
Rubiacearum Americanarum Magna Hama Pars XXIII: Overview of the Guettardeae Tribe in Central and South America, with Five New Species and Three New Combinations in *Chomelia*, *Neoblakea*, *Pittoniotis*, and *Stenostomum*

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ABSTRACT. Delimitation of genera in the Neotropical tribe Guettardeae (Rubiaceae) has varied; here a key outlines the current taxonomy in South America and southern Central America. Three new species of *Chomelia* Jacq. are described and illustrated: the unarmed species *C. chiquitensis* C. M. Taylor of deciduous vegetation in eastern Bolivia differs from *C. sericea* Müll. Arg. of Bahia, Brazil, in its linear bracts and shorter corollas; the spiny species *C. costaricensis* C. M. Taylor of humid vegetation in northern Costa Rica differs from *C. microloba* Donn. Sm. in its longer corolla and lack of domatia on the leaves; and the unarmed species *C. torrana* C. M. Taylor of wet montane vegetation in northwestern Colombia is distinguished by its short inflorescences with red-violet corollas and its leaves with the higher-order venation not visible. A second species of *Neoblakea* Standl., *N. ecuadorensis* C. M. Taylor of seasonal vegetation in western Ecuador, differs from *N. venezuelensis* Standl. in its leaves broadly obtuse to rounded at the base and its larger fruits. A second species of *Pittoniotis* Griseb., *P. rotata* C. M. Taylor, is described based on a specimen from Ecuador and is also known from Peru; it differs from *P. trichantha* Griseb. of seasonal lowland vegetation in the Caribbean basin in its corollas with shorter tubes, its larger fruits, and its habitat in wet premontane vegetation. The genus *Stenostomum* C. F. Gaertn. has been recently circumscribed to include several Neotropical species, and three additional species are here transferred to it: *Chione darienensis* Dwyer, as *S. darienense* (Dwyer) C. M. Taylor; *Guettarda acreana* K. Krause, as *S. acreanum* (K. Krause) C. M. Taylor; and *G. turrialbana* N. Zamora & Poveda, as *S. turrialbanum* (N. Zamora & Poveda) C. M. Taylor. Conservation status assessments are presented for all of these species except *G. acreanum*, which is widespread and in need of further study.

en América del Sur y el sur de América Central. Se describen e ilustran tres nuevas especies de *Chomelia* Jacq.: la especie inerme *C. chiquitensis* C. M. Taylor de vegetación caducifolia del este de Bolivia difiere de *C. sericea* Müll. Arg. de Bahía, Brasil, por sus brácteas lineares y corolas más cortas; la especie espinosa *C. costaricensis* C. M. Taylor de vegetación húmeda del norte de Costa Rica difiere de *C. microloba* Donn. Sm. por su corola más larga y la ausencia de domacios en las hojas; y la especie inerme *C. torrana* C. M. Taylor de vegetación húmeda montana del noroeste de Colombia se distingue por sus inflorescencias cortas con corolas de un rojo-violeta y sus hojas con la nervadura de orden mayor no visible. Una segunda especie de *Neoblakea* Standl., *N. ecuadorensis* C. M. Taylor, de vegetación estacional del oeste de Ecuador difiere de *N. venezuelensis* Standl. en sus hojas ampliamente obtusas a redondeadas en la base y los frutos más grandes. Una segunda especie de *Pittoniotis* Griseb., *P. rotata* C. M. Taylor, se describe de una muestra de Ecuador y también es conocida de Perú, y difiere de *P. trichantha* Griseb. de la vegetación de tierras bajas estacional del Caribe por sus corolas con tubos más cortos, sus frutos más grandes y su hábitat de vegetación premontana húmeda. El género *Stenostomum* C. F. Gaertn. se ha circunscrito recientemente para incluir varias especies neotropicales, y aquí se transfieren tres especies adicionales: *Chione darienensis* Dwyer, como *S. darienense* (Dwyer) C. M. Taylor; *Guettarda acreana* K. Krause, como *S. acreanum* (K. Krause) C. M. Taylor; y *G. turrialbana* N. Zamora & Poveda, como *S. turrialbanum* (N. Zamora & Poveda) C. M. Taylor. Se presentan evaluaciones del estado de conservación para todas estas especies excepto *G. acreanum*, que está muy extendida y necesita de más estudio.

RESUMEN. La delimitación de los géneros de la tribu neotropical Guettardeae (Rubiaceae) ha variado; aquí se presenta una clave que delinea la actual taxonomía

Key words: *Allenanthus*, Bolivia, Cerro del Torrá, *Chione*, *Chomelia*, Colombia, Costa Rica, Ecuador, *Guettarda*, Guettardeae, IUCN Red List, *Machaonia*,

Malanea, *Neoblakea*, Panama, Peru, *Pittoniotis*, Rubiaceae, *Stenostomum*.

During ongoing study of Neotropical Rubiaceae species for several flora projects, the new species described below and the need for the new combinations made below were discovered. These species were found through floristic exploration of several tropical regions that are not well known to science and have added information about several genera that are not well known to science.

Genera of Guettardeae are distinguished within Rubiaceae by their interpetiolar stipules that are usually (though not always) densely strigose to sericeous adaxially; the lack of raphides in their tissues; their inflorescences that are sometimes terminal but usually axillary and paired at the nodes; their 2- to multi-locular ovaries with the ovules solitary and pendulous from the top in each locule; and their fruits that are drupaceous with one multilocular pyrene, or in the Neotropics also dry and schizocarpous in *Allenanthus* Standl. and *Machaonia* Bonpl. (or elsewhere sometimes drupaceous with two to numerous unilocular pyrenes). Additionally, species of Guettardeae are often, though certainly not always, characterized by leaves with the tertiary and/or quaternary venation lineolate or very regularly areolate, inflorescences with the axes scorpioid and the flowers sessile, salverform corollas with well-developed tubes and the lobes sometimes crisped to appendaged, and succulent fruits. The Guettardeae are widespread in the Neotropics and well represented here, with probably as many species found in seasonal and dry forest as in wet forest, while the reverse is the more common pattern among Rubiaceae in this region. In the Neotropics most if not all the species appear to be distylous, though sometimes without markedly different positions of the anthers or stigmas between the two floral forms (Faivre & McDade, 2001). Many species of Guettardeae have a well-developed, unequal, presumably seasonal growth form. In these species, the stems terminate in several nodes that produce leaves and are separated by relatively short internodes, then growth from this apex stops and prolongation of the stem continues from a lower node where an axillary bud produces several elongated, often arching internodes. This new stem then repeats this pattern, producing several leaf-bearing nodes separated by relatively short internodes and then terminating with growth continuing from a lower node. This characteristic growth form is found in a number of Rubiaceae that belong to other tribes as well.

The genera of Guettardeae with the ovules and seeds solitary in each locule known from Central and

South America are currently separated taxonomically as outlined in the key below. Robbrecht and Manen (2006) differed from some, though not all, previous authors in including *Allenanthus* in Guettardeae, and this genus is included in the key below. Several additional genera with ovules and seeds several to numerous per locule were also included in Guettardeae by Robbrecht and Manen and by Rova et al. (2002, based on what they described as weak support), in particular *Gonzalagunia* Ruiz & Pav., *Arachnothryx* Planch., and *Rogiera* Planch. However, the inclusion of these other genera in this tribe is controversial (Achille et al., 2006), and they are not included in the key here. The roman numerals in the key below identify the genera that are discussed further in this article and their order of presentation.

Limits and correct names of the genera in this tribe are still problematic, and taxonomic stability most likely will not be reached in the imminent future; however, the current provisional classification represents an advance and a useful basis for floristic work. Many Neotropical Rubiaceae species with imbricate corolla lobes and drupaceous fruits were previously included in the polymorphic, poorly defined genus *Antirhea* Comm. ex Juss., but Chaw and Darwin (1992) restricted this genus to its Paleotropical species and included those Neotropical species variously in several wholly Neotropical genera, notably *Pittoniotis* Griseb. and *Stenostomum* C. F. Gaertn. Achille et al. (2006) suggested, based on molecular analysis, that *Guettarda* L. and *Stenostomum* are polyphyletic as currently circumscribed and will eventually be subdivided. However, their study presented a first broad overview of the tribe based on necessarily limited sampling of species, and their results were not all strongly supported; consequently, they did not make new combinations or outline new generic circumscriptions. Additional comments about characters and circumscription of the individual genera treated here are presented below, in the discussion of the corresponding genus.

The descriptions and measurements here are based primarily on dried herbarium specimens. Flower buds of Rubiaceae species often open prematurely in the press at a smaller size than fully developed flowers and the succulent fruits often shrink when dried, so the measurements of herbarium specimens may differ from those of living plants. High-resolution digital images of representative specimens of the species detailed here are available at <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 <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 IUCN for publication in the Red List (<www.iucnredlist.org>), and the basis for these assessments should be carefully evaluated by the reader.

KEY TO GENERA OF GUETTARDEAE WITH OVULES SOLITARY IN EACH OVARY LOCULE FROM CENTRAL AND SOUTH AMERICA

- 1a. Inflorescences terminal, or terminal and also produced in uppermost leaf axils; fruits dry, indehiscent or schizocarpous.
 - 2a. Stipules triangular; fruits samaroid with the body flattened and winged *Allenanthus* Standl.
 - 2b. Stipules triangular, 2-lobed, or 3-lobed; fruits ellipsoid to obovoid, angled or rounded to somewhat flattened, sometimes with samaroid calyx lobes.
 - 3a. Stipules triangular or 2-lobed; bracts eglandular; fruit schizocarpous, splitting into 2 mericarps, or indehiscent with samaroid calyx lobes that enlarge as fruits develop *Machaonia* Bonpl.
 - 3b. Stipules 3-lobed; bracts of higher-order axes eglandular or usually glandular abaxially at base; fruit indehiscent, with calyx lobes linear and similar in size to calyx lobes in flower II. *Neoblakea* Standl.
- 1b. Inflorescences axillary, borne at nodes below stem apex; fruits fleshy, indehiscent.
 - 4a. Corolla lobes 4, valvate or valvate-induplicate in bud; leaves with tertiary or higher-order venation not visible or lineolate.
 - 5a. Erect to scandent subshrubs, shrubs, or lianas, unarmed or with axillary spines; stipules acute; corollas salverform, with well-developed tubes and glabrous in throat I. *Chomelia* Jacq.
 - 5b. Scandent shrubs or lianas, unarmed; stipules acute to rounded; corollas rotate to funnelform and pubescent in throat *Malanea* Aubl.
 - 4b. Corolla lobes 4 or 5, imbricate in bud; leaves with tertiary and/or higher-order venation not visible, lineolate, or regularly to irregularly areolate.
 - 6a. Leaves with tertiary and/or higher-order venation lineolate; corollas with lobes equal to or longer than tube; anthers exerted on well-developed filaments; pyrenes 2-locular III. *Pittoniotis* Griseb.
 - 6b. Leaves with tertiary and higher-order venation not visible, or if visible then irregularly to rather regularly areolate; corollas with lobes shorter than tube; anthers included or exerted on short filaments; pyrenes 1- to 9-locular.
 - 7a. Stems at apex and stipules not resinous; pyrenes solid in center. *Guettarda* L.
 - 7b. Stems at apex and stipules sparsely to copiously resinous; pyrenes in the center variously solid or with a central locule or space IV. *Stenostomum* C. F. Gaertn.

I. *CHOMELIA*

The Neotropical genus *Chomelia* comprises at least 50 species of shrubs, small trees, and lianas found in dry to wet, usually lowland forests and brushlands from central Mexico to Paraguay (Lorence & Taylor, 2001; Taylor et al., 2004). Many *Chomelia* species have distinctive lineolate (i.e., closely set and parallel) tertiary or quaternary venation visible on the abaxial leaf surface; in the remaining species the tertiary venation is sometimes irregularly areolate or sometimes not visible, and the higher-order venation

is usually not visible. The corolla lobes of many species of *Chomelia* are marginally irregular and weakly crisped to sometimes elaborately appendaged, similarly to several Rubiaceae genera of various tribes (e.g., *Joosia* H. Karst., *Arachnothryx*). Species of *Chomelia* with elaborately appendaged lobes were previously separated in *Anisomeris* C. Presl, but Steyermark (1967) showed that there is variation in this feature even within species so it does not distinguish two distinct groups of plants, and consequently he combined these genera. Some authors (e.g., Burger & Taylor, 1993) have reported both

valvate and imbricate corolla aestivation in *Chomelia*, but in the current circumscription the species of this genus all appear to have valvate or valvate-induplicate aestivation. Some *Chomelia* species bear paired spines along their stems; this condition has been used to distinguish species, but can be difficult to interpret because individual plants of usually spinescent species sometimes do not produce any spines. Many *Chomelia* species show a characteristic growth form, with internodes of the principal stems regularly developed and the lateral shoots reduced to spur shoots (i.e., brachyblasts). *Chomelia* has not been studied as a whole, although some regional treatments have been published (e.g., Steyermark, 1967, 1974; Taylor et al., 2004). The name *Chomelia* was at one time incorrectly used for some Asian Rubiaceae that are mostly now classified in *Tarenna* Gaertn. and *Aidia* Lour.; this historical error has generated some persistent confusion about the geographic range and morphological characters of *Chomelia*.

1. *Chomelia chiquitensis* C. M. Taylor, sp. nov.

TYPE: Bolivia. Santa Cruz: prov. Chiquitos, Valle de Tucabaca, a 20 km al O de Santo Corazón, tramo entre La Cal y Campamento Los Murciélagos, 18°05'S, 59°03'W or 18°01'30"S, 59°01'50"W [see discussion of coordinates below], 500 m, 24–28 Oct. 1994, I. G. Vargas C., G. Navarro & H. Justiniano 3547 (holotype, USZ not seen; isotypes, F, MO-05006411, MO-5828914). Figure 1A, B.

Haec species a *Chomelia sericea* Müll. Arg. bracteis linearibus atque corolla brevior distinguitur.

Shrubs to 3 m tall, without spines; stems subterete, hirtellous and/or pilosulose-tomentulose to glabrescent, terminating in clustered nodes, with both well-developed principal stems and short to well-developed lateral stems. *Leaves* usually clustered near ends of stems, elliptic to lanceolate-elliptic, 2–4 × 0.8–2.4 cm, drying papery, adaxially strigillose to sparsely tomentulose, abaxially densely hirtellous-tomentulose or pilosulose-tomentulose, base acute to obtuse, apex acute; secondary veins 4 to 5 pairs, with pubescent domatia in abaxial axils, costa and secondary veins prominulous on both surfaces, tertiary and higher-order venation plane, visible, closely lineolate; *petioles* 1–9 mm, hirtellous; *stipules* generally persistent, triangular to broadly triangular, 2–4 mm, abaxially strigillose to strigose, acute. *Inflorescences* subcapitate to congested-cymose, branched to 1 order, paired in axils at ends of stems, densely pilosulose to hirtellous, with 3 to 11 flowers; peduncle 0.8–2.5 cm; bracts free, linear, 0.8–2 mm. *Flowers* sessile; ovary

portion ellipsoid, ca. 1.2 mm, densely pilosulose-hirtellous; *calyx limb* strigose to sericeous, lobed, with tubular portion ca. 0.5 mm, lobes linear, 1–1.5 mm, separated by concave sinuses; *corolla* greenish white, slenderly funnelform, outside moderately to sparsely strigose, tube 9–10 mm, cylindrical, ca. 0.8 mm diam., lobes elliptic, 2.2–2.5 mm, obtuse to rounded, entire, in bud induplicate-valvate, together forming an obtuse bud apex; *anthers* narrowly elliptic-oblong, ca. 2 mm, subsessile, included with apices positioned ca. 1.5 mm below top of corolla tube; *stigmas* 2, linear, ca. 0.8 mm, included on styles ca. 3 mm. *Fruits* not seen.

Habitat, distribution, and phenology. *Chomelia chiquitensis* is known from deciduous, rather dry forest on limestone substrates at ca. 500 m in eastern Bolivia; it has been collected in flower in October.

IUCN Red List category. This species meets the geographic range criterion for Critically Endangered based on the small AOO. It is found within a legally protected area, where continued decline in the habitat is possible, but has not been confirmed; because of the lack of information, this species does not meet the subcriteria for this evaluation. However, the known localities for *Chomelia chiquitensis* are relatively close together, so this species could be threatened by a stochastic event such as fire and it is here evaluated as Vulnerable due to restricted range: VU D2.

Discussion. This new species is distinguished by its relatively small acute leaves with densely hirtellous-tomentulose or pilosulose-tomentulose pubescence on their abaxial surfaces, its subcapitate to congested-cymose inflorescences with three to 11 flowers borne on well-developed peduncles, its linear bracts and calyx lobes, and its corollas with slender, well-developed tubes and entire lobes. The flowers of both of the collections studied are similar and resemble the short-styled form of distylous species of *Chomelia*. This new species is similar to *C. sericea* Müll. Arg. of Bahia in eastern Brazil; *C. sericea* can be distinguished by its ovate bracts 1–1.5 mm wide and its longer corollas (15–18 mm long vs. 11.2–12.5 mm in *C. chiquitensis*). This new species is also similar to *C. kirkbridei* Delprete of northeastern Brazil; *C. kirkbridei* can be separated by its mostly shorter calyx lobes (0.7–1 mm long) and its shorter corolla lobes (1.3–1.7 mm long). *Chomelia chiquitensis* is known only from two collections from the Chiquitos region of eastern Bolivia; the specific epithet refers to this region.

There are two specimens at MO of the type collection, I. G. Vargas et al. 3547; the data on the two labels are the same, except two different sets of latitude and longitude coordinates are given. The first set of coordinates cited in the protologue above is

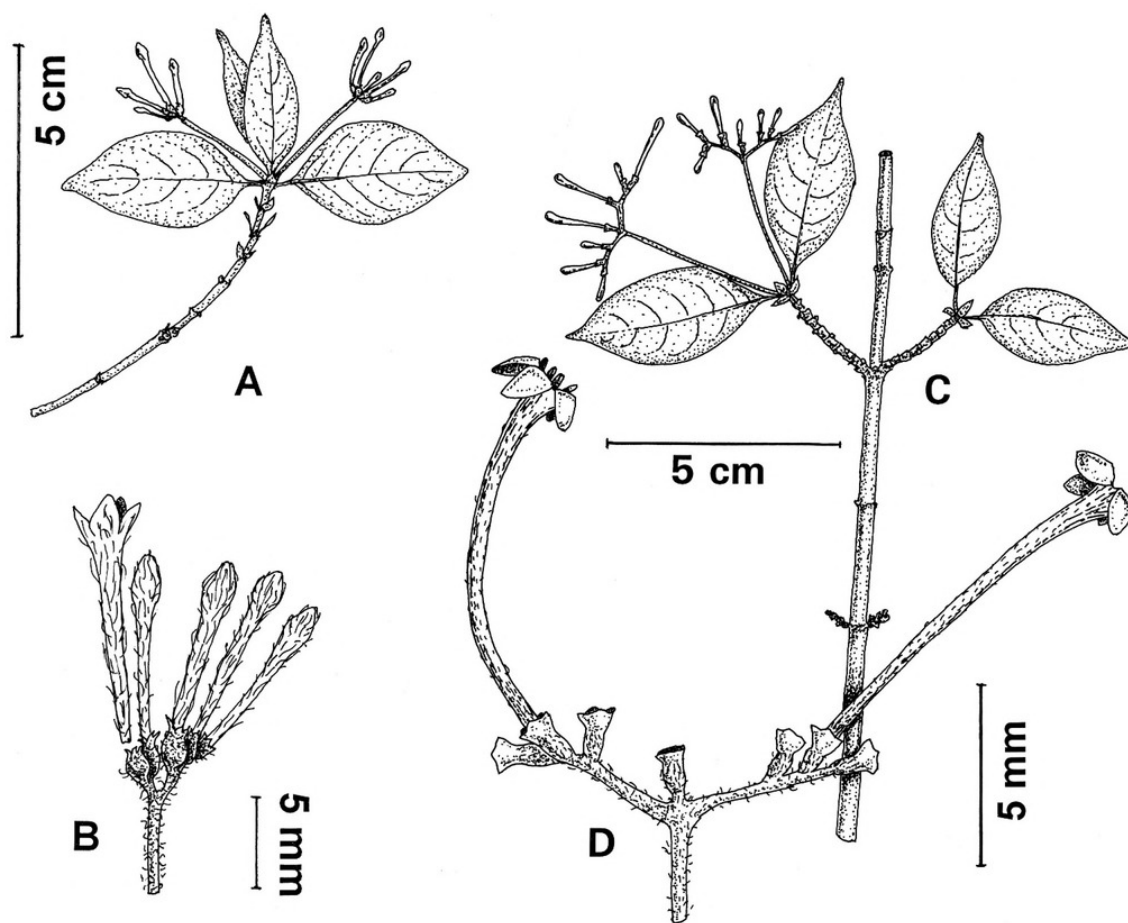


Figure 1. A, B. *Chomelia chiquitensis* C. M. Taylor; based on the type Vargas *et al.* 3547 (MO). —A. Flowering branch. —B. Portion of inflorescence with one flower bud near anthesis that is partially opened and four flower buds. C, D. *Chomelia costaricensis* C. M. Taylor; based on the type Rivera 1376 (INB). —C. Flowering stem. —D. Portion of inflorescence with dichasial axes, two flowers at anthesis, and five flowers from which the corollas have fallen.

found on the label of MO-05006411, while the second set cited above is found on the label of MO-5828914. These two sets of coordinates identify points that are quite close to each other. The reasons for this discrepancy and which set of coordinates is more accurate are unknown at this time.

Paratypes. BOLIVIA. **Santa Cruz:** prov. Chiquitos, Valle de Tucabaca, a 20 km al O de Santo Corazón, tramo entre La Cal y Campamento Los Murciélagos, 18°05'S, 59°03'W, I. G. Vargas C., G. Navarro & H. Justiniano 3565 (F, MO, USZ).

2. *Chomelia costaricensis* C. M. Taylor, sp. nov.
TYPE: Costa Rica. Alajuela: Parque Nac. Rincón de la Vieja, Colonia Blanca, Finca Los Moras, junto a Quebrada Mora, 10°46'N, 85°16'W, 770 m, 13 June 1991, G. Rivera 1376 (holotype, INB; isotype, MO-6173020). Figure 1C, D.

Haec species a *Chomelia grandicarpa* Dwyer spinis praesentibus, foliis minoribus atque limbo calycino truncato undulato, a *C. microloba* Donn. Sm. foliis ad axillas abaxiales venarum domatiis carentibus atque tubo corollino valde longiore distinguitur.

Shrubs, height not noted, armed with woody spines 5–10 mm, borne on shoots with developed internodes; stems subquadrangular, strigillose to glabrescent, with both well-developed principal stems and short lateral spur stems. *Leaves* borne on principal stems and spur shoots, elliptic, 2.5–6 × 1–3 cm, drying chartaceous, adaxially glabrous, abaxially glabrous except sparsely strigose to strigillose along costa, apex acute to a little acuminate with ultimate tips then obtuse to rounded, base cuneate to obtuse; secondary veins 5 to 6 pairs, without domatia, higher-order venation not visible; petioles 1–5 mm, strigillose or strigose to glabrous; *stipules* persistent, triangular, 2–4 mm, abaxially strigose then glabrescent, acute. *Inflorescences* cymose, paired at nodes along and at apices of spur shoots, strigillose to glabrescent, ebracteate; peduncle 0.5–3.7 cm; branched portion dichasial at first (i.e., basalmost) node, axes 2, scorpioid, 3–6 mm, each with 2 to 3 flowers. *Flowers* sessile; ovary portion cylindrical, ca. 2 mm, moderately strigillose; *calyx* limb 1–1.2 mm, sparsely strigillose to glabrescent, truncate to undulate or shallowly 4-lobed; *corolla* white or green flushed with red, slenderly salverform,

outside moderately to densely strigillose, inside glabrous, tube 21.5–22 mm, cylindrical, ca. 0.8 mm diam. near middle, lobes elliptic, 2.5–3 mm, obtuse, entire, in bud valvate or thinly valvate-induplicate, together forming an obtuse bud apex; *anthers* narrowly oblong, ca. 3.5 mm, subsessile, partially exerted; *stigmas* 2, linear, 1.2–1.5 mm, included, situated just above middle of corolla tube. *Fruits* not seen.

Habitat, distribution, and phenology. *Chomelia costaricensis* is known from wet forest at ca. 770 m on the eastern slopes of the Cordillera de Guanacaste in northwestern Costa Rica; it has been collected in flower in June.

IUCN Red List category. This species meets the geographic criteria for Critically Endangered based on having only a single known locality. It is found within a legally protected area, where decline in the habitat has not been confirmed, and in an area where very little at all is known of the flora (M. Grayum, pers. comm.). Because of this lack of information, this species does not meet the subcriteria for this evaluation and is here considered Data Deficient: DD.

Discussion. Although *Chomelia costaricensis* is known from only one specimen, this specimen is adequate to document this distinctive new species. The specific epithet refers to its geographic distribution. The flowers seen resemble the short-styled form of distylous *Chomelia* species. This new species is generally similar to *C. microloba* Donn. Sm., which is found in seasonal forests of Costa Rica and Panama; however, *C. microloba* differs from *C. costaricensis* in its shorter corollas, with the tubes 6–8 mm long, and its leaves abaxially with well-developed domatia in the form of tufts of pubescence borne in the axils of the secondary veins. This new species is also similar to *C. grandicarpa* Dwyer of central Panama; however, *C. grandicarpa* differs in its lack of spines, its calyx limbs that are lobed for half their length or more, and its generally larger leaves (4.5–10 × 2.5–5.5 cm). *Chomelia grandicarpa* is notable within the genus for its relatively large fruits (ca. 30 × 22 mm); the fruits of *C. costaricensis* are so far unknown, but may be smaller and thus may also separate these two species.

3. *Chomelia torrana* C. M. Taylor, sp. nov. TYPE: Colombia. Chocó: mun. San José del Palmar, Cerro del Torrá, vertiente E, mesa abajo de cumbre, 2500–2550 m, 13 Aug. 1988, P. A. Silverstone-Sopkin, N. Paz, R. T. González, J. E. Ramos, L. H. Ramos & A. Henao 4367 (holotype, CUV; isotype, MO-4048455). Figure 2C, D.

Haec species a congeneris foliorum venatione ordinis superioris non manifesta, inflorescentia brevi pauciflora, corolla obscure rubroviolacea atque fructu parvo distinguitur.

Shrubs to 2.5 m tall, without spines; stems subquadangular, glabrous except with dense rings of persistent trichomes, 0.5–1 mm at nodes, with regularly developed internodes. *Leaves* borne along principal stems, elliptic to ovate, 2.5–8.2 × 2–4.2 cm, drying chartaceous, on both surfaces glabrous on lamina and strigillose on margins, costa, and secondary veins, base cuneate to obtuse, apex acute to acuminate with tips 4–10 mm; secondary veins 4 to 9 pairs, without domatia, tertiary and higher-order venation not visible; *petioles* 4–6 mm, strigillose; *stipules* caducous, triangular, 7–12 mm, smooth to costate, abaxially glabrous or strigose near base, acute to acuminate. *Inflorescences* cymose, 1–2 cm, paired at nodes along principal stems, densely and finely strigillose, with 3 to 7 flowers; peduncle 0.4–1 cm; developed axes 1 or 2, scorpioid; bracts triangular, 0.1–0.5 mm, often caducous. *Flowers* sessile; ovary portion cylindrical-ellipsoid, ca. 2 mm, puberulous; *calyx limb* 0.5–0.8 mm, strigillose-puberulous, truncate to undulate; *corolla* dark red-violet on tube and paler on lobes, salverform, outside puberulous-tomentulose, tube 9–9.5 mm, weakly funnelform, ca. 1 mm diam. near middle, lobes triangular, 1.8–2 mm, acute, along margins with 3 ellipsoid to obovate appendages 1–1.5 mm, these with margins crisped to strongly ruffled, in bud valvate or thinly induplicate-valvate, together forming an obtuse bud apex; *anthers* and *stigmas* not seen. *Fruits* ellipsoid, 6–7 × ca. 4 mm, weakly 4-ribbed, black; pyrene ellipsoid, longitudinally 4-ridged, 4-locular.

Habitat, distribution, and phenology. *Chomelia torrana* is known from wet montane forests of the Cerro del Torrá, an outlier of the Western Cordillera of the Andes in northwestern Colombia, at 2500–2550 m; it has been collected in flower and fruit concurrently in January and August (i.e., the months when collecting expeditions visited the area).

IUCN Red List category. This species meets the geographic range criteria for Critically Endangered based on the few known localities and small overall range. It is known from several collections made at different times on a single mountain, which is not within a legally protected area, but is relatively isolated and inaccessible; decline in the habitat here is possible, but has not been confirmed. Because of the lack of demonstrated threat, this species does not meet the subcriteria for this evaluation, but the known range of *Chomelia torrana* is relatively small, so this species could be threatened by a stochastic event such as rapid habit destruction and is here evaluated as Vulnerable due to restricted range: VU D2.

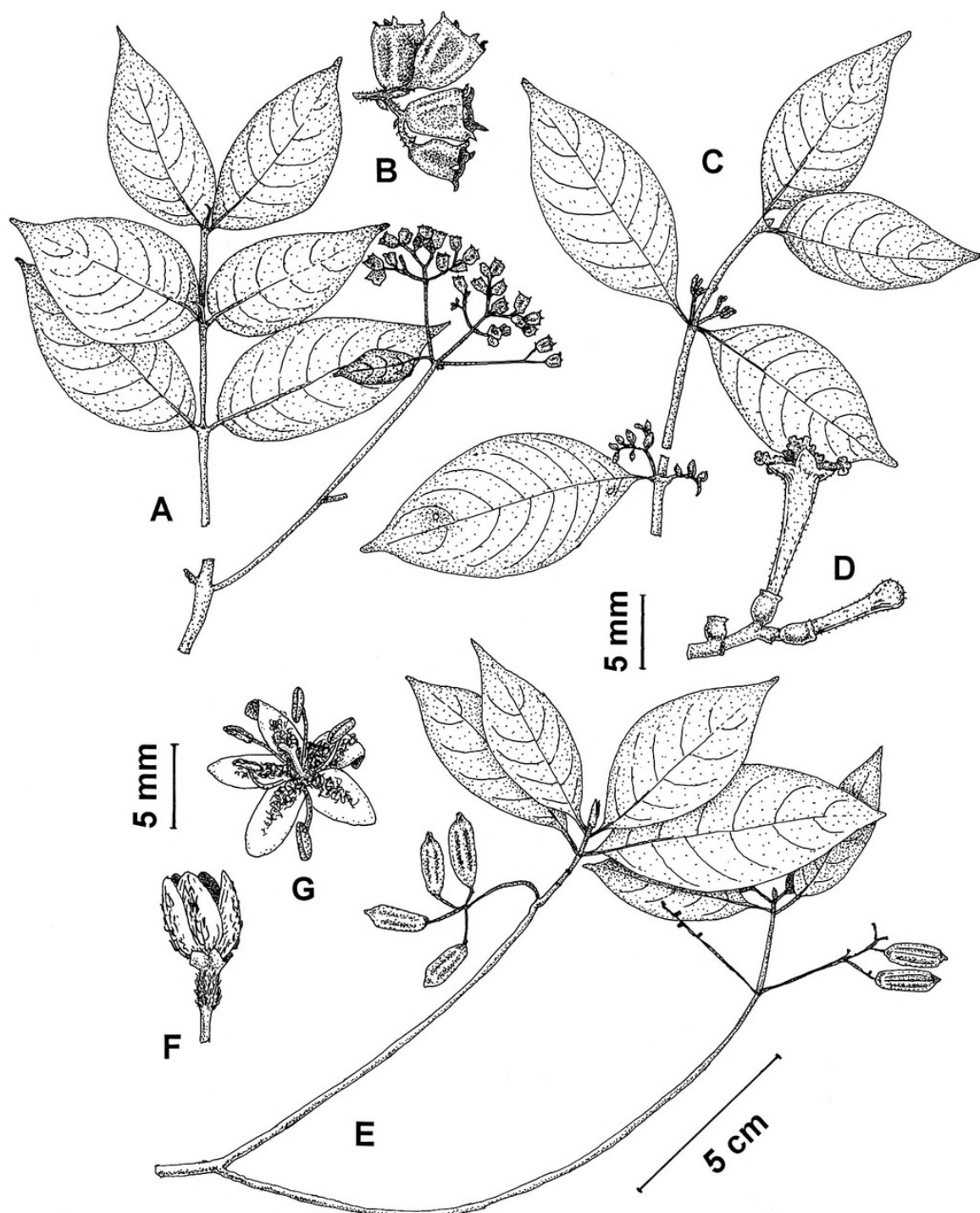


Figure 2. A, B. *Neoblakea ecuadorensis* C. M. Taylor, based on the type *Dodson et al. 13588* (MO). —A. Fruiting stem, divided, with upper leaf-bearing portion and lower nodes bearing infructescence. —B. Portion of inflorescence with four fruits. C, D. *Chomelia torrana* C. M. Taylor. —C. Stem with inflorescences and infructescences; based on the type *Silverstone-Sopkin et al. 4367* (MO). —D. Portion of inflorescence with one flower at anthesis, one flower bud, and one flower from which the corolla has fallen; based on the paratype *Silverstone-Sopkin et al. 4801* (MO). E–G. *Pittoniotis rotata* C. M. Taylor. —E. Fruiting branch; based on the paratype *Monteagudo et al. 4956* (MO). —F. Mature flower bud, starting to open. —G. Flower at anthesis. F, G based on the type *Jaramillo & Zak 8164*. A, C, E to same 5-cm scale; B, D to same 5-mm scale; F, G to same 5-mm scale.

Discussion. This new species resembles several montane species of *Guettarda* in general aspect, but its four valvate to valvate-induplicate corolla lobes indicate its placement in *Chomelia*. Here it is

distinguished by its dark red-violet corollas and relatively small fruits. *Chomelia rubra* Lorence & C. M. Taylor of lowland central Panama also has these characters, but this Panamanian species is found at

elevations below 1000 m and differs from *C. torrana* in its leaves with well-developed foveolate domatia in the abaxial vein axils, its mostly shorter stipules (2–3.5 mm long), its sessile or subsessile flowers or cymes, its corollas with longer tubes (15–16 mm long) and entire shorter lobes (ca. 2.5 mm long), and its larger fruits (ca. 15 × 6 mm). The internal details of the flowers are not described here, because available material of this new species is limited and the remote locality from which it is known is unlikely to be explored botanically again soon. Therefore, the very few flowers available have not been dissected.

The area from which *Chomelia torrana* is known, the Cerro del Torrá (Silverstone-Sopkin & Ramos-Pérez, 1995), is a partially isolated mountain from which several other apparently endemic Rubiaceae species are also known (e.g., *Palicourea sopkinii* C. M. Taylor). Its flora is closely related to that of the main Andean mountains and some unusual species are also known from both of these areas (e.g., *Notopleura biloba* C. M. Taylor), and other species are expected to eventually be found in both places as discussed by Silverstone-Sopkin and Ramos-Pérez.

Paratypes. COLOMBIA. **Chocó:** mpio. San José del Palmar, Cerro del Torrá, vertiente E a NE, plan o mesa abajo de la cumbre, P. A. Silverstone-Sopkin, N. Paz, A. Duque & H. Bayden 1775 (CUVC, MO), P. A. Silverstone-Sopkin, N. Paz, R. T. González, J. E. Ramos, L. H. Ramos & A. Henao 4449 (CUVC, MO), 4576 (CUVC, MO), 4801 (CUVC, MO).

II. NEOBLAKEA

This genus has been treated since its description (Standley, 1930) as including a single species, *Neoblakea venezuelensis* Standl., found at relatively low elevations (0–600 m) in north-central Venezuela (Steyermark, 1974). Its small 3-lobed stipules and small, obconic, corky-woody fruits are unusual within the Rubiaceae and therefore distinctive. The discovery of a second species of this genus with a disjunct distribution in northwestern Ecuador is notable, but probably not unique; both of these areas are not yet well explored botanically.

In his original description, Standley (1930) considered *Neoblakea* not closely related to any other genus then known. He classified it in the Guettardeae based on its general similarity to *Machaonia*, although he considered these genera not closely related based on their different fruits (dry schizocarps or indehiscent samaras in *Machaonia*; see also the Key to Genera, above, for a contrast of the fruits of these two genera). These genera have not been compared since. With additional species and morphological variation now documented in *Machaonia* and more material avail-

able of *Neoblakea*, their relationship may deserve reevaluation.

1. *Neoblakea ecuadorensis* C. M. Taylor, sp. nov.
TYPE: Ecuador. Guayas: rd. to Clina de Las Iguanas W of Guayaquil–Duale rd. at Km 19, due W of Pasquales, 70 m, 20 Jan. 1983, C. H. Dodson, P. M. Dodson, F. M. Valverde, G. Tazan & P. de Velez 13588 (holotype, MO-3023207; isotype, SEL-047785). Figure 2A, B.

Haec species a *Neoblakea venezuelensi* Standl. fructu majore atque foliis ad basim late obtusis vel rotundatis distinguitur.

Small trees to 3 m tall; stems weakly flattened to subterete, glabrescent, sometimes lenticellate. *Leaves* elliptic to elliptic-ovate, 3.5–8 × 2–4 cm, drying papery to stiffly papery, adaxially glabrous, abaxially glabrous except strigillose on costa, secondary veins, and margins, base broadly obtuse to rounded, apex acute to acuminate with tips to 10 mm; secondary veins 8 to 9 pairs, higher-order venation visible abaxially, closely densely areolate; *petioles* 2–4 mm, hirtellous in lines; *stipules* deciduous, interpetiolar, 1.5–2.2 mm, glabrous, deeply 3-lobed with central lobe longest, lobes linear to narrowly triangular. *Inflorescences* and *flowers* not seen. *Infructescences* cymose-corymbose, terminal on relatively short lateral branches, branched to 2 to 3 orders, with 11 to 50 fruits, pilosulose to puberulous sometimes in lines; peduncle 0.5–4 cm; branched portion 1–3 × 2–7 cm; bracts narrowly triangular to narrowly lanceolate, 1–2 mm, acute to acuminate, those borne on higher-order axes often with a deciduous ellipsoid gland ca. 0.1 mm at each side of base. *Fruits* sessile, perhaps immature, obovoid to obconic, to 5 × 4 mm, 3-locular, puberulous to hirtellous, weakly flattened to quadrangular with 4 broadly rounded ridges or corners, woody-corky, base rounded to subtruncate, top flattened with persistent calyx limb lobed nearly to base, lobes triangular, 0.8–1.2 mm, acute to acuminate.

Habitat, distribution, and phenology. *Neoblakea ecuadorensis* is known from seasonal forest at ca. 70 m in western Ecuador; it has been collected in fruit in January.

IUCN Red List category. This species meets the criteria for Critically Endangered based on its documentation from a single known locality. It is found outside of any legally protected area in a region of very advanced and continuing habitat degradation, and is here evaluated as Critically Endangered due to its restricted AOO, lack of re-collection, and highly threatened habitat: CR B2ab(iii).

Discussion. Although only one collection of this new species has been seen, the characters of *Neoblakea* and several features of *N. ecuadorensis* are distinctive. This new species is distinguished within *Neoblakea* by its larger fruits together with its leaves that are broadly obtuse to rounded at the base and have densely finely areolate venation visible on the abaxial surface. In contrast, *N. venezuelensis* has generally smaller, broader fruits ($2\text{--}4 \times 3\text{--}5$ mm) and leaves that are acute to cuneate at the base and have the tertiary and higher-order venation not or only intermittently visible on the abaxial surface. This new species represents a significant expansion of the range of this genus, into Ecuador; the specific epithet refers to this distribution.

III. *PITTONIOTIS*

This Neotropical genus has been treated by recent authors (e.g., Steyermark, 1974) to include a single species, *Pittoniotis trichantha* Griseb., that is distinct from other Neotropical genera of Guettardeae in the combination of its leaves with the higher-order venation lineolate, its subrotate corollas with the five lobes imbricated in bud and as long as or longer than the reduced corolla tube, and its drupaceous fruits each with one ridged, 2-locular pyrene. Some recent authors have included *Pittoniotis* in *Antirhea* (e.g., Dwyer, 1980), but subsequent authors (Chaw & Darwin, 1992; Achille et al., 2006) have demonstrated these to be better separated. A second Neotropical species has sometimes been included in *Pittoniotis* also, *P. protracta* (Bartl. ex DC.) Griseb., but this latter species differs from *P. trichantha* and matches *Chomelia* in its corollas with four valvate-induplicate lobes that are significantly shorter than the corolla tube, and accordingly this latter species has been treated by most recent authors as *C. protracta* (Bartl. ex DC.) Standl. (e.g., Standley & Williams, 1974).

The unusual new species described below is provisionally included in *Pittoniotis*. Its addition gives *Pittoniotis* a broader range of corolla form and pubescence and a markedly larger range of fruit size and habitat than it previously included, but this new range of variation is comparable to that found within related genera.

1. ***Pittoniotis rotata*** C. M. Taylor, sp. nov. TYPE: Ecuador. Pichincha: Reserva Flor.-Ecol. Río Guajalito, a 3.5 km al NE del Km 59 de la carr. antigua Quito–Santo Domingo de los Colorados, estribaciones occidentales del Volcán Pichincha, $00^{\circ}14'S$, $78^{\circ}48'W$, 1800–2200 m, 27 Aug. 1985, J. Jaramillo & V. Zak 8164 (holotype, QCA; isotype, MO-6173019). Figure 2E–G.

Haec species a *Pittoniotide trichantha* Griseb. corollae tubo brevior latioreque lobis adaxialiter pubescentibus atque fructu majore distinguitur.

Trees to 20 m tall; stems flattened, densely sericeous to glabrescent except densely pilose at nodes with ascending persistent trichomes to 1.5 mm, prolonged then terminating in clustered nodes, then with growth continuing from a lower node. *Leaves* clustered near stem apices, narrowly elliptic to oblanceolate, $5\text{--}10 \times 1.2\text{--}3$ cm, drying papery to stiffly papery, adaxially moderately to sparsely strigose to sericeous, abaxially densely and finely sericeous on lamina and strigose on principal veins, base acute, apex acute to weakly acuminate; secondary veins 7 to 9 pairs, with densely tomentulose or pilosulose domatia, adaxially with venation plane, with quaternary venation evident and closely lineolate, abaxially with costa and secondary veins prominulous, and remaining venation plane and mostly not visible; *petioles* 6–12 mm, strigillose to strigose-hirtellous; *stipules* deciduous, triangular, 4–7 mm, abaxially strigose except glabrous near margins, acute to acuminate. *Inflorescences* cymose-corymbose, paired in axils near stem apices, branched to 2 to 3 orders, strigillose-hirtellous; peduncle 2–3.6 cm, branched portion $1.5\text{--}2.5 \times 2\text{--}4$ cm; axes weakly scorpioid, with 2 to 4 flowers; bracts subtending axes narrowly triangular to linear, 0.8–3 mm. *Flowers* sessile, ebracteolate; ovary portion cylindrical, 1.5–2 mm, densely sericeous; *calyx* limb funnelliform, 1–1.2 mm, lobed for $1/3\text{--}1/2$, sparsely strigillose to glabrescent, lobes obtuse to acute; *corolla* white, rotate, outside strigillose; tube funnelliform, ca. 1 mm; lobes elliptic-obovate, ca. 4 mm, adaxially densely villosulous in lower and central part, rounded; stamens exserted, filaments ca. 1.8 mm, glabrous, inserted at top of corolla tube, anthers basifixed, narrowly elliptic, ca. 1.5 mm; stigmas ca. 0.3 mm, subcapitate, exserted on styles ca. 3 mm. *Fruits* ellipsoid to obovoid, $2\text{--}2.5 \times 0.8\text{--}1$ cm, glabrescent, mature color unknown; pyrene 1, 2-celled, laterally somewhat flattened, with ca. 3 rounded ridges grouped on each of main sides.

Habitat, distribution, and phenology. *Pittoniotis rotata* is known from cloud forests at 1800–2200 m in north-central Ecuador, where it has been collected in flower in August and in fruit in March, and from wet premontane forests at 1020–1320 m in Peru, where it has been collected in fruit in April and June.

IUCN Red List category. This species meets the geographic range criterion for Critically Endangered based on its restricted AOO. It is not found within a legally protected area, and is known from only two widely separated sites that were explored a decade

apart and lie in a region and vegetation zone that are not well known floristically and have not been confirmed to have a continuing habitat decline. *Pittoniotis rotata* may be difficult to detect due to its habit as a rather large tree and its apparently infrequent local occurrence, as suggested by the very few collections made in the site in Oxapampa, Peru, where the botanical inventory work was intensive; or this may be a species with a low density across a broad range. Due to this lack of information it is here evaluated as Data Deficient: DD.

Discussion. This new species is distinguished by its rotate corollas with relatively short tubes and well-developed lobes that are pubescent with villous trichomes internally and by its relatively large fruits. Additionally, its stem nodes with a dense ring of well-developed persistent trichomes and the rather narrow leaves with ascending secondary veins and silky pubescence on the adaxial surface are distinctive. The other species of this genus, *Pittoniotis trichantha*, is found in lowland, generally seasonal vegetation in the southern and western Caribbean region and can be separated from *P. rotata* by its shortly funnelform corollas that are glabrous internally and have a longer tube (1.5–2 mm long) and shorter lobes (2–3 mm long), its inflorescences with usually well-developed, many-flowered axes, and its smaller fruits (5–6 × 2–3.5 mm). The fruiting specimens from Peru cited below are included here even though no flowers have been seen; no vegetative or fruiting differences are otherwise evident between these and the Ecuadorian specimens.

Paratypes. ECUADOR. **Pichincha:** Reserva Flor.-Ecol. Río Guajalito, a 3.5 km al NE del Km 59 de la carr. antigua Quito–Santo Domingo de los Colorados, estribaciones occidentales del Volcán Pichincha, V. Zak 1791 (MO, QCA). PERU. **Pasco:** prov. Oxapampa, distr. Pozuzo, Parque Nac. Yanachaga Chemillén carr. ca. a la Quebrada Misho, A. Monteagudo, C. Mateo, G. Ortiz & R. Francis 4956 (HOXA, HUT, MO, USM), A. Monteagudo, G. Ortiz & R. Francis 5006 (HOXA, HUT, MO, USM).

IV. *STENOSTOMUM*

The genus *Stenostomum* in recent circumscriptions comprises several Neotropical species of shrubs and trees found in dry to wet forests of the Antilles, Mexico, and Central America (Moynihan & Watson, 2001; Achille et al., 2006). It is characterized by its resinous young growth, its leaves with the tertiary veins either not visible or arranged in generally regular rectangular areoles, its axillary inflorescences, its perfect flowers, its 4- to 5-lobed calyx limbs, its slender tubular to salverform corollas with the four to five lobes imbricate in bud, its “three-colpate” pollen

(Chaw & Darwin, 1992; presumably 3-colporate), and its drupaceous fruits with a single, bony, 2- to 10-locular pyrene. Many *Stenostomum* species have distinctive scorpioid cymes, and the flowers are apparently usually distylous although not all species have been surveyed. *Stenostomum* was previously included in *Antirhea* when the latter was considered a pantropical genus, but Chaw and Darwin (1992) and Achille et al. (2006) showed that the hermaphroditic Neotropical plants are better separated from the dioecious Paleotropical plants with their inaperturate or 1-porate pollen (Chaw & Darwin, 1992). The Paleotropical plants remain in *Antirhea*, while the Neotropical plants have been included variously in *Neolaugeria* Nicolson, *Stenostomum*, and *Pittoniotis*. The results of Achille et al. (2006) suggested that *Stenostomum* is indeed distinct from *Guettarda* and also probably polyphyletic, with the shrubby Caribbean plants not closely related to the arborescent species of the Antilles and Central America; this latter group includes the type species of the genus. However, their results are not well supported, and they did not explicitly separate these groups taxonomically. The species transferred to *Stenostomum* here appear to be more closely related to the group of species that includes the type of this genus than to *Guettarda*, and accordingly are included here. The species of *Stenostomum* have not been studied as a whole in either the restricted or broad circumscription of the genus. *Stenostomum* is similar to *Guettarda*, which can be separated by its young growth that is not resinous; to *Pittoniotis*, which can be separated by its closely lineolate leaf venation, corollas with the tubes shorter than the lobes, and exerted anthers; to *Chomelia*, which can be separated by its valvate or valvate-induplicate corolla lobes and its tertiary and higher-order leaf venation that is either regularly lineolate or not visible; and to *Machaonia*, which can be separated by its dry schizocarpous or indehiscent fruits and its ovaries that are typically a little compressed instead of rounded.

1. *Stenostomum acreanum* (K. Krause) C. M. Taylor, comb. nov. Basionym: *Guettarda acreana* K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem 6: 204. 1914. TYPE: Brazil. Acre: Alto Acre bei San Francisco, Sep. 1911, E. Ule 9709 (holotype, B destroyed, photo [F neg. 388] MO).

Discussion. This species has been classified in *Guettarda*, but is unusual morphologically there, in particular in the combination of its little-branched, markedly scorpioid cymes, its sparsely resinous stipules, and its smooth, obovoid pyrenes that at least sometimes have five to six cells arranged in a circle

around a central space or cavity (e.g., *Strudwick et al.* 3314, Brazil [MO, NY]). This species has been suggested by several authors to be most closely related to species now included in *Stenostomum* (Bremekamp, 1959; Taylor et al., 2004), and this proposed relationship was weakly supported by the results of Achille et al. (2006). Accordingly, this species is here transferred to *Stenostomum*. It is known from Costa Rica through the Guianas, Peru, and western Brazil; a morphological description and additional nomenclatural synonymy were presented by Taylor et al. (2004).

There appears to be variation in fruit morphology within this widespread species, with the pyrenes variously multilocular, 3-locular without a central cavity (Bremekamp, 1959; as *Antirhea surinamensis* Bremek.), or 2-locular without a central cavity (Dwyer, 1980; as *Chomelia panamensis* (Standl.) Dwyer). Thus, the taxonomy of *Stenostomum acreanum* as currently circumscribed is in need of further study. Because of this lack of taxonomic knowledge, the conservation status of this species is not assessed here nor is the name *Guettarda acreana* lectotypified (or neotypified) yet.

- 2. *Stenostomum darienense*** (Dwyer) C. M. Taylor, comb. nov. Basionym: *Chione darienensis* Dwyer, Ann. Missouri Bot. Gard. 67: 94. 1980. TYPE: Panama. Darién: Río Balsa, betw. Manene & Tusijunda, 26 July 1967, *J. A. Duke 13571* (holotype, MO-1968196; isotypes, MO-1956611, MO-2187000).

Discussion. Dwyer (1980) classified a single fruiting specimen from eastern Panama in *Chione* DC., no doubt based on its interpetiolar triangular stipules and its rather large, ellipsoid, apparently drupaceous fruits with what he interpreted to be an immature, single, 7-locular pyrene. However, his plant differs from *Chione* in its stipules that are arranged with one margin of each overlapping the other stipule (“imbricated”) in bud rather than with the margins meeting along their edges (“valvate,” as in *Chione*) and in its axillary inflorescences with the axes strongly scorpioid rather than the terminal dichasial inflorescences of *Chione*. Additionally, the fruit of Dwyer’s plant actually has seven locules that are individually stiffly indurated, rather than fused into a single bony structure, and these locules or cavities are arranged with one centrally placed and the others regularly spaced around it. This species thus cannot be included in *Chione* and was formally excluded from this genus by Taylor (2003), who suggested its affinities might be with *Guettarda*. *Chione darienensis* does agree with *Guettarda* in most

features, but differs from *Guettarda* in its resinous stem apices and the arrangement of its fruit locules, peripherally around a central locule or cavity. It also differs in the stiff and apparently free walls of these locules, but as noted by Dwyer, this fruit appears to be immature. This peripheral locule arrangement is found in species of *Stenostomum*, as are resinous stem apices; additionally the immature fruits of some species of *Stenostomum* have stiff-walled individual locules that are rather easily separated. Consequently, *C. darienensis* is here transferred to *Stenostomum*.

IUCN Red List category. *Stenostomum darienense* meets the geographic range criterion for Critically Endangered based on its restricted AOO. It is found within one legally protected area and is known from only two widely separated sites that were explored a decade apart and lie in a region of continuing habitat decline, including in some protected areas. However, this region is not at all well known floristically, and whether this species is restricted to these two sites or distributed continuously between them is unknown. Due to this lack of information, it is here evaluated as Data Deficient: DD.

Additional specimen studied. COLOMBIA. **Chocó:** mpio. Bahía Solano, correg. El Valle, orilla de la carr. entre El Valle y el puente sobre la quebrada Tundó, *J. Espina 2931* (CHOCO, MO).

- 3. *Stenostomum turrialbanum*** (N. Zamora & Poveda) C. M. Taylor, comb. nov. Basionym: *Guettarda turrialbana* N. Zamora & Poveda, Ann. Missouri Bot. Gard. 75: 1157, fig. 1. 1988. TYPE: Costa Rica. Cartago: bosque Los Espabeles, CATIE, Turrialba, 600 m, 26 June 1986, *N. Zamora, M. M. Chavarría & H. Gómez 1263* (holotype, CR; isotypes, F, MO-3477655).

Discussion. This species differs from *Guettarda* in its markedly resinous stem apices and the arrangement of the ovary locules, which are peripheral around a central space or cavity. This species agrees with *Stenostomum* in these features, and consequently is here transferred to this latter genus.

IUCN Red List category. This species meets the geographic range criteria for Endangered, based on its few known localities and relatively small range (additional specimens included in the analysis are databased in <www.tropicos.org>). It is found within one legally protected area and is known from several separated sites found in a region and vegetation zone that are incompletely known floristically and that have not all been confirmed to have a continuing habitat decline; thus, it fails to fulfill the required subcriteria for this evaluation. However, *Stenostomum turrialba-*

num is apparently fragmented in its distribution, so the species could be threatened by stochastic events such as rapid habitat destruction, and is here evaluated as Vulnerable due to restricted range: VU D2.

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