers, with a slender, often narrowly winged column.

Coelogyne holochila P.F. Hunt & Summerh., Kew Bull. 20, 1: 52. 1966. TYPE: MYANMAR [as "Burma"]. Chin Hills, *leg. Mrs. Wheeler Cuffe,* fl. in cult. 16 June 1914, *cult. R.B.G. Glasnevin s.n.* (Holotype: K, image seen). Fig. 1A.

Usage synonym: *Coelogyne calcicola auct. non* A.F.G. Kerr, Nyan Tun, Wild Orch. Myanmar 114. 2014.

Distribution: India and Myanmar.

Additional specimen examined: MYANMAR. Chin Hills, Kaupetlet, 2285 m, April 1939, *F.G. Dickason 8611* (AMES).

From near the type locality in Myanmar (Mt. Victoria = Natmataung) of *C. holochila* we have only seen one collection that could be referred to it. In this specimen the midkeel is prominent in the lower third of the lip and dentate-lacerate, the outer two keels are thinly laminate and about twice the height of those found in *C. stricta* (D. Don) Schltr., the lip appears trilobed due to lateral inflexion points between the hypochile and epichile but when spread out appears entire. Another feature in this specimen seems to be the larger flowers (sepals to 26.5 mm long vs. 18–21 mm long in *C. stricta*). Hunt and Summerhayes (1966) note sepal measurements of 25–30 mm long in the protologue of *C. holochila*.

Two other problems bear mentioning, and these have contributed to the confusion between *C. holochila* and *C. stricta*. Hooker (1857) published a plate labelled *C. elata*

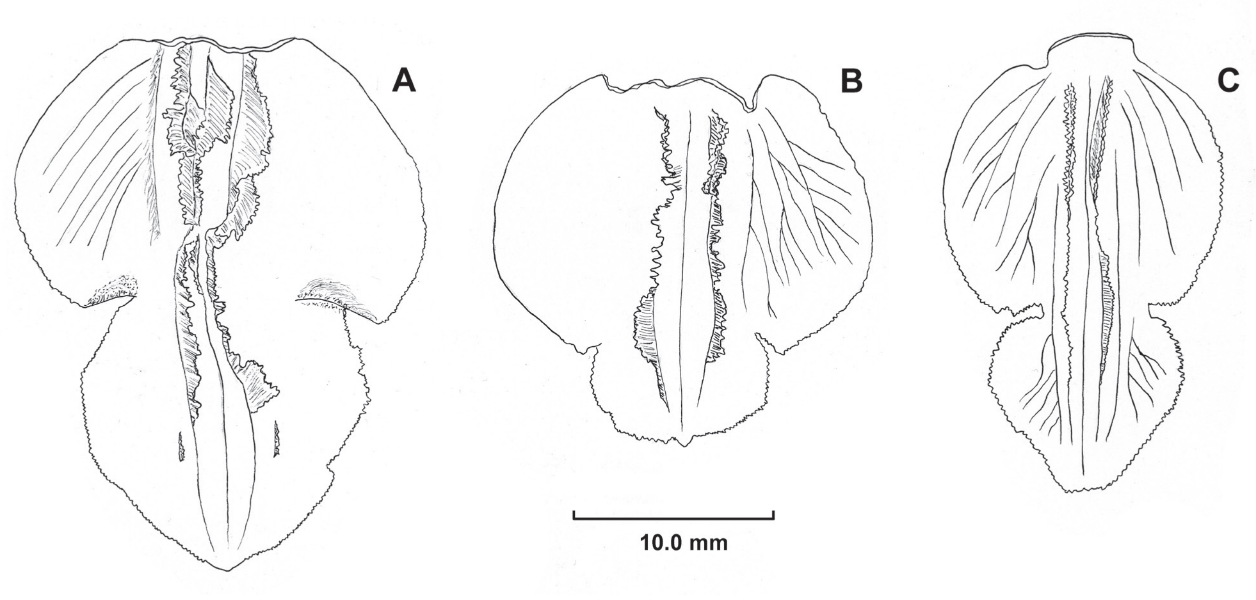

FIGURE 1. *Coelogyne holochila* P.F. Hunt & Summerh. **A**, labellum. *Coelogyne stricta* (D. Don) Schltr. **B–C**, labellum variation. A from *F. G. Dickason 8611* (AMES). B from *F. G. Dickason 7360* (AMES). C from *R. Pantling 123* (AMES).

Lindl. (= *C. stricta*), this was referred to *C. holochila* by Hunt and Summerhayes (1966) due to the entire lip. In this drawing the lip appears almost elliptic-obovate and bears a wishbone shaped orange-yellow colored area in its upper half. If the plate is accurate then it may depict an undescribed taxon.

Clayton (2002) and George (2011) depict as *C. holochila* an entity which seems to have the lip epichile broader than long (ca. 10 × 15 mm according to the drawing in Clayton [2002]) and bearing a broad transverse orange-yellow patch on the upper half of the lip. This also could be another taxon but further studies into the variability of *C. holochila* are needed.

Coelogyne stricta (D. Don) Schltr., Rep. Sp. Nov. Regni Veg., Beih. 4: 184. 1919.

Basionym: *Cymbidium strictum* D. Don, Prodr. Fl. Nepal.: 35. 1825. TYPE: NEPAL. *N. Wallich s.n.* (Holotype: BM, not seen). Fig. 1B–C.

Distribution: Nepal; India, Bhutan, Myanmar, China, Laos, and Vietnam.

Specimens examined: INDIA. Sikkim, without locality, 1525 m, May and June 1891, *R. Pantling 123* (AMES). BHUTAN. Gaylegphug District, Rang Khola, 4 km NE of Surey, 980 m, 29 March 1982, *A.J.C. Grierson & D.G. Long 4120* (AMES). MYANMAR. Pioneer (Haka), 1890 m, 2 April 1938, *F.G. Dickason 7360* (AMES); Taunggyi, May 1938, *F.G. Dickason 9360* (AMES).

The above two Myanmar collections were wrongly listed under *C. holochila* P.F. Hunt & Summerh. in Ormerod et al. (2021). The distinguishing characters of the latter species are said to be the entire lip, basally bearing three keels (the middle one entire), the outer two quite sinuous, and the lip margins entire or much less dentate. These characters appear rather weak since in material of *C. stricta* the lobing of the lip seems rather variable, the lip base can bear three keels but the middle one quite weak, the keels can be quite sinuous, and the depth of dentation of the lip margins varies. However, as noted above, we have accepted *C. holochila* as a distinct entity on account of its larger flowers, and twice as high keels on the labellum.

Cylindrolobus Blume, Fl. Jav. Praef.: 6. 1828.

Type species: *Ceratium compressum* Blume

This is a genus of about 80–85 species distributed from Sri Lanka and India to Papua New Guinea. It may generally be recognised by its caulescent habit (stems clavate to terete), glabrous leaves spread along the stem or gathered near its apex, axillary (rarely pseudoterminal), short (rarely elongated but then floral bracts relatively conspicuous) inflorescences of one to few flowers, and often spreading, coloured, relatively large floral bracts. The seven known Myanmar species were *C. biflorus* (Griff.) Rauschert, *C. clavicaulis* (Wall. ex Lindl.) Rauschert, *C. cristatus* (Rolfe) S.C. Chen & J.J. Wood, *C. foetidus* (Aver.) Schuit., Y.P. Ng & H.A. Pedersen, *C. glabriflorus* X.H. Jin & J.D. Ya, *C. marginatus* (Rolfe) S.C. Chen & J.J. Wood, and *C. truncatus* (Lindl.) Rauschert.

None of the recorded taxa are endemic, but we found a new endemic species amongst the collections of F.G. Dickason. Furthermore, our studies show that the recently described *C. glabriflorus* is a synonym of the Chinese *C. tenuicaulis*.

Cylindrolobus karenensis Ormerod & Kurzweil, *sp. nov.* TYPE: MYANMAR. Karen State, Nataung, 1980 m, October 1939, *F.G. Dickason 9466* (Holotype: AMES). Fig. 2.

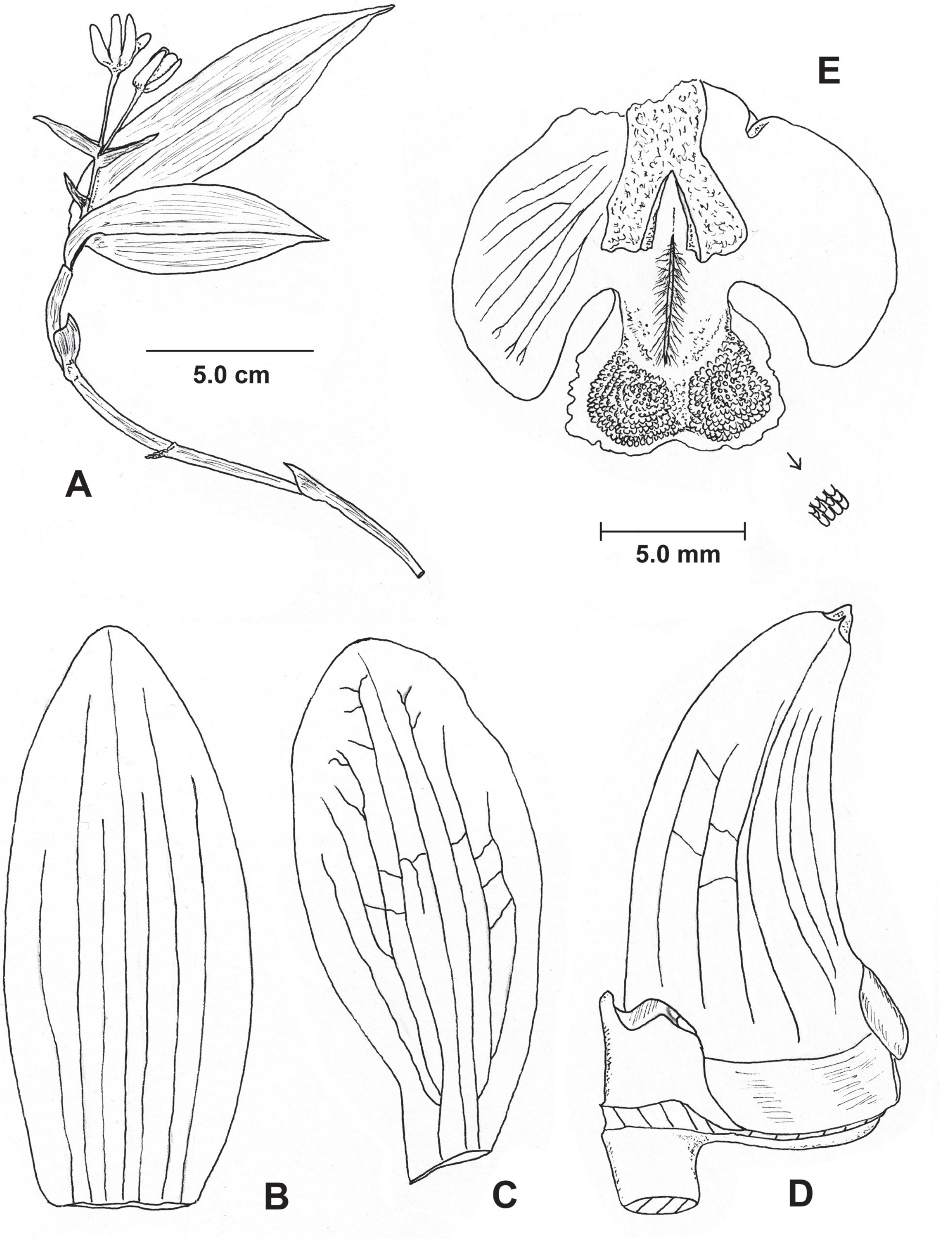

FIGURE 2. *Cylindrolobus karenensis* Ormerod & Kurzweil. **A**, plant; **B**, dorsal sepal; **C**, petal; **D**, lateral sepal and column; **E**, labellum. Drawn from holotype.

Usage synonym: *Cylindrolobus clavicaulis auct. non* (Wall. ex Lindl.) Rauschert, Ormerod, Kurzweil & Watthana, Phytotaxa 481, 1: 80–81. 2021 p.p. [*quoad F.G. Dickason 9466*].

Related to *C. clavicaulis* (Wall. ex Lindl.) Rauschert but the labellum with a basal, V-shaped (vs. oblong, terminating in two globose thickenings) callus, in front of which a linear, long-pubescent (vs. triangular in section, shortly farinaceous) keel, and the epichile covered with a thickened obcordate, papillose area (vs. having a median keel, flanked at each margin by another keel).

Epiphytic *herb*. *Roots* and *rhizome* not seen. *Stems* narrowly clavate, laxly 3-sheathed (these to 22 mm long), apex bifoliate, 155.0–175.0 × 2.5–6.0 mm. *Leaves* oblong-lanceolate, acute to subacuminate, 61.0–110.0 × 25.5–28.5 mm. *Inflorescences* subterminal, 23–28 mm long; peduncle 20–25 mm long; peduncular sheath one, broadly ovate, acute, 15 × 12 mm; rachis 2-flowered, 3 mm long; floral bracts oblong-lanceolate to ovate-lanceolate, acute, 22 × 8 mm. *Flowers* white, with yellow on the lip, glabrous. *Pedicel with ovary* narrowly clavate, 30 mm long. *Dorsal sepal* oblong-elliptic, obtuse, 7-veined, 17.5 × 8.0 mm. *Lateral sepals* obliquely oblong-lanceolate, subacute, 7-veined, 16 × 10 mm, forming with the column foot an obtuse mentum about 7.5 mm long. *Petals* narrowly elliptic-obovate, obtuse, 7-veined, 17 × 8 mm. *Labellum* trilobed, 11.2 × 14.2 mm; hypochile 6 mm long medially, each side with an obliquely subquadrate sidelobe, 5.0 × 5.2–5.3 mm; epichile obcordate, broadly covered by an obcordate, papillose thickening, 4.5–4.9 × 7.2 mm; callus on hypochile broadly V-shaped, scurfy pubescent, in front of which a narrow, long pubescent keel that ends in the basal half of the epichile. *Column* short, semiterete, 4 mm long; column foot at right angles to column, concave, 6 mm long.

Distribution: Myanmar.

Etymology: Named after Karen (now Kayin) State, the type locality.

This species shares with *C. clavicaulis* a similar habit, glabrous floral bracts and flowers. It however differs in details of the flowers (see diagnosis above). The flowers of *C. karenensis* have a labellum much more like *C. cristatus* and *C. marginatus,* that is each of these taxa have a pair raised rectangular pads on the hypochile, in front of which a long-pubescent keel, and then a broad papillose-pubescent area on the epichile. However both the latter taxa have pubescent (not glabrous) flowers.

Cylindrolobus tenuicaulis (S.C. Chen & Z.H. Tsi) S.C. Chen & J.J. Wood, Fl. China 25: 349. 2009.

Basionym: *Eria tenuicaulis* S.C. Chen & Z.H. Tsi, Guihaia 15: 109. 1995. TYPE: CHINA. Tibet, Medog County, Bei Ben District, between Xi-lan and De-yang, 1500–2200 m, 22 April 1983, *B.S. Li & S.Z. Cheng 04285* (Holotype: PE 00027168, image seen; Isotype: PE 00027169, image seen). Fig. 3.

Homotypic synonym: *Eria gracilicaulis* S.C. Chen & Z.H. Tsi, Bull. Bot. Res. (Harbin) 8, 1: 9. 1988 *nom. illeg.* (non Kraenzl. 1910).

Heterotypic synonyms: *Eria jengingensis* Hegde, J. Orch. Soc. India 7, 1–2: 13. 1993 *nom. inval., syn. nov.*

BASIS FOR NAME: INDIA. Arunachal Pradesh, East Siang District, Jengging, 700 m, 22 March 1993, *S.N. Hegde 27608-A* (OHT, lost; Naharlagun, lost).

Cylindrolobus glabriflorus X.H. Jin & J.D. Ya, PhytoKeys 130: 109. 2019 *syn. nov.* TYPE: MYANMAR. Kachin State, Putao, Hponkanrazi Wildlife Sanctuary, 2200 m, 12 April 2018, *X.H. Jin & J.D. Ya 18HT1618* (Holotype: KUN, image seen).

Epiphytic *herb*. *Rhizome* short. *Roots* terete, slender, pubescent, 0.3–0.5 mm thick. *Stems* caespitose, slender, terete, covered in close-fitting sheaths, apex 4–6-leaved, 205.0 × 2.0–2.5 mm. *Leaves* lanceolate, acute, 32.0–62.0 × 6.0–12.5 mm. *Inflorescences* axillary, emerging from between the leaves and from nodes along the upper half of the stem, 4.2 mm long; peduncle terete, glabrous, 1.2 mm long; peduncular sheaths two, ovate, acute, concave, 5–6 mm long; rachis 2-flowered, 3 mm long; floral bracts ovate-elliptic, acute, concave, 7-veined, to 6.0 × 4.4 mm. *Flowers* dingy flesh color, glabrous. *Pedicel with ovary* narrowly clavate, 5 mm long. *Dorsal sepal* oblong-lanceolate, obtuse, 3-veined, 5.00 × 1.95–2.20 mm. *Lateral sepals* obliquely ovate-triangular, obtuse, 3-veined, 5.0–5.3 × 3.4–3.9 mm, forming with the column foot an obtuse mentum about 2 mm long. *Petals* ovate-elliptic, obtuse, 3-veined, 4.00 × 1.95 mm. *Labellum* trilobed, 3.95 × 2.00 mm; hypochile broadly clawed, 2 mm long medially, with obliquely subquadrate sidelobes that are obliquely truncate apically, inside finely, minutely, and laxly pubescent; epichile trilobulate, broadly elliptic, obtuse, fleshy, each side with an raised wing or edge, finely, minutely, and laxly pubescent, 1.95 × 1.30 mm; calli on hypochile obliquely subquadrate, divergent; callus on epichile subglobose. *Column* subterete, with a flared stigmatic entrance, 1.8 mm long; column foot at right angles to column, 1.75 mm long.

Distribution: India (Arunachal Pradesh); China (Tibet), Myanmar.

Additional specimen examined: INDIA. Arunachal Pradesh, Mishmi Hills, above lake, 1525 m, 25 April 1949, *F. Kingdon Ward 18556* (AMES; BM, NY, images seen).

Ecology: Common epiphyte forming large clumps high up in trees along a ridge, 1525 m (*F. Kingdon Ward 18556*).

This taxon was first validly described under the homonymic name *Eria gracilicaulis,* which was renamed to *Eria tenuicaulis*. Judging from the description and drawings in the protologue, and images and drawings on the type sheet we believe that *Eria gracilicaulis* was described from immature flowers. The laterally compressed lamella on the lip epichile is only evident in immature flowers, we find that this callus becomes semiglobose in mature flowers based on observations of the above cited specimen. The earlier invalidly published *Eria jengingensis* (two herbaria cited for the holotype) was later wrongly included in the synonymy of *Eria hegdei* Agrawala & H.J. Chowdhery (Agrawala & Chowdhery 2008). *Cylindrolobus hegdei* (Agrawala & H.J. Chowdhery) A.N. Rao has pubescent (not glabrous) inflorescences and flowers, the lip with lamellate lateral keels (not two subquadrate lamellae), and a simple (not trilobulate) lip epichile.

Dendrobium Swartz, Nova Acta Regiae Soc. Sci. Upsal. ser. 2, 6: 82. 1799 *nom. cons.*

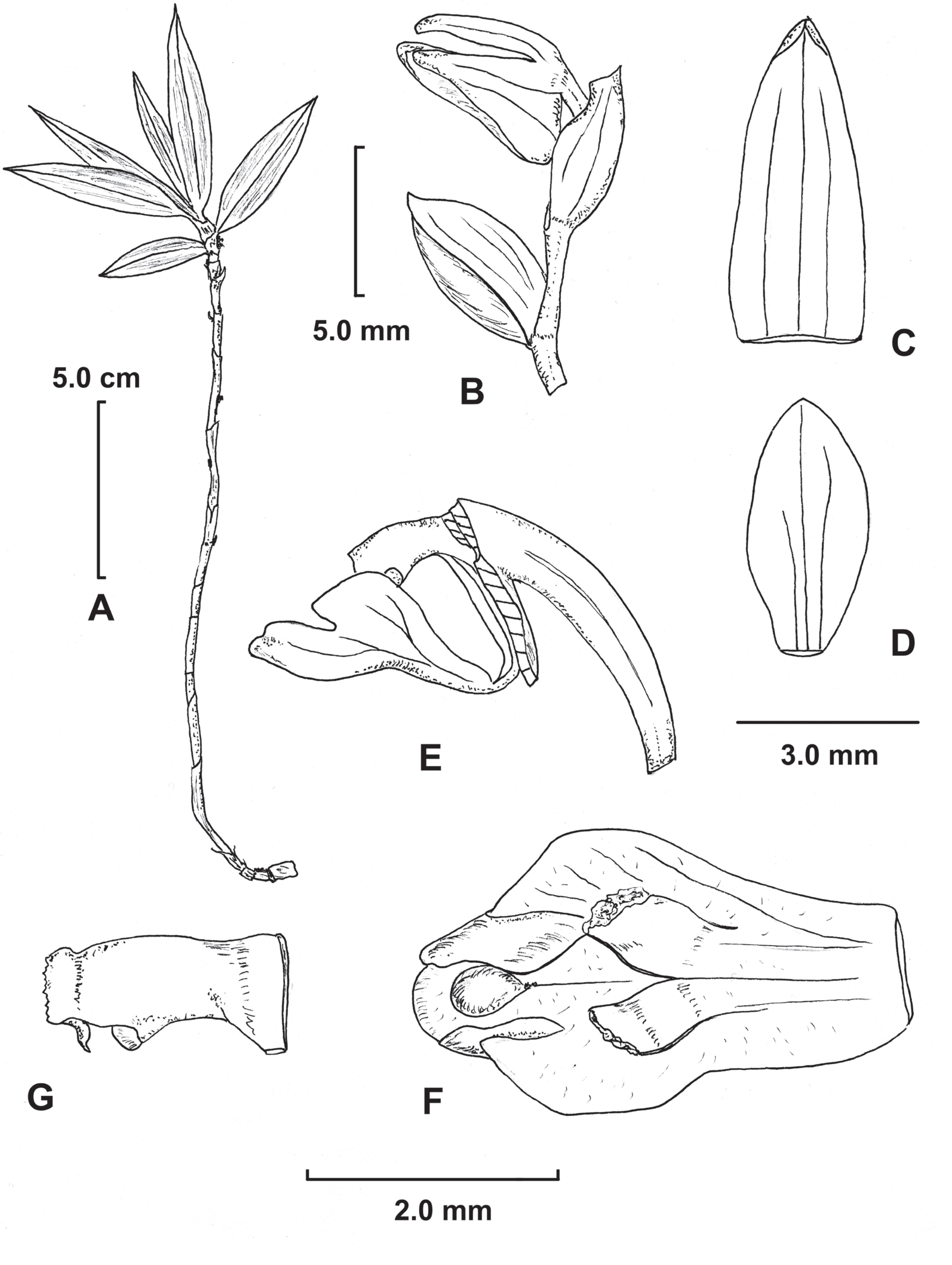

FIGURE 3. *Cylindrolobus tenuicaulis* (S.C. Chen & Z.H. Tsi) S.C. Chen & J.J. Wood. **A**, plant; **B**, inflorescence (less one flower); **C**, dorsal sepal; **D**, petal; **E**, flowers minus tepals; **F**, labellum; **G**, column. Drawn from *F. Kingdon Ward 18556* (AMES).

Type species: *Dendrobium moniliforme* (L.) Swartz *typ. cons.*

A genus of about 1520–1530 species distributed from Sri Lanka and India to Tahiti. Many of the southeast Asian species are popular in culture and they have been long collected for the horticultural trade.

Dendrobium aphyllum (Roxb.) C.E.C. Fischer, in J.S. Gamble, Fl. Madras 8: 1416. 1928.

Basionym: *Limodorum aphyllum* Roxb., Coromandel Pl. 1, 2: 34. 1795. TYPE: INDIA. Coromandel Coast, *W. Roxburgh s.n.* (Holotype: lost).

Heterotypic synonym: (?) *Dendrobium pierardii* Roxb. ex W.J. Hook. var. *brachybulbon* Schltr., Orchis 8: 83. 1914. TYPE: MYANMAR [as "Birma"]. Without locality, *cult. W. Hennis s.n.* (Holotype: lost).

Distribution: India, Nepal, Bhutan, China, Myanmar, Laos, Vietnam, Thailand, and Malaysia (Peninsula).

Ormerod et al. (2021) overlooked the above variety in our checklist. It was poorly described by Schlechter who said it differed from the typical species in the shorter stems, which were like those of *D. nobile* Lindl. in shape (clavate, not terete) and length (*c.* 25–30 cm, vs. to 100 cm long). We have seen no specimens like this, and such material should be looked for among Myanmar populations of *D. aphyllum*.

Dendrobium inversum Courtauld, Gard. Chron. s. 3, 17: 800. 29 June 1895; The Garden (1871–1927) 47: 465. 29 June 1895; Orch. Review 3, 32: 253. August 1895. TYPE: MYANMAR [as "Burmah"]. Exhibited at the R.H.S. 25 June 1895, *cult. Whiffen for J. Bradshaw s.n.* (Holotype: lost). Lectotype, here designated: Fig. 2, Gard. Chron. s. 3, 20: 7. 1896 (as *D. arachnites* Rchb.f.).

Heterotypic synonyms: *Dendrobium arachnites* Rchb.f., Gard. Chron. n.s. 2: 354. 1874 *nom. illeg. (non* Thouars 1822). TYPE: MYANMAR [as "Burmah"]. Without locality, *imp. S. Low ex W. Boxall 74* (Holotype: W-R 32355).

Callista arachnites O. Kuntze, Rev. Gen. Pl. 2: 654. 1891.

Dendrobium seidenfadenii Senghas & Bockemuhl, Orchidee (Hamb.) 29, 5, centre page pull out: 2. 1978.

Dendrobium dickasonii L.O. Williams, Bot. Mus. Leafl. Harv. Uni. 8: 107. 1940. TYPE: MYANMAR [as "Burma"]. Chin State, Falam, 1830 m, 28 April 1938, *F.G. Dickason 7779* (Holotype: AMES).

Distribution: India, Myanmar, and Thailand.

The name *D. inversum* was wrongly attributed to Hawkes (1963) in Ormerod et al. (2021 *sub D. dickasonii*), the former attributing it to Kraenzlin without any reference. Since then, we have discovered the original place of publication of *D. inversum* and find it is the earliest valid available name for this taxon which has been known in recent years as *D. seidenfadenii,* and later as *D. dickasonii*. We have chosen as lectotype of *D. inversum* a figure that shows Mr. Bradshaw's original plant. In the accompanying article by James O'Brien (1896) *D. inversum* is synonymized with *D. arachnites*.

Dendrobium lituiflorum Lindl., Gard. Chron.: 372. 1856. TYPE: WITHOUT ORIGIN. *Cult. R. Hanbury s.n.* (Syntype: K-L); *cult. J. Edwards s.n.* (Syntype: lost).

Heterotypic synonym: *Dendrobium lituiflorum* Rchb.f. var. *robustius* Rchb.f., Gard. Chron. n.s. 7: 781. 1877. TYPE: MYANMAR [as "Burmah"]. Without locality, *leg. W. Boxall, comm. Messrs. Low s.n.* (Holotype: W-R, not seen).

Distribution: India; Myanmar; China; Laos; Thailand.

Ormerod et al. (2021) overlooked the Myanmar variety *robustius* which differs in its thicker, erect stems. In our opinion this is part of the variation of the species and thus it is included in the synonymy.

Eulophia R. Br., Bot. Reg. 7: sub t. 573. 1821 *nom. et orth. cons.*

Type species: *Eulophia guineensis* Lindl. *typ. cons.*

A genus of about 240 species when treated in the broad sense of Chase et al. (2021) but it is likely authors working on the African and Madagascan floras will continue to recognise the subsumed genera *Acrolophia* Pfitz., *Cymbidiella* Rolfe, *Eulophiella* Rolfe, and *Oeceoclades* Lindl. However the genus *Geodorum* G. Jacks. is nested in core *Eulophia* (Bone et al., 2015) and unfortunately must be included in the latter despite it being easily recognisable by its nutant inflorescence. The taxonomy of the *Geodorum* group is extremely complex and it is difficult to resolve using herbarium material alone.

In Myanmar, 13 species of *Eulophia* have been recorded, to which can be added the seven species previously segregated in *Geodorum*. The correct names in *Eulophia* of the seven latter taxa are: *E. attenuata* (Griff.) M.W. Chase, P. Kumar & Schuit. (for *Geodorum attenuatum* Griff.), *E. citrina* (G. Jacks.) Ormerod & Kurzweil (for *Geodorum citrinum* G. Jacks.), *E. eulophioides* (Schltr.) M.W. Chase, P. Kumar & Schuit. (for *Geodorum eulophioides* Schltr.), *E. exigua* M.W. Chase, P. Kumar & Schuit. (for *Geodorum siamense* Rolfe ex Downie), *E. picta* (R. Br.) Ormerod (for *Geodorum densiflorum* (Lam.) Schltr.), and *E. recurva* (Roxb.) M.W. Chase, P. Kumar & Schuit. (for *Geodorum recurvum* (Roxb.) Alston, records from Myanmar and other SE Asian localities are misidentifications of taxa yet to be identified, see below).

Geodorum pulchellum Ridl. was not transferred to *Eulophia,* presumably because Watthana and Pedersen (in Pedersen et al., 2014) considered it a synonym of *Geodorum recurvum* (Roxb.) Alston. We find *G. pulchellum* to be a good species, quite distinct from *G. recurvum,* and accordingly transfer it to *Eulophia*.

Eulophia citrina (G. Jacks.) Ormerod & Kurzweil, *comb. nov.*

Basionym: *Geodorum citrinum* G. Jacks., in Andr., Bot. Repos. 10: t. 626. 1811.

TYPE: MALAYSIA. Penang Island, cult. at Stepney, *sine coll. s.n.* (Holotype: lost).

Heterotypic synonyms: *Geodorum citrinum* G. Jacks. var. *albidopurpureum* C.S.P. Parish & Rchb.f., Trans.

Linn. Soc., Bot. 30: 145. 1874. TYPE: MYANMAR. Moulmein, *C.S.P. Parish 180* (Lectotype, proposed by Clayton [2017: 77]: K; Iconotype: K).

Geodorum duperreanum Pierre ex Regnier, Rev. Hortic. (Paris) 54: 501. 1882 *syn. nov.* TYPE: VIETNAM AND CAMBODIA. Without locality, 1866, *cult. Bot. Gard. Saigon,* 1882, *cult. at Fontenay-sous-Bois, A. Regnier s.n.* (Neotype, here designated: W-R 16108, image seen; possible drawing W-R 25183, August 1887, image seen, on sheet with *"Geodorum godefroyi"*).

Eulophia duperreana (Pierre ex Regnier) M.W. Chase, P. Kumar & Schuit., Phytotaxa 491, 1: 52. 2021.

Geodorum augustii Hort., The Garden (1871–1927) 47: 455. 1897. TYPE: WITHOUT ORIGIN. Exhibited at the Royal Horticultural Society 15 June 1897, *cult. T. Lawrence s.n.* (Holotype: lost).

Geodorum citrinum G. Jacks. var. *augustii* (Hort.) Cogn., Dict. Icon. Orch. 55, 5: *Geodorum* t.1. 1901.

Distribution: Myanmar, Vietnam, Cambodia, Thailand, and Malaysia (Peninsula).

Seidenfaden (1992) treated *Geodorum duperreanum* as a synonym of *G. recurvum* (Roxb.) Alston but gave no reasons for doing so. *Geodorum duperreanum* was based on material sent by Pierre that was cultivated in the botanical garden of Saigon (now Ho Chi Minh City) to Godefroy at Fontenay-sous-Bois. Regnier worked at Godefroy's establishment. In September 1882 material of this collection was sent to Reichenbach who gave it the manuscript name *"Geodorum godeffroyi"* (W-R 25183, right hand sketch plus dissected flower). We have chosen as neotype a collection named *Geodorum duperreanum* that was sent to Reichenbach f. by Regnier, a possible sketch of this collection is dated August 1887. The protologue, along with the material in W leave no doubt *Geodorum duperreanum* is a synonym of *Eulophia citrina*. Also in W-R is a copy of a sketch from John Day's orchid albums (vol. 31: t. 27. 5 November 1882) named *"Geodorum duparreanum"*. The plant figured came from France and was sold at Steven's Salesrooms. It was said to be from Japan. The figure also represents *Eulophia citrina*. In Paris (P 00387277, image seen) there is one collection named *Geodorum duperreanum,* it is kept under the name *Geodorum recurvum* (Roxb.) Alston. This specimen was collected in Vietnam by Auguste Regnier (no. 361) and does not come from Fontenay-suis-Bois where the original *G. duperreanum* was cultivated. It is possible *Geodorum augustii* was derived from French sourced Vietnamese material or perhaps plants later collected in Vietnam by Auguste Regnier.

The name *Eulophia terrestris* (L.) M.W. Chase, P. Kumar & Schuit. has recently been used (Chase et al. 2021) as the earlier one for *Geodorum citrinum* (here transferred to *Eulophia*). This is in our view unacceptable, and it requires an expansive explanation which is detailed below.

Epidendrum terrestre L. (Syst. Nat. ed. 10: 1246. 1759) was proposed with the following diagnosis "fol. radicalibus lanceolatis nervosis membranaceis, scapo vaginato, petalis oblongis, nectario cymbiformi bifido. Rumph. amb. 6, t.52, f.1". Ormerod (1994) chose the cited figure as lectotype, aware that the protologue was based on a mixture of elements (certainly at least a *Phaius* and a *Spathoglottis).* Garay (1997) argued that Ormerod had overlooked one of the elements Linnaeus had used in describing the species, namely an herbarium specimen in LINN (No. 1062.19). Garay further argued that the "Code of Botanical Nomenclature always gives preference to existing specimens over cited illustrations" and he thus lectotypified *Epidendrum terrestre* anew with the specimen in LINN. However since the choice of Ormerod is not in conflict with the protologue (even with an overlooked element), Garay's new choice of type is superfluous. Furthermore the International Code of Nomenclature does not give any preference to specimens over cited illustrations, except in the case of fossils (Art. 8.5, Turland et al., 2018).

Chase et al. (2021) also argued that the lectotypification of the name *Epidendrum terrestre* by Ormerod (1994) was in serious conflict with protologue. They pointed out that because Linnaeus used the term "nectario cymbiformi" in the protologue then only the *Geodorum* element in LINN was in agreement with the original diagnosis. They also noted that the Linnean diagnosis "… contrary to Ormerod's assertion does not contain elements referring to a *Spathoglottis"*. However the latter assertion was made by Smith (in Merrill, 1917) and for reasons elucidated below it is still a correct statement.

Linnaeus took the epithet *terrestre* from the pre-1753 taxon *Angraecum terrestre* Rumph. The latter entity is a broad concept containing at least two species. First there is *Angraecum terrestre primum purpureum* Rumph (not illustrated by Rumph) which is believed to be *Spathoglottis plicata* Blume. The second entity is *Angraecum terrestre alterum* Rumph (illustrated Herb. Amb. 6: t. 52, f. 1. 1750), the latter once well known as *Phaius amboinensis* Blume [= *Phaius terrestris* (L.) Ormerod].

Thus there seems little doubt that Smith (in Merrill, 1917) is correct when he considers the diagnosis of *Epidendrum terrestre* to contain elements from both *Angraecum terrestre primum purpureum* and *Angraecum terrestre alterum*. Furthermore it is also evident the *Geodorum* element in LINN has been used in the diagnosis in regard to the lip ("nectario cymbiformi" but not "bifido" since the lip is entire). Looking at the descriptions of the two Rumphian taxa it seems the term "bifido" is drawn from the floral diagnosis of *Epidendrum terrestre primum purpureum* where the bilobed callus of the lip is described. In *Angreaecum terrestre alterum* the lip does not seem to be described but then Rumphius mentions one of the floral segments is shaped like a boat (i.e. cymbiform). The latter observation could just as well influenced Linnaeus as the *Geodorum* specimen before him now in LINN.

As can be seen from the above the protologue of *Epidendrum terrestre* highly likely contains three elements. There is no overwhelming case to reject the first valid lectotypification by Ormerod (1994) merely because of a single word ("cymbiformi") which on the evidence presented is not particularly diagnostic.

Eulophia pulchella (Ridl.) Ormerod & Kurzweil, *comb. nov.*

Basionym: *Geodorum pulchellum* Ridl., J. Str. Br. Roy. As. Soc. 50: 138. 1908.

TYPE: THAILAND [as "Siam"]. Bangtaphan [= Bang Saphan], 13 May 1890, *A. Keith 359* (Lectotype, here designated: K); Bangtaphan, 25 May 1890, *A. Keith 446* (Syntype: SING); Singgora [= Songkhla], fl. in Singapore Bot. Gard. April 1908, *St. V. B. Down s.n.* (Syntype: SING).

Heterotypic synonym: *Eulophia regnieri* Gagnep., Bull. Mus. Natl. Hist. Nat. (Paris) s.2, 4: 712. 1932. TYPE: VIETNAM [as "Cochinchina"]. Cai-Cong, April 1883, *A. Regnier s.n.* (Lectotype, here designated: P 00152036; Isolectotypes: P 00152037, P 00152038).

Distribution: India, Myanmar, China, Thailand, and Vietnam.

Additional specimens examined: INDIA. Manipur, Naga Hills, Kachni, 1600 m, 3 June 1948, *S.K. Mukerjee 2949* (CAL, image seen). CHINA. Yunnan, between Likiang, Youngning, and Youngpei, en route to Mili (SW Szechuan), May/June 1922, *J.F. Rock 5067* (AMES).

Watthana and Pedersen (in Pedersen et al., 2014) considered this species a synonym of *Geodorum recurvum* but the latter taxon is a rare entity confined to peninsular India and Sri Lanka with less densely arranged flowers, larger flowers (sepals 16–24 mm vs 10–16 mm long), a differently colored labellum (white with a broad subapical transverse pink to purple band, inner part of lip broadly yellow vs. white with an apical yellow section, inner part with a central purple area) that is broadly elliptic without a narrowed upper part (vs. broadly elliptic in lower two thirds, with a narrower subquadrate upper part or "epichile").

Unfortunately, Seidenfaden (1983) applied the name *Geodorum recurvum* to a variety of southeast Asian *Geodorum* specimens that bear no resemblance to the original plant from south India. The only modern report of *G. recurvum* was made by Prasad and Prasad Rao (2010) from the Nallamalai Hills, an area northeast of Madras and not far from Roxburgh's type locality (the rather broad "Coromandel Coast").

Ormerod et al. (2021) listed *Geodorum pulchellum* from India, from where it has not been previously found. Our record is based on the above cited specimen that was discovered in CAL by Sathish Kumar. The Chinese specimen listed above is of interest because Joseph Rock says the flowers are pale pink (rather than with white tepals, with a white lip that is apically yellow, the inner part of which with a central purple area). Examination of the flowers revealed no differences in size or shape.

Holcosia J.M.H. Shaw, Orch. Review Suppl., 111, 1252: 59. 2003.

Holcosia is a hybrid genus originally proposed for artificial crosses between the genera *Holcoglossum* Schltr. and *Luisia* Gaud. It has not been reported to occur in nature, however two entities described from Taiwan that were previously assigned to the genera *Vanda* R. Br. and *Papilionanthe* Schltr. are here suggested to be the first naturally occurring members.

Holcosia pseudotaiwaniana (T.C. Hsu) Ormerod & Kurzweil, *comb. nov.*

Basionym: *Papilionanthe pseudotaiwaniana* T.C. Hsu, Illustr. Fl. Taiwan 2: 157. 2016.

TYPE: TAIWAN. Hengchun, 21 April 2010, *W.M. Lin s.n.* (Holotype: TAI, not seen).

Distribution: Taiwan.

This taxon is quite similar to *H. taiwaniana* but the epichile has a distinct cuneate claw and lanceolate, acute lobules. One parent appears to be *Holcoglossum quasipinifolium* (Hayata) Schltr., whilst the other is likely either *Luisia megasepala* Hayata or *L. teres* (Thunb. ex J.A. Murray) Blume.

Holcosia taiwaniana (S.S. Ying) Ormerod & Kurzweil, *comb. nov.*

Basionym: *Vanda taiwaniana* S.S. Ying, Mem. Coll. Agric. Natl. Taiwan Uni. 29, 2: 65. 1989.

TYPE: TAIWAN. Pingtung, Schetzouchi to Shihmen, near Hungchan, 26 December 1987, *S.S. Ying s.n.* (Holotype: NTUF, not seen).

Homotypic synonyms: *Papilionanthe taiwaniana* (S.S. Ying) Ormerod, Taiwania 47, 4: 242. 2002.
Papilisia taiwaniana (S.S. Ying) J.M.H. Shaw, Orch. Review Suppl., 112, 1257: 47. 2004.

Distribution: Taiwan.

This entity does deceptively resemble *Papilionanthe teres* (Roxb.) Schltr. but the floral features are just a coincidence caused by the hybridisation of *Holcoglossum quasipinifolium* and either *Luisia megasepala* or *L. teres*.

Mengzia W.C. Huang, Z.J. Liu & C. Hu, Molec. Phylogen. Evol. 167, 107362: 7. 2021.

Type species: *Pogonia foliosa* King & Pantl.

A genus of a single species belonging to subtribe Arethusinae, distinguished from *Bletilla* Rchb.f. (subtribe Coelogyninae) by its lateral (vs. terminal) inflorescence, and flowers with four (not eight) pollinia. Its validity was confirmed through molecular studies by Huang et al. (2021).

Mengzia foliosa (King & Pantl.) W.C. Huang, Z.J. Liu & C. Hu, Molec. Phylogen. Evol. 167, 107362: 7. 2021. TYPE: MYANMAR [as "Upper Burma"]. Shan State, Fort Stedman [= Nyaungshwe], 1893, *Abdul Khalil s.n.* (Holotype: CAL).

Basionym: *Pogonia foliosa* King & Pantl., J. Asiat. Soc. Bengal 2, 66: 598. 1897.

Homotypic synonym: *Bletilla foliosa* (King & Pantl.) T. Tang & F.T. Wang, Acta Phytotax. Sin. 1, 1: 68. 1951.

Distribution: China; Myanmar; Thailand.

Later described as *Arethusa sinensis* Rolfe from China (see e.g. Ormerod et al. 2021 for synonymy).

Phalaenopsis Blume, Bijdr.: 294. 1825.

Type species: *Epidendrum amabile* L.

A genus of Aeridinae with 65–70 species in the broad sense. It is very popular in horticulture and thus many of the species are under threat in the wild from collecting for culture and sale. Since our paper on the orchids of Myanmar was published (Ormerod et al., 2021) one new species has been added to the flora, and it is also necessary to correct one of the names we used.

Phalaenopsis marriottiana (Rchb.f.) Kocyan & Schuit., Phytotaxa 161, 1: 67. 2014.

Basionym: *Vanda parishii* Rchb.f. var. *marriottiana* Rchb.f., Gard. Chron. n.s. 13: 743. 1880. TYPE: WITHOUT ORIGIN [later said to be Myanmar. Mandalay]. *leg. W. Boxall, imp. Messrs. Low, cult. W. Marriott s.n.* (Holotype: W-R 37132).

Heterotypic synonyms: *Vanda parishii* Rchb.f., Xenia Orch. 2: 138. 1868. TYPE: WITHOUT ORIGIN [from "*Herrn Parish*"]. MYANMAR. Tenasserim, Moulmein District, Ta-Ok [as Te-Ok], 1864, *C.S.P. Parish 178* (Lectotype, proposed by Clayton [2017: 86]: K; Isolectotype: W-R 26296).

Phalaenopsis hygrochila J.M.H. Shaw, Orch. Review 123, 1309 (Suppl.): 23. 2015.

Phalaenopsis marriottiana (Rchb.f.) Kocyan & Schuit. var. *parishii* (Rchb.f.) Kocyan & Schuit. ex Clayton, Charles Parish–Pl. Hunt. Bot. Art.: 86. 2017.

Not *Phalaenopsis parishii* Rchb.f. 1865.

Distribution: India; China; Myanmar; Thailand; Laos; Vietnam.

Ormerod et al. (2021, where full synonymy is given) when treating this entity in the broad sense wrongly used the later name *P. hygrochila* J.M.H. Shaw. We also overlooked that Clayton (2017) inadvertently validated the combination *P. marriottiana* var. *parishii*. The first correct available name in *Phalaenopsis* is *P. marriottiana*. On the type sheet of *Vanda parishii* there is a note by Parish that says the flowers smell like elecampane (= *Inula helenium* L.), a member of the daisy family.

Phalaenopsis putaoensis X.H. Jin & H.A. Mung, Phytotaxa 484, 2: 244. 2021.

TYPE: MYANMAR. Kachin State, Putao Township, 500 m, 7 June 2016, *X.H. Jin et al. PT-2020* (Holotype: PE, not seen).

Distribution: Myanmar.

This distinctive new species was compared in its protologue with *P. honghenensis* F.Y. Liu and *P. wilsonii* Rolfe, both members of section *Aphyllae* H.R. Sweet. However the broadly rhombic lip which has two high keels, and broadly laminate basal callus strongly indicates *P. putaoensis* belongs in section *Parishianae* H.R. Sweet. Its closest ally appears to be *P. lobbii* (Rchb.f.) H.R. Sweet which has a similar lip but with smaller, more basal keels.

Phreatia Lindl., Gen. Sp. Orch. Pl.: 63. 1830.

Type species: *Phreatia elegans* Lindl.

A genus of Thelasinae with about 212 species spread from Sri Lanka and India to Tahiti. The plants are mostly epiphytes, either with stems (very short to elongate) or pseudobulbs. The flowers are quite small (sepals usually less than 2.5 mm long) and often in shades of white, less commonly yellowish green. The three species treated below have been placed in *Octarrhena* Thwaites but do not belong in that genus because their flowers possess a distinct column foot and the lip is relatively larger and trilobulate (vs. smaller, cymbiform to elliptic). These three Vietnamese species belong to *Phreatia* section *Rhizophyllum* (Blume) J.J. Sm., a group characterized by having very short stems in which the leaf sheaths overlap each other.

Phreatia emarginata (Aver., B.V. Truong & V.C. Nguyen) Ormerod & B.V. Truong, *comb. nov.*

Basionym: *Octarrhena emarginata* Aver., B.V. Truong & V.C. Nguyen, Phytotaxa 459, 4: 273. 2020.

TYPE: VIETNAM. Lam Dong Prov., Lam Ha Distr., 1000 m, *leg. Ngo Quang Dang s.n.,* fl. in cult. 28 October 2019, *L.V. Averyanov, N.V. Canh & T.V. Maisak AL 1216* (Holotype: LE, image seen).

Distribution: Vietnam.

Phreatia minuscula (Aver. & N.V. Duy) Ormerod & B.V. Truong, *comb. nov.*

Basionym: *Octarrhena minuscula* Aver. & N.V. Duy, Wulfenia 22: 174. 2015.

TYPE: VIETNAM. Dak Nong Prov., Dak Song Distr., 5 December 2014, *N.V. Canh, Q.V. Hoi, L.V. Averyanov, N.V. Duy & N.T. Hiep CPC 7694* (Holotype: LE, image seen).

Distribution: Vietnam.

Phreatia perpusilla (Aver. & Eskov) Ormerod & B.V. Truong, *comb. nov.*

Basionym: *Octarrhena perpusilla* Aver. & Eskov, Phytotaxa 459, 4: 267. 2020.

TYPE: VIETNAM. Lam Dong Prov., Lac Duong Distr., Bidoup National Park, near Giang Ly Forest Station, 1544 m, 15 November 2018, *A.K. Eskov & N.G. Prilepsky AL 491* (Holotype: LE, image seen).

Distribution: Vietnam.

Sarcoglyphis Garay, Bot. Mus. Leafl. Harv. Uni. 23, 4: 200. 1972.

Type species: *Sarcanthus mirabilis* Rchb.f.

A genus of Aeridinae with about 14 species distributed from India to Java. Their flowers bear a strong structural resemblance to the allied genus *Cleisostoma* Blume but differ in details of the column, which has a rostellum that has a humped base, and a pollinarium with a tiny viscidium, linear stipes, and four ellipsoid pollinia.

Sarcoglyphis parishii (W.J. Hook.) A.N. Rao, Pleione 14, 2: 349. 2020.

Basionym: *Sarcanthus parishii* W.J. Hook., Curtis's Bot. Mag. 86: t. 5217. 1860. TYPE: MYANMAR [as "Burma"]. Tenasserim, Moulmein, *leg. C.S.P. Parish,* fl. in cult. August 1860, *cult. Messrs. H. Low s.n.* (Holotype: lost). Lectotype, here designated: t. 5217, in Curtis's Bot. Mag. 86. 1860. Fig. 4.

Homotypic synonym: *Cleisostoma parishii* (W.J. Hook.) Garay, Bot. Mus. Leafl. Harv. Uni. 23, 4: 173. 1972.

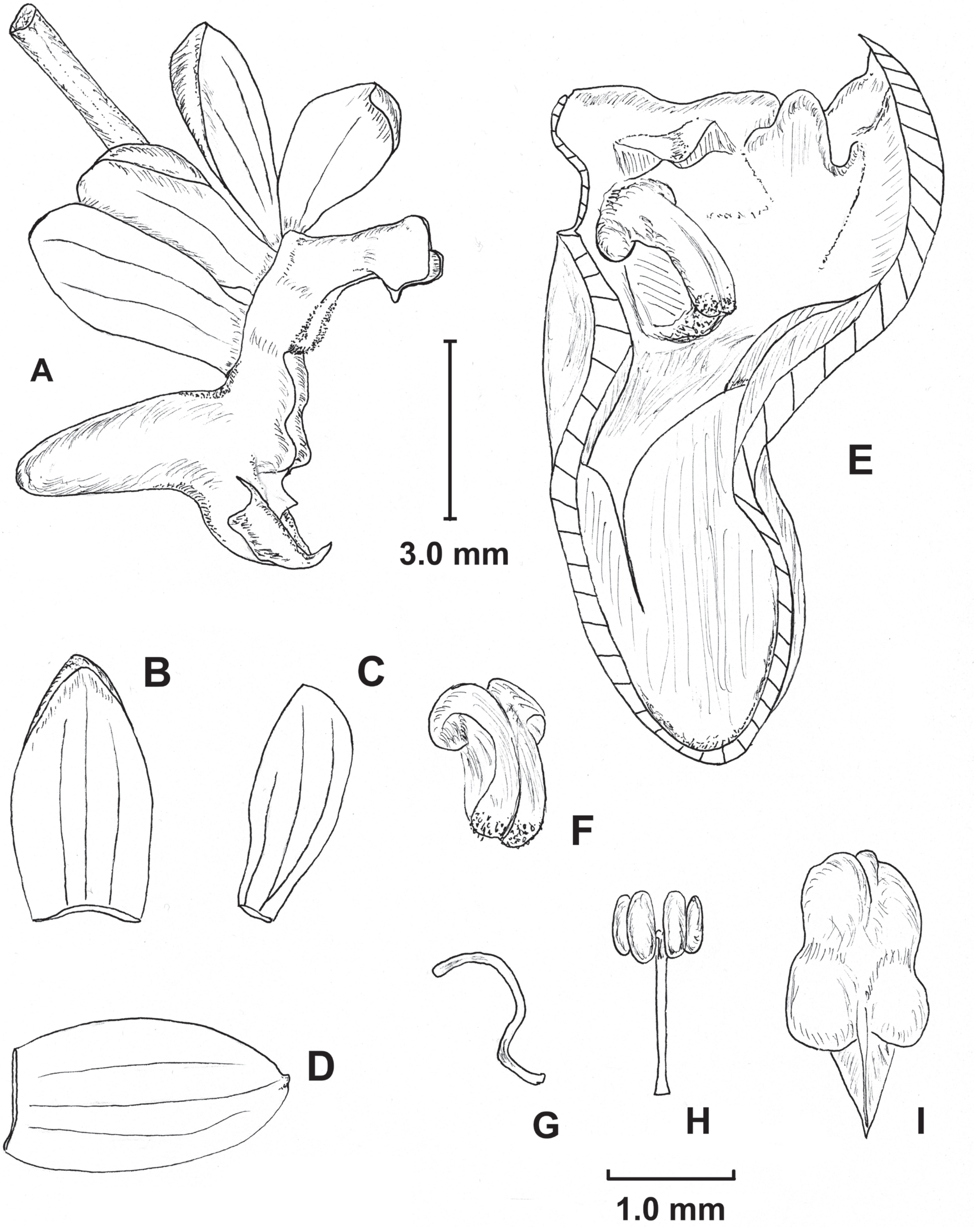

FIGURE 4. *Sarcoglyphis parishii* (W.J. Hook.) A.N. Rao. **A**, flower; **B**, dorsal sepal; **C**, petal; **D**, lateral sepal; **E**, labellum (longitudinal section); **F**, backwall callus of labellum; **G**, stipes of pollinarium (lateral view); **H**, pollinarium (no scale); **I**, anther cap. Drawn from *S. K. Lau 26693* (AMES).

Heterotypic synonyms: *Cleisostoma melanorachis* Aver. & Averyanova, Komarovia 4: 8. 2006 *syn. nov.* TYPE: VIETNAM. Cao Bang Prov., Tra Linh District, Quoc Toan Municipality, vicinity of Thang Heng and Lung Tao Villages near Thang Heng Lake, 500–650 m, 25–27 May 1997, *L.V. Averyanov & Nguyen Tien Hiep VH 4860* (Holotype: HN, not seen; Isotype: LE, image seen).

Sarcoglyphis manipurensis A.N. Rao, Vik. Kumar & H.B. Sharma, Nord. J. Bot. 34: 191. 2016. TYPE: INDIA. Manipur, Chandel District, Songpiyang Hills, 420 m, 25 May 2014, *H.B. Sharma 596* (Holotype: CAL, not seen; Isotype: COGCEHR, not seen).

Distribution: India; Myanmar; Laos; Vietnam; China.

Specimens examined: CHINA. Hainan, Bak Sa, 9 May 1936, *S.K. Lau 26693* (AMES); Tam District, N of Chung Kum, Hung Mo Mountain, 20 July 1929, *W.T. Tsang & Fung (532) 18066* (AMES).

Rao (2020) agreed his *Sarcoglyphis manipurensis* was conspecific with *Cleisostoma parishii* but pointed out the older taxon should therefore be transferred to *Sarcoglyphis,* which he did. While the Indian and Myanmarese plants have two reddish-brown stripes on the sepals and petals, those plants from China, Laos and Vietnam have pale whitish to pale purplish sepals and petals without stripes. *Cleisostoma melanorachis* would appear at first to differ in its long-peduncled inflorescence, and smaller anther cap, but later collections and photographs on the LE website show that the peduncle length varies from short to long, and that the anther cap was larger than first depicted. Furthermore, critical characters of the flowers such as midlobe shape and backwall callus shape and ornamentation do not differ either. We therefore have no hesitation in reducing *Cleisostoma melanorachis* to *Sarcoglyphis parishii*.

We (Ormerod et al., 2021) cited *Parish 27* as holotype of *Sarcanthus parishii* but this is not correct. The species was based on a collection sent by Parish, that was cultivated in England by Messrs. H. Low & Co. This collection does not appear to survive, so we have chosen the plate in Curtis's Botanical Magazine as lectotype. In June 1861 another collection flowered at Kew from presumably the same source (K 000942286, image seen). The latter was cited as holotype by Clayton (2017) but it postdates the protologue, so it cannot be the holotype.

Vanda W. Jones ex R. Br., Bot. Reg. 6: t. 506. 1820.
Type species: *Vanda roxburghii* R. Br.

A genus of Aeridinae with about 85 species in the broad sense, distributed from Sri Lanka and India to New Guinea and northeast Australia. It is quite popular in horticulture and many of the wild populations are under collecting pressure. In Ormerod et al. (2021) we treated *Vanda parviflora* var. *albiflora* in the synonymy of *V. testacea* (Lindl.) Rchb.f., but it correctly belongs in the synonymy of *V. lilacina* as Seidenfaden (1988) had it.

Recently Motes (2021) published a popular monograph of the genus in which he added two species to flora of Myanmar, namely *V. bicolor* Griff. and *V. coelestis* (Rchb.f.) Motes (formerly well known as *Rhynchostylis coelestis* (Rchb.f.) A.H. Kent). We have not seen vouchers for these records. He also extended the distribution of *V. longitepala* D.L. Roberts, L.M. Gardiner & Motes from Myanmar to India.

Vanda hennisiana Ormerod & Kurzweil, *nom. nov.*
Basionym: *Vanda petersiana* Schltr., Notizbl. Bot. Gart. Berlin-Dahlem 7: 280. 1918 *nom. illeg., non V. peetersiana* (Cogn.) Andre 1898.
TYPE: MYANMAR. Without locality, fl. in cult. June 1915, *W. Hennis s.n.* (Holotype: B, destroyed). Lectotype, here designated: Fig. 295, Taf. 74 in Schlechter (1934).
Usage synonym: *Vanda bensonii auct. non* Bateman, Nyan Tun, Wild Orch. Myanmar: 441, upper photo. 2014.

Distribution: Myanmar.

Etymology: Named after Wilhelm Hennis (1856–1943), German horticulturalist who first imported and flowered this taxon.

We have had to coin a new name for this entity due to the prior existence of the very similar binomial *Vanda peetersiana* (Cogn.) Andre (Andre, 1898). The latter name was based on *Vanda coerulea* Griff. ex Lindl. var. *peetersiana* Cogn. (Cogniaux 1897a), a supposed form of *V. coerulea* that was said to be imported from the Khasia Hills in India. It was illustrated in Cogniaux (1897b) and seems to be a natural hybrid involving *V. coerulea,* and perhaps *V. coerulescens*. Rolfe (1913) suspected its origin might be Myanmar and that *Vanda coerulea* var. *peetersiana* could be a backcrossed hybrid of the endemic Myanmar natural hybrid *V. charlesworthii* Rolfe (*V. bensonii* Bateman × *V. coerulea* Griff. ex Lindl.). However this origin seems unlikely since the pandurate, apically bilobed lip is not apparent. It is possible the unlocalised *V. coerulea* var. *sanderae* H.J. Veitch (Gard. Chron. s. 3, 48: 398. 1910) is a later synonym of *V. peetersiana* since it has the same coloring (white flowers with magenta edging and suffusion on the tepals and a deep magenta-pink lip). We (Ormerod et al. 2021) did not investigate the complicated issues surrounding a number of supposed varieties of *V. coerulea* that are likely of hybrid origin and that were usually published without the importation locality, illustrations, or any preserved material. Rolfe (1911) suggested that the Shan States area in Myanmar could be the source area for these hybrids due to the number of different *Vanda* species (some of which are now placed in *Holcoglossum* Schltr.) imported from there.

Vanda hennisiana is quite rare and seems to have been found only once later (see usage synonym above). Its floral characters seem to be intermediate between *V. bensonii* Bateman and *V. cristata* Lindl., whilst the plant and tall, lax inflorescence resemble *V. bensonii*. Also, it is worth repeating that the specimen in Munich (*Doring 5578,* image seen) treated by Seidenfaden (1988) as an isotype is a later collection of a different plant differing in details of the labellum (such as triangular sidelobes and broader ligulate epichile lobules vs. circular sidelobes and linear-lanceolate epichile lobules). For this reason, we have chosen the published drawing of Schlechter as lectotype.

Vanda lilacina Teijsm. & Binn., Nat. Tijdschr. Ned. Ind. 24: 325. 1862. TYPE: THAILAND. Near Ratburi, *J.E. Teijsmann s.n*. (Holotype: lost).

Heterotypic synonym: *Vanda testacea* (Lindl.) Rchb.f. var. *parviflora* J.D. Hook., Fl. Brit. Ind. 6: 50. 1890.

TYPE: MYANMAR. Tenasserim, Moulmein, 29 January 1870, *icon C.S.P. Parish 22* (Lectotype, here designated: K, image seen).

Distribution: Myanmar; Thailand; Laos; Cambodia; Vietnam.

Seidenfaden (1988) correctly reduced *V. testacea* var. *albiflora* to *V. lilacina*. We have been unable to add any other records of the species to the flora of Myanmar. Parish's original drawing that was the basis of *Vanda testacea* var. *albiflora* is reproduced in Clayton (2017).

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FOREST DIVERSITY OF THE CUMARIBO REGION (VICHADA DEPARTMENT) IN THE TRANSITION ZONE BETWEEN THE AMAZONIA AND THE ORINOQUIA OF COLOMBIA

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Abstract. Forest vegetation (flooded, semi-flooded, and non-flooded or "terra firme") of the Cumaribo region was characterized using data from 29 plots. This sector is located in municipality at the Vichada department, and in adjacent areas of the Guainía and Guaviare departments, Colombia. In 1000 m^2 plots, all individuals with a diameter (DAP) > 10 cm were measured, the basal area (m^2), relative abundance (%), and relative dominance (%) were calculated. The latter values helped to estimate the "reduced" importance value index (IVI).The Sigmatist school guidelines were used to classify the forests. According to floristic composition, patterns of structure, and spatial distribution of the species, forests were grouped in class *Brosimo lactescentis-Eschweileretea subglandulosae* with an estimated basal area of 165.7 m^2 in 10,579 individuals belonging to 685 species. In Mabeo nitidae-Mespilodaphnetalia cymbari forests (14 plots, 14000 m^2 of sampled area), the basal area value of 101.9 m^2 was estimated at 4770 individuals in 348 species, and the *Duguetio quitarensis-Amphirrhocion longifoliae* alliance covered 55.94 m^2 at 1901 individuals of 192 species. The association *Vitici compressae-Attaleetum butyraceae* presented the highest value of dominance index (basal area/sampling area) with 1.2%. In the alliance *Virolo surinamensis-Mespilodaphnion cymbari,* the basal area was 21.9 m^2 with 1461 individuals in 138 species. The association *Aspidospermo desmanthi-Mespilodaphnetum cymbari* presented a basal area of 24.4 m^2 with 1408 individuals and 211 species. In *Phenakospermo guyannenses-Minquartietalia guianensis* forests (13 plots, 13000 m^2) basal area was 63.8 m^2 in 5809 individuals and 486 species. These values were provided by the alliance *Attaleo maripoae-Iryantherion laevis* with its five associations, where the palm association *Attaleo maripae-Euterpetum precatoriae* showed the highest richness value index with 6.3%. The *Micropholio venulosae-Eschweileretum bracteosae* forests presented the highest density index with a 0.6 number of individuals/ sampling area. The present study grouped forest vegetation into one class, two orders, 2 alliances, and 10 associations. These results represent the first proposal of a phytosociological classification of the forests located in the transition region of the Orinoquia and the Colombian Amazon.

Keywords: Tropical forests, phytosociology, floristic composition, structural aspects, Orinoquia-Amazonia.

Resumen. Se utilizó la información de 29 levantamientos (parcelas) para caracterizar los bosques (inundables, semi-inundables y no inundables o de "tierra firme") en la región de Cumaribo, departamento del Vichada, y en localidades adyacentes de los departamentos del Guainía y Guaviare, Colombia. En parcelas de 1.000 m^2 se midieron todos los individuos con un diámetro a la altura del pecho (DAP) > 10 cm, y se calculó el área basal (m^2), abundancia relativa (%), dominancia relativa (%), con estos valores se estimo el indice de valor de importancia "reducido" (IVI). En la clasificación de la vegetación, se siguieron los lineamientos de la escuela sigmatista. De acuerdo con la composición florística, los bosques se agruparon en la clase *Brosimo lactescentis-Eschweileretea subglandulosae*, con un área basal estimada de 165,7 m^2, en 10.579 individuos pertenecientes a 685 especies y en el orden *Mabeo nitidae-Mespilodaphnetalia cymbari* (14 parcelas, 14000 m^2 de superficie muestreada) con un área basal de 101,9 m^2 en 4.770 individuos en 348 especies. En la clasificación fitosociológica, figura la alianza *Dugetio quitarensis-Amphirrhocion longifoliae* con 55,94 m^2, 1901 individuos en 192 especies, con varios tipos de bosques y el palmar mixto *Vitici compressae-Attaleetum butyraceae*, el cual tuvo el valor mayor de índice de dominancia (área basal/área de muestreo, 1.2%). En la alianza *Virolo surinamensis-Mespilodaphnion cymbari*, el área basal es de 21,9 m^2 para 1461 individuos en 138 especies. En los bosques de la asociación *Aspidospermo desmanthii-Mespilodaphnetum cymbari* se encontró un área basal de 24,4 m^2 de 1408 individuos y 211 especies. En los bosques del orden *Phenakospermo guyannenses- Minquartetlia guianenesis* (13 parcelas, 13000 m^2 de superficie muestreada), el área basal fue de 63,8 m^2 en 5809 individuos y 486 especies. Estos valores los aportó la alianza *Attaleo maripae-Iryantherion laevis* con sus cinco asociaciones, de las cuales el palmar de *Attaleo maripae-Euterpetum precatoriae* mostró el mayor valor de índice de riqueza (6.3%). Los bosques de *Micropholio venulosae-Eschweileretum bracteosae* presentaron el mayor valor del índice de densidad (número de individuos/área de muestreo, 0.6%). En el presente estudio, la vegetación se agrupó en una clase, dos órdenes, 2 alianzas y 10 asociaciones, resultados que representan la primera propuesta de clasificación fitosociológica de la vegetación boscosa en la región de transición entre la Orinoquia y la Amazonia de Colombia.

Palabras clave: Bosques tropicales, fitosociología, composición florística, aspectos de la estructura, Orinoquía-Amazonia.

The Orinoco region of Colombia is divided into four physiographic units, accordingly to their physical and biotic components and named as foothills or "piedemonte", alluvial plain, highplains, and Macarena Mountain range (FAO, 1965; Goosen, 1971; Rangel-Ch. et al., 1995, Rangel and Minorta, 2014). This region is also known as the Colombian Eastern Plains or the Colombian Orinoquia (van der Hammen and Rangel, 1997; Rangel-Ch., 2014). The southwestern boundary

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of the Colombian plains that contacts the northwestern Amazon region is defined by a wide mosaic of forests, shrublands and grasslands commonly grouped under the term “savannah” in the basins of the Vichada, Matavén, and Guaviare rivers as well their main tributary, the Inírida River (Aymard et al., 2021). This transition region, between the Colombian Orinoquia and the northwestern macrothermal humid forests of the Colombian Amazon basin is determined by different physiographic, climatic, and edaphological variables (Jaramillo and Rangel, 2014).

In this area, the climatic/edaphological frontier is determined in great measure by the influence of the northeast and southeast trade winds, and the soils derived from the residual parent materials of the Guiana Shield and the alluvial plains respectively (Cortés-Lombana, 1981). The northeast trade winds are characterized by their thermal inversion, entering the Venezuelan coast in a north-south direction towards the plains through the Unare river basin. These winds circulate freely, accelerating during the strongest part of the dry season (which increases their drying power) due to low pressures originating in the plains (Andressen, 2003). Both variables determine the vegetation response to water availability and soil types. Such is the case of the dry savannas of the Vichada plains in Colombia and the lower stature forests, mixed with hawthorns and “cardonales” from the central and eastern plains in Venezuela llanos. These communities are characterized by the presence of numerous deciduous species of Capparaceae, Euphorbiaceae, Fabaceae, and Zygophyllaceae families (Aymard et al., 2021). However, south of the Guaviare, Guainía and Inírida basins, towards the equatorial zone (2°N, 2°S), there is a sector of warming and humid air melting from the north and south latitudes of the equator.

This region is strongly influenced by a low-pressure center known as the intertropical front or the intertropical convergence zone (ITCZ; Richards et al., 2015). Here, annual rainfall increases towards the northwest part of the Amazon basin, due to the north and south trade winds that merge from both latitudes from May to September. The movement of the Intertropical Convergence Zone (ITCZ) rain belt produces seasonal drought and increased rainfall variability along the southern and eastern Amazon rim (Garreaud et al., 2009). Therefore, increasing rainfall in equatorial countries represents an atmospheric phenomenon that largely allows the permanence of equatorial rainforests.

The Amazon basin harbors a noteworthy variation in floristic composition and forest structure, even at local and regional scales and environmental gradients (Prance, 2001; Valencia et al., 2005; Stropp et al., 2009). According to numerous studies, such variation and geographic gradients are substantially correlated with geomorphology, soils, geology, drainage, water types, and climate (Pitman et al., 2008; Aymard et al., 2009; Schargel and Marvez, 2009; Quesada et al., 2011, 2012; Wittmann et al., 2017; Figueiredo et al., 2017; Toumisto et al., 2019; Hofhansl et al., 2020; Ríos-Villamizar et al., 2020; Lehtonen et al., 2021).

The classification of vegetation in the basin have been proposed according to geological units and geomorphology, based on climate conditions such as precipitation amounts (Hilker et al., 2014) and average temperature values, and the flow regime that periodically waterlogged habitats associated with rivers and their influence on the land (Carvajal et al., 1979; Prance 1979; Luize et al., 2018). A study aimed to regionalize the Amazon tree flora identified 13 subregions inside the basin through the 5081 indicator taxa (Silva-Souza and Souza, 2020).

Recently, Oliveira-Filho et al. (2021), using data for virtually all known tree species in the Amazon (8,224) distributed across 1.584 sites, applied ordination analyses and multiple regressions to test the floristic differentiation among Amazonian vegetation types. They found that the traditional classification of Amazonian vegetation (i.e., Caatinga Amazonica, Igapó, Terra Firme, Várzea) are consistent with quantitative patterns of tree species composition.

However, most studies on ecology and distribution of the Amazon flora still lack several physiognomy aspects (i.e., high or low forests) and drained substrate conditions (flooded forests, terrace forests, terra firme forests). These exercises *hardly* lead to a comprehensive understanding of the relationships between vegetation and abiotic components (Duivenvoorden and Lips, 1993). The regional forest matrix was assumed as uniform with few variations in their floristic patterns. Nevertheless, the vegetation ecological classifications or ordinations based on species and their expressions of dominance and abundance were rarely used to detect changes in floristic composition. Towards the end of last century, classifications based on floristic composition with a hierarchical approach appeared, like Urrego’s (1992, 1997) on the phytosociology of palm groves and mixed floodplain forests in the middle basin of the Caquetá River and Duivenvoorden and Lips’s (1993), based on dominance. Cantillo and Rangel (2011) also presented the phytosociological characterization of the Amazon trapezium (Leticia) forests. Duque et al. (2003), Rudas and Prieto (2005), and Cárdenas and Giraldo (1997) partially referred to aspects of forest dominance and variability without considering the hierarchical phytosociological classification.

This contributions show new results on forest diversity (floristic composition and aspects of structure-architecture) in a geographical transition zone in the east of Colombia as a case study. These results promote a methodological approach that highlights the characteristics of the regional plant richness (flora and vegetation) and constitute an adequate tool for management and conservation plans of very high expression of biological richness.

Study Area

The study area is placed in the alluvial plain inside the great high plains in the Orinoquia bioregion, in localities very close to the northern limits of the Amazon region, over Tertiary alluvial plains, at a 100–200 m altitude. According to data recorded during the rainfall seasons, the climatic regime corresponds to super-humid. Rainfall amounts range from 1564 to 3100 mm/year. The rainfall distribution is unimodal-bi-seasonal, with rainfall predominating between April–May and September–October, a period in which more than 80.5% of the annual precipitation originates. The humidity gradient goes from humid sites (to the south) with higher precipitation amounts, reaches the highest values in the middle band (4°29'N, 4°57'N), and decreases towards the north, reaching the lowest values in the band in between (5°40'N, 6°10'N). The monthly averages (multi-year) of mean, minimum, and maximum temperature are 26.6°C, 22.5°C, and 30.7°C, respectively. Climate types according to Thornthwaite range from B4RA' very humid to B2RA' moderately humid, with very little or no water deficiency (Minorta-Cely and Rangel-Ch., 2014).

The predominant soil orders are Inceptisols, Oxisols and Entisols, Ultisols and Spodosols. The most frequently found groups are Fluventic Dystrudepts (Inceptisol), Typic acrudox (Oxisol), Typic Kandiudults (Ultisol), and Typic Quartzipsamments (Entisol). The pH values fluctuate between 3.9 (extremely acidic) and 6 (medium acidic). The contents of calcium, magnesium, and potassium, as well as those of total bases, are low. Organic carbon values (%) are predominantly low (<1.2 %, 47 %), but high (>2.3 %) and medium (1.2–2.3 %) values are well represented in Typic Quartzipsamments (Entisol), Fluvaquentic Humaquepts (Inceptisol), and Typic Kandiudults (Ultisol) soils. Phosphorus contents are very low. Aluminum contents and saturation are high. In some places, nitrogen has high values (>0.20 %), though low values predominate (Rangel et al., 2019).

This sector of the Guaviare River alluvial plain has different dissection degrees, where forest vegetation prevails over scrublands and pastures. Areas of permanent and semi-permanent swamps are also frequent (Minorta-Cely et al., 2020b). The landscape of the study area has slopes between 3° and 8° and is dominated by terraces of various dissection degrees of fluvial-lacustrine origin, overflow plains, and areas of poor drainage, on which there are large swamp areas distributed in parallel to the interfluves that drain the Guaviare and Inirida rivers (Minorta-Cely et al., 2020b). Along the banks and recent alluvium (river valleys), soils vary from moderately to well-drained with moderately coarse to fine textures, and large contribution of sands and clays. Large extensions of forest formations and mixed palm communities are distributed along the great alluvial plain of the Guaviare River and its tributaries. Also, wider belts of scrub and semi-permanent swamps are found between the peneplains and the river alluvial plains. These communities connect with the riparian forests through the meanders along the banks of the large riverbeds ("madreviejas") during the rainy season. There are also some dense "terra firme" forests located at the base of the lower hills ("lomeríos") surrounding the higher terraces (Minorta-Cely et al., 2020b; Aymard et al., 2021).

Methodology

The study area is represented by 29 localities, placed in the middle and lower basin of the Guaviare river, southeast of San José del Guaviare, on the transition between the eastern plains and the Amazon plains of Colombia (Fig. 1, Table 1). Table 1 presents information on the geographic location of the 1000 m^2 (100 × 10 m) vegetation surveys (plots, *relevés*). These were established in areas (flooded, semi-flooded, and non-flooded) in the Guainía, Guaviare, and Vichada departments, respectively. The individuals' census (direct count) and the cover and abundance or density estimation were carried out stratum by stratum according to Rangel and Lozano (1986). The cover was estimated by the projection of the individual canopy on the ground (initial calculation in m^2), then transformed into % (Cleef et al., 1984). The number of individuals with a diameter at chest height, DBH > 10 cm per stratum is a real figure over the inventoried area. Botanical samples were processed and determined in the Colombian National Herbarium (COL), where the *exsiccatae* were deposited under the numbering of Vladimir Minorta-Cely et al. The basic catalog of flora from the study area was published in Minorta-Cely et al. (2020a). The species names and nomenclatural validity were revised and updated by consulting the website Tropicos (http://legacy.tropicos.org/Home.aspx) and the International Plant Names Index (https://www.ipni.org/). The syntaxonomy names follow the International Code of Phytosociological Nomenclature rules (Izco and Del Arco, 2003; Theurillat et al., 2021). Characterization of the vegetation follows Avella-M. and Rangel-Ch. (2012), Rangel-Ch. (2012), and Rangel-Ch. and Minorta-Cely (2014). These authors combined classification approaches from the European Sigmatist School (Braun-Blanquet, 1979), and the Anglo-Saxon forest schools method based on dominance and other structure parameters (Curtis and McIntosh, 1950; Curtis and Cottam, 1962). Based on floristic composition information, vegetation hierarchical classification was carried out by using the TWINSPAN algorithm (the two-way divisive technique: plots, species with indicator species) with the PC-ORD version 6 program (McCune and Mefford, 2011). This previous classification detected the tendency to assemble the vegetation into classes, orders, alliances, and associations as well. These preliminary tables were manually processed to obtain a classification of communities or associations defined in their floristic composition and contrasted with field observations. The coverage value (%) was used as a variable, although a species can be represented by individuals in different strata, in the final table, it only appears on one occasion with the highest value that it reached in any defined strata. Characterization of aspects of the vegetation structure (according to the height of individuals) and the types of habit or growth forms (tree, sapling, shrub, herb, liana, and liana creeper) follow the recommendations of Rangel-Ch. and Lozano (1986). Each unit was described according to its floristic composition, focusing on species with the highest values in cover, and structural variables such as frequency, basal area, and the number of individuals (Avella and Rangel-Ch., 2012).

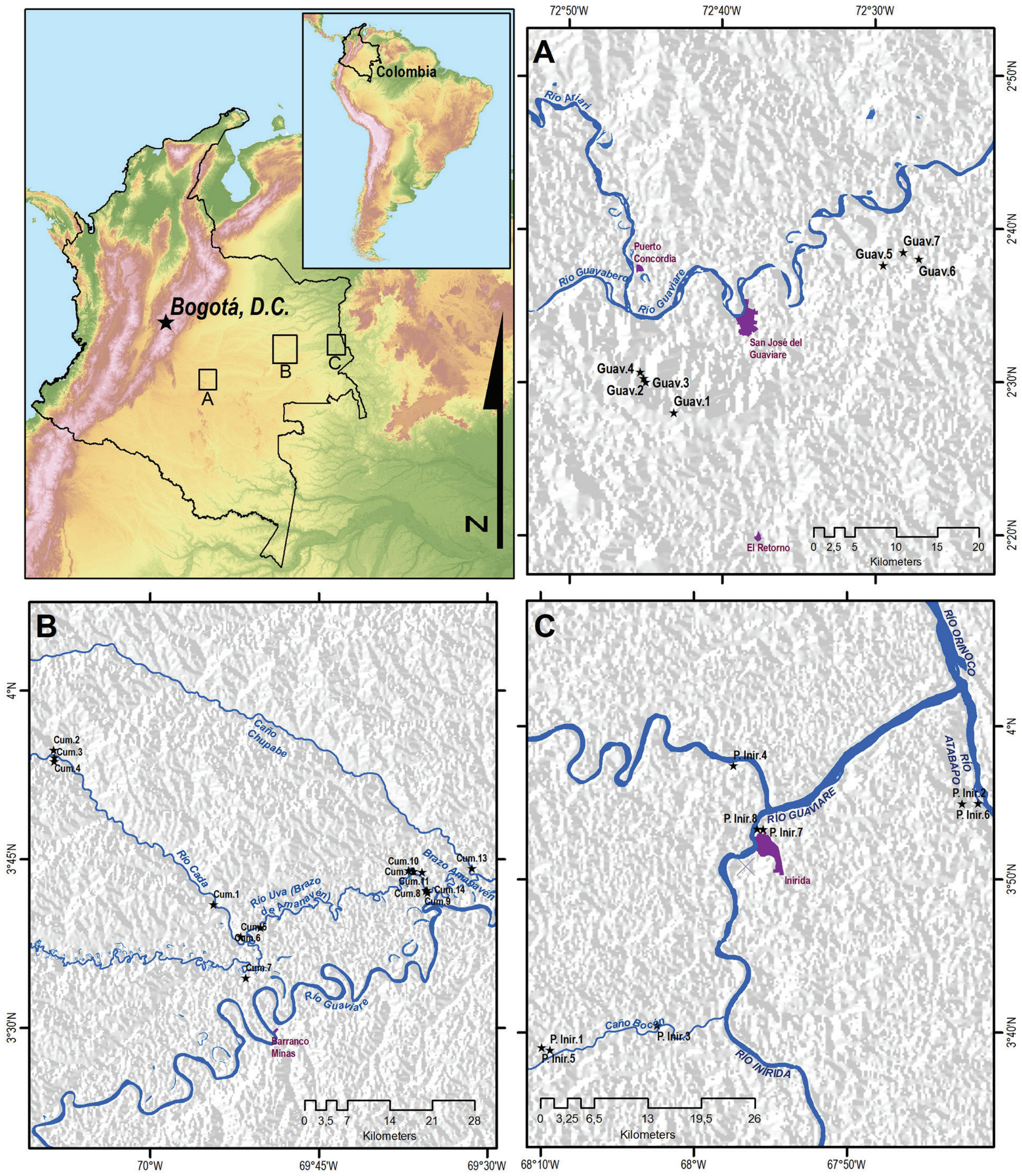

Figure 1. Map of the transition region of the Orinoquia and the Colombian Amazon. The localities are the plots contained in Table 1.

TABLE 1. Location of sampling plots (1,000 m^2).

PLOT NUMBER	HABITAT	DPTO.	MPIO.	PLACE	LATITUD	LONGITUD	ALTITUD (M)
Cum.1	Semi-flooded area	Vichada	Cumaribo	Caño Cada, El Pesebre	-69,90611	3,68269	288
Cum.10	Flooded area	Vichada	Cumaribo	Río Uva	-69,60933	3,73194	133
Cum.11	Flooded area	Vichada	Cumaribo	Río Uva, Laguna Negra	-69,61658	3,73286	99
Cum.12	“Terra firme”	Vichada	Cumaribo	Río Uva, Finca Minesitas	-69,59683	3,73039	115
Cum.13	Flooded area	Vichada	Cumaribo	Caño Chupave, Sector Sardinas	-69,52306	3,73631	115
Cum.14	Semi-flooded área	Vichada	Cumaribo	Caño Minitas	-69,58869	3,70021	137
Cum.2	“Terra firme”	Vichada	Cumaribo	Caño Pelusa	-70,14322	3,91164	148
Cum.3	“Terra firme”	Vichada	Cumaribo	Caño Cada	-70,14306	3,89461	175
Cum.4	Área de rebalse	Vichada	Cumaribo	Caño Pelusa	-70,14222	3,90021	149
Cum.5	Semi-flooded área	Vichada	Cumaribo	Caño Cada	-69,86567	3,63433	135
Cum.6	Flooded area	Vichada	Cumaribo	Río Uva	-69,83636	3,64844	113
Cum.7	Flooded area	Vichada	Cumaribo	Río Uva	-69,85844	3,57364	124
Cum.8	Semi-flooded area	Vichada	Cumaribo	Caño Minesitos	-69,58961	3,70367	143
Cum.9	Flooded area	Vichada	Cumaribo	Río Uva	-69,59128	3,70292	116
Guav.1	“Terra firme”	Guaviare	San José del Guaviare	La Pizarra (Nueva Tolima)	-72,71929	2,46668	200
Guav.2	“Terra firme”	Guaviare	San José del Guaviare	Vereda El Retiro, La Lindosa	-72,75217	2,50383	249
Guav.3	“Terra firme”	Guaviare	San José del Guaviare	Vereda El Retiro, La Lindosa	-72,75001	2,50002	249
Guav.4	“Terra firme”	Guaviare	San José del Guaviare	Vereda El Retiro, La Lindosa	-72,75575	2,51064	249
Guav.5	“Terra firme	Guaviare	San José del Guaviare	Resguardo La Fuga	-72,49125	2,62714	100
Guav.6	Flooded areas with mixted waters	Guaviare	San José del Guaviare	Resguardo La Fuga	-72,45237	2,63380	207
Guav.7	Flooded areas with mixted waters	Guaviare	San José del Guaviare	Resguardo La Fuga	-72,46944	2,64108	207
P. Inír.1	Flooded areas with black waters	Guainía	Puerto Inírida	Comunidad Yuri	-68,15646	3,64737	117
P. Inír.2	Flooded area	Guainía	Puerto Inírida	Comunidad Caño Raya	-67,69034	3,91596	114
P. Inír.3	Flooded area	Guainía	Puerto Inírida	Comunidad Santa Rosa	-68,03998	3,67401	109
P. Inír.4	Flooded área	Guainía	Puerto Inírida	Laguna Macasabe (río Guaviare)	-67,95666	3,95727	87
P. Inír.5	Semi-flooded área	Guainía	Puerto Inírida	Comunidad Yuri	-68,16545	3,64984	103
P. Inír.6	“Terra firme”	Guainía	Puerto Inírida	Comunidad Caño Raya	-67,70777	3,91561	108
P. Inír.7	“Terra firme”	Guainía	Puerto Inírida	Comunidad Paujil	-67,92423	3,88755	109
P. Inír.8	“Terra firme”	Guainía	Puerto Inírida	Comunidad Paujil	-67,93053	3,88819	121

RESULTS

Syntaxonomical units

The present phytosociological study assembles vegetation into one class, two orders, two alliances, and ten associations (Fig. 2). These syntaxonomic units are described below. Results represent the first proposal to classify the forest vegetation in the transition region of the Orinoquia and the Colombian Amazon.

***Brosimo lactescentis-Eschweileretea subglandulosae*,**
class nov. in this contribution (Table 2)
Typus: *Mabeo nitidae-Mespilodaphnetalia cymbari*,
ord. nov.

Floristic composition: Characteristic-dominant species: *Eschweilera subglandulosa* (this record represents the first collection of this taxon to Colombia flora), *Brosimum lactescens*, *Matayba elegans*, *Amphirrhox longifolia*, *Euterpe precatoria*, *Protium llanorum*, *Brosimum guianense*, *Virola sebifera*, *Hydrochorea corymbosa*, *Tovomita spruceana*, *Abuta grandifolia*, *Swartzia leptopetala*, *Gustavia augusta*, *Moquilea subarachnophylla*, *Attalea butyracea*, *Sorocea muriculata*, *Zygia inaequalis*, *Licania mollis*, *Stylogyne longifolia,* and *Adenocalymma cladotrichum*.

Physiognomy-structure: mixed forests and palm communities in flooded and semi-flooded areas, exceptionally in non-flooded areas. Individuals with an average height of 22 m and several individuals emerging up to 30 m. Upper tree stratum is dominated by *Eschweilera subglandulosa*, *Euterpe precatoria,* and *Mespilodaphne cymbarum* with a DBH average of 45 cm. These taxa concentrated the maximum value of basal area (86 m^2). Small tree stratum was dominated by *Amphirrhox longifolia*, *Aparisthmium cordatum*, *Attalea maripa*, *Phenakospermum guyannense*, *Brownea coccinea,* and *Sorocea muriculata*. This group has the largest number of individuals (4208).

Order: ***Mabeo nitidae-Mespilodaphnetalia cymbari***,
ord. nov. in this contribution (Table 2)
Typus: ***Duguetio quitarensis-Amphirrhocion longifoliae***,
all. nov. in this contribution.

Floristic composition: Characteristic-dominant species: *Mespilodaphne cymbarum*, *Mabea nitida*, *Brownea coccinea*, *Pouteria cuspidata, P. gomphiifolia, Pseudolmedia laevigata*, *Hirtella paniculata*, *Cynometra marginata*, *Garcinia madruno*, *Myrcia ruiziana, M. splendens*, *Calophyllum brasiliense*, *Faramea torquata*, *Palicourea justiciifolia*, *Eschweilera decolorans*, *E. parvifolia*, *Adenocalymma impressum*, *Mouriri guianensis*, *Ceiba pentandra*, *Quiina rhytidopus*, *Salacia* aff. *S. macrantha*, *Virola pavonis, V. schultesii*, *Simarouba amara*, *Socratea exorrhiza*, *Annona ambotay*, *Doliocarpus dentatus*, *Nectandra cuspidata*, *Swartzia leptopetala,* and *Xylopia discreta*.

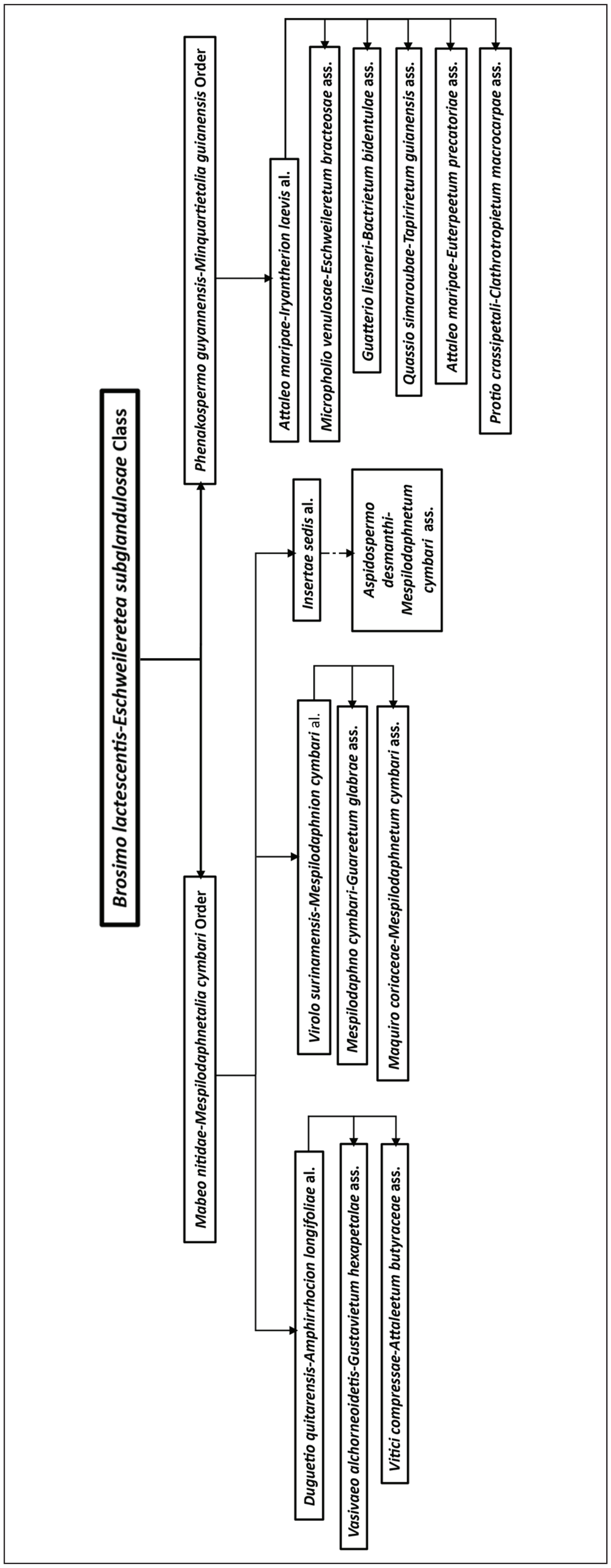

FIGURE 2. Syntaxonomic assembly of the *Brosimo lactescentis-Eschweileretea subglandulosae* class.

Physiognomy-structure: forests in semi-flooded to flooded areas, with individuals of an average height of 22 m and emerging trees of 30 m. Upper tree stratum dominated by *Mespilodaphne cymbarum*, *Euterpe precatoria*, *Eschweilera subglandulosa,* and *Socratea*

TABLE 2. Floristic composition of forests of the class *Brosimo lactescentis-Eschweileretea subglandulosae*.

PLOTS	Cum .8	Cum .9	Cum. 11	Cum. 10	Cum. 14	Cum .4	Guav .4	Cum. 13	Cum .6
	Relative coverage values (%)								
***Brosimo lactescentis-Eschweileretea subglandulosae* class**									
Eschweilera subglandulosa	9	1	.	2	4	70	.	.	45
Brosimum lactescens	4	.	18	30	.	17	.	.	.
Amphirrhox longifolia	33	70	2	2	8				
Matayba elegans	2	.	1	2	.	.	1	1	.
Euterpe precatoria	16	13	.	.	51	3	.	.	.
Hydrochorea corymbosa	.	.	4	6	5	.	.	5	.
Tovomita spruceana	1	.	.	.	.	2	.	.	2
Sorocea muriculata	1	4	.	.	.	.	.	.	15
Zygia inaequalis	.	.	6	6	1	.	.	.	.
Brosimum guianense	2	1	.	.	.	.	.	.	.
Protium llanorum	.	1	.	.	.	.	1	.	.
Virola sebifera	.	.	.	.	.	2	1	.	.
Gustavia augusta	.	1	.	2	.	.	.	.	.
Stylogyne longifolia	.	.	12	2	.	.	.	.	.
Licania mollis	.							6	4
***Mabeo nitidae-Mespilodaphnetalia cymbari* ord.**									
Mabea nitida	.	.	9	5	.	.	.	14	.
Mespilodaphne cymbarum	.	.	6	15	.	8	.	10	14
Brownea coccinea	16	11	.	.	.	.	.	.	28
Byrsonima japurensis	.	.	7	1	.	.	.	1	.
Symmeria paniculata	1	.	9	1	.	.	.	.	.
Pouteria gomphiifolia	.	.	4	26	.	2	.	.	.
Pseudolmedia laevigata	1	1	1	2	.	.	1	14	.
Curarea aff. *C. toxicofera*	1	1	1	3	1	1	.	.	.
Hirtella paniculata	1	1	1	.	.	1	.	.	1
Pouteria cuspidata	.	.	2	2	.	8	3	8	3
Garcinia madruno	.	.	1	9	.	.	.	1	.
Myrcia splendens	1	.	3	2	.	11	1	6	.
Calophyllum brasiliense	.	.	.	.	23	.	.	.	3
Faramea torquata	.	.	2	1	.	3	.	2	3
Duroia micrantha	.	.	4	.	.	.	.	1	.
Palicourea justiciifolia	.	.	2	2	.	1	.	1	.
Eschweilera decolorans	.	.	2	.	.	1	.	.	.
Eschweilera parvifolia	.	.	.	.	5	.	.	81	.
Mouriri guianensis	.	.	1	.	.	.	.	1	.
Ceiba pentandra	24	.	.	.	.	.	.	.	9
Quiina rhytidopus	.	.	.	1	.	.	.	1	.
Salacia aff. *S. macrantha*	.	.	1	.	.	.	.	1	.
Virola schultesii	.	.	.	.	3	.	.	3	.
Ischnosiphon arouma	.	.	1	.	.	.	3	.	.
Strychnos bredemeyeri	.	.	1	.	.	.	.	1	.
Simarouba amara	2	.	.	.	.	.	1	.	.
Socratea exorrhiza	.	.	.	.	8	.	2	.	.
Virola pavonis	.	.	1	.	.	.	.	7	.
Annona ambotay	.	.	1	.	.	.	1	.	.
Doliocarpus dentatus	.	.	.	1	.	.	1	.	.
Nectandra cuspidata	.	1	.	.	.	1	.	.	.
Simira rubescens	1	.	.	.	.	1	.	.	.
***Duguetio quitarensis-Amphirrhocion longifoliae* all.**									
Duguetia quitarensis	2	4	28	16	1	.	.	.	.
Apeiba glabra	11	3	2	3	.	.	.	.	.
Tapura acreana	1	.	5	1	9	.	.	.	6
Tapura guianensis	5	2	4	1	.	.	.	.	.
Garcinia macrophylla	.	1	5	2	.	.	.	.	.
Mouriri pauciflora	.	1	1	1	.	.	.	3	.
Campsiandra angustifolia	.	4	4	35	.	.	.	.	.
Adenocalymma impressum	1	1	2	.	.	.	.	1	.
Cynometra marginata	.	6	3	.	4	.	.	.	.
Ditaxis polygama	1	.	.	2	.	.	.	.	.
Ficus albert-smithii	26	.	.	9	.	.	.	.	.
Lecythis sp.	.	2	.	.	13	.	.	.	.
Eugenia florida	.	7	.	1	.	8	.	.	.
Cynometra bauhiniifolia	.	1	.	1	.	.	.	.	.
Machaerium floribundum	.	2	.	1	.	.	.	.	.
Campsiandra nutans	2	.	.	.	6	.	.	.	.

TABLE 2 CONT. Floristic composition of forests of the class *Brosimo lactescentis-Eschweileretea subglandulosae*.

PLOTS	Cum .8	Cum .9	Cum. 11	Cum. 10	Cum. 14	Cum .4	Guav .4	Cum. 13	Cum .6
	Relative coverage values (%)								
***Duguetio quitarensis-Amphirrhocion longifoliae* all.**									
Chomelia tenuiflora	.	1	1	.	.	.	.	.	.
Vismia macrophylla	1	.	1	.	.	.	.	.	.
Virola calophylla	6	.	.	.	1	.	.	.	.
Minquartia guianensis	.	3	1	.	.	.	.	.	.
Abuta grandifolia	1	1	.	.	.	.	.	.	.
***Vitici compressae-Attaleetum butyraceae* ass.**									
Vitex compressa	3	39	.	.	.	.	.	.	.
Attalea butyracea	59	65	.	.	2	.	.	.	.
Mabea trianae	4	4	.	.	.	.	.	.	.
Piparea dentata	1	1	1	.	.	.	.	.	.
Macrolobium angustifolium	1	1	.	.	.	.	.	.	.
Lindackeria paludosa	1	1	.	.	.	.	1	.	.
Xylopia sericea	1	2	.	.	.	.	1	.	.
Clathrotropis brachypetala	6	1	.	.	.	.	.	.	3
Machaerium biovulatum	1	1	.	.	.	.	.	1	.
Cordia panamensis	1	2	.	.	.	.	.	.	.
Seguieria aculeata	1	1	.	.	.	.	.	.	.
Doliocarpus major	1	3	.	.	.	.	.	.	.
Hieronyma alchorneoides	5	3	.	.	.	.	.	.	.
Euterpe oleracea	1	5	.	.	.	17	.	.	.
Ocotea leptobotra	1	1	.	.	.	.	.	.	.
Protium unifoliolatum	1	10	.	.	.	.	.	.	.
Rinorea falcata	9	2	.	.	.	.	.	.	.
Swartzia myrtifolia	1	1	.	.	.	.	.	.	.
***Vasivaeo alchorneoidis-Gustavietum hexapetalae* ass.**									
Vasivaea alchorneoides	.	.	8	6	6	.	.	.	1
Gustavia hexapetala	.	.	15	7	14	.	.	1	.
Tabernaemontana macrocalyx	.	.	1	6	.	.	.	1	.
Alibertia bertierifolia	.	.	1	8	.	.	.	.	.
Cecropia peltata	.	.	1	1	.	.	.	.	.
Pterocarpus dubius	.	.	9	1	.	.	.	.	.
Ficus americana subsp. guianensis	.	.	1	1	.	.	.	.	.
Guatteria inundata	.	.	16	9	.	.	.	.	.
Leptolobium nitens	.	.	5	1	.	.	.	.	.
Pouteria glomerata	.	.	2	2	.	.	.	.	.
Pouteria multiflora	.	.	3	3	.	.	.	.	.
Ruprechtia tenuiflora	.	.	1	3	.	.	.	.	.
Salacia elíptica	.	.	1	3	.	.	.	.	.
Styrax guyanensis	.	.	2	1	.	.	.	.	.
Croton cuneatus	.	.	8	1	.	.	.	.	.
Macrolobium acaciifolium	.	.	4	7	.	.	.	.	.
Salacia insignis	.	.	38	1	.	.	.	.	.
Strychnos mitscherlichii	.	.	1	3	.	.	.	.	.
***Aspidospermo desmanthii-Mespilodaphnetum cymbari* ass.**									
Aspidosperma desmanthum	.	.	.	.	.	5	3	.	3
Macrosamanea consanguinea	.	.	.	.	.	1	.	1	1
Caraipa densifolia	.	.	.	.	.	1	.	.	1
Oenocarpus minor	.	.	.	.	.	1	1	.	.
Protium llanorum	.	.	.	.	.	4	.	1	.
Combretum laxum	.	.	1	.	.	.	1	1	.
Discocarpus gentryi	.	.	.	.	.	3	.	.	1
Piparea multiflora	.	.	.	.	.	2	2	.	3
Tachigali plúmbea	.	.	.	.	.	1	.	5	.
Zygia latifolia	.	.	.	.	.	8	.	.	11
Pseudolmedia laevis	.	.	.	.	.	.	1	1	.
Lacmellea foxii	.					1	1		
Endlicheria levelii	.	.	.	.	.	3	1	.	.
Phenakospermum guyannense	.	.	.	.	.	2	19	.	.
Aspidosperma excelsum	.	.	.	.	.	.	3	4	.
Aniba panurensis	.	.	.	.	.	1	1	.	.
Myrcia ruiziana				1					20
Swartzia leptopetala	.	.	6	.	.	.	.	10	3
Xylopia discreta	.	1	.	.	.	.	.	.	29
Attalea maripa							5		1
Miconia splendens							3	2	3

Table 2 cont. Floristic composition of forests of the class *Brosimo lactescentis-Eschweileretea subglandulosae*.

Other species:

Swartzia sp. (Cum.6: 1). Piparea multiflora (Guav.4: 1). Oenocarpus bacaba (Guav.4: 1) Didymopanax morototoni (Guav.4: 2) Aparisthmium cordatum (Guav.4: 1) Brosimum utile (Guav.4: 1) Clusia grandiflora (Guav.4: 4) Licania mollis (Cum.13: 3) Piper arboreum (Guav.4: 2) Aniba cylindriflora (Guav.4: 2) Protium laxiflorum (Guav.4: 4) Sloanea eichleri (Guav.4: 2) Stachyarrena penduliflora (Cum.13: 2) Alchornea discolor (Cum.11: 1) Astrocaryum gynacanthum (Guav.4: 5) Bactris maraja (Cum.8: 1) Bathysa bracteosa (Guav.4: 5) Cordia ucayaliensis (Guav.4: 6) Couma macrocarpa (Guav.4: 1) Dichapetalum spruceanum (Guav.4: 1) Enterolobium schomburgkii (Guav.4: 1) Euterpe oleracea (Cum.4: 13) Geonoma deversa (Guav.4: 2) Goupia glabra (Guav.4: 2) Guatteria punctata (Guav.4: 4) Hieronyma oblonga (Guav.4: 5) Inga alba (Guav.4: 8) Inga thibaudiana (Guav.4: 1) Jacaranda copaia (Cum.4: 1) Moquilea subarachnophylla (Guav.4: 1) Maprounea guianensis (Guav.4: 1) Maquira calophylla (Cum.14: 13) Miconia elata (Guav.4: 1) Micropholis venulosa (Cum.10: 2) Mouriri myrtilloides (Cum.8: 1) Olyra latifolia (Guav.4: 1) Sacoglottis guianensis (Guav.4: 3) Sagotia racemosa (Cum.6: 1)Siparuna guianensis (Guav.4: 1) Sloanea aff. tuerckheimii (Cum.13: 1) Syagrus orinocensis (Guav.4: 11) Tabernaemontana undulata (Guav.4: 1) Tapura amazonica (Cum.8: 1) Miconia tococoronata (Cum.13: 1) Miconia tococa (Cum.4: 4) Vitex triflora (Guav.4: 1) Clathrotropis macrocarpa (Cum.6: 1)Dormilón VMC 3254 (Cum.6: 7)Trattinnickia aspera (Guav.4: 3) Erythroxylum divaricatum (Cum.6: 1)Maquira coriacea (Cum.11: 1) Alchornea triplinervia (Guav.4: 4) Adenocalymma cladotrichum (Guav.4: 1) Protium crassipetalum (Guav.4: 1) Myrcia sp. (Guav.4: 1) Inga sp. (Guav.4: 1) Pouteria sp. (Guav.4: 2) Zygia cataractae (Cum.10: 1) Oenocarpus bataua (Guav.4: 4) Swartzia leptopetala (Cum.11: 1) Ocotea sp. (Guav.4: 1) Tapirira guianensis (Guav.4: 13) Astrocaryum chambira (Guav.4: 2) Iryanthera laevis (Guav.4: 1) Bactris simplicifrons (Cum.4: 2) Hevea benthamiana (Cum.6: 6) Perebea mollis (Guav.4: 1) Pourouma tomentosa (Cum.4: 2) Mouriri nigra (Cum.4: 1) Rinorea pubiflora (Cum.6: 7) Alchorneopsis floribunda (Guav.4: 5) Annona duckei (Guav.4: 2) Batocarpus orinocensis (Guav.4: 2) Bellucia grossularioides (Guav.4: 4) Bizcocho VMC 3273 (Cum.6: 1) Byrsonima crispa (Guav.4: 1) Couepia paraensis (Cum.13: 1) Crepidospermum sp. nov. (Cum.9: 1) Dalbergia inundata (Cum.13: 1) Diospyros guianensis (Cum.13: 1) Ficus guianensis (Guav.4: 1) Ficus sp.1 (Cum.8: 2) Forsteronia gracilis (Guav.4: 2) Genipa americana (Cum.14: 4) Humiria balsamifera (Guav.4: 1) Inga cf. pilosula (Cum.4: 1) Inga marginata (Cum.13: 1) Iryanthera ulei (Guav.4: 2) Lacmellea foxii (Guav.4: 1) Casearia suaveolens (Cum.11: 1) Malouetia naias (Cum.11: 1) Miconia poeppigii (Guav.4: 2) Ocotea oblonga (Guav.4: 3) Ormosia grandiflora (Guav.4: 1) Orthomene schomburgkii (Cum.9: 1) Ouratea ferruginea (Cum.11: 1) Panopsis rubescens (Cum.13: 2) Parinari rodolphii (Guav.4: 1) Passiflora guazumifolia (Cum.10: 1) Paypayrola grandiflora (Cum.9: 1) Pleonotoma jasminifolia (Cum.11: 1) Potalia resinifera (Cum.4: 1) Pouteria elegans (Cum.13: 2) Pouteria sp.3 (Cum.13: 1) Protium guianense (Guav.4: 1) Protium heptaphyllum (Guav.4: 1) Pseudoxandra lucida (Cum.4: 1) Psychotria sp. (Cum.13: 1) Pterocarpus sp. (Cum.6: 2)Tetracera costata (Cum.8: 1) Tetracera willdenowiana (Cum.14: 1) Toulicia pulvinata (Cum.9: 4) Uncaria guianensis (Cum.8: 1)Virola carinata (Cum.4: 8) Zanthoxylum compactum (Cum.11: 1) Adenocalymma flaviflorum (Cum.10: 1) Apuleia leiocarpa (Cum.11: 1) Bauhinia longicuspis (Cum.10: 1) Schnella glabra (Cum.8: 1) Bejuco indet. VMC 3693 - B (Cum.9: 1) Bignoniaceae sp. VMC 3656 (Cum.8: 1) Bignoniaceae sp. VMC 4127 (Cum.13: 1) Byttneria aff. coriacea (Cum.10: 1) Myrcia (Calyptranthes) sp.1 (Cum.8: 1) Casearia aff. leandra (Cum.8: 1) Cathedra sp. (Cum.10: 1) Chomelia aff. polyantha (Cum.10: 4) Chrysophyllum argenteum (Cum.8: 2) Citharexylum aff. spinosum (Cum.8: 1) Clusia rosea (Cum.13: 1) Crudia glaberrima (Cum.8: 1) Cupania macrostylis (Cum.8: 1) Cyclanthus bipartitus (Guav.4: 1) Cymbosema roseum (Cum.10: 1) Cynometra spruceana (Cum.13: 13) Deguelia densiflora (Cum.9: 1) Deguelia amazonica (Guav.4: 2) Desmoncus polyacanthos (Cum.4: 1) Diclidanthera bolivarensis (Cum.10: 1) Dipteryx odorata (Cum.13: 1) Discocarpus gentryi (Cum.13: 8) Doliocarpus gentryi (Cum.8: 1) Dulacia macrophylla (Cum.13: 1) Erythroxylum mucronatum (Guav.4: 1) Eschweilera coriacea (Guav.4: 2) Eschweilera sp.4 (Cum.10: 1) Eugenia aff. anastomosans (Cum.6: 1) Eugenia sp. VMC 3360 (Cum.4: 3) Fabaceae sp.1 (Cum.14: 10) Ficus insipida (Cum.10: 6) Ficus trigona (Cum.9: 1) Guadua sp. VMC 3773 (Cum.10: 1) Heisteria sp. 1 (Cum.10: 2) Heliconia hirsuta (Cum.11: 1) Higuerilla (Cum.6: 4) Hirtella brachystachya (Cum.8: 1) Homalium sp. (Cum.11: 1) Hypolytrum longifolium (Cum.4: 1) Indet. (Guav.4: 2) Indet. Sp. VMC 3665 (Cum.8: 2) Indet. Sp. VMC 4100 (Cum.13: 4) Myrcia ruiziana (Cum.6: 11)Inga cf. cylindrica (Cum.8: 7) Inga cf. edulis (Cum.9: 4) Inga stenoptera (Cum.9: 1) Lacmellea sp. (Cum.4: 1) Leopoldinia pulchra (Cum.13: 60) Leretia cordata (Cum.8: 1) Licania steyermarkii (Guav.4: 1) Luhea cymulosa (Cum.10: 6) Lundia densiflora (Cum.4: 1) Macairea lasiophylla (Guav.4: 1) Macrolobium bifolium (Cum.13: 1) Malouetia duckei (Cum.13: 1) Malouetia pubescens (Cum.11: 6) Maquira guianensis (Cum.10: 1) Mobteverdia (Maytenus) sp. VMC 3872 (Cum.11: 1) Adenocalymma sp. VMC 3663 (Cum.8: 1) Miconia tomentosa (Guav.4: 1) Micropholis egensis (Cum.11: 2) Monotagma sp. VMC 3345 (Cum.4: 1) Myrcia sp. 1 (Cum.4: 4) Myrcia sp. VMC 3647 (Cum.8: 1) Myrcia sp. VMC 3794 (Cum.10: 1) Myrcia sp. VMC 3798 (Cum.10: 1) Myrcia sp. VMC 3802 (Cum.10: 1) Myrcia sp. VMC 3870 (Cum.11: 2) Myrcia sp. VMC 3877 (Cum.11: 1) Myrcia sp. VMC 3878-A (Cum.11: 1) Myrcia sp. VMC 4109 (Cum.13: 1) Myrcianthes sp. VMC 3782 (Cum.10: 1) Myrtaceae sp. VMC 3373 (Cum.4: 2) Myrtaceae sp. VMC 4094 (Cum.13: 1) Myrtaceae sp. VMC 4098 (Cum.13: 3) Myrtaceae sp. VMC 4110 (Cum.13: 1) Myrtaceae sp. VMC 4114 (Cum.13: 1) Myrtaceae sp. VMC 4116 (Cum.13: 1) Myrtaceae sp. VMC 4121 (Cum.13: 1) Norantea guianensis (Guav.4: 1) Ocotea javitensis (Guav.4: 1) Ocotea leptobotra (Cum.13: 1) Ocotea puberula (Cum.11: 1) Passiflora costata VMC 3847 (Cum.13: 1) Passiflora franciscoi VMC 3847 (Cum.11: 1) Pera arborea (Guav.4: 1) Perebea sp. (Guav.4: 1) Piranhea trifoliata (Cum.10: 4) Myrcia argentigemma (Cum.11: 5) Plinia sp. VMC 3896 (Cum.11: 2) Plinia sp.1 VMC 4083 (Cum.13: 1) Plinia sp.2 VMC 4119 (Cum.13: 1) Pouteria aff. gomphiifolia (Cum.4: 1) Pouteria sp.2 (Cum.10: 12) Pouteria surumuensis (Cum.10: 1) Psidium sp. VMC 3807 (Cum.10: 1) Psychotria remota (Cum.11: 1) Quiina longifolia (Cum.11: 1) Raputia sp. (Guav.4: 1) Richeria grandis (Cum.6: 1) Rinorea lindeniana (Cum.6: 2) Rodriguezia lanceolata (Cum.4: 1) Salicaceae sp. (Cum.11: 1) Sarcaulus brasiliensis (Guav.4: 1) Securidaca pendula (Cum.13: 1) Senna reticulata (Cum.10: 1) Theobroma cacao (Cum.6: 15) Trichillia quadrijuga (Cum.10: 3) Triplaris weigeltiana (Cum.9: 1) Vismia cayennensis (Guav.4: 1) Vitex klugii (Cum.14: 5) Xylopia emarginata (Cum.13: 1) Xylopia sericophylla (Cum.4: 4) Zygia coccinea (Cum.13: 9).

exorrhiza has a DBH average of 48 cm. This stratum concentrates the maximum value of basal area (59 m^2) and was composed of *Chomelia* aff. *C. polyantha*, *Cynometra spruceana*, *Duguetia quitarensis, Gustavia hexapetala*, *Myrcia splendens,* and *Rinorea falcata*. This stratum harbors the higher species number of individuals (2202). In the vegetation of the *Duguetio quitarensis-Amphirrhocion longifoliae* alliance, the 31 species characteristic of the order represent 54.4% of the reduced IVI, with a predominance of *Mespilodaphne cymbarum* and *Mabea nitida* (Table 3).

Duguetio quitarensis-Amphirrhocion longifoliae, *all. nov.* in this contribution (Table 2)
Typus: *Vitici compressae-Attaleetum butyraceae*, *ass. nov.*

Floristic composition: Characteristic-dominant species: *Duguetia quitarensis*, *Apeiba glabra*, *Tapura acreana*, *T. guianensis*, *Garcinia macrophylla*, *Mouriri pauciflora*, *Campsiandra angustifolia*, *C. nutans, Ditaxis polygama*, *Ficus albert-smithii*, *Eugenia florida*, *Cynometra bauhiniifolia*, *Machaerium floribundum*, *Chomelia tenuiflora*, *Vismia calophylla,* and *V. macrophylla*.

Physiognomy-structure: forests with an average height of 23 m and some individuals emerging up to 31 m. Upper tree stratum dominated by *Apeiba glabra*, *Euterpe precatoria,* and *Hydrochorea corymbosa*, with a DBH average of 50 cm, and high-value basal area (37 m^2). Smaller tree stratum dominated by *Guatteria inundata*, *Pouteria glomerata*, *Strychnos mitscherlichii, Stylogyne longifolia*, *Salacia insignis,* and *Duguetia quitarensis* with 1014 individuals. The 17 characteristic species represent 23% of the total value of the reduced IVI, especially due to the high amount of individuals of *Duguetia quitarensis, Campsiandra angustifolia,* and *Ficus albert-smithii* (Table 3).

Vitici compressae-Attaleetum butyraceae *ass. nov.*, in this contribution (Table 2)
Typus: Cum.9

Floristic composition: Characteristic-dominant species: *Vitex compressa*, *Mabea trianae*, *Piparea dentata*, *Attalea butyracea*, *Macrolobium angustifolium*, *Lindackeria paludosa*, *Xylopia sericea*, *Clathrotropis brachypetala*, *Machaerium biovulatum*, *Cordia panamensis*, *Seguieria aculeata*, *Doliocarpus major*, *Hieronyma alchorneoides*, *Euterpe oleracea*, *Ocotea leptobotra*, *Protium unifoliolatum*, *Rinorea falcata,* and *Swartzia myrtifolia*.

Physiognomy-structure: forests with an average height of 18 m, some individuals emerging to 29 m. Upper arboreal dominated by *Vitex compressa*, *Attalea butyracea,* and *Toulicia pulvinata* with a DBH average of 60 cm (11.7 m^2). Small tree stratum dominated by *Amphirrhox longifolia*, *Brownea coccinea*, *Rinorea falcata, Matayba elegans*, *Euterpe precatoria,* and *Lindackeria paludosa*. The main 17 species concentrate 46% of total reduced IVI, especially by *Vitex compressa* and *Rinorea falcata* (Table 3).

Vasivaeo alchorneoidis-Gustavietum hexapetalae *ass. nov.*, in this contribution (Table 2)
Typus: Cum.11

Floristic composition: Characteristic-dominant species: *Vasivaea alchorneoides* (this record represents the first collection of this taxon to Colombia flora), *Gustavia hexapetala*, *Tabernaemontana macrocalyx*, *Alibertia bertierifolia*, *Cecropia peltata*, *Pterocarpus dubius*, *Ficus americana* subsp. *guianensis*, *Guatteria inundata*, *Leptolobium nitens*, *Pouteria glomerata*, *P. multiflora*, *Ruprechtia tenuiflora*, *Salacia eliptica*, *Styrax guyanensis*, *Croton cuneatus*, *Macrolobium acaciifolium*, *Salacia insignis,* and *Strychnos mitscherlichii*.

Physiognomy: forests with an average height of 23 m and some emerging to 32 m. Upper tree stratum dominated by *Socratea exorrhiza, Euterpe precatoria* and *Brosimum lactescens* with a DBH average of 47 cm and maximum value of basal area at 25.4 m^2. Small tree stratum dominated by *Chomelia aff. C. polyantha, Combretum laxum, Vasivaea alchorneoides, Virola calophylla, Stylogyne longifolia,* and *Pouteria glomerata*. This group harbors the largest number of individuals (517). The 18 characteristic species concentrate ca. 49.6% of the total value of the IVI, especially by *Alibertia bertierifolia* and *Gustavia hexapetala*.

Alliance not defined
Aspidospermo desmanthi-Mespilodaphnetum cymbari, *ass. nov.* in this contribution (Table 2)
Typus: Cum.4

Floristic composition: Characteristic-dominant species: *Aspidosperma desmanthum*, *A. excelsum*, *Macrosamanea consanguinea*, *Caraipa densifolia*, *Oenocarpus minor*, *Protium llanorum*, *Combretum laxum*, *Discocarpus gentryi*, *Piparea multiflora*, *Tachigali plumbea*, *Zygia latifolia*, *Pseudolmedia laevis*, *Lacmellea foxii*, *Endlicheria levelii*, *Phenakospermum guyannense*, *Licania mollis,* and *Aniba panurensis*.

Physiognomy-structure: forests with an average height of 20 m and emerging individuals with 28 m tall. Upper tree stratum dominated by *Eschweilera subglandulosa*, *Mespilodaphne cymbarum,* and *Xylopia sericophylla*.The DBH average is 46 cm, with a higher value of basal area (9.7 m^2). Small tree stratum with the largest number of individuals (715) dominated by *Attalea maripa*, *Euterpe oleracea*, *Brosimum lactescens*, *Brownea coccinea,* and *Cynometra spruceana*. The 17 characteristic species concentrate 9.37% of the total value of the IVI (Table 3), mainly by the input of *Aspidosperma desmanthum* and *Phenakospermum guyannense*.

Virolo surinamensis-Mespilodaphnion cymbari, *all. nov.* in this contribution (Table 5)
Typus: *Mespilodaphno cymbari-Guareetum glabrae* (in this contribution)

Floristic composition: Characteristic-dominant species: *Virola surinamensis*, *Zygia cataractae*, *Pouteria gomphiifolia*, *Casearia zizyphoides*, *Maquira coriacea*, *Salacia amplifolia*, *Myrcia splendens*, *Inga ingoides*, *Malouetia virescens*, *Nectandra membranacea*, *Eschweilera subglandulosa*, *Euterpe precatoria*, *Tacarcuna amanoifolia,* and *Trichilia quadrijuga*.

Physiognomy-structure: forests with a height average of 21 m, and some emerging up to 28 m. Upper tree stratum

TABLE 3. Aspects of the alliance's vegetation structure *Duguetio quitarensis-Amphirrhocion longifoliae* (order *Mabeo nitidae-Mespilodaphnetalia cymbari*).

SINTAXONOMIC UNIT	SPECIES	BASAL AREA (M^2) -%	ABUNDANCE - U	IVI RED.
***Mabeo nitidae-Mespilodaphnetalia cymbari* ord.**	*Mespilodaphne cymbarum*	9.21 (9.01)	18 (0.38)	9.38
	Mabea nitida	1.23 (1,2)	80 (1.68)	2.88
	Brownea coccinea	0.92 (0.9)	97 (2.03)	2.93
	Pseudolmedia laevigata	0.11 (0.11)	63 (1.32)	1.43
	Eschweilera parvifolia	1.38 (1.35)	80 (1.68)	3.03
	Ceiba pentandra	3.03 (2.96)	2 (0.04)	3
	Sum with 31 other characteristic species	**23.66 (29.4)**	**828 (25)**	**54.4**
	Other species	**56.68 (70.5)**	**2481 (75)**	**145.5**
	All species	**80.38 (100)**	**3309 (100)**	**200**
***Duguetio quitarensis-Amphirrhocion longifoliae* all.**	*Duguetia quitarensis*	0.44 (0.8)	90 (4.7)	5.5
	Apeiba glabra	0.52 (0.9)	4 (0.2)	1.1
	Tapura acreana	0.53 (0.9)	6 (0.3)	1.3
	Tapura guianensis	0.39 (0.7)	12 (0.6)	1.3
	Campsiandra angustifolia	1.77 (3.2)	22 (1.2)	4.3
	Ficus albert-smithii	2.02 (3.6)	2 (0.1)	3.7
	Sum with 11 other characteristic species	**7.14 (12.8)**	**187 (9.8)**	**22.6**
	Other 175 species	**48.8 (87.2)**	**1714 (90.2)**	**177.4**
	Total 192	**55,94 (100)**	**1901 (100)**	**200**
***Vitici compressae-Attaleetum butyraceae* ass.**	*Vitex compressa*	5.49 (23.8)	9 (1.1)	24.8
	Mabea trianae	0.09 (0.4)	15 (1.8)	2.2
	Machaerium biovulatum	0.06 (0.3)	11 (1.3)	1.6
	Hieronyma alchorneoides	0.33 (1.4)	13 (1.6)	3
	Protium unifoliolatum	0.19 (0.8)	14 (1.7)	2.5
	Rinorea falcata	0.18 (0.8)	29 (3.5)	4.3
	Sum with 11 other characteristic species	**6.84 (29.6)**	**138 (16,7)**	**46.3**
	Other 74 species	**16.29 (70.4)**	**687 (83,3)**	**153.7**
	Total 91	**23.13 (100)**	**825 (100)**	**200**
***Vasivaeo alchorneoidis-Gustavietum hexapetalae* ass.**	*Vasivaea alchorneoides*	0.24 (0.72)	32 (2.97)	3.69
	Gustavia hexapetala	0.5 (1.53)	39 (3.62)	5.15
	Alibertia bertierifolia	0.14 (0.42)	76 (7.06)	7.48
	Pouteria multiflora	0.73 (2.22)	4 (0.37)	2.59
	Salacia eliptica	0.04 (0.13)	27 (2.51)	2.64
	Sum with 11 other characteristic species	**5.54 (16.88)**	**351 (32.62)**	**49.5**
	Other 119 especies	**27.27 (83.12)**	**725 (67.38)**	**150.5**
	Total 137	**32.81 (100)**	**1076 (100)**	**200**
***Aspidospermo desmanthii-Mespilodaphnetum cymbari* ass.**	*Aspidosperma desmanthum*	0.66 (2.7)	12 (0.85)	3.55
	Tachigali plumbea	0.23 (0.96)	3 (0.21)	1.17
	Zygia latifolia	0.37 (1.52)	12 (0.85)	2.37
	Phenakospermum guyannense	0.22 (0.89)	46 (3.27)	4.16
	Licania mollis	0.12 (0.51)	13 (0.92)	1.43
	Aspidosperma excelsum	0.35 (.42)	7 (0.5)	1.91
	Sum with 11 other characteristic species	**2.34 (9.56)**	**138 (9.8)**	**19.37**
	Other 194 especies	**22.1 (90.44)**	**1270 (90.2)**	**180.63**
	Total 211	**24.44 (100)**	**1408 (100)**	**200**

Table 4. Aspects of the alliance's vegetation structure *Virolo surinamensis-Mespilodaphnion cymbari* (*Mabeo nitidae-Mespilodaphnetalia cymbari* ord.).

	Species	Basal area (m²) -%	Abundance - U	IVI red.
Mabeo nitidae-Mespilodaphnetalia cymbari ord.	*Mespilodaphne cymbarum*	3.86 (17.6)	7 (0.5)	18.1
	Matayba elegans	0.23 (1.1)	16 (1.1)	2.1
	Amphirrhox longifolia	0.03 (0.1)	10 (0.7)	0.8
	Brosimum lactescens	0.47 (2.2)	17 (1.2)	3.3
	Eschweilera subglandulosa	1.3 (6)	31 (2.1)	8.1
	Euterpe precatoria	0.56 (2.6)	9 (0.6)	3.2
	Sum with other 11 species	**8.16 (37.3)**	**271 (18.5)**	**55.9**
	Other 121 species	**13.73 (62.7)**	**1190 (81.5)**	**144.1**
	Total 138	**21.9 (100)**	**1461 (100)**	**200**
Virolo surinamensis-Mespilodaphnion cymbari all.	*Mespilodaphne cymbarum*	3.9 (17.6)	7 (0.5)	18.1
	Psychotria sp.	0.1 (0.2)	172 (11.8)	12.0
	Salacia amplifolia	0.5 (2.4)	127 (8.7)	11.1
	Eschweilera subglandulosa	1.5 (7)	32 (2.2)	9.2
	Maquira coriacea	1.8 (8.2)	9 (0.6)	8.8
	Virola surinamensis	0.9 (4)	40 (2.7)	6.8
	Sum with other 5 species	**11.8 (53.8)**	**588 (40.2)**	**94**
	Other 127 species	**10.1 (46.2)**	**873 (59.8)**	**106**
	Total 138	**21.9 (100)**	**1461 (100)**	**200**
Mespilodaphno cymbari-Guareetum glabrae ass.	*Psychotria* sp.	0.1 (0.9)	172 (28)	28.9
	Mespilodaphne cymbarum	1.6 (26.3)	2 (0.3)	26.6
	Pouteria reticulata	0.9 (14.8)	3 (0.5)	15.3
	Eschweilera subglandulosa	0.6 (9.6)	5 (0.8)	10.4
	Virola surinamensis	0.3 (4.3)	32 (5.2)	9.5
	Guarea glabra	0.2 (2.8)	37 (6)	8.8
	Sum with other 9 species	**5.4 (90.6)**	**476 (77.5)**	**168.1**
	Other 36 species	**0.6 (9.4)**	**138 (22.5)**	**31.9**
	Total 51	**5.9 (100)**	**614 (100)**	**200**
Maquiro coriaceae-Mespilodaphnetum cymbari ass.	*Mespilodaphne cymbarum*	2.3 (14.4)	5 (0.6)	15
	Maquira coriacea	1.8 (11.2)	9 (1.1)	12.3
	Eschweilera subglandulosa	1 (6.1)	27 (3.2)	9.3
	Mabea nitida	0.5 (3.4)	37 (4.4)	7.8
	Salacia amplifolia	0.5 (3.1)	67 (7.9)	11
	Sum with other 10 species	**10.9 (68.8)**	**477 (56.4)**	**125.1**
	Other 94 species	**5 (31.4)**	**406 (47.9)**	**79.3**
	Total 109	**15.9 (100)**	**847 (100)**	**200**

dominated by *Mespilodaphne cymbarum* and *Virola surinamensis*, has a DBH average of 47 cm, and a maximum value of the basal area of 12 m². The shrub and small tree stratum have the largest number of individuals (734), which was dominated by *Faramea torquata*, *Mabea nitida*, *Myrcia splendens*, *Miconia tococoronata,* and *Astrocaryum jauari*. The eleven characteristic-dominant species concentrate 94% of the total IVI, especially contributed by *Mespilodaphne cymbarum*, *Salacia amplifolia,* and *Eschweilera subglandulosa* (Table 4).

Mespilodaphno cymbari-Guareetum glabrae, *ass. nov*. in this contribution (Table 5)
Typus: P. Inír3.

Floristic composition: Characteristic-dominant species: *Guarea glabra, Astrocaryum jauari, Mouriri myrtilloides, Machaerium quinatum, Eschweilera subglandulosa, Matayba elegans, Virola surinamensis, Mespilodaphne cymbarum,* and *Zygia cataractae*.

Physiognomy-structure: forests with an average height of 16 m and emerging individuals up 31 m. Upper

TABLE 5. Floristic composition of *Mabeo nitidae-Mespilodaphnetalia cymbari* ord.

PLOTS	P.Inír.2	P.Inír.3	Guav.6	Guav.7	Cum.7
	Valores de cobertura relativa %				
***Brosimo lactescentis-Eschweileretea subglandulosae* class**					
Matayba elegans	10	14	10	.	.
Amphirrhox longifolia	1	5	1	.	.
Brosimum lactescens	.	.	19	14	1
Eschweilera subglandulosa	22	19	4	.	37
Euterpe precatoria	.	.	1	.	24
Swartzia leptopetala	2	1	5	3	.
Gustavia augusta	.	16	.	.	2
Hydrochorea corymbosa	.	1	9	1	.
Stylogyne longifolia	.	4	.	.	.
Brosimum guianense	.	.	2	.	.
Adenocalymma cladotrichum	.	.	10	.	.
Zygia inaequalis	.	2	2	.	.
***Mabeo nitidae-Mespilodaphnetalia cymbari* ord.**					
Mabea nitida	11	7	9	56	.
Byrsonima japurensis	.	.	9	1	.
Symmeria paniculata	.	.	1	9	.
Myrcia splendens	.	.	17	16	.
***Virolo surinamensis-Mespilodaphnion cymbari* all.**					
Virola surinamensis	17	34	15	34	.
Mespilodaphne cymbarum	11	38	5	33	21
Zygia cataractae	4	4	18	27	.
Malouetia virescens	8	3	1	1	.
Pouteria gomphiifolia	18	1	1	.	.
Casearia zizyphoides	9	1	1	.	.
Salacia amplifolia	2	.	13	13	.
Inga ingoides	.	2	.	1	33
Coccoloba sp.	.	1	2	.	.
Miconia tococoronata	.	1	.	3	.
Nectandra membranacea	.	1	2	10	.
Tabernaemontana siphilitica	.	1	1	.	.
Guatteria sp.	1	.	.	3	.
Cathedra acuminata	.	1	1	.	.
***Mespilodaphno cymbari-Guareetum glabrae* ass.**					
Psychotria sp.	10	26	.	.	.
Guarea glabra	38	36	.	.	.
Mouriri myrtilloides	8	1	.	.	.
Myrcia sp.	33	13	.	.	.
Astrocaryum jauari	4	13	.	.	.
Machaerium quinatum	38	3	.	.	.
Tovomita spruceana	1	2	.	.	.
Quiina florida	1	1	.	.	.
***Maquiro coriaceae-Mespilodaphnetum cymbari* ass.**					
Maquira coriacea	.	.	35	7	1
Stylogyne turbacensis	.	.	1	7	1
Trichilia quadrijuga	.	.	1	3	5
Strychnos bredemeyeri	.	.	1	6	.
Croton cuneatus	.	.	2	1	.
Eugenia florida	.	.	1	2	.
Mouriri acutiflora	.	.	5	4	.
Combretum laurifolium	.	.	1	4	.
Dalbergia foliosa	.	.	1	2	.
Dulacia candida	.	.	1	1	.
Eschweilera parviflora	.	.	1	5	.
Heisteria acuminata	.	.	1	7	.
Posoqueria panamensis	.	.	3	2	.
Tacarcuna amanoifolia	.	.	4	1	.
Guapira pacurero	.	.	3	.	.
Attalea maripa					37

Table 5 cont. Floristic composition of *Mabeo nitidae-Mespilodaphnetalia cymbari* ord.

Other species:
Duguetia sp. (Guav.6: 1) Adenocalymma cladotrichum (Guav.6: 1) Erythroxylum divaricatum (Guav.7: 2) Heterostemon mimosoides (P.Inír.3: 5) Ormosia sp. (P.Inír.2: 1) Calophyllum brasiliense (Guav.6: 2) Macrolobium acaciifolium (Guav.6: 3) Micropholis venulosa (Guav.7: 1) Tapura amazonica (Guav.6: 2) Micropholis sp. (P.Inír.3: 0,08) Astrocaryum chambira (Cum.7: 0,16) Ocotea sp. (P.Inír.3: 0,12) Dormilón VMC 3254 (Cum.7: 2) Duguetia cauliflora (Cum.7: 8) Cecropia sciadophylla (Cum.7: 4) Bactris simplicifrons (Cum.7: 14) Bocageopsis multiflora (Cum.7: 2) Hevea benthamiana (Cum.7: 6) Ocotea sp.1 (Cum.7: 0,08) Osteophloeum platyspermum (Cum.7: 1) Aspidosperma desmanthum (Cum.7: 0,48) Hymenolobium petraeum (Cum.7: 1) Salacia impressifolia (Cum.7: 1) Brownea coccinea (Cum.7: 10) Licania mollis (Cum.7: 3) Garcinia madruno (Guav.6: 1) Alchornea fluviatilis (P.Inír.3: 2) Faramea sessilifolia (P.Inír.2: 3) Hirtella racemosa (Guav.6: 0,034) Ouratea castaneifolia (Guav.7: 0,05) Rinorea flavescens (Guav.6: 3) Securidaca sp. (Guav.7: 1) Duroia micrantha (P.Inír.3: 1) Cynometra bauhiniifolia (Guav.7: 2) Xylopia discreta (Cum.7: 4) Strychnos mitscherlichii (Cum.7: 0,12) Faramea torquata (P.Inír.3: 8) Dalbergia inundata (P.Inír.3: 0,36) Ficus sp.1 (Cum.7: 0,48) Casearia suaveolens (Guav.7: 0,24) Malouetia naias (Guav.7: 0,1) Panopsis rubescens (Guav.6: 1) Passiflora guazumifolia (Guav.7: 1) Toulicia pulvinata (Guav.6: 2) Uncaria guianensis (Guav.6: 3) Zanthoxylum compactum (Cum.7: 1) Amanoa guianensis (Guav.7: 2) Casearia zizyphoides (Guav.6: 0,102) Chomelia sp. (Guav.6: 2) Clusia amazonica (Guav.7: 0,24) Combretum frangulifolium (Guav.6: 0,34) Couepia guianensis (P.Inír.2: 0,48) Discocarpus spruceanus (Guav.6: 7) Dracontium asperum (Cum.7: 0,01) Eugenia biflora (Guav.6: 1) Faramea occidentalis (Guav.6: 0,204) Guadua sp. (P.Inír.3: 10) Gustavia sp. (Guav.6: 1) Heisteria duckei (P.Inír.3: 0,32) Henriettea succosa (Guav.7: 0,25) Henriettea sp. (Guav.6: 0,14) Homalium guianense (P.Inír.3: 0,12) Inga ingoides (Cum.7: 19) Leptobalanus apetalus (Guav.6: 0,17) Deguelia densiflora (Guav.6: 1) Lonchocarpus sp. (Guav.6: 2) Maprounea amazonica (P.Inír.3: 0,16) Melastomataceae sp. VMC 3468 (Cum.7: 0,15) Moluetia sp. (P.Inír.3: 8) Montrichardia arborescens (P.Inír.3: 0,48) Panopsis sp. (Guav.6: 0,255) Pouteria reticulata (Guav.6: 3) Pterocarpus amazonum (Guav.6: 6) Quiina macrophylla (Guav.6: 1) Randia armata (Guav.6: 0,07) Randia sp. (P.Inír.2: 0,4) Rosenbergiodendron formosum (Guav.6: 0,42) Simira rubescens (Guav.7: 0,1) Solanaceae sp. VMC 3467 (Cum.7: 1) Stachyarrhena spicata (Guav.7: 1) Tovomita longifolia (P.Inír.3: 0,36) Trichilia sp. (Cum.7: 3) Vatairea guianensis (P.Inír.3: 15) Vatairea sp. (P.Inír.2: 18).

tree stratum dominated by *Mespilodaphne cymbarum*, *Machaerium quinata*, *Pouteria reticulata,* and *Eschweilera subglandulosa*. DBH average of 42 cm and the highest value of basal area (3.9 m^2). Small tree stratum harbors 143 individuals with species of *Guarea glabra*, *Virola surinamensis*, *Astrocaryum jauari, Faramea sessilifolia*, *Inga ingoides,* and *Mabea nitida*. The fifteen characteristic-dominant species concentrate 168% of the total reduced IVI, contributed especially by *Mespilodaphne cymbarum*, *Pouteria reticulata,* and *Eschweilera subglandulosa* (Table 4).

Maquiro coriaceae-Mespilodaphnetum cymbari, *ass. nov.* in this contribution (Table 5)
Typus: Guav.7

Floristic composition: Characteristic-dominant species: *Eschweilera subglandulosa, Maquira coriacea, Trichilia quadrijuga, Mabea nitida, Stylogyne turbacensis, Matayba elegans, Virola surinamensis, Brosimum lactescens, Swartzia leptopetala, Mespilodaphne cymbarum* and *Zygia cataractae*.

Physiognomy-structure: forests with an average height of 17 m and emerging individuals up 27 m. Upper tree stratum with a DBH average of 51 cm, that concentrates the maximum value of the basal area of 8m^2 dominated by *Mespilodaphne cymbarum*, *Maquira coriacea,* and *Eschweilera subglandulosa*. Small tree stratum with 330 individuals, dominated by *Attalea maripa*, *Trichilia quadrijuga*, *Zygia cataractae, Eschweilera subglandulosa*, *Brownea coccinea,* and *Inga ingoides*. The fifteen characteristic-dominant species concentrate 125% of the total reduced IVI, especially contributed by *Mespilodaphne cymbarum*, *Maquira coriacea,* and *Eschweilera subglandulosa* (Table 4).

Phenakospermo guyannensis-Minquartietalia guianensis, *ord. nov.* in this contribution (Table 6)
Typus: *Attaleo maripae-Iryantherion laevis*, *all. nov.*

Floristic composition: Characteristic-dominant species: *Minquartia guianensis, Phenakospermum guyannense, Piparea multiflora, Oenocarpus bacaba, Brosimum utile, Trichilia elegans, Brosimum rubescens, Stachyarrena penduliflora, Guapira sipapoana, Virola sebifera, Annona ambotay,* and *Ficus guianensis*.

Physiognomy-structure: forests located in semi-flooded areas, with an average height of 17 m and emerging individuals up 28 m. Upper arboreal stratum with DBH average of 41 cm and the maximum value of the basal area of 23 m^2. The dominating species were *Eschweilera subglandulosa*, *Brosimum guianense*, *Oenocarpus bacaba*, *Matayba elegans*, and *Minquartia guianensis*. The shrub and small stratum had 2,300 individuals, with *Amphirrhox longifolia*, *Bactris bidentula*, *Bocageopsis multiflora*, *Perebea mollis,* and *Sorocea muriculata*. The six characteristic species concentrate 16.4% of the total value of the IVI, contributed especially by *Phenakospermum guyannense*, *Oenocarpus bacaba,* and *Minquartia guianensis* (Table 7).

Attaleo maripae-Iryantherion laevis, *all. nov.* in this contribution (Table 6)
Typus: *Guatterio liesneri-Bactrietum bidentulae*, *ass. nov*.

Floristic composition: Characterístic-dominant species: *Iryanthera laevis*, *Attalea maripa*, *Duguetia cauliflora*, *Iriartella setigera*, *Ocotea aurantiodora*, *Virola elongata*, *Astrocaryum chambira*, *Aniba panurensis*, *Inga marginata*, *Myrcia splendens*, *Erisma uncinatum*, *Clathrotropis macrocarpa*, *Pseudolmedia laevis*, *Endlicheria levelii*, *Oenocarpus bataua*, *Bactris simplicifrons*, *Bocageopsis multiflora*, *Perebea mollis*, *Theobroma subincanum*,

TABLE 6. Floristic composition of *Phenakospermo guyannenses-Minquartietalia guianensis* order and subordinates and units.

PLOTS	P.Inír.1	P.Inír.6	Cum.3	Cum.2	Cum.1	Guav.3	Guav.1	Guav.2	Cum.5	Guav.5	P.Inír.7	P.Inír.8	Cum.12
	Relative cover values %												
Species *Brosimo lactescentis-Eschweileretea subglandulosae* class													
Escheweilera subglandulosa	.	.	11	6	1	.	.	.	43	.	.	.	19
Protium llanorum	.	72	.	6	3	3	.	.	.	.	17	6	1
Matayba elegans	1	3	.	.	.	.	.	.	.	1	16	1	.
Brosimum guianense	20	.	.	.	.	1	.	1	.	1	1	.	.
Moquilea subarachnophylla	.	.	.	.	.	2	2	.	.	.	.	.	.
Amphirrhox longifolia	60	.	22	1	.	.	.	.	.	.	.	.	16
Trichilia elegans	.	1	.	.	.	.	.	1	.	.	13	4	.
Abuta grandifolia	.	2	.	.	.	3	.	3	1	.	.	.	.
Brosimum utile	2	5	.	.	.	1	1	1	.	.	.	1	.
Brosimum lactescens	1	.	.	.	.	.	.	.	.	1	.	.	1
Swartzia leptopetala	9	.	.	.	1	.	.	.	.	.	.	30	.
Guapira sipapoana	.	.	.	.	.	.	4	.	.	.	1	.	.
***Phenakospermo guyannenses-Minquartietalia guianensi* ord.**													
Minquartia guianensis	8	4	.	2	.	2	4	8	.	.	.	.	.
Phenakospermum guyannense	.	.	20	20	41	43	5	1	2	34	.	1	6
Piparea multiflora	.	1	3	.	.	1	1	1	.	.	1	.	.
Virola sebifera	.	1	5	6	.	1	.	.	.	6	.	3	.
Oenocarpus bacaba	.	16	2	.	83	.	1	.	.	.	3	.	.
Brosimum rubescens		5										1	
Annona ambotay	.	5	.	.	.	.	.	.	.	1	2	.	1
***Attaleo maripae-Iryentherion laevis* all.**													
Iryanthera laevis	.	3	18	15	18	.	4	.	3	1	23	2	3
Attalea maripa	.	.	.	20	.	21	1	20	20	21	.	.	3
Duguetia cauliflora	1	.	.	.	2	.	.	.	2	.	1	5	4
Iriartella setigera	.	4	1	2	6	.	.	.	.	.	10	1	.
Ocotea aurantiodora	1	4	.	.	.	1	.	1	.	2	.	4	.
Virola elongata	.	.	.	.	.	1	.	.	.	1	3	2	1
Astrocaryum chambira	.	.	8	.	3	2	2	1	.	.	.	.	.
Aniba panurensis	.	.	.	3	1	2	.	3	.	1	.	.	.
Didymopanax morototoni	.	.	.	.	.	5	4	2	.	1	.	.	1
Mouriri nigra	.	2	1	.	.	.	.	.	1	.	1	.	1
Cecropia sciadophylla	.	.	6	20	2	.	.	.	.	7	.	.	2
Inga marginata	1	1	.	.	.	.	.	.	.	.	2	3	1
Cordia nodosa	.	1	.	.	.	.	.	1	.	1	1	.	1
Myrcia splendens	20	1	.	.	.	8	.	1	.	.	.	.	.
Erisma uncinatum	.	6	.	.	.	.	.	.	19	.	5	.	1
Ischnosiphon arouma	.	.	.	1	1	1	.	.	.	.	.	.	16
Aparisthmium cordatum	.	.	51	2	.	.	3	.	9	.	.	.	.
Pseudolmedia laevis	.	.	.	.	.	1	1	.	.	24	.	.	3
Endlicheria levelii	.	.	.	.	1	.	1	1	.	1	.	.	.
Oenocarpus bataua	.	6	.	.	.	.	.	.	.	4	2	29	.
Bactris simplicifrons	1	.	.	.	.	.	.	.	2	.	1	.	2
Bocageopsis multiflora	.	1	.	1	3	.	.	.	.	.	.	.	1
Perebea mollis	.	.	2	8	.	.	.	.	.	.	.	1	4
Theobroma subincanum	.	.	.	1	3	.	.	.	1	.	.	.	2
Dendropanax arboreus							7			1			
Conceveiba guianensis	.	1	.	.	.	.	.	.	3	.	.	3	.
Inga heterophylla	.	3	.	.	.	.	.	.	.	.	.	2	1
Trattinnickia aspera	.	.	.	.	.	9	.	7	.	1	.	.	.
Cochlospermum orinocense	.	.	.	.	.	1	.	3	.	4	.	.	.
Inga brachyrhachis	.	.	.	.	.	2	.	2	.	1	.	.	.
Protium sagotianum	.	.	.	.	.	.	.	.	.	9	.	.	5
Hymenaea oblongifolia	.	.	.	.	.	.	.	.	.	2	.	.	5
Matisia ochrocalyx	.	.	1	.	.	.	.	.	.	1	.	.	1
Siparuna guianensis						1				1			
Petrea volubilis	.	.	.	.	.	.	.	.	.	2	.	.	1
Bactris maraja	.	.	.	.	.	.	.	.	.	1	.	.	1
Hieronyma oblonga	.	.	.	.	.	.	.	.	.	6	.	.	1
Protium amazonicum	.	1	.	.	.	.	.	.	.	1	.	.	1
Socratea exorrhiza	.	.	.	.	.	1	.	.	.	1	.	.	3
Pourouma minor	.	.	.	1	.	.	.	.	.	11	.	.	14
Ocotea aurantiodora						1							1
Virola calophylla	.	.	.	2	.	.	.	.	34	.	.	.	10
Jacaranda copaia	.	.	.	.	.	.	.	.	.	2	.	.	9
***Micropholio venulosae-Eschweileretum bracteosa* ass.**													
Eschweilera bracteosa	79	8	.	3	.	.	.	.	.	.	.	.	.
Micropholis venulosa	8	7	.	.	.	.	.	.	.	.	1	2	.
Faramea capillipes	2	5	.	.	.	.	.	.	.	.	5	.	1
Ouratea sp.	1	1	.	.	.	.	.	.	.	.	1	.	.
Doliocarpus dentatus	2	2	.	.	.	.	.	.	.	.	.	.	.
Stachyarrena penduliflora	1	1	.	.	.	.	.	.	.	.	.	.	.
Pouteria ucuqui	.	9	.	.	.	2	.	.	.	.	7	.	.

TABLE 6 CONT. Floristic composition of *Phenakospermo guyannenses-Minquartietalia guianensis* order and subordinates and units.

PLOTS	P.Inír.1	P.Inír.6	Cum.3	Cum.2	Cum.1	Guav.3	Guav.1	Guav.2	Cum.5	Guav.5	P.Inír.7	P.Inír.8	Cum.12
	Relative cover values %												
***Micropholio venulosae-Eschweileretum bracteosa* ass.**													
Bactris hirta	.	1	.	.	.	.	.	.	.	.	1	.	.
Terminalia macrophylla	.	3	.	.	.	.	.	.	.	.	1	.	.
***Guatterio liesneri-Bactrietum bidentulae* ass.**													
Bactris bidentula	.	.	6	46	45	.	.	.	.	.	.	.	.
Guatteria liesneri	.	.	1	8	30	.	.	.	.	.	.	.	.
Leptabalanus longistylus	.	.	8	11	5	.	.	.	.	.	.	.	.
Pourouma tomentosa	.	.	1	16	13	.	.	.	.	.	.	.	.
Miconia dispar	.	.	6	11	1	.	.	.	1	.	.	.	.
Hevea benthamiana	.	.	12	17	.	.	.	.	15	.	.	.	.
Vochysia aff. V. tetraphylla	.	.	5	6	.	.	.	.	.	.	.	.	.
Simira rubescens	.	.	1	3	.	.	.	.	.	.	.	.	.
Euterpe oleracea	.	.	1	22	.	.	.	.	.	.	.	.	.
Rinorea pubiflora	.	.	4	9	.	.	.	.	37	.	.	.	.
Virola pavonis	.	.	1	11	.	.	.	.	1	.	.	.	.
Nectandra cuspidata	.	.	3	.	5	.	.	.	.	.	.	.	.
Alchornea triplinervia	.	.	.	5	7	3	.	.	.	.	.	.	.
Osteophloeum platyspermum	.	.	.	4	2	.	.	.	.	.	.	.	.
Chamaedorea pinnatifrons	.	.	.	1	1	.	.	.	.	.	.	.	.
Dacryodes granatensis	.	.	2	6	.	.	.	.	.	.	.	.	8
Qualea paraensis	.	.	.	34	4	.	.	.	.	.	.	.	.
Attalea butyracea	.	.	.	14	61	.	.	.	.	.	.	.	.
***Quassio simaroubae-Tapiriretum guianensis* ass.**													
Tapirira guianensis	2	.	.	.	.	9	6	22	.	.	.	1	.
Simarouba amara	.	.	.	.	.	10	22	1	.	.	.	.	.
Hymenopus latifolius	.	.	.	.	.	1	1	28	.	.	.	.	.
Protium laxiflorum	.	.	.	.	.	5	8	10	.	.	.	.	.
Clusia grandiflora	.	.	.	.	.	4	6	8	.	.	.	.	1
Sloanea eichleri	.	.	.	.	.	3	1	5	.	.	.	.	.
Aniba cylindriflora	.	.	.	.	.	1	4	1	.	.	.	.	.
Piper arboretum	.	.	.	.	.	1	1	1	.	2	.	.	.
Ficus guianensis	.	.	.	.	.	1	.	6	.	.	.	.	.
Guarea cristata	.	.	.	.	.	1	.	1	.	.	.	.	.
Miconia tococoidea	.	.	.	.	.	.	1	1	.	.	.	.	.
Maprounea guianensis	.	.	.	.	.	.	3	9	.	.	.	.	.
Duroia fusifera	.	.	.	.	.	1	3	.	.	.	.	.	.
Miconia minutiflora	.	.	.	.	.	.	2	.	.	.	.	1	.
Miconia tococa	.	.	.	.	.	.	1	.	.	.	.	1	.
Myrcia fallax	.	.	.	.	.	1	.	5	.	.	.	.	.
Adenocalymma cladotrichum	.	.	.	.	.	3	.	1	.	.	.	.	.
Bathysa bracteosa	.	.	.	.	.	8	.	6	.	.	.	.	.
Cordia ucayaliensis	.	.	.	.	.	3	.	1	.	.	.	.	.
Couma macrocarpa	.	.	.	.	.	8	.	27	.	.	.	.	.
Enterolobium schomburgkii	.	.	.	.	.	8	.	7	.	.	.	.	.
Inga alba	.	.	.	.	.	3	.	28	1	.	.	.	.
Sacoglottis guianensis	.	.	.	.	.	1	.	2	.	.	.	.	.
Syagrus orinocensis	.	.	.	.	.	13	.	61	.	.	.	.	.
***Attaleo maripae-Euterpetum precatoriae* ass.**													
Trattinnickia lawrancei	.	.	.	.	.	.	.	.	2	4	.	.	4
Euterpe precatoria	17	.	.	.	.	.	.	.	64	8	.	.	1
Clarisia racemosa	.	.	.	.	.	.	.	.	1	1	.	.	1
Sorocea muriculata	.	.	.	.	.	.	.	.	36	.	.	.	1
Cedrelinga cateniformis	.	.	.	.	.	.	.	.	2	.	.	.	1
Cupania scrobiculata	.	.	.	.	.	.	.	.	5	.	.	.	1
Pachira paraensis	.	.	.	.	.	.	.	.	1	.	.	.	1
Licania mollis	.	.	.	.	.	.	.	.	1	.	.	.	1
Inga heterophylla	.	.	.	.	.	.	.	.	2	.	.	.	2
Ocotea aurantiodora	.	.	.	.	.	1	.	.	2	.	.	.	3
Protium aracouchini						1				41			
***Protio crassipetali-Clathrotropietum macrocarpae* ass.**													
Clathrotropis macrocarpa	.	.	.	.	1	.	.	.	.	.	25	30	15
Dacryodes chimantensis	.	5	.	.	.	.	.	.	.	.	6	1	3
Protium crassipetalum	.	.	.	.	.	.	.	.	.	.	3	5	8
Trymatococcus amazonicus	.	2	.	.	.	.	.	.	.	.	.	3	1
Pouteria ucuqui											3	4	
Sandwithia sp.											21	23	
Macrolobium limbatum											1	2	
Anaxagorea rufa											8	21	
Aspidosperma sp.											1	11	
Caraipa sp.											2	1	

TABLE 7. Aspects of the alliance's vegetation structure *Attaleo maripae-Iryantherion laevis* (*Phenakospermo guyannenses-Minquartietalia guianensis* ord.).

SINTAXONOMIC UNITS	SPECIE	BASAL AREA (M²) -%	ABUNDANCE - U	IVI RED.
***Brosimo lactescentis-Eschweileretea subglandulosae* class**	*Eschweilera subglandulosa*	5 (8.5)	74 (1.4)	10
	Protium llanorum	0.6 (1)	121 (2.4)	3.4
	Amphirrhox longifolia	0.8 (1.4)	285 (5.6)	6.9
	Euterpe precatoria	0.7 (1.2)	80 (1.6)	2.8
	Trichilia elegans	0.1 (0.2)	50 (1)	1.1
	Sum with other 8 characteristic species	**7.8 (13.3)**	**692 (13.5)**	**26.7**
	Other 473 species	**54 (86.7)**	**4439 (86.5)**	**173.3**
	Total 486	**61.8 (100)**	**5131 (100)**	**200**
Phenakospermo guyannenses-Minquartietalia guianensis ord.	*Minquartia guianensis*	0.8 (1.4)	9 (0.2)	1.5
	Phenakospermum guyannense	2.8 (4.8)	257 (5)	9.8
	Virola sebifera	0.2 (0.4)	44 (0.9)	1.3
	Oenocarpus bacaba	0.9 (1.5)	96 (1.9)	3.4
	Sum with 2 other characteristic species	**4.7 (8.1)**	**426 (7.3)**	**16.4**
	Other 480 species	**57.1 (91.9)**	**5383 (92.7)**	**183.6**
	Total 486	**61.8 (100)**	**5809 (100)**	**200**
Attaleo maripae-Iryantherion laevis all.	*Iryanthera laevis*	0.9 (1.5)	80 (1.6)	3.1
	Attalea maripa	2.6 (4.4)	92 (1.8)	6.2
	Iriartella setigera	0.2 (0.3)	63 (1.2)	1.6
	Cecropia sciadophylla	1.4 (2.4)	21 (0.4)	2.8
	Erisma uncinatum	1.9 (3.2)	12 (0.2)	3.4
	Clathrotropis macrocarpa	0.6 (0.9)	60 (1.2)	2.1
	Sum with 24 other characteristic species	**11.21 (19.2)**	**1027 (18)**	**39.2**
	Other 453 species	**50.6 (80.8)**	**4782 (82)**	**160.8**
	Total 486	**61.8 (100)**	**5809 (100)**	**200**
Micropholio venulosae-Eschweileretum bracteosae ass.	*Micropholis venulosa*	0.07 (1.6)	4 (0.4)	2
	Faramea capillipes	0.04 (1)	28 (2.5)	3.5
	Pouteria ucuqui	0.1 (3.5)	25 (2.3)	5.8
	Bactris hirta	0.02 (0.5)	7 (0.6)	1.1
	Sum with 6 other characteristic species	**0.3 (7.7)**	**86 (7.8)**	**15.5**
	Other 87 species	**3.8 (92.3)**	**1016 (92.2)**	**184.5**
	Total 97	**4.09 (100)**	**1102 (100)**	**200**

Dacryodes chimantensis, *Conceveiba guianensis*, *Protium crassipetalum*, *Inga heterophylla*, *Trymatococcus amazonicus*, *Trattinnickia aspera*, *Cochlospermum orinocense,* and *Inga brachyrhachis*.

Physiognomy-structure: mixed palm communities with an upper tree stratum dominated by *Eschweilera subglandulosa*, *Oenocarpus bacaba,* and *Qualea paraensis*, with the highest basal area value (28 m²). Lower arboreal stratum is dominated by *Euterpe precatoria*, *Iryanthera laevis*, *Protium llanorum,* and *Attalea maripa*, and small trees of *Anaxagorea rufa*, *Aparisthmium cordatum*, *Bactris bidentula*, *Clathrotropis macrocarpa*, *Iryanthera paraensis,* and *Phenakospermum guyannense*. Shrub and small tree stratum dominated by *Amphirrhox longifolia*, *Bactris bidentula,* and *Sorocea muriculata*. This stratum concentrates the largest number of individuals (2,300). The thirty characteristic species concentrate 39.2% of the total value of the reduced IVI, with a dominance of *Iryanthera laevis*, *Attalea maripa,* and *Iriartella setigera* (Table 7).

Micropholio venulosae-Eschweileretum bracteosae, *ass. nov*. in this publication (Table 6)

Typus: P. Inír.6

Floristic Composition: Characteristic-dominant species:

TABLE 7 CONT. Aspects of the alliance's vegetation structure *Attaleo maripae-Iryantherion laevis* (*Phenakospermo guyannenses-Minquartietalia guianensis* ord.).

Sintaxonomic units	**Specie**	**Basal area (m^2) -%**	**Abundance - U**	**IVI red.**
Guatterio liesneri-Bactrietum bidentulae ass.	*Bactris bidentula*	0.3 (1.2)	169 (13.5)	14.7
	Guatteria liesneri	0.4 (1.9)	35 (2.8)	4.7
	Pourouma tomentosa	0.8 (3.8)	19 (1.5)	5.3
	Vochysia aff. V. tetraphylla	0.7 (3.1)	19 (1.5)	4.6
	Qualea paraensis	2.4 (11.5)	7 (0.6)	12.1
	Attalea butyracea	1.1 (5.4)	68 (5.4)	10.8
	Sum with 12 other characteristic species	**7.8 (37.3)**	**516 (41.3)**	**78.6**
	Other 78 species	**13.1 (62.7)**	**732 (58.7)**	**121.4**
	Total 96	**20.9 (100)**	**1248 (100)**	**200**
Simaroubo amarae-Tapiriretum guianensis ass.	*Tapirira guianensis*	0.4 (3.8)	20 (2)	5.8
	Simarouba amara	0.5 (4.4)	6 (0.6)	5
	Hymenopus latifolius	0.4 (3.7)	7 (0.7)	4.4
	Protium laxiflorum	0.2 (1.6)	27 (2.7)	4.3
	Bathysa bracteosa	01 (08)	39 (3.9)	4.8
	Couma macrocarpa	0.4 (3.5)	2 (0.2)	3.7
	Syagrus orinocensis	0.4 (3.6)	51 (5.2)	8.7
	Sum with other 17 caratheristics species	**3.2 (30.2)**	**272 (27.5)**	**57.6**
	Other 97 species	**7.4 (69.8)**	**718 (72.5)**	**142.4**
	Total 121	**10.6 (100)**	**990 (100)**	**200**
Attaleo maripae-Euterpetum precatoriae ass.	*Eschweilera subglandulosa*	2.6 (21.3)	21 (2.4)	23.7
	Erisma uncinatum	1.9 (15.5)	6 (0.7)	16.2
	Attalea maripa	1.2 (9.7)	42 (4.8)	14,6
	Euterpe precatoria	0.6 (5.5)	66 (7.66)	13.2
	Sorocea muriculata	0,3 (2.1)	86 (10)	12
	Phenakospermum guyannense	0.6 (5.1)	54 (6.2)	11.3
	Sum with other 9 caratheristics species	**9.6 (80.2)**	**452 (52.3)**	**132.5**
	Other 110 species	**2.4 (19.8)**	**412 (47.7)**	**67.5**
	Total 125	**12 (100)**	**864 (100)**	**200**
Protio crassipetali-Clathrotropietum macrocarpae ass.	*Eschweilera subglandulosa*	1.7 (12)	15 (0.9)	12.9
	Clathrotropis macrocarpa	0.5 (3.8)	57 (3.6)	7.4
	Compsoneura sprucei	1.4 (9.7)	29 (1.8)	11.5
	Protium crassipetalum	0.2 (1.7)	37 (2.3)	4
	Pouteria ucuqui	0.5 (3.5)	28 (1.7)	5.2
	Phenakospermum guyannense	1.2 (8.3)	23 (1.4)	9.7
	Sum with other 9 caratheristics species	**9.04 (63.6)**	**614 (38.3)**	**101.9**
	Other 163 species	**5.2 (36.4)**	**991 (61.7)**	**98.1**
	Total 178	**14.2 (100)**	**1605 (100)**	**200**

Micropholis venulosa, *Faramea capillipes*, *Ouratea sp*., *Eschweilera bracteosa*, *Doliocarpus dentatus*, *Brosimum utile*, *Stachyarrena penduliflora*, *Pouteria ucuqui*, *Bactris hirta,* and *Terminalia macrophylla*.

Physiognomy-structure: forests with an average height of 17 m and several emerging individuals reaching 25 m. The high arboreal stratum is dominated by *Brosimum guianense*, *Aspidosperma excelsum,* and *Pouteria ucuqui*, with DBH average of 31 cm.

Lower arboreal stratum dominated by *Clathrotropis macrocarpa*, *Micropholis venulosa*, *Oenocarpus bacaba,* and *Schnella guianensis*. The highest value of basal area (2 m^2) is concentrated by *Amphirrhox longifolia*, *Anaxagorea rufa*, *Bactris simplicifrons*, *Eschweilera bracteosa,* and *Faramea capilipes* with 723 individuals. The ten characteristic species concentrate 15.5% of the total value of the IVI, especially contributed by *Micropholis venulosa*, *Faramea capillipes,* and *Pouteria ucuqui* (Table 7).

Guatterio liesneri-Bactrietum bidentulae*, ass. nov*. in this publication (**Table 6**)
Typus: Cum.2

Floristic Composition: Characteristic-dominant species: *Bactris bidentula*, *Guatteria liesneri*, *Leptabalanus longistylus*, *Pourouma tomentosa*, *Miconia dispar*, *Hevea benthamiana*, *Dacryodes granatensis*, *Vochysia* aff. *V. tetraphylla*, *Euterpe oleracea*, *Rinorea pubiflora*, *Virola pavonis*, *Miconia splendens*, *Nectandra cuspidata*, *Alchornea triplinervia*, *Osteophloeum platyspermum*, *Chamaedorea pinnatifrons*, *Qualea paraensis,* and *Attalea butyracea*.

Physiognomy-structure: forests with an average height of 15 m and some emerging up to 32 m. Upper arboreal stratum dominated by *Oenocarpus bacaba*, *Qualea paraensis,* and *Guatteria liesneri* with DBH average of 42 cm and the highest value of the basal area of 12 m^2. Lower arboreal stratum with 602 individuals, with *Bactris bidentula*, *Attalea butyracea*, *Astrocaryum chambira, Guatteria liesneri*, *Iryanthera laevis,* and *Sagotia racemose* as dominating species. The 18 characteristic species concentrate 78.6% of the total reduced IVI, with the dominance of *Bactris bidentula, Qualea paraensis,* and *Attalea butyracea* (Table 7).

Quassio simaroubae-Tapiriretum guianensis, *ass. nov*. in this publication (Table 6)
Typus: Guav.2

Floristic Composition: Characteristic-dominant species: *Tapirira guianensis*, *Simarouba amara*, *Hymenopus latifolius*, *Protium laxiflorum*, *Clusia grandiflora*, *Sloanea eichleri*, *Aniba cylindriflora*, *Guarea cristata*, *Miconia tococoidea, Maprounea guianensis*, *Myrcia fallax*, *Adenocalymma cladotrichum*, *Bathysa bracteosa*, *Cordia ucayaliensis*, *Couma macrocarpa*, *Enterolobium schomburgkii*, *Inga alba*, *Sacoglottis guianensis,* and *Syagrus orinocensis*.

Physiognomy-structure: forests with an average height of 17 m and some emerging trees up 25 m. Upper arboreal stratum dominated by *Couma macrocarpa*, *Enterolobium schomburgkii,* and *Hymenopus latifolius* with DBH average of 40 cm. In the medium stratum, *Attalea maripa*, *Tapirira guianensis*, *Protium laxiflorum,* and *Clusia grandiflora* concentrate a basal area maximum value of 5.5 m^2. Small tree stratum had 424 individuals, and was dominated by *Syagrus orinocensis*, *Astrocaryum gynacanthum*, *A. chambira, Phenakospermum guyannense*, *Bathysa bracteosa,* and *Simarouba amara*. The 24 characteristic species concentrate 57.6% of the total reduced IVI, with dominance of *Tapirira guianensis, Simarouba amara,* and *Syagrus orinocensis* (Table 7).

Attaleo maripae-Euterpetum precatoriae*, ass. nov*. in this publication (Table 6)
Typus: Cum5.

Floristic Composition: Characteristic dominant species: *Trattinnickia lawrancei*, *Clarisia racemosa*, *Virola calophylla*, *Sorocea muriculata*, *Cedrelinga cateniformis*, *Cupania scrobiculata*, *Inga heterophylla*, *Pachira paraensis*, *Licania mollis*, *Ocotea aurantiodora*, *Pourouma minor,* and *Protium aracouchini*.

Physiognomy-structure: forests with an average height of 15 m and some emerging up to 30 m. Upper arboreal dominated by *Eschweilera subglandulosa*, *Erisma uncinatum* and *Protium crassipetalum*, with DBH average of 44 cm and a basal area maximum value of 12 m^2. Shrub stratum had 825 individuals and was dominated by *Amphirrhox longifolia*, *Bactris acanthocarpa*, *Compsoneura sprucei*, *Geonoma interrupta,* and *Ischnosiphon arouma*. The 15 characteristic species concentrate 57.6% of the total reduced IVI with dominance of *Eschweilera subglandulosa, Erisma uncinatum, and Attalea maripa* (Table 7).

Protio crassipetali-Clathrotropietum macrocarpae, *ass. nov*. in this publication (Table 6)
Typus: Cum12

Floristic Composition: Characteristic dominant species: *Clathrotropis macrocarpa, Protium crassipetalum, Trymatococcus amazonicus, Iryanthera laevis, Attalea maripa, Duguetia cauliflora,* and *Protium llanorum*.

Physiognomy-structure: Forests with an average height of 16 m and some emerging up to 30 m. Upper arboreal stratum dominated by *Clathrotopis macrocarpa, Eschweilera subglandulosa*, *Pouteria ucuqui*, and *Aspidosperma excelsum*, with DBH average of 41 cm and basal area maximum value of 6.6 m^2. Small tree stratum had 654 individuals and was dominated by *Clathrotropis macrocarpa*, *Oxandra euneura*, *Protium crassipetalum, Anaxagorea rufa*, *Compsoneura sprucei*, and *Phenakospermum guyannense*.

Syntaxonomy and diversity

Table 8 shows the information on the number of species, basal area, and the number of individuals in each defined association. Parameters varied as follows:

Richness

The number of species ranged from 51 in the forests of *Mespilodaphno cymbari-Guareetum glabrae* to 211 in the forests of *Aspidospermo desmanthi-Mespilodaphnetum cymbari*. When related to the sampling area, the highest richness index value (6.3) was observed in the palm community of *Attaleo maripae-Euterpetum precatoriae*.

Basal area

Values ranged from 32.81 m^2 in the forests of *Vasivaeo alchorneoidis-Gustavietum hexapetalae* to 4.09 m^2 in the forests of *Micropholio venulosae-Eschweileretum bracteosae*. When related to the sampling area, the highest value was found in the mixed palm community of *Vitici compressae-Attaleetum butyraceae* with 1.2%.

Abundance

The number of individuals with a DBH > 10 cm fluctuated between 614 in the forests of *Mespilodaphno cymbari-Guareetum glabrae* and 1605 in the forests of *Protio crassipetali-Clathrotropietum macrocarpae*. When related to the sampling area, the highest value of the density index (0.6%) was present in the forests of *Micropholio venulosae-Eschweileretum bracteosae*.

Table 8. Species number, basal area, individual's number, and indexes among the associations.

Order	Alliance	Associations	Sampling area	Total species	Richness I, % (#spp/area x 10^{-2})	Basal area (m^2)	Dominance I, % (basal area/sampling areao)	Abundance	Density I. % (Individulas number/sampling area)
***Mabeo nitidae-Mespilodaphnetalia cymbari* 14000 m2**	*Duguetio quitarensis-Amphirrhocion longifoliae* 5000 m2	*Vitici compressae-Attaleetum butyraceae*	2000	**91**	**4.6**	**23.13**	**1.2**	**825**	0.4
		Vasivaeo alchorneoidis-Gustavietum hexapetalae	3000	**137**	**4.6**	**32.81**	**1.1**	**1076**	0.4
		Aspidospermo desmanthii-Mespilodaphnetum cymbari	4000	**211**	**5.3**	**24.44**	**0.6**	**1408**	0.4
	Virolo surinamensis-Mespilodaphnion cymbari 5000 m2	*Mespilodaphno cymbari-Guareetum glabrae*	2000	**51**	**2.6**	**5.9**	**0.3**	**614**	0.3
		Maquiro coriaceae-Mespilodaphnetum cymbari	3000	**109**	**3.6**	**15.9**	**0.5**	**847**	0.3
Phenakospermo guyannenses-Minquartietalia guianensis 13000 m2	*Attaleo maripae-Iryantherion laevis* 13000 m2	*Micropholio venulosae-Eschweileretum bracteosae*	2000	**97**	**4.9**	**4.09**	**0.2**	**1102**	0.6
		Guatterio liesneri-Bactrietum bidentulae	3000	**96**	**3.2**	**20.9**	**0.7**	**1248**	0.4
		Quassio simaroubae-Tapiriretum guianensis	3000	**121**	**4**	**10.6**	**0.4**	**990**	0.3
		Attaleo maripae-Euterpetum precatoriae	2000	**125**	**6.3**	**12**	**0.6**	**864**	0.4
		Protio crassipetali-Clathrotropietum macrocarpae	3000	**178**	**5.9**	**14.2**	**0.5**	**1605**	0.5

Discussion

The final phytosociological arrangement grouped vegetation into one class, two orders, two alliances, and 10 associations (Fig. 1). The syntaxonomic units described here represent the first proposal to classify the forest vegetation in the transition region of the Orinoquia and the Colombian Amazon. The analysis technique used showed strongly floristic differences between the groups. Structurally, it was observed that these forest communities can be differentiated by topography. A clear example is the *Attaleo maripae-Euterpetum precatoriae* alliance, a palm community only found on poorly drained soils in the alteration plains.

These forests have at least four well-defined strata, with an average canopy height of 25 m. The 20 characteristic-dominant species account for 20% of the total basal area, with an upper tree stratum (individuals > 25 m in height) accounting for more than 50% of the parameter. The upper strata grouped 60% of the total individuals, characteristics that are associated with individuals of large size and coverage in the different vegetation types.

In 29000 m^2, which covered the 29 inventory plots of forests of the *Brosimo latescentis-Eschweileretea subglandulosae* class, there are 9901 individuals and 165.7 m^2 of basal area (Table 9). In the forests of the order *Mabeo nitidae-Mespilodaphnetalia cymbari* (14 plots, 14,000 m^2 of sampled area), the highest basal area value (102.2 m^2) was found in 4770 individuals of 348 species. In this order, the alliance *Duguetio quitarensis-Amphirrhocion longifoliae* contributed with 55.94 m^2 of 1901 individuals of 192 species. The mixed palm communities of the association *Vitici compressae-Attaleetum butyraceae* presented the highest value of dominance index (basal area/sampling area) with a 1.2%. In the alliance *Virolo surinamensis-Mespilodaphnion cymbari*, the basal area was 21.9 m^2 of 1461 individuals and 138 species. The association *Aspidospermo desmanthi-Mespilodaphnetum cymbari* presented a basal area of 24.4 m^2 of 1408 individuals and 211 species.

In the forests of the order *Phenakospermo guyannenses-Minquartetlia guianenesis* (13 plots, 13,000 m^2 of sampled area), 63.8 m^2 of the basal area was found in 5809 individuals of 486 species. In this order, the *Aspidospermo desmanthi-Mespilodaphnetum cymbari* alliance contributed with its five associations, of which the *Attaleo maripae-Euterpetum precatoriae* palm communities showed the highest richness index value (6.3%). The *Micropholio venulosae-Eschweileretum bracteosae* forests presented the highest density index value (number of individuals/ sampling area, 0.6%).

Table 9. DBH, basal area and abundance to class level and the vegetation orders.

	Stratum	**DBH Average (cm)**	**Basal area (m^2)**	**Abundance**
Brosimo lactescentis-Eschweileretea subglandulosae class	Small trees	7	27.3	4488
	Inferior stratum	18	45.8	1380
	Upper stratum	45	87.9	379
	Shrubs	3	4.7	4332
	Total		165.7	10579
Mabeo nitidae-Mespilodaphnetalia cymbari ord.	Small trees	8	13	2202
	Inferior stratum	20	28	698
	Upper stratum	49	59	213
	Shrubs	3	1.9	1657
	Total		101.9	4770
Phenakospermo guyannenses-Minquartietalia guianensis ord.	Small trees	7	14.3	2286
	Inferior stratum	16	17.8	682
	Upper stratum	41	28.9	166
	Shrubs	3	2.8	2675
	Total		63.8	5809

Synecology and Some Phytogeographic Relationships

There are important floristic relationships between the transition forests of the Colombian Amazon and Orinoquia with other phytogeographic regions of the Neotropics. Rangel-Ch. (2020) synthesized the ecological features of the different types of vegetation of the Colombian Amazon and highlighted as characteristic species of the floodplain the following taxa: *Mauritia flexuosa*, *Maquira coriacea*, *Virola flexuosa*, *Inga punctata*, *Micropholis guyanensis*, *Hymatanthus bracteata*, *Escheweilera coriacea*, *E. juruensis*, *Clathrotropis macrocarpa*, *Pseudolmedia laevis*, *Oenocarpus bataua*, *Pouteria guianensis,* and *Iryanthera ulei*. In terra firme forests, this author mentioned *Brosimum lactescens*, *Minquartia guianensis*, *Attalea maripa,* and *Iryanthera laevis* as characteristic species.

The vegetation characterized in Cumaribo and the surrounding localities shows floristic relationships and several aspects of structure that clearly associate it with the vegetation of the Amazon region of Colombia. Similarities were also detected in the floristic patterns and aspects of structure with those of other neighboring countries and with the natural regions of Colombia.

In Venezuela, the vegetation of the study area resembles the complex of the alluvial plains of the middle Orinoco and its transition with the regions of the Guayana and the Amazon. The Cumaribo region has relationships with the vegetation in the Caño Carinagua basin, Amazonas state (Venezuela) through the dominance of the palms genera *Attalea*, *Oenocarpus,* and *Euterpe*. On the alluvial plains, forests dominated by *Phenakospermum guayanense*, *Erisma uncinatum,* and *Eschweilera subglandulosa* are established (Aymard *et al*., 2009). Gama et al. (2005) reported in the state of Pará (Brazil) the importance-dominance of *Tapirira guianensis*, *Inga alba*, *Hevea brasiliensis*, *Guarea kunthiana*, *Micropholis venulosa*, *Clarisia racemosa*, *Enterolobium schomburgkii*, *Goupia glabra*, *Dipteryx odorata*, *Protium altsonii*, *Trattinnickia rhoifolia*, *Inga heterophylla*, *Casearia discolor*, *Pterocarpus officinalis*, *Brosimum guianensis*, *Didymopanax morototoni*, *Socratea exorrhiza,* and several species of the genera *Protium*, *Eschweilera,* and *Licania* (*s.l.*). In Peru, Laurance et al. (1998; 2004) mentioned the importance of *Protium* (*Crepidospermum*) *goudotianum*, *P. sagotianum,* and *Ocotea aurantiodora* in the Amazonian forest. In the forests of La Macarena mountain range, Stevenson et al. (2004) and Stevenson and Rodríguez (2008) mentioned *Protium* (*Crepidospermum*) *goudotianum*, *P. rhoifolium*, *P. sagotianum,* and *Socratea exorrhiza* among the species with high values of dominance. In a forest located south of the Guaviare River, several taxa were found that share with the study area such as *Cecropia sciadophylla*, *Pourouma minor*, *Oenocarpus bataua*, *Pseudolmedia laevis*, *P. laevigata,* and *Brosimum lactescens*. This region also has larger palms communities dominated by *Oenocarpus bataua* and *Iryanthera laevis* (Minorta-Cely et al., 2020). Forests dominated by *Mabea trianae* are characteristic of the alluvial plains of the department of Arauca, including mixed palm associations dominated by *Attalea maripa* and *Phenakospermum guyannense*, and forests of *Aniba panurensis* and *Eschweilera subglandulosa* (Minorta-Cely et al., 2020). The two species are also dominant in the forests of Vichada, Guaviare, and Guainía.

Regarding other vegetation types characterized in similar environments in the Amazonian region of Colombia, several dominant species in the Orinoco-Amazon transition zone have been mentioned as characteristic-dominant by Van Andel (1992), Urrego (1997), Duivenvoorden and Lips (1993), Cárdenas and Giraldo-Cañas (1997), Rudas and Prieto (2005), and Cantillo and Rangel (2011). These species mentioned in these works highlight *Minquartia guianensis*, a species that dominates the vegetation in the middle part of the Caquetá River. Forests dominated by *Iryanthera laevis* are established in the floodplain of Amazonian rivers. In the mainland vegetation of the Amacayacu National Natural Park, the dominant species are *Clathrotropis macrocarpa*, *Phenakospermum guyannense*, *Eschweilera coriacea,* and *Pseudolmedia laevigata*. *Euterpe precatoria* is dominant in the mixed palm communities with *Didymocistus chrysadenius* in the floodplain of the Caquetá River. The latter also dominated in the *Mauritia flexuosa* palm communities that are established in dissected areas in the Amacayacu National Natural Park. *Eschweilera subglandulosa* dominates in the forests that are established in colluvial and lower hills in localities of the National Natural Park Amacayacu, Tarapacá, accompanied by *Clathrotropis macrocarpa* (Rudas and Prieto, 2005).

Pseudolmedia laevigata dominates in forests of the alluvial plain in transition to the terraces of the Apaporis River and in the terra firme forests of the Amacayacu National Natural Park (Rudas and Prieto, 2005). *Minquartia guianensis* is dominant in the forests established in the channel complex of the Caquetá River; *Qualea pulcherrima*, *Iryanthera ulei* and *Pouteria torta* also appear as associate species. In the well-drained terraces of the middle part of the Caquetá River, *Clathrotropis macrocarpa* is dominant in the mixed palm communities with *Chamaedorea pinnatifrons*.

According to Carvajal et al. (1979), *Clathrotropis macrocarpa* typifies the forests that extend widely in the Amazon region in Caquetá and Putumayo. It is also dominant in terra firme forests on well-drained sites along the middle Caquetá River basin (Duivenvoorden and Lips, 1993). *Oenocarpus bataua* is dominant in the mixed palm groves of the alluvial plain in transition with the terraces of the Caquetá River (IGAC, 1993). In general, it is a dominant species of the vegetation of the low terraces of the Amazonian rivers. It has also been mentioned as dominant in the forests with palm communities in the middle terraces in the foothills of the La Macarena mountain range.

Among the most striking similarities for the Colombian Caribbean region is the presence of palm communities dominated by *Attalea butyracea*, a taxon that dominates areas with good water content in the soil, around the marshes of the Cesar department. The species also characterizes the remnants of palm communities in the mountain foothills towards the Magdalena River valley and in the Orinoco region. *Chamaedorea pinnatifrons* is the characteristic palm of the understory and lower strata in the different vegetation types established along the altitudinal gradient of the Perijá mountain range (Rangel-Ch., 2012).

Tapirira guianensis is the dominant species of the *Cratevo tapiae-Astronietea graveolentis* class, which encompasses all the vegetation of flooded sites, good water saturation in soils around the Caribbean marshes, especially in the Córdoba and Sucre departments (Rangel-Ch. et al., 2010). *Matayba elegans* is a dominant species of the forests around the marshes of the Córdoba department, which is associated with *Pseudolmedia laevigata*, *Brosimum guianensis,* and *Piparea multiflora* (Rangel-Ch. *et al*., 2010).

Brosimum utile characterizes the forests of the humid zone in the south of the Córdoba department (Rangel-Ch, 2012). It is the dominant species in the forests of the foothills of the western slopes of the Cordillera Occidental and in the vegetation of very humid and pluvial sites within the Colombian Pacific depression (Rangel-Ch., 2004). Finally, *Machaerium biovulatum* typifies large formation of forests with *Eugenia procera* that are established in the tropical dry forest at the foothills of the Sierra Nevada de Santa Marta, the Besotes sanctuary, and the foothills of the Tayrona Park (Berdugo and Rangel-Ch., 2015).

Separation in terms of floristic composition and structure at the level of forest types in the present phytosociological classification confirms the existence of a high diversity o Beta diversity among habitats. A clear separation was detected in terra firme forests (i.e., *Protio crassipetali-Clathrotropietum macrocarpae* association) and those forests with drainage problems (i.e., *Mabeo nitidae-Mespilodaphnetalia cymbari* order).

Transition forests of the Colombian Orinoquia and Amazon are composed of a wide mosaic of forest vegetation. This shows that the concept of forest types is used to describe and understand the extensive variation in floristic composition and its environmental determinants. However, changes are sometimes gradual and without obvious boundaries; therefore, vegetation types defined are no more than sections of a continuous gradient. In the present study, several forest types were recognized based on the dominant species in a definite number of established plots. The segregation of the different types of forests is a relevant result that indicates the convenience of not extrapolating floristic characterizations since the plots are clearly associated with the habitat's ecological conditions. Due to this peculiarity, one future tasks is to continue studying through phytosociological analysis if the variations in floristic composition and environment are gradual to demonstrate the usefulness of classifying forest communities using the Sigmatist school.

Another key point to consider in vegetation studies is the accurate identification and documentation of all plants studied through collections of botanical specimens, rigorous herbarium work, and the specialists' consultations (see acknowledgments).

As in all regions of the Amazon and Orinoco basins, pressure to exploit the study region is growing every day. In many cases, these projects do not take into consideration scientific information indispensable for the elaboration of the different use management, and conservation plans for these valuable ecosystems. It is obvious that these ecosystems must be exploited in some way. The rational way to do it should be to use them in such a way that they can renew and reproduce themselves. At present, not enough scientific knowledge has been generated to form the basis for this type of development, due to the size of the territory, and the enormous quantity and variability of soil, water, flora, fauna, and ecosystem resources that the region harbors.

Finally, all forests studied are located on very poor soils that are susceptible to rapid degradation if intensively used, considering the rainfall magnitude in the area. Here lies the importance of conserving the superficial horizon, since it is the source that continuously supplies nutrients to the natural vegetation. A poor nutrient bank determines a very restricted natural fertility of the soils, which, combined with the topographic characteristics (slope), climate, and drainage, severely limits their use. To date, shifting agriculture has allowed long periods of recovery for the forest. However, if this activity increases, this could destroy in the short term not only the forests but also the soils that sustain them.

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TWO NEW SPECIES OF *CROSSOGLOSSA* (ORCHIDACEAE, MALAXIDEAE) FROM THE WESTERN ANDES OF COLOMBIA

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Abstract. Two new species of *Crossoglossa* from the western Andes of Colombia are proposed. The new taxa, *C. dapaensis* and *C. elvirae*, are described and illustrated. ecological notes and a distribution map are also supplied.

Keywords: *Crossoglossa,* new species, Dapa, Colombia

Crossoglossa Dressler & Dodson (Orchidaceae, in Dodson and Escobar, 1993) is a genus of 55 species (taxa described herein included) distributed from Nicaragua to Bolivia, and east to Venezuela. These taxa had been placed previously in *Liparis* L.C. Rich., Malaxis Sol. ex Sw., and *Microstylis* (Nutt.) Eaton (sections *Caulescentes* Ridl., *Tipuloidea* Ridl., and *Blephariglottis* Schltr.). The genus may be characterised by the combination of short to elongate, few to many-leaved stems, often with a rhizome derived from the previous stem, herbaceous leaves, flowers with a short column, and a basally auriculate labellum with a simple to complex basal callus.

Colombia is the center of diversity for *Crossoglossa,* from where 22 species (all endemic) have now been recorded. Most of the species were described recently, based on herbarium material (Ormerod 2013, 2014; Szlachetko and Kolanowska, 2013, 2015). Due to Colombia's complex and diverse ecosystems, rainfall, microclimate diversity, and orographic factors, we expect that a number of taxa remain to be described. Most of the Colombian species of *Crossoglossa* are only known from the original collection, which indicates the rarity of the plants in nature, and also the likelihood that they are narrow endemics.

During exploration of the La Elvira National Protective Forest Reserve (part of the Arroyohondo River Basin, Valle del Cauca) in September 2020, two species of *Crossoglossa* were identified. Subsequent investigations revealed that both of them were undescribed.

Crossoglossa dapaensis Reina-Rodr. & Ormerod, *sp. nov.* TYPE: COLOMBIA. Valle del Cauca: Municipio de Yumbo, Corregimiento Dapa, Parcelacion Los Morales, Parcela Familia Rubiano-Hurtado, Microcuenca El Rincon, tributary of the rio Arroyohondo, 2255 m, 10 September 2018, *G. Reina-Rodriguez, M. Rubiano, J. Rubiano & K. Reyes 3071* (Holotype: CUVC). Fig. 1.

Crossoglossa dapaensis is similar to *C. liparidoides* (Finet) Dodson but the stems have more leaves (10–13 versus 4–8), the leaves are larger (9.5–14.3 × 2.4–3.0 cm versus 7.0 × 1.8 cm), the inflorescence peduncle longer (13.5 cm vs. 3.7 cm), and the flowers with oblong-lanceolate (versus ligulate) petals, and an elliptic-obovate, subpandurate (versus ovate) labellum.

Terrestrial *herb*. *Rhizome* terete, elongate. *Roots* terete, pubescent, 9–17 × 0.11–0.13 cm. *Stems* short, 10–13 leaved (possibly each new stem 5–6-leaved), ca. 2 cm long, 0.5 cm thick. *Leaves* oblong-elliptic, basal third subpetiolate to sessile, acute, margin laxly undulate, mid-green above, 9.5–14.3 × 1.2–3.0 cm. *Inflorescence* terminal, erect, 44.6–56.5 cm long; peduncle *c*. 13.2 cm long; rachis densely many (97–112 cm) flowered, with about 80–95% of the flowers open simultaneously, 31.4–43.0 cm long; floral bracts lanceolate, apex apiculate, margin irregular, 3.3–11.0 × 1.1–3.5 mm. *Flowers* with light green sepals and petals, lip whitish with an orange callus and an orange median stripe, column and anther cap orange, stigma green, pollinia yellow. *Pedicel with ovary* subcylindric, almost patent to almost erect, light green, 3.0–4.5 mm long. *Dorsal sepal* ovate-elliptic, obtusish, weakly concave, 3 veined, 1.8 × 1.1 mm. *Lateral sepals* obliquely ovate to ovate-elliptic, obtuse, 1 veined, 1.7 × 1.1 mm. *Petals* obliquely oblong-lanceolate, subacute, 1 veined, 1.65 × 0.46 mm. *Labellum* elliptic-obovate, subpandurate, obtuse, base auriculate with a patch of papillae on each auricle, margin ciliate-denticulate, 1.7 mm long medially (2 mm long including auricles), 1.6 mm wide; callus bilobulate, consisting of two obliquely ovate lobules. *Column* short, stout, semiterete, 0.56 mm long, 0.47 mm wide dorsally; stigma circular, concave, ventral; anther cap reniform, 0.43 × 0.47 mm; pollinia two, obovoid, 0.19 × 0.13 mm.

Distribution: Colombia.

Ecology: Montane rainforest, of western Colombian Andes between 2000–2250 m, with well drained volcanic soils. The annual precipitation is 1900–2100 mm and annual temperature average between 15°C and 17°C (CVC 2009) (Fig. 3). According to Holdridge (1987), this area can be classified as montane rain forest, more widely known as subandean forest.

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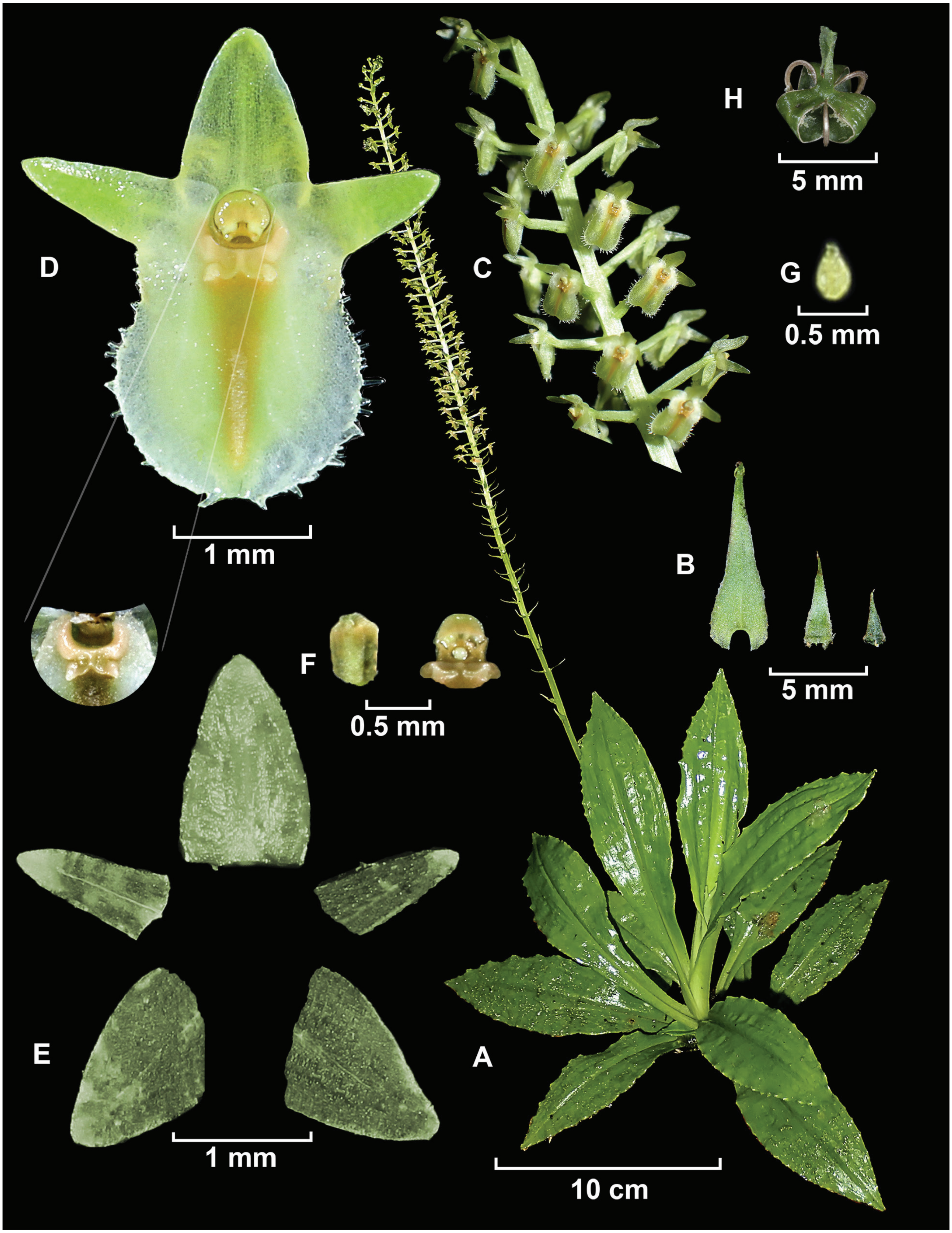

FIGURE 1. *Crossoglossa dapaensis* Reina-Rodr. & Ormerod. **A**, Habit; **B**, Floral bracts; **C**, Flowers; **D**, Flower, frontal view and projection to callus; **E**, Dissected perianth; **F**, Column, dorsal and ventral view; **G**, Pollinia; **H**, Dry fruit. LCDP by Francisco López-Machado. Photographs by Mayo Rubiano and G. Reina-Rodríguez based on the type (CUVC).

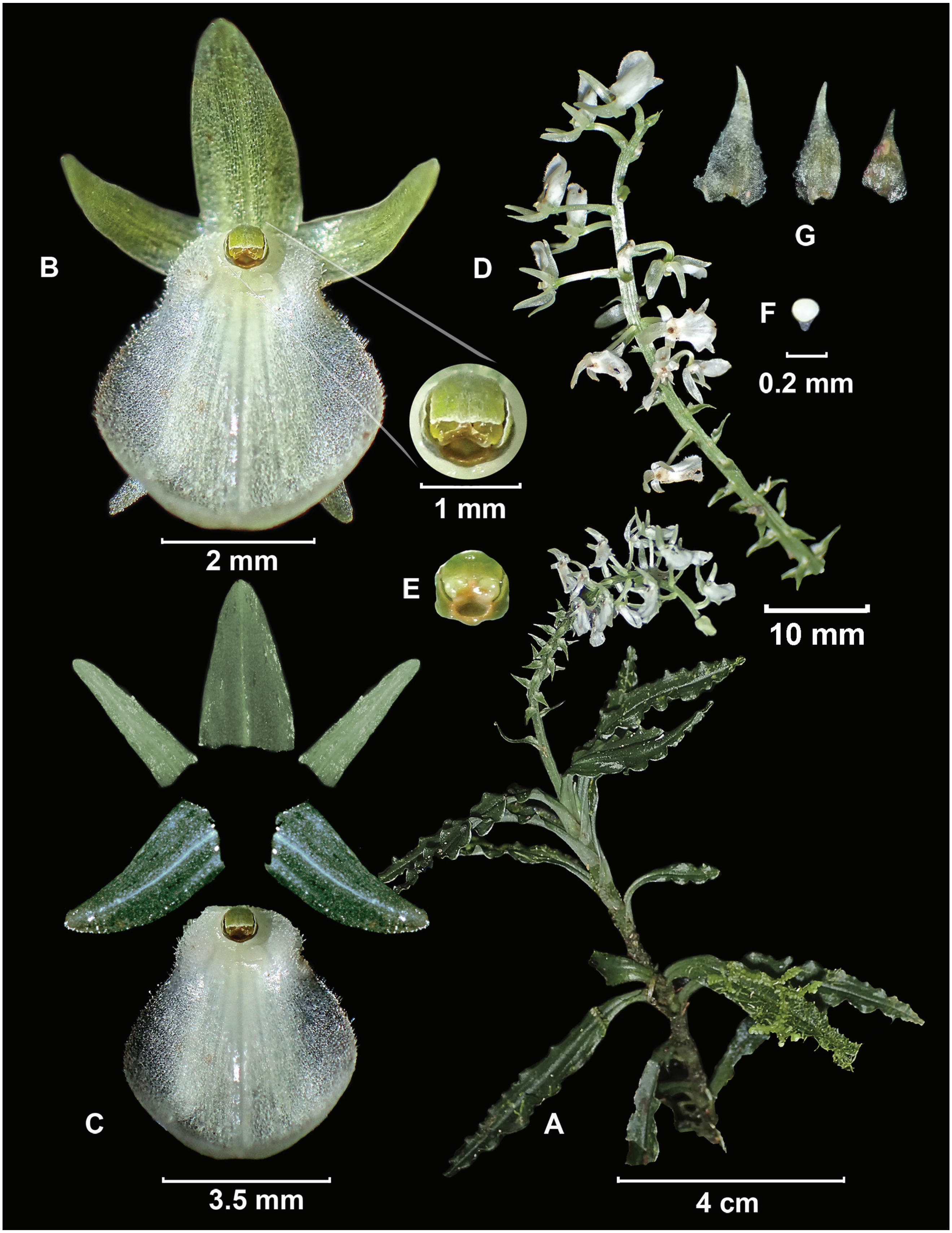

FIGURE 2. *Crossoglossa elvirae* Reina-Rodr. & Ormerod. **A**, Habit; **B**, Flower, frontal view and projection to column; **C**, Dissected perianth; **D**, Flowers; **E**, Column, frontal view; **F**, Pollinia; **G**, Floral bracts. LCDP by Francisco López-Machado. Photographs by Mayo Rubiano and G. Reina-Rodríguez, based on of the type (CUVC).

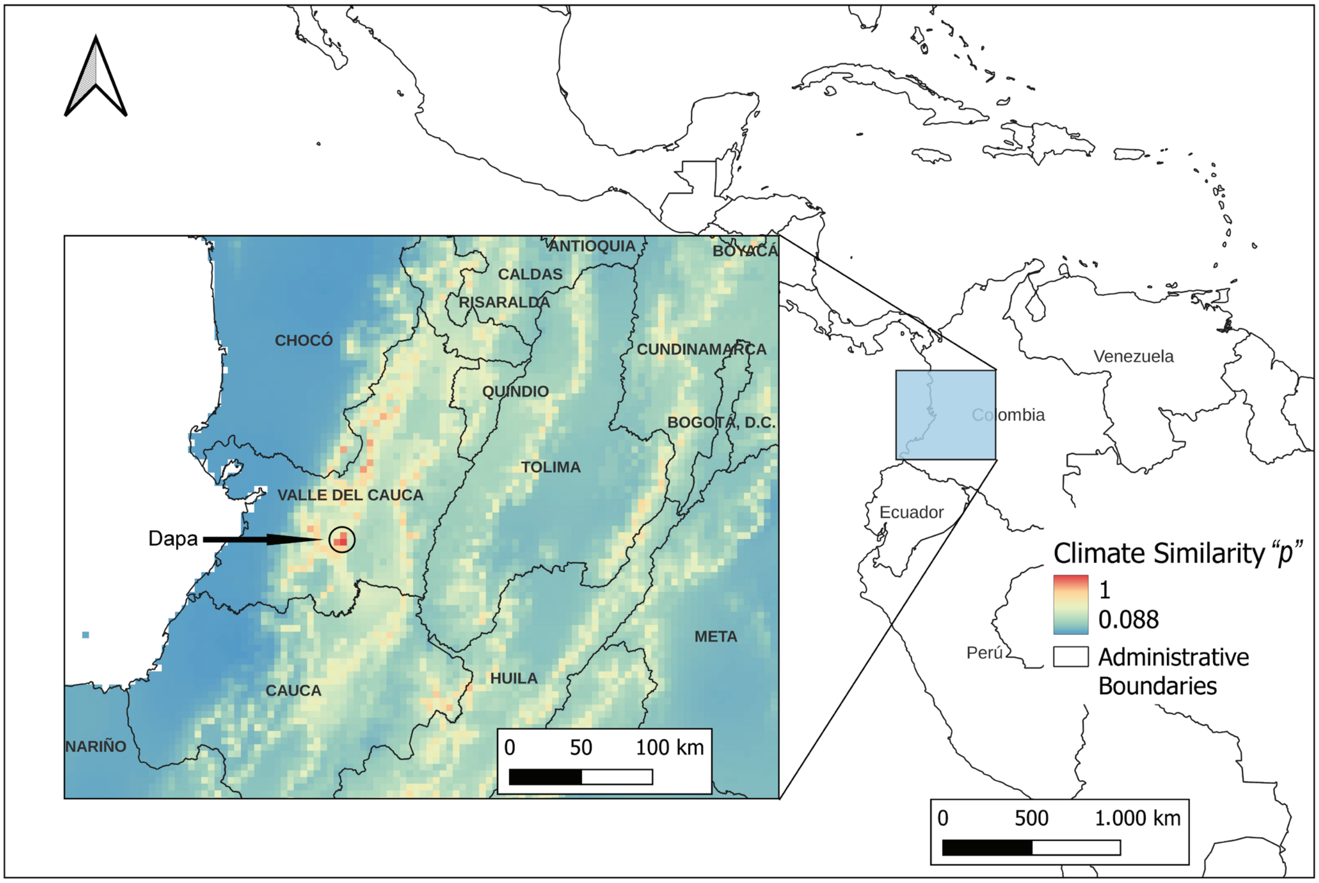

FIGURE 3. Climate similarities of the location site of the two new species. Describes the surrounding climate similarities to the site where the two species were collected (p=1). The map was generated using Analogue (Arango et al., 2020), an R package to identify climate analogues. The most similar areas are located along the western Colombian range either in the pacific or the Atlantic drainage basins.

Etymology: Named after the Dapa Hills, the type locality.

Conservation status: Critically Endangered IUCN Criteria CR B1ab(iii) (IUCN 2012). The Extent of occurrence estimated to be less than 100 km^2 and known to exist at only a single location. The area of known distribution is very limited, it is around the Dapa hills summit area of the Cordillera Occidental of the Andes. The population habitat is pressured by cattle ranching and deforestation for country houses.

As noted above this species is most closely related to *C. liparidoides* (Finet) Dodson, a species of uncertain origin (most likely from Ecuador). Both taxa share floral size (sepals *c.* 2 mm long) and lip callus shape, but *C. dapaensis* is a much larger and leafier plant, with broader petals and an obovate-elliptic (vs. elliptic) lip. Another florally similar species is *C. dalstroemii* (Dodson) Dodson from Ecuador, Peru, and Bolivia. It is, however, a short (30–55 mm long) stemmed, densely leaved plant, with smaller (38–125 × 7.5–13.0 mm), narrower leaves, slightly larger (dorsal sepal 2.40–2.75 mm long) flowers, and ligulate petals. *Crossoglossa polyblephara* (Schltr.) Dodson from Colombia is also florally similar, but it too is a short (30 mm long) stemmed, densely leaved plant, with smaller (60–110 × 10–13 mm), narrower leaves, also the lip bears a semilunate callus.

A fourth florally and vegetatively similar species is *C. zarucchii* Szlach. & Kolan. The figure in the protologue of *C. zarucchii* shows the lip to be oblong-subpandurate, and the callus to have small oblong lobules. However, study of the isotype in MO shows the lip to be obovate-elliptic, weakly subpandurate, prominently papillose-ciliate margined, and the callus to be transversely lunate (i.e., with acute, divaricate, ligulate-lanceolate arms). In *C. dapaensis* the lip callus differs in having obliquely ovate lobules like those found in *C. dalstroemii* and *C. liparidoides*.

Crossoglossa elvirae Reina-Rodr. & Ormerod, *sp. nov.* TYPE: COLOMBIA. Valle del Cauca: Municipio de Yumbo, Corregimiento Dapa, Parcelacion Los Morales, Parcela Familia Rubiano-Hurtado, Microcuenca El Rincon, tributary of the rio Arroyohondo, 2135 m, 12 August 2018, *G. Reina-Rodriguez, M. Rubiano, J. Rubiano & K. Reyes 3072* (Holotype: CUVC). Fig. 2.

Crossoglossa elvirae is similar to *C. dalstroemii* (Dodson) Dodson but its stems are more laxly leaved, its flowers are larger (sepals 2.20–2.75 mm long vs. sepals 3.5–3.7 mm long), and its labellum is obovate-elliptic (vs. ovate-elliptic).

Terrestrial *herb*. *Rhizome* terete, elongate. *Roots* terete, pubescent, 4.1–5.0 × 0.07–0.15 cm. *Stems* erect, short, 12–15 leaved (possibly each new stem 5–6 leaved), ca. 3 cm long, 0.5 cm thick. *Leaves* lanceolate, acute, basal part subpetiolate to sessile, acute to obtuse, margin strongly undulate, upper surface dark green, lower surface grey-green, 5.0–5.1 × 0.9–1.0 cm. *Inflorescence* terminal, erect, ca. 9.5 cm long; peduncle ca. 1 cm long; rachis subdensely many flowered, keeled below each floral bract, hexagonal in section, *c*. 5.2 cm long; floral bracts triangular, subacuminate, margin minutely irregularly dentate, 3.5–4.8 × 1.5–2.5 mm. *Flowers* translucent light green, lip translucent white, column and anther cap olive green, stigma orange-green, pollinia yellow. *Pedicel with ovary* terete, light green, 2.0–2.5 mm long. *Dorsal sepal* oblong-ovate, obtuse, 3 veined, 3.5–3.7 × 1.8–2.0 mm. *Lateral sepals* obliquely oblong-lanceolate, obtuse, 1 veined, 3.5 × 1.35 mm. *Petals* lanceolate, obtuse, 1 veined, 2.9 × 0.85 mm. *Labellum* obovate-elliptic, subpandurate, obtuse, base auriculate with a patch of papillae on each auricle, margin minutely papillose-ciliate, ca. 4 mm long medially (ca. 4.5 mm long including auricles), 4 mm wide; callus bilobulate, consisting of two obliquely ovate, acute, foveolate lobules. *Column* short, stout, semiterete, 0.8 mm long, 0.8 mm wide dorsally; stigma circular, concave, ventral; anther cap reniform-semicircular, 0.35 × 0.2 mm; pollinia two, subglobose, 0.18 × 0.15 mm.

Distribution: Hitherto restricted to Colombia.

Ecology: Montane rainforest, of western Colombian Andes between 2000–2250 m, with well drained volcanic soils. The annual precipitation is 1900–2100 mm and annual temperature average between 15˚C and 17˚C (CVC, 2009) (Fig. 3). According to Holdridge (1987), this area can be classified as montane rain forest, more widely known as subandean forest.

Etymology: Named after the La Elvira National Protective Forest Reserve.

This species appears to be mostly closely related to *C. dalstroemii* differing from it in having more laxly leafy stems, larger flowers, and a differently shaped (obovate-elliptic vs. ovate-elliptic) lip.

Conservation status: Critically Endangered IUCN Criteria CR B1ab(iii) (IUCN, 2012). The Extent of occurrence estimated to be less than 100 km^2 and known to exist at only a single location. The area of known distribution is very limited, it is around the Dapa hills summit area of the Cordillera Occidental of the Andes. The population habitat is pressured by cattle ranching and deforestation for country houses.

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NOMENCLATURAL NOTES ON NEW WORLD *CYPERUS* (CYPERACEAE)

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Abstract. We discuss nomenclatural and taxonomic matters pertaining to three species of New World *Cyperus*. We provide correct names for three species hitherto known as: *Cyperus friburgensis*, *C. niger*, and *C. spectabilis*. Also, *C. multifolius*, and *C. penicillatus* are noted as overlooked synonyms of *C. prolixus*. New combinations are made for the varieties previously recognized in *C. niger*.

Keywords: Neotropical, Cyperaceae, *Cyperus*, sedge, nomenclature

The genus *Cyperus* L. (Cyperaceae) includes over 900 species, occurring worldwide in warm temperate and tropical regions (Larridon et al., 2011a, 2011b). The distribution of species ranges from nearly cosmopolitan, e.g., *C. squarrosus* L. and *C. flavescens* L., to regional and narrow endemics found in most tropical and temperate regions (Alves et al., 2007; Kükenthal, 1935–1936; Tucker, 1994, 2013; Tucker et al., 2002). In the New World, areas of high diversity and endemism include the southeastern United States, Mexico, the Greater Antilles, and eastern Brazil (Ribeiro et al., 2015; Tucker, 2007, 2013). Recent molecular studies (Larridon et al., 2011b; 2013; Reid et al., 2017) have demonstrated that the "*Cyperus Clade"* comprises 13 or more genera, confirming the majority of subgenera and sections proposed by Kükenthal (1935–1936) and including other genera traditionally segregated (*Kyllinga* Rottb., *Lipocarpha* R. Br., *Remirea* Aubl.).

This study was based on examination of type specimens and relevant literature, including taxonomic assessment of numerous synonyms. We found earlier valid names for three species hitherto known as: *Cyperus friburgensis* Boeckeler, *C. niger* Ruiz & Pav., and *C. spectabilis* Link. Also, *C. multifolius* Kunth and *C. penicillatus* Conzatti are noted as overlooked synonyms of *C. prolixus* Kunth. New combinations are made for the varieties previously recognized in *C. niger.*

An earlier name for *Cyperus friburgensis*

Cyperus sect. *Diffusi* Kunth includes about 26 species in Old and New World Tropics (Kükenthal, 1935–1936). In the Neotropics, there are 12 species (Tucker, 2007). Within the preceding section, Nees (in Martius, 1842: 32) described *C. martianus* Schrad. ex Nees, as a new species from Brazil, notably characterized in having digitate spikelets, cuspidate scales, and only one stamen per flower. The species name, however, was a later homonym of *C. martianus* Schultes (1824). MacBride (1929) provided a new name for the species, *C. schraderi*. Meanwhile, in 1890 and 1895, Boeckeler described two new Brazilian *Cyperus* species, viz., *C. friburgensis* Boeckeler and *C. fuscoferrugineus* Boeckeler, respectively. The synonymy citation follows the chronology provided by Kükenthal (1935–1936) for *C. friburgensis*.

While studying the species of *Cyperus* sect. *Diffusi* housed at the MNHN Herbarium (Paris), the taxonomy of the type specimen of *C. caducus* Steud. was assessed. Kükenthal (1936: 215–216) treated this name as *incertae cedis*. The specimen (Fig. 1) was annotated as "Cyperus martianus" by C.B. Clarke in 1888. However, we assert that the specimen having primary, secondary, and tertiary branching in the inflorescence and numerous single spikelets is readily identifiable as *C. friburgensis* (Tucker, 2007). We conclude that *C. caducus* is the earliest available name for the species generally recognized hitherto as *C. friburgensis*.

Cyperus caducus Steud., Syn. Pl. Glumac. 2(10): 315. 1855. TYPE: "America." *s. coll.* [Anonymous *s.n.*], Herb. Steudel (ex herb. Boeck.) (Holotype: P-00542053).

Heterotypic synonyms: *Cyperus martianus* Schrad. ex Nees in Martius, Fl. brasil. 2(1): 32. 1842, not Schult., 1824. TYPE: [BRAZIL]. "Habitat in udis ad margines silvarum ad Ytú et alibi in provincia S. Pauli et juxta S. Barbara provincia Minarum: M(artius) [*s.n., s.d*]. – ad Retiro praedium prov. Rio de Janeiro: Pohl, Herb. Vindob. 946." [A lectotype should be designated from among these syntypes. We have been unable to locate any of the syntype materials.]

Cyperus schraderi J. F. MacBr., Publ. Field Mus. Nat. Hist., Bot. Ser. 4(7): 167. 1929, *nom. nov.* for *C. martianus* Schrad. ex Nees.

Cyperus friburgensis Boeckeler, Beitr. Cyper. 2: 2–3. 1890. TYPE: [BRAZIL] Brasilia. Friburgo, *F. R. Mendonca* [*Mendonça*] 909, 1308 (*Vidi in herb. Mus. bot. Berolin.*)

We thank Dr. Anthony R. Brach (A, GH) for helpful comments on this manuscript. We also thank the curators of the following herbaria for permission to reproduce herein images of type specimens: P and SEV. During the course of this study, and preceding studies by Tucker of New World species of *Cyperus*, some 50,000 herbarium specimens have been borrowed from, or examined at, or viewed online, from the herbaria listed below. Sincere thanks are extended to the staff members of these institutions, without whose kind cooperation this study would not have been possible: A, ARIZ, ASU, B, BH, BM, BR, C, CAS, CCNL, CHAPA, CLEMS, CONN, CR, CU, DAV, DS, DUKE, E, ENCB, EIU, F, G, GH, HAL, IBUG, ILL, ILLS, K, LCA, M, MA, MASS, MEXU, MICH, MO, MSC, MT, NY, P, PR, PRC, RSA, S, SD, SEV, TEX, TRT, UC, UCR, US, UTEP, VT, WIS, WRSL, YU, and Z.

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FIGURE 1. Holotype of *Cyperus caducus* Steudel.

Cyperus fuscoferrugineus Boeckeler, Allg. bot. Zeitschr. 1: 226. 1895 (as *fusco-ferrugineus*). TYPE: BRAZIL. Rio de Janeiro: Friburgo, *F. R. Mendonça 909* (Holotype: B-100146616).

Perennial *herb*, 25–70 (–130) cm tall. *Rhizomes* 5–10 mm thick, indurate, covered with fibrous remnants, ± horizontal. *Culms* 1–2.5 (–3.5) mm wide, trigonous or roundly trigonous, smooth. Leaves 1–5, 10–40 cm long, 4–10 mm wide, flat, the margins and keels scabrellate; sheaths yellowish green. *Inflorescence bracts* 8–14, 4–12 (–22) cm long, 2–9 mm wide, v-shaped, the margins and keels scabrellate, ascendant at 30–45˚. *Rays* 8–18, 3–18 cm long; secondary rays 1.5–3.5 cm long; tertiary rays 5–15 mm long; quaternary rays often present, 3–6 mm long. *Heads* digitate (many spikelets often solitary as well), 6–11 mm wide. *Spikelets* 1–3, 4–6 mm long, 1.7–2 mm wide, broadly lanceolate, compressed; rachilla persistent, 0.5 mm wide, 0.2 mm thick, straight or slightly geniculate, purplish-brown with yellow scale scars, successive scales 0.5–0.6 mm apart, wingless. *Scales* deciduous, 10–14, 1.5 mm long (excluding the mucronate apex of 0.2–0.3 mm), 1.0–1.2 mm wide, lanceolate, laterally nerveless, pale brown, medially 3 nerved, green. *Stamen* 1; filament ribbonlike, 1.2 mm long; anthers about 0.7 mm long, narrowly ellipsoid, the connective apex about 0.1 mm long, reddish brown, glabrous. *Styles* 1 mm long; stigmas 3, 2–3 mm long. *Achenes* 1.2–1.4 mm long, 0.5–0.6 mm wide, trigonous, oblong-ellipsoid, apiculate, stipitate, the faces slightly concave, the surface puncticulate, brown.

Selected specimens examined: ARGENTINA. Salta: Orán: Finca Arazayal, *Novara 383* (CORD). BOLIVIA. Santa Cruz: Ñuflo de Chavez Prov., 2 km N de la comunidad Las Trancas, *Mamani & Jardim 744* (EIU, USZ); Sara Prov., B. Vista, *Steinbach 7429* (F). BRASIL. Goias: Serra do Caiapó, 5 km S of Caiapônia, *Anderson 9486* (AAU, NY). São Paulo: Mpio. Teodoro Sampaio, Serra do Diabo, *Muñiz 326* (EIU, SP). COLOMBIA. Boyaca: Carretera a Yopal, río Charté, *Idrobo 5212* (AAU). ECUADOR: Zamora-Chinchipe: El Padmi, Vivar & Toledo 1817 (AAU). PARAGUAY. Guairá: Tororo, San Pedro, *Degen 1178* (MO). Caazapa: Tavai, *Soria 3326* (FCQ, MA). VENEZUELA. Yaracuy: carreterra San Felipe–Nirgua, *Aristeguieta 1169* (US).

THE IDENTITY OF *CYPERUS MULTIFOLIUS* AND *C. PENICILLATUS*

Cyperus multifolius Kunth was accepted as a species by Kükenthal (1935–1936), and assigned to *C.* sect. *Subulati* C.B. Clarke of the subgenus *Cyperus*. The type specimen, although immature, is undoubtedly identifiable as a plant of *C. prolixus* Kunth. The strongly ascendent bracts with conspicuous septa, presence of secondary rays, and ascendent spikelets support this identification (Tucker 1994). The length of the floral scales and separation of the scales matches the dimensions of *C. prolixus*. Also, Kükenthal described the rays of *C. multifolius* as being compressed, a condition not found in any other members of Subgenus *Cyperus*. *Cyperus multifolius* had been proposed for IUCN Red List status.

Another overlooked synonym of *C. prolixus* is *C. penicillatus* Conz. Examination of an isotype (MICH) shows that it is in no way distinguishable from *C. prolixus*. It was annotated as such by Tucker in 1985.

Cyperus prolixus Kunth in H.B.K., Nov. Gen. Sp. 1: 166 (ed. fol.); 206 (ed. qto.). 1816. TYPE: COLOMBIA, "*Crescit in montosis regni Novogranatensis cum in alta planitie Bogotensi inter Facatativa et Canoas, tum prope lacum Guatavitae, regione quae aeterno premitur frigore, alt.* 1360–1080 *hexap. Floret Julio*", *A. J. A. von Humboldt & F. W. H. A. Bonpland s.n.* (Lectotype, here designated: P-128949; Isolectotypes: BW no. 1397; Herb. Bonpland, P).

Heterotypic synonyms: *Mariscus polyphyllus* Kunth in H.B.K., Nov. Gen. 1: 174 (ed. fol.); 217 (ed. qto.). 1816, *non C. polyphyllus* Vahl, Enum. Pl. 2: 317. 1805. TYPE: ECUADOR: "*Crescit locis alsis regni Quitensis prope Chillo, Conocoto et Alangasi, alt.* 1350 *hex. Floret Februario*"; *A. J. A. Bonpland & F. W. H. A. von Humboldt* in Willd. herb. 1434 (Lectotype, here designated: P; Isolectotypes: B, P).

Cyperus multifolius Kunth, Enum. Pl. 2: 91. 1837, nom. nov. for *M. polyphyllus* Kunth *Cyperus amplissimus* Steud., Syn. Pl. Glumac. 2(10): 316. 1855. TYPE: South America. "Ex Hrbo *Boeckeler* Collector ignotus, sine loco speciali nisi America" (Holotype: P-542063).

Cyperus longeradiatus Steud., Syn. Pl. Glumac. 2(7): 37. 1854. TYPE: MEXICO. Oaxaca: 1845, *Buchinger s.n.* (Holotype: P-0542062).

Cyperus penicillatus Conz., [Fl. Taxon Mex. 2: 230. 1943, *nom. invalid.* (*sine descr. lat.*)] Fl. Taxon Mex., ed. 2, 1: 334. 1946. TYPE: MEXICO. Oaxaca: Mineral Zavaleta, 1931/10/02, *C. Conzatti 4647* (Holotype: not located; Isotype MICH).

Perennial *herb*, 0.5–3 m tall. *Culms* 3–30 mm in diameter, stoutly trigonous, smooth, basally indurate, thickened. Rhizomes 3–20 cm long, 1–2 cm in diameter, indurate. *Leaves* 3–10, 40–130 cm long, 1015 mm wide, v-shaped, with crossveins, the margins and keel scabrous. *Inflorescence bracts* (6–) 9 or –10, (5–) 15–90 cm long, 0.5–20 mm wide, v-shaped or inversely w-shaped, the margins scabrous, ascendent at 45–75°; longest bract 2–4 times longest inflorescence bract. *Rays* (5–) 9–12, 2–22 (-30) cm long (flattened-elliptic in cross-section); secondary rays 1–10 cm long; tertiary rays 0.5–3 cm long. *Spikes* (2–) 3–45 mm long, (4–) 7–10 mm wide, narrowly cylindric (appressedascendent); rachis 2.5–4.0 cm long. *Spikelets* (4–) 10–35, 7–12 (–15) mm long, 0.6–1.2 mm wide, linear, compressed (appressed-ascendent); rachilla persistent, 0.3–0.4 mm wide, about 0.2 mm in diam., flexuous, light brown, with hyaline wings 0.20.4 mm wide, successive scale scars 1.5–2.2 mm apart. *Scales* deciduous, 6–20, (3.2–) 3.8–4.3 mm long, 1.2–1.7 mm wide, oblongovate, acute to obtuse, mucronulate, the apices spreading, marginally hyaline, laterally 2– or 3–veined, brown, medially 1-veined, green. *Stamens* 3; filaments 24 mm long; anthers 0.7–0.9 mm long, the connective apex up to 0.1 mm long, oblong, bright red. *Styles* 0.8–1.3 mm long; stigmas 3, 2.0–3.3 mm long. *Achenes* 1.8–2.5 mm long, 0.8–1.3 mm wide, trigonous, narrowly ellipsoid, the apex subacute (not apiculate), the base sessile, the faces planar or slightly concave, the surface puncticulate, brown.

Phenology: Flowers and fruits from July to November.

Distribution: Neotropical; Louisiana; northwestern Mexico south through Central America and South America to northern Argentina; found along streams, rivers, and roadside ditches from (500–) 1000–2000 m.

THE CORRECT NAME FOR *CYPERUS NIGER* RUIZ & PAV.

Found from the southwestern U.S.A. to northern Argentina, *Cyperus niger* Ruiz & Pav. (1798) is a common species of the Neotropical region in upland areas. However, the preceding name is illegitimate, as it is a later homonym of *C. niger* Salisb. (1796), a situation that has been hitherto overlooked. The date of publication of *C. niger* Ruiz & Pav. was incorrectly given as "1789" by Corcoran (1941) in her monograph of this subgenus of *Cyperus*. Kükenthal (1935–1936) in his worldwide monograph of *Cyperus*, did not include the Salisbury name.

Several names have been proposed for this species. The earliest available name is *Cyperus melanostachyus* Kunth (1815), which we consider as the correct name for the species generally treated as "*C. niger*."

Cyperus melanostachyus Kunth in H. B. K., Nov. gen. sp. 1: 167 (ed. Fol.); 207 (ed. Qto.). 1816. TYPE: COLOMBIA. "*Crescit in praeruptis temperatis regni Novogranatensis, cum ad radices Andium Quinduensium prope Combeima, tum inter Alto de Gascas et Santa Fe de Bogota, alt*. 700–900 *hexap. Floret Augusto*." *S.d*., *F. W. H. A. Humboldt s.n*. (Lectotype designated here (or perhaps Holotype): P; Isolectotype (or Isotype): HAL).

Homotypic synonyms: *Chlorocyperus melanostachyus* (Kunth) Rikli, Jahrb. Wiss. Bot. 27: 564. 1895.

Pycreus melanostachyus (Kunth) C.B. Clarke, Bot. Jahrb. Syst. 30: 8. 1901.

Heterotypic synonyms: *Cyperus niger* Ruiz & Pav., Fl. Peruv. 1: 47. 1798, *non* Salisb. (1796). TYPE: PERU. Habitat in nundatis et stagnatis Provinciae Cercado et Chancay. Floret Junio, et Julio," Chancay, *H. Ruiz & J. A. Pavon 12/62* (Lectotype designated here: MA; photograph, F).

*Pycreus nige*r Cufod., Bull. Jard. Bot. Natl. Belg. 40(3, Suppl.): 1443. [Enum. Pl. Aethiop. Spermat.] 1970, *nom. superfl. & illegit*. [Cufodontis cited *Cyperus melanostachyus* Kunth (1816) and *Pycreus melanostachyus* (Kunth) C.B. Clarke (1901) as synonyms].

Cyperus cimicinus J.Presl & C.Presl, Reliq. Haenk. 1:166 1828. TYPE: "Hab. in Peruvia? In Chili?", *T. P. X. Haenke s.n*. (holotype: PRC; isotype: HAL).

Chlorocyperus cimicinus (J.Presl & C.Presl) Rikli, Jahrb. Wiss. Bot. 27: 563 1895.

Pycreus cimicinus (J.Presl & C.Presl) Pfeiff., Feddes Repert. 28: 17. 1930.

Cyperus melanostachyus var. *gracilis* Liebm., Mexic. halvgr. 14. 1850. TYPE: MEXICO. Puebla, Chinantla, July 1841, *F. M. Liebmann 14439* (Lectotype, designated by Tucker, 1986: C; isolectotype: C).

Cyperus niger var. *pseudoelegantulus* Kük., Pflanzenreich IV. 20 (Heft 101): 345. 1936 (as *pseudo-elegantulus*). TYPE: COSTA RICA. "La Palma (A. Tonduz 12627); Ufer des Rio grande bei San Ramön (*A. M. Brenes 14438*). COLOMBIA. Hochland von Popayän, 1600–2000 m (*F. C. Lehmann 417*, *5741*). Südbrasilien: Paranä, Calmon (*P. K. H. Düsen 9312*)." Lectotype, selected from the syntypes listed above (designated by Tucker, 1994): COSTA RICA. Bords du Río Grande près San Ramón, 18 June 1901, *A. M. Brenes 14438* (GH; Isolectotype: US).

Cyperus piceus f. *densior* Kük., Pflanzenreich IV. 20(Heft 101): 397. 1936. TYPE: COSTA RICA. Cartago: "Gräben und feuchte Weiden bei Turrialba", [Nov. 1893] (*A. Tonduz 8266*) (*sic*) (holotype: B, not located; Isotypes: BM, Z) Lectotype, here designated: Z; isolectotype: BM.

Cyperus intricatoramosus Boeckeler, Allg. Bot. Z. Syst. 1: 186. 1895 (as *intricato-ramosus*). TYPE: BOLIVIA. "Mandon PI. Andium Boliviens. No. 1400. Viciniis Sarota alt. 3000 m in paludosis." (Lectotype, here designated: GH; Isolectotype: NY).

Cyperus niger var. *intricatoramosus* (Boeckeler) Kük., Pflanzenr. (Engler) IV. 20 (Heft 101): 345. 1936.

Perennial *herb*, 540 (–95) cm tall. *Culms* 0.31.4 (–2.0) mm in diameter, trigonous to triquetrous, smooth. *Rhizomes* about 1 mm in diameter, soft, producing culms 130 (–50) mm apart. *Leaves* (2 or–) 3–7, 3–20 (–30) cm long, 1.53 mm wide, broadly v-shaped, the margins scabrellate for the entire length, or apically only. *Inflorescence bracts* 2 or 3, 1–15 cm long, 1–3 mm wide, broadly v-shaped, the margins and keel scabrellate, erect, horizontal to reflexed downward parallel to the culm. *Rays* 1 or 2, 3–45 mm long (rays sometimes none, the inflorescence 620 mm in diameter, densely ovoid). *Spikes* 7–16 mm in diameter, loosely to densely ovoid to hemispherical; rachis 1–2 mm long, or absent. *Spikelets* (3–) 525 (–60), (3–) 5–9 mm long, 1.8–2.3 mm wide, linear to oblonglinear, flattened; rachilla persistent, 0.4–0.6 mm wide, 0.4–0.5 mm in diam., quadrate, stramineous to reddish brown, wingless, successive scales scars 0.8–1.1 mm apart. *Scales* deciduous, 4–18, 1.5–2.1 mm long, 1.4–2.2 mm wide, ovate to orbiculate, obtuse, laterally nerveless, castaneous, black, or light brown, medially distinctly bicarinate basally, 2 (or 3)-veined, green or greenish brown. *Stamens* 2; filaments 1.6–2.3 mm long; anthers 0.6–0.8 mm long, narrowly ellipsoid, the connective apex not prolonged. *Styles* 0.4–0.6 mm long; stigmas 2, 0.7–2.1 mm long. *Achenes* 1.2–1.4 mm long, 0.6–0.8 mm wide, lenticular, ovoid-ellipsoid, apiculate (or not), the base slightly stipitate, the faces convex, the surface puncticulate, brown.

Distribution: Southeastern Oklahoma to western California, south through the mountains of Mexico and Central America to northern Argentina; disjunct in the mountains of East Africa. Rather common in most of its range, occurring in ditches, wet pastures, seepage, streambanks and wet meadows, from (800–) 1500–2200 (–3200) m.

Kükenthal recognized several varieties with his concept of *C. niger*. Corcoran (1941) reviewed these. She accepted several. Southernmost populations have been distinguished as *C. niger* var. *lorentzianus*, although some have treated these at the specific level, as *C. lorentzianus*, distinguished from *C. niger* by having blunt achenes (not apiculate). We accept the varieties of *C. niger* described by Corcoran (1941), making needed combinations below.

KEY TO THE VARIETIES OF *CYPERUS MELANOSTACHYUS*

1a. Culms 2–4 mm in diam., flattened, flaccid; bracts 3–4 mm wide; Mexico. . . . . var. *robustus*
1b. Culms 0.5-2 mm in diam., not flattened; bracts 0.2-3 mm wide; South America, south west United States and Mexico; East Africa. 2
2a. Achenes not apiculate, about 1 mm long (about half as long as the scale); leaves, culms, and bracts not vesiculate; southern South America. . . . . var. **lorentzianus**
2b. Achenes apiculate, 1-1.4 mm long (nearly as long as the scale); leaves, culms, and bracts usually vesiculate; south west United States and Mexico; East Africa. 3
3a. Scales castaneous; spikelets 8–10 mm long; rays absent; south west United States and Mexico. . . . . var. **capitatus**
3b. Scales black; spikelets 4–8 mm long; rays present or absent; Mexico to Peru and E Africa.. 4
4a. Scales with greenish midvein; achenes 0.4–0.5 mm wide; Mexico to Peru. . . . . var. *melanostachyus*
4b. Scales with greenish-yellow midvein; achenes 0.5-0.6 mm wide; East Africa. . . . . .var. *elegantulus*

Cyperus melanostachyus* Kunth var. *melanostachyus

Synonymy as per species.

Selected specimens examined: MEXICO. Sierra de las Cruces, *Pringle 6671* (BRU, CM, US). Oaxaca: about 1 km W of Natividad, *Tucker 2161* (DUKE, ENCB). San Luis Potosí: Las Canoas, *Pringle 3789* (ARIZ, BRU, E, GH, M, MO, NY, TEX, UC, US, Z). PANAMA. Chiriquí: Reserva Forestal de Fortuna, *Thomas & Wilson 14026* (MO, NY). VENEZUELA. Merida: between Timotes and Chachopo, *Alston 6563* (BM, P). Trujillo: municipio Bocono, *Gonto & Fernandez 5971* (MA).

Cyperus melanostachyus* var. *robustus Liebm., Mexic. halvgr. 13. 1850. TYPE: MEXICO. Puebla: San Lorenzo in the Tehuacán Valley, Dec. 1841, *F. M. Liebmann 14441* (Lectotype, designated by Tucker, 1986: C).

C. niger var. *robustus* (Liebm.) Kük., Pflanzenreich IV. 20(Heft 101): 344. 1936.

Cyperus variegatus Kunth in H. B. K., Nov. gen. sp. 1: 167 (ed. Fol.); 208 (ed. Qto.). 1816. TYPE: MEXICO. ”*Crescit in calidis regni Mexicani prope rivum San Pedro Jorullensium* [San Pedro Jorullo], alt. 405 hexap.; *item in declivitate ipsius montis ignivomi. Floret Septembri*.” *S.d, F. W. H. A. Humboldt s.n.* ((Lectotype designated here (or perhaps holotype): P).

Selected specimens examined: MEXICO. Chihuahua: *Gentry 1795* (MO), 1996 (MO). Puebla: *Arsene 2322* (MO, US), *1389* (MO, US); San Lorenzo. *Liebmann 14441* (GH). Tlaxcala: Sta. Ana Chinantepan, *Arsène 1726* (ILL, MO, NY, US). GUATEMALA. Chimaltenango: *Wallace et al. 439* (MO).

Although *Cyperus variegatus* Kunth was initially treated as a synonym of *C. melanostachyus* (e.g., Liebmann, 1850: 200), Kükenthal (1836: 344) made it a synonym of his taxon *C. niger* var. *robustus* as shown above.

Cyperus melanostachyus var. **capitatus** (Britton) G. C. Tucker & Gandhi, *comb. nov*.

Basionym: *Cyperus diandrus* var. *capitatus* Britton, Bull. Torr. Bot. Club 13: 205. 1886. TYPE: “Texas and northern Mexico to California. Here I include the var. *castaneus* of Watson in Botany of California, ii., p. 214; No. 1949 of C. Wright’s New Mexican Collection, and No. 49a of Dr. Palmer’s Chihuahuan Collection of 1885.” Lectotype (designated here): U.S.A. New Mexico: *C. Wright 1949* (NY; Isolectotype: GH).

Homotypic synonyms: *Cyperus flavescens* subvar. *capitatus* (Britton) Farw., Amer. Midl. Naturalist 12: 118. 1930.

Cyperus niger var. *capitatus* (Britton) O’Neill, Rhodora 44: 86. 1942.

Cyperus niger var. *castaneus* Kük., Pflanzenreich IV.20(Heft 101): 344. 1936, *nom. superfl.*

Cyperus diandrus Torr. var. *castaneus* sensu S. Watson, Bot. Calif. 2: 214. 1880, *non* (Pursh) Torr. 1836.

Selected specimens examined: U.S.A. Arizona: *Kearney & Peebles 1448* (US). Yavapai Co., Crescent Moon Ranch, *Licher 2566* (ASU). California: *Parish 3811* (F). Butte Co., *Ahart 8274* (UC, UTEP). New Mexico: *Arsene 18461* (US); *Wright 1949* (GH, NY). Hidalgo Co., *Sivinski et al. 8117* (UNM). MEXICO. Baja California Sur: Sierra de San Francisquito, 22 March 1892, *Brandegee s.n.* (UC). Jalisco: *Pringle 3848* (COL, NY). Oaxaca: *Conzatti 50* (US). Tlaxcala: *Arsene 10140* (US). GUATEMALA. *Steyermark 32306* (F). PANAMA. *Killip 4534* (US).

Cyperus melanostachyus var. **lorentzianus** (Boeckeler) G. C. Tucker & Gandhi, *comb. nov*.

Basionym: *Cyperus lorentzianus* Boeckeler, Linnaea 35: 357. 1874. TYPE: ARGENTINA. Cordoba: Cerro de San Lorenzo, *P. G. Lorentz 36* (holotype: B, not found; lectotype, here designated: CORD).

Heterotypic synonyms: *Cyperus pergracilis* Boeckeler, Cyper. Nov. 2: 1. 1890. TYPE: ARGENTINA. S.d., *G. Niederlein s.n.* (Holotype: B, not located). [Application of name follows Kükenthal (1936: 344)]

Cyperus biradiatus Boeckeler, Allg. Bot. Zeit. 1: 186. 1895. TYPE: BRAZIL. Santa Catharina: Serra do Orontario, *E. H. Ule 1604* (Holotype: B, not located; no duplicates found). [Application of name follows Kükenthal (1936: 344).]

Selected specimens examined: ARGENTINA. Buenos Aires: *Cabrera 2730* (US). Córdoba: *Barros 2357* (LCA), *Lossen 137* (F, GH); *Lorentz & Hieronymus s.n.* in 1873 (NY). Tucumán: *Venturi 4370* (US) and *10036* (GH, US). BOLIVIA. *Fries 1228* (US).

Cyperus melanostachyus var. **elegantulus** (Steud.), G. C. Tucker & Gandhi, *comb. nov*.

Basionym: *Cyperus elegantulus* Steud., Flora 25(2): 583. 1842. TYPE: ETHIOPIA. In uliginosis prope Demerki, 9. Aug. 1838, *W. Schimper 574* (holotype: P).

Homotypic synonym: *Cyperus niger* subsp. *elegantulus* (Steud.) Lye, Sedges & Rushes E. Afr. (Haines & Lye) 271 in error "Appendix 3". 1983.

Cyperus melanocephalus R.Br., Voy. Abyss. [Salt] Append. 62. 1814, *nom. nud.*

Cyperus atronitens Hochst., Flora 24(1, Intelligenzbl.): 20. 1841, *nom. nud.*

AN OLDER NAME FOR *CYPERUS SPECTABILIS*

The accomplishments of the Royal Expedition to New Spain, made during 1787–1803 and led by Sesse and Mociño, are well documented by McVaugh (1977) and others. In addition to herbarium specimens and botanical illustrations, seeds were collected and sent back to the Real Jardín Botánico in Madrid. Many new species were described by Lagasca from these living plants. In the account of *Cyperus* for the *Flora Novo-Galiciana*, Tucker and McVaugh (1993) treated this name, *Cyperus acutiusculus* Lag., as *incertae sedis*, since the name could not be matched with certainty with any Mexican species, based on Lagasca's protologue. The name was not included by Kükenthal (1935–1936) in his worldwide monograph of *Cyperus* or Benedict Ayers (1946) in his account of Mexican *Cyperus*. Recently, with the help of staff at MA and SEV, authentic material was located at SEV. The specimen (Fig. 2), pressed from plants grown from seed by Lagasca, is readily identifiable as the species treated by Kükenthal, Benedict Ayers, Tucker & McVaugh, and Tucker et al. (2002) as *Cyperus spectabilis* Link. The ovoid spikes have widely spaced spikelets [about 14 per cm], and light brown, spreading scales. The scales are 2-2.5 mm long, and laterally 3-veined, and separated by 2.6-3 mm on the rachilla. These features match those of *C. spectabilis*, confirming the identification. We provide synonymy, description, and representative specimens below.

Cyperus acutiusculus Lag., Gen. Sp. Nov. 2. 1816. TYPE: "H[abitat] in N[ueva] H[ispania]. *Semina misit D. Sessé*." (Lectotype, here designated: SEV H9412).

Heterotypic synonyms: *Cyperus spectabilis* Link, Hort. Berol. 1: 318. 1827. Type: based on a cultivated plant from the Berlin Botanical Gardens (Holotype: not located at B; Lectotype, here designated: BR; Isolectotype: P).

Cyperus scaberrimus Nees, Linnaea 19: 697. 1847.

Cyperus spectabilis var. *scaberrimus* (Nees) Boeckeler, Linnaea 35: 606. 1868. TYPE: MEXICO. *A. Aschenborn 683* (Holotype: B, destroyed; Lectotype, here designated: B; isolectotype WRSL).

Cyperus buckleyi Britton ex J.M.Coult., Contr. U. S. Natl. Herb. 2: 461. 1894. TYPE: U.S.A. Texas: *S. B. Buckley s.n.* (Lectotype, designated by Tucker & McVaugh, 1993: NY; Isolectotype: GH).

Cyperus parryi Britton ex C.B. Clarke, Kew Bull. Addit. Ser. 8: 9. 1908.

Cyperus spectabilis var. *parryi* (C.B. Clarke) Kük., Pflanzenreich IV. 20(Heft 101): 462. 1936. TYPE: MEXICO. San Luis Potosí: *C. C. Parry &* Edw. *Palmer 906* (Lectotype, designated by Tucker, 1994: NY; Isolectotypes: GH, US).

Perennial *herb*, (12–) 30–80 (–90) cm tall, tending to form small clumps by basal offshoots. *Rhizome* 1–5 cm long, 2–5 mm in diam., covered with fibrous brown scale remnants. *Culms* 0.7–1.7 mm in diameter, trigonous, smooth or essentially so. Leaves 3–5, 20–45 cm long, 2–4 mm wide, flat to vshaped, the margins and keel scabrellate. *Inflorescence bracts* 2–4, 1–15 (–24) cm long, 0.4–3.5 mm wide, v-shaped, the keel and margins scabrous, ascendant at 15–30°. *Rays* 1–4, 1–15 cm long. *Spikes* (1.5–) 2.5–7.0 cm long, (1.0-) 1.5–3.5 cm wide, loosely ovoid to ovoidellipsoid; rachis (4–) 10–30 mm long, with 12–16 [range: 3–28] spikelets per cm. Spikelets (3–) 8–40, 8–18 mm long, (2.4–) 2.8–4 mm wide, linear, compressed-quadrate; rachilla ± deciduous, about 0.4 mm wide, 0.1–0.2 mm in diam., flat, greenish, whitish or stramineous, wingless or essentially so, successive scale scars (2.0–) 2.4–3.0 mm apart. *Scales* deciduous, (2–) 4–12, 1.6–2.6 mm long, (1.6–) 1.8–2.4 (–2.7) mm wide, oblong-ovate, obtuse, sometimes mucronulate, laterally weakly 2- or 3-nerved, light brown to reddish brown, medially 1 (–3) -veined, green or light brown. Stamens 3; filaments 1.6–2.8 mm long; anthers 0.4–0.6 mm long, linearellipsoid, the connective apex not prolonged. *Styles* 0.3–0.6 mm long; stigmas 3, 0.6–1.0 mm long. *Achenes* 1.7–2.2 mm long, 0.8–1.1 mm wide, trigonous, ellipsoid, the apex obtuse, slightly apiculate, the base substipitate, 0.1–0.2 mm long, whitish, the faces slightly concave, the surface papillose, dark brown to black.

Phenology: Flowers and fruits from early July to early September (–early November).

Distribution: Oklahoma to Arizona south to Chiapas; also in the mountains of Bolivia and northwestern Argentina. Grows in pine and pine oak woods, pinyon-juniper woodlands, grasslands with cacti, chaparral, damp arroyos in semi-desert scrub, and sometimes as a weed of croplands; (1000–) 1500–2000 (–2400) m.

Representative specimens examined: U.S.A. Arizona: Yavapai Co., *Keil 2801* (ASU, EIU). Texas: Jeff Davis Co., Colleen Canyon, *Worthington 6727* (UTEP). MEXICO. Aguascalientes: 4 km W of Asientos, *Rzedowski 25077* (ENCB, MICH). Chiapas: San Cristóbal, *Breedlove 37964* (DS). Chihuahua: Sierra La Brena, Tinaja Wash, *Spencer &*

FIGURE 2. The lectotype of *Cyperus acutiusculus* Lag., from a plant grown at the Madrid Botanical Garden.

Atwood 1173 (ARIZ, BYU). Distrito Federal: near Mexico City, *Pringle 13233* (ARIZ, C, CU, F, GH, K, MICH). Guanajuato: between Guanajuato and Santa Rosa, *Moore 1356* (BH, GH). Guerrero: Dis. Mina, Zihuaqueo, *Hinton 9323* (GH, K, LCU, US). Jalisco: 4.4 miles N of Guadalajara, *Denton 2090* (MICH); 54 km N of Guadalajara, Carr. Saltillo, *Puga 7599* (IBUG). México: Río Hondo Canyon, *Pringle 3159* (ARIZ, ASU, C, DUKE, F, GH, LL, MICH, MSC, TEX, UC, WIS, Z). Oaxaca: Portillo San Dionisio, *Tucker 2781* (CAS, DUKE, ENCB, MICH). Tamaulipas: 3 mi. N of Miquihuana, *Stanford et al. 2448* (DAO). Zacatecas: 29 miles SW of Fresnillo, *Anderson & Laskowski 3594B* (MICH). ARGENTINA Catamarca: Ambato: Cuesta de la Loma Larga, *Hunziker & Di Fulvio 21201* (CORD). BOLIVIA. Cochabamba: Quillacollo to Morochata, *Ritter & Wood 2816* (MO, NHA).

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CORRECTION OF LOCALITY CITATIONS IN THE PROTOLOGUE OF NINE NAMES OF CHINESE TAXA

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Abstract. According to Article 9.2 of International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code, 2018), errors in the citation of the locality in the protologues of nine names of Chinese plants, including *Carex melinacra* var. *changningensis* (Cyperaceae), *Celastrus rugosa* (Celastraceae), *Ctenitis changanensis* (Aspidiaceae), *Huodendron tomentosum* (Styracaceae), *Ostodes kuangii* (Euphorbiaceae), *Pleione microphylla* (Orchidaceae), *Rubus rufus* var. *longipedicellatus* (Rosaceae), *Sorbus* (Rosaceae), and *Trichosanthes subrosea* (Cucurbitaceae), were corrected. The holotypes of two names and the isotypes of seven names are deposited in the Harvard University Herbaria; the holotypes of seven names are deposited in the Chinese National Herbarium (PE).

Keywords: Chinese plants, locality errors, protologues, holotype specimens

The Harvard University Herbaria include six integrated herbaria: the Herbarium of the Arnold Arboretum (A); Economic Herbarium of Oakes Ames (ECON); Orchid Herbarium of Oakes Ames (AMES); Farlow Herbarium (FH); Gray Herbarium (GH); and the New England Botanical Club Herbarium (NEBC). The current collections contain more than five million specimens and over 100 thousand type specimens of vascular plants. Of special interest are more than 10,000 type specimens of Chinese plants.

With the support of the National Plant Specimen Resource Center Project (NPSRC) and the Chinese Virtual Herbarium (CVH) project, we undertook a review from 2018 to 2021 of the Chinese type specimens in the Harvard University Herbaria and in the Chinese National Herbarium. During our review we discovered errors in some of the cited localities that need to be corrected. This paper presents the incorrectly cited locality in the protologues and gives the correct citation. Another paper, "Correction of date errors in the protologues of eighteen taxon names from China," was recently published in this journal (Lin et al., 2021).

We reviewed the literature and examined all the electronic images of type specimens of Chinese plants deposited in A, AMES, and GH. Following ICN Art. 9.2, "If a designation of holotype made in the protologue of the name of a taxon is later found to contain errors (e.g., in locality, date, collector, collection number, herbarium code, specimen identifier, or citation of an illustration), these errors are to be corrected provided that the intent of the original author(s) is not changed" (Turland et al., 2018).

We herewith correct the locality errors in the protologues of nine names of taxa described from China. The nine names are arranged alphabetically by genus, each followed by a brief discussion. Images of the specimens at A, AMES, GH, and PE are linked to the barcodes cited in the following text.

1. *Carex melinacra* Franch. var. ***changningensis*** S. Yun Liang (Cyperaceae), Acta Phytotax. Sin. 37(2): 193. 1999. TYPE**:** CHINA. Yunnan Province: Shunning Hsien [Xian] (=Fengqing Hsien [Xian]), alt. 3000 m, 10 June 1938, *T. T. Yu 16205* (Holotype: PE [00030526]; Isotype: A [00248498], image seen).

The name *Carex melinacra* var. *changningensis* (Liang, 1999) was validly published with the type designated as *T. T. Yu 16205* (PE). The collection locality was cited as "Changning," but the collection locality on the label of the holotype specimen is Shunning (=Fengqing). Therefore, the original type citation is erroneous and it is to be corrected.

2. *Celastrus rugosa* Rehder & E. H. Wilson (Celastraceae) in Sargent, Pl. Wilson. 2(2): 349. 1915. TYPE: CHINA. Sichuan Province: Ebian Hsien [Xian], Wa Shan, alt. 1525-1830 m, June to October 1908, *E. H. Wilson 1106* (Holotype: A [00049665], image seen).

The name *Celastrus rugosa* (Rehder and Wilson, 1915) was validly published with the type designated as *E. H. Wilson 1106* (A). The locality of collection was cited as "Western Szech'uan: west and near Wên-ch'uan Hsien [Xian]." However, we reviewed the image of *E. H. Wilson 1106* in A (A 00049665), and its label indicates that the holotype specimen was collected in Wa-shan, which is in Ebian Hsien [Xian], not in Wên-ch'uan Hsien [Xian]. Therefore, the original type citation is erroneous and it is to be corrected.

3. *Ctenitis changanensis* Ching (Aspidiaceae), Bull. Fan Mem. Inst. Biol., Bot. Ser. 8: 297. 1938. TYPE: CHINA. Guangxi: Yung Hsien [Xian] (i.e., Yongfu), Chang'an, alt. 200 m, 23 October 1933, *A. N. Steward & H. C. Chen 1165* (Holotype: PE [00050286]; Isotype: GH [00135558], image seen).

The name *Ctenitis changanensis* (Ching, 1938) was validly published with the type designated as *A. N. Steward & H. C. Chen* 1165 (PE). The collection locality was cited as "Kweichow: Chang-an, Yung Hsien [Xian]." However, the

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collection locality on the label of the holotype specimens is "Kwangsi Province, Chang-an, Yung Hsien [Xian]." Therefore, the original type citation is erroneous and it is to be corrected.

4. *Huodendron tomentosum* Y. C. Tang ex S. M. Hwang (Styracaceae), Acta Phytotax. Sin. 18(2): 164, f. 4. 1980. TYPE: CHINA. Yunnan: Gongshan Hsien [Xian], alt. 1900 m, 7 July 1938, *T. T. Yu 19219* (Holotype: PE [00857020]; Isotype: A [00277411], image seen).

Huodendron tomentosum (Hwang, 1980) was validly published with the type designated as *T. T. Yu* 19219 (PE). The collection locality was cited as "Ruili." However, the collection locality on the label of the holotype specimens is "Salwin-kiukiang Divide [Salwin-Nu Jiang divide], Newahlung." In fact, the Salwin-kiukiang Divide is located in Gongshan Xian, not Ruili Xian. Therefore, the original type citation is erroneous and it is to be corrected.

5. *Ostodes kuangii* Y. T. Chang (Euphorbiaceae), Acta Phytotax. Sin. 20(2): 224. 1982. TYPE: CHINA. Yunnan: Che-li Hsien [Xian] (=Jinghong City), alt. 1800 m, September 1936, *C. W. Wang 78509* (Holotype: PE [00935324]; Isotype: A [00217463], image seen).

Ostodes kuangii (Chang, 1982) was validly published with the type designated as *C. W. Wang* 78509 (PE). The locality of collection was cited as "Menghai." However, the collection locality on the label of the holotype specimen is Meng-soong, Dahmeng-lung, Che-li Hsien [Xian] (=Jinghong Xian). Therefore, the original type citation is erroneous and it is to be corrected.

6. *Pleione microphylla* S. C. Chen & Z. H. Tsi (Orchidaceae), Acta Phytotax. Sin.38(2): 182, f. 1. 2000. TYPE: China. Guangdong: Boluo Hsien [Xian], Luofu Shan, 25 April 1936, *F. P. Metcalf 18230* (Holotype: AMES [00243089], image seen).

Pleione microphylla (Chen and Tsi, 2000) was validly published with the type designated as *F. P. Metcalf 18230* (AMES). The locality of the collection was cited as "China. Guangdong: Zengcheng, Luofushan." We reviewed the image of *F. P. Metcalf 18230* (AMES 00243089). Its label indicates that the holotype specimen was collected on Loh Fau Shan [Luofu Shan], which is in Boluo Hsien [Xian], not in Zengcheng Hsien [Xian]. The original type citation is therefore erroneous and it is to be corrected.

7. *Rubus rufus* Focke var. ***longipedicellatus*** T. T. Yu & L. T. Lu (Rosaceae), Acta Phytotax. Sin. 20(4): 457. 1982. TYPE: CHINA. Yunnan: Shangpa Hsien [Xian] (i.e., Fugong Xian), alt. 2800 m, 20 October 1934, *H. T. Tsai 58804* (Holotype: PE [00020797]; Isotype: A [00133140], image seen).

Rubus rufus var. *longipedicellatus* (Yu and Lu, 1982) was validly published with the type designated as *H. T. Tsai 58804* (PE). The locality of collection was cited as "Yunnan: Shuangbai." However, the collection locality on the label of the holotype specimen is "Shang-pa", which is in Fugong Hsien [Xian], not Shuangbai Hsien [Xian]. Therefore, the original type citation is erroneous and it is to be corrected.

8. *Sorbus rubiginosa* T. T. Yu (Rosaceae), Acta Phytotax. Sin. 8(3): 209, 223. 1963. TYPE: CHINA. Yunnan: Nan-Chiao Hsien [Xian] (i.e. Menghai Hsien [Xian]), alt. 1900 m, June 1936, *C. W. Wang 75374* (Holotype: PE [00934282]; Isotype, A [00135437], image seen).

Sorbus rubiginosa (Yu and Kuan, 1963) was validly published with the type designated as C. *W. Wang 75374* (PH [i.e., PE]). The locality of collection was cited as "Zhenkang." However, the collection locality on the label of the holotype specimen is Nan-Chiao, which is in Menghai Hsien [Xian], not Zhenkang Hsien [Xian]. Therefore, the original type citation is erroneous and it is to be corrected.

9. *Trichosanthes subrosea* C. Y. Cheng & C. H. Yueh (Cucurbitaceae), Acta Phytotax. Sin. 18(3): 349, pl. 5: 7, 6: 15. 1980. TYPE: CHINA. Yunnan: Gongshan Hsien [Xian], 26 July 1938, *T. T. Yu 19429* (Holotype: PE [01199677]; Isotype: A [00261132], image seen).

Trichosanthes subrosea (Yueh and Cheng, 1980) was validly published with the type designated as *T. T. Yu 19429* (PE). The locality of collection was cited as "Zhenkang Xian." However, the collection locality on the label of the holotype specimens is Kiukiang [Nu Jiang] Valley, (Taron), which is in Gongshan Hsien [Xian], not Zhenkang Hsien [Xian]. Therefore, the original type citation is erroneous and it is to be corrected.

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STUDIES ON PHILIPPINE *MELASTOMA* (MELASTOMATACEAE)— THE RARELY COLLECTED *M. LAEVIFOLIUM* GROUP

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Abstract. Members of the *Melastoma laevifolium* group in the Philippines which include the poorly known *M. culionense* from Culion Island and the new species *M. lawrenceliaoi sp. nov.* from Tawi-Tawi Island are herein taxonomically reassessed and described, respectively. Having the holotype missing/lost, *M. culionense* is herein lectotypified. *Melastoma lawrenceliaoi* is closely related to *M. laevifolium* from Borneo but differs by having flattened and furrowed young twigs, shorter leaves, midrib and longitudinal veins with slightly curved lanceolate scales up to ca. 0.8 mm long on the lower leaf surface, solitary flowers, shorter and grass green bracteoles, hypanthium sparsely covered with neatly appressed linear scales up to ca. 0.8 mm long, longer hypanthium lobes, ovate petals and shorter greyish anthers on the longer stamens. Taxonomic notes on *M. laevifolium* is herein provided too.

Keywords: Culion Island, lectotype, Melastomataceae, Tawi-Tawi Island, taxonomy

Melastoma Linnaeus (1735: 389) is a genus of shrubs and small trees (Neo et al., 2017; Huang *et al*., 2018) in Melastomataceae, which is characterized by having leaves being opposite with three prominent longitudinal veins (Haron et al., 2015), inflorescence being terminal, flowers being diplosteonous, hypanthium generally campanulate and covered with scales or bristles, petals being commonly ciliate along the apical margin, stamens being dimorphic (anisomorphic) or isomorphic, among others (Meyer, 2001). The genus is distributed in tropical Asia and Oceania (Meyer, 2001; Chen and Renner, 2007). Species number within the genus is uncertain as species delimitation is problematic, multiple names have often been applied for the same taxa across different studies (Keng and Li, 1977; Chen, 1984; Huang and Huang, 1993; Meyer, 2001; Yang and Liu, 2002; Chen and Renner, 2007; Dai et al., 2012; Chao et al., 2014; Huang *et al*., 2018) and new species from poorly surveyed areas would be expected as many are narrowly endemic (Wong, 2016; Neo et al., 2017).

In the Philippines, there are currently nine recognized species of *Melastoma* (Pelser et al., 2011 onwards) including two being taxonomically uncertain (Meyer, 2001), distributed from Luzon to Mindanao Islands. Although a species was very recently described from Luzon Island (Agcaoili et al., 2020), the number of *Melastoma* species in the Philippines is significantly fewer in contrast to previous knowledge. The reduction of the number of species from the Philippines was a result of the concise revision of the genus by Meyer (2001) when she adopted broad concept of species delimitation which resulted in simultaneous synonymy of an overwhelming number of taxa without enough clarification and consultation to most specimens. For an instance, *Melastoma malabathricum* L. was relegated with sixty-six different taxa including many of those described from the Philippines while *M. normale* D. Don was reduced for subspecific rank and synonymized with eleven different taxa. The later species has now been reinstated back to its previous species-level status after critical taxonomic investigation of Wong (2015) which utilized noteworthy characters for species delimitation in the genus while a number of taxa previously synonymized with *M. malabathricum* were reassessed and reinstated back to their deserving ranks (Wong 2015, 2016). However, despite the significant number of species being lumped from the Philippines with Meyer's accepted taxa, none of these entities were reassessed or re-examined.

One of the two most poorly understood Philippine species, *M. culionense* Merr. from Culion Island was considered as *species dubiae* in Meyer's work due to the scarcity of examined materials from this species and for its morphological resemblance with *M. laevifolium* Merr., a species endemic to the sandstone hills of Sandakan in the island of Borneo. These species are indeed morphologically similar based on the original description provided by the same authority. Another very similar yet undescribed species was documented from the Island of Tawi-Tawi in 2020. These taxa, including *M. decipiens* Bakh.f. from Indonesia, clearly constitute a taxonomic group which is characterized by having lanceolate leaves and funnel-shaped hypanthium neatly appressed with small ovate, triangular or linear scales which are sparsely produced and are interspersed with smaller scales. In addition to Meyer's wide morphological concept for detecting species boundaries in the genus, the suspicion on the taxonomic homogeneity of these species has been sustained for years since Borneo, Palawan and Tawi-Tawi Islands are geographically next to one another and were once connected (Woodruff, 2010). Furthermore, there were only few specimens (type specimens) of *M. laevifolium* available for examination during Meyer's revision and new collections of materials from this species has just been recently obtained and studied (Wong, 2016).

With the recent accessibility to all of these species' materials and as part of a series of studies to resolve taxonomic ambiguities on Philippine *Melastoma*, this taxonomic group is hereby formally reassessed including the description of a new species from Tawi-Tawi Island.

The author is grateful to the Ministry of Environment, Natural Resources and Energy for the issuance of necessary permits needed in this study, to Dr. Khoon Meng Wong of the Herbarium of Botanic Singapore Gardens for sharing invaluable resources and insights, to Louise Neo of the National University of Singapore for the assistance in taking photographs of *M. laevifolium* specimens and to Dr. Marnel Scherrenberg of the herbarium of Leiden University (L), Netherlands for the assistance in taking photographs of *M. culionense* specimens and to the local people of Panglima Sugala for the assistance during the field work in Tawi-Tawi Island.

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Materials And Methods

Herbarium specimens (including type) of *Melastoma culionense* and *M. laevifolium* where they are deposited were studied from several herbaria such as A, L, SING and US. A search for the holotype and isotypes of *M. culionense* in several herbaria (e.g. A, B, BM, C, E, L, K, P, PNH, NY, SING, US) was conducted but only isotypes were successfully located. Published morphological descriptions for these species were also studied (e.g. Merrill 1917; Merrill 1922; Wong 2016). In addition, photographic data obtained from recent collections and sightings were also utilized for species description. Specimens of the new species were mounted in herbarium sheets for dry preservation and were deposited in local herbaria (e.g. PNH, CEBU, FEUH) and was compared extensively with all species in the genus from specimens in consulted herbaria including their published morphological descriptions. The terminologies on the descriptions were based from the recent morphological descriptions of Wong (2016) while herbarium acronyms follow Thiers (continuously updated).

Taxonomic Treatment

Melastoma culionense Merr., Philipp. J. Sci., Bot. 12: 353. 1917. TYPE: PHILIPPINES. Calamian Islands, Culion Island, August 1913, *L. Escritor 21647* (Lectotype, designated here: L [254737]; Isolectotypes: US [120449], PNH [not seen], NY [00228910]). Fig. 1.

Shrub up to ca. 5 m tall. *Young twigs* sparsely covered with slightly incurved narrowly lanceolate scales, 1–1.5 mm long, 0.2–0.4 mm wide at the base, surface mostly visible among scales. *Leaves* lanceolate, rarely becoming narrowly elliptic, 8–10 cm long, 3.5–4.5 cm broad; *longitudinal nerves* running from the base to apex 4 in addition to the midrib, adaxially markedly impressed, prominent below; *secondary veins* adaxially inconspicuous, abaxially immersed in the lamina, subparallel, tertiary veins branching into a conspicuous reticulate network; *upper leaf surface* in dried material abundantly appressed with flattened, elongate and thin minute hairs 0.5–0.9 mm long, becoming longer and incurved along the margin; *lower leaf surface* with root-like bristles up to 1.5 mm long on midrib, longitudinal veins and secondary veins, with shorter fewer bristles on the tertiary veins; *petioles* 1–1.2 cm long, ca. 1 mm in diameter, covered with scales similar on twigs but much smaller. *Flowers* many, produced in compact terminal cymes, peduncle robust, up to 3.5 cm long, densely covered with scales similar on hypanthia, pedicels slender, up to 1 cm long, neatly appressed with scales similar on hypanthia; *bracteoles* in pair, attached at the mid-length of the pedicel, narrowly elliptic, 7.5–8 mm long, 3–4 mm broad, apex markedly acuminate, adaxially covered with bristly scales similar on hypanthia but much smaller and denser; *bracts* not observed, highly deciduous; *hypanthium* funnel-shaped, 7.2–8.2 mm long, 7–7.8 mm wide, sparsely covered with upcurved lanceolate scales 0.6–0.8 mm long, up to 2 mm wide at the base, apex markedly acuminate, margin entire, interspersed with very small triangular scales, 0.1–0.2 mm long; *hypanthium lobes* 5, lanceolate, apex markedly acuminate, 7.5–8.2 mm long, with narrowly lanceolate intersepalar lobes bearing lanceolate scales up to 2 mm long, bearing short triangular scales at the apices; *petals* 5, broadly obovate, up to 2 cm long and 11 mm broad, purple; *stamens* anisomorphic comprising 5 longer stamens (with ca. 10–11 mm long strongly incurved magenta filaments, 7 mm long magenta anthers, and ca. 10–12 mm long yellow connective with a basal bifurcate yellow extension) and 5 shorter stamens (with ca. 5–5.5 mm long yellow filaments, ca. 2.8–3 mm long linear-rostrate pale yellow anthers and inconspicuous connectives); style filiform and curved apically, 1.3–1.5 cm long, *stigma* truncate.

Distribution: Endemic in the country, collected and documented from Culion and Bicawayan Islands within the Calamian Island group in Western Philippines.

Additional specimen examined: PHILIPPINES. Calamian Islands, Bicawayan Island, September 1922, *M. Ramos 41289* (US2921790).

Photographs of this species has just recently obtained from its type locality (Tobias, pers.com.) from specimens which were not collected. Photographs have verified the characteristics of petals and stamens which were obscurely described by Merrill (1917). Its affinity with *M. laevifolium* has already been suggested by Meyer (2001) but kept as *species dubiae* for failure to obtain enough specimens for examination. It differs from *M. laevifolium* by having young twigs sparsely covered with slightly incurved narrowly lanceolate scales (vs. tiny triangular-ovate appressed scales), upper leaf surface abundantly appressed with flattened, elongate and thin minute hairs (vs. subglabrous), narrowly elliptic bracteoles (vs. absent [unique linear bracts present instead]), hypanthium sparsely covered with upcurved lanceolate scales, margin entire (vs. hypanthium sparsely covered by neatly appressed ovate or triangular scales, margin serrulate) and lanceolate hypanthium lobes (vs. linear).

Melastoma lawrenceliaoi Tahil, *sp. nov*.
TYPE: PHILIPPINES. Sulu archipelago, Tawi-Tawi Province: municipality of Panglima Sugala, Brgy. Balimbing, Mt. Gaha, 05'16.52"N, 119°96'00.83"E, ca. 600 m, October 24, 2020, *A. Tahil 397* (Holotype: PNH; Isotypes: CEBU, FEUH). Fig. 2–3.

A species closely similar to *M. laevifolium* Merr. by the production of lanceolate leaves, funnel shaped hypanthium and linear hypanthium lobes but is readily distinguishable by having flattened and furrowed young twigs (vs. terete), shorter leaves (7–9 cm vs. 5.5–13.6 cm long), midrib and longitudinal veins with slightly curved lanceolate scales up to ca. 0.8 mm long on the lower leaf surface (vs. ovate scales up to 0.5 mm long), solitary flowers (vs. 1–3 in a cyme), shorter (13–15 mm vs. 18–22 mm long) and grass green bracts (vs. reddish), hypanthium sparsely covered with neatly appressed linear scales up to ca. 0.8 mm long (vs. ovate or triangular scales up to 0.5 mm long), longer hypanthium lobes (20–25 mm vs. 16–17 mm long), ovate petals (vs. broadly obovate) and shorter (9–10 mm vs. 12–13 mm long) greyish anthers (vs. pink anthers) on the longer stamens.

Shrub up to ca. 4.5 m tall. *Young twigs* flattened, slightly furrowed, slender, glabrous. *Leaves* lanceolate, apex shortly acuminate, 7–9 cm long, 2.5–3 cm broad; *longitudinal*

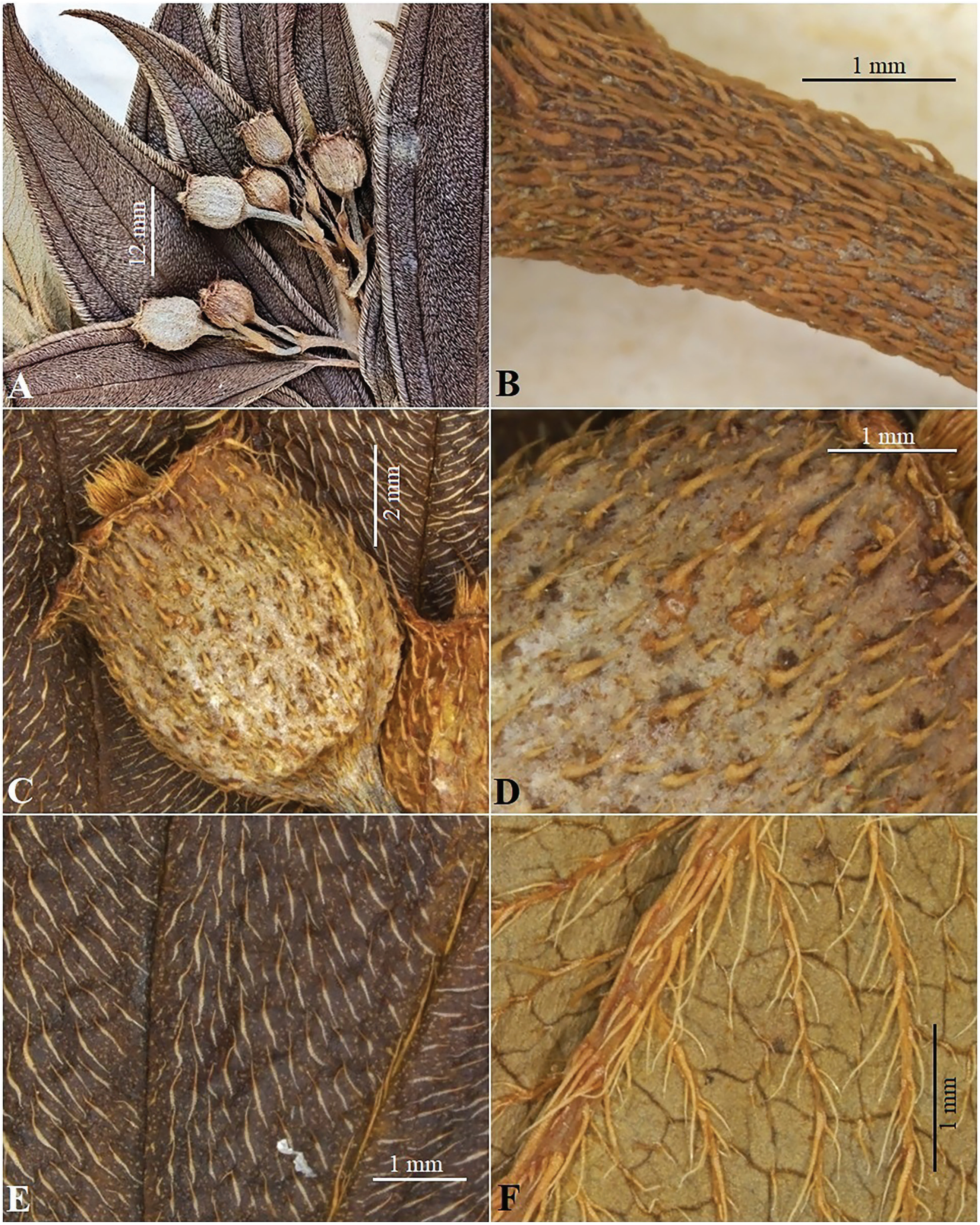

FIGURE 1. Lectotype of *Melastoma culionense* Merr. (L254737). **A**, Leaves and inflorescence; **B**, Twig scales; **C**, Hypanthium; **D**, Close-up of scales; **E**, Upper leaf surface; **F**, Lower leaf surface. Photograph courtesy of M. Scherrenberg.

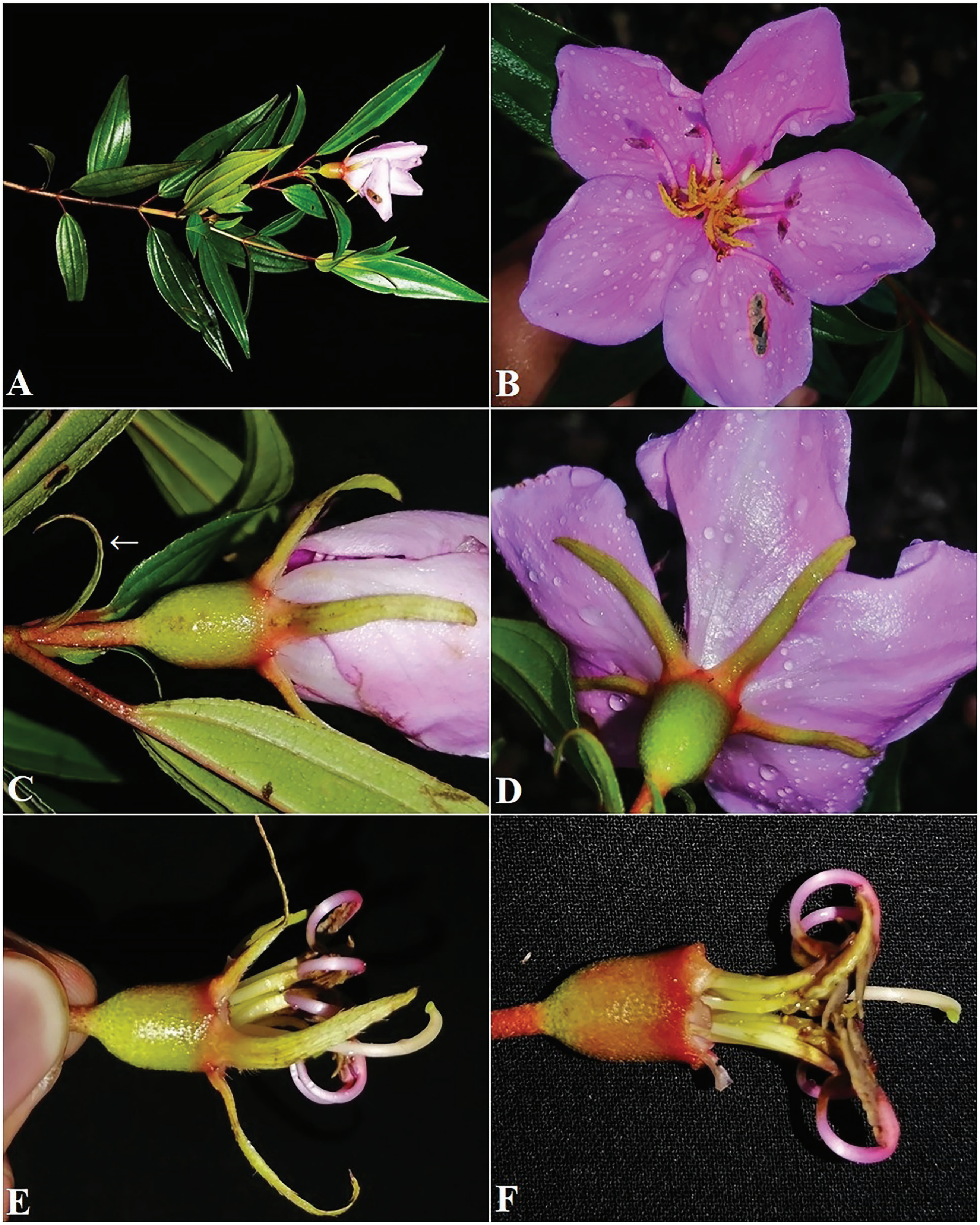

FIGURE 2. Fresh specimen of *Melastoma lawrenceliaoi* Tahil. **A**, Leafy branch with flower; **B**, Anterior view of flower; **C**, Flower showing linear bract (arrow); **D**, Posterior view of flower; **E**, Lateral view of hypanthium; **F**, Hypanthium with artificially removed hypanthium lobes showing stamens. Photographs by A. Tahil based on *A. Tahil 397.*

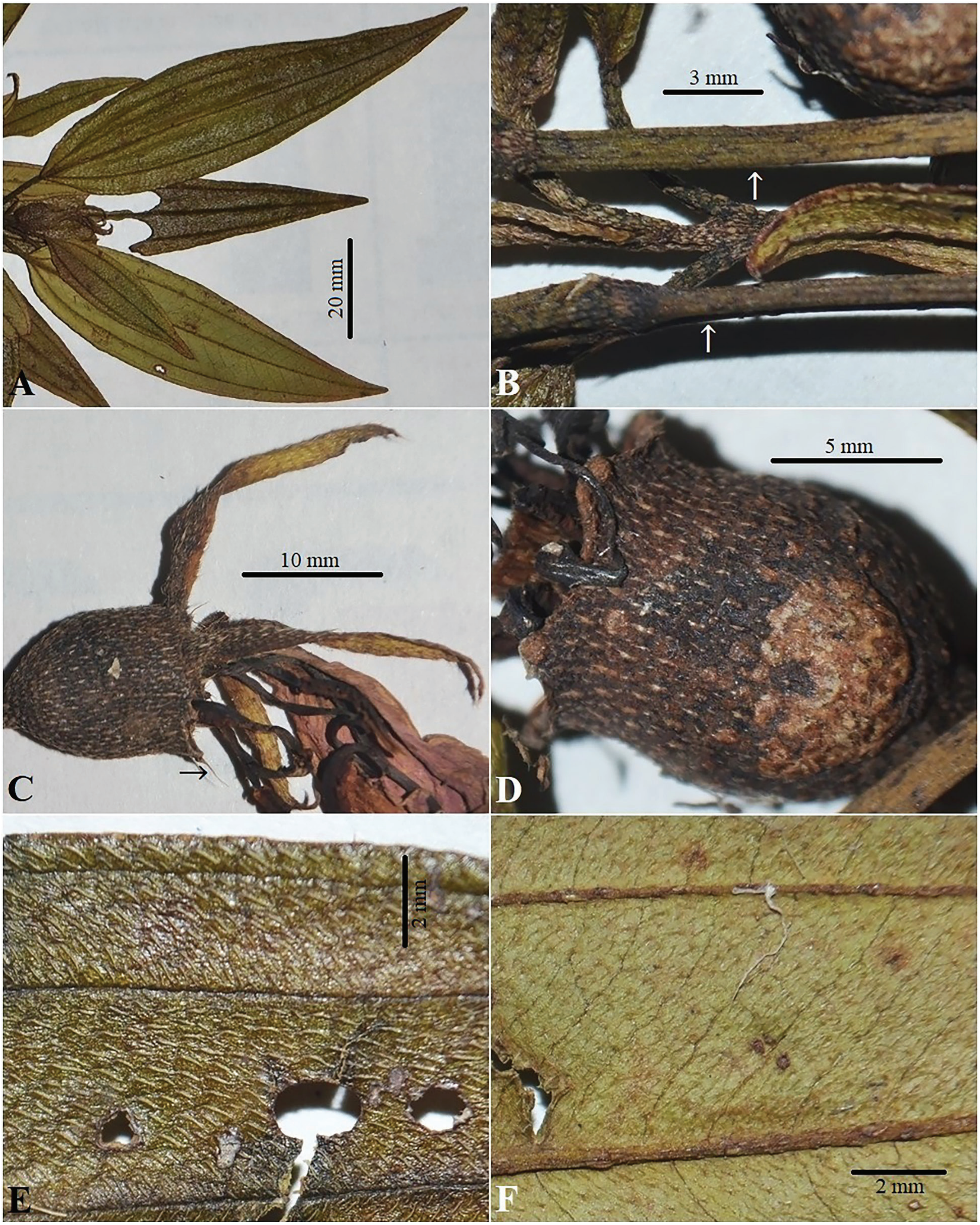

FIGURE 3. Holotype of *Melastoma lawrenceliaoi* Tahil. **A**, Leaves; **B**, Flattened twigs (arrows); **C**, Hypanthium showing the hypanthium lobes and intersepalar emergence (arrow); **D**, Close-up of hypanthium; **E**, Upper leaf surface; **F**, Lower leaf surface. Photographs by A. Tahil based on *Tahil 397*.

nerves running from the base to apex 4 in addition to midrib, adaxially deeply impressed, prominent below; *secondary veins* adaxially inconspicuous, abaxially impressed, subparallel, tertiary veins inconspicuous; *upper leaf surface* in dried material appressed with rows of spicule-like crystalliferous cells up to ca. 1 mm long; *lower leaf surface* subglabrous, lamina and secondary veins devoid of bristles but the adaxially appressed spicule-like crystalliferous cells are markedly prominent herein, midrib and longitudinal veins with sparsely produced slightly curved lanceolate scales up to ca. 0.8 mm long; *petioles* 10–15 mm long, ca. 1 mm in diameter, adaxially flattened, sparsely covered with slightly curved bristles up to ca. 0.8 mm long. *Flowers* solitary, pedicel 8–10 mm long, covered with scales similar on hypanthia but denser; *bracteoles* absent; *bracts* attached at the very base of pedicel, linear, 13–15 mm long, 3–3.5 mm broad, apex acute or blunt, leaf-like, grass green, apically curved outside, glabrous; *hypanthium* funnel-shaped, 12–13 mm long, 9–11 mm wide, sparsely and neatly appressed with linear scales up to ca. 0.8 mm long, ca. 0.01 mm wide, apex acute, margin entire, interspersed with much shorter and smaller linear scales of up to ca. 0.04 mm long; *hypanthium lobes* 5, linear, claw-like, apex acuminate, slightly incurved, 20–25 mm long, 4–5 mm broad, adaxially covered with appressed triangular scales of up to ca. 0.05 mm long especially on the mid-part and becoming sparse and absent towards the margin, intersepalar lobes bearing narrowly lanceolate scale, up to ca. 3 mm long, ca. 0.8 wide at the base, apex extremely acuminate, bristle-like; *petals* 5, ovate, 5–5.5 cm long, 4–4.5 cm broad, mauve; *stamens* anisomorphic comprising 5 longer stamens (with ca. 13–15 mm slightly outcurved pinkish filaments, ca. 9–10 mm grayish linear-rostrate anthers, and ca. 5–8 mm pinkish connective with a very short basal bifurcate yellow extension) and 5 shorter stamens (with ca. 9–10 mm long yellow filaments, ca. 12–14 mm long linear–rostrate yellow anthers and inconspicuous connectives); *style* filiform, strongly curved apically, ca. 2.5–3 cm long, *stigma* blunt.

Additional specimen examined: PHILIPPINES. Sulu archipelago, Tawi-Tawi, Panglima Sugala, Mt. Gaha, 05'16.52"N, 119°96'00.83"E, ca. 530 m, October 24, 2020, *A. Tahil 398* (CEBU).

Eponymy: This handsome species is named after Phycologist Dr. Lawrence M. Liao, Professor at the Graduate School of Biosphere Science, Hiroshima University, in honor for his significant contributions to the marine botany of the Philippines.

Distribution and ecology: *Melastoma lawrenceliaoi* is presently only known from Mt. Gaha, a small forested limestone mountain which occupies a total area of less than 30 km^2. The forest of Mt. Gaha is ca. 1000 ha area of secondary forest over limestone at ca. 600–700 m. This new species grows on limestone structures along with *Paraboea* sp. Epiphytes such as *Hoya* and *Dischidia* spp. were observed growing on this species. Bees were also observed visiting the flowers of this species.

Conservation status: Botanical studies were carried out in all small mountains and hills of the province of Tawi-Tawi since September 2020. *M. lawrenceliaoi* was only documented in the eastern side of Mt. Gaha, a small forested limestone mountain with no protected status. Lower parts of the mountain were already converted for agricultural purposes and the density of local settlers in this part is apparently increasing. Rampant logging was also observed in the area. In addition, less than 50 mature individuals were documented from the type locality. Following the Red List Criteria of the International Union for the Conservation of Nature, this species is hereby considered as Critically Endangered (CR B1ab (i, ii, iii) + B2ab (I, ii, iii); D, IUCN 2017).

Melastoma lawrenceliaoi is undoubtedly one of the most handsome species described from the Philippines and currently the only limestone-obligate species present in the archipelago. Its distinctive linear hypanthium lobes are by far, the longest known in the genus *Melastoma*. Interestingly, unlike most *Melastoma* species which inhabit ultramafic or mountainous areas, both *M. lawrenceliaoi* and *M. laevifolium* appear to be restricted on stone hills or structures (limestone for *M. lawrenceliaoi* while sandstone for *M. laevifolium*). Table 1 presents diagnostic characters and morphological differences between *M. culionense*, *M. laevifolium* and *M. lawrenceliaoi*.

NOTES ON *MELASTOMA LAEVIFOLIUM* MERR.

Described by Merrill (1922) from materials collected from an unspecified locality in Sandakan, Sabah, Borneo and subsequently recollected from 1938 to 1965 in nearby localities, *M. laevifolium* Merr. was reassessed after 94 years of its discovery (Wong, 2016). It has been mistakenly relegated with *M. sanguineum* Sims by Meyer (2001) which is an unrelated species by having filiform bristles on its hypanthium (vs. neatly appressed ovate or triangular scales). In addition, *M. decipiens* Bakh.f. which was synonymized with *M. laevifolium*, should be reinstated for having diagnostic characters comparable from the latter species. The long hypanthium lobes of *M. laevifolium* together with those of *M. lawrenceliaoi*, are among the longest in the genus. In addition, bracts of *M. laevifolium* weren't described by Wong (2016) despite that these are present among the specimens examined and are distinguishable from those of the associated taxa (e.g. *M. decipiens*, *M. lawrenceliaoi*, *M. sanguineum*). The bracts of this species are linear, attached from the base of pedicel, ca. 18–22 mm long, ca. 3–4 mm broad, slender and reddish. Moreover, the neatly appressed ovate or triangular scales in the hypanthium of *M. laevifolium* are interspersed with smaller, linear scales. The reddish lower surface of the longitudinal veins of this species are diagnostic too. The affinity demonstrated by Western and Southern Philippine species, *M. culionense* and *M. lawrenceliaoi* respectively, with the Northern Bornean species *M. laevifolium* suggests an evidence of transitioning speciation of *Melastoma* from these adjacent ecoregions. See Fig. 4 for features of this species.

Additional specimens examined: MALAYSIA. Borneo, Sandakan, September–December 1920, *M. Ramos 1132* (A72593; A112329). Trig Hill, 28 November 2015, *Wong et al. WKM 3512* (SING).

FIGURE 4. Hypanthium and branch of *Melastoma laevifolium* Merr. (SING0222894). **A**, Young flower showing the hypanthium; **B**, Close-up of hypanthium; **C**, Leafy branch. Photographs courtesy of K. M. Wong (A) and L. Neo (B and C).

Table 1. Diagnostic characters and morphological differences between *M. culionense*, *M. laevifolium* and *M. lawrenceliaoi*.

Characters	*Melastoma culionense*	*Melastoma laevifolium*	*Melastoma lawrenceliaoi*
Twig scales	Slightly incurved narrowly lanceolate scales	Tiny triangular-ovate appressed scales	Glabrous
Upper leaf surface	With flattened, elongate and thin minute hairs	With spicule-like rows of crystalliferous cells	With spicule-like rows crystalliferous cells
Lower leaf surface (midrib and longitudinal veins)	Root-like bristles	Ovate scales	Slightly curved lanceolate scales
Leaf length	8–10 cm	5.5–13.6 cm	7–9 cm
Inflorescence	Many, in a compact cyme	1–3 in a cyme	Solitary
Bract shape, color and length	Not seen	Linear, reddish, 13–15 mm	Linear, grass green, 18–22 mm
Bracteole shape	Narrowly elliptic	Absent	Absent
Hypanthium scales	Sparsely covered with upcurved lanceolate scales (up to 0.8 mm long)	Neatly appressed ovate or triangular scales (up to 0.5 mm long)	Neatly appressed with linear scales (up to 0.8 mm long
Scale margin	Entire	Serrulate	Entire
Length and shape of hypanthium lobes	7.5–8.2 mm, lanceolate	16–17 mm, linear	20–25 mm, linear
Petal shape	Broadly obovate	Broadly obovate	Ovate
Length and color of anthers in longer stamens	7 mm, magenta	12–13 mm, pink	9–10 mm, greyish

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MEA CULPA

In the last issue of *Harvard Papers in Botany* (volume 26, No. 2), a correction sent to the editor for Tahil (2021) was somehow overlooked, and a mistake appeared on page 472, in the legend of Figure 1 ("… **A**, plant showing a branch with leaves **and and** inflorescences…"). The editor apologizes to the author in question and to the readers for this oversight.

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INDEX TO NEW NAMES AND COMBINATIONS

Harvard Papers in Botany, Vol. 27, No. 1, 2022, p. 127.

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Page 128 intentionally left blank.

INDEX TO NEW PHYTOSOCIOLOGICAL NAMES

The authors of the following new phytosociological names are: Rangel-Ch., Minorta-C., Castro-L., Niño-A. & Aymard-C.

Harvard Papers in Botany, Vol. 27, No. 1, 2022, p. 129.

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Page 130 intentionally left blank.

(Continued from the back cover)

Harvard Papers in Botany was initiated in 1989 to consolidate the following journals published by the Harvard University Herbaria: *Botanical Museum Leaflets—Harvard University* (vols. 1–30, 1932–1986), *Contributions from the Gray Herbarium of Harvard University* N.S. (nos. 1–214, 1891–1984), and *Occasional Papers of the Farlow Herbarium of Cryptogamic Botany* (nos. 1–19, 1969–1987). Starting with no. 8, it incorporates the *Journal of the Arnold Arboretum* (vols. 1–71, 1920–1990) and the *Journal of the Arnold Arboretum Supplementary Series* (1, 1991).

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(Continued on the inside back cover)

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