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Rubiacearum Americanarum Magna Hama Pars XXIV: New Species of Central and South American *Bouvardia*, *Hillia*, *Joosia*, *Ladenbergia*, *Pentagonia*, and *Posoqueria*

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ABSTRACT. Recent Neotropical exploration and floristic studies have continued the discovery of species of Rubiaceae new to science, including the six species described here: *Bouvardia costaricensis* C. M. Taylor of central Costa Rica is distinguished by its foliaceous enlarged calyx lobes and long white salverform corollas; *Hillia pumila* C. M. Taylor of dwarf montane forests in central Peru is distinguished by its quite small leaves and stipules; *Joosia antioquiiana* C. M. Taylor of northwestern Colombia is distinguished by its long stipules, leaves with numerous secondary veins, and four entire (i.e., unornamented) corolla lobes; *Ladenbergia franciscana* C. M. Taylor of southern Ecuador is distinguished by its calyptrate stipules, small, mostly obtuse leaves, and shallowly lobed calyx limb; *Pentagonia osaensis* C. M. Taylor of southern Costa Rica is distinguished by its dense pilosulose to velutinous pubescence and its subtruncate to very shallowly lobed calyx limb; and *Posoqueria laevis* C. M. Taylor of Panama is distinguished by its leaves with the secondary and higher-order venation not visible.

RESUMEN. Recientes exploraciones y estudios florísticos neotropicales han seguido con el descubrimiento de especies de Rubiaceae nuevas para la ciencia, incluidas las seis especies descritas a continuación: *Bouvardia costaricensis* C. M. Taylor, del centro de Costa Rica, se distingue por sus lóbulos del cáliz agrandados y foliáceos y la corola larga, blanca, hipocraterimorfa; *Hillia pumila* C. M. Taylor, de los bosques montanos enanos del centro de Perú, se distingue por sus hojas y estípulas muy pequeñas; *Joosia antioquiiana* C. M. Taylor, del noroeste de Colombia, se distingue por sus estípulas largas, hojas con numerosas nervaduras secundarias y cuatro lobos de la corola enteros (es decir, no ornamentados); *Ladenbergia franciscana* C. M. Taylor, del sur de Ecuador, se caracteriza por su estípulas caliptradas, las hojas pequeñas y mayormente obtusas y el limbo del cáliz ligeramente lobulado; *Pentagonia osaensis* C. M. Taylor, del sur de Costa Rica, se distingue por la densa pubescencia pilósula a velutina y el limbo

calicino subtruncado a muy ligeramente lobulado; y *Posoqueria laevis* C. M. Taylor de Panamá se distingue por sus hojas con la nervadura secundaria y de orden superior no visible.

Key words: *Bouvardia*, Cinchoneae, Colombia, Costa Rica, Ecuador, Hedyotideae, Henriquezieae, *Hillia*, Hillieae, Hippotideae, IUCN Red List, *Joosia*, *Ladenbergia*, Panama, *Pentagonia*, Peru, *Posoqueria*, Posoquerieae, Rubiaceae, Spermaceae.

During study of specimens of Neotropical Rubiaceae, the new species described below were discovered among specimens made by projects focused on floristic study of tropical forest regions that are not well known to science, with most of the collections made within the last 15 years. Additional collection data for the specimens cited here and high-resolution digital images of the type specimens are available on the Internet at <<http://www.tropicos.org>>.

Conservation status assessment methodology. The study presented here is taxonomic and floristic: the objective is enumeration of the species that belong to various Rubiaceae genera and the species that occur in the area of tropical Central and South America. The methods employed here correspond only to this objective; thus this study is based on survey of specimens collected over a number of years using varied survey methods aimed at various objectives. The specimens here used to delineate the range and commonness of these new species were located through a non-exhaustive survey of several herbaria, and no field studies have been done targeting the occurrence of these species where they are known or expected to grow. Thus the floristic information presented here is a simplified presence report based on incomplete survey of the available data, which are uneven and incomplete for this region (Schulman et al., 2007). Knowledge of the true geographic range and the population size and dynamics of a species are essential to understanding the threats to its existence, and thus to understanding its actual conservation status; documentation of the existence of a species

based on one or several museum collections does not provide adequate data to evaluate these factors. Conservation assessments are provided here for these newly described species using IUCN categories and criteria (IUCN, 2001) based on the totality of our current knowledge. The basis for these assessments in the form of a map and the calculated assessment parameters are available under the corresponding species names at <<http://www.tropicos.org>> (assessment parameters for each map can be seen using “Show Detail”). The assessment parameters were calculated using the IUCN Rating tool (Moat, 2007) in ArcView GIS 3.2 (ESRI, 1999), with the grid cell size used for calculating Area of Occupancy (AOO) varied between 1.00 and 3.16 km depending on characteristics of the species and data (IUCN Standards and Petitions Working Group, 2008). These assessments are not being submitted to the IUCN for publication in the Red List (<<http://www.iucnredlist.org>>), and the basis for these assessments should be carefully evaluated by the reader.

BOUWARDIA

This Mexican and Central American genus of shrubs and herbs is recognized by its opposite or verticillate leaves; the persistent interpetiolar stipules that are fused to the bases of the adjacent petioles and are often setose or lacinate; the several-flowered cymose inflorescences that are generally terminal and bracteate; the distylous, rather showy flowers with white or brightly colored corollas with the four lobes valvate and the tube usually well developed; and the stiffly papery capsular fruits that are loculicidal and contain numerous flattened, winged, thinly papery, orbicular seeds. *Bouvardia* Salisb. has sometimes been classified within the Rubiaceae in the tribe Cinchoneae (Robbrecht, 1988), but most recently has been considered to belong to the Hedyotideae (Andersson & Persson, 1991; Andersson et al., 2002) or the expanded tribe Spermaceae s.l. (including the Hedyotideae; Groeninckx et al., 2009).

Bouvardia was last studied comprehensively by Blackwell (1968), who recognized 31 species with most restricted to Mexico, and several additional species have been described subsequently from that country. Additionally, one Mexican species currently treated as *Arcytophyllum serpyllaceum* (Schltdl.) Terrell has been suggested, based on molecular data, to be more closely related instead to *Bouvardia* (Andersson et al., 2002). Blackwell recognized three subgenera of *Bouvardia*, based on leaf arrangement, inflorescence arrangement, and corolla details.

The arrangement of the inflorescences in *Bouvardia* is basically cymose, and has been described somewhat

differently by different authors. Blackwell (1968) described the inflorescences as composed of solitary flowers or “partial inflorescences,” which he defined as a “flower or group of flowers, and their pedicels and peduncle, arising from each leaf-axil of the terminal 1 to 4 leaf-pairs of a floriferous stem tip” (1968: 3). Here he used the term “pedicel” to refer to the structure immediately supporting the flower, connecting that flower to either the peduncle or the stem. However, some other authors describe inflorescence structures differently in *Bouvardia*, in particular following the terminology of Lawrence (1951: 764) and using the term “peduncle” instead of “pedicel” for the supporting structure of a solitary flower, which is assumed to represent a reduced cyme. Some authors have also described for *Bouvardia* the overall inflorescence in terms of branching pattern, instead of the partial inflorescences (e.g., Lorence, 1994). In several species of *Bouvardia*, the structure supporting the solitary flower is articulated near the middle and sometimes even bears reduced bracts at this articulation: this solitary flower is assumed in *Bouvardia* to represent a reduced cyme (Blackwell, 1968), with the portion of its supporting structure below the articulation corresponding to the former peduncle and the portion above the articulation corresponding to the former pedicel. Such articulated supporting structures have been variously described as pedicels (Blackwell, 1968: *B. glabra*, p. 19; Lorence, in prep., *Flora Mesoamericana*), described as peduncles (Taylor & Lorence, in prep., *Manual de Plantas de Costa Rica*), or have had the sections described separately as the peduncle and the pedicel (Lorence, in prep., *Flora Mesoamericana*). Below, the structure that supports a flower and connects it directly to the stem is described as a peduncle, whether articulated or not, and the overall inflorescence is described rather than the partial inflorescences.

Bouvardia costaricensis C. M. Taylor, sp. nov.

TYPE: Costa Rica. San José: cantón de Acosta, Fila Bustamante, Hacienda Tiquires, 9°44'N, 84°11'W, 1000 m, 24 May 1995, *M. M. Chavarría* & *A. Solís* 848 (holotype, INB; isotype, MO-6110554). Figure 1C.

Haec species a congeneris calycis lobis ellipticis vel lanceolatis 20–25 × 8–11 mm atque corollae albae tubo 70–80 mm longo distinguitur.

Subshrubs or shrubs to 4 m tall, glabrous or glabrescent throughout. *Leaves* opposite; blades lanceolate, 7–11.5 × 2–4 cm, drying papery, base acute to rounded, apex acute to acuminate; secondary veins 5 to 6 pairs, sometimes broadly looping or reticulating to interconnect near margins; *petioles* 2–11 mm;

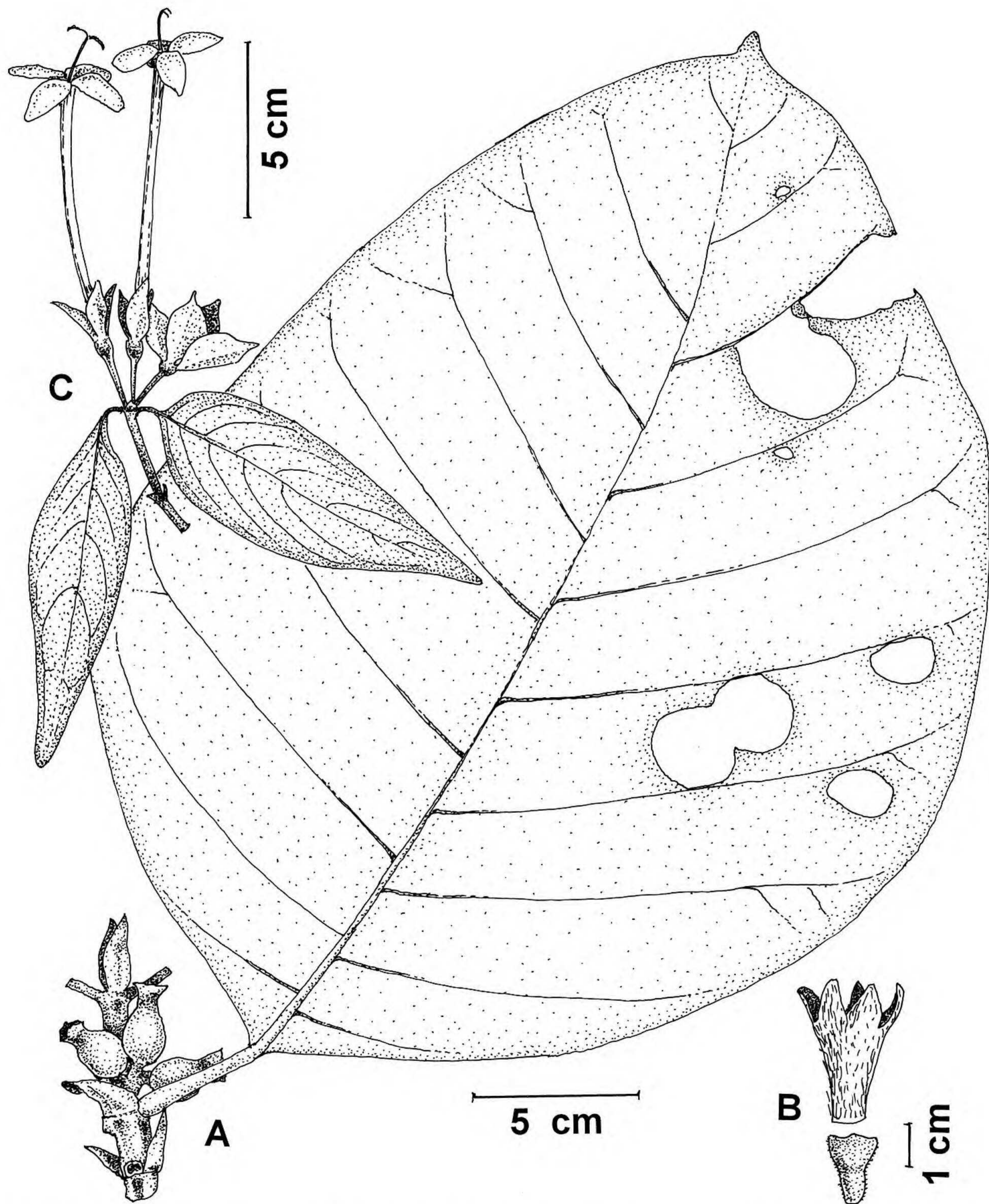


Figure 1. A, B. *Pentagonia osaensis* C. M. Taylor. —A. Portion of fruiting stem; based on the paratype *Morales 3945* (MO). —B. Flower, partially dissected; based on the type *Hammel et al. 16823* (MO). —C. *Bouvardia costaricensis* C. M. Taylor, portion of flowering stem, with two flowers with mature corollas and one flower from which the corolla has fallen; based on the type *Chavarría & Solís 848* (MO).

stipules broadly triangular, 2–3 mm, entire or with 3 or 5 lobes with central lobe markedly longer. *Inflorescences* terminal and sometimes also in axils of uppermost leaves, 3- or 5-flowered, fasciculate-cymose; peduncles 10–25 mm, sometimes articulated near middle, sometimes at the articulation with bracts 2–3 mm, stipuliform. *Flowers* with ovary ellipsoid or turbinate, 3–4 mm; *calyx* limb divided essentially to base, lobes 4, elliptic to lanceolate, 20–25 × 8–11 mm, acute to shortly acuminate, costate

or weakly trinerved; *corolla* white, salverform, tube cylindrical, 70–80 mm, 2.5–3 mm diam., lobes elliptic to lanceolate, 12–15 × 7–8 mm, obtuse to acute, abaxially puberulous; *anthers* narrowly ellipsoid, ca. 5 mm, included with tips positioned ca. 3 mm below top of corolla tube; *stigmas* linear, ca. 7 mm, exerted by 10–15 mm from corolla tube. Immature *fruit* subglobose, 7–8 × 10–12 mm, laterally somewhat flattened, with calyx lobes persistent.

Habitat, distribution, and phenology. *Bouvardia costaricensis* is known from moist forests at 1000–1900 m in central Costa Rica; it has been collected in flower in May, June, and August, and in immature fruit in September.

IUCN Red List category. This species meets the geographic range criteria for Endangered, based on the few known localities and small overall area, and only one of the known localities is within a legally protected area. The habitat in which it is found is in general under threat from development and is declining; however, this species appears to grow in secondary vegetation and has been collected frequently in recent years, so it may not fulfill the subcriterion of continuing decline in species-specific habitat. However, all the known localities for *Bouvardia costaricensis* are relatively close together, so the species could be threatened by a stochastic event such as rapid overall habitat destruction and is here evaluated as Vulnerable due to restricted range: VU D2.

Discussion. This new species is similar in general aspect to *Bouvardia glabra* Pol. and *B. longiflora* (Cav.) Kunth, both of which also have salverform white corollas with well-developed tubes and similarly shaped lobes. However, *B. costaricensis* is separated from these other species by its generally longer corolla, its markedly larger calyx lobes, and its several flowers borne on well-developed peduncles or pedicels; in contrast, *B. glabra* has corolla tubes 15–70 mm long, narrowly triangular or narrowly elliptic calyx lobes 0.5–5 mm wide, and cymose inflorescences with the pedicels 0.5–19 mm long, and *B. longiflora* has corolla tubes 35–85 mm long, linear to linear-lanceolate or oblanceolate calyx lobes 1–4 mm wide, and the flowers solitary or in groups of two or three and subsessile or on reduced peduncles, to about 1 mm long. The corollas vary markedly in length within each of these last two species and may vary similarly in *B. costaricensis*. This is the only species of *Bouvardia* that is restricted to Costa Rica, and the name refers to its geographic distribution.

Bouvardia costaricensis belongs to *Bouvardia* subg. *Bouvardioides* Schlttdl. (Blackwell, 1968) based on its paired leaves, salverform white corollas with well-developed tubes and the lobes spreading at ca. 90°, and few-flowered inflorescences with the partial inflorescences reduced to a single flower. This last condition is shown by the peduncles produced in the leaf axils that are articulated, and represent a reduced 3-flowered cyme. Often three peduncles without evident articulations are borne together at the stem apex, and apparently comprise an unreduced cyme.

Paratypes. COSTA RICA. **San José:** R.F. Los Santos, cuenca del Naranjo y Paquita, *B. Hammel & I. Pérez 23735* (INB, MO); Z.P. Cerros de Escazú, cuenca del Pirrís-Damas, *R. Kriebel & D. Cordero 1309* (INB, MO); cantón de Acosta, Fila Bustamante, en la falda N de Loma León 7 Alto Reflis, *J. F. Morales 4220* (INB, MO).

HILLIA

The Neotropical genus *Hillia* Jacq. comprises about 25 species of fleshy, erect to climbing epiphytes found in wet forests from sea level to 2400 m elevation, and from Mexico and the Antilles through to both Bolivia and southeastern Brazil (Taylor, 1994). *Hillia* is distinguished by its capsular fruits; its flattened seeds that bear a tuft of filaments 1–3 cm long at one end; its epiphytic habit; its well-developed, ligulate to lanceolate, caducous interpetiolar stipules; and its showy, usually solitary flowers. The relationships of this genus have been shown based on morphological analysis to be with *Cosmibuena* Ruiz & Pav., and these two genera were included in the tribe Hillieae (Andersson, 1995). More recently, both of these genera have been included based on molecular data in the Neotropical tribe Hamelieae (Robbrecht & Manen, 2006). Several species with similar fruits, seeds, and habit but with red flowers were previously separated in the genus *Ravnia* Oerst., but have more recently been included in *Hillia* based on vegetative and fruit morphology (Taylor, 1989, 1994).

Hillia pumila C. M. Taylor, sp. nov. TYPE: Peru. Pasco: Oxapampa, dist. Chontabamba, La Suiza Nueva, bosque achaparrado con suelo muy húmedo [dwarf forest with very wet soil], 10°39'S, 75°27'W, 2200 m, 1 Nov. 2006, *R. Rojas, R. Vásquez & B. Vásquez 3996* (holotype, USM; isotypes, HOXA, HUT, MO-6173589). Figure 2B.

Haec species a *Hillia parasitica* Jacq. foliis minoribus, stipulis minoribus acutis saepe costatis atque floribus minoribus distinguitur; etiam in nebulisylva nana Peruviae centralis invenitur.

Weak to climbing shrubs to 1.5 m tall, epiphytic or apparently terrestrial on saturated soils, glabrous generally throughout; bark gray to reddish brown, smooth. *Leaves* opposite; blades elliptic to lanceolate-elliptic, 1.6–3.5 × 0.9–2 cm, drying stiffly papery, base obtuse to rounded, apex acuminate with tip 2–8 mm; midrib plane to impressed adaxially, plane to thickened abaxially; secondary veins pinnate, 3 to 4 pairs, visible but plane on both surfaces; margins plane to thinly revolute; *petioles* 3–7 mm; *stipules* lanceolate, 3–9 × 1–3 mm, smooth or usually weakly to distinctly costate, rounded to usually acute or

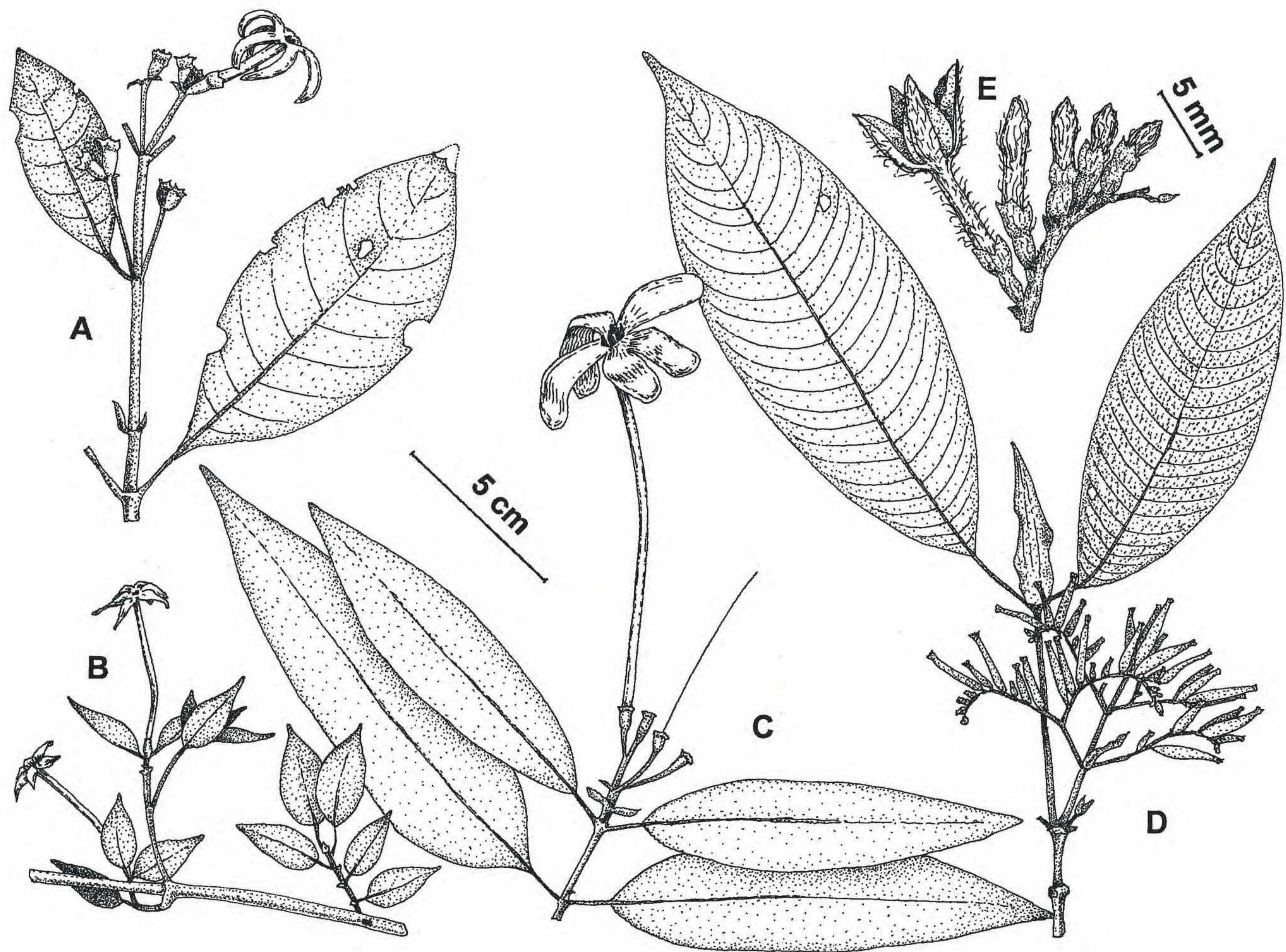


Figure 2. —A. *Ladenbergia franciscana* C. M. Taylor, portion of flowering stem with one flower with mature corolla and seven flowers from which corollas have fallen; based on the type Homeier & Kottke 1406 (MO). —B. *Hillia pumila* C. M. Taylor, portion of flowering stem with two flowers; based on the type Rojas *et al.* 3996 (MO). —C. *Posoqueria laevis* C. M. Taylor, portion of flowering stem with one flower with mature corolla and four flowers from which corollas have fallen; based on the type McPherson & van der Werff 19956 (MO). D, E. *Joosia antioquiiana* C. M. Taylor. —D. Portion of fruiting stem; based on the paratype Cárdenas *et al.* 2640 (MO). —E. Portion of inflorescence with one flower with corolla in process of opening and four immature buds; based on the type Ramírez *et al.* 69 (MO). A–D to same 5-cm scale.

weakly acuminate. *Flowers* solitary, terminal, sessile or with peduncle to 1 mm; bracts similar in shape and size to stipules; ovary cylindrical, ca. 2 mm; *calyx* limb reduced to a minute low ridge; *corolla* white, salverform; tube 30–45 mm, often weakly curved; lobes 6, narrowly lanceolate to narrowly triangular, 12–15 × 3–4 mm, obtuse to acute; *anthers* 6, 3–4 mm, included, tips positioned ca. 3 mm below top of corolla tube; *stigmas* 2, subcapitate, ca. 0.8 mm, included, positioned next to tips of anthers. *Capsules* cylindrical, 50–95 × 5–7 mm including beak ca. 1 mm, smooth, not stipitate; seeds fusiform, ca. 4 × 1 mm, with trichomes 10–15 mm.

Habitat, distribution, and phenology. *Hillia pumila* is known from dwarf cloud forest at 2200–2500 m in central Peru; it has been collected in flower in September and November, and in fruit in February and July.

IUCN Red List category. This species meets the geographic range criteria for Critically Endangered based on the few known localities from a small overall

area, but fails to fulfill the required subcriteria for this evaluation. However, all the known localities for *Hillia pumila* are relatively close together, so the species could be threatened by a stochastic event such as rapid habitat destruction and is here evaluated as Vulnerable due to restricted range: VU D2.

Discussion. This new species is similar to *Hillia parasitica* Jacq., but differs in the smaller size of its leaves, flowers, and stipules; the specific epithet refers to its smaller size. As in other species of *Hillia*, there is variation in flower size in *H. pumila*: the corolla tubes range from 30–45 mm long (i.e., 33% difference in length) on the flowers that are borne along a single branch of the type collection. *Hillia pumila* belongs to *Hillia* subg. *Hillia* (Taylor, 1994).

The similar species *Hillia parasitica* is wide-ranging and morphologically variable (Taylor, 1994), and the plants included here in *H. pumila* might represent a reduced form that grows in dwarf forest and thus arguably should be considered for recognition as a variety. However, these characteristically small plants have been collected in several different

localities, and their anthers are consistently smaller and their stipules differently shaped. These small plants differ markedly and consistently in these characters from the local populations of *H. parasitica*, and thus seem better considered a distinct species in Peru. *Hillia parasitica* has been collected in the same region (e.g., *D. N. Smith 4139*, 10°35'S, 75°30'W, 1830 m, disturbed edges of high montane forest, MO) with leaves 4–7 × 1.5–3 cm, ligulate to narrowly elliptic stipules 20–25 mm long, bracts ca. 50 mm long, corollas with the tube ca. 90 mm long and the lobes ca. 30 mm long, and anthers 6–8 mm long. *Hillia pumila* is also similar to *H. wurdackii* Steyerl., a montane species from northern Peru and southern Ecuador; however, *H. wurdackii* can be separated by its leaves with four to eight pairs of secondary veins that are prominent on the abaxial leaf surface, its obtuse to rounded stipules 14–40 mm long, its broader corolla lobes 12–26 × 9–12 mm, and its larger anthers 10–11 mm long.

Paratypes. PERU. **Pasco:** Oxapampa, dist. Huanca-bamba, Parque Nac. Yanachaga-Chemillén, sector San Daniel, *R. Vásquez, A. Monteagudo, A. Peña, J. Mateo & V. Flores 31094* (HOXA, HUT, MO, USM); Grapanazú, camino hacia la Laguna San Daniel, *S. Vilca C., E. Ortíz & J. Mateo M. 268* (HOXA, HUT, MO, USM).

JOOSIA

This Neotropical genus of shrubs and small trees is distinguished by its lineolate (i.e., regularly finely parallel) tertiary leaf venation, its well-developed interpetiolar stipules that are quickly deciduous, its cymose inflorescences, its salverform 4- or 5-lobed corollas, and its slender, cylindrical, septicidal capsules containing numerous flattened seeds. *Joosia* H. Karst. comprises about 12 species found in wet forests at low to middle elevations from southern Central America to Venezuela and Peru (Andersson, 1997a). The corollas are distinctive in their lobes that often have irregular crisped appendages borne along their margins, and a fleshy marginal wing that runs from either the apex of the corolla lobe or the base of the marginal appendages down to the base of this lobe. Andersson (1997a) revised the genus and recognized 11 species, with *J. umbellifera* H. Karst. distributed throughout the range of the genus and morphologically variable; the largest number of species are so far known from Ecuador. The genus has generally been included in the tribe Cinchoneae, which appears to be wholly Neotropical (Andersson & Antonelli, 2005).

Joosia antioquiensis C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: San Luis, Quebrada La Cristallina, Bh-T, Bmh-T [Bosque húmedo Trop-

ical, Bosque muy húmedo Tropical], 660–740 m, 8 Aug. 1985, *J. G. Ramírez, E. Rentería & O. Mesa 69* (holotype, JAUM; isotype, MO-05017430). Figure 2D, E.

Haec species a *Joosia umbellifera* H. Karst. stipulis longioribus acutis, foliis venis secundariis numerosioribus ad paginam inferiorem pubescentia sericea bene evoluta vestitis, inflorescentia infructescentiaque cymosis plerumque sat congestis, lobis corollinis 4 margine alatis elobulatis atque seminibus minoribus distinguitur; etiam in substratis erupibus sedimentariis oriundis ut videtur crescens.

Shrubs and small trees to 8 m tall; stems glabrous or sericeous then quickly glabrescent. *Leaves* opposite; blades elliptic, 8–21 × 3–7.8 cm, drying stiffly papery to chartaceous, adaxially glabrous or often densely silky-lanose and eventually glabrescent, abaxially densely silky to silky-lanose sometimes to glabrescent on lamina, base cuneate to broadly obtuse, apex acuminate with tips 5–12 mm; secondary veins 12 to 28 pairs, adaxially plane to prominulous, abaxially prominulous, tertiary venation weakly to hardly visible adaxially, weakly to distinctly visible abaxially; *petioles* 10–30 mm; *stipules* caducous or deciduous after distalmost several nodes, narrowly ligulate-triangular, acute, at basalmost node of lateral branches 5–17 mm and glabrous, at other nodes 25–40 mm and densely puberulous to sericeous or silky-lanose. *Inflorescences* congested-cymose, branched to 1 to 2 orders, densely silky-strigillose to glabrescent; peduncle 1.2–3 cm; branched portion 2–3 × 5–8 cm, axes monochasial, flowers 5 to 12; bracts narrowly triangular or triangular-ligulate, 1–2 mm, deciduous. *Flowers* sessile or subsessile; ovary cylindrical, ca. 2 mm, densely sericeous-strigose and/or puberulous; *calyx* limb ca. 2 mm, densely to moderately silky-lanose and/or puberulous to glabrescent, irregularly lobed for ca. 1/2, lobes ligulate to triangular, obtuse to acute; *corolla* white, salverform, outside densely sericeous; tube ca. 10 mm; lobes 4, triangular to lanceolate, ca. 7 mm, acute, marginally entire, with wing ca. 1 mm wide; *anthers* and *stigmas* not seen. *Capsules* slenderly cylindrical, 7–20 × 2.5–3 mm, silky-lanose to glabrescent, old valves becoming twisted; seeds 1.5–3 × ca. 1 mm including wing.

Habitat, distribution, and phenology. *Joosia antioquiensis* is known from wet forests at 500–925 m in northwestern Colombia, at least sometimes on sandstone substrates; it has been collected in flower in August and in fruit in March, April, November, and December.

IUCN Red List category. *Joosia antioquiensis* meets the geographic range criterion for an evaluation of Endangered based on the limited known AOO, and

it is found outside legally protected areas in habitats that are in continuing decline. Thus it is here evaluated as Endangered due to limited distribution and habitat threat: EN B2ab(iii).

Discussion. This new species has previously been confused with *Joosia umbellifera*, and these species are similar. However *J. umbellifera* can be separated by its obtuse stipules; its laxer inflorescences, with the branched portion up to 8×12 cm; its usually five corolla lobes, with irregular marginal appendages $3\text{--}5 \times 2.5\text{--}3.5$ mm; and its notably larger seeds $7\text{--}11$ mm long. Additionally, *J. umbellifera* can often be separated by its generally larger stipules, $9\text{--}28$ mm long, and its leaves with eight to 18 pairs of secondary veins (Andersson, 1997a). The number of secondary leaf veins of *J. antioquiiana* varies among the leaves along an individual stem, usually in correlation with leaf size, but on all the specimens seen at least some leaves have 21 or more pairs of secondary veins, more than found in *J. umbellifera*. Only one specimen seen of *J. antioquiiana* has mature flowers and these are few and have not been dissected, thus the mature anthers and stigmas have not been seen and the floral biology is not determined. The silky pubescence of the abaxial leaf surface of *J. antioquiiana* differs from the glabrous to puberulous abaxial leaf surface of *J. umbellifera* in Colombia. Similar leaf pubescence is found on some Peruvian plants that were provisionally included in *J. umbellifera* by Andersson (in herb., e.g., *Klug 2151*, MO), but the Peruvian plants differ from *J. antioquiiana* in their larger laxer inflorescences and fewer secondary leaf veins. The rather dimorphic stipules, smaller and glabrous at the first nodes of lateral stems but larger and pubescent at other nodes, are apparently characteristic only of *J. antioquiiana*.

The collections seen of *Joosia antioquiiana* are all from an area of unusual sedimentary substrates that was studied floristically by researchers from Jardín Botánico Joaquín Antonio Uribe (JAUM) and Universidad de Antioquia, Medellín (HUA). Several other Rubiaceae species are also known only from there, e.g., *Coussarea antioquiiana* C. M. Taylor and *Simira hirsuta* C. M. Taylor. The specific epithet refers to the geographic distribution of this new species.

Paratypes. COLOMBIA. **Antioquia:** mpio. San Francisco, carr. a Aquitania, quebrada La Alemania, nacimiento de quebrada La Cristalina, D. Cárdenas L., G. Ramírez, A. Daza & J. Daza 2640 (JAUM, MO); mpio. San Luis, vereda el Portón, camino a la autopista Medellín–Bogotá, margen derecha del río Samaná, D. Cárdenas L., J. G. Ramírez & J. Mejía 2510 (JAUM, MO); sector Río Samaná–Río Claro, camino hacia la vereda Tulipán, A. Cogollo & A. Cruz Estrada 191 (JAUM, MO); vereda La Josefina, autopista Medellín–Bogotá, camino de caño la Mariola hacia Santa Bárbara, S. Hoyos & J. Hernández 606 (JAUM, MO).

LADENBERGIA

This Neotropical genus of trees and shrubs is distinguished by its cymose terminal inflorescences, its salverform white corollas with five to seven valvate lobes, and its septicial capsular fruits bearing numerous flattened seeds. *Ladenbergia* Klotzsch comprises about 35 species found in wet forests at low to upper elevations from southern Central America to southeastern Brazil (Andersson, 1997b). *Ladenbergia* was at one time separated from *Cinchona* L. based on capsule dehiscence, basipetal in *Ladenbergia* versus acropetal in *Cinchona*. However, Andersson concluded that capsule dehiscence is variable within both of these genera and even within some individual species, while these two genera are well separated by their flowers. In particular, the corollas are white with the lobes adaxially ridged and marginally entire to papillose on the nocturnal flowers of *Ladenbergia* versus pink-flushed to red with the lobes flat adaxially and villous to ciliate marginally on the diurnal flowers of *Cinchona*. *Remijia* DC. is similar to both of these genera in its flowers, fruits, and vegetative characters, but can be separated by its consistently axillary inflorescences.

Ladenbergia franciscana C. M. Taylor, sp. nov.

TYPE: Ecuador. Zamora-Chinchipe: area of Estación Científica San Francisco, rd. Loja–Zamora, ca. 35 km from Loja, $3^{\circ}58'S$, $79^{\circ}04'W$, 2250 m, 16 Oct. 2004, J. Homeier & I. Kottke 1406 (holotype, LOJA; isotypes, GOET, MO-5828678, QCNE). Figure 2A.

Haec species a *Ladenbergia brenesii* Standl. et *L. moritziana* Klotzsch folii apice obtuso usque subacuto, stipulis calyptratis, calyce non profunde lobato, ovario dense pubescente atque foliis constanter minoribus distinguitur.

Shrubs and small trees to 2.5 m tall; stems strigillose to glabrescent. *Leaves* opposite; blades elliptic, $5.5\text{--}10.5 \times 2.1\text{--}4.7$ cm, $2.1\text{--}2.7\times$ as long as wide, drying stiffly subcoriaceous, glabrous adaxially, abaxially glabrous to minutely strigillose, base cuneate to obtuse, apex obtuse to subacute; secondary veins 6 to 9 pairs, adaxially plane to thickened, abaxially prominulous, with well-developed hirtellous domatia in axils; *petioles* $8\text{--}25$ mm, strigillose to glabrescent; *stipules* caducous, calyptrate, $8\text{--}15$ mm, densely strigillose, splitting along one side. *Inflorescences* cymose, unbranched or branched to one order, densely strigillose to tomentulose; *peduncle* $1.8\text{--}4$ cm; branched portion pyramidal, $4.5\text{--}8 \times 5\text{--}8$ cm; bracts narrowly triangular, $3\text{--}5$ mm; *pedicels* to 1.5 mm. *Flowers* subsessile to shortly pedicellate in groups of 3 to 5; ovary ellipsoid,

ca. 4 mm, densely pilosulose-tomentulose; *calyx* limb 3–4 mm, outside densely strigillose, inside glabrous, shallowly lobed, lobes ca. 1 mm, narrowly triangular, separated by concave sinuses; *corolla* white, salverform, fleshy, outside densely tomentulose-strigillose, inside glabrous and smooth; tube 23–33 mm, 3–4 mm diam. at base, ca. 5 mm diam. at throat; lobes 5, narrowly triangular, 12–18 mm, adaxially papillose along middle, acute; *anthers* ca. 7 mm, included, positioned just below corolla throat; *stigmas* not seen. *Capsules* subglobose, laterally somewhat compressed, 14–17 × 10–15 mm, with endocarp woody, ca. 0.5 mm thick; seeds not seen.

Habitat, distribution, and phenology. *Ladenbergia franciscana* is known from wet montane forests at 2200–2300 m in southern Ecuador; it has been collected in flower and fruit in October.

IUCN Red List category. *Ladenbergia franciscana* meets the geographic range criterion for Critically Endangered based on the very small AOO, and it is found close to but outside legally protected areas in habitats that are in continuing decline. The flora of this region is not well known, and this species might be found within the nearby protected area as well, and could also be distributed more widely in this region. Due to this lack of information it is here evaluated as Data Deficient: DD.

Discussion. This new species is known from southern Ecuador, an area of high species diversity for *Ladenbergia* (Andersson, 1997b); the specific epithet refers to the type locality, at the San Francisco research station. This new species is similar to *L. moritziana* Klotzsch of montane forests of northern Venezuela and to *L. brenesii* Standl. of montane forests of Costa Rica. These last two species can both be separated from *L. franciscana* by their leaves that are acute to markedly acuminate at the apex; their rounded to obtuse, glabrous, interpetiolar stipules 9–35 mm long; their calyx limbs that are deeply lobed for half or more of their length, with the lobes ligulate to broadly triangular; and their relatively slender capsules, 18–70 × 5–11 mm. As far as known, species of *Ladenbergia* are distylous (Andersson, 1997b), but the material available of *L. franciscana* is not adequate to determine its floral biology.

Paratypes. ECUADOR. **Zamora-Chinchipec:** area of Estación Científica San Francisco, ca. 30 km from Loja at rd. to Zamora, *D. Wolff* 85 (MO), 158 (MO).

PENTAGONIA

The Neotropical genus *Pentagonia* Benth. comprises about 30 to 40 species of shrubs and small trees, mostly with very large leaves, found at low to montane

elevations from Guatemala to Peru (Taylor, 2002; Andersson & Rova, 2004). *Pentagonia* is distinguished by its robust and sometimes rather fleshy habit; its well-developed interpetiolar stipules that are triangular and twisted in bud; its leaves with the secondary veins evident but the higher-order venation not visible, and the surfaces characteristically finely striate (Rova & Andersson, 1995); its axillary, capitate to cymose inflorescences; its relatively large fleshy flowers; its corollas with the tube well developed and five valvate lobes; and its rather leathery, berry-like fruits with numerous angled seeds. *Pentagonia* belongs to the small Neotropical tribe Hippotideae (Rova & Andersson, 1995) and is notable in the tribe and the family for its several species with deeply pinnatifid to rarely partially pinnate leaves (e.g., *P. tinajita* Seem.).

Pentagonia has not been studied as a whole, and its individual species are also mostly not well known. Many of the plants or species have an unbranched, monocaule (i.e., “pole”) habit, which together with their unusually large leaves (up to 200 × 120 cm on petioles up to 30 cm long, e.g., *P. grandiflora* Standl.) makes the collecting of museum specimens difficult; extensive field observations are still needed to understand these plants. Andersson and Rova (2004) noted considerable morphological plasticity of the species they studied and adopted a rather broad species concept. Dwyer (1980) and Taylor (2002) considered habit and other characters less variable and used a narrower species concept. In particular, Andersson and Rova noted variation in habit, from unbranched to extensively branched within a species; they observed significant variation in the size of leaves and flowers on specimens, due primarily to differences in shrinkage during drying; and they considered pubescence characters to vary widely within a species. In contrast, others (e.g., Taylor, 2002; Cornejo, 2006) have considered the variation in these characters at least provisionally more limited within a species.

Pentagonia osaensis C. M. Taylor, sp. nov. TYPE: Costa Rica. Puntarenas: Reserva Forestal Golfo Dulce, Osa Peninsula, Rancho Quemado, at S end of valley, 8°40'S, 83°34'W, 160 m, 3 May 1988, *B. Hammel, R. Robles & J. Marín* 16823 (holotype, CR; isotype, MO-3655725). Figure 1A, B.

Haec species a *Pentagonia macrophylla* Benth. bracteis reductis saepe caducis atque limbo calycino subtruncato vel usque ad tertiam partem lobato distinguitur.

Shrubs to 10 m tall, apparently branched; stems stout, markedly quadrangular, densely pilosulose,

tomentulose, and/or velutinous, to often glabrescent. *Leaves* opposite; blade broadly elliptic to elliptic-obovate, 35–58 × 26–30 cm, drying papery to chartaceous, adaxially glabrous, abaxially moderately to densely pilosulose or hirtellous, base rounded to truncate, apex broadly rounded to obtuse then abruptly acuminate with tip 0.5–2 cm; secondary veins 11 to 22 pairs; *petioles* 5–9 cm, densely pilosulose or tomentulose; *stipules* triangular to narrowly triangular, 2.5–3 cm, densely tomentulose or velutinous, acute. *Inflorescences* subcapitate to congested-cymose, subsessile, with 4 to 10 flowers, densely tomentulose or velutinous; bracts 0.5–2 mm, generally caducous; pedicels 0.5–3 mm. *Flowers* subsessile to shortly pedicellate; ovary slenderly ellipsoid, ca. 7 mm, moderately to densely pilosulose; *calyx* limb 6–12 mm, subtruncate to irregularly lobed for up to 1/3 its length, sparsely to densely pilosulose; *corolla* white, funnelform, outside densely velutinous-tomentulose, tube 20–40 mm, lobes triangular, 6–10 mm; *anthers* and *stigma* not seen. *Fruits* subglobose, 2–2.5 cm diam., gray, pilosulose to glabrescent, densely finely lenticellate; seeds angled, somewhat flattened, 3–5 mm.

Habitat, distribution, and phenology. *Pentagonia osaensis* is known from wet forests at 1–750 m in the Golfo Dulce, Osa Peninsula, and Puriscal regions of southern Costa Rica; it has been collected in flower in May and June, and in fruit in August.

IUCN Red List category. This species meets the geographic range criteria for Endangered based on the few known localities and small overall area, but fails to fulfill the required subcriteria for this evaluation. All but one of the known localities are within legally protected areas (according to the collection data), and additionally plants of *Pentagonia* are physically difficult to make into museum specimens and not always collected in botanical surveys, so this species is very possibly more common than the limited number of specimens suggests. *Pentagonia osaensis* is here evaluated as Least Concern (LC), although if these protected areas become ecologically threatened then this species could be considered Endangered.

Discussion. *Pentagonia osaensis* can be recognized within *Pentagonia* by the combination of its dense pilosulose to velutinous pubescence on the stems, stipules, undersides of the leaves, inflorescences, and calyx; its entire petiolate leaves; its truncate to shortly, irregularly lobed calyx limb; and its densely velutinous-tomentulose corolla. This species has incorrectly been called *P. sprucei* (in herb.); however, Andersson and Rova (2004) clarified that the type of *P. sprucei* Standl., from the Andes of

Ecuador, is a synonym of *P. macrophylla* Benth. based on its well-developed inflorescence bracts, 5–15 mm long, and its calyx limb that is regularly lobed for half or more of its length with the lobes elliptic and imbricated. Consequently, these Costa Rican plants comprise a distinct species, undescribed until now; the specific epithet refers to the geographic distribution of this new species on the Osa Peninsula. Only two mature flowers are available on the specimens seen, and these were not dissected in order to preserve them; therefore, the internal corolla pubescence, anthers, and stigmas cannot be described here.

Paratypes. COSTA RICA. **Puntarenas:** cantón de Osa, Península de Osa, R.F. Golfo Dulce, Cerro de Oro, Albergue Unioro, *Angulo 458* (INB, MO); P.N. Corcovado, Arco de Piedras to Río Corcovado, *Kernan 1149* (CR, MO). **San José:** cantón de Puriscal, Cerros de Puriscal, Cerro Pelón, en la falda W, cuenca del Río Caliente, ca. del camino a Quepos, *Morales 3945* (INB, MO).

POSOQUERIA

This Neotropical genus of shrubs and small to medium-sized trees is distinguished by its cymose terminal inflorescences, its salverform white corollas with prolonged tubes and five imbricate lobes, and its relatively large indehiscent fruits with numerous flattened seeds embedded in juicy pulp. *Posoqueria* Aubl. comprises about 15 species found in moist to dry forests at low to montane elevations from Mexico to southeastern Brazil. Macias (1988) studied this genus with a focus on the Brazilian species. Species have been separated rather differently by the various authors who have studied this genus (e.g., Taylor et al., 2004). The relationships of *Posoqueria* were not all well known before molecular data provided new information and insights: recent studies have shown that it is more closely related to some other Neotropical genera that also often have weakly zygomorphic corollas, and *Posoqueria* has most recently been included with *Molopanthera* Turcz. in the Posoquerieae (Delprete et al., 2004), or these have both been included in the Henriquezieae (Robbrecht & Manen, 2006).

Posoqueria laevis C. M. Taylor, sp. nov. TYPE: Panama. Colón: Teck Cominco Petaquilla mining concession, 8°50'N, 80°41'W, 362 m, 4 Dec. 2007, G. McPherson & H. van der Werff 19956 (holotype, PMA; isotype, MO-6173021). Figure 2C.

Haec species a ceteris speciebus *Posoqueriae* Aubl. centraliamericanae et Americae australis partium borealium foliis acutis sat parvis venatione utrinque non manifesta vel venis secundariis abaxialiter leviter evolutis distinguitur.

Trees to 10 m tall, glabrous nearly throughout; stems somewhat flattened. *Leaves* opposite; blades lanceolate to narrowly elliptic-oblong, 6.8–18 × 1.5–5 cm, drying stiffly papery, matte on both surfaces, base obtuse to rounded, apex acute; secondary veins not visible or 6 to 7 pairs and thinly prominulous abaxially on some but not all leaves of a stem, higher-order venation not visible; *petioles* 5–14 mm; *stipules* caducous, deciduous through fragmentation, or sometimes with basal parts persistent and becoming indurated, ovate to ligulate, 2–3 mm, sometimes puberulous, obtuse to rounded. *Inflorescences* fasciculate or shortly cymose, branched to one order, with 2 to 5 flowers; peduncle 3–6 mm; bracts reduced or foliaceous; pedicels 6–10 mm. *Flowers* pedicellate; ovary cylindrical, ca. 4 mm; *calyx* limb 1.5–2 mm, lobed for 1/3–1/2, lobes ligulate to triangular, obtuse to rounded, marginally hyaline and/or ciliolate; *corolla* white, salverform; tube 9.5–14 cm, ca. 2.5 mm diam.; lobes ligulate to oblanceolate, 2.3–2.8 cm, obtuse to rounded; *anthers* narrowly elliptic-oblong, ca. 6 mm, partially exerted, positioned in corolla throat, abaxially uniformly puberulous, at apex with triangular appendage ca. 1.2 mm, with filaments ca. 2 mm; stigmas not seen. *Fruit* ellipsoid, 8–9.5 × ca. 5 cm, smooth to lenticellate, with stipe to 20 mm; endocarp woody, 4–5 mm thick; seeds angled, 8–10 mm, smooth.

Habitat, distribution, and phenology. This species is known from wet forests at 220–323 m in central Panama; it has been collected in flower in September, November, and December, and in immature or perhaps mature fruit in February and December.

IUCN Red List category. This species meets the geographic range criteria for Critically Endangered based on the single known location and small overall range, which falls entirely outside of legally protected areas in a site and habitat that are potentially threatened by development. However, establishment of legal protection to preserve some of the natural vegetation of this site is underway, though it will still leave this species subject to stochastic events such as a hurricane or future degradation of the ecosystem. Therefore, this species is here evaluated as Vulnerable due to restricted range: VU D2.

Discussion. This new species is distinguished within *Posoqueria* by its average-sized fruits together with its relatively small leaves with unusual venation: the secondary and higher-order venation is not visible at all, or sometimes the secondary veins are evident on the abaxial leaf surface on some but not all leaves of a stem. The specific epithet refers to these leaves that are untextured by any evident venation. The pubes-

cence of the stipules sometimes varies on an individual plant, which is unusual in Rubiaceae. The flowers of *P. laevis* resemble those of the plants that have been called *P. panamensis* (Walp. & Duchass.) Walp. (Steyermark, 1967; Burger & Taylor, 1993), but the plants included in *P. panamensis* differ in their broader leaves, with at least some leaves 8–17 cm wide, and their secondary leaf veins evident and usually prominent to prominulous on one or both leaf surfaces.

Posoqueria laevis appears to be endemic to central Panama. Several other Rubiaceae are also apparently restricted to this region, e.g., *Isertia scorpioides* B. M. Boom, *Hamelia sanguinea* T. S. Elias, *Psychotria insignis* Standl., and *P. sanblasensis* C. M. Taylor. However, some other Rubiaceae species suggested to be endemic to central Panama have subsequently been found to have a wider range, e.g., *P. fendleri* Standl., so this new *Posoqueria* species might be expected in northwestern South America as well.

Paratypes. PANAMA. **Colón:** Teck Cominco Petaquilla mining concession, *G. McPherson* 19833 (MO, PMA), *G. McPherson & H. van der Werff* 19861 (MO, PMA), *G. McPherson & M. Merello* 20077 (MO, PMA), *M. Merello, J. I. González & R. Gómez* 3094 (MO, PMA).

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