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ANN ARBOR, MICHIGAN  
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13 August 2007

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## REVISION OF GALPHIMIA (MALPIGHIACEAE)

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**ABSTRACT.** *Galphimia* (Malpighiaceae, Byrsonimoideae, Galphimieae) comprises 26 species of suffrutescent herbs, shrubs, and treelets. Four species (*G. amambayensis*, *G. australis*, *G. brasiliensis*, *G. platphylla*) occur in South America south of the Amazon basin, and the remainder in Mexico; one species (*G. angustifolia*) extends into Texas and one (*G. speciosa*) into Central America. One species, *G. gracilis*, is cultivated worldwide in warm regions. The genus is characterized by bilaterally symmetrical flowers with yellow to red petals; in eight species the petals are persistent. The sepals lack oil glands, but a few species bear calyx glands that resemble the leaf glands. The fruit is a globose schizocarp breaking apart into three small 1-seeded cocci. The base chromosome number is  $x=6$ . For each species a full synonymy, detailed description, and range map are provided; all but two species are illustrated. Three new species (*G. calliantha*, *G. floribunda*, *G. speciosa*) are proposed.

### INTRODUCTION

The Neotropical genus *Galphimia* Cav. (Malpighiaceae, tribe Galphimieae) comprises 26 species of large herbs, shrubs, and treelets of mostly drier habitats. Most species occur in Mexico, with one extending to Texas and one ranging to northern Nicaragua, but four are restricted to South America, south of the Amazon basin. *Galphimia* is characterized by flowers with yellow petals (often suffused with red) borne in racemes, either solitary or arranged in panicles; in eight species the petals are persistent in fruit. The sepals lack the large oil glands typically found in other New World Malpighiaceae, but in a few species the calyx has one or more small glands that resemble the leaf glands. Ten fertile stamens surround a tricarpellate ovary with three subulate styles. The globose fruit is a schizocarp that breaks into three 1-seeded cocci.

The history of *Galphimia* is one of confusion, caused in part by misinterpretation of the earliest described taxa, competing generic names (*Galphimia* Cav. vs. *Thryallis* L.), and misapplication of various names to one cultivated species (*G. gracilis*), but also by the superficial morphological similarity of many of the species. The showy inflorescences catch the eye of collectors, who often label all specimens from Mexico as *G. glauca* or *G. gracilis*, and those from South America as *G. brasiliensis*. This revision builds on preliminary studies of the genus (C. Anderson 2003, 2005a, b) and clarifies the circumscriptions of the species and associated nomenclature. It is intended as a basis for detailed future studies. Many species are still known from only few collections. Questions remain concerning the phylogeny, phylogeographic history, pollination and dispersal strategies, ploidal levels, as well as developmental aspects, such as the nature of the unusual calyx glands, the shift to persistent petals, and the suppression of the peduncle.

### TAXONOMIC HISTORY

The nomenclature of *Galphimia* and the application of names have been problematical, partly owing to uncertainty about the status of the generic name *Thryallis* L. and partly to doubtful interpretation of original descriptions without access to type

material. Now *Thryallis* Mart. has been conserved over *Thryallis* L., a synonym of *Galphimia* Cav., and the opportunity to study types allows for assignment of names as intended by the original authors.

The taxonomic history of the genus now accepted as *Galphimia* begins with Linnaeus's (1762) description of his new genus *Thryallis*, containing only *T. brasiliensis*. In 1799 Cavanilles published the genus *Galphimia* (an anagram of *Malpighia*) to accommodate two species from Mexico (*G. glauca*, *G. hirsuta*) to which he added *G. glandulosa* in 1801. Lindley (1828) and Martius (1829) added new species from Brazil to *Thryallis*, and Martius also provided a generic description reflecting his concept of *Thryallis*. It was Adrien de Jussieu (1833), the first monographer of the Malpighiaceae, who realized that *T. brasiliensis* is not congeneric with Lindley's *T. brachystachys* and Martius's *T. longifolia* and *T. latifolia*. He transferred *T. brasiliensis* to *Galphimia* Cav., as *G. brasiliensis* (L.) Adr. Juss., and recognized *Thryallis* sensu Martius, in which he included *T. longifolia*, *T. latifolia*, and *T. brachystachys* (Jussieu 1840).

Most botanists followed Jussieu's lead in recognizing *Galphimia* and *Thryallis* sensu Martius (e.g., Grisebach 1858) until Kuntze (1891) opted to retain *Thryallis* L. for all the species that had been placed in *Galphimia* and proposed the new genus *Hemstleyana* to replace *Thryallis* sensu Martius. Kuntze's views were accepted most notably by Rose (1909) and Small (1910), but they were rejected by Niedenzu (1914, 1928), who accepted Jussieu's generic classification. The controversy was not settled until a proposal by Morton and Cuatrecasas (1967) to conserve *Thryallis* sensu Martius over *Thryallis* L. was accepted by the Nomenclature Section of the 11th International Botanical Congress in 1969. *Thryallis* Mart. thus is now included in the list of conserved names of the *International Code of Botanical Nomenclature* (McNeill et al. 2006). It is a South American genus of five species not associated with the Galphimieae (C. Anderson 1995). Yet, the confusion concerning the correct generic name persists, particularly in the horticultural trade, and names in *Thryallis* are still used occasionally for species of *Galphimia*.

Only two authors provided comprehensive accounts of *Galphimia* after Jussieu's (1843) treatment and Rose's (1909) brief synopsis: Small in 1910 (as *Thryallis*) for the series *North American Flora* (thus excluding the South American taxa), and Niedenzu (as *Galphimia*) in 1914 as a monograph and in 1928 as part of his treatment of Malpighiaceae for *Das Pflanzenreich*. Regrettably, the work of both authors was hindered by a paucity of good collections and a lack of opportunity to study the majority of types. As a result, their publications are flawed and, as primary references, contributed to the many misunderstandings of species circumscriptions and nomenclature that have plagued all those concerned with *Galphimia* since the early part of the 20th century.

At the time that Jussieu defined *Galphimia*, the genus included only the three species of Cavanilles in addition to *G. brasiliensis*. To these Bartling (1840) added *G. gracilis*, *G. grandiflora*, and *G. paniculata* (his names *G. latifolia* and *G. humboldtiana* are synonyms of *G. paniculata*) and Jussieu (1843) described *G. multicaulis* in his monograph of the family. Explorations of southern South America and of the American West and Mexico in the late 1800s and early 1900s resulted in the discovery of additional species from those regions. Chodat (1890) described *G. australis* and *G. platyphylla* from Paraguay. By the time Rose (1909) published his review of the genus (as *Thryallis*) five more species were known from Mexico: *G. angustifolia* (including *G. linifolia*; also in Texas), *G. montana*, *G. sessilifolia*, *G. tuberculata* (including *G. humilis*), and *G. vestita*; however, the Oaxacan endemic *G. elegans*, which Baillon (1874) based on cultivated plants, was overlooked. Blake (1917) described another

Mexican species, *G. langlassei* (as *Thryallis langlassei*). My studies (C. Anderson 2003, 2005a, b) added one new species from Paraguay (*G. amambayensis*) and five from Mexico (*G. arenicola*, *G. mexiae*, *G. mirandae*, *G. oaxacana*, *G. radialis*); three new species, *G. calliantha* from Guerrero, *G. floribunda* from western Mexico, and *G. speciosa* from southern Mexico and Central America, are proposed here. *Galphimia* now includes 26 species.

## MORPHOLOGY

*Habit and vesture.* Most species of *Galphimia* are shrubs that may reach 4 m and some form treelets (to 6 m), but those without peduncles are mostly large, often sprawling, suffrutescent herbs arising from a woody base or small shrubs to 1.5 m high.

In most species the vesture is composed of medifixed, straight to wavy or crisped, reddish brown, sessile or subsessile hairs to ca. 1 mm long. In a few species the medifixed hairs are borne on persistent tubercles, which roughen the structure after the hair is shed (Fig. 4c). Such tubercles may be strongly expressed, as in *G. tuberculata*, or subtly and then are seen only with magnification, as in *G. brasiliensis* and the petioles of *G. gracilis*. Basifixed hairs occur on the ovary and fruit of some species with deciduous petals. The hairs may be evenly distributed (but sometimes absent near the apex) or restricted to the sutures.

In general, the stems and foliage are pubescent when very young but soon become glabrescent to glabrous at maturity; the inflorescence axes are commonly moderately to densely pubescent but also eventually glabrescent in age. *Galphimia glandulosa* and *G. floribunda* lack such vesture; *G. glandulosa* is entirely glabrous (except for a pilose ovary), and *G. floribunda* may have only some scattered hairs on parts of the inflorescence or lack them. *Galphimia gracilis* is unusual in that the laminas have a tuft of hairs at the apex; this tuft is sloughed off in age and seen best in younger leaves. Three species are easily recognized by the vesture of the vegetative parts. In *G. elegans*, the laminas are abaxially pubescent with reddish brown hairs, which may be sloughed off, and older leaves may be only patchily pubescent or eventually glabrescent. Younger leaves are also adaxially sparsely pubescent, but the hairs are soon shed. Frequently the epidermis is raised at the point of attachment, which is evident after the hair has fallen. *Galphimia vestita* and *G. hirsuta* are abundantly pubescent in all parts, including the abaxial surfaces of the calyx and the petals. *Galphimia hirsuta* is covered with hairs borne on persistent tubercles. In *G. vestita* the dense tangled covering is composed of white or translucent T-shaped hairs, which have a trabecula 1–2 mm long borne on a stalk ca. 0.5 mm long. Such hairs do not occur in any other species of *Galphimia*, although they are found in many other genera of Malpighiaceae.

*Leaves.* Most collections of *Galphimia* consist of the inflorescence and subtending shoot, but only occasionally include leaves from other parts of the plant, which are often larger than those near the flowers. Thus, for some species the measurements given in the descriptions may not reflect the full range of leaf dimensions. The leaves are opposite and, in most species, petiolate, although the petioles may be very short; in species lacking peduncles and also one species with persistent petals, *G. multicaulis*, petioles generally are much less than 1 cm long. In *G. sessilifolia* the petioles are absent or rudimentary (to 1 mm long). In the majority of species the laminas vary from elliptical to lanceolate to ovate, and in some to rhombic (e.g., *G. tuberculata*).

*Galphimia vestita* has linear leaves less than 1 cm wide. In two widespread species, *G. angustifolia* and *G. australis*, laminas are exceptionally variable in shape, from linear to ovate, sometimes on the same individual (Fig. 15a).

The margin is entire, but in species bearing tuberculate hairs the margin of mature leaves, at least proximally, bears the persistent tubercles. The laminas of *G. arenicola* commonly bear elongate, multicellular, epidermal processes in addition to such tubercles along the margin. *Galphimia oaxacana* is distinctive in that the margin forms a thickened, narrow, light-colored band.

All species have circular leaf glands, which are often diagnostic, especially their size and position, except in *G. speciosa*, in which the placement of the leaf glands is variable, even along the same shoot (Fig. 27c). In general, a pair of glands is borne on the lamina margin, near or at the base, or on the petiole, mostly in the distal 1/2. *Galphimia glandulosa* is distinctive in that the leaf glands are usually borne in the proximal 1/6–1/2 of the petiole (Fig. 7b, c). The glands may be flush with the surface or barely raised (e.g., *G. gracilis*, Fig. 1b), but more commonly are prominent (e.g., *G. langlassei*, Fig. 9b) to peglike (e.g., *G. tuberculata*, Fig. 4b, c). Sometimes, one or more smaller additional glands are found along the margin, distally from the main pair, and sometimes one or both glands are absent. In *G. sessilifolia* only the first pair of leaves on a shoot has one or two glands (Fig. 13b), though sometimes it, too, is eglandular; this first pair also differs from other leaves on the same shoot in having relatively small, orbicular laminas.

The stipules are distinct, intrapetiolar, linear to narrowly triangular (e.g., Fig. 1b, 20b), and persistent on the stems. In most species, stipules are 1–3 mm long, but in *G. radialis* they are commonly 3.5–6 mm long (Fig. 12c) and in *G. vestita* 3.5–9 mm long (Fig. 17b).

**Inflorescences.** The basic pattern in *Galphimia*, as in many genera of Malpighiaceae, is a single flower on a pedicel, which is borne on a peduncle; this unit represents a reduced inflorescence. A pair of bracteoles subtends the pedicel; in many genera the bracteoles are borne at the base of the pedicel, but in *Galphimia* they are found on the peduncle, near the apex (e.g., *G. gracilis*, Fig. 1c) or, more commonly, between the base and the apex of the peduncle (e.g., *G. grandiflora*, Fig. 34c). A bract always subtends the base of the peduncle. Bracts and bracteoles are persistent. In six species the peduncle is lost or rudimentary, and the pedicel is then subtended by three structures, the bract and the pair of bracteoles (e.g., *G. angustifolia*, Fig. 15f, j; *G. vestita*, Fig. 17h); in *G. angustifolia* and *G. brasiliensis* the peduncle is mostly not evident but sometimes expressed in some inflorescences. The bracts and bracteoles are persistent; they are eventually sloughed off in old inflorescences.

The 5-merous, bilaterally symmetrical flowers are borne in terminal racemes, which are solitary in most species or grouped in ternate panicles, especially in robust individuals. In a few species, e.g., *G. paniculata*, the racemes are aggregated into large panicles, and most of the flowers are crowded along the axes. In species lacking peduncles the flowers are more widely spaced, often separated by a distance approximating the length of the pedicel (e.g., Figs. 15a, 18a); except in *G. platyphylla*, the small flowers characteristic of these species and their opening only one to three at a time add to the sparser appearance of the raceme when compared to the inflorescences of the remainder of the genus. In species with persistent petals the flowers are usually closely spaced along the axes, and among these species the persistent petals add to the dense aspect of the inflorescences (e.g., Figs. 33a, 36a).

The inflorescence axes are sparsely to densely pubescent during anthesis, but the vesture may be abraded or sloughed off in age. The peduncles and pedicels are also

usually somewhat pubescent, and within an inflorescence the pedicels are commonly more densely so than the peduncles. Frequently, the line indicating the articulation between the pedicel and peduncle is covered a with dense ring of hairs. In many species the pedicels have the hairs concentrated in a line extending from the calyx to the peduncle. Two species are distinctive in their lack of vestiture in the inflorescence: *G. glandulosa*, which is entirely glabrous (except for a pilose ovary), and *G. floribunda*, in which the racemes are glabrate (with a few scattered hairs) to glabrous.

**Calyx.** The calyx is composed of five oblong to elliptical sepals, which may be distally minutely denticulate or minutely crose and sometimes ciliate; in *G. calliantha* the margin is fringed. The sepals are mostly glabrous, but pubescent in *G. amambayensis*, *G. hirsuta*, and *G. vestita*. The species lacking peduncles all have a tuft of hairs at the apex of the sepal (e.g., *G. angustifolia*, Fig. 15f); this tuft is seen best in buds and recently opened flowers.

*Galphimia* lacks the oil glands that are found on the calyx of most genera of New World Malpighiaceae, and most species have large anthers, which are associated with pollination syndromes in which pollen is the reward. Yet, some species have glands at the base of the sinus between adjacent sepals (e.g., Figs. 3d, 7d, 20c), which resemble the leaf glands in appearance and not the oil glands found in other genera. The nature of these glands in *G. australis* (as "*G. brasiliensis*") was investigated by Castro et al. (2001).

Calyx glands occur only in nine species, all with deciduous petals (*G. arenicola*, *G. glandulosa*, *G. hirsuta*, *G. montana*, *G. oaxacana*, *G. mirandae*, and *G. tuberculata* in Mexico, and *G. australis* and *G. platyphylla* in South America). The expression of calyx glands is often unstable, and only *G. hirsuta* has five calyx glands in every flower; however, *G. hirsuta* is known from only three collections. In *G. arenicola*, *G. glandulosa*, and *G. oaxacana* the number of glands per calyx varies from one to five. In *G. australis*, *G. montana*, *G. platyphylla*, and *G. tuberculata* some or all flowers in an inflorescence may lack calyx glands or bear one to five glands. Only one calyx of one specimen of *G. mirandae* bore one gland, but for this species, too, only limited material is available.

**Corolla.** The corolla is composed of five clawed petals, which are yellow, but often marked or suffused with red, and glabrous, but with hairs on and adjacent to the abaxial midrib in *G. hirsuta* and *G. vestita*, two species characterized by abundant vestiture, and in *G. amambayensis*. In the majority of species, the petals are deciduous. Eight species (*G. calliantha*, *G. elegans*, *G. floribunda*, *G. glauca*, *G. grandiflora*, *G. multicaulis*, *G. paniculata*, *G. speciosa*) have persistent petals, which stiffen as the fruit matures and remain even after the cocci have fallen (e.g., Fig. 31d). Surprisingly, none of the authors who have published on *Galphimia* remarked on this highly unusual phenomenon, even though some (e.g., Cavanilles 1799; Bartling 1840; Baillon 1874) observed living plants cultivated in botanical gardens.

The basic corolla pattern is four equal lateral petals and one posterior petal (the "flag" petal) with a longer and stouter claw and differently shaped limb. The species lacking peduncles all have subequal petals, i.e., the posterior petal is like the lateral ones though sometimes a little bit larger. Except for *G. platyphylla*, these species have very small petals, the limb only to 5 mm long. Only one species with peduncles has subequal petals, *G. radialis*.

**Androecium.** The androecium is composed of ten glabrous stamens. The filaments are of unequal length. The filament opposite the anterior sepal is the longest,

that opposite the posterior petal the shortest; the lateral filaments are of intermediate length. Only *G. brasiliensis* and *G. vestita* depart from this pattern. In *G. brasiliensis* the filaments of stamens opposite the lateral sepals are equal to each other and only slightly shorter than that opposite the anterior sepal, and the filaments of stamens opposite all petals are equal. In *G. vestita* the filaments are all equally long. Adjacent filaments are usually very briefly connate at base.

The anthers are subequal within an androecium and open by longitudinal slits. In most species they range from 2.5 to 3.5 mm long (*G. elegans*: 1.8–2 mm; *G. glandulosa*: 3.3–4.4 mm), but in species lacking peduncles they are much shorter (*G. angustifolia*, *G. brasiliensis*: 0.7–0.9 mm long; *G. amambayensis*, *G. australis*, *G. platyphylla*, *G. vestita*: 1–1.5 mm long).

*Gynoecium.* The ovary is tricarpellate and bears three subequal, subulate styles with a terminal minute stigma. Two carpels are anterior and one posterior, on the plane of symmetry. The ovary is always glabrous in species with persistent petals. Ten species have a pilose ovary; in seven the hairs are evenly distributed (*G. amambayensis*, *G. angustifolia*, *G. brasiliensis*, *G. glandulosa*, *G. langlassei*, *G. mexiae*, *G. vestita*), but in three the hairs are concentrated along the sutures (*G. oaxacana*, *G. radialis*, *G. tuberculata*). Ovary pubescence is variable in *G. montana*; in some specimens the ovaries bear some hairs along the sutures and in others they are glabrous. The hairs are basifixed and in most species ca. 0.1–0.3 mm long and thus easily overlooked, especially in species with hairs mostly on the sutures; in *G. radialis* the hairs are up to 0.8 mm long.

*Fruits.* The fruit is a schizocarp that breaks into three cocci. Each pebble-like coccus contains a globose seed with a dark brown, smooth seed coat. The globose to ellipsoid embryo is folded in half, the larger outer cotyledon enfolding the smaller inner one. Cocci generally are from 3 to 5 mm long, but only 2.5 mm long in *G. glauca*. The cocci are smooth to somewhat rugose when dry, and glabrous or minutely pilose (like the ovaries), and lack any obvious dispersal mechanism. They fall into the "detritus fruit" category, i.e., small pebble-like units blown about by wind or dispersed by water. In herbarium specimens with mature fruits, the cocci are often slightly dehiscent along the dorsal suture, although the opening is not sufficient to release the seed; it is not known whether this dorsal splitting is natural or an artifact of drying. The base of the coccus and the areole often have some aerenchyma, which may provide some buoyancy.

## DISTRIBUTION

*Galphimia*, in general, occurs in dry habitats and has an unusual range. The majority of species are found in Mexico, with one (*G. speciosa*) extending into Central America and another (*G. angustifolia*) into Texas. The Mexican species are recorded mostly from dry situations in pine-oak forests and shrublands ("matorral") and also disturbed areas. Only *G. grandiflora* occurs in mesic sites in forests dominated by oaks, pines, and firs. *Galphimia arenicola* has been found only on dunes and in coastal deciduous forest on the Pacific coast of the Isthmus of Tehuantepec. See the appendix for a list of species found in Mexico and sorted by state.

Four species are found in South America, south of the Amazon basin (Figs. 19, 21), all in open habitats (open woodlands and grasslands, cerrado, caatinga, campo limpo, campo sujo, matorral, and secondary sites). *Galphimia australis*, a widespread and variable species found from eastern Bolivia and southern Brazil to northern

Argentina, is sympatric with *G. amambayensis* (known only from the type from eastern Paraguay) and *G. platphylla* (eastern Paraguay and adjacent Brazil). *Galphimia brasiliensis* is restricted to eastern Brazil, from Paraíba to Bahia and adjacent Piauí. The South American species are morphologically most similar to *G. angustifolia* and *G. vestita* of northern Mexico, which grow in dry and desert habitats, from thorn scrub and tropical deciduous forest to sandy washes and arroyos; *G. angustifolia* is also reported from limestone, caliche, and gypsum substrates. *Galphimia angustifolia* is a common species found from central Texas to Tamaulipas and west to Coahuila (and some collections from the Durango border) as well as in eastern Baja California Sur and westernmost Sonora and adjacent Sinaloa (Fig. 16). The range of *G. vestita* extends from Sonora to Nayarit, with one collection from southwestern Chihuahua (Fig. 10).

### GENERIC AND INFRAGENERIC AFFINITIES

The phylogeny of Malpighiaceae and the relationships of the genera are currently the focus of a study by W. R. Anderson and C. C. Davis; earlier results were reported by Cameron et al. (2001) and Davis et al. (2001). *Galphimia* is placed in the tribe Galphimieae of subfamily Byrsonimoideae, with *Lophanthera* Adr. Juss., *Spachea* Adr. Juss., and *Verrucularia* Adr. Juss. (W. R. Anderson 1978). In addition to the shared characteristics noted by Anderson (1978), the presence of latex has been reported for all four genera (*Lophanthera*, *Spachea*: W. R. Anderson 1981, 2001; *Galphimia*, *Verrucularia*: Vega et al. 2002). In a review of chromosome numbers of Neotropical Malpighiaceae, W. R. Anderson (1993) noted that  $n=6$  is the lowest number reported for the family and that  $n=6$  or a multiple of 6 is typical for members of subfamily Byrsonimoideae. Counts reported for *Lophanthera* and *Verrucularia* are  $n=6$ ; none are known for *Spachea*. Few counts are available for *Galphimia*, but they indicate that also in *Galphimia*  $x=6$ . W. R. Anderson (1993) predicted that the low number and morphological evidence place the Galphimieae near the base of the family phylogeny, a position confirmed by Cameron et al. (2001) and Davis et al. (2001).

Two vouchered counts of *G. gracilis* are  $n=12$ . Of these only one was obtained from buds collected in the field (Fryxell & Anderson 3483; W. R. Anderson 1993) and the only one for which I saw the voucher. MacBryde (1970) also cited a voucher for his cultivated source (MacBryde & Herrera-MacBryde 63). Literature reports of counts  $n=12$  from cultivated plants of *Galphimia* most likely apply to *G. gracilis*; however, garden specimens of Malpighiaceae are often mislabeled even to genus, and in the absence of vouchers the identity of sources remains uncertain. Lombello and Forni-Martins (2002) report  $2n=24$  for "*G. brasiliensis*." The voucher (Lombello 50, UEC, not seen) was collected from plants cultivated in Campinas and likely represents *G. gracilis* or perhaps *G. australis*. MacBryde (1970) and Semple (1970) listed in the same summary of chromosome reports differing counts for *G. angustifolia*. MacBryde cited  $n=12$  (voucher: Lynch 710, MO!) and Semple listed  $n=20$  (voucher: MacBryde 72, not seen). Both vouchers were prepared from transplanted individuals collected in Texas. Three vouchered counts for "*G. glauca*," all  $n=6$ , have been published for two species with persistent petals: *G. floribunda* (voucher: Breedlove 19114, Seavey 1975) and *G. speciosa* (voucher: Breedlove 7072, Kyhos 1966; voucher: Anderson 13555, W. R. Anderson 1993). A very preliminary molecular survey of species of *Galphimia* (C. C. Davis, pers. comm.) indicates that *G. gracilis* may be basal to the rest of the genus. It is intriguing that species with persistent petals, which are presumed to be among the more recently derived in the genus, have a lower chromosome number than the two species with deciduous petals.

A reliable phylogeny of *Galphimia* is not yet available; therefore, the species of *Galphimia* are here assigned to three informal groups and within these groups are placed according to morphological similarity. Groups II and III may prove to form derived clades. It is possible that the two North American species and the four South American species of Group II represent two separate migrations; possibly *G. brasiliensis*, which differs notably from the other three South American taxa, represents a third event.

Group I comprises 12 species from Mexico and is the most diverse. All species have deciduous petals and well-developed pedicels and peduncles. In all but *G. radialis* the posterior petal differs from the lateral ones. Some species have an entirely or partially pilose ovary and fruit, and some have a glandular calyx. Four species (*G. arenicola*, *G. gracilis*, *G. hirsuta*, *G. tuberculata*) have the vestiture composed of hairs borne on persistent tubercles; this condition is not as strongly expressed in *G. gracilis* as in the other three. Three species have relatively long, elongate laminae with the glands borne on the margin (never on the petiole); of these, *G. langlassei* and *G. mexiae* have pilose ovaries, but in *G. radialis* such hairs are found only on the sutures.

Group II includes the four South American species, and two from northern Mexico (*G. angustifolia* into Texas, *G. vestita*). In all, the peduncle is lost or rudimentary, and the wand-like, elongate racemes bear widely spaced flowers with subequal petals; usually only one to three flowers are open at the same time (up to seven in *G. platyphylla*). The sepals bear an apical tuft of hairs, which is eventually sloughed off. The flowers, except in *G. platyphylla*, are small, with petals only to 5 mm long, and all have small anthers, to 1.5 mm long. The ovary and fruit are glabrous only in *G. australis* and *G. platyphylla*, the only species with calyx glands. *Galphimia vestita* has linear leaves, a shape found also in the variable *G. angustifolia* and *G. australis* but in no other species in the genus. *Galphimia brasiliensis* is the only species of this group with hairs borne on persistent tubercles.

Group III comprises eight species that have persistent petals. The flowers are closely spaced along the inflorescence axis, and the crowded aspect of the racemes is enhanced by the large petals, which are retained beyond maturation of the fruit. All species have well-developed peduncles, an eglandular calyx, and a glabrous ovary and fruit. The lateral petals are of a different shape and size than the posterior one. Overall, the flowers are the largest in the genus. The limb of the petals is mostly longer than 7 mm and in *G. grandiflora* it measures to 15.5 mm long. These eight species may be the most recently derived. They share an overall similar aspect and are the taxa most often misdetermined; many collectors label any specimen with persistent petals "*G. glauca*."

## TAXONOMY

Note: Measurements of floral parts were taken from flowers rehydrated with Pohl's solution (Pohl 1965).

**Galphimia** Cav., Icon. 5: 61. 1799. *Malpighia* [subgenus] *Galphimia* (Cav.) Persoon, Syn. pl. 1: 506. 1805.—LECTOTYPE, designated by O'Donell and Lourteig, 1943: *Galphimia glauca* Cav.

*Thryallis* L., Sp. pl. (ed. 2) 554. 1762, nom. rej., non *Thryallis* Martius, 1829, nom. conserv. *Vorstia* Adanson, Fam. pl. 2: (23). 1763, nom. superfl. *Galphimia* sect. *Microgalphimia* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunschweig 5: 21. 1914, nom. superfl.—TYPE: *Thryallis brasiliensis* L. [= *Galphimia brasiliensis* (L.) A. Dr. Juss.].

Suffrutescent herbs arising from a woody base, subshrubs, shrubs, or treelets. Leaves opposite, petioled or subsessile to sessile; lamina linear, lanceolate, elliptical, ovate, rhombic, obovate, or occasionally suborbicular, apex acute or apiculate, base acute, attenuate, cuneate, or truncate, narrowly decurrent or not, glabrous (pubescent in *G. hirsuta* and *G. vestita*, sparsely so in *G. elegans*), margin entire (with tubercles in *G. arenicola*, *G. gracilis*, *G. hirsuta*, and *G. tuberculata*, with elongate multicellular outgrowths in *G. arenicola*), costa prominent abaxially, secondary veins prominent or prominulous or not evident; stipules distinct, intrapetiolar, linear or narrowly triangular, persistent on stems. Leaf glands usually 2 and paired, disklike and prominent or flush with the surface, or peglike and stalked, borne in the proximal portion of the lamina on the margin near or at the base, or borne on the petiole, the pair of glands subopposite or separated, sometimes with additional glands on the laminar margin or with only 1 gland, or sometimes glands absent. Inflorescence a terminal raceme or a panicle; flowers borne on a pedicel, peduncles present and subtended by a bract and bearing a pair of bracteoles, the articulation commonly marked with a ring of hairs, or peduncle absent or rudimentary and the pedicel subtended by a bract and a pair of bracteoles. Flowers bilaterally symmetrical. Sepals 5, oblong, elliptical, or lanceolate, eglandular or with a gland at the base of the sinus between all or some adjacent sepals. Petals 5, clawed, subequal or the posterior petal (the "flag") differing from the lateral ones, glabrous (pubescent on the midvein abaxially in *G. hirsuta* and *G. vestita*, also sometimes in *G. amambayensis*), yellow and often suffused with red, deciduous or persistent, the limb elliptical to ovate or triangular. Stamens 10, glabrous, filaments differing in length (equal in *G. vestita*), that opposite the anterior sepal the longest, those opposite the posterior and posterior-lateral petals the shortest, anthers subequal, dehiscent by longitudinal slits. Ovary spherical, tricarpellate (2 carpels anterior, 1 carpel posterior), trilocular (all 3 locules fertile), glabrous or finely pilose with basifixed hairs; styles 3, subulate, glabrous; stigma minute, terminal. Fruit a schizocarp, splitting into 3 cocci, these glabrous or pilose like the ovary, carpophore absent; seed coat shiny (dark) brown; embryo globose or subglobose, radicle straight, cotyledons oblong and folded at the proximal 2/3–2/5, the outer cotyledon larger than and enclosing the inner one. Base chromosome number:  $x=6$ .

#### KEY TO THE SPECIES OF GALPHIMIA

##### 1. Plants of South America.

2. Sepals abaxially tomentose or patchily so in fruit; ovary and fruit pilose along the sutures and on the proximal 2/3 of the surface, the distal 1/3 glabrous; Paraguay (Amambay).  
17. *G. amambayensis*
2. Sepals glabrous or with scattered hairs near the base and/or with a tuft of hairs at the apex; ovary and fruit glabrous or uniformly pilose.
3. Ovary and fruit pilose; petioles 3–10 mm long, tuberculate-strigose, or in older leaves only the persistent tubercles remaining; Brazil (Bahia, Paraíba, Pernambuco, and adjacent Piauí).  
15. *G. brasiliensis*
3. Ovary and fruit glabrous; petioles 1.5–6 mm long, glabrous.
4. Laminas linear to linear-lanceolate to lanceolate to narrowly elliptical, (0.5–) 1–2.5 (–3.3) cm wide, length/width ratio (2–) 2.5–7 (–9); pedicels tomentulose or with scattered hairs or sometimes glabrous; sepals 2.5–3.5 (–4) mm long, 1–1.8 mm wide; petal limb 3–5 mm long; cocci 3–3.8 mm long; common in southern Brazil, eastern Bolivia, Paraguay, northeastern Argentina and adjacent Uruguay.  
16. *G. australis*
4. Laminas elliptical, broadly lanceolate, ovate to broadly ovate, occasionally suborbicular, (1.5–) 2–4 (–5) cm wide, length/width ratio 1.2–2.3 (–3); pedicels glabrous; sepals 4–5.7 mm long, 2–2.5 mm wide; petal limb 7–8.5 mm long; cocci 4–5 mm long; Paraguay (Amambay, Caaguazú, Canendiyá) and adjacent Brazil (Mato Grosso do Sul).  
18. *G. platyphylla*

1. Plants of the U.S.A. (Texas; *G. angustifolia*), Mexico, and Central America (*G. speciosa*).
5. Inflorescence a terminal raceme with only 1-2 (-3) flowers open at one time, flowers widely spaced along the axis, usually the distance between flowers about as long or longer than the length of the pedicels; peduncles absent or rudimentary; petals deciduous, subequal; anthers 0.7-1.5 mm long.
6. Leaves glabrous or with a few scattered hairs; sepals glabrous except for an apical tuft of hairs (best seen in bud and young flowers); U.S.A. (Texas) and Mexico (Baja California Sur, Chihuahua, Coahuila, Durango, Nuevo León, San Luis Potosí, Sinaloa, Sonora, Tamaulipas).  
13. *G. angustifolia*
6. Leaves densely pubescent; calyx densely pubescent; southwestern Chihuahua, Nayarit, Sinaloa, Sonora.  
14. *G. vestita*
5. Inflorescence a terminal raceme or a panicle, more than 3 flowers open at one time, flowers closely spaced along the axis, the distance between flowers variable and shorter than the length of the pedicels; peduncles present; petals deciduous or persistent, the posterior petal differing from the lateral petals (petals subequal in *G. radialis*); anthers 1.8-4.4 mm long.
7. Petioles absent or rudimentary (up to 1 mm long); lamina base shallowly cordate or truncate; leaf glands present only on basal pair of leaves of a shoot, these leaves much smaller than the distal ones and suborbicular; Oaxaca.  
11. *G. sessilifolia*
7. Petioles present, at least 3 mm long; lamina base acute or cuneate or decurrent (sometimes truncate in *G. montana*); leaf glands not restricted to basalmost pair of leaves of a shoot.
8. Laminas abaxially pubescent, at least those close to the inflorescence.
9. Laminas all evenly pubescent on both surfaces; petals deciduous, often abaxially pubescent; calyx abaxially pubescent and glandular; Guerrero.  
4. *G. hirsuta*
9. Laminas, at least those close to the inflorescence, abaxially pubescent or patchily so in older leaves, adaxially only sparsely pubescent and glabrescent; petals persistent, glabrous; calyx with scattered hairs and eglandular; Oaxaca.  
20. *G. elegans*
8. Laminas glabrous or with a few scattered hairs.
10. Inflorescence axes, peduncles, and pedicels glabrous or with a few scattered hairs.
11. Petals deciduous, commonly suffused with red; calyx usually glandular; ovary and fruit pilose; leaf glands borne on the petiole in the proximal 1/6-1/2 (rarely distally); Guerrero, Jalisco, México, Michoacán, Sinaloa.  
7. *G. glandulosa*
11. Petals persistent, yellow; calyx eglandular; ovary and fruit glabrous; leaf glands borne on the margin of the lamina or near the apex of the petiole; Chihuahua, Durango, Jalisco, Sinaloa, Sonora, Nayarit.  
26. *G. floribunda*
10. Inflorescence axes, peduncles, and pedicels moderately to densely pubescent.
12. Petals persistent and spreading below the fruit, retained even after the cocci have fallen, limb of lateral petals 7.5-15.5 mm long; calyx glands absent; ovary and fruit glabrous.
13. Petioles rudimentary or very short, even in the largest leaves only 0.3-0.8 (-1) cm long; Guanajuato, Jalisco, Michoacán and adjacent México, disjunct to Oaxaca.  
22. *G. multicaulis*
13. Petioles well developed, (0.8-) 1-5 cm long (shorter only in smallest leaves of *G. glauca*).
14. Leaf glands borne at about the middle of the petiole (sometimes more distally in the smallest leaves near the inflorescence); Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, western Oaxaca, Puebla, Zacatecas.  
23. *G. paniculata*
14. Leaf glands borne on the margin of the lamina, or at or near the apex of the petiole.
15. Limb of lateral petals 10-15.5 mm long, 6-11 mm wide; sepals 4-5.5 mm long; bracts 3-6.7 mm long.
16. Sepals with a fringed margin; leaf glands a pair borne well above the base of the lamina, the glands sessile, ca. 0.5 mm in diameter, often with additional smaller glands distally; Guerrero.  
24. *G. calliantha*
16. Sepals with a glabrous margin; leaf glands a pair borne at the base of the lamina, often at the tip of a basal tooth, or at the apex of the petiole, each gland 0.6-1.3 mm in diameter, prominent to peglike (and then up to 1.5 mm long); Colima, Jalisco, México, Michoacán, Morelos.  
25. *G. grandiflora*
15. Limb of lateral petals 7-9.5 (-10) mm long, 5-8.5 mm wide; sepals 2.5-4 mm long; bracts 1.5-3 (-4) mm long.

17. Leaf glands borne above the base of the lamina, often at the apex of a tooth; limb of lateral petals elliptical to lanceolate, limb of posterior petal broadly triangular; cocci ca. 2.5 mm long, ca. 2 mm in diameter; inflorescence a terminal raceme; Aguascalientes, Guanajuato, Hidalgo, Jalisco, Nuevo León, Querétaro, San Luis Potosí, Tamaulipas, Zacatecas. 19. *G. glauca*
17. Leaf glands borne at the base of the lamina and/or the distal portion of the petiole, commonly variable among the leaves of a branchlet; limb of lateral petals triangular to ovate, limb of posterior petal broadly triangular to suborbicular; cocci 3.5–4 mm long, ca. 3 mm in diameter; inflorescence a terminal raceme or leafy ternate panicle; Mexico (Chiapas, Oaxaca, Puebla, Veracruz), Guatemala, Honduras, and adjacent Nicaragua. 21. *G. speciosa*
12. Petals deciduous, limb of lateral petals 4.5–8.5 mm long; calyx glands present or absent; ovary and fruit pilose or glabrous.
18. Petals subequal, the posterior petal only slightly larger than the lateral petals; ovary and fruit with hairs on the sutures and in the proximal 1/4–1/2, the hairs up to 0.8 mm long; stipules up to 0.6 mm long; Guerrero. 10. *G. radialis*
18. Petals unequal, the posterior petal differing from the lateral petals in size and shape; ovary and fruit glabrous or with hairs up to 0.3 mm long; stipules to 0.3 mm long.
19. Ovary and fruit evenly pilose over the entire surface.
20. Anthers 3–4 mm long; filament of stamen opposite the anterior sepal 3.5–4.5 mm long, filament of stamen opposite the posterior petal shorter than that of stamens opposite the posterior-lateral sepals (1.6–2.6 mm vs. 3.5–4.6 mm); limb of lateral petals 6–7 mm long, 4.5–5.5 mm wide; peduncles 0.6–1.2 (–1.6) times as long as pedicels; Colima, Guerrero, Jalisco, Michoacán. 8. *G. langlassei*
20. Anthers 2.3–2.5 (–2.8) mm long; filament of stamen opposite the anterior sepal 2.2–3 mm long, filaments of stamens opposite the posterior petal and posterior-lateral sepals subequal [1.5–1.7 (–2) mm vs. 1.5–1.8 (–2.2) mm]; limb of lateral petals 4.5–6 mm long, 3.7–4.7 mm wide; peduncles 0.3–0.5 (–0.7) times as long as pedicels; northwestern Jalisco and adjacent Nayarit. 9. *G. mexiae*
19. Ovary and fruit glabrous, or with hairs only on the sutures (in *G. tuberculata* also in the basal 2/3).
21. Secondary veins of lamina not or barely evident abaxially; ovary glabrous.
22. Pedicels 14.5–18.5 mm long; peduncles 0.2–0.3 times as long as pedicels; sepals 3.5–4.2 mm long; laminas elliptical to broadly so, obovate, rhombic, ovate, or suborbicular, the base often decurrent; Guerrero, Puebla. 12. *G. mirandae*
22. Pedicels 2–10 mm long; peduncles 0.5–3 times as long as pedicels; sepals 2.5–2.8 mm long; laminas narrowly lanceolate to narrowly elliptical to elliptical, the base not decurrent (or slightly so in *G. arenicola*).
23. Margin of lamina entire; bracteoles borne at or just below the apex of the peduncle; pedicels 5–10 mm long, peduncles 0.5–1 times as long as pedicels; limb of posterior petal 7–8.5 mm long; Tamaulipas, San Luis Potosí, and Veracruz, and adjacent regions of Hidalgo, Puebla, and Querétaro. 1. *G. gracilis*
23. Margin of lamina (at least near the base) with scattered tubercles and/or somewhat longer epidermal processes; bracteoles borne in the proximal 1/4–1/2 of the peduncle; pedicels 2–5 mm long, peduncles 1.2–3 times as long as the pedicels; limb of posterior petal ca. 4.5 mm long; coastal Oaxaca. 6. *G. arenicola*
21. Secondary veins of lamina evident abaxially, prominent to prominent; ovary with hairs on sutures (or glabrous in *G. montana*).

24. Vegetative parts with hairs borne on persistent tubercles and/or only with the tubercles (the hairs already shed); branchlets commonly roughened by persistent tubercles; peduncles 1–2.2 times as long as pedicels; Colima, Guerrero, Jalisco, Nayarit, Sinaloa, 5. *G. tuberculata*
24. Vegetative parts with sessile hairs or glabrous; branchlets smooth or the bark lightly fissured; peduncles 0.2–0.8 times as long as pedicels.
25. Laminas thick-textured (coriaceous when dried), abaxially papillose or the epidermis at least blistered, the margin a thickened light-colored band to 0.2 mm wide; secondary veins prominent abaxially; ovary and fruit with hairs on sutures Pacific slope of Oaxaca. 3. *G. oaxacana*
25. Laminas thin-textured (papery when dried), abaxially smooth, the margin not thickened; secondary veins evident to prominent abaxially; ovary and fruit with hairs on sutures or glabrous; Colima, Guerrero, Jalisco, Michoacán, Nayarit, Sinaloa, and southwestern Durango and Zacatecas. 2. *G. montana*

GROUP I (petals deciduous; peduncles present)

**I. *Galphimia gracilis*** Bartling, *Linnaea* 13: 552. 1840 ["1839"]. *Thryallis gracilis* (Bartling) Kuntze, *Rev. gen. pl.* 1: 89. 1891.—TYPE: based on plants cultivated in the botanical garden of Göttingen (holotype: unknown).—NEOTYPE, designated by Cuatrecasas and Croat, 1981: a specimen prepared from plants cultivated at the botanical garden in Paris (P-JU 11510, microfiche: MICH!, photo: MICH!).

*Galphimia gracilis* var. *gracillima* Hieronymus, *Bot. Jahrb. Syst.* 20, Beibl. 49: 36. 1895.—TYPE: COLOMBIA. Cauca: specimens cultivated in Cerrito, *Lehmann 7439* (lectotype, designated by Cuatrecasas and Croat, 1981; F: isoelectotypes: GH! K! S! US!).

Fig. 1.

Shrub or subshrub to 4 m; stems strigose to tomentulose, becoming glabrate to glabrous in age. Vesture of all vegetative parts of straight to wavy, reddish brown hairs 0.3–0.6 (–0.9) mm long, subsessile or each hair borne on a persistent tubercle to 0.05 mm high, hairs on the petiole borne on a persistent tubercle up to 0.1 mm high. Laminas of the larger leaves 2.5–7 cm long, 2–3 cm wide, elliptical or narrowly elliptical, apex apiculate and with a tuft of hairs in young leaves (sometimes retained in mature leaves), base acute, glabrous or with a few hairs scattered on the costa abaxially, secondary veins not or barely evident, margin entire; petioles 0.7–1.5 cm long, tomentulose to glabrate, irregularly tuberculate; glands usually a pair borne on the margin of the lamina 2–10 mm above the base or sometimes with 3–4 glands, each gland 0.3–0.4 mm in diameter, disklike and prominent or flush with the margin, or sometimes peglike and ca. 0.1 mm long; stipules 1.3–3.2 mm long, 0.4–0.7 mm wide, linear, with scattered hairs at the apex and along the margin. Inflorescence a terminal raceme, the axes tomentulose or strigose; peduncles 3–6.3 mm long, pedicels 5–10 mm long, both tomentulose or strigose, peduncles 0.5–1 times as long as pedicels; bracts 2.5–3 mm long, 0.6–0.8 mm wide, linear, bracteoles 1.4–2 mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs along the margin; bracteoles subopposite or up to 0.5 mm apart, usually borne at or just below the apex of

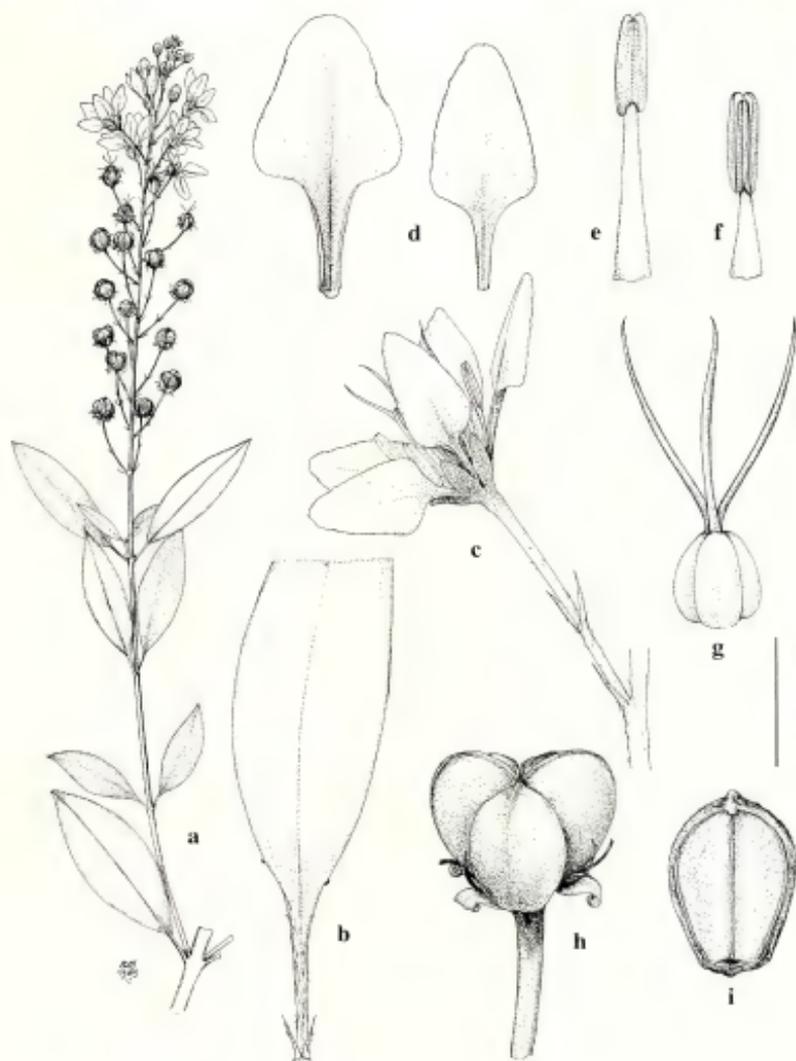


FIG. 1. *Galphimia gracilis*. a. Flowering and fruiting branch. b. Base of leaf and stipules, adaxial view. c. Flower, side view, posterior petal at upper right, adaxial views. d. Posterior petal (left) and lateral petal (right), adaxial views. e. Stamen from opposite sepal, abaxial view. f. Stamen from opposite petal, adaxial view. g. Gynoecium. h. Fruit. i. Coccus, adaxial view. Scale bar: a, 3 cm; b, c, 6 mm; d, h, 4.2 mm; e-g, i, 3 mm. (Based on Fryxell & Anderson 3484, MICH.)

the peduncle. Sepals 2.5–3.2 mm long, 1.2–1.5 mm wide, elliptical or oblong, margin denticulate-erose in distal 1/2, glabrous; glands absent. Petals deciduous, unequal, yellow or the claws suffused with red, glabrous, margin erose to irregularly denticulate and with scattered fimbriae; lateral petals: claw 2–2.5 mm long, 0.5–0.7 mm wide, limb 6–7 (–8.5) mm long, 4–4.6 (–5) mm wide, narrowly elliptical to narrowly ovate, apex obtuse, base acute; posterior petal: claw 4–5 mm long, 1–1.5 mm wide, limb 7–8.5 mm long, 6–7 (–8) mm wide, broadly triangular, apex broadly obtuse, base truncate. Stamens of unequal length; filament opposite anterior sepal (4.2–) 4.5–5 mm long, filaments opposite anterior-lateral petals 3–4 mm long, filaments opposite anterior-lateral sepals 4–5.2 mm long, filaments opposite posterior-lateral petals 2–3 mm long, filaments opposite posterior-lateral sepals 3.5–4 mm long, filament opposite posterior petal 2–2.3 mm long; anthers 2.3–3 mm long. Ovary glabrous; styles (5–) 6–7 mm long. Coccus 4.5–5 mm long, 3–3.3 mm in diameter, glabrous; areole 3.5–3.7 mm long, 2.8–3 mm wide; outer cotyledon 3–4 mm long, inner cotyledon 2.4–3 mm long. Chromosome number:  $n=12$  (W. R. Anderson 1993).

Phenology. Collected in flower throughout the year (except March and October), in fruit in January and February and from April through September.

Distribution (Fig. 2). Mexico (Hidalgo, Puebla, Querétaro, San Luis Potosí, Tamaulipas, Veracruz); deciduous lowland forest, acahuales, roadsides, often in wet situations, such as streambanks and ditches, commonly cultivated and adventive outside the natural range; 20–900 m.

REPRESENTATIVE SPECIMENS. **MEXICO.** HIDALGO: Mpio. Huejutla, Tehuetlán, *Hernández M. et al.* 6385 (CAS, ENCB, MEXU, MO, XAL); Mpio. Huejutla, near Huejutla, *Seler & Seler* 660 (GH, US).—PUEBLA: Mpio. Metlatoyuca, Metlatoyuca, *Turra* 2337 (ENCB).—QUERÉTARO: Jalpan, al oriente de Tanchanaquito, El Sabinito, *López* 366 (IEB, MICH).—SAN LUIS POTOSÍ: Mpio. San Antonio, Tanjasne, *Alcorn* 1836 (MEXU, TEX); S of Villa Juárez, *Clark* 6837 (MO); Mpio. Ciudad Valles, 2 mi W of Chontal, on Rancho Pago Pago, *Fryxell & Anderson* 3484 (CAS, CHAPA, DUKE, ENCB, MBM, MEXU, MICH, NY, TEX); 2 mi E of Tamazunchale, N side of river, *Hitchcock & Stanford* 7318 (DS, UC, US); 2 mi N of Tanquián, *Johnston & Crutchfield* 5675 (LL, MEXU, MICH, TEX); Tamazunchale, *Lundell & Lundell* 7145 (MICH, US); Valles, *Lundell & Lundell* 7275 (LL, MEXU, MICH, NY, US); San Dieguito, *Palmer* 104 in 1904 (F, GH, K, MO, NY, UC, US); Rascon Station, *Pringle* 3099 (A, BM, BR, ENCB, F, G, GH, GOET, LL, MEL, MEXU, MO, NY, S, TEX, UC, W); Huichihuayán, *Rzedowski* 7819 (ENCB, MEXU, TEX).—TAMAULIPAS: near Limón, 73 mi S of Ciudad Victoria, *Frye & Frye* 2665 (DS, GH, MICH, MO, NY, UC, US); 3 km al E de Nuevo Morelos, *González Medrano* 12187 (MEXU, MO); Chancel, Ocampo Rd., *Kenoyer & Crum* 3579 (GH, MICH); 10 km al S de Llera, *Puig* 5212 (ENCB, MICH).—VERACRUZ: Tantoyuca, *Berlandier* 2149 (G, GH, NY); Mpio. Tempoal, El Mirador, presa Paso de Piedras, 21°31'N 98°07'W, *Calzada et al.* 6217 (ENCB, F, IEB, MEXU, XAL); Mpio. Tepetzintla, San José Copalilita, 7 km al NE de Tepetzintla, *Casillo C. & Benavides* 2294 (F, MEXU, XAL); Mpio. Ozuluama, *Casillo C. et al.* 270 (F, IBUG, MICH, XAL, WIS); along Hwy 180 between Tampico and Pozarica, 12 mi N of Ozuluama, 38 km N of Naranjos, *Crist* 6602 (CAS, MICH, MO); Mpio. Pánuco, 1.7 km WNW of Hwy Mex-70, 10 km E of Ebano, 22°12'N, 98°17'W, *Diggs & Nee* 2572 (F, MICH, NY, XAL); Mpio. Chicontepec, carr. a Benito Juárez, 3 km antes de Benito Juárez, 20°54'N, 98°13'W, *Durán E. et al.* 264 (XAL); Wartenberg, near Tantoyuca, prov. Huasteca, *Ervenberg* 130 (G, GH, GOET); 13 mi S of Tampico, Hwy 180 to Tuxpan, *Lasseigne* 4897 (ENCB, MEXU, MICH, MO, NY, WIS); 36 mi N of Tantoyuca on Rte 120, *Ozment et al.* 388 (WIS); road from Tamiagua to Tuxpan, about 6 mi S of Tamiagua, *Tucker* 2060 (DUKE, ENCB); Mpio. Alto Lucero, carr. Santa Ana–Los Atlisos, 19°52'N, 96°32'W, *Vázquez B.* 1818 (XAL).

*Galphimia gracilis* is an attractive shrub native to eastern Mexico. The shoots appear reddish owing to the vestiture, composed of straight to wavy hairs that are subsessile or borne on persistent tubercles ca. 0.05 mm high, but to 0.1 mm high on the petioles. The narrowly elliptical to elliptical laminae have an apical tuft of hairs (sloughed off in age) and glands on the margin placed well above the base. The bracteoles are usually borne at or near the apex of the peduncle.

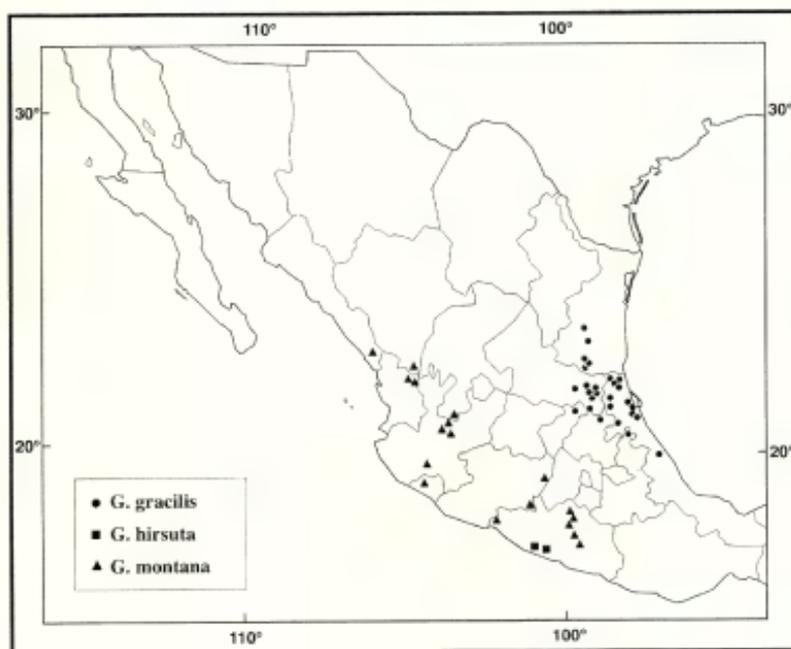


FIG. 2. Distribution of *Galphimia gracilis* and *G. montana*.

The names *Galphimia gracilis* (and *Thryallis gracilis*) have been widely misapplied to many other species of *Galphimia* of Mexico, particularly to those with deciduous petals. *Galphimia gracilis* also is often confused with the partly sympatric *G. glauca*, which is easily separated by its persistent petals and smaller fruits (2.5 mm long vs. 4.5–5 mm long in *G. gracilis*). *Galphimia glauca* also differs in its bracteoles (placed well below the apex of the peduncle) and lack of tubercles; the laminas vary from elliptical to lanceolate or ovate to rarely suborbicular, whereas the laminas of *G. gracilis* are only elliptical or narrowly so. Small (1910) included *G. gracilis* within his very broadly circumscribed *Thryallis glauca*.

*Galphimia gracilis* is widely cultivated in warm regions, as “goldshower” and “shower-of-gold” (and equivalents in local languages), and also as “thryallis.” It is frequently adventive and occasionally locally naturalized. The species was introduced to gardens as “*Galphimia glauca*” (e.g., Maund 1837). In horticultural publications, in the nursery trade, and on websites, *G. gracilis* is often listed and pictured as “*Galphimia glauca*,” “*Galphimia brasiliensis*,” “*Thryallis glauca*,” and “*Thryallis gracilis*.” See also the discussion under *G. glauca*.

Bartling (1840) based *G. gracilis* on living plants grown at the botanical garden in Göttingen, and no authentic material is known. Given the many well-prepared collections available for this species, it is unfortunate that a fragmentary garden specimen in the Jussieu herbarium was chosen as neotype.

2. *Galphimia montana* (Rose) Nied. in Engler, Pflanzenreich IV. 141: 601. 1928. *Thryallis montana* Rose, Contr. U.S. Natl. Herb. 12: 281. 1909.—TYPE: MEXICO. Durango: Sierra Madre near Huazamota (fide McVaugh, 1972), 15 Aug 1897, Rose 2309 (holotype: US!; isotypes: MEXU! NY!).

*Galphimia glauca* f. *parvifolia* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 5: 25. 1914.—TYPE: MEXICO. Jalisco: slopes of the barranca of Guadalajara, 4500 ft, 8 Aug 1902, Pringle 9698 (holotype: B, destroyed; lectotype, designated by Cuatrecasas and Croat, 1981: NY!; isotypes: F, GH! K! L! MEXU! MO! NY! US!).

Shrub or treelet to 3.5 m; stems and branchlets sparsely tomentulose when very young, soon glabrous. Vesture of all vegetative parts composed of sessile, straight or wavy to crisped, reddish brown hairs 0.2–0.6 mm long. Laminae of the larger leaves 2–5 (–5.5) cm long, 1–3 cm wide, lanceolate to ovate to orbicular, apex apiculate, base acute or sometimes truncate, glabrous, secondary veins always evident and usually prominulous abaxially, margin entire; petioles 0.4–1.5 cm long, glabrate or glabrous; glands usually a pair borne on the margin at or near the base of the lamina or to 10 mm above the base or sometimes 1 or both glands borne on the petiole, sometimes with only 1 gland or glands absent, each gland 0.4–0.6 mm in diameter, disklike and prominent, or peglike and up to 0.7 mm long; stipules 1–2.5 mm long, 0.3–1 mm wide, linear to narrowly triangular, glabrous. Inflorescence a terminal raceme, the axes sparsely tomentulose to glabrate; peduncles 2–5 mm long, sparsely tomentulose, pedicels 5.5–10.5 mm long, glabrate or sparsely tomentulose, peduncles 0.2–0.6 times as long as pedicels; bracts 1.5–3 mm long, 0.4–0.5 mm wide, linear, bracteoles 1–1.5 (–2) mm long, 0.2–0.4 mm wide, linear, bracts and bracteoles glabrous; bracteoles subopposite or to 2 mm apart, borne at about the middle of the peduncle, or only 1 bracteole borne at the middle and the other near the base or in the proximal 1/4–1/3. Sepals 2.4–3 mm long, 1–1.4 mm wide, oblong, glabrous, margin denticulate (–ciliate) in the distal 1/2; glands 0–3 (–5?) per calyx, 0.2–0.5 mm in diameter, sessile to 0.3 mm long. Petals deciduous, unequal, glabrous, yellow, the claws suffused with red, margin irregularly denticulate/fimbriate; lateral petals: claw 1.2–2.2 mm long, ca. 0.5 mm wide, limb 5.5–6.8 (–7.5) mm long, 3.5–4.2 mm wide, elliptical or narrowly lanceolate, apex obtuse, base attenuate; posterior petal: claw 3–4 mm long, 1–1.5 mm wide, limb 5–6.5 mm long, 4.5–6 mm wide, broadly triangular or sometimes suborbicular, apex broadly rounded, base truncate or slightly cordate. Stamens of unequal length: filament opposite anterior sepal 3–3.7 mm long, filaments opposite anterior-lateral petals 2.6–3 (–3.5) mm long, filaments opposite anterior-lateral sepals 2.5–3.1 (–3.5) mm long, filaments opposite posterior-lateral petals 1.5–2 mm long, filaments opposite posterior-lateral sepals 2.7–3.2 (–3.5) mm long, filament opposite posterior petal 1.5–2 mm long; anthers (2.2–) 2.5–3 mm long. Ovary glabrous or pilose only on the sutures; styles 4–5 mm long. Coccus 3–3.5 mm long, 2.6–2.8 mm in diameter, glabrous or pilose only on the sutures; areole ca. 3 mm long, ca. 2.3 mm wide; outer cotyledon 2–2.3 mm long, inner cotyledon 1.5–1.7 mm long. Chromosome number unknown.

Phenology. Collected in flower and fruit from July through December.

Distribution (Fig. 2). Mexico (Colima, southern Durango, Guerrero, Jalisco, Michoacán, Nayarit, southern Sinaloa, southern Zacatecas); tropical low deciduous forest ("selva baja caducifolia," "bosque tropical deciduo"); 150–1200 m.

ADDITIONAL SPECIMENS EXAMINED. **Mexico**. COLIMA: 11–12 mi by rd S of Colima, rd to Manzanillo, 19°05'N, 103°47'W, Webster & Breckon 16116 (MEXU).—GUERRERO: Mpio. Ahuacatzingo, cerca de Trapiche Viejo, 40 km al NE de Chilapa, Acosta & López 73 (MICH); Guayameo, Dto. Minas. Hinton

*et al.* 9372 (DS, F, GH, MEXU, MICH, NY, US); Mpio. Tepeacoahuilco, 33 km al S de Iguala Terracería a Coacoyula, *Koch & Fryxell 8246* (CAS, CHAPA, ENCB, MEXU, MICH, NY); Río Balsas, *Orcutt 4183* (BM, DS, F, GH, MEXU, MO, US); hillsides near Balsas Station, *Pringle 10063* (BM, C, CAS, F, G, GH, GOET, L, MEXU, MICH, MO, NY, S, UC, US, W).—JALISCO: Mpio. San Cristóbal de la Barranca, Km 37 adelante del pueblo de San Cristóbal Barranca, *Ornelas U. & Cházaro B. 767* (CHAPA, ENCB, IBUG); barranca near Guadalajara, *Palmer 97* in 1886 (BM, G, GH, K, MEXU, MICH, MO, NY, US); between Bolaños and Guadalajara, *Rose 3050* (NY, US); Mpio. Tuxcacuesco, 5–6 km WSW de Tuxcacuesco, Cerro del Palacio, 19°40'40"N, 104°01'10"W, *Santana M. & Rosales 6494* (MICH, WIS); Mpio. Amatitán, Barranca Santa Rosa, orilla Río Santiago, *Villarreal 6658* (IBUG).—MICHOACÁN: Dto. Zitácuaro, *Hinton 13220* (BM, DS, ENCB, F, GH, MEXU, MICH, NY, S, UC, US); Mpio. Huetamo, Mal Paso, *Hinton et al. 8039* (A, BM, F).—NAYARIT: Mpio. Nayar, Jesús María, camino a La Mesa, cerca del arroyo El Fraile, *Colunga & Zizumbo 32* (CAS, MEXU); valley of the Río Jesús María near village of Jesús María, *Feddema 1243* (MICH); Mpio. Nayar, 3.9 km al NE de Jesús María, camino a Huejuquilla, 22°16'N, 104°30'W, *Flores F. 1059* (MEXU, MICH, MO); Cañón de Jesús María, Tepic, *Goldsmith 159* (F, GH, MO, UC, US); Mpio. Acaponeta, near Jesús María, *Norris & Taranto 13961* (IEB, MICH); Mpio. Nayar, 7 km al W de Jesús María, carr. a la Mesa del Nayar, 22°15'N, 104°38'W, *Ramírez R. 442* (IEB, MICH, MEXU, MO); Mpio. Nayar, El Puente, 12 km al NW de Jesús María, carr. a La Mesa del Nayar, 22°15'N, 104°33'W, *Tenorio L. 16570* (MEXU, MICH, MO).—SINALOA: Mpio. San Ignacio, San Agustín, *González Ortega 526 p.p.* (MEXU); rd to Mictotondas la Palma, 1.3 mi E of Hwy 15, this junction 26 mi S of Hwy 40 junction S of Mazatlán and 1.5 mi N of Rosario, *Reveal 4021* (K, MICH, MO); Mpio. Concordia, Cerro del Ocote, *Trejo & Dehesa 1085* (F, US).—ZACATECAS: Mpio. Moyahua, Santa Rosa, Cerro La Garruñera, *Enríquez E. 136* (MEXU); Mpio. Moyahua, San Lorenzo, Cerro de Las Anonas, *Enríquez E. 48* (IBUG, MEXU).

*Galphimia montana* is a graceful shrub or treelet of the deciduous woodlands of western Mexico, which shows considerable variation throughout its range. The slender shoots bear thin-textured lanceolate to ovate to orbicular leaves; the glands may be borne on the margin of the lamina or at/near the apex of the petiole. The calyx may be eglandular or have 1 or more glands. The ovary and fruit is usually glabrous, but occasionally each carpel/locus bears a row of hairs along the dorsal suture; *G. montana* is the only species in the genus that exhibits such variability in ovary vestiture. In its habit *G. montana* resembles *G. sessilifolia*, endemic to Oaxaca and named for the distinctive coriaceous sessile leaves.

Collections of *G. montana* are often confused with *G. gracilis*, which is native to eastern Mexico but widely cultivated and often adventive. Both have deciduous petals, but *G. gracilis* differs in its larger flowers lacking calyx glands, larger glabrous fruits (4.5–5 mm long, 3–3.3 mm in diameter), elliptical laminas that bear a tuft of hairs at the apex, and bracteoles usually borne at or near the apex of the peduncle. In *G. montana* hairs are sessile, whereas in *G. gracilis* they are often attached to a tiny persistent tubercle; the petioles are usually roughened by such tubercles. Specimens of *G. montana* have also been misdetermined as *G. glauca*, which has persistent petals; Niedenzu (1914) even described a collection of *G. montana* as a form of *G. glauca* (*f. parvifolia*). Two other species with deciduous petals from western Mexico with which *G. montana* might be confused are *G. langlassei* and *G. mexiae*. Both have densely pilose ovaries and fruits, and lack calyx glands.

**3. *Galphimia oxacana*** C. Anderson, Contr. Univ. Michigan Herb. 24: 15. 2005.—TYPE: MEXICO. Oaxaca: Dto. Tehuantepec, Rancho Ricardo, al N de Buenos Aires, entrando por Hierba Santa, 12 Sep 1985, *Torres C. 7306* (holotype: MICH!; isotypes: F! MEXU!). Fig. 3.

Shrub or treelet to 6 m; stems and branchlets sparsely pubescent when young, soon glabrous. Vestiture of all vegetative parts of sessile, straight to wavy, reddish brown hairs 0.3–0.8 mm long. Laminas of the larger leaves 3.5–6 cm long, 1.5–3.5 cm wide, elliptical or ovate to lanceolate, apex apiculate or sometimes acute, base acute, glabrous, abaxially papillose or sometimes only slightly so (the epidermis at

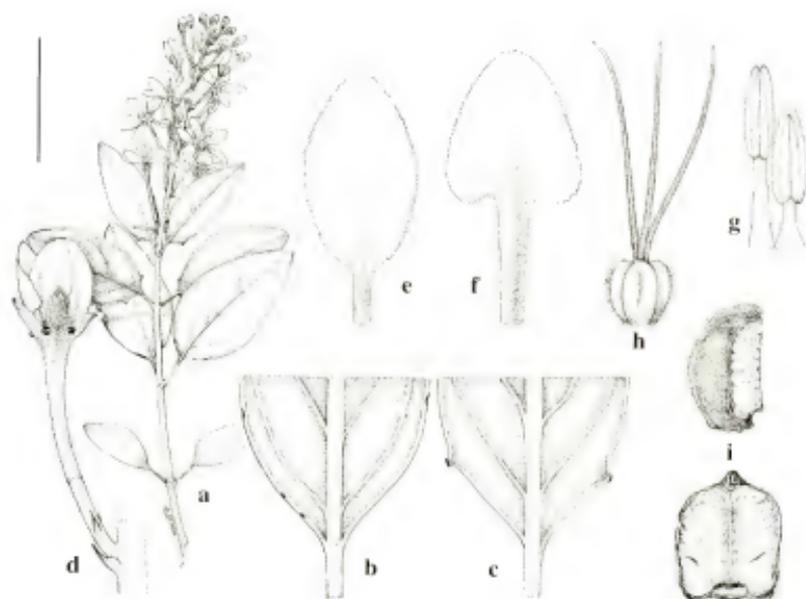


FIG. 3. *Galphimia obtusata*. a. Flowering branch. b, c. Proximal portion of two leaves, abaxial view. d. Flower bud, opening, borne on pedicel and peduncle, with portion of inflorescence axis; note calyx glands. e. Lateral petal. f. Posterior petal. g. Stamens, adaxial view, opposite posterior petal (right) and posterior-lateral sepal (left). h. Gynoecium. i. Cocci, lateral view (above) and adaxial view (below). Scale bar: a, 4 cm; b-d, 8 mm; e, f, 5 mm; g, 4 mm; h, 2.7 mm; i, 3.3 mm. (Based on: a, b, g, i, *Martinez R. 55*, MICH; c-f, h, *Torres C. 122*, MEXU.)

least blistered), thick and coriaceous when dried, secondary veins (at least the first two pairs) prominent abaxially (usually appearing white in dry material); margin entire, thickened; petioles 0.8–1.5 cm long, glabrous or with a few scattered hairs; glands usually a pair borne on the margin of the lamina 8–15 mm above the base or sometimes with 3–6 glands, each gland 0.4–0.7 mm in diameter, disklike and prominent, or sometimes flush with the margin; stipules 1.5–2.5 mm long, 0.8–1 mm wide, narrowly triangular, glabrous. [Sometimes shrubs with only the terminal branches bearing a flush of small leaves along short internodes (to ca. 1 cm long) and a short inflorescence, the leaves 1–2.5 cm long, 0.5–0.9 cm wide; see discussion.] Inflorescence a terminal raceme, the axes sparsely tomentulose or strigose; peduncles 3.5–6.5 mm long, pedicels (7–) 10–15 mm long, both sparsely tomentulose, peduncles 0.3–0.5 times as long as pedicels; bracts (1.5–) 2–2.8 mm long, 0.5–0.9 mm wide, linear, bracteoles 0.8–1.7 mm long, 0.3–0.6 mm wide, linear, bracts and bracteoles glabrous; bracteoles borne in the proximal 1/5–1/2 of the peduncle, subopposite. Sepals 2.5–3 mm long, 1.3–1.5 mm wide, oblong, glabrous, margin denticulate-ciliate in the distal 1/4; glands 1–3 (–5) per calyx, 0.3–0.5 mm in diameter, to 0.2 mm long. Petals deciduous, unequal, yellow, the claws suffused with red, glabrous, margin denticulate; lateral petals: claw (1.5–) 2–2.5 mm long, 0.5 mm wide, limb (5–) 6.5–8 mm long, (3.8–) 4–4.5 mm wide, elliptical to narrowly lanceolate, apex obtuse, base acute; posterior petal: claw (3–)

4–5 mm long, (1–) 1.2–1.5 mm wide, limb (4.5–) 5–6.5 mm long, (4–) 5.5–6 mm wide, triangular, apex broadly obtuse, base cordate. Stamens of unequal length; filament opposite anterior sepal 4–4.5 mm long, filaments opposite anterior-lateral petals 2.5–3 mm long, filaments opposite anterior-lateral sepals 3.6–4.2 mm long, filaments opposite posterior-lateral petals 1.5–2 mm long, filaments opposite posterior-lateral sepals 3.3–3.5 mm long, filament opposite posterior petal 1.5–2 mm long; anthers (2.5–) 2.8–3.5 mm long. Ovary pilose on the sutures, otherwise glabrous, hairs ca. 0.1 mm long; styles (4.7–) 5–5.3 mm long. Coccus ca. 3.5 mm long, ca. 2.7 mm in diameter, pilose on the sutures, otherwise glabrous; areole ca. 3 mm long, ca. 2.5 mm wide; mature seed not seen. Chromosome number unknown.

**Phenology.** Collected in flower from August to October, in fruit from September to December.

**Distribution** (Fig. 10). Mexico (Oaxaca, Pacific slopes of the Isthmus of Tehuantepec); in deciduous forest (“selva baja caducifolia”) and transition to pine-oak forest; 500–1100 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Mexico.** OAXACA: alrededores del Cerro Guiengola, a 10 km aprox. al NW de Tehuantepec, *Cabrera 7413* (MEXU, MO); Dto. Santo Domingo Tehuantepec, Mpio. Mixtequilla, a 18 km de Mixtequilla, carretera a Paso Escondido, 16°27'N, 95°19'W, *Calzada 19255* (MEXU); Mpio. Santiago Laollaga, recorrido por el aguaje Coyol, al W de Laollaga, 16°34'N, 95°14'W, *Campos V. 4039* (F, MEXU, MO); Mpio. Santiago Laollaga, recorrido hacia y por el Arroyo de Hierba Santa, al E de Guichixu, brecha Laollaga–Guevea de Humboldt, 16°41'N, 95°16'W, *Campos V. 4129* (F, MEXU, MO); Dto. Tehuantepec, Mpio. Buenos Aires, Buenos Aires, rumbo a El Cerro Arenal, *Martínez R. 55* (IEB, MICH, MO); Dto. Tehuantepec, ruinas del Cerro Guiengola, *Torres C. 40* (MEXU, MO); Dto. Tehuantepec, “Las Palmitas,” ladera oriente del Cerro Guiengola, *Torres C. 122* (IEB, MEXU, MO); Dto. Tehuantepec, 11 km al W de la Chiviza, hacia Lachiguiri, *Torres C. 5717* (MEXU, MICH, XAL); Dto. Tehuantepec, 12.2 km al W de la Chiviza, hacia Lachiguiri, *Torres C. 5720* (F, MEXU); Dto. Tehuantepec, 11.3 km al N de La Chiviza, *Torres C. & Martínez 5880* (MEXU, MICH).

*Galphimia oaxacana* is known only from dry habitats on the Pacific side of the Isthmus of Tehuantepec. The leaves are coriaceous and have a thickened margin. The abaxial epidermis is generally papillose; the cells are at least slightly raised to give a blistered aspect. The costa and major secondary veins are abaxially very prominent and appear white in dried specimens. The collections *Torres C. 122*, *Torres C. 5717*, and *Torres C. & Martínez 5880* are unusual in that they consist of terminal branches bearing a flush of very small leaves along short internodes (to ca. 1 cm long) and a short inflorescence; the leaves are 1–2.5 cm long, 0.5–0.9 cm wide. Except for size, these collections match *G. oaxacana* in all aspects, and this growth form may reflect particularly dry growing conditions. The only other species found in the Isthmus of Tehuantepec is the coastal *G. arenicola*, which has membranous leaves, lacks calyx glands, and has a glabrous ovary and fruit; it differs most notably in the presence of elongate epidermal processes on the laminar margin and hairs borne on persistent tubercles.

**4. *Galphimia hirsuta*** Cav., *Icon.* 5: 62. May 1799. *Malpighia hirsuta* (Cav.) Persoon, *Syn. pl.* 1: 506. 1805 [combination also proposed by Poiret in Lamarck, *Encycl.*, *Suppl.* 4: 6. 1816]. *Galphimia hirsuta* f. *rufa* K. Koch, *Berliner Allg. Gartenzeitung* 1857(50): 394. 1857, nom. superfl. *Thryallis hirsuta* (Cav.) Kuntze, *Rev. gen. pl.* 1: 89. 1891.—**TYPE:** MEXICO. Guerrero: inter Chilpancingo et Río Azul, *Neé s.n.* (holotype: MA-475693, microfiche: MICH1, photo: MO!; possible isotypes: BM! MA-475694, microfiche: MICH1!).

Shrub to 1 m; stems pubescent when young, becoming glabrous but roughened by tubercles. Vesture of all vegetative parts of straight or crisped, reddish brown hairs 0.5–1.8 mm long, each hair borne on a persistent tubercle up to 0.1 mm high. Laminas of the larger leaves 5–7.5 cm long, 2–3 cm wide, lanceolate to elliptical to rhombic, apex apiculate, base cuneate-decurrent, pubescent, secondary veins prominulous abaxially, margin entire, evenly pubescent on both surfaces; petioles 0.2–1 cm long, pubescent, in older leaves some or all hairs abraded and only the tubercles persistent; glands a pair borne on the margin at or near the base of the lamina, each gland 0.2–0.4 mm in diameter, peglike, 0.4–0.6 mm long; stipules 2.5–3 mm long, 0.5–0.7 mm wide, linear, abaxially with scattered hairs. Inflorescence a terminal raceme, the axes pubescent; peduncles 5–7.3 mm long, pedicels 4.5–6.2 mm long, both pubescent, peduncles 0.9–1.3 times as long as pedicels; bracts 2.2–3 mm long, 0.5–0.7 mm wide, linear, bracteoles 1.4–1.6 mm long, 0.4 mm wide, linear, bracts and bracteoles with scattered hairs abaxially and along the margin; bracteoles borne at about the middle of the peduncle, subopposite or up to 1 mm apart. Sepals ca. 2.5 mm long, ca. 1 mm wide, oblong, pubescent, margin ciliate; glands 5 per calyx, 0.4–0.5 in diameter, to 0.3 mm long. Petals deciduous, unequal, yellow, with scattered hairs on the claw and midvein abaxially, margin finely denticulate; lateral petals: claw 2–2.2 mm long, 0.4–0.5 mm wide, limb 6.5–7 mm long, 4–4.5 mm wide, narrowly triangular, apex obtuse, base cordate; posterior petal: claw ca. 3.5 mm long, ca. 1.3 mm wide, limb 5.5–6 mm long, ca. 6 mm wide, broadly triangular, apex obtuse, base truncate. Stamens of unequal length; filament opposite anterior sepal ca. 3.8 mm long, filaments opposite anterior-lateral petals ca. 3.6 mm long, filaments opposite anterior-lateral sepals ca. 3.2 mm long, filaments opposite posterior-lateral petals ca. 2.2 mm long, filaments opposite posterior-lateral sepals ca. 3 mm long, filament opposite posterior petal ca. 2.5 mm long; anthers 3.3–3.5 mm long. Ovary glabrous; styles ca. 5.5 mm long. Mature fruit not seen.

Phenology. Collected in flower and immature fruit in July and September.

Distribution (Fig. 2). Mexico (Guerrero); pine-oak forest; 100–1000 m.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** GUERRERO: DUJO, Galeana, Atoyac, Hinton 14533 (GH, MICH, NY, US); ca. 20 mi N of San Luis de la Loma, Rowell 3144 (MICH).

*Galphimia hirsuta* differs from all but one other species of *Galphimia* in that it is pubescent in nearly all its parts (only the androecium and gynoecium are glabrous). The vesture is composed of hairs borne on tubercles, which persist and give a roughened aspect to older parts. The laminas vary from lanceolate to elliptical to rhombic and bear a pair of peglike glands on the margin at or near the cuneate-decurrent base. The only other species in the genus that is entirely pubescent is *G. vestita* of northern Mexico, but the hairs are not borne on tubercles; it also differs from *G. hirsuta* in its linear laminas, lack of peduncles, much smaller subequal petals, and pilose ovaries and fruits. *Galphimia hirsuta* might be confused with the more widely distributed and perhaps sympatric *G. tuberculata*, which is also characterized by persistent tubercles and calyx glands, but that species is easily separated by its essentially glabrous leaves and calyx, and the pubescent ovary and fruit.

The likely isotype at BM consists of a flowering shoot and bears the note "misit amicis. Zea"; the specimen apparently belonged to the Roemer herbarium, which came to the BM holdings as part of the Shuttleworth herbarium.

Earlier students of *Galphimia* (e.g., Bartling 1840; Jussieu 1843; Rose 1909; Niedenzu 1914, 1928) misapplied the name *G. hirsuta* to specimens of *G. elegans*, a Oaxacan endemic with persistent petals and abaxially sparsely pubescent laminas, which had been introduced to botanical gardens in the 1800s; see that species (no. 20).

- 5. *Galphimia tuberculata*** (Rose) Nied. in Engler, Pflanzenreich IV, 141: 602. 1928. *Thryallis tuberculata* Rose, Contr. U.S. Natl. Herb. 12: 281. 1909.—TYPE: MEXICO. Sinaloa: between Rosario and Colomas, 12 Jul 1897, *Rose 1607* (holotype: US!, photos: A! F! NY!; isotypes: NY-fragment! GH!).
- Thryallis humilis* Rose, Contr. U.S. Natl. Herb. 12: 280. 1909. *Galphimia humilis* (Rose) Nied. in Engler, Pflanzenreich IV, 141: 601. 1928.—TYPE: MEXICO. Nayarit: road between Concepción and Acaponeta, Territorio de Tepic, 29 Jul 1897, *Rose 1907* (holotype: US!, photos: A! F! NY!; isotype: NY!).

Fig. 4.

Shrub or subshrub to 2 m; stems tuberculate-strigose when young, in age only the tubercles remaining. Vestiture of all vegetative parts of wavy to crisped, reddish brown hairs 0.3–1.9 mm long, borne on a persistent tubercle up to 0.2 (–0.5) mm high. Laminae of the larger leaves 3.8–7.5 cm long, 1.4–3 cm wide, elliptical or lanceolate or rhombic, apex acute or apiculate or sometimes obtuse-apiculate, base cuneate-decurrent, glabrous or with scattered hairs on the midrib abaxially, in older leaves the midrib and also the margins near the base with tubercles only, secondary veins prominent or prominulous abaxially; petioles 0.2–1.2 cm long, tuberculate-strigose or only the tubercles remaining; glands borne on the margin 0.5–2 mm above the base of the lamina or rarely at the base, usually a pair or sometimes only 1 gland, each gland 0.2–0.5 mm in diameter, peglike, (0.2–) 0.5–1.2 (–1.6) mm long, or the glands absent; stipules (1.5–) 2–3.6 mm long, 0.5–1.2 mm wide, linear, glabrous or with scattered hairs along the margin. Inflorescence a terminal raceme, the axes tuberculate-strigose like the stems; peduncles 4.5–11 mm long, pedicels 2.5–7 mm long, both tuberculate-strigose, peduncles 1–2.2 times as long as pedicels; bracts 2.5–4.5 mm long, 0.5–0.8 (–1) mm wide, linear, bracteoles 1.1–2.6 mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs at the apex and along the margin; bracteoles borne in the proximal 1/3–1/2 of the peduncle, subopposite or up to 3 mm apart. Sepals 3–3.7 mm long, 1.4–1.7 mm wide, oblong to narrowly elliptical, glabrous, the apex denticulate (–ciliate) or entire; glands 0–5 per calyx, 0.2–0.4 mm in diameter, usually 0.2–0.3 mm long or rarely on a spur up to 1.2 mm long. Petals deciduous, unequal, yellow or yellow marked with red, glabrous, margin subentire or finely denticulate; lateral petals: claw 2.2–3 mm long, 0.5–0.7 mm wide, limb 6–7.3 mm long, 4.5–6 mm wide, narrowly triangular (–ovate), apex obtuse, base truncate or cordate; posterior petal: claw 3.4–4.5 mm long, 1.4–2 mm wide, limb 6–6.5 mm long, 6–7.2 mm wide, broadly triangular, apex obtuse, base truncate to slightly cordate. Stamens of unequal length; filament opposite anterior sepal (2.5–) 3.2–4.5 mm long, filaments opposite anterior-lateral petals 3–4 mm long, filaments opposite anterior-lateral sepals 3–4 mm long, filaments opposite posterior-lateral petals 1.8–2.2 mm long, filaments opposite posterior-lateral sepals 3–3.5 mm long, filament opposite posterior petal (1.6–) 1.8–2.2 mm long; anthers (2.5–) 3–3.5 mm long. Ovary pilose, in the distal 1/3 only on the sutures, hairs ca. 0.1 mm long; styles (5.2–) 5.5–6.2 mm long. Coccus 3.5–4.5 mm high, ca. 3 mm in diameter, pilose, in the distal 1/3 only on the sutures; areole ca. 4 mm long, ca. 3 mm wide; mature seed not seen. Chromosome number unknown.

**Phenology.** Collected in flower in March and from May through September, and in fruit in March, May, July, and August.

**Distribution** (Fig. 5). Mexico (Colima, Guerrero, Jalisco, Nayarit, Sinaloa); deciduous forest, matorral, and in secondary vegetation; sea level to 400 m.

**REPRESENTATIVE SPECIMENS.** Mexico. COLIMA: coastal lowlands ca. 15 mi SE of Tecomán, rd to Coahuayana, Mich., ca. 2 mi from Río Coahuayana, *McVaugh 16070* (MEXU, MICH).—GUERRERO: Tecpan,

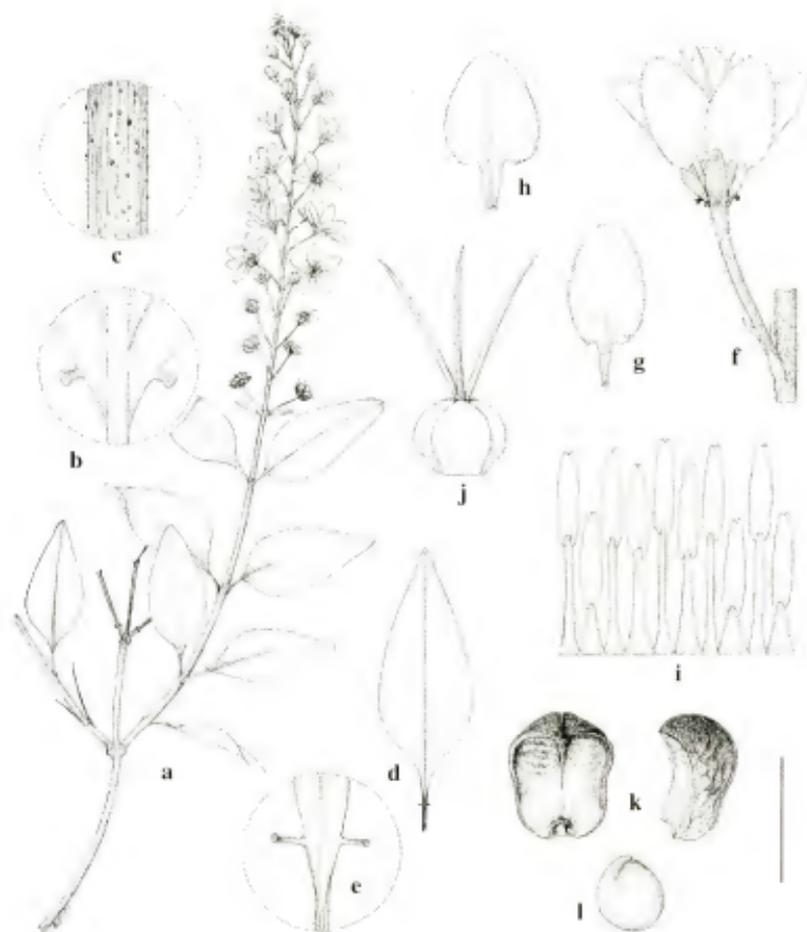


FIG. 4. *Galphimia tuberculata*. a. Flowering branch. b. Base of lamina, abaxial view. c. Branch enlarged to show tubercles. d. Detached large leaf, adaxial view. e. Base of lamina in "d," adaxial view. f. Flower with subtending pedicel and peduncle and portion of inflorescence axis. g. Lateral petal. h. Posterior petal. i. Androgynous bud out, abaxial view, the stamen at right opposite posterior petal. j. Gynoecium. k. Coccoi, adaxial view (left) and lateral view (right). l. Seed. Scale bar: a, d, 4 cm; b, c, e, i-l, 4 mm; f-h, 8 mm. (Based on: a-c, f-j, McVaugh 16070, MICH; d, e, Ortega 6757, F; k, l, Lot 3741, MICH.)

torre de microondas cerca de Papanoa, 54 km al NW de Tecpan, Koch & Fryxell 82221 (CHAPA, ENCB, MEXU, MICH, NY); La Unión, Langlassé 255 (F, G, GH, P, US).—JALISCO: Punta Firalón, Bullock 2053 (CAS); Mpio. La Huerta, camino antiguo sur, Est. Biología Chamela, 19°30'N, 105°03'W, Lot 1739 (CAS, MICH, TEX, WIS); Mpio. La Huerta, Rancho Cuixmala, Cumbres 1, rd through deforested area, 19°31'N, 104°56'W, Lot 3741 (CAS, MICH).—NAVARIT: Mpio. Tepic, Vivero Forestal El Corte, Benítez-Paredes 3166 (MEXU); Mpio. Ruiz, 1-3 km W of El Venado, rd from Ruiz to Jesús María, Breedlove 45278 (CAS, MICH); Mpio. Huajucoí, 8 km al N de Huajucoí, carr. a Quisiquinte, 22°43'N, 105°19'W, Ramírez 656 (IEB, MICH, MEXU, MO); Mpio. Acaponeta, Rose 1450 (NY, US).—SINALOA: Mpio. San Agustín, González Ortega 4001 (MEXU, US); Mazatlán, González Ortega 7271 (CAS, F, G, K, MEXU, US).

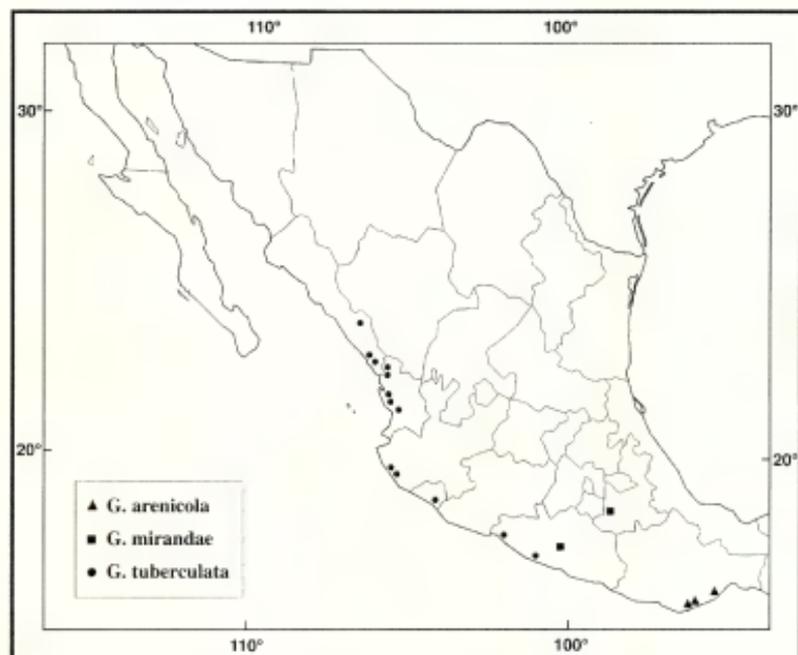


FIG. 5. Distribution of *Galphimia elegans*, *G. mirandae*, and *G. tuberculata*.

*Galphimia tuberculata* is named for the persistent tubercles that roughen the shoots and leaves after the hairs they bear are shed. Such tubercles are also found in *G. brasiliensis* (eastern Brazil), *G. gracilis* (eastern Mexico), and *G. hirsuta* (Guerrero), but they are most pronounced in *G. tuberculata* and the Oaxacan *G. arenicola*, both species of Pacific coastal lowlands. *Galphimia arenicola* differs in its smaller flowers, eglandular calyx, glabrous ovary and fruit, and the unusual multicellular processes that are found along the margin in the proximal part of the lamina. *Galphimia hirsuta* is known only from the lowlands of Guerrero and, like *G. tuberculata*, has a glandular calyx. It is named for the abundant vestiture that covers nearly all parts of the plant, whereas in *G. tuberculata* only the youngest parts and inflorescence axes are pubescent.

6. *Galphimia arenicola* C. Anderson, Syst. Bot. 28: 217. 2003.—TYPE: MEXICO, Oaxaca: Mpio. Tehuantepec, de Rincón Bamba a Garrapatero, Rincón Bamba se encuentra a 44 km al W de Salina Cruz, carr. a Pochutla, 15°59'N, 95°27'W, 31 Aug 1988, Martínez 1817 (holotype: MO!; isotypes: IEB! MEXU!).

Fig. 6.

Shrub to 4 m; stems pubescent when young, becoming glabrous but roughened by tubercles. Vestiture of all vegetative parts of straight to wavy, reddish brown hairs, 0.5–1 mm long, each hair borne on a persistent tubercle up to 0.1 mm high. Laminae

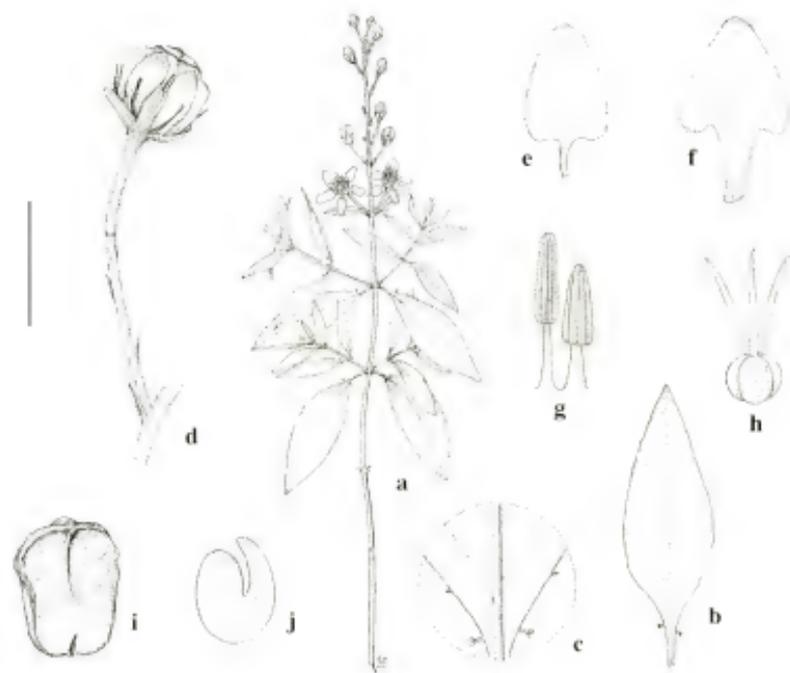


FIG. 6. *Galphimia arenicola*. a. Flowering branch. b. Leaf. c. Base of lamina, showing a pair of marginal leaf glands and marginal processes. d. Fruit borne on pedicel and peduncle, with portion of inflorescence axis. e. Lateral petal. f. Posterior petal. g. Stamens, adaxial view, opposite posterior petal (right) and posterior-lateral sepal (left). h. Gynoecium. i. Coccus, adaxial view. j. Embryo. Scale bar: a, 4 cm; b, 2 cm; c, d, 8 mm; e, f, 5.7 mm; g-i, 4 mm; j, 2.7 mm. (Based on: a-c, *Martinez 1817, MO*; d-h, *Castillo C. et al. 9642, MEXU*; i, j, *Castillo C. et al. 9498, XAL.*)

of the larger leaves 2.5–4.8 cm long, 1–2 cm wide, narrowly lanceolate to narrowly elliptical, apex acute, base acute or slightly decurrent, adaxially glabrous, abaxially with scattered hairs (especially on the costa) when young but soon glabrous but with persistent tubercles, secondary veins only faintly evident abaxially, margin with irregularly spaced, elongate, multicellular, epidermal processes, similar to the tubercles but at least twice as long; petioles 0.4–1 cm long, very sparsely strigose to glabrous, roughened by persistent tubercles; glands a pair, borne on the margin 2–5 mm above the base of the lamina, rarely with 4 or 5 glands, each gland 0.4–0.5 mm in diameter, disklike and prominent, or peglike and up to 0.8 mm long, stipules 1.5–2.5 mm long, 0.5–0.7 mm wide, narrowly triangular to subulate, abaxially with scattered hairs and the margin ciliate. Inflorescence a terminal raceme, the axes tuberculate and strigose, peduncles 4–7.8 mm long, pedicels 2–5 mm long, both tomentulose, peduncles 1.2–3 times as long as pedicels; bracts 2.3–3 mm long, 0.5–0.6 mm wide, linear, bracteoles 1.3–1.7 mm long, 0.4 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs along the margin; bracteoles borne in the proximal 1/4–1/2 of the peduncle, subopposite or up to 1 mm apart. Sepals 2.5–2.8 mm long, 1.4–1.6 mm wide, elliptical, glabrous or with scattered hairs near the base, margin denticulate-erose in the distal

1/2; glands absent. Petals deciduous, unequal, yellow and suffused with red, glabrous, margin denticulate; lateral petals: claw 2–2.3 mm long, 0.5–0.6 mm wide, limb 5–5.5 mm long, 3.3–4 mm wide, ovate to elliptical, apex obtuse, base truncate or slightly cordate; posterior petal: claw ca. 3.5 mm long, 1.6 mm wide, limb ca. 4.5 mm long, ca. 4.5–5 mm wide, triangular, apex broadly obtuse, base cordate to auriculate. Stamens of unequal length; filament opposite anterior sepal 3–3.5 mm long, filaments opposite anterior-lateral petals 2.5–3 mm long, filaments opposite anterior-lateral sepals 3–3.1 mm long, filaments opposite posterior-lateral petals 1.5–1.8 mm long, filaments opposite posterior-lateral sepals 2.5–2.6 mm long, filament opposite posterior petal 1.6–2 mm long; anthers 2.4–2.8 mm long. Ovary glabrous; styles ca. 3.6 mm long. Coccus ca. 5 mm high, ca. 4 mm in diameter, glabrous; areole 4–4.8 mm long, 3.3–4 mm wide; outer cotyledon 2.7–2.8 mm long, inner cotyledon 2.3–2.5 mm long. Chromosome number unknown.

Phenology. Collected in flower and fruit in August and September.

Distribution (Fig. 5). Mexico (Oaxaca); on sandy soils, in dunes and coastal deciduous forest; sea level to 70 m.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** OAXACA: Mpio. Huatulco, 5 km de la carr. nac. por la brecha a las playas de Cacaluta, 15°45'10"N, 96°10'10"W, *Castillo C. et al.* 9498 (XAL); Mpio. Huatulco, Playa de San Agustín, 15°40'30"N, 96°14'20"W, *Castillo C. et al.* 9642 (MEXU, XAL); Dto. Tehuantepec, Mpio. Santiago Astata, Las Peñas, 500 m al suroeste de la laguna que encuentra a 2 km al sur de Barra de la Cruz, 15°49'25.4"N, 95°57'58.5"W, *Elorsa C.* 5030 (MICH); Playa Coyote, *Liebmann* 8675 (C); San Agustín, *Liebmann* 8676, 8682 (C); Dto. Tehuantepec, Mpio. San Pedro Huamelula, Cerro Piedra del Aire, 200 m al sureste del Rancho El Paraíso, 15°52'7.8"N, 95°50'14.3"W, *Salas M.* 4122 (MICH).

*Galphimia arenicola* is found on dunes and in deciduous forest along the coast of Oaxaca. It is unique in the genus in that the margins of the laminae bear elongate, multicellular, epidermal processes. Like *G. tuberculata*, a lowland species found from Sinaloa to Guerrero, *G. arenicola* is marked by persistent tubercles on its shoots and leaves, but differs in its smaller flowers with an eglandular calyx and a glabrous ovary. *Galphimia oaxacana*, which is known only from the Isthmus of Tehuantepec, lacks tubercles; it has a pilose ovary and (usually) calyx glands.

**7. *Galphimia glandulosa*** Cav., *Anales Hist. Nat.* 1: 37. Oct 1799, non *Galphimia glandulosa* Rose, 1897. *Malpighia glandulosa* (Cav.) Persoon, *Syn. pl.* 1: 506. 1805, non *Malpighia glandulosa* Cav., 1789. *Malpighia biglandulosa* Poir. in Lam., *Encycl.*, Suppl. 4: 7. 1816. *Galphimia glandulosa* var. *lanceolata* DC., *Prodr.* 1: 582. 1824, nom. superfl. *Thryallis glandulosa* (Cav.) Kuntze, *Rev. gen. pl.* 1: 89. 1891.—TYPE: MEXICO, Guerrero: "Acapulco, Acambaro, &c.," *Née s.n.* (holotype: MA-29470, excluding the inflorescence mounted in middle of sheet and the branchlet at lower right, which are *G. paniculata* Bartl.; microfiche: MICH!, photos: F! MICH! MO!)

*Galphimia glandulosa* Rose, *Contr. U.S. Natl. Herb.* 5: 137. 1897, non *Galphimia glandulosa* Cav., 1799. *Thryallis palmeri* Rose, *Contr. U.S. Natl. Herb.* 12: 281. 1909. *Galphimia paniculata* var. *glandulosa* Nied. in Engler, *Pflanzenreich* IV, 141: 599. 1928.—TYPE: MEXICO, Guerrero: near Acapulco, *Palmer* 474 in 1895 (holotype: US!, photos: F! NY!; isotype: NY-fragment!).

*Thryallis dasycarpa* Small, *N. Amer. Fl.* 25: 151. 1910.—TYPE: MEXICO, Sinaloa: Rosario, Jan 1895, *Lamb* 470 (holotype: NY!; isotypes: DS! F, G! GH! NY-fragment! UC-fragment! US!).

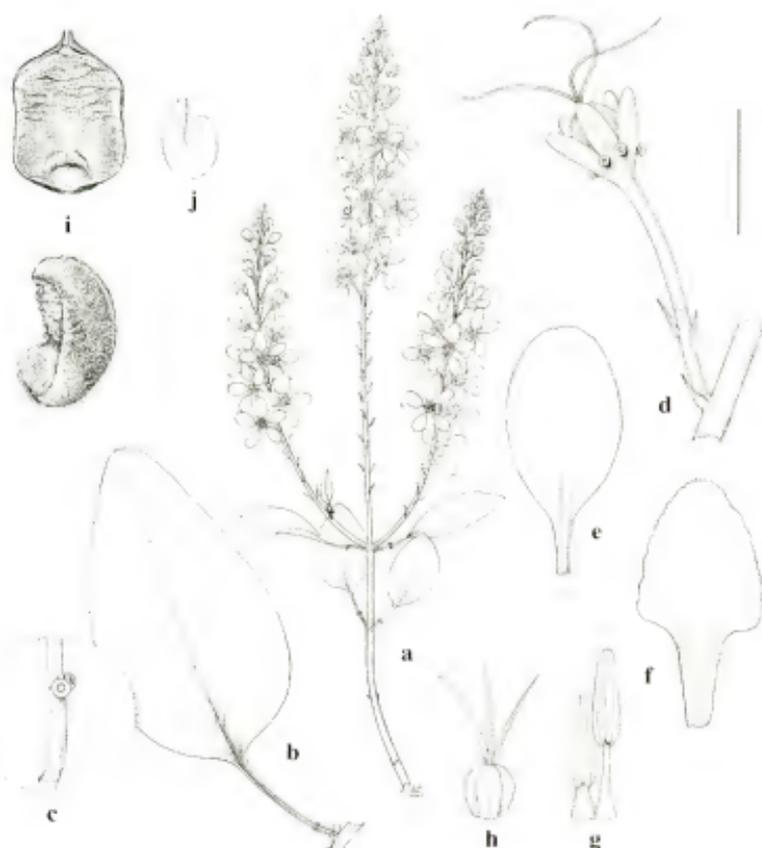


FIG. 7. *Galphimia glandulosa*. a. Flowering branch. b. Large leaf. c. Base of petiole with glands. d. Old flower with maturing fruit, borne on pedicel and peduncle with portion of inflorescence axis; note calyx glands. e. Lateral petal. f. Posterior petal. g. Stamens, adaxial view, opposite posterior petal (left) and posterior-lateral sepal (right). h. Gynoceium. i. Cocci, adaxial view (above) and lateral view (below). j. Embryo. Scale bars: a, b, 4 cm; c, 8 mm; d-h, 5 mm; i, j, 4 mm. (Based on: a, d. González; *Ortega 5141*, US; b, c. Pérez 1562, MEXU; e-h. McVaugh 22903, MICH; i, j. Anderson & Anderson 5849, MICH.)

Shrub or suffrutescent herb to 4 m; flowering shoots usually leafless or bearing only young leaves, sometimes with mature leaves present. Vesture absent except for pilose ovary and fruit. Laminas of the larger leaves 4.5–14 cm long, 2–6 cm wide, lanceolate to elliptical to ovate to rhombic, apex apiculate, base cuneate, secondary veins prominulous abaxially; petioles 1–4 cm long; glands a pair usually borne on the petiole in the basal 1/6–1/2, opposite or up to 4 mm apart, rarely also at the base of the blade or absent, each gland 0.8–1.5 mm in diameter, disklike and prominent; stipules 1.2–1.8 mm long, 0.7–0.8 mm wide, linear or very narrowly triangular. Inflorescence a terminal raceme or a panicle, the axes lax and commonly whip-like; peduncles 2.5–6.5 (–10.5) mm long, pedicels 6.2–12.3 mm long, peduncles 0.3–0.7 (–1) times as long as pedicels; bracts 1.7–3.2 mm long, 0.4–0.7 mm wide, linear, bracteoles 1.2–1.7 (–2) mm

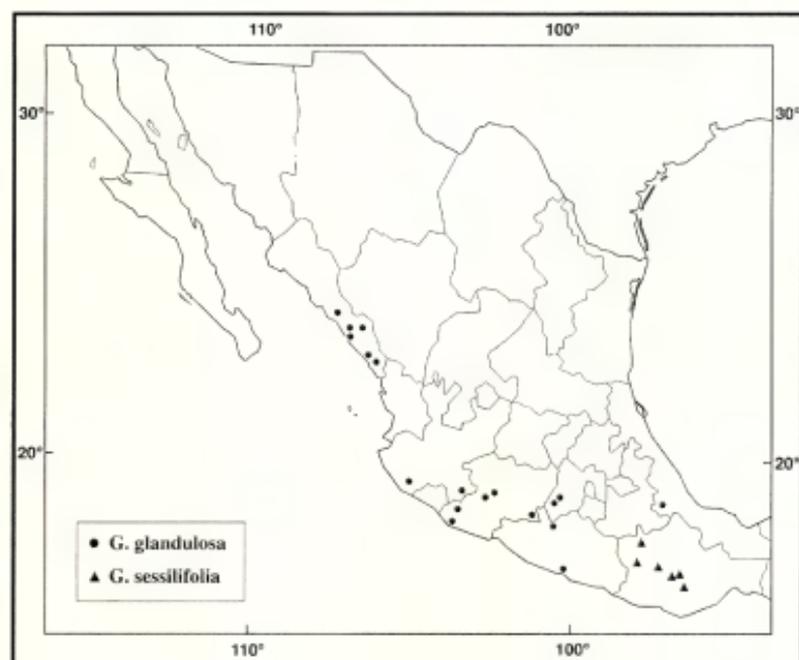


FIG. 8. Distribution of *Galphimia glandulosa* and *G. sessilifolia*.

long, 0.3–0.5 mm wide, linear; bracteoles opposite or subopposite, borne in the proximal 1/2 of the peduncle to near its base. Sepals (2–) 3–3.5 mm long, 1.2–1.7 mm wide, linear to oblong, margin entire or finely denticulate in the distal 1/2; glands usually 5 per calyx, sometimes fewer or none, 0.3–0.5 (–0.7) mm in diameter, prominent or peglike and up to 0.5 mm long, each borne at the base of the sinus between adjacent sepals. Petals deciduous, unequal, yellow but usually suffused with red, margin denticulate; lateral petals: claw 1.3–2 mm long, 0.5–0.6 mm wide, limb 6–7.5 mm long, 3.5–4.5 mm wide, elliptical, apex obtuse, base attenuate; posterior petal: claw 2.5–3.3 mm long, 1.5–2 mm wide, limb 5.5–7 mm long, 4–5 (–5.8) mm wide, ovate-triangular, apex broadly rounded, base gradually attenuate. Stamens of unequal length; filament opposite anterior sepal 3–3.2 mm long, filaments opposite anterior-lateral petals 2–2.5 mm long, filaments opposite anterior-lateral sepals 2.7–3 mm long, filaments opposite posterior-lateral petals 1.5–1.6 mm long, filaments opposite posterior-lateral sepals 2.8–3.5 mm long, filament opposite posterior petal 1.5–1.9 mm long; anthers 3.3–4.4 mm long. Ovary pilose throughout or sometimes the distal 1/3 glabrous, hairs to 0.1 mm long; styles (3.7–) 4–5.5 mm long. Coccus 4.5–5 mm high, 3.2–3.5 mm in diameter, pilose throughout or sometimes the distal 1/3 glabrous; areole 4.5–5 mm long, ca. 3 mm wide; outer cotyledon ca. 3 mm long, inner cotyledon ca. 2.2 mm long. Chromosome number unknown.

Phenology. Collected in flower and fruit from December to May, one collection in flower in October (*González M. 4010*).

Distribution (Fig. 8). Mexico (Guerrero, Jalisco, México, Michoacán, Sinaloa; one collection from Veracruz); in oak forest and deciduous forest; 20–1150 (–2450) m.

REPRESENTATIVE SPECIMENS. **Mexico.** GUERRERO: Temisco, *Bruff 1308* (MEXU); trail E of Temisco, N of Río Balsas, Dfno. Adama, *Mexia 8948a* (UC); arriba Icaeos Acapulco, *Miranda 4346* (MEXU); Acholila, *Reko 4919* (US).—JALISCO: Mpio. La Huerta, Arroyo Chamela, 0.3 km E of Hwy 200 (Barra de Navidad–Puerto Vallarta), Km 63.5, environs of Est. Biol. Chamela (UNAM), *Bullock 1114* (MICH); steep hills 3–15 km by rd S of Jilotlán, *McVaugh 22903* (ENCB, MICH); Mpio. La Huerta, Est. Biol. Chamela, *Pérez J. 1562* (MEXU); Mpio. La Huerta, Chamela, rd along Río Chamela near grounds of the “Instituto de Biología” of UNAM, 19°32' N, 105°05' W, *van Rosden 726* (MEXU, MICH).—MEXICO: El Palmar Chico, Tejuapilco, *González M. 4010* (MEXU); pic de la loma, Tejuapilco, *González M. et al. 5538* (MEXU, XAL); Platanal, Temascaltepec, *Hinton et al. 5749* (A, F, G, NY); Mpio. Temascaltepec, Nanchiutla, *Hinton et al. 7354* (BM, ENCB, F, GH, LL, MEXU, NY, S, US).—MICHOACÁN: 20 km by rd S of Uruapan on rd to Cuatro Caminos, *Anderson & Anderson 5849* (MICH); rd to Apatzingán, ca. 2 km N Aguillita, *Burch 2016* (MO); Mpio. Pómaro, al N de Maruata, camino a Pómaro, *Guevara F. 1620* (CHAPA, ENCB, IBUG); Mpio. Tiquicheo, entre Huatamo y Tiquicheo, *Medrano 4124* (MEXU).—SINALOA: Mpio. San Ignacio, Balboa, San Javier, *González Ortega 5138* (MEXU, US); Balboa, *González Ortega 5141* (US); Mpio. Mazatlán, Guaracha, El Quelite(?), *González Ortega 5419* (ENCB, MEXU, US); Mpio. Mazatlán, Mazatlán, *González Ortega 5631* (ENCB, K, MEXU, US); vic. of Culiacán, *González Ortega 6693* (US); 31 mi N of Mazatlán on coast hwy, *Kimmach 1918* (CAS, MEXU); vicinity of Rosario, *Rose 14567* (A, C, F, GH, MO, NY, P, S, US); vicinity of Guadalupe, *Rose 14776* (GH, NY, US).—VERACRUZ: Córdoba, *Reko 5133* (US).

*Galphimia glandulosa* is readily separated from all other species of by its lack of vestiture (except for the pilose ovary and fruit), its petioles with a pair of glands in the proximal 1/6–1/2, and the whip-like inflorescences. The flowers have a (commonly) glandular calyx and petals mostly entirely suffused with red. This species flowers before or while the leaves develop and thus is rarely collected with mature leaves. The partly sympatric *G. floribunda* is also commonly glabrous in all its parts, but it has an eglandular calyx, persistent yellow petals, and a glabrous ovary and fruit, and bears the leaf glands at the base of the lamina. The range of *G. glandulosa* extends from central Sinaloa to southern México and Guerrero; the record from Veracruz is surprising and the locality perhaps of doubtful accuracy.

Several students of *Galphimia* were uncertain about the application of the name *G. glandulosa* Cav., and thus this species has been known under several synonyms. Rose described it in 1897 as a novelty with the same epithet. Later (1909) he accepted Kuntze's (1891) transfer of all species of *Galphimia* to *Thryallis* L., and provided the nomen novum *Thryallis palmeri* for *G. glandulosa* Rose, because the combination *Thryallis glandulosa* (Cav.) Kuntze had already been published; Rose listed *Thryallis glandulosa* (Cav.) Kuntze among the “uncertain species.” Small (1910) accepted *T. palmeri*, from which he excluded *G. glandulosa* Cav. (but did not accommodate the Cavanilles name elsewhere in his treatment), and also published *Thryallis dasycarpa*, which he differentiated by its eglandular calyx and smaller leaves. The type collection of *Thryallis dasycarpa* consists of flowering branchlets and only the smaller leaves associated with the inflorescences; the calyces of the holotype are indeed eglandular but a few in the isotypes do have a gland or two.

**8. *Galphimia langlassei*** (S. F. Blake) C. Anderson, Syst. Bot. 28: 715. 2003. *Thryallis langlassei* S. F. Blake, Contr. Gray Herb. 52: 71. 1917.—TYPE: MEXICO. Guerrero (fide McVaugh, 1951): San Andrés, 700 m, 22 Mar 1899, *Langlasse 955* (holotype: GH!; isotypes: F, G! K! P! US!; photo of P isotype: MICH!).

Fig. 9.

Shrub or subshrub to 3 m; stems sparsely tomentulose when young, soon glabrous. Vestiture of all vegetative parts composed of sessile, straight or wavy to crisped, reddish brown hairs 0.2–0.8 mm long. Laminas of the larger leaves 5–14 cm long, 1.5–4.8 cm wide, elliptical or narrowly so to lanceolate, apex acute or apiculate, base

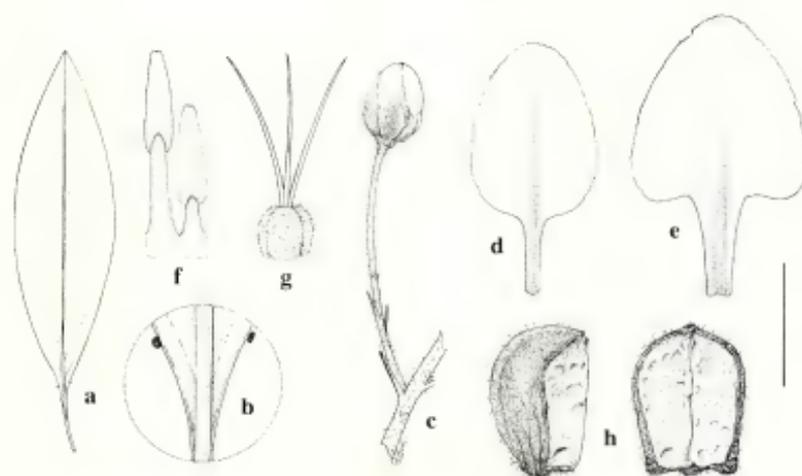


FIG. 9. *Galphimia langlassei*. a. Leaf. b. Base of lamina, showing pair of marginal glands. c. Flower bud borne on pedicel and peduncle, with portion of inflorescence axis. d. Lateral petal. e. Posterior petal. f. Stamens, abaxial view, opposite posterior petal (right) and posterior-lateral sepal (left). g. Gynoecium. h. Coccid, lateral view (left) and adaxial view (right). Scale bar: a, 4 cm; b, f–h, 4 mm; c, 1 cm; d, e, 5 mm. (Based on: a, b, *Cuevas & Rosales 1828, IEB*; c, *Daniel & Bartholomew 4849, MICH*; d, e, *Cochrane et al. 11687, WIS*; f, g, *Santana M. et al. 4807, WIS*; h, *Pepito 86, ZEA*.)

attenuate and somewhat decurrent, glabrous or sometimes with a few scattered hairs abaxially on the midrib, costa and secondary veins prominent abaxially, margin entire; petioles 1–2.5 cm long, glabrous or with a few scattered hairs; glands usually a pair (rarely only 1 gland) borne on the margin of the lamina 0.1–1 cm above the base, each gland 0.5–1.1 mm in diameter, disklike and prominent, or peglike and up to 1.2 mm long; stipules 1.2–2.8 (–3.5) mm long, 0.4–1 mm wide, linear or narrowly triangular, margin distally ciliate. Inflorescence a terminal raceme or panicle, the axes tomentulose or sparsely so; peduncles 4.5–12.5 mm long, pedicels 4.5–13 mm long, both tomentulose, peduncles 0.6–1.2 (–1.6) times as long as pedicels; bracts 1.3–2.2 (–3.4) mm long, 0.5–0.8 mm wide, linear, bracteoles 1–2 (–2.5) mm long, 0.3–0.5 (–0.7) mm wide, linear, bracts and bracteoles glabrous or with a few scattered hairs along the margin; bracteoles subopposite or up to 2 mm apart, borne in the distal 1/4–1/2 of the peduncle. Sepals 2.7–3.5 mm long, 1.2–2 mm wide, oblong to elliptical, glabrous, margin distally denticulate-ciliate; glands usually absent [in *Hinton et al. 11683* some calyces with 1–3 glands, each gland 0.3–0.5 mm in diameter, prominent]. Petals deciduous, unequal, yellow, often suffused with red, especially along the claw and midrib of the limb, glabrous; lateral petals: claw 2.3–2.8 (–3) mm long, 0.5–0.6 mm wide, limb 6–7 mm long, 4.5–5.5 mm wide, ovate, apex rounded, base truncate or subacute; posterior petal: claw 3.5–4 mm long, 1.3–1.5 mm wide, limb 6.5–7.7 (–8) mm long, 6–7.7 mm wide, broadly triangular, apex broadly rounded, base truncate to cordate. Stamens of unequal length; filament opposite anterior sepal 3.5–4.5 mm long, filaments opposite anterior-lateral petals 2.8–3.5 (–3.7) mm long, filaments opposite anterior-lateral sepals 3–4 (–4.5) mm long, filaments opposite posterior-lateral petals 1.6–2.5 (–2.8) mm long, filaments opposite posterior-lateral sepals 3.5–4.6 mm long,

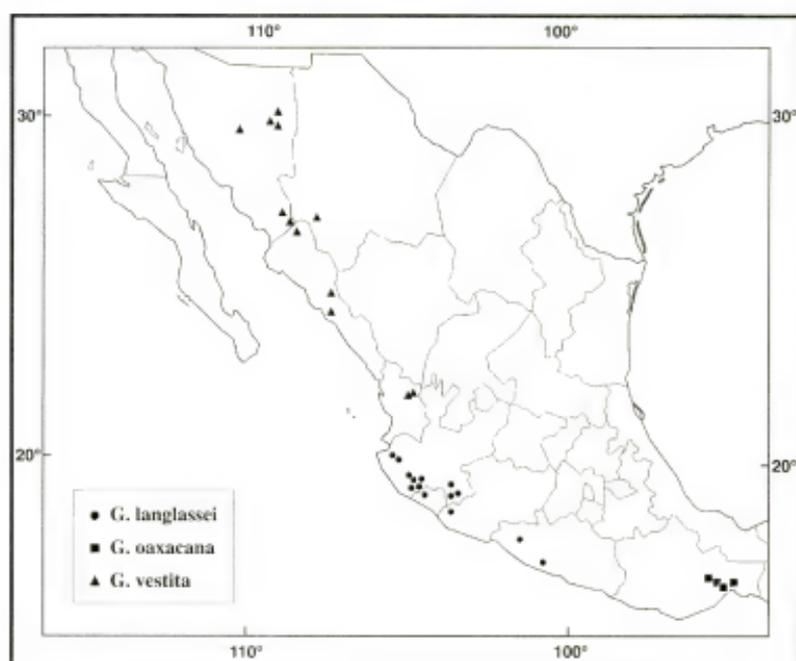


FIG. 10. Distribution of *Galphimia langlassei*, *G. oxacana*, and *G. vestita*.

filament opposite posterior petal 1.6–2.6 mm long; anthers (2.8–) 3–3.6 (–4) mm long. Ovary pilose, hairs to 0.3 mm long; styles 5–6.5 (–6.8) mm long. Coccus 4–4.5 mm high, 3–3.8 mm in diameter, pilose to glabrescent when mature; areole 3.5–4.2 mm long, 2.5–3.8 mm wide; mature embryo not seen. Chromosome number unknown.

Phenology. Collected in flower from November through June, in fruit from February through June.

Distribution (Fig. 10). Mexico (Colima, Guerrero, Jalisco, Michoacán); oak forests and pine-oak forests; 100–1710 m.

REPRESENTATIVE SPECIMENS. **Mexico.** COLIMA: 9–10 km E or SE by winding rd from Minatitlán, *McVaugh* 26226 (MICH).—GUERRERO: Mpio. Montes de Oca, San Antonio, *Hinton et al.* 11683 (GH, US).—JALISCO: Mpio. Casimiro Castillo, 3–4 km SE of Casimiro Castillo; Arroyo Tacubaya, at base of Cerro La Petaca, ca. 20 km SSW of Autlán, 19°34'50"–54"N, 104°24'29"–45"W, *Cochrane et al.* 11687 (WIS); Mpio. Casimiro Castillo, 1–2 km al E de Casimiro Castillo, *Cuevas & Rosales* 1828 (IEB, WIS, ZEA); rd to Microondas Los Mazos near summit of pass (Puerto Los Mazos) between Autlán and La Huerta, *Daniel & Bartholomew* 4899 (CAS, MICH); Mpio. Tecalitlán, carr. Cd. Guzmán–Pihuamo, Km 46, terracería Llanitos–Mexiquillo a 16 km, *Fuentes O.* 47 (CHAPA, ENCB, IBUG, MICH); Mpio. Autlán, 12–13 km al SSE de Autlán, 500–1000 m al SSE de Ahuacapán, 19°39'50"N, 104°19'07"W, *Guzmán & Cuevas* 879 (IBUG, MEXU, WIS, ZEA); Mpio. Talpa de Allende, brecha de Talpa a La Cuesta, *Machuca N. et al.* 7063 (MICH); along hwy SW of Autlán toward Manzanillo, on upper slopes of barranca above the pass, *McVaugh* 10234 (MEXU, MICH); precipitous mountainsides 10–12 km above (N of) La Cuesta, below pass to Talpa de Allende, *McVaugh* 23357 (ENCB, MICH); 3 km S por brecha a Las Joyas–Ahuacapán, *Pepita* 86 (ZEA); Mpio. Tecalitlán, Km 6, brecha a Jilotlán de Dolores, *Pérez de la Rosa* 7 (IBUG, MICH); Mpio. Cuautitlán, entre Ayotitlán y Chancel, 19°28'N, 104°10'W, *Robles et al.* 712 (IEB, WIS, ZEA); Mpio. Cuautitlán, 4–5 km al NW de Minatitlán, 2–3 km al NNE de Peña Colorada, Las Pesadas, 19°24'N, 104°04'W, *Santana M. et al.* 4807 (WIS, ZEA).—MICHOACÁN: Aquila, Dtto. Coalcomán, *Hinton et al.* 15867 (NY, US).

*Galphimia langlassei* is a common shrub or subshrub of the pine-oak forests of lowland western Mexico. It has elongate leaves bearing glands on the margin of the lamina, and the ovary and fruit is abundantly pilose; only one collection examined, *Hinton et al. 11683*, had calyx glands on a few flowers. The other species in its range with pilose ovaries and fruits are *G. glandulosa*, *G. mexiae*, and *G. radialis*. *Galphimia glandulosa* is readily distinguished by its elongate, whip-like inflorescences bearing flowers with nearly all-red petals and a glandular calyx. In addition, the leaf laminae are borne in the basal 1/6–1/2 of the petiole. *Galphimia radialis* differs from *G. langlassei* in that its petals are subequal and the hairs on the ovary and fruit are to 0.8 mm long; it is known only from central Guerrero. See the discussion of *G. mexiae* (no. 9) for a comparison with *G. langlassei*.

**9. *Galphimia mexiae*** C. Anderson, Syst. Bot. 28: 717. 2003.—TYPE: MEXICO, Jalisco: San Sebastián [del Oeste] to Hacienda de Ottotal, 1425 m, 2 Mar 1927, *Mexia 1778* (holotype: CAS!; isotypes: A! GH! MO! US!). Fig. 11.

Herb or subshrub to 3 m; stems sparsely tomentulose when young, soon glabrous. Vesture of all vegetative parts of sessile, wavy to crisped, reddish brown hairs 0.2–0.5 mm long. Laminae of the larger leaves 4–8.5 (–12) cm long, 1.8–4 cm wide, lanceolate to elliptical to narrowly rhombic, apex acute or apiculate, base cuneate and somewhat decurrent, glabrous, secondary veins prominent or prominulous abaxially; petioles 1–2 (–3.5) cm long, glabrous; glands a pair borne on the margin of the lamina commonly ca. 1 cm above the base, each gland 0.4–0.8 mm in diameter, disklike and prominent, or rarely peglike and up to 0.5 mm long; stipules 2–3 mm long, 0.5–1.8 mm wide, linear to narrowly triangular, glabrous and distally ciliate. Inflorescence a terminal raceme or small panicle, the axes tomentulose; peduncles 3.5–7 mm long, pedicels 8.5–12 mm long, both sparsely tomentulose to glabrate, peduncles 0.3–0.5 (–0.7) times as long as pedicels; bracts 2–4 mm long, 0.6–1.2 mm wide, linear, bracteoles 1.2–2 mm long [2.5–3.7 mm long in *Nelson 4060*], 0.4–0.6 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs along the margin distally; bracteoles subopposite or up to 2 mm apart, borne in the distal 1/4–1/2 of the peduncle or sometimes just below the apex. Sepals 2.5–3 mm long, 1.4–2.3 mm wide, oblong to narrowly elliptical, glabrous, margin entire to distally denticulate (–ciliate); glands absent. Petals deciduous, unequal, yellow and suffused with red along the claw and midrib of the limb, glabrous, margin finely denticulate; lateral petals: claw 2–2.8 mm long, 0.5–0.6 mm wide, limb 4.5–6 mm long, 3.7–4.7 mm wide, ovate-triangular, apex subacute to obtuse, base truncate or slightly attenuate; posterior petal: claw 3.3–4 mm long, 1.4–1.8 mm wide, limb 5–6.5 mm long, 5–6.5 mm wide, broadly triangular or ovate-triangular, apex broadly rounded, base truncate or acute. Stamens of unequal length; filament opposite anterior sepal (2.2–) 2.6–3 mm long, filaments opposite anterior-lateral petals (2.2–) 2.4–3 mm long, filaments opposite anterior-lateral sepals 2–2.8 mm long, filaments opposite posterior-lateral petals 1.8–2.3 (–3) mm long, filaments opposite posterior-lateral sepals 1.5–1.8 (–2.2) mm long, filament opposite posterior petal 1.5–1.7 (–2) mm long; anthers 2.3–2.5 (–2.8) mm long. Ovary pilose, hairs to 0.3 mm long; styles 4–5 mm long, Cocculus 4.5–5.5 mm high, 3.5–4 mm in diameter, pilose to glabrescent in age; areole 4–4.5 mm long, 3–3.5 mm wide; outer cotyledon 2.5–2.8 mm long, inner cotyledon 1.8–2.1 mm long. Chromosome number unknown.

Phenology. Collected in flower and fruit from February through May.

Distribution (Fig. 25). Mexico (northwestern Jalisco and adjacent Nayarit); pine-oak forest; 630–1880 m.

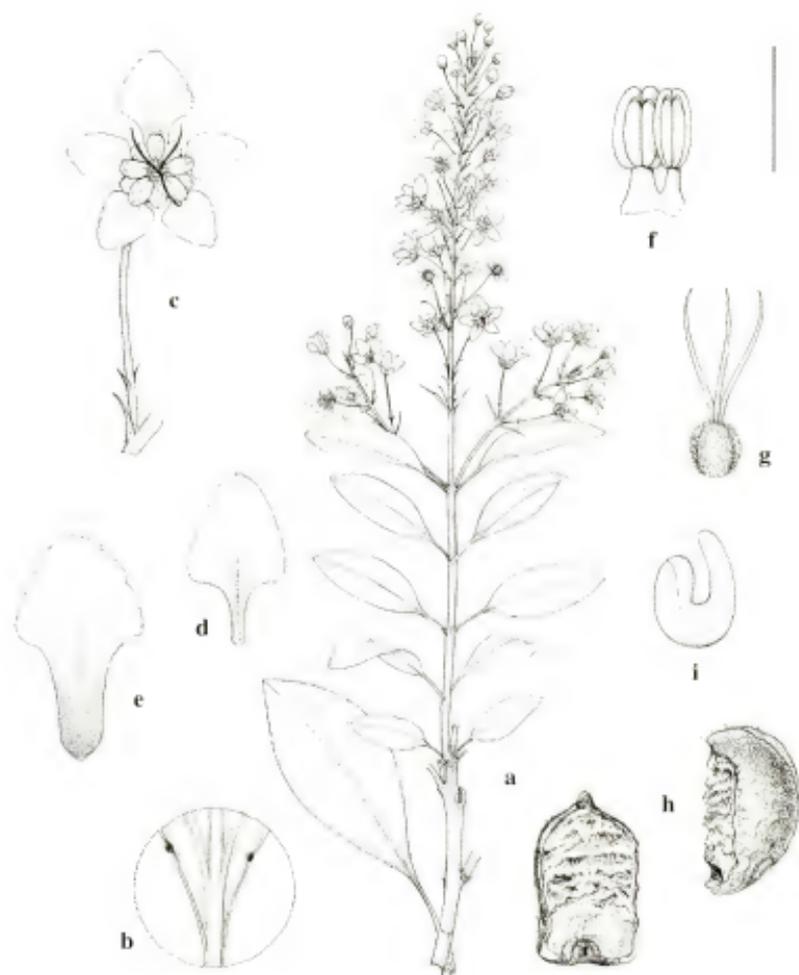


FIG. 11. *Galphimia mexiae*. a. Flowering branch. b. Base of lamina, showing marginal glands. c. Flower with posterior petal uppermost, borne on pedicel and peduncle, with portion of inflorescence axis. d. Lateral petal. e. Posterior petal. f. Stamens, adaxial view, opposite posterior petal (left) and posterior-lateral sepal (right). g. Gynoecium. h. Cocci, lateral view (right) and adaxial view (left). i. Embryo. Scale bar: a, 4 cm; b, 8 mm; c, 1 cm; d, e, 5 mm; f-h, 4 mm; i, 2.7 mm. (Based on: a-c, *Anderson & Anderson 6122*, MICH; d-g, *Nelson 4060*, US; h, i, *Almeda 2543*, MICH.)

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** JALISCO: 27.8 mi SSE of Puerto Vallarta, *Almeda 2543* (CAS, MICH); low hills ca. 35 km (str. line) E of Cabo Corrientes, on rd from Puerto Vallarta to El Tuito, *Anderson & Anderson 6122* (MICH); Mpio. Talpa, entre Cumbre del Tejamanil y Cuale, *González T. 102* (MICH); Mpio. Cabo Corrientes, steep mountainsides 3-10 km generally E on rd to Mina del Cuale, from junction 5 km NW of El Tuito, *McVaugh 26411A* (MICH); trail San Sebastián to Las Mesitas, *Mexia 1863-a* (F, US); rd between Mascota and San Sebastián, *Nelson 4060* (GH, US).—NAYARIT: 17.7 km al W de Tepic, 7 km al W de Carranza, *Cowan 4773* (MICH, TEX); Mpio. Tepic, 7 km al S de la entrada al camino del Cuarenteño, 21°28'N, 105°00'W, *Flores F. 2531* (MEXU).

*Galphimia mexiae* is known only from a small region in northwestern Jalisco and adjacent Nayarit. It is distinctive in its androecium, composed of very short filaments and anthers. All petals have a broadly triangular limb; that of the posterior petal narrows only slightly to an exceptionally broad claw. These traits readily separate it from the sympatric *G. langlassei*, which also has usually narrow laminae with glands on the margin near the base and a pilose ovary and fruit. Collections of *G. mexiae* have been misdetermined as *G. glandulosa* (as "*Thryallis dasycarpa*") and *G. tuberculata*, which also share a pilose ovary and fruit, but not the characters of the androecium and corolla. *Galphimia glandulosa* is entirely glabrous, bears the leaf glands in the proximal 1/6–1/2 of the petiole, and has whip-like inflorescences; the flowers have nearly all-red petals and a glandular calyx. *Galphimia tuberculata* is named for the persistent tubercles found on the axes, petioles, and laminar margins; *G. mexiae* lacks such tubercles.

**10. *Galphimia radialis*** C. Anderson, Syst. Bot. 28: 719. 2003.—TYPE: MEXICO. Guerrero: Mpio. Chichihualco, 29 km al W de Filo de Caballo, carr. a Pto. del Gallo, 2100 m, 18 Aug 1982, Tenorio L. 1471 (holotype: MICH!). Fig. 12

Shrub to 3 m; stems tomentulose when young, soon glabrous. Vesture of all vegetative parts of subsessile, wavy to crisped, reddish brown hairs 0.2–0.7 mm long. Laminae of the larger leaves 7–12 cm long, 2–5 cm wide, lanceolate to elliptical, apex apiculate, base cuneate-decurrent, glabrous, secondary veins prominent, margin entire; petioles 1.5–2.3 cm long, glabrous; glands a pair borne on the margin of the lamina commonly 2–2.5 cm above the base, each gland 0.4–0.5 mm in diameter, flush with the margin; stipules 3.5–6 mm long, 1.2–1.5 mm wide, linear, glabrous or distally ciliate. Inflorescence a terminal raceme, the axes tomentulose; peduncles 4–9.5 mm long, pedicels 7–13.5 mm long, both tomentulose, peduncles 0.5–0.8 times as long as pedicels; bracts 3–6 mm long, 0.5–0.7 mm wide, linear, abaxially with scattered hairs especially along the margin, bracteoles 1.6–3 mm long, 0.4–0.6 mm wide, linear, glabrous; bracteoles subopposite or up to 2.2 mm apart, the proximal bracteole inserted below to ca. the middle of the peduncle, the distal one at about the middle to the distal 1/4 of the peduncle. Sepals 3.5–4.5 mm long, 1.6–2 mm wide, linear to oblong, glabrous or with a few scattered hairs abaxially, margin denticulate-ciliate or only in the distal 1/4; glands absent. Petals deciduous, subequal, the posterior petal slightly larger than the lateral ones, glabrous, yellow and suffused with red along the claw and midrib of the limb, margin denticulate-fimbriate; claw 1.8–2.8 mm long, 0.6–0.7 mm wide, limb 6.2–7.7 mm long, 5.5–6.5 mm wide, broadly ovate, apex broadly rounded, base subtruncate. Stamens of unequal length; filament opposite anterior sepal 4.5–4.8 mm long, filaments opposite anterior-lateral petals 4.2–4.5 mm long, filaments opposite anterior-lateral sepals 4.4–4.5 mm long, filaments opposite posterior-lateral petals 3.2–4 mm long, filaments opposite posterior-lateral sepals 4–4.3 mm long, filament opposite posterior petal 3–3.5 mm long; anthers 2.2–2.5 mm long. Ovary pilose along the sutures and in the basal 1/3–1/2, hairs to 0.8 mm long; styles 4.6–5.2 mm long. Cocci 4.7–5 mm long, 3.8–4 mm in diameter, pilose along the sutures and in the basal 1/3–1/2; areole ca. 4 mm long, 2.5–3 mm wide, mature seed not seen. Chromosome number unknown.

Phenology. Collected in flower in January, May, August, and November, in fruit in March and August.

Distribution (Fig. 25). Mexico (Guerrero); pine-oak forest; 1700–2100 m.

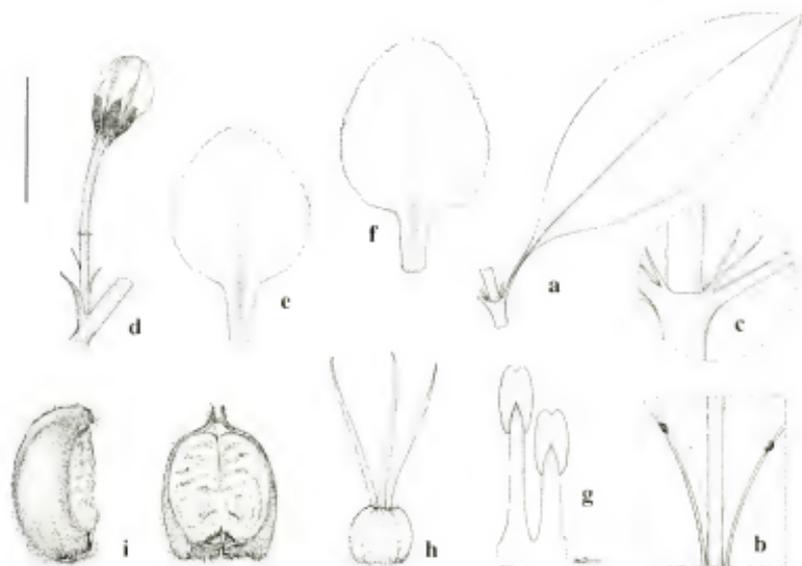


FIG. 12. *Galphimia radialis*. a. Leaf. b. Base of lamina, showing marginal glands. c. Node, showing long stipules. d. Flower bud, borne on pedicel and peduncle, with portion of inflorescence axis. e. Lateral petal. f. Posterior petal. g. Stamens, abaxial view, opposite posterior petal (right) and posterior-lateral sepal (left). h. Gynoecium. i. Cocci, lateral view (left) and adaxial view (right). Scale bar: a, 4 cm; b, c, 1 cm; d, 1.3 cm; e, f, 5 mm; g-i, 4 mm. (Based on: a, Estrada R. 119, IEB; b-d, Fonseca 1001, MEXU; e-h, Tenorio L. 1471, MICH; i, Paray 2014, ENCB.)

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** GUERRERO: Mpio. Atoyac de Alvarez, trayecto entre Los Arrayanes y El Descanso, Estrada R. 119 (IEB); Mpio. Chichihualco, cerca de Hierba Buena, Fonseca 1001 (MEXU); Mpio. Tlacotepec, faldas del Cerro Tlacotepec, Paray 2014 (ENCB); Cerro Teotepac y alrededores, Paray 4065 (MEXU); Mpio. Malinaltepec, Malinaltepec, 17°14'N, 98°40'W, Wagenbreth 807 (MO).

*Galphimia radialis* is the only species among those with well-developed peduncles in which the petals are subequal. It also has larger stipules (3.5–6 mm long) than most species (usually 1–3 mm long), and unusually long hairs on the ovary (to 0.8 mm long vs. 0.1–0.3 mm long). It may be confused with *G. langlassei*, which has similar leaves, but unequal petals and longer anthers (3–4 mm).

**11. *Galphimia sessilifolia*** Rose, Contr. U.S. Natl. Herb. 3: 313. 1895. *Thryallis sessilifolia* (Rose) Rose, Contr. U.S. Natl. Herb. 12: 281. 1909.—TYPE: MEXICO, Oaxaca: Las Sedas, 6000 ft, 1 Aug 1984, Pringle 4901 (holotype: US!; isotypes: A! BM! BR! CM, F, G! GH! GOET! K! MEXU! MO! NY! P! S! UC! US! W!; photo of P isotype: MICH!).

Fig. 13.

Shrub to ca. 1 m; stems sparsely strigose when young, soon glabrous. Vesture of all vegetative parts of subsessile to sessile, straight to wavy, reddish brown hairs 0.2–0.7 mm long. Laminas of the larger leaves 1.5–4 cm long, 1–2.5 cm wide, ovate or narrowly so, apex apiculate, base truncate or shallowly cordate, glabrous, coriaceous,

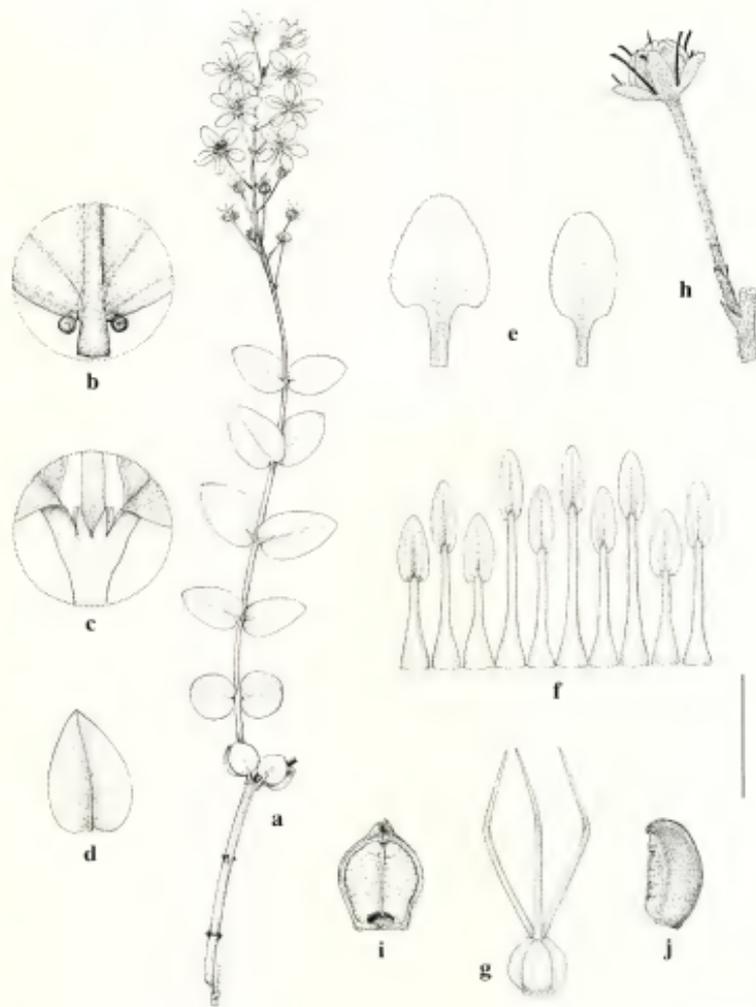


FIG. 13. *Galphimia sessilifolia*. a. Flowering branch. b. Base of leaf with glands, abaxial view. c. Node with stipules. d. Detached large leaf. e. Posterior petal (left) and lateral petal (right). f. Androecium laid out, abaxial view, the stamen at left opposite posterior petal. g. Gynoecium. h. Fruit borne on pedicel and peduncle, with portion of inflorescence axis. i. Coccy, adaxial view. j. Coccy, lateral view. Scale bar: a, d, 4 cm; b, c, f, g, i, j, 4 mm; e, h, 8 mm. (Based on: a, b, f, g, *Lorence 4626*, MEXU; c, *Torres C. 7151*, MICH; d, *Pringle 4901*, MEXU; e, *Pringle 7458*, MEXU; h, *Lorence 4626*, MO; i, j, *Salinas T. 6607*, MICH.)

secondary veins prominulous abaxially; margin entire; leaves subsessile, petioles to 1 mm long, glabrous; glands absent, or present only on the first pair of leaves at the base of a shoot, these laminas the smallest and suborbicular and with 1 or 2 glands borne on the margin at or near the base, glands 0.3–0.4 mm in diameter, disklike and sessile, or peglike and up to 0.7 mm long; stipules 1–2 mm long, ca. 0.5 mm wide, linear, glabrous. Inflorescence a solitary terminal raceme, the axes glabrate; peduncles 1–5 mm long, pedicels 7.5–12 mm long, both sparsely tomentulose, peduncles 0.2–0.6 (–0.9) times as long as pedicels; bracts 1.5–2.5 mm long, 0.7–0.8 mm wide, linear, bracteoles 1–2 mm long, ca. 0.5 mm wide, linear, bracts and bracteoles glabrous; bracteoles borne variously on the peduncle from near the base to just below the apex, subopposite or up to 0.5 mm apart. Sepals 2.5–3 mm long, 1.2–1.5 mm wide, oblong, glabrous, margin denticulate-ciliate in the distal 1/4–1/3; glands absent. Petals deciduous, unequal, yellow and tinged with red at the apex and often with a red stripe abaxially along the median vein, glabrous, margin denticulate; lateral petals: claw 2–2.5 mm long, ca. 0.5 mm wide, limb 6.5–7 mm long, 3.5–4.5 mm wide, oblong or narrowly ovate, apex obtuse, base attenuate to subtruncate; posterior petal: claw 3–4 mm long, 1.2–1.4 mm wide, limb 6.5–7 mm long, 5–6 mm wide, triangular, apex broadly rounded, base cordate. Stamens of unequal length; filament opposite anterior sepal 5–5.3 mm long, filaments opposite anterior-lateral petals 4–4.5 mm long, filaments opposite anterior-lateral sepals 4.5–5 mm long, filaments opposite posterior-lateral petals 3–3.2 mm long, filaments opposite posterior-lateral sepals ca. 4.5 mm long, filament opposite posterior petal ca. 3 mm long; anthers 2.5–4 mm long. Ovary glabrous; styles 5.5–7 mm long. Coccus ca. 3.5 mm long, ca. 2.5 mm in diameter, smooth, glabrous; areole ca. 2.7 mm long, ca. 2.3 mm wide; mature seed not seen. Chromosome number unknown.

Phenology. Collected in flower in July and August, in fruit in July, August, and December.

Distribution (Fig. 8). Mexico (Oaxaca); in arid scrub, matorral, dry sites in pine-oak and deciduous forest; 1980–2400 m.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** OAXACA: near Penan, *Conzatti s.n.* (US); along hwy between Oaxaca and Tehuacán, 26.2 mi NNW jet. Hwy 190, *Daniel & Baker 3758* (MICH); Mpio. Huitzo, Dto. Etla, ca. 0.5 km al E de Las Sedas, *Lorence 4626* (F, MEXU, MICH, MO, UAMIZ); 15 km by rd SE of Miahuatlán on rd to Puerto Angel in high mtns of Sierra Madre del Sur, 16°12'N, 96°30'W, *Mareks & Marcks 1603* (LL, MICH, TEX, WIS); Las Sedas, *Pringle 7458* (F, MEXU); Mpio. San Jerónimo Sosola, El Parián, Dto. Etla, 17°23'N, 97°00'W, *Salinas T. 6607* (CAS, MICH); Dto. Tlaxiaco, 3.7 km al NE del Ojite, cerca de Tlaxiaco, *Torres C. 7151* (F, MEXU, MICH, UAMIZ).

*Galphimia sessilifolia*, known from a few collections from Oaxaca, is readily recognized by its subsessile, ovate, coriaceous leaves; leaf glands develop only on the first pair of leaves of a shoot, which has notably smaller and orbicular laminas. *Galphimia multicaulis*, which occurs in Oaxaca, is the only other species in the genus in which the petioles are rudimentary or very short. Unlike *G. sessilifolia*, it has persistent petals and glands present on the margin of all laminas.

**12. *Galphimia mirandae*** C. Anderson, Contr. Univ. Michigan Herb. 24: 13, 2005.—

TYPE: MEXICO. Puebla: Mpio. Tehuiztzingo, 12 km al NW of El Pitayo, carr. a Izúcar de Matamoros Puebla, 1350 m, 28 Jul 1983, *Torres C. 3296* (holotype: MEXU; isotype: BM! MO!).

Fig. 14.

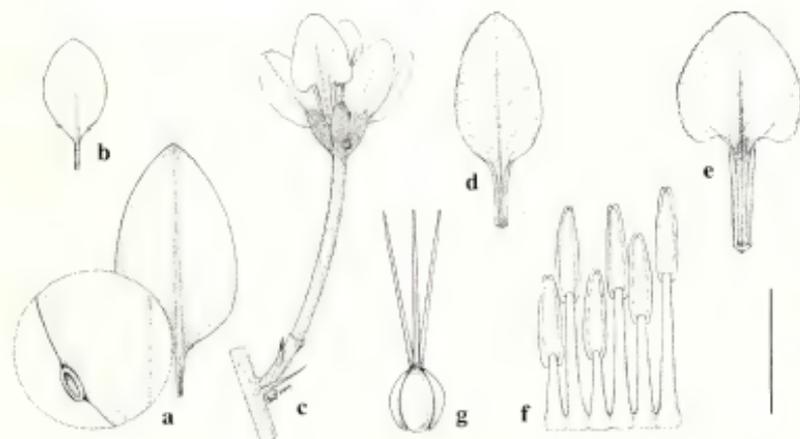


FIG. 14. *Galphimia mirandae*. a. Leaf with ovate lamina (detail of base of lamina showing marginal gland). b. Leaf with elliptical lamina. c. Flower borne on pedicel and peduncle, with portion of inflorescence axis; note calyx gland. d. Lateral petal. e. Posterior petal. f. Six stamens laid out, abaxial view; stamen at left opposite posterior petal. g. Gynoecium. Scale bar: a, 4 cm (4 mm); b, 4 cm; c, 1 cm; d, e, 5.7 mm; f, g, 4 mm. (Based on: a, *Miranda 2147*, MEXU; b–g, *Torres C. 3296*, MEXU.)

Shrub or treelet to 4 m; stems tomentulose, soon glabrescent to glabrous. Vesture of all vegetative parts of sessile, wavy to crisped, reddish brown hairs 0.4–1 mm long. Laminas of the larger leaves 3–6.5 cm long, 2–4 cm wide, elliptical to broadly so, obovate, rhombic, ovate, or suborbicular, apex obtuse to acute, base acute to decurrent (especially in larger leaves), glabrous, secondary veins prominulous or not evident; margin entire; petioles 0.5–1 cm long, glabrous; glands commonly a pair on the margin of the lamina well above or at the base, if base decurrent then superficially appearing placed on the petiole, sometimes 1 or more additional glands borne on the margin of the lamina, each gland 0.5–1 mm in diameter, disklike and with a thick rim; stipules 2–4 mm long, 0.7–1.2 mm wide, narrowly triangular, glabrous. [Sometimes with only the terminal branches bearing a flush of small leaves along short internodes, the laminas 1.5–2.5 cm long, 1–1.5 cm wide.] Inflorescence a terminal raceme, the axes, peduncles, and pedicels tomentulose but glabrescent in older parts; peduncles 3–6 mm long, pedicels 14.5–18.5 mm long, peduncles 0.2–0.3 times as long as pedicels; bracts 2.5–3.2 mm long, 0.5–0.8 mm wide, linear, bracteoles 1.5–2 mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles glabrous or with a few scattered hairs abaxially; bracteoles borne at about the middle of the peduncle, subopposite or up to 0.3 mm apart. Sepals 3.5–4.2 mm long, 1–1.5 mm wide, narrowly ovate to oblong, glabrous, margin entire or finely denticulate at the apex; glands absent, or rarely with one gland 0.5 mm in diameter. Petals deciduous, unequal, yellow, glabrous, margin finely denticulate; lateral petals: claw 2.5–2.8 mm long, 0.5 mm wide, limb 7–8.5 mm long, 4.5–5.5 mm wide, elliptical or narrowly lanceolate, apex subacute, base gradually attenuate; posterior petal: claw 4–4.2 mm long, 1–1.2 mm wide, limb 6.2–7.5 mm long, 6–7 mm wide, triangular or sometimes suborbicular, apex obtuse, base slightly cordate or slightly so. Stamens of unequal length; filament opposite anterior sepal

4–4.5 mm long, filaments opposite anterior-lateral petals 3–3.2 mm long, filaments opposite anterior-lateral sepals 3.7–4 mm long, filaments opposite posterior-lateral petals 2–2.2 mm long, filaments opposite posterior-lateral sepals 3.6–4 mm long, filament opposite posterior petal 2–2.3 mm long; anthers 3.3–3.7 mm long. Ovary glabrous or with scattered hairs on the sutures, hairs to 0.1 mm long; styles 5–6.6 mm long. Mature coccus not seen. Chromosome number unknown.

Phenology. Collected in flower and immature fruit in July.

Distribution (Fig. 5). Mexico (Guerrero, Puebla); tropical deciduous forest; 1350 m.

ADDITIONAL SPECIMEN EXAMINED. **Mexico.** GUERRERO: 8 km al NW de Chilpancingo, sobre la carretera a Chichihualco, 1350 m, 7 Jul 1966, *Asseizca* (ENCB), *Cabrera s.n.* (ENCB), *Rzedowski 22755* (DS, ENCB, MICH, TEX).—PUEBLA: [Izúbar de] Matamoros, 24 Jul 1942, *Miranda 2147* (MEXU).

*Galphimia mirandae* has succulent laminas with large, thick-rimmed glands on the margin (Fig. 14a); if the base is decurrent the glands may appear to be borne on the petiole, but careful examination shows them embedded in the laminar tissue. The species is also distinctive in that the pedicels are very long (14.5–18.5 mm) and greatly exceed the peduncles. *Galphimia mirandae* is known from only five gatherings; of these the two Puebla collections are from nearby localities, and label data of the Guerrero collections indicate that they were probably obtained from the same population. Additional collections are needed to determine the variability of leaf shape, style length, and ovary and fruit pubescence.

#### GROUP II (petals deciduous; peduncles absent or rudimentary)

**13. *Galphimia angustifolia*** Benth., Bot. voy. Sulphur, 9, pl. 5. 1844. *Thryallis angustifolia* (Benth.) Kuntze, Rev. gen. pl. 1: 89. 1891 [combination also proposed by Rose, Contr. U.S. Natl. Herb. 12: 280. 1909].—TYPE: MEXICO, Baja California Sur: Cape St. Lucas, 1841, *Hinds s.n.* (holotype: K!, photo: MICH!).

*Galphimia linifolia* A. Gray, Gen. amer. bor. 2: 196, pl. 173. 1849. *Thryallis linifolia* (A. Gray) Kuntze, Rev. gen. pl. 1: 89. 1891.—TYPE: U.S.A. [Texas:] banks of the Medina River, Jun 1849, *Wright 93* (lectotype, here designated: GH!; isolectotypes: BM! G! MEL! NY! P! US!).

*Galphimia linifolia* var. *oblongifolia* A. Gray, Pl. Wright. 1: 36. 1852. *Galphimia angustifolia* var. *oblongifolia* (A. Gray) S. Watson, Proc. Amer. Acad. Arts. 24: 42. 1889. *Thryallis angustifolia* var. *oblongifolia* (A. Gray) Vail, Bull. Torrey Bot. Club 22: 228. 1895.—TYPE: U.S.A. [Texas:] banks of the Medina River, Jun 1849, *Wright 94* (holotype: GH!; isotypes: BM! DS! G! K! NY! US!).

*Galphimia angustifolia* var. *ovalifolia* Arènes, Notul. Syst. (Paris) 12: 189. 1946.—TYPE: MEXICO, Sonora: Guaymas, *Palmer 217* in 1887 (lectotype, here designated: P!, photo: MICH!; isolectotypes: BM! C! GH! K! NY! UC! US!). [Cited erroneously by Arènes as "Scott Elliot, Madagascar, sans num. ni loc."]

Fig. 15.

Suffrutescent herb and small shrub to 1 m; stems densely pubescent when young, glabrescent in age. Vestiture of all vegetative parts of straight to wavy, white to reddish brown, subsessile hairs 0.6–1.5 mm long. Laminas of the larger leaves 2.5–4 cm long, 0.3–2 cm wide, linear to narrowly elliptical or narrowly lanceolate or narrowly ovate to elliptical or ovate, apex acute or apiculate, base acute, glabrous or abaxially

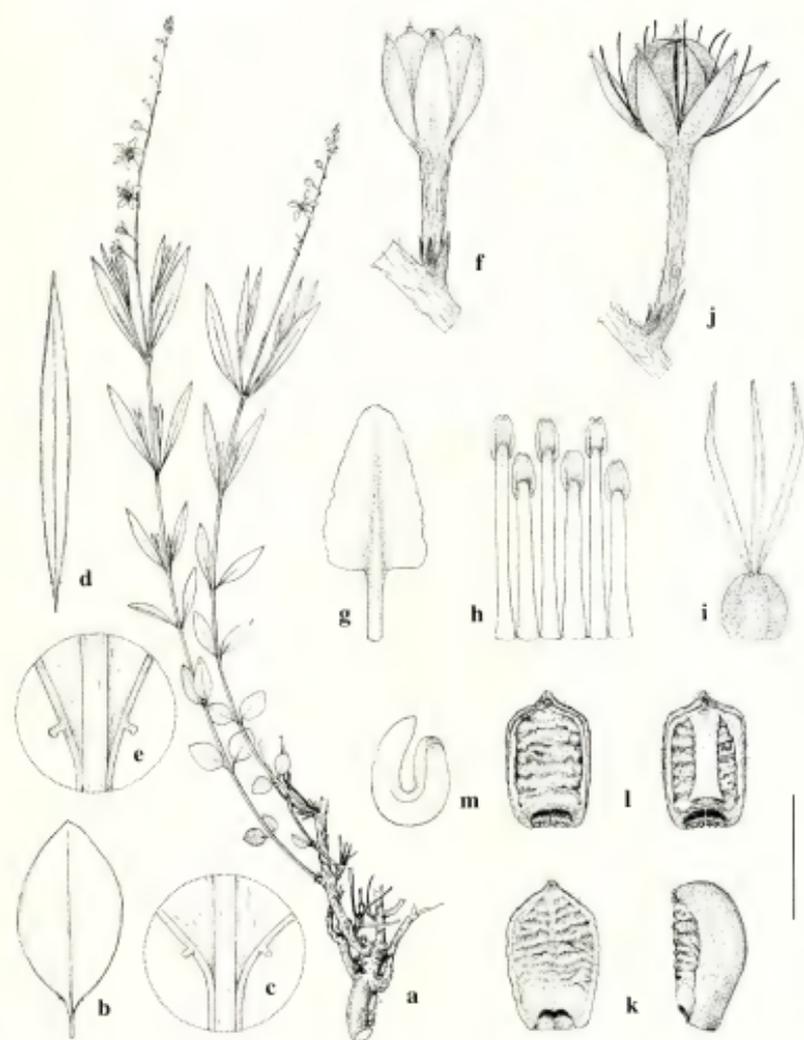


FIG. 15. *Galphimia angustifolia*. a. Flowering habit. b. Wide leaf, adaxial view. c. Base of lamina in "b," abaxial view. d. Narrow leaf, abaxial view. e. Base of lamina in "d," abaxial view. f. Flower bud, with sessile pedicel subtended by bract and two bracteoles. g. Petal. h. Partial androecium laid out, abaxial view, the stamen at right opposite posterior petal. i. Gynoecium. j. Fruit. k. Two cocci, adaxial view (left) and lateral view (right). l. Two cocci, adaxial views. m. Embryo. Scale bar: a, 4 cm; b, d, 2 cm; c, e, h, i, m, 2 mm; f, j, 4 mm; g, k, l, 2.7 mm. (Based on: a, Pringle 1940, GH; b, c, Reverchon 1505, NY; d, e, Correll 29602, LL; f, Miller et al. 5665, MICH; g-i, McGregor 16749, US; j, l, m, Daniel 6895, CAS; k, Butterwick & Lott 3728, TEX.)

with some scattered hairs on the proximal portion of the costa, secondary veins not evident or slightly prominulous abaxially; margin entire; petioles 0.1–0.9 cm long, pubescent but glabrescent with age; glands usually a pair borne on the margin at the base of the lamina to 5 mm above the base, or sometimes with only 1 gland or rarely the glands absent, each gland 0.1–0.3 mm in diameter, sessile or prominent, or peglike and up to 0.4 mm long, sometimes with 1 or rarely 2 additional smaller glands borne on the margin in the proximal half of the lamina; stipules 2–3.5 mm long, 0.3–0.5 mm wide, linear, glabrous or with scattered hairs on the margin. Inflorescence a terminal raceme, the axes sparsely to densely pubescent but glabrescent in age, peduncles usually absent or rudimentary (rarely to 3.5 mm long), pedicels 2–10 mm long, pubescent or sparsely so; bracts 2–3.7 mm long, 0.5–0.7 mm wide, linear, bracteoles 1.2–1.5 (–1.8) mm long, 0.2–0.3 (–0.5) mm wide, linear, bracts and bracteoles glabrous or with scattered hairs along the margin or only at apex. Sepals 3.2–3.5 mm long, 1.3–1.5 mm wide, narrowly lanceolate, glabrous but with a tuft of hairs at the apex; glands absent. Petals deciduous, subequal, the posterior petal sometimes a little larger, yellow, becoming orange or red in age, glabrous, margin slightly erose-undulate; claw 1.5–2 mm long, 0.4 mm wide, limb 3.5–4.5 mm long, 2.3–3 mm wide, ovate to narrowly triangular, apex obtuse, base subtruncate to acute. Stamens of unequal length; filament opposite anterior sepal 3.7–4 mm long, filaments opposite anterior-lateral petals 2.6–3.5 mm long, filaments opposite anterior-lateral sepals 3.2–3.7 mm long, filaments opposite posterior-lateral petals 2.7–3.3 mm long, filaments opposite posterior-lateral sepals 3.2–3.7 mm long, filament opposite posterior petal 2.5–3.3 mm long; anthers 0.7–0.9 mm long. Ovary pilose, hairs ca. 0.1 mm long; styles 3.5–4.8 mm long. Coccus 3–3.5 mm long, 2–2.2 mm in diameter, pilose, glabrescent in age; areole 2–3 mm long, 1.5–2 mm wide; outer cotyledon 2.3–2.7 mm long, inner cotyledon 1.8–2.2 mm long. Chromosome number unknown.

**Phenology.** Collected in flower and fruit from April through November (–December), in Sonora also in January and February, in Baja California Sur from August through May.

**Distribution (Fig. 16).** U.S.A. (Texas) and Mexico (Baja California Sur, Coahuila, Durango, Nuevo León, San Luis Potosí, Sinaloa, Sonora, Tamaulipas); on limestone, caliche, and gypsum substrates in dry and desert habitats, in washes and arroyos, in open tropical deciduous forest, matorral, and thorn scrub, on dunes; sea level to 1730 m.

**REPRESENTATIVE SPECIMENS.** U.S.A. TEXAS. Bandera Co.: Medina Lake, *Palmer 12269* (A, CAS, GH, MO). Bee Co.: N of Beeville, *Albers 46332* (F, TEX). Bexar Co.: near Bracken, *Groth 64* (CAS, F, GH, US). Blanco Co.: Pedernales Falls State Park, study plot no. 1, *Oefinger 3244* (TEX). Brewster Co.: above bed of San Francisco Canyon, ca. 3 mi up from the Rio Grande, ca. 18 mi S of Sanderson, *Butterwick & Lott 3728* (TEX). Comal Co.: Smithson Valley, 15 mi NW of New Braunfels, *Cutler 3248* (F, GH, MO, NY). Duval Co.: 7 mi S of San Diego towards Benavides, *Correll & Johnston 25504* (S, TEX). Edwards Co.: 3/4 mi S of dam on Hackberry Creek, W side below Deadman's Hollow, *Smith & Butterwick 224* (LL). Fayette Co.: without locality, *Mathes 241* (G, W). Goliad Co.: McNamara Ranch, 0.2 mi NE of FM-1351 on S side of Hwy 59, *Hill 5462* (ENCB). Hays Co.: 12 mi W of San Marcos on rd to Wimberly, Edwards Plateau, *Johnson 266* (TEX); San Marcos and vicinity, *Stanfield s.n.* (NY). Jim Hogg Co.: without locality, *Lehmann & Davis 6* (F). Karnes Co.: 0.2 mi W of Coy City, Farm-to-Market Rd 81, *Johnson 1305* (TEX). Kendall Co.: 13 mi NW of Boerne, *Barneby 14496* (CAS, NY). Kerr Co.: *Heller 1737* (BR, C, F, G, GH, K, MICH, MO). Kimble Co.: N of Castroville, *Reverchon 1505* (DS, F, MO, NY, S). Kinney Co.: Anacacho Mts on Anacacho Ranch, *Correll 30433* (GH, MO, TEX). Live Oak Co.: rd to Fiesta Marina just E of Rte 534, 4.6 mi N of Rte 359, *Hill 10628* (ENCB, GH, MICH, MO, NY). Medina Co.: along state farm rd 1283, 4 mi E of Medina Dam, 29°23'N, 99°24'W, *Miller et al. 5841* (MICH, MO). Mendocino Co.: S Geronimo Valley, *Reverchon 26* (GH). Real Co.: lookout over Frio River, along Rte 83 several mi NE of Leakey, *Correll 29602* (GH, LL). San Patricio Co.: ca. 2 mi NW of Mathis along edge of Frebs caliche pit, *Turner 80-86M* (TEX). Starr Co.: 2 km S of Santa Margarita, between Falcon and Roma, *Butterwick & Strong 1335* (TEX).

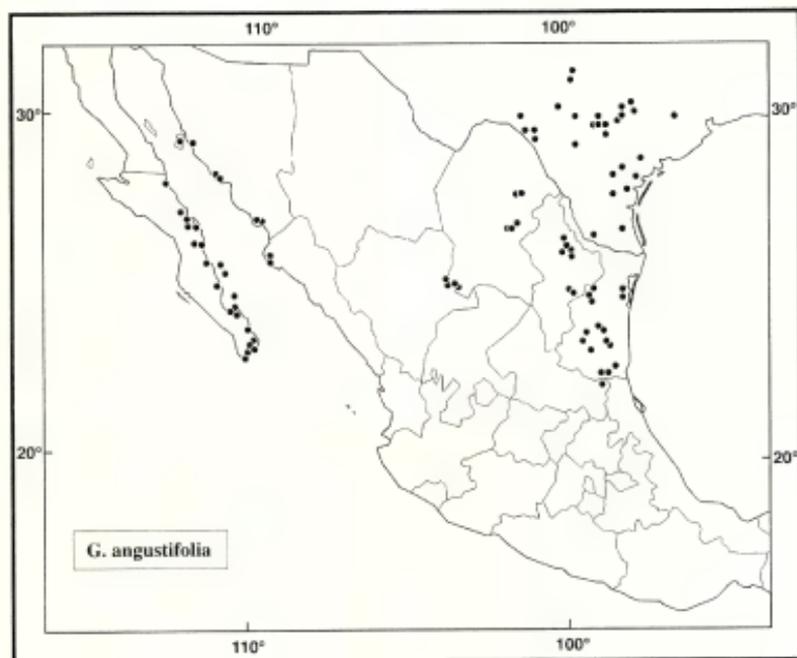


FIG. 16. Distribution of *Galphimia angustifolia*.

Travis Co.: Mount Bonnell, *Albers et al.* 46460 (F, MO, NY, S, TEX). Uvalde Co.: 2 mi N of Blewett, *Muller* 8013 (LL, MICH). Val Verde Co.: above dam at foot of Devil's Lake, ca. 20 mi NNW of Del Rio, *McVaugh* 10589 (BM, DUKE, ENCB, G, GH, MICH, NY, LL); lookout over Frio River, along Rte 83 several mi NE of Leakey, 29°28'N, 100°58'W, *Miller et al.* 5665 (MICH, MO, TEX). County unknown: Upper Guadalupe, *Lindheimer* 361 (BM, G, GH, K, MO, NY-fragment, P, US, W).

**Mexico.** BAJA CALIFORNIA SUR: E of Cabo San Lucas, *Carter* 2259 (DS, MEXU, UC, US); Arroyo del Salto, E of La Paz, 24°12'N, 110°7.5'W, *Carter* 2586 (DS, K, UC, US); Cañón de los Potrerillos, ca. 5 km NW of Loreto, 26°01'N, 111°22'W, *Carter* 4590 (BM, MEXU, MICH, UC); Caliente Manantiales along Rio Agua Caliente, 13 km SW of Santiago, foothills of E slope of Sierra de la Laguna, 23°26'N, 109°49'W, *Daniel* 6895 (CAS, MICH); Las Cuevitas below Comondu, *Gentry* 4223 (DS, GH, MO, UC, US); Bahía San Nicolás, *Johnston* 3736 (CAS, GH, MO, NY, UC, US); Miraflores, *Jones* 24169 (A, CAS, F, MO, UC); W side of Santa Cruz Island, 25°17'N, 110°44'W, *Moran* 3825 (DS); hill S of Mulegé, 26°52'N, 111°59'W, *Moran* 9037 (MICH, SD, UC); Danzante Island, *Moran* 9264 (CAS, SD); above Ensenada Ballena, Espíritu Santo Island, 29°29'N, 110°20'W, *Moran* 9651 (SD); 10 mi S of Mulegé, *Shreve* 7085 (DS, F, MICH, US); 5 mi N of Santiago, *Shreve* 7288a (DS, F, MICH, US); Isla Sta. Catalina, lado SW de la isla, a 10 m de la playa, 25°35'N, 110°47'W, *Sousa, P.* 92 (CAS, ENCB, IBUG, IEB, MEXU); Cape Region, Arroyo Santa Anita near Casa Vieja, ca. 5 mi SW of La Palma, 8 mi NW from Santa Anita, *Thomas* 7740 (CAS, DS, ENCB, GH, MEXU, UC, US); San José de Magdalena, *Wiggins* 11380 (CAS, DS, ENCB, GH, MO, NY, SD, UC, US); 1.5 mi NW of San Bartolito, *Wiggins* 14755 (CAS, DS, GH, K, MEXU, TEX, UC); Cape St. Lucas, *Xantus* 15 (GH, K, NY, US).—COAHUILA: near Rancho Margarita headquarters, Serranías del Burro Mts, 65 mi NW of Sabinas, *Gould* 10649 (ENCB, MICH, TEX); 32 air mi NE of San Pedro, 1 mi SW of Las Delicias, 26°14'N, 102°49'W, *Henrickson* 6061 (TEX); 13 km N of Las Margaritas, 26°34'30"N, 102°50'51"W, *Johnston et al.* 10357E (CAS, LL, MEXU, NY); mts 24 mi NE by N from Monclova, *Palmer* 128 in 1880 (F, G, GH, NY, US); 5 km NE of Jimulco, 25°N, 103°W, *Stanford et al.* 134 (DS, GH, MEXU, MO, NY, UC); canyons in Sierra del Sobaco a few km W of Las Delicias, *Stewart* 2802 (GH); 12.6 km NNE of Las Margaritas, 26°34'N, 102°51'W, *Wendt et al.* 9491 (CAS, LL, MEXU, NY); Mpio. Múzquiz, Hacienda Mariposa,

near Puerto Santa Ana, *Wynnd & Mueller 282* (A, K, MICH, MO, NY, S, US); Mpio. Torreón, Sierra de Jimuleo, 150 km E de La Mina de San José, 25°06'N, 103°13'W, *Villarreal 5520* (TEX).—DULANGO: 30 km SW of Gómez Palacios, 25°24'30"N, 103°43'W, *Johnston et al. 10400C* (CAS, F, LL, MEXU, MO, NY); 20 km NW of Estación Chocolate, 25°25'N, 103°43'W, *Johnston et al. 12199* (CAS, F, LL, MEXU, MO, NY, SD).—NUEVO LEÓN: 5 mi S of Sabinas Hidalgo, along road to Monterrey near Km 1074, *Chute M-260* (MEXU, MICH); Linares, *Clark 6809* (MO, NY); Mpio. Sabinas Hidalgo, 12.8 mi S of Sabinas Hidalgo, *Cowan 5354* (NY, TEX); ca. 25 km NW of Monterrey, along rd to Nuevo Laredo, *Dierle 3677* (ENCB, MEXU, MICH); Mpio. Sabinas Hidalgo, 12 mi S of Sabinas Hidalgo, 26°20'N, 100°07'W, *Dorr 2484* (CAS, CHAPA, MEXU, NY, TEX); between Monterrey and Montemorelos, *Dziakowski et al. 1736* (ENCB, NY); 11 mi NE of Sabinas Hidalgo, 5 mi SW of Vallecillos, *Johnston & Graham 4607* (MEXU, MICH, TEX); Obispedo, Los Alamillos, *Lacis 408* (F); 29 mi N of Sabinas Hidalgo, *McGregor 16749* (LL, US); Mpio. Villaldama, Sierra Gomas, in Canyon El Alamo, 26°21'N, 100°27'W, *Patterson 6671* (TEX); Monterrey, *Pringle 1940* (BM, F, G, GH, L, NY, S, UC, US, W); hills near Monterrey, *Pringle 2708* (F, MEXU, MO, NY, UC); 40 mi S of Laredo, *Schery 16* (MICH, MO); 7.3 mi S of Sabinas Hidalgo, *Weaver 2024* (DUKE, MEXU, MO).—SAN LUIS POTOSÍ: 3 mi S of Tamaulipas line on Antiguo Morelos-Válles hwy, *Johnston & Graham 4998* (MEXU, MICH, TEX); without locality, *Parry 94* (GH, K, MO, NY, P, USF).—SINALOA: Cerros del Fuerte, 18–24 mi N of Los Mochis, *Gentry 14291* (LL, MEXU, MICH, US); Cerros de Navachiste about Bahía Topolobampo, *Gentry 14365* (US); hills near Yacht Hotel, Topolobampo, *Hastings & Turner 64-112* (DS, SD); Topolobampo, *Palmer 184* in 1897 (C, DS, MICH, P, S, UC, US).—SONORA: Cañón Nacapulí, ca. 4 km N of Bahía San Carlos, *Felger 85-865* (MICH); Cañón las Barajitas, Sierra El Aguaje, ca. 18 km NW of San Carlos, 28°02'32.0"N, 111°12'40.1"W, *Felger 95-128* (CAS); Ensenada Grande (=San Pedro Bay), *Felger et al. 11579* (SD); 3.6 mi by road NE of New Kino, *Felger 15297* (ENCB, LL, SD); Navojoa, *Gentry 1661* (F, GH, K, MO); Ensenada de Perros, lado E de la Isla Tiburón, 28°46'N, 112°16'W, *Tenorio L. 9503* (TEX); San Agustín Bay, 28°03'N, 111°04'W, *Turner 79-26* (MEXU, U, C); Río Mayo region; base of Cerro (Mesa) Masiaaca on rd to microwave tower, 1.3 mi E of Hwy 15 (SE of Navojoa), 26°46'35"N, 109°18'30"W, *Van Devender 95-1090* (MICH).—TAMAULIPAS: Cerro Tinaja, vicinity of San José, Sierra de San Carlos, *Bartlett 10319* (L, MEXU, MICH, US); La Tamaulipeca, vic. of San Miguel, Sierra de San Carlos, *Bartlett 10582* (ENCB, F, LL, MEXU, MICH, NY, US); Mpio. Ciudad Victoria, 13.6 km from Villa de Casas toward Soto La Marina, *Cowan 5211* (CAS, NY, TEX); along hwy between Gonzáles and Est. Zaragoza, 5.4 mi SE of turnoff to Est. Zaragoza, 23°10'N, 98°44'W, *Daniel 811* (MICH); along rd to San Francisco, 1.0 mi E Hwy 85 S of Cd. Victoria, *Daniel & Baker 3705* (MICH); 4.7 mi W of junction of Hwy 80 & 85 on Hwy 80, along grade W of Antiguo Morelos, *Dunn et al. 17574* (ENCB); 22 mi S of Villagrán, *Johnston & Crutchfield 4310A* (TEX); vicinity of Victoria, *Palmer 483* in 1907 (F, GH, NY, US); rd between La Pesca and Soto La Marina, 8.1 mi E of Soto La Marina, 23°51'N, 98°00'W, *Patterson 7272* (TEX); *Jau-mave, Viereck 665* (US).

*Galphimia angustifolia* is a common species of southern Texas and northern Mexico; it is the only species of *Galphimia* found in the United States. It forms sprawling suffrutescent herbs or small shrubs composed of many ascending shoots arising from a woody base and terminating in lax, small-flowered inflorescences. Leaf shape varies greatly from linear to ovate, and some regional patterns can be discerned. In most collections from Baja California Sur and Sonora the laminas are elliptical to ovate, yet in some, including the type of *G. angustifolia*, and those from Sinaloa, the laminas are very narrow. Collections from the remainder of the range have mostly linear to narrowly lanceolate/elliptical laminas, but specimens with broader laminas are not uncommon. On occasion, a specimen bears broader laminas near the base of a shoot and narrower ones distally (Fig. 15a). Superficially *G. angustifolia* is most similar to the equally widespread and variable South American *G. australis*, from which it is readily separated by its pilose ovary and fruit and eglandular calyx. In Mexico *G. angustifolia* is easily differentiated from most other species of *Galphimia* in its range by the broom-like habit, lack of peduncles, and small flowers; the only species sharing these characters is the densely pubescent *G. vestita*.

- 14. *Galphimia vestita*** S. Watson, Proc. Amer. Acad. Arts 21: 421. 1886. *Thryallis vestita* (S. Watson) Rose, Contr. U.S. Natl. Herb. 12: 281. 1909.—TYPE: MEXICO, Chihuahua: Hacienda San Miguel, near Batopilas, *Palmer 187* in 1885 (holotype: GH!, photos: A! F! NY!; isotype: US!).

Fig. 17.

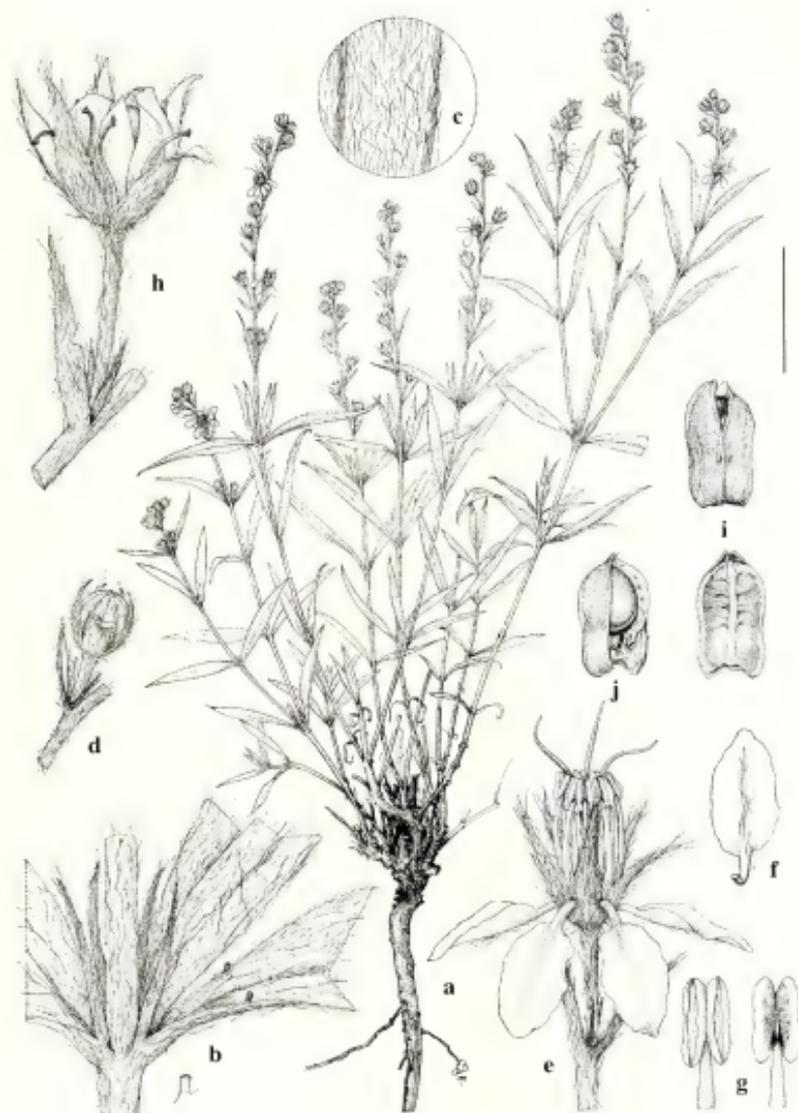


FIG. 17. *Galphimia vestita*. a. Habit. b. Node with stipules (and detached marginal leaf gland). c. Abaxial leaf surface. d. Flower bud, anterior sepal bent down. e. Flower. f. Petal, abaxial view; g. Anthers, adaxial view (left) and abaxial view (right). h. Fruit. i. Cocci, abaxial view (above) and adaxial view (below). j. Coccus with half of abaxial wall removed. Scale bar: a, 4 cm; b, 4 mm (2 mm); c, h-j, 4 mm; d, 5.7 mm; e, f, 5 mm; g, 2 mm. (Based on: a-d, *White 3574*, GH; e-j, *Wiggins 7471*, DS.)

Herb or small shrub from woody rootstock, to 0.5 m; stems, leaves, and inflorescence densely pubescent. Vesture of all parts of white or translucent T-shaped hairs, the trabecula 1–2 mm long, straight to wavy or crisped, the stalk ca. 0.5 mm long. Laminas of the larger leaves 2.5–5 cm long, 0.2–0.8 cm wide, linear, apex acute to acuminate, base acute, secondary veins not evident; margin entire; petioles 1–3 cm long; glands usually a pair borne on the margin to 2 mm above the base of the lamina or sometimes at the base, each gland ca. 0.1 mm in diameter, disklike and prominent, or peglike and up to 0.5 mm long, sometimes the laminar tissue extended into a tooth and the gland borne at the apex; stipules 3.5–9 mm long, 0.5–0.8 mm wide, linear. Inflorescence a terminal raceme; peduncles absent, pedicels 4.5–9 (–11) mm long; bracts 4–14 mm long (often exceeding the pedicel), 0.5–1 mm wide, linear, bracteoles 1.5–2.5 mm long, 0.2–0.3 mm wide, linear. Sepals 4.5–5.3 mm long, 1.5–1.7 mm wide, narrowly triangular to narrowly lanceolate, pubescent abaxially; glands absent. Petals deciduous, subequal, yellow or yellow suffused with red especially on the midrib, becoming red in age, pubescent on the midrib abaxially, margin shallowly erose-undulate; claw ca. 1.5 mm long, 0.3–0.4 mm wide, limb 3.5–5 mm long, 3 mm wide, narrowly ovate or narrowly elliptical, apex obtuse or apiculate, base gradually acute or subtruncate. Stamens subequal; filaments 4–5.5 mm long; anthers 1.3–1.5 mm long. Ovary pilose, hairs ca. 0.1 mm long; styles 6.8–7.8 mm long. Coccus 3.5–4 mm long, 2.3–2.4 mm in diameter, pilose, in age the hairs sloughed off the surface but retained along the sutures; areole 2.8–3 mm long, ca. 2 mm wide; outer cotyledon ca. 2.5 mm long, inner cotyledon ca. 2 mm long. Chromosome number unknown.

Phenology. Collected in flower from July through December, and in fruit from August through October.

Distribution (Fig. 10). Mexico (southwestern Chihuahua, Nayarit, Sinaloa, Sonora); in thorn forest and sandy washes; 400–600 m.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** Nayarit: Mpio. El Nayar, Jesús María, camino a la pista de aterrizaje, *Colunga & Zizumbo 42* (CAS, MEXU); Mpio. Acaponeta, near Cancial along trail W of Jesús María, *Norris & Turano 14063* (MICH), 14085 (MICH).—Sinaloa: Cofradía, vic. of Culiacán, 20 Oct 1904, *Brandegee s.n.* (UC); Cofradía, 27 Oct 1904, *Brandegee s.n.* (C, UC); Cieneguita, SE of Badiraguato, *Gentry 5939* (ARIZ); Choix, *Gentry 6779* (GH, MICH, NY).—Sonora: El Coyote, in E-central Sonora, *Felger 3616* (ARIZ, ENCB, SD); 19.8 mi by rd E of main hwy (Mex. Hwy 15) on rd to Ures, *Felger 3912* (MEXU); Arroyo Guajaray, Río Mayo, *Gentry 1137* (F, GH, K, MEXU, MO, S, UC, WIS); San Bernardo, Río Mayo, *Gentry 2282* (GH, MO); Mpio. Yecora, Cúrea, 28°18'42"N, 109°16'42"W, *Reina G. et al. 98-1261* (MICH); near intersection of Hwy 15 and road through Suhural toward San Agustín, *Stevens 1518* (ENCB); Cañón de las Bellotas, region of Río de Bavispe, NE Sonora, *White 3574* (ARIZ, BR, GH, MEXU, MICH); 13 mi S of Divisaderos, *Wiggins 7464D* (DS, US); 14 mi S of Divisaderos, *Wiggins 7471* (DS, MICH, US).

*Galphimia vestita* is easily recognized by its linear and densely pubescent leaves. The only other species with abundant vesture on nearly all its parts is *G. hirsuta* of Guerrero, which has broad laminas; its much larger flowers are borne on pedicels subtended by peduncles and have unequal petals. The androecium of *G. vestita* is unique in the genus in that the stamens are subequal; in all other species at least some stamens have filaments differing in length. *Galphimia vestita* is sometimes misidentified as *G. angustifolia*, which also occurs in northern Mexico and in some populations has linear laminas, but its leaves are glabrous or bear only a few scattered hairs.

- 15. *Galphimia brasiliensis* (L.) A. Dr. Jussieu in A. St.-Hilaire, Fl. bras. merid. 3: 71. 1833 [“1832”]. *Thryallis brasiliensis* L., Sp. pl., ed. 2, 2: 554. 1762.—TYPE:** “Fruticescens herba pisonis. Margr. bras. 79. f. 3” [the illustration; p. 79, in Piso, G.: *De medicina brasiliensi*; Marcgrave, G.: *Historiae rerum naturalium brasiliae*, 1648.]

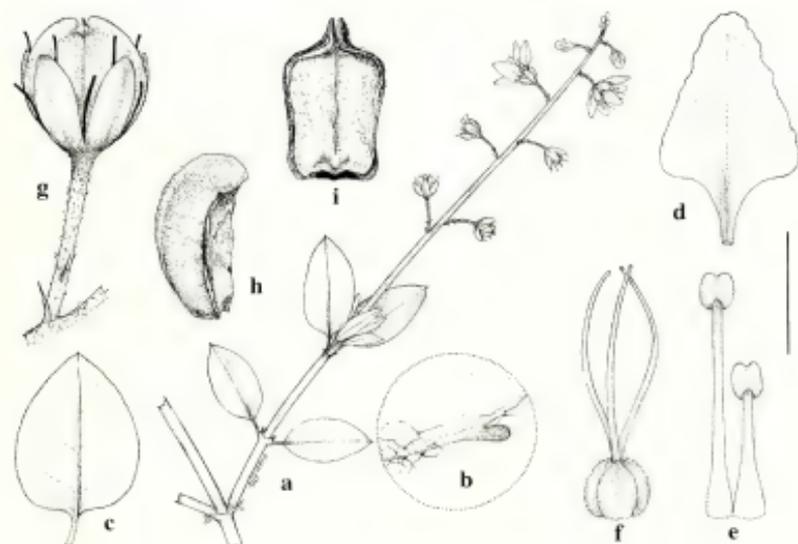


FIG. 18. *Galphimia brasiliensis*. a. Branch with inflorescence. b. Detail of lamina base, showing marginal gland. c. Leaf. d. Petal. e. Stamens opposite posterior-lateral sepal (left) and posterior petal (right), abaxial view. f. Gynoecium. g. Fruit, subtended by calyx and filaments, borne on pedicel and peduncle with portion of inflorescence axis. h. Coccus, lateral view. i. Coccus, adaxial view. Scale bar: a, c, 2 cm; b, 1 mm; d, h, i, 2.7 mm; e, f, 2 mm; g, 4 mm. (Based on: a, d–g, *Anderson 11737*, MICH; b, c, *Harley 16312*, MICH; h, i, *Blanchet 3904*, G.)

*Galphimia brasiliensis* var. *pubescens* f. *ovata* Nied., *Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg* 5: 22. 1914.—TYPE: BRAZIL, Bahia: without locality, 1830, *Salzmann s.n.* (lectotype, designated by C. Anderson, 2005a: G!; isolectotypes: MO! P!).

Fig. 18.

Subshrub and shrub to 1.5 m, often sprawling and scrambling; stems pubescent when young, becoming glabrous but often roughened by tubercles. Vesture of all vegetative parts of straight to wavy, light brown to white hairs, 0.3–0.8 mm long, each hair borne on a persistent tubercle to 0.25 mm high or the epidermis only slightly raised at point of attachment. Laminas of the larger leaves 2–5 cm long, 1–3.8 cm wide, ovate or elliptical, apex apiculate or acute, base acute to truncate, glabrous but often with a few scattered hairs on the abaxial costa and along the margin near the base, secondary veins prominulous or barely so abaxially; margin entire and commonly with a few persistent tubercles near the base; petioles 0.3–1 cm long, tuberculate-strigose or only the tubercles remaining; leaf glands usually a pair borne on the margin to 0.6 mm above the base of the lamina, sometimes with only 1 gland or the glands absent, each gland 0.1–0.3 mm in diameter, disklike and prominent or sometimes drawn out into a tooth to 0.3 (–0.5) mm long; stipules 1.5–2.7 mm long, 0.3–0.6 wide, linear or very narrowly triangular, with scattered hairs along the margin. Inflorescence a terminal raceme, the axes pubescent and tuberculate; peduncles absent or rudimentary and up to 2 (–3) mm long, glabrate, pedicels 2.5–5.5 mm long, pubescent; bracts 1.2–2 mm

long, 0.4–0.5 mm wide, linear, bracteoles 0.5–0.8 mm long, 0.3–0.4 mm wide, linear, bracts and bracteoles glabrous. Sepals ca. 2.5 mm long, 1–1.1 mm wide, narrowly elliptical, glabrous or with scattered hairs at the base, usually with a tuft of hairs at the apex; glands absent. Petals deciduous, subequal but the posterior petal sometimes with a slightly wider claw, yellow, often marked with red, becoming pink/red in age, glabrous, margin finely denticulate-crose; claw 0.5–1 mm long, 0.4–0.5 mm wide, limb ca. 4 mm long, ca. 3 mm wide, triangular-ovate, apex obtuse, base gradually acute. Stamens of unequal length; filament of stamen opposite anterior sepal ca. 3.5 mm long, filaments of stamens opposite lateral sepals 3.2–3.3 mm long, filaments of stamens opposite petals subequal, ca. 2 mm long; anthers 0.7–0.8 mm long. Ovary finely pilose, the hairs ca. 0.05 (–0.1) mm long; styles 3.3–4.3 mm long. Coccus ca. 3.6 mm long, ca. 2 mm in diameter, finely pilose; areole ca. 2.6 mm long, ca. 1.7 mm wide; mature seed not seen. Chromosome number unknown.

**Phenology.** Collected in flower and fruit throughout the year.

**Distribution** (Fig. 19). Eastern Brazil (Bahia, Paraíba, Pernambuco, Piauí); in caatinga, cerrado, at edges of woods and gallery forests, in thorn scrub; 280–1150 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Brazil.** **BAHIA:** Mpio. Jussiape, estrada Jussiape/Abaira, ca. 5 km de Jussiape, *Amorim et al.* 2833 (MO); 10 km W of Serrinha on rd to Conceição do Coité, 11°38'S, 39°W, *Anderson* 11737 (CAS, MBM, MICH, NY); Valente, 6 km N of Valente on rd to Santaluz, *Anderson* 13689 (MICH); camino de Filadélfia a Pindobaçu, a 14 km da BR-407, 10°48'S, 40°14'W, *Arbo et al.* 7334 (CEPEC); BR-324, 12 km NW de Jacobina, camino a Umburanas, 11°06'S, 40°36'W, *Arbo et al.* 7359 (CEPEC); Itaçu, Fda. Lapa, 12°42'S, 39°56'W, *Arouck-Ferreira* 256 (MBM); Pasto Barreiro, Faz. Serra da Montã, Itaberaba, *Bastos* 162 (CEPEC, MICH); *Blanchet* 1046 (G); *Blanchet* 2184 (BM, G); Serra de Jacobina, *Blanchet* 2674 (BM, BR, C, G, MO, NY, P, W); *Blanchet* 3904 (BM, F, G); Conceição de Feira, margem esquerda do Rio Paraguaçu, 12°32'35"S, 39°03'06"W, *Carvalho et al.* 544 (CEPEC, MICH); Barragem de Bananeiras, cachoeira, vale dos Rios Paraguaçu e Jacupé, 12°32'S, 39°05'W, *Cavalo* 201 (CEPEC, MICH); entre Jeremoabo e Paulo Afonso, *Gonçalves* 41 (CEPEC); Lagoa de Eugénia, southern end near Camaleão, *Harley* 16227 (CEPEC); 64 km N of Senhor do Bonfim on BA-130 to Juazeiro, 09°55'S, 40°15'W, *Harley* 16312 (K, MICH, MO, NY, RB); Serra da Jacobina, 8 km N of Senhor do Bonfim on BA-130 to Juazeiro, 10°23'S, 40°15'W, *Harley* 16500 (K, MICH, MO, NY); Piauí, *Harley* 24152 (K); Milagres, arredores, *Hatschbach* 42452 (MBM, MICH); Itaberaba, Fda. Morros, *Hatschbach* 48206 (BR, CEPEC, MBM, MICH, MO); Morro da Garafã, 12°45'18"S, 39°51'W, *Melo et al.* 2043 (CEPEC); Pasto Buffel, Faz. Serra da Montã, Itaberaba, *Oliveira* 544 (MO); Mairi, *Oliveira* 647 (MO); Faz. Lagã do Canto, Ipirã, *Oliveira* 682 (MO); Faz. Várzea Ipirã, *Oliveira* 713 (CEPEC, MO); Santa Terezinha, 0.6 km NE de Sta. Terezinha, na estrada entre Sta. Terezinha e Monte Cruzeiro, 12°48'56"S, 39°32'05"W, *Queiroz et al.* 1540 (CEPEC, F, MBM); Santa Inês, Km 20 da Rod. Ubaira/Sta. Inês, *Santos* 3070 (CEPEC, MICH); bei Remonso, *Ule* 7180 (G, I); Santa Luz, 30 km W of Queimadas, 15 km NW of Santa Luz, 11°09'S, 39°28'W, *Webster* 25670 (CAS, MICH).—**PARAÍBA:** without locality, *Coelho de Moraes* 2116 (A, NY, S).—**PERNAMBUCO:** Sertânia, Fazenda Coxí, *Alencar* 3 (MICH); Area-projeto Suape, Cabo de Sto. Agostinho, parte anterior (Estação D), *Andrade-Lima & Medeiros-Costa* 48 (F, MBM); Praia do Guaibó, 35 km S of Recife, *Deguchi et al.* B-1739 (MO); near Pernambuco, *Gardner* 944 (BM, GH, NY, S, W); 20 km de Petrolina em direção a Afrânio, *Heringer et al.* 185 (UB); 20 km de Petrolina a Afrânio, *Heringer et al.* 975 (RB); *Houllet* s.n. (BR); Olinda, *Pickel* 676 (SP); *Riddle et al.* s.n. (BM); Alagoinha, SW von Caruarú, *Vogel* 129 (MICH).—**PIAUI:** Lagoa Comprida, *Gardner* 2077 (BM, GH).

*Galphimia brasiliensis* is characterized by its pubescence composed of hairs borne on tiny persistent tubercles, mostly ovate leaves, and a finely pilose ovary. The androecium is unique in the genus in that the filaments of stamens opposite the lateral sepals are subequal, as are those of stamens opposite all petals. In all other species, except *G. vestita*, anterior-lateral filaments differ from the posterior-lateral ones.

*Galphimia brasiliensis* is restricted to eastern Brazil (Paraíba to Bahia and adjacent Piauí), but traditionally the name has been applied to any specimen of *Galphimia* from South America, especially to the widespread *G. australis*, which lacks tubercles and has a glabrous ovary and fruit, a (usually) glandular calyx, and a more southern range. Occasionally plants of *G. gracilis* cultivated in South America are

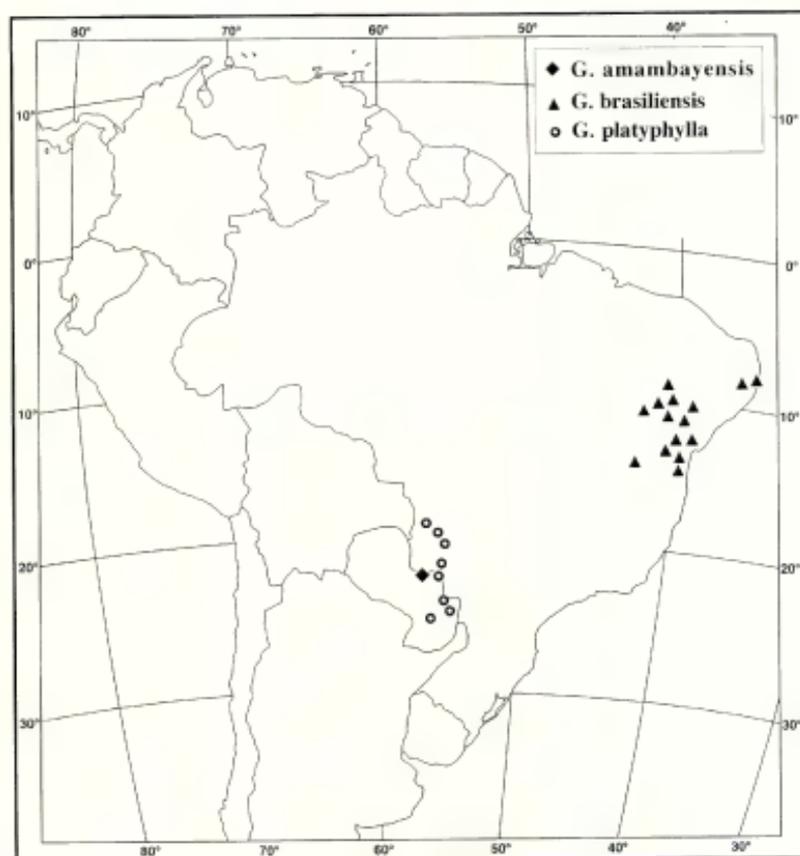


FIG. 19. Distribution of *Galphimia amambayensis*, *G. brasiliensis*, and *G. platyphylla*.

labeled as "*Galphimia brasiliensis*," but they are readily distinguished from true *G. brasiliensis* by their large showy flowers borne on pedicels subtended by peduncles, which bear two bracteoles at or just below the apex.

Jussieu (1833) was the first to realize that Linnaeus's *Thryallis brasiliensis* belongs in *Galphimia* and is not related to species assigned to *Thryallis* Mart., but his description of *G. brasiliensis* was based on specimens of *G. australis*.

**16. *Galphimia australis*** Chodat, Arch. Sci. Phys. Nat., sér. 3, 24: 500. 1890. *Galphimia brasiliensis* var. *australis* (Chodat) Chodat, Bull. Soc. Bot. Genève, sér. 2, 9: 96. 1917.—TYPE: PARAGUAY. Guairá: Prairies de Cosme, entre Villa Rica et Caaguazú, Nov 1874, *Balansa 2393* (lectotype, designated by C. Anderson, 2005a: G!; isolectotypes: K! P!; photo of P isolectotype: MICH!).

*Galphimia brasiliensis* var. *pubescens* Adr. Juss. in St.-Hil., Fl. bras. merid. 3: 72. 1833 ["1832"].—TYPE: BRAZIL. Rio Grande do Sul: ad ripas Uruguay juxta vicum S.-Francisco de Borja [São Borja], Feb, *St.-Hilaire C2, 2495bis* (holotype: P!, photo: MICH!).

*Galphimia australis* f. *angustifolia* Chodat, Mém. Soc. Phys. Genève 31, part 2, no. 3: 23. 1892. *Galphimia brasiliensis* f. *angustifolia* (Chodat) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 5: 22. 1914.—TYPE: PARAGUAY: Guairá: pátureau d'Itangu, près de Villa-Rica, 17 Feb 1876, *Balansa* 2394 (holotype: G!).

Fig. 20.

Subshrub or suffrutescent herb from a woody caudex, to 1 m; stems sparsely pubescent when young, soon becoming glabrous, or pubescent and only the oldest parts glabrescent (Rio Grande do Sul and Uruguay). Vestiture of all vegetative parts of sessile, mostly wavy or crisped but sometimes straight, reddish brown hairs 0.2–0.7 mm long. Laminas of the larger leaves 2.5–7 (–8) cm long, (0.5–) 1–2.5 (–3.3) cm wide, length/width ratio 2.5–7 (–9), linear to linear-lanceolate to lanceolate to narrowly elliptical, apex apiculate, base acute, glabrous, secondary veins barely prominulous or not evident; margin entire; petioles (0.1–) 0.2–0.6 cm long, glabrous; leaf glands borne on the margin near the base of the lamina or up to 0.8 cm above it, usually a pair, or sometimes with 1 or 2 additional glands, or sometimes only 1 gland or the glands absent, each gland 0.2–0.5 mm in diameter, circular, flush with the margin or prominent or sometimes with a stalk to 0.5 mm long; stipules (1.5–) 2–4.2 (–5) mm long, 0.5–1 mm wide, linear, glabrous. Inflorescence a terminal raceme, the axes often tomentulose in the youngest part, usually becoming glabrate in age, or glabrous throughout; peduncles absent or rudimentary and up to 1.5 (–2.5) mm long, pedicels 2–5 (–10) mm long, tomentulose or with some scattered hairs or sometimes glabrous; bracts 1–5 (–7) mm long, 0.4–1 mm wide, linear, bracteoles 0.5–1.5 (–2) mm long, 0.2–0.5 (–0.7) mm wide, linear, bracts and bracteoles glabrous. Sepals 2.5–3.5 (–4) mm long, 1–1.8 mm wide, oblong, glabrous but with a tuft of hairs at the apex (best seen in bud and early anthesis); glands (0–) 1–3 (–5) per calyx, 0.2–0.5 mm in diameter, prominent. Petals deciduous, subequal, the posterior petal sometimes a little larger, yellow, becoming red in age, glabrous, margin finely denticulate-crose; claw 1.3–1.5 (–1.7) mm long, ca. 0.5 mm wide, limb 3–5 mm long, 2.5–4 mm wide, triangular-ovate, apex obtuse, base acute to truncate. Stamens of unequal length; filament opposite anterior sepal 2.5–3 (–3.4) mm long, filaments opposite anterior-lateral petals 2–2.3 (–2.5) mm long, filaments opposite anterior-lateral sepals 2.3–2.5 (–3) mm long, filaments opposite posterior-lateral petals 1.8–2 (–2.5) mm long, filaments opposite posterior-lateral sepals 2–2.3 (–3) mm long, filament opposite posterior petal (1.8–) 2–2.2 (–2.5) mm long; anthers 1–1.2 mm long. Ovary glabrous; styles 3.5–4.6 (–5.2) mm long. Coccus 3–3.8 mm long, 2–2.5 mm in diameter, glabrous; areole 2.2–3 mm long, 1.6–2 mm wide; outer cotyledon 1.8–2.7 mm long, inner cotyledon 1.5–2 mm long. Chromosome number unknown.

Phenology. Collected in flower and fruit throughout the year.

Distribution (Fig. 21). Southern Brazil, adjacent Bolivia, Paraguay, northeastern Argentina, western Uruguay; open woodlands and grasslands, cerrado, caatinga, campo limpo, campo sujo, matorral, and secondary sites; 90–900 m.

REPRESENTATIVE SPECIMENS. **Argentina.** CORRIENTES: Depto. Santo Tomé, Playadito 17 km W of Apóstoles, *Anderson* 12362 (CAS, MBM, MICH, NY); Depto. Santo Tomé, Ayo, Chimiray, *Krapovickas & Cristóbal* 25195 (CTES); Depto. Mercedes, Mercedes, a Itá Corá, Ayo, Pay-Ubre, *Quarín & González* 2036 (CTES, ENCB); Depto. Berón de Astrada, 46 km W de Itá Ibaté, Valencia, *Schinini* 14017 (CTES, F, MICH); Depto. Santo Tomé, Ea. Timbó, Ayo, Ciriaco y ruta 40, *Schinini et al.* 23447 (CTES, MICH).—ENTRE RÍOS: Depto. Concordia, Parque Rivadavia, *Burkart & Troncoso* 27703 (NY); Depto. Federación, Santa Ana, barranca del Río Uruguay, *Burkart et al.* 29359 (CTES, GH); Concepción del Uruguay, *Lorenz* 563 (BM, F, G, GH, K).—MISIONES: 9 km al NW de Concepción de la Sierra, *Krapovickas et al.* 15148 (C,

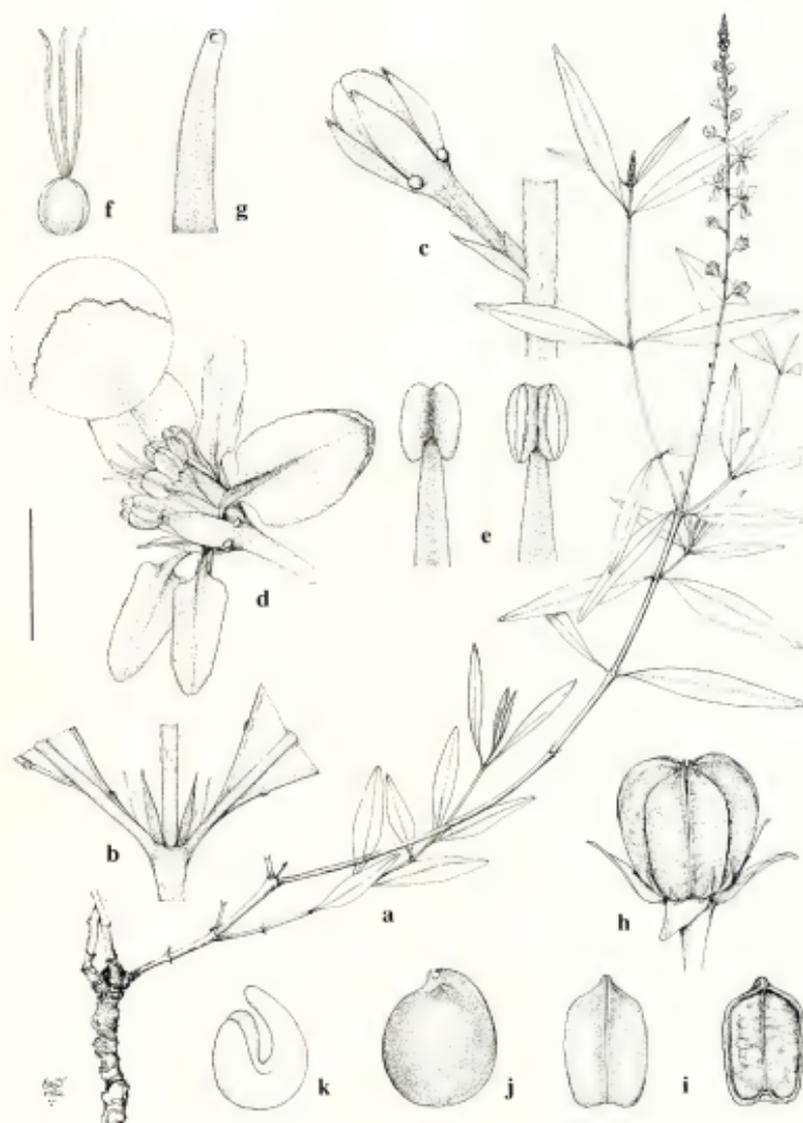


FIG. 20. *Galphimia australis*. a. Habit. b. Node with stipules and basal portion of leaves. c. Flower bud; note calyx glands. d. Flower, side view (adaxial apex of lateral petal enlarged). e. Distal portions of stamens, abaxial view (left) and adaxial view (right). f. Gynoecium. g. Apex of style. h. Fruit. i. Cocci, abaxial view (left) and adaxial view (right). j. Seed. k. Embryo. Scale bar: a, 3 cm; b, 6 mm; c, 3 mm; d, 3.8 mm (3 mm); e, 1.8 mm; f, 3 mm; g, 0.3 mm; h, i, 3.8 mm; j, k, 2.1 mm. (Based on: a–g, *Schinini 14017*, MICH; h–k, *Krapovickas & Schinini 32151*, MICH.)

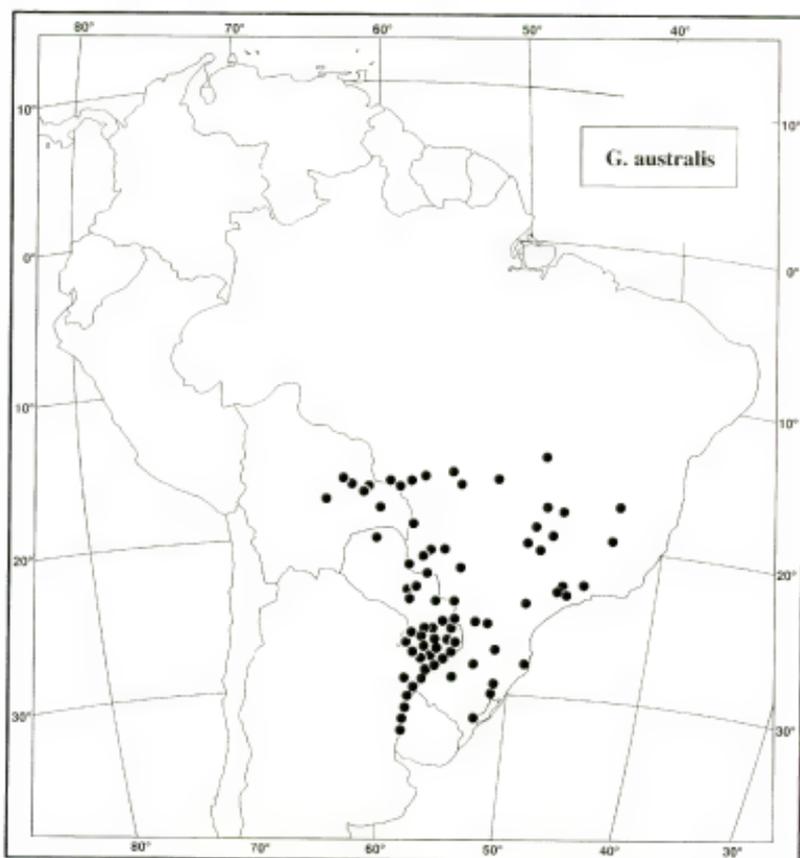


FIG. 21. Distribution of *Galphimia australis*.

CTES, MBM, MO, P, WIS); Depto. Caniguán, Puerto Rico, *Montes 3995* (CTES, MICH); Depto. Apóstoles, Apóstoles, *Xifreda & Maldonado 381* (MBM). **BOLIVIA**, SANTA CRUZ: Prov. Velasco, San Ignacio, 100 km N comunidad San Miguelito, *Bruderreck 24* (CTES, NY); Prov. Nullo de Chávez, Embocada del Carmen, ca. 40 km SSW de Concepción, 16°38'S, 62°26'W, *Krapovickas & Schinini 32151* (CTES, F, MBM, MICH); Prov. Sandoval, San Matías, 16°21'S, 58°26'W, *Krapovickas & Schinini 36157* (CTES, MICH); Prov. Andrés B Ibáñez, Jardín Botánico de Santa Cruz, 12 km E of center of Santa Cruz on road to Cotoca, *Nee 44434* (NY); Prov. Sara, lomería de Buena Vista, *Steinbach 7370* (A, BM, F, G, GOET, MO, S). **BRAZIL**, GOIÁS: Mpio. Caldas Novas, 12 km due W of the city of Caldas Novas, *Heringer & Eiten 14190* (HB, K, MO, SP, UB); BR-158, 5 km SE de Aragarças, *Krapovickas & Cristóbal 42948* (K, MBM, MICH).—MATO GROSSO: Oásis, 47 km E de Cáceres, BR-070, Km 680, Serra das Araras, *Krapovickas et al. 40260* (MICH); Mpio. Cuiabá, Rod. BR-070, Contorno Sul, *Hatschbach 65660* (MBM).—MATO GROSSO DO SUL: Mpio. Campo Grande, Rio Anhandui, *Hatschbach 21813* (MBM); Mpio. Rio Brilhante, Rod. BR-267, entroncamento, *Hatschbach 25071* (MBM); Bela Vista, 10–15 km O, *Hatschbach 49160* (BR, G, MBM, US); Mpio. Porto Martinho, Rod. Bonito–Campo dos Índios, Fazenda Agua Doce, *Hatschbach et al. 74009* (MICH); Mpio. Rio Verde, base escarpa de la Serra Alegre, ca. 20 km N de Rio Verde, *Krapovickas 29878* (CTES).—MINAS GERAIS: ca. 5 km SE of Paracitú, *Irwin et al. 26193* (F, MICH, MO, NY); estrada Santo Hipólito a Diamantina, Km 69, *Shepherd et al. 3837* (MBM, NY).—PARANÁ: Ibaré opp., Morungava praedium, *Dusén 17413* (GH, MO, S); Km 127, Mpio. Laranjeiras do Sul, *Hatschbach 23123* (MBM, MICH).—RIO GRANDE:

DO SUL: BR-101, Km 6, Campo Bonito, ca. 8 km SW de Torres, *Krapovickas & Cristóbal 38484* (CTES, MICH); I. A. S., Pelotas, *Costa Sacco 407* (F, HB, NY).—SANTA CATARINA: Rod. BR-470, Km 354, Mpio. Campos Novos, *Poliqueni 495* (CEPEC, CTES, MBM, UB).—SÃO PAULO: Dist. Rubião Junior, 1–2 km SW da Faculdade de Ciências Médicas e Biológicas de Botucatu, *Gotsberger & Campos 14-301072* (F, MBM, MICH, UB); Jales, Pastos de Retiro, *Hoehne SPF13903* (MBM, RB). **PARAGUAY.** ALTO PARANÁ: Ea. Santa Elena, Pira Pyta, *Schinini & Caballero M. 27152* (G, MICH).—AMAMBAY: 32 km SE de Bella Vista, Ayo. Negla, *Schinini 21495* (F, G, MICH).—CAAGUAZÚ: Colonia Pindo, camino entre Itaquary y Curuguaty, 24°35'S, 55°20'W, *Schinini & Caballero M. 30243* (MICH).—CANENDIYÚ: iter ad Yerbales montium Sierra de Maracayú, in regione fluminis Corrientes, *Hassler 4524* (BM, F, G, GH, K, NY, W).—CONCEPCIÓN: prope Concepción, *Hassler 7572* (BM, G, K, NY).—CORDILLERA: Piribebuy, Colonia Pedro Pablo Caballero, *Rojas 12731* (S, W).—GUAIRÁ: Iturbe, *Montes 12595* (CTES, MICH).—ITAPÚA: Capitán Miranda, 4.2 km N del Hotel Tirol detrás del Barrio CONAVI, *Krapovickas & Cristóbal 44463* (CTES, G, MICH).—MISIONES: 16–17 km S de Santa Rosa, camino a General Delgado, *Arbo et al. 6141* (G, MICH).—REMBUCÚ: San Juan Bautista, *Purvey 390* (CTES, MO).—PARAGUARI: National Park Ybycu'í, NW corner of park along Arroyo Mina, 26°01'S, 56°46'W, *Zardini & Tillería 28962* (MO).—PRESIDENTE HAYES: Primavera, *Woolston 192* (NY, S). **URUGUAY.** PAYSANDÚ: Chapicuy, orillas del Río Uruguay, Sta. Sofía, *Rosengurt B-3278 1/2* (GH, MO, SP).

*Galphimia australis* is a variable species found in southern Brazil, Bolivia, Paraguay, and eastern Argentina and adjacent Uruguay. Traditionally and in accordance with Niedenzu (1914, 1928) it has been called *G. brasiliensis*, but that name applies to a species restricted to eastern Brazil (see discussion of *G. brasiliensis*, no. 15). *Galphimia australis* is sympatric with *G. platyphylla*, which has very broad laminas and larger flowers, and with *G. amabayensis*, which is readily separated by its tomentulose calyx. In general aspect, it is most similar to the North American *G. angustifolia*, which has a pilose ovary and fruit, and lacks calyx glands, but is also characterized by variation in the shape of the lamina. Most populations of *G. australis* have narrow laminas, ranging from linear to linear-lanceolate to lanceolate to narrowly elliptical, which taper toward the apex and are 3–6 (–9) times as long as wide. Occasionally, some laminas on a specimen are only 2.5 times as long as wide, e.g., *Schinini 14017* and *Schinini et al. 23447* from Argentina. Chodat (1892) assigned specimens with very narrow leaves to his forma *angustifolia*, based on *Balansa 2394* from Paraguay. In some populations some of the leaves on a shoot, or sometimes all, are wider than usual and approach the leaf shape found in *G. amabayensis* and *G. platyphylla* (e.g., *Hassler 4524*, *Hatschbach 25071*, *49160*, *Krapovickas 29878*, *Krapovickas & Cristóbal 25195*), but these specimens match *G. australis* in all other aspects.

A variant from Rio Grande do Sul (Brazil), in which the vesture found on young shoots and inflorescence axes is retained, was named by Jussieu (1833) and accepted by Niedenzu (1914, 1928) as *G. brasiliensis* var. *pubescens*. Such exceptional populations with persistent vesture occur occasionally in other parts of the range as well (e.g., Argentina: *Lorentz 563*, Entre Ríos; *Xifreda & Maldonado 381*, Misiones) and do not merit formal recognition.

Vega et al. (2002) reported the presence of articulated laticifers and production of latex in *G. australis* (as *G. brasiliensis*).

- 17. *Galphimia amabayensis*** C. Anderson, Contr. Univ. Michigan Herb. 24: 2. 2005.—TYPE: PARAGUAY. Amambay: 30 km al N del cruce Bellavista y Pedro Juan Caballero, en matorral, 11 Feb 1982, *Fernández Casas & Molero 6190* (holotype: NY!; isotype: MO!). Fig. 22.

Subshrub to 0.6 m high; stems tomentose when young but becoming glabrous in age. Vesture of sessile, crisped or curled, reddish brown hairs 0.3–0.7 mm long, but straight and appressed on the laminas. Laminas of the larger leaves 4.5–6.5 cm long,

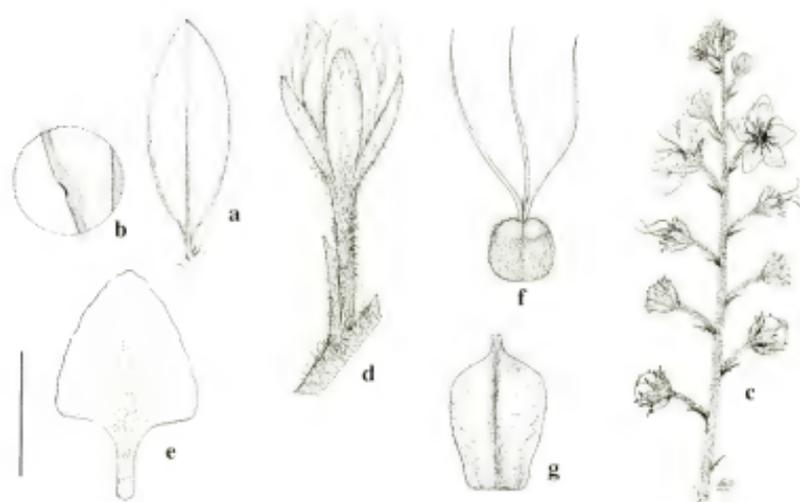


FIG. 22. *Galphimia amambayensis*. a. Leaf. b. Detail of lamina showing marginal gland. c. Portion of inflorescence. d. Opening bud borne on pedicel, with portion of inflorescence axis. e. Petal, abaxial view. f. Gynoceium. g. Coccus, abaxial view. Scale bar: a, 4 cm; b, 8 mm; c, 2 cm; d-g, 4 mm. (Based on Fernández Casas & Molero 6190, NY.)

1.5–2.8 cm wide, elliptical or narrowly so, apex apiculate, base acute, adaxially and abaxially sparsely pubescent when young, mostly glabrous when mature but sometimes with some scattered hairs remaining, secondary veins barely prominulous or not evident; margin entire; petioles 0.3–0.6 cm long, glabrous; glands a pair borne on the margin near the base of the lamina or to 0.6 mm above it, each gland 0.4–0.5 mm in diameter, disklike and flush with the margin; stipules 4–4.5 mm long, 0.7–1 mm wide, linear, pubescent on margin and with scattered hairs abaxially. Inflorescence a terminal raceme, the axes densely tomentose, glabrescent in age; peduncles absent or rudimentary, pedicels 4–6.5 mm long, densely tomentose; bracts 2.5–3.5 mm long, 0.7–0.8 mm wide, linear, bracteoles 1.2–1.5 mm long, ca. 0.5 mm wide, linear, bracts and bracteoles abaxially tomentulose or only along the margin. Sepals 3.5–5 mm long, 1.3–1.5 mm wide, narrowly elliptical, abaxially tomentulose or patchily so in age; glands absent. Petals deciduous, subequal, yellow, becoming red in age, abaxially mostly with scattered hairs on the claw and on the limb adjacent to the midrib, or sometimes glabrous, margin very finely denticulate to subentire; claw ca. 2 mm long, ca. 0.5 mm wide, limb 5–5.5 mm long, 4–4.5 mm wide, broadly triangular, apex obtuse, base gradually acute to subtruncate. Stamens of unequal length; filament opposite anterior sepal 3.5–4 mm long, filaments opposite anterior-lateral petals 4–4.5 mm long, filaments opposite anterior-lateral sepals 3.5–4 mm long, filaments opposite posterior-lateral petals 4.5–5 mm long, filaments opposite posterior-lateral sepals 3.8–4.3 mm long, filament opposite posterior petal 4.8–5.2 mm long; anthers ca. 1.3 mm long. Ovary pilose, in the distal 1/3 only on the sutures and adjacent to them, hairs ca. 0.1 mm long; styles 5.5–6.5 mm long. Coccus ca. 4.5 mm long, ca. 3 mm in diameter, pilose but glabrescent in age; areole ca. 4 mm long, ca. 2.5 mm wide; outer cotyledon 3.2–3.4 mm long, inner cotyledon 2.5–3 mm long. Chromosome number unknown.

*Galphimia amambayensis* is known only from the type collected in eastern Paraguay (Fig. 19). It is readily separated from the other South American species by its densely tomentose inflorescence axes and calyx. Like *G. andustifolia* and *G. brasiliensis*, it has a pilose ovary, but in the distal 1/3 the vestiture is present only on the sutures and adjacent to them. The petals bear scattered hairs abaxially though are sometimes glabrous, but in these instance the hairs may have broken off.

**18. *Galphimia platyphylla*** Chodat, Arch. Sci. Phys. Nat. sér. 3, 24: 500. 1890. *Galphimia brasiliensis* var. *platyphylla* (Chodat) Nied. in Chodat & Hassl., Bull. Herb. Boissier, sér. 2, 7: 294. 1907. *Galphimia brasiliensis* f. *platyphylla* (Chodat) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 5: 22. 1914.—TYPE: PARAGUAY. Caaguazú: dans les campos, Caaguazú, Nov 1874, *Balansa* 2396 (holotype: P!, photo: MICH!; isotype: G!). Fig. 23.

Subshrub to 0.5 m high, from a woody caudex; stems glabrous except for the youngest parts. Vestiture of all vegetative parts of sessile, straight, reddish brown hairs 0.2–0.7 mm long. Laminae of the larger leaves 3–7.5 cm long, (1.5–) 2–4 (–5) cm wide, length/width ratio 1.2–2.3 (–3), elliptical to lanceolate to ovate to broadly ovate, occasionally suborbicular, apex obtuse or acute or sometimes apiculate or emarginate, base acute to truncate, glabrous, secondary veins prominulous or barely so; margin entire; petioles 0.1–0.6 cm long, glabrous; glands usually a pair borne on the margin near the base of the lamina or up to 0.5 cm above it, or sometimes with 1 or 2 additional glands, or sometimes only 1 gland or the glands absent, each gland 0.2–0.5 mm in diameter, flush with the surface or slightly prominent; stipules 2–4 mm long, 0.6–1.2 mm wide, triangular to narrowly so, glabrous or with scattered hairs along the margin. Inflorescence a terminal raceme, the axes with scattered hairs and glabrescent; peduncles absent, pedicels 1.5–8 mm long, 0.7–1 mm wide, glabrous; bracts 1.5–3 mm long, 0.7–1.2 mm wide, triangular, bracteoles 0.7–1.2 mm long, 0.4–0.7 mm wide, triangular, bracts and bracteoles glabrous. Sepals 4–5.7 mm long, 2–2.5 mm wide, elliptical or sometimes oblong, glabrous but with a tuft of hairs at the apex (best seen in bud and early anthesis); glands (0–) 1–5 per calyx, glands 0.3–0.6 mm in diameter. Petals deciduous, subequal, the posterior petal sometimes a little larger, yellow, becoming red in age, glabrous, margin erose-denticulate; claw 2–2.5 mm long, ca. 0.5 mm wide, limb 7–8.5 mm long, (4–) 5–5.5 mm wide, ovate, apex obtuse, base acute or truncate. Stamens of unequal length; filament opposite anterior sepal 3.3–4.5 mm long, filaments opposite anterior-lateral petals 2.7–3.5 mm long, filaments opposite anterior-lateral sepals 3–4 mm long, filaments opposite posterior-lateral petals 2.5–3.3 mm long, filaments opposite posterior-lateral sepals 2.8–3.7 mm long, filament opposite posterior petal 2.5–3.5 mm long; anthers 1–1.2 mm long. Ovary glabrous; styles 4.2–5.3 mm long. Coccus 4–5 mm long, 3–3.7 mm in diameter, glabrous; areole 3–3.5 mm long, 2.5–3 mm wide; mature seed not seen. Chromosome number unknown.

Phenology. Collected in flower and fruit in March and from July through December.

Distribution (Fig. 19). Eastern Paraguay (Amambay, Caaguazú, Canendiyú) and adjacent Brazil (Mato Grosso do Sul); campo, cerrado, campo limpo, open woodlands; 300–400 m.

ADDITIONAL SPECIMENS EXAMINED. **Brazil**. MATO GROSSO DO SUL: Mpio. Camapuã, Capão Redondo, *Hatschbach* 33058 (MBM, NY); Mpio. Ponta Porã, Pacoari, *Hatschbach* 45921 (BR, G, MBM, MICH!); Amambai, rod. p/ Ponta Porã, *Hatschbach* 48498 (MBM, MICH!); Coxim, 5 km S, *Oliveira* 162 (MBM);

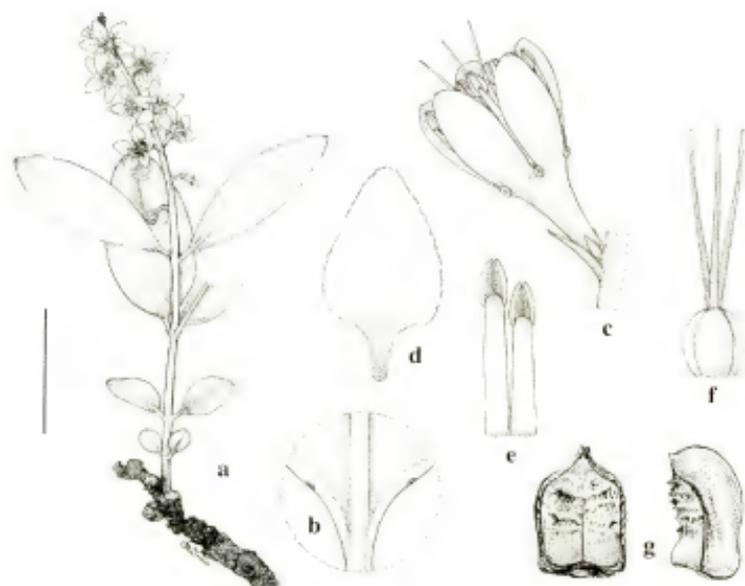


FIG. 23. *Galphimia platyphylla*. a. Habit. b. Base of lamina, showing marginal glands. c. Old flower (the petals fallen) borne on pedicel with portion of inflorescence axis; note calyx glands. d. Petal. e. Stamens, abaxial view, opposite posterior-lateral sepal (left) and posterior petal (right). f. Gynoecium. g. Cocci, adaxial view (left) and lateral view (right). Scale bar: a, 4 cm; b, 8 mm; c, d, 5 mm; e, f, 2.7 mm; g, 4 mm. (Based on: a. c. Hassler 9132, G. d-l. Pedersen 14726, MICH; g. Krapovickas et al. 45943, MICH.)

Mpio. Guía Lopes de Laguna, on rd (BR-267) from Maracajú to Guía Lopes, ca. 12 km W of Ervania, Pedersen 14726 (C, MICH). —**Paraguay**. AMAMBAY: Sierra de Amambay, Hassler 9884 (BM, G, NY, W); alrededores de Pedro Juan Caballero, ruta 5, Krapovickas et al. 45943 (CTES, G, MICH). —CAAGUAZÚ: prope Caaguazú, Hassler 9132 (BM, F, G, GH, K, NY, P, S, W); Ruta 2, Pastoreo, Km A-197, Krapovickas & Crisóbal 13355 (CTES); camino a Itú, 14 km N de Caaguazú, Schinini et al. 28326 (CTES); Cnia. Pindo, camino entre Itaquiry y Curuguatí, Schinini & Caballero M. 30112 (CTES, MICH); near J. E. Estigarribia, Zardini & Guerrero 49141 (MICH). —CANENDIYÚ: in regiones Yerbales de Maracajú, Apepú et Tajairaguay [?], Hassler 4327 (BM, F, G, K, NY, P, W); iter ad Yerbales montium Sierra de Maracajú, in regione fluminis Capibary, Hassler 4393 (BM, G, W); Mbaracajú Natural Reserve, around Aguará-Nú, Zardini & Ramirez B. 51023 (MO). —Depto. unknown: "Alto Piraná," 22-23°S, Fiebrig 6348 (G).

*Galphimia platyphylla* is characterized by thick and broad laminas, which vary from broadly elliptical or broadly lanceolate to broadly ovate or even suborbicular; they are only 1.2–2.3 times as long as wide and often have an obtuse apex. In all other species with rudimentary peduncles usually only 1–3 flowers are open at one time, but in *G. platyphylla* a raceme may bear up to seven open flowers (e.g., Hassler 9132). This species has sometimes been included in *G. australis*, which has linear to lanceolate or narrowly elliptical laminas of thinner texture. Also, the flowers and fruits of *G. platyphylla* are larger, and the plants are apparently shorter (to 0.5 m vs. to ca. 1 m tall) although more robust, i.e., the axes tend to be stouter. Shoots of *G. platyphylla* generally are composed of three to four internodes and have a terminal inflorescence; sometimes lateral shoots develop and these follow the same pattern. *Galphimia platyphylla* is also sympatric with *G. amambayensis*, which is easily distinguished by its tomentose inflorescence axes and calyx.

## GROUP III (petals persistent; peduncles present)

- 19. *Galphimia glauca*** Cav., Icon. 5: 61, pl. 489. May 1799. *Malpighia glauca* (Cav.) Pers., Syn. pl. 1: 506. 1805 [combination also proposed by Poiret in Lamarck, Encycl. Suppl. 4: 7. 1816]. *Thryallis glauca* (Cav.) Kuntze, Rev. gen. pl. 1: 89. 1891.—TYPE: based on plants cultivated at the botanical garden in Madrid in October, 1794; provenance of propagules: “[MEXICO: Guanajuato:] Acambaro et Salvatierra,” *Née s.n.* (holotype: MA-475692, microfiche: MICH!, photo: MO!). Fig. 24.

Shrub to 2 (–3) m tall; stems sericeous when young, soon glabrous. Vesture of all vegetative parts of subsessile, mostly straight or wavy, reddish brown hairs 0.2–0.6 mm long. Laminae of the larger leaves (1.5–) 2–5.6 cm long, (0.7) 1.3–3.5 cm wide, elliptical to lanceolate or ovate, rarely suborbicular, apex apiculate, base acute, glabrous, secondary veins prominulous abaxially; margin entire; petioles 0.4–1.5 cm long, sparsely sericeous to soon glabrous; glands usually a pair borne on the margin well above the base of the lamina, sometimes nearer the base, each gland 0.4–0.7 mm in diameter, disklike and sessile, or sometimes peglike and up to 0.5 mm long, occasionally with additional tiny glands along the margin in the proximal half; stipules (1.4–) 2–3 mm long, 0.5–1 mm wide, linear or narrowly triangular, glabrous, with scattered hairs on the margin. Inflorescence a terminal raceme, the axes densely tomentulose; peduncles 3–7.5 mm long, pedicels (6–) 8–12 mm long, both tomentulose, peduncles 0.3–0.8 (–0.9) times as long as pedicels; bracts 2–3 (–4) mm long, 0.5–0.8 mm wide, linear, bracteoles 1.5–2.5 mm long, 0.4–0.5 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs on the margin; bracteoles borne in the distal 1/5–1/4 of the peduncle, subopposite or up to 1 mm apart. Sepals 3–4 mm long, 1.3–2 mm wide, linear to oblong or elliptical, glabrous or with a few scattered hairs at base abaxially, margin irregularly denticulate-erose-ciliate; glands absent. Petals persistent, unequal, yellow, sometimes marked with red in age, glabrous, margin finely denticulate; lateral petals: claw 1.5–2 mm long, 0.5 mm wide, limb 7.5–9.5 mm long, 5–6.5 mm wide, elliptical to lanceolate, apex obtuse to subacute, base gradually attenuate; posterior petal: claw 2.8–4 mm long, 1.3–1.7 mm wide, limb 7.5–9.5 mm long, 7–8.5 mm wide, broadly triangular, apex rounded, base slightly cordate. Stamens of unequal length; filament opposite anterior sepal 4–6 mm long, filaments opposite anterior-lateral petals 3–5 mm long, filaments opposite anterior-lateral sepals 4–7 mm long, filaments opposite posterior-lateral petals 2.2–4 mm long, filaments opposite posterior-lateral sepals 3.8–5.5 mm long, filament opposite posterior petal 2–3.5 mm long; anthers 2.4–3 mm long. Ovary glabrous; styles 5.5–6.7 mm long. Coccus 2.5 mm long, 2 mm in diameter, glabrous; areole 2 mm long, 1.8 mm wide; outer cotyledon 1.8–2 mm long, inner cotyledon 1.3–1.5 mm long. Chromosome number unknown.

Phenology. Collected in flower from May through November, in fruit from May through January.

Distribution (Fig. 25). Mexico (Aguascalientes, Guanajuato, Hidalgo, Jalisco, Nuevo León, Querétaro, San Luis Potosí, Tamaulipas, Zacatecas); in deciduous forest, pine forest, pine-oak forest, matorral, and at roadsides; 700–2300 m.

REPRESENTATIVE SPECIMENS. **Mexico.** AGUASCALIENTES: Mpio. Calvillo, Los Lobos, 17 km al S de Malpaso, de la Cerda & García R. 885 (ENCB); Mpio. Calvillo, Río Gil, García R. 2705 (IEB); without locality, Hartweg 13 (BM, G, GH, K, L, NY, W).—GUANAJUATO: Dolores Hidalgo, Hernández X. et al. X-2403 (MEXU); 13 km al W de Xichú, sobre la carr. a San Luis de la Paz, Rzedowski 41562 (ENCB, IEB); Mpio. Atarjea, Casas Viejas, 8 km al S de La Joya, Ventura & López 6516 (ENCB, IEB, MEXU, MICH);



FIG. 24. *Galphimia glauca*. a. Flowering branch, with detached leaf to right. b, c. Base of laminae to show marginal glands. d. Opening flower, borne on pedicel and peduncle with portion of inflorescence axis. e. Lateral petal. f. Posterior petal. g. Androecium laid out, abaxial view, the stamens on right opposite posterior petal. h. Gynoceum. i. Coeci, adaxial view (left) and lateral view (right). j. Seed. k. Embryo. Scale bar: a, 4 cm; b, d–f, 8 mm; c, e, g, h, 4 mm; i–k, 2.7 mm. (Based on: a, d–h, Ventura & López 6919, MICH.; b, c, González 970, IEB; i–k, Ventura & López 6516, MICH.)

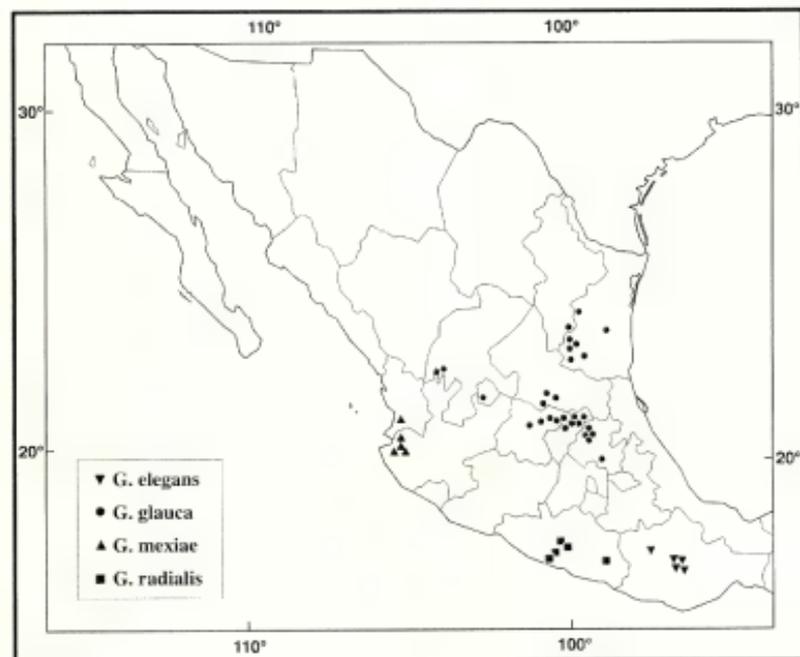


FIG. 25. Distribution of *Galphimia elegans*, *G. glauca*, *G. mexiae*, and *G. radialis*.

Lagunilla, 15 km al N de Victoria, *Ventura & López 6919* (CHAPA, GUADA, IEB, MICH); La Presa, 8 km al N de Doctor Mora, *Ventura & López 7048* (GUADA, IEB, MICH); Mpio. Victoria, Rancho la Luz, *Ventura & López 8481* (IEB, MICH, XAL).—HIDALGO: 2.3 mi NE of Zimapán, Mex. Hwy 85, *Anderson & Laskowski 4027* (DUKE, ENCB, GH, MICH, NY, US); Mpio. Jacala, *Chase 7281* (F, GH, MICH, MO); S of Pachuca, *Clark 7361* (MO, NY); Mpio. Zimapán, 3 km al NE de Zimapán, carr. a Jacala, *García P. 1039* (CAS, CHAPA, ENCB, GUADA, IBUG, LL, MEXU, MICH, TEX, XAL); 40 mi NNW of Ixmiquilpan, *Hitchcock & Stanford 7004* (DS, GH, NY, UC, US); Mpio. Ixmiquilpan, barranca de Tolanongo, 40 km al NE de Ixmiquilpan, *Tenorio 513* (ENCB, UAMIZ, XAL).—JALISCO: descent from Mesa de Cristo to Huejauquilla el Alto, 18 mi by rd SW of Valparaiso, *Anderson & Laskowski 3617* (DUKE, ENCB, GH, MICH, US); Salcillo, *Jones 29* (US).—NUEVO LEÓN: Mpio. Zaragoza, Potreritos, *Hinton et al. 24313* (MEXU, NY, TEX); near El Caracol, 3 mi NE of Dulces Nombres, 24°N, 99°30'–100°30'W, *Meyer & Rogers 2532* (BM, BR, G, GH, MO).—QUERÉTARO: along Hwy 120 between Cadereyta and Vizarrón, 3.5 mi S of Vizarrón, 20°50'N, 99°45'W, *Daniel 378* (CAS, CHAPA, MICH); 6.5 mi W of Colón, *Denton 1996* (ENCB, MICH, UC); Vizarrón, *Zamudio R. 2318* (GUADA, IEB, MICH, MO, TEX); Mpio. Jalpan, 4–5 km al S de La Parada, *Servín 268* (IEB, MICH); Mpio. Landa, Puerto del Malpaís, 3.5 km al NW de El Madroño, *González 970* (IEB); Mpio. Peñamiller, Magüey Verde 17 km al SE de Pinal de Amoles, carr. Pinal de Amoles–Peñamiller, *Tenorio L. 2337* (MEXU, MO); Mpio. Pinal de Amoles, 1 km al NE de El Llano, *Carranza 679* (ENCB, IBUG, IEB, MEXU); Mpio. Tolimán, Rancho Magüey Manso, *Zamudio R. 2203* (IEB).—SAN LUIS POTOSÍ: Km 53, near Las Rusias, ca. 4 mi E of San Francisco, 22°04'N, 100°33'W, *Moran 6339* (MEXU, SD); Km 54 carr. San Luis Potosí–Ríoverde, *Rzedowski 8057* (ENCB, MEXU, MICH, TEX).—TAMAULIPAS: arroyo along Hwy 101, 0.2 mi N of La Presita, 23°15'N, 99°40'W, *Daniel 286* (CAS, ENCB, MICH); Mpio. Jaumave, Alvarez y Urbina, 29 km al N de Magdalena Aguilar (Santiaqui), *González M. 9731* (MEXU, MICH); Mpio. Bustamente, camino de Felipe Angeles al Ojo de Agua San José, *Hernández 1608* (ENCB, MO, TEX); Mpio. Hidalgo, Los Caballos–Potreritos, *Hinton et al. 24875* (TEX); Mpio. Tula, La Presita, Km 66 carr. Tula–Victoria, *Martínez 1224* (ENCB, MEXU, MO); Mpio. Villa de Casas, rd from Rancho “Las Yucas” to Santa María de los Nogales, *Martínez M. & Borja*

*L. F-1972* (TEX); Mpio. Gómez Farías, camino de Julio a Joya de Salas, *Puig 7173* (ENCB); 6 km W of Miquihuana, 23°42'N, 99°45'W, *Stanford et al. 721* (DS, GH, MO, NY); 3 km N of Huisachal, 30 km from Victoria, *Stanford et al. 2031* (DS, G, UC, US).—ZACATECAS: ridge 2 mi N of Potrero de las Yeguas, 13 mi S of Valparaíso, *McVaugh 17773* (ENCB, MICH).

*Galphimia glauca* is a shrub or suffrutescent herb of northeastern and central Mexico. The flowers are arranged in racemes terminating branches bearing rather small leaves with elliptical to ovate laminas. The leaf glands are borne on the margin of the lamina well above the base (Fig. 24a–c); the glands vary from flush with the margin to prominent or sometimes peglike. The posterior petal has a broadly triangular limb that contrasts with the elliptical to lanceolate limb of the lateral petals. The cocci are the smallest in the genus, only ca. 2.5 mm long and ca. 2 mm in diameter.

The name *Galphimia glauca* has been widely and indiscriminately applied to all Mexican species of *Galphimia* with persistent petals, as well as to some species with deciduous petals, in part because the early introductions of *Galphimia* to horticulture were all so labeled and then widely distributed; for example, Maund's (1837) account and illustration of "*G. glauca*" applies to *G. gracilis*, and Bartling's (1840) treatment of "*G. glauca*" applies to *G. multicaulis*. Most notably the commonly cultivated *G. gracilis*, which has deciduous petals, continues to be identified erroneously as *G. glauca* in the nursery trade and in botanical gardens. Images of "*G. glauca*" in horticultural publications and on websites are almost always of *G. gracilis*. That species is native to eastern Mexico and is partly sympatric with *G. glauca*, from which it differs in addition to the petal characters in its large cocci (4.5–5 mm long), bracteoles placed at or just below the apex of the peduncle, and hairs often borne on tubercles.

The Cavanilles Herbarium, housed at MA, has two sheets of *G. glauca*, MA 475691 and MA 475692. As noted by Garilleti (1993), the sheet annotated by Cavanilles (MA 475692) is the holotype; the other sheet (MA 475691) should not be considered type material.

**20. *Galphimia elegans*** Baillon, Hist. pl. 5: 431, figs. 429–435. 1874.—TYPE: specimen taken from plants cultivated at the Jardin des Plantes in Paris (holotype: P!, photo: MICH!).

*Galphimia hirsuta* f. *virescens* K. Koch, Berliner Allg. Gartenzeitung 1857(50): 394, t. 9. 1857.—TYPE: based on a living plant cultivated at the botanical garden in Berlin; lectotype, here designated; the illustration in the protologue.

Fig. 26.

Shrub to 3 (–5) m; stems strigose when young, soon becoming glabrous. Vesture of all vegetative parts of subsessile, crisped, reddish brown hairs (0.1–) 0.2–0.8 mm long. Laminas of the larger leaves 3.5–6 cm long, 1.5–3.5 cm wide, narrowly elliptical to lanceolate to ovate to rhombic, apex acute or apiculate, base acute, adaxially sparsely tomentulose to glabrescent in age, abaxially tomentulose, becoming patchily to sparsely tomentulose, eventually glabrescent, secondary veins prominent abaxially; margin entire; petioles 0.8–2 cm long, tomentulose to glabrescent; glands usually a pair placed adjacent or up to 2 mm apart at the middle of petiole or sometimes near the apex of petiole (especially in small/young leaves), sometimes with only 1 gland or the glands absent, each gland 0.4–1.2 mm in diameter, disklike and very prominent, or peglike and up to 1.5 mm long; stipules 1.5–2 mm long, 0.7–1.2 mm wide, linear or narrowly triangular, glabrous. Inflorescence a terminal raceme or sometimes a small panicle, the axes tomentose but patchily so in age; peduncles 3.5–6 (–8) mm long, pedicels 7–10.5 mm long, both tomentulose, peduncles 0.3–0.7 (–1) times as long as

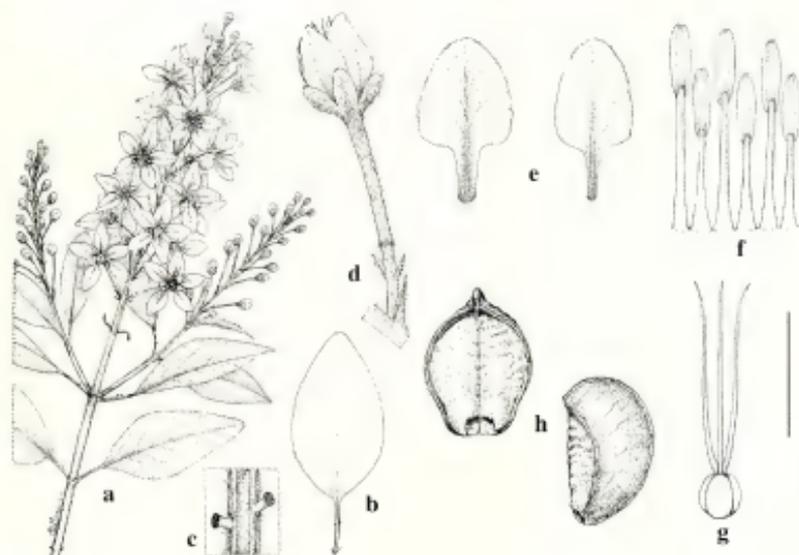


FIG. 26. *Galphimia elegans*. a. Flowering branch. b. Large leaf. c. Detail of petiole to show glands. d. Opening flower, borne on pedicel and peduncle with portion of inflorescence axis. e. Petals, lateral (right) and posterior (left). f. Partial androecium laid out, abaxial view, the stamen on right opposite posterior petal. g. Gynoecium. h. Cocci, adaxial view (left) and lateral view (right). Scale bar: a, b, 4 cm; c, f, g, 4 mm; d, e, 8 mm; h, 2.7 mm. (Based on: a, c–g, *Lorence 4734*, MEXU; b, *Conzatti 2283*, MEXU; h, *Saynes V. 29*, ENCB.)

pedicels; bracts 1.5–3 mm long, 0.4–0.8 mm wide, linear, bracteoles 1–1.7 mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles tomentulose abaxially; bracteoles borne at middle of the peduncle, subopposite. Sepals 3–3.5 mm long, 1.5–2 mm wide, oblong or elliptical, with scattered hairs, margin irregularly denticulate and distally ciliate; glands absent. Petals persistent, unequal, yellow, glabrous, margin denticulate; lateral petals: claw 1.8–3 mm long, 0.5 mm wide, limb 7–9 mm long, 4.5–5.2 mm wide, lanceolate, apex obtuse, base acute; posterior petal: claw 2–3.5 mm long, ca. 1 mm wide, limb 7–9 mm long, 5–6 mm wide, broadly ovate, apex obtuse to rounded, base truncate or slightly cordate. Stamens of unequal length; filament opposite anterior sepal 5–5.8 mm long, filaments opposite anterior-lateral petals 4–4.3 mm long, filaments opposite anterior-lateral sepals 4.5–4.7 mm long, filaments opposite posterior-lateral petals 3–3.5 mm long, filaments opposite posterior-lateral sepals 5–5.5 mm long, filament opposite posterior petal 3–3.2 mm long; anthers 1.8–2 mm long. Ovary glabrous; styles 6.2–7 mm long. Coccus ca. 3 mm long, ca. 2.5 mm in diameter, smooth, glabrous; areole ca. 2.7 mm long, ca. 2.2 mm wide; mature seed not seen. Chromosome number unknown.

**Phenology.** Collected in flower and fruit from July through November.

**Distribution** (Fig. 25). Mexico (Oaxaca); matorral, pine-oak forest, deciduous forest; 1740–2200 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Mexico.** OAXACA: 1.5 km N of Ixtlán de Juárez, junction on rd to Valle Nacional, *Breedlove 60033* (CAS); cercanías de Oaxaca, *Conzatti 1373* (US); Cerro San Felipe, Dfco. Centro, *Conzatti 2283* (F, GH, MEXU); without locality, 1859, *Cuming s.n.* (G, P); along road to

Microondas Nuevas Puntas, 7.7 mi SE jct. rd to Mitla along Hwy 190, *Daniel 1271* (MICH); without locality, 1842, *Franco s.n.* (G); Yavezia, Sep 1844, *Galeotti 4335* (BR, G, K, MEXU, P, W); Yodonocuito, 5 km al E de Teposcolula, Dto. Teposcolula Mixteca Alta, *García M. 1044* (ENCB, MEXU, MO); without locality, *Karwinski s.n.* (G); Mpio. Ixtlán, Sierra de Juárez, Ruta 175 a 0.5 km al N de Ixtlán, *Lawrence 4734* (MEXU, MICH); Playa de Río Calebra, Macuiltianguis, *Lucero L-92* (ENCB, MEXU, XAL); Monte Albán, near Oaxaca, *Pringle 4873* (A, BM, BR, G, GH, GOET, MEL, MEXU, MO, NY, S, UC, US, W); Mpio. Oaxaca, Cerro de San Felipe del Aguan, *Saynes V. 29* (CHAPA, ENCB, GUADA, IEB, MEXU, MO); Mpio. Oaxaca, Cerro de Donaji, *Saynes V. 852* (IEB, NY, XAL); Jayacatlán, *Smith 83* (GH); Sierra de San Felipe, *Smith 647* (NY); Monte Albán, near Oaxaca, *Smith 648* (MO, NY, UC, US).

*Galphimia elegans* is the only species with persistent petals that has pubescent leaves. Young leaves and those near the inflorescence are abaxially sparsely to abundantly tomentulose; the vesture is composed of reddish hairs, which commonly are sloughed off eventually in age. In larger leaves the glands are borne at about the middle of the petiole and are very prominent or peglike (Fig. 26c); on very short petioles the glands are close to the apex. *Galphimia elegans* is also distinctive in its short anthers (1.8–2 mm long) and distally ciliate sepals. The species is endemic to Oaxaca and sympatric with the variable *G. speciosa* and *G. multicaulis*, which have always glabrous leaves with marginal glands as well as larger anthers (2.2–3 mm long). In addition, the leaves of *G. multicaulis* have rudimentary to very short petioles [0.3–0.8 (–1) mm long].

Although Baillon described *G. elegans* in 1874, the identity of this species and its distinctness have gone mostly unrecognized. The name *G. elegans* was overlooked and is not listed in Index Kewensis and the Gray Index; yet, Baillon's brief description and illustrations fulfill the requirement for valid publication, and there is a holotype at P. The species was introduced to botanical gardens in the 19th century with the name "*G. glauca*," and collections are still commonly so misdetermined. Earlier botanists who noted the presence of leaf vesture misapplied the name *G. hirsuta* to garden plants and herbarium specimens of *G. elegans* (e.g., Bartling 1840; Neumann 1847). Jussieu (1843) cited *Galeotti 4335*, a collection of *G. elegans* with widely distributed duplicates, as an example of *G. hirsuta*, which helped to perpetuate the error (e.g., Koch 1857; Rose 1909; Niedenzu 1914, 1928). Occasionally specimens of *G. elegans* in botanical gardens and in the horticultural trade were also labeled "*Galphimia mollis*"; the name *Galphimia mollis* H. B. K. is a synonym of *Tetrapterys cotoneaster* A. DC. Juss.

**21. *Galphimia speciosa*** C. Anderson, sp. nov.—TYPE: MEXICO, Chiapas: 2.5 km NW of Comitán on rd to San Cristóbal de las Casas, brushy cut-over roadside, 1820 m, 27 Oct 1988, *Anderson 13555* (holotype: MICH!; isotypes: CHAPA! DUKE! IEB! BM! MO! NY!). Fig. 27.

Frutex vel arbor parva. Laminae foliorum majorum 2.5–7 cm longae, 1.5–4 cm latae, ellipticae vel lanceolatae vel ovatae, glabrae, margine integra, glandulis 0.5–1.5 mm diametro, sessilibus vel pedicellatis; petioli 0.8–2.5 cm longi. Inflorescentia racemosa, axibus tomentulosis vel sparse tomentulosis. Petala persistentia; petala lateralia ungue (1.6–) 2–2.5 mm longo, limbo 7–9 (–10) mm longo, 5–6 (–7) mm lato, oblongo vel ovato; petalum posticum ungue 2.5–3.5 mm longo, limbo 7–8 (–9.5) mm longo, 6–7.8 mm lato, triangulari vel suborbiculari. Antherae 2.3–2.5 (–3) mm longae. Ovarium glabrum; styli 5.5–6 mm longi. Coccus 3.5–4 mm longus, glaber.

Shrub or sometimes a treelet to 3 (–6) m tall; stems strigose to tomentulose when young, soon glabrescent to glabrous. Vesture of all vegetative parts of subsessile, mostly straight or wavy, reddish brown hairs 0.2–0.6 (–0.8) mm long. Laminas of the larger

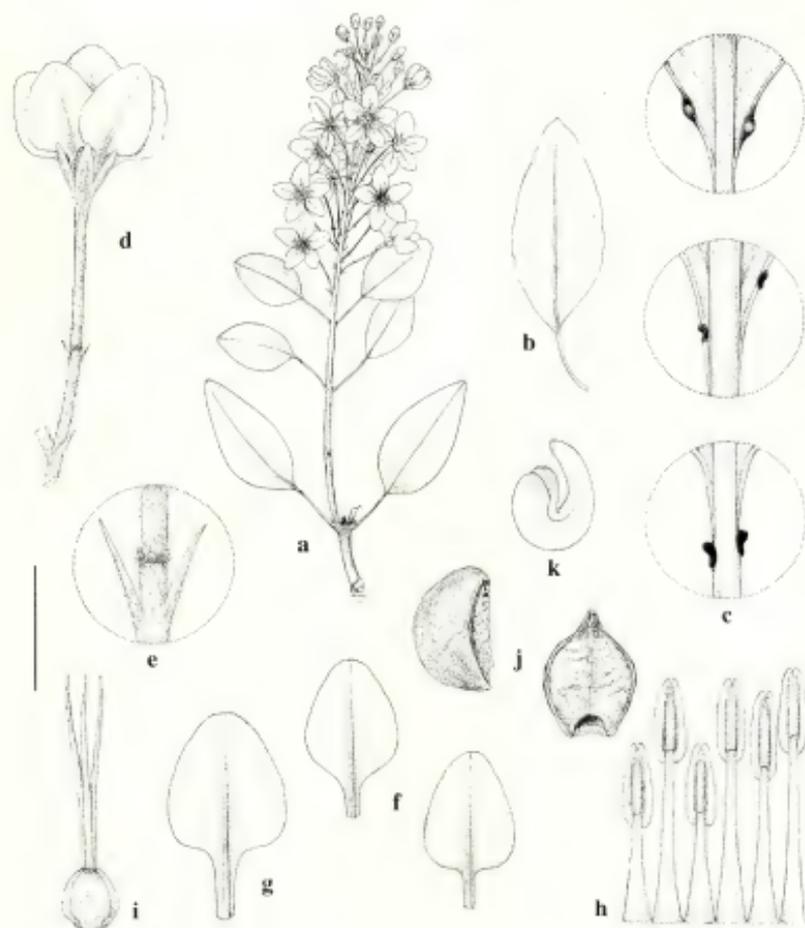


FIG. 27. *Galphimia speciosa*. a. Flowering branch. b. Detached large leaf. c. Variation in position of glands on petiole and base of lamina. d. Flower subtended by pedicel and peduncle with portion of inflorescence axis. e. Pedicel-peduncle joint with bracteoles on peduncle. f. Lateral petals. g. Posterior petal. h. Partial androecium laid out, abaxial view, the stamen on left opposite posterior petal. i. Gynoecium. j. Cocci, lateral view (left) and adaxial view (right). k. Embryo. Scale bar: a, b, 4 cm; c, h-j, 4 mm; d, 1 cm; e, 2 mm; f, g, 8 mm; k, 2.7 mm. (Based on: a-i, *Anderson 13555*, MICH; j, k, *Prigge 3237*, MICH.)

leaves 2.5–7 cm long, 1.5–4 cm wide, elliptical to lanceolate or ovate, rarely suborbicular, apex acute to apiculate, base acute, glabrous, secondary veins prominent abaxially; margin entire; petioles 0.8–2.5 cm long, with scattered hairs or glabrous; glands usually a pair borne at the base of the lamina or at the apex of the petiole or on decurrent laminar tissue in the distal 1/3–1/2 of the petiole, sometimes with only 1 gland or the glands absent, each gland 0.3–0.8 mm in diameter, disklike and prominent, or sometimes peglike and up to 0.5 mm long; stipules 1.5–2.5 (–3) mm long, 0.5–1 mm wide, linear or narrowly triangular, with scattered hairs along the margin.

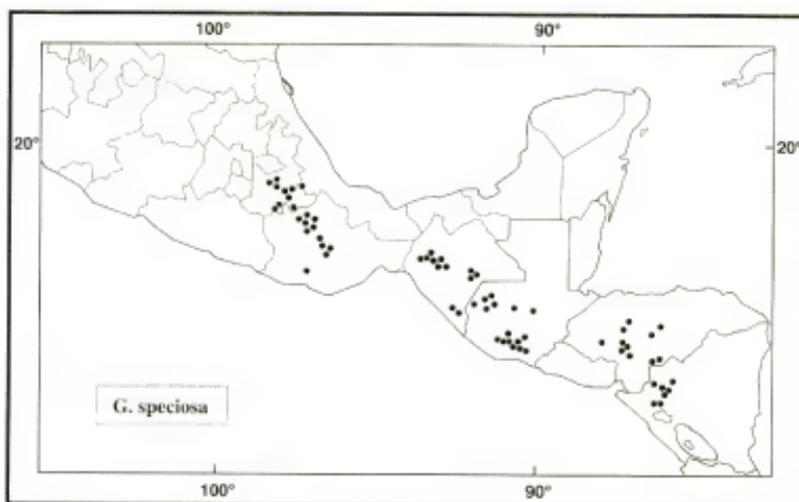


FIG. 28. Distribution of *Galphimia speciosa*.

Inflorescence a terminal raceme, in vigorous plants 3 racemes sometimes aggregated in a leafy ternate panicle, the axes tomentulose, sparsely so in age; peduncles (2.5–) 3–6 (–7.5) mm long, pedicels (6.5–) 8–13 mm long, both tomentulose, peduncles 0.2–0.5 times as long as pedicels; bracts 1.5–2.8 mm long, 0.4–0.8 mm wide, linear to narrowly triangular, bracteoles 1–2 (–2.5) mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs along the margin; bracteoles borne at the apex of the peduncle or in the distal 1/4–1/2, subopposite or up to 0.5 mm apart. Sepals 2.5–3.8 mm long, 1.5–2 mm wide, oblong, glabrous, margin irregularly denticulate-erose and often distally ciliate; glands absent. Petals persistent, unequal, yellow and often marked with red especially on the claw and midrib, glabrous, margin finely denticulate to subentire; lateral petals: claw (1.6–) 2–2.5 mm long, 0.5 mm wide, limb 7–9 (–10) mm long, 5–6 (–7) mm wide, oblong or ovate, apex broadly rounded, base truncate or very briefly acute; posterior petal: claw 2.5–3.5 mm long, 1–1.2 mm wide, limb 7–8 (–9.5) mm long, 6–7.8 mm wide, broadly triangular to suborbicular, apex broadly rounded, base truncate. Stamens of unequal length; filament opposite anterior sepal 4–5.5 mm long, filaments opposite anterior-lateral petals 3–4.5 mm long, filaments opposite anterior-lateral sepals 3.8–5.3 mm long, filaments opposite posterior-lateral petals 2.2–3 (–4) mm long, filaments opposite posterior-lateral sepals 3.5–5 mm long, filament opposite posterior petal 2.2–3 (–4) mm long; anthers 2.3–2.5 (–3) mm long. Ovary glabrous; styles 5.5–6 mm long. Coccus 3.5–4 mm long, 2.7–3 mm in diameter, glabrous; areole 2.5–3 mm long, 2.3–2.8 mm wide; outer cotyledon 3.2–3.5 mm long, inner cotyledon 1.5–1 mm long. Chromosome number:  $n=6$  (Kyhos 1966; W. R. Anderson 1993; both as "*G. glauca*").

Phenology. Collected in flower and fruit throughout the year but most commonly from June through December.

Distribution (Fig. 28). Southern Mexico (southern Puebla and adjacent Veracruz, Oaxaca, Chiapas) and Central America (Guatemala, Honduras, Nicaragua); in subtropical deciduous forest, pine-oak forest, matorral, and at roadsides; (110–) 800–2400 m.

**REPRESENTATIVE SPECIMENS.** **Mexico.** CHIAPAS: 8.7–9.0 mi N of Tuxtla Gutiérrez on rd to Sumidero, *Anderson 4229* (DUKE, ENCB, GH, MICH, MO, NY, US); 5 km N of Soyolá, rd to Bochil, *Breedlove 21324* (CHAPA, DS, F, LL, MEXU, MICH, MO, NY); Mpio. Tototapa, 6–8 km W of Teopisca on side of Cerro Chenek 'ultik, *Breedlove 27081* (CHAPA, DS, MEXU, MICH, MO); Mpio. Berriozábal, 1.3–2.6 km N of Berriozábal toward La Cabaña, 16°48'N, 93°17'W, *Daniel 8369* (MICH); Mpio. Escuintla, Mi. Ovando, *Matuda 16240* (MEXU, MICH, MO, US); Mpio. Escuintla, Buenavista, *Matuda 1878* (DS, F, GH, MEXU, MICH, NY, US); Miramar, *Matuda 395* (LL, MEXU, MICH, US).—OAXACA: 97 km S of Teotitlán on rd to Oaxaca, *Anderson 12991* (CAS, DUKE, IEB, MBM, MEXU, MICH, MO, NY); 20 km SE of Mitla, *Conrad 3044* (GH, MO, SC, XAL); 1 km al S de Magdalena Jicotlán, Dto. Coixtlahuaca, *García M. 1923* (F, MEXU, MICH, MO, UAMIZ, XAL); 2 km W of Tutla on rd to Tamazulapan along Pan-American Hwy, Km 382, *Itlis 1333* (F, K, MEXU, MICH, SP, US, WIS); near Tamazulapan, *Nelson 1957* (GH, US); Cerro Solo, ca. 7 km NE of Tepelmeme de Morelos, *Prigge 3237* (ENCB, MEXU, MICH); Mpio. Albarradas, 4 km al NE de San Bartolo Albarradas, camino a Zacatepec, *Rzedowski 37038* (ENCB, IEB, MEXU); 5 km al NE de Teotongo, por la terracería a Tepelmeme, 17°46'N, 97°30'W, *Salinas T. F. 3507* (CHAPA, F, MEXU, MO); 2 km al N de Cayotepeji, carretera a Tehuacán, 17°57'N, 97°41'W, *Salinas T. F. 3720* (IEB, MEXU, WIS); Mpio. Concepción Buenavista, Cerro La Culebra, al SW de El Encero, *Tenorio L. 7143* (MEXU, MO, TEX).—PUEBLA: Santiago Miahuatlán, 18°50'N, *Cházaro B. 652* (MEXU, XAL); ca. 12 km NE de Tehuacán, por la carr. a Esperanza, *Chiang F-270* (CHAPA, IEB, MEXU, MO); vicinity of San Luis Tultitlanapa, Sierra de Mixteca, *Purpus 2733* (BM, F, G, GH, MO, NY, UC, US); Mpio. Caltepec, La Laguna, faldas del Cerro El Gavilán, 2 km al E de Caltepec, 18°10'N, 93°38'E, *Salinas F. 3452* (F, IEB, MEXU, MICH, WIS); 2.5–3.5 mi NW of Coaleapan, 18°34'N, 97°40'W, *Webster 17239* (DUKE, GH, MEXU, MICH, MO).—VERACRUZ: Acultzingo, Güilupa, *Ventura A. 15419* (ENCB, IEB, MEXU, MO, XAL).

**Guatemala.** ALTA VERAPAZ: Rd to San Juan Chamelco, *Molina R. 12285* (F, LL, NY, US).—CHIMALTENANGO: rd from Chimaltenango to San Martín Jilotepeque, *Standley 57864* (A, ECON, F, MICH, NY, US).—HUEHUETENANGO: entre Naranjales y Boquerón, carretera hacia La Mesilla, *Castillo 1373* (MICH, NY); San Miguel Acatán, *Skutch 999* (A, BM, F, G, NY, US); Canyon of Río Seligua, 40 km NW of Huehuetenango, *Williams 41147* (BM, F, NY, US).—GUATEMALA: Amatitlán, *Ruano 834* (US).—QUICHÉ: San Miguel Uspantán, *Heyde 3272* (US).—SACATEPÉQUEZ: Volcán Acatenango, *Smith 2548* (GH, US); near Pastores, *Standley 59913* (F); along Río Guacalate, rd between Antigua and Chimaltenango, *Standley 80988* (F, US).—SANTA ROSA: Barberena, *Heyde 3704* (G, GH, MICH, NY, US).—SOLOLA: above Panajachel, Lake Atitlán, *Hunnell 14708* (GH, MICH); slopes above Lake Atitlán, 3–5 km W of Panajachel, *Williams 25260* (F, GH, NY, US, WIS). **Honduras.** COMAYAGUA: Km 128 Tegucigalpa–Siguatepéque hwy, *Edwards P-511* (A, F, S, UC, US); entre Las Lajas y Yure, 90 km NW de Comayagua, *Nelson 6054* (MEXU, MO, TEFH).—EL PARAIISO: Hac. San Isidro betw. Quebrada El Pescadero and El Paraiso, *Molina R. 18786* (F, NY); Danlí, *Valerio R. 1989* (F).—FRANCISCO MORAZÁN: rd to Agalteca, *Molina R. 18715* (F, GH, NY); Valle de Amarateca, 32 km N de Tegucigalpa, *Navarro O. 58* (TEFH, MO).—OLANCHO: Río Juticalpa, 6 km de Juticalpa, *Molina R. 13225* (F, LL, NY, US); Montaña Uval, carretera a San Francisco La Paz, *Molina R. 13327* (F, LL, NY).—YORO: Yoro, *Edwards P-738* (A, F, MO, NY, US); Victoria, orilla del Río Sulaco, *Nelson 7013* (MICH, MO, TEFH). **Nicaragua.** ESTELI: Esteli River, 5 km from Esteli, *Molina R. 23031* (NY); SW de Santa Cruz, 1 km de Carretera Panamericana, 13°00'N, 86°18'W, *Moreno 5564* (MICH, MO); San José de Laguna, 13°29'N, 86°21'W, *Moreno 8089* (MICH, MO); along new rd from Hwy 1 (at ca. Km 135.5 and ca. 10.6 km W of bridge at La Trinidad) to San Nicolás, ca. 8.0 km from Hwy 1, *Stevens 10243* (CAS, MEXU, MICH, MO); Llano Almaciguera, 8.4 km S of Hwy 1, just S of Esteli, rd through Estanzuela 2.8 km S of Río Estanzuela bridge, 13°00'N, 86°21'W, *Stevens 10753* (DUKE, ENCB, MICH, MO, TEX); mountains near Esteli, *Williams 10959* (A, F, MICH, UC, US); Río Estanzuela, 8 km SW of Esteli, *Williams 20185* (F, NY, US).—JINOTEGA: camino viejo Matagalpa–Jinotega, ca. 6 km al NO de ciudad Matagalpa, *Grijalva 4027* (MO); ca. 20.3 km NE of Hwy 1 at Esteli on rd to Yalí, 13°13'N, 86°15'W, *Stevens 15775* (MICH, MO).—LEÓN: camino a San Nicolás, La Guayaba, a 11 km de la Carretera Panamericana, 12°57'N, 86°21'W, *Moreno 17790* (MICH).

*Galphimia speciosa* is widespread and highly variable; future studies may reveal evidence to support recognition of varieties. The shrubs and treelets occur from southern Mexico to northern Nicaragua, but *G. speciosa* has not been recorded from El Salvador. The leaves usually bear the glands on the margin of the lamina near the base or at the apex of the petiole, but the position is variable even on the same shoot. The limb of the all petals is usually triangular, broadly so in the posterior petal, and has a rounded apex, but sometimes the limb of the lateral petals is broadly elliptical to ovate. The only other species with persistent petals occurring within the range of

*G. speciosa* are *G. elegans*, with distal leaves abaxially pubescent, leaf glands borne near the middle of the petiole, and smaller anthers (1.8–2 mm long), and *G. multicaulis*, with rudimentary to very short petioles (even in the largest leaves less than 1 cm long).

- 22. *Galphimia multicaulis*** ADR. JUSS., ANN. SCI. NAT. BOT., sér. 2, 13: 327. 1840. *Thryallis multicaulis* (ADR. JUSS.) KUNTZE, REV. GEN. PL. 1: 89. 1891.—TYPE: MEXICO, Oaxaca: "juxta Huauapan," *Andrieux 496* (holotype: K!; isotypes: G! K! M, P! P-JU, microfiche!; photo of P and P-JU isotype: MICH!; photos of M isotype: F! GH! MICH! MO!).

Fig. 29.

Small multi-branched shrub to 1.5 m tall; stems pubescent when young, soon glabrous. Vesture of all vegetative parts of subsessile, crisped, reddish brown hairs 0.2–0.6 mm long. Laminae of the larger leaves 4–8.5 cm long, 2–5.2 cm wide, elliptical to lanceolate or ovate, apex apiculate, base acute, glabrous, secondary veins commonly prominent abaxially; margin entire; petioles 0.3–0.8 (–1) cm long, with scattered hairs abaxially to glabrous; glands borne on the margin near the base of the lamina (to ca. 4 mm above the base) or sometimes at the base, usually a pair but sometimes with an additional gland, or sometimes only 1 gland or the glands absent, each gland 0.3–1 mm in diameter, disklike and prominent, or peglike and up to 1 mm long, sometimes the laminar tissue extended into a tooth; stipules 2–5 mm long, 0.7–1.8 mm wide, triangular, glabrous. Inflorescence a dense terminal raceme, in larger plants the racemes ternate or grouped in a small panicle, the axes tomentulose, glabrescent in age; peduncles 1.5–6.5 mm long, pedicels 3.5–13 mm long, both tomentulose, peduncles 0.1–1.8 times as long as pedicels; bracts 2.2–4.5 mm long, 0.5–1 mm wide, linear, bracteoles 1.5–3 mm long, 0.3–0.7 mm wide, linear, bracts and bracteoles glabrous or with scattered hairs along the margin; bracteoles borne in the proximal 1/4–2/3 of the peduncle, subopposite or up to 1 mm apart. Sepals 2.5–3.8 mm long, 1.4–1.8 mm wide, oblong to elliptical, glabrous, margin entire or finely erose; glands absent. Petals persistent, unequal, yellow, glabrous, margin entire or finely and irregularly denticulate; lateral petals: claw 1.5–2 mm long, 0.5 mm wide, limb 7.5–10 mm long, 4.5–5.2 mm wide, narrowly ovate to narrowly elliptical, apex subacute, base subtruncate or subacute; posterior petal: claw 2–3.5 mm long, 1.2–1.3 mm wide, limb 8–10.5 mm long, 6–7 mm wide, triangular or sometimes ovate, apex obtuse, base truncate or shallowly cordate. Stamens of unequal length; filament opposite anterior sepal 4–5.5 mm long, filaments opposite anterior-lateral petals (3–) 4–5 mm long, filaments opposite anterior-lateral sepals (3.7–) 4–5 mm long, filaments opposite posterior-lateral petals (2.5–) 3.2–4 mm long, filaments opposite posterior-lateral sepals (3.7–) 4.3–5 mm long, filament opposite posterior petal 2.5–3.5 mm long; anthers 2.2–3 mm long. Ovary glabrous; styles 5–6.5 mm long. Coccus ca. 3 mm long, 2–2.6 mm in diameter, glabrous; areole 3 mm long, 2 mm wide; outer cotyledon ca. 2.5 mm long, inner cotyledon ca. 2.3 mm long. Chromosome number unknown.

Phenology. Collected in flower from August through December, in fruit from September through November, in Oaxaca also in flower in June and in bud in May.

Distribution (Fig. 30). Mexico (Guanajuato, Jalisco, Michoacán and adjacent México, disjunct to Oaxaca); pine-oak forest and matorral; 1450–2350 m.

REPRESENTATIVE SPECIMENS. **Mexico**. GUANAJUATO: Mpio. Victoria, Malinto, *Badillo 3* (MICH); Montes de Obrajuco, 12 Oct 1913, *Salazar s.n.* (MEXU, US).—JALISCO: Mpio. Zapotlán del Rey, Cerro de Santa Fé, *Chalzo B. 503?* (CHAPA, ENCB, IBUG, IEB, XAL); Mpio. Ciudad Guzmán, 20 km al NW de Cd. Guzmán, brecha a Yerbalito, *Fuentes O. 827* (CHAPA, IEB, MICH); Mpio. Jocotepec, Cerro Viejo, vereda a

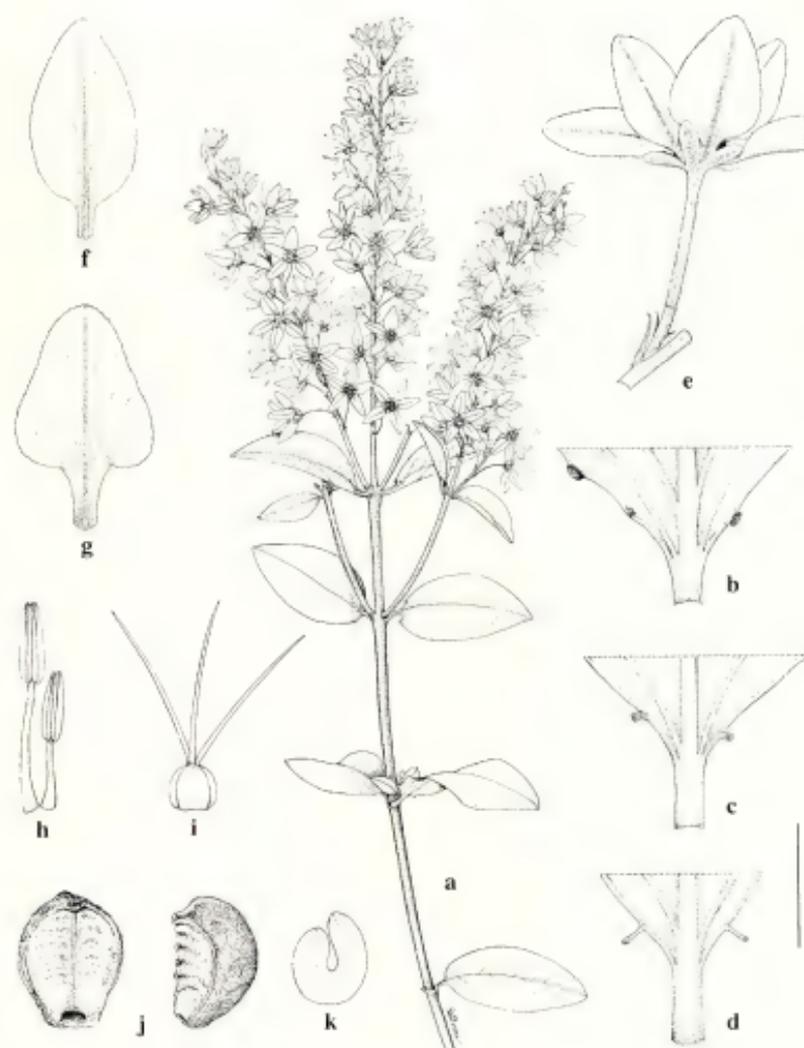


FIG. 29. *Galphimia multicaulis*. a. Flowering branch. b-d. Leaf bases, abaxial view, to show variation in glands. e. Flower borne on pedicel and peduncle, with portion of inflorescence axis. f. Lateral petal. g. Posterior petal. h. Stamens, adaxial view, stamen at right opposite posterior petal, stamen at left opposite posterior-lateral sepal. i. Gynoecium. j. Cocci, adaxial view (left) and lateral view (right). k. Embryo. Scale bar: a, 4 cm; b-e, 8 mm; f, g, 5 mm; h, i, 4 mm; j, k, 2.7 mm. (Based on: a, Jones 40975, MO; b, Díaz & Barriga 4760, MICH; c, Machuca N. 4412, XAL; d, e, j, k, King & Soderstrom 4671, MICH; f-i, Cházaro B. 5033, CHAPA.)

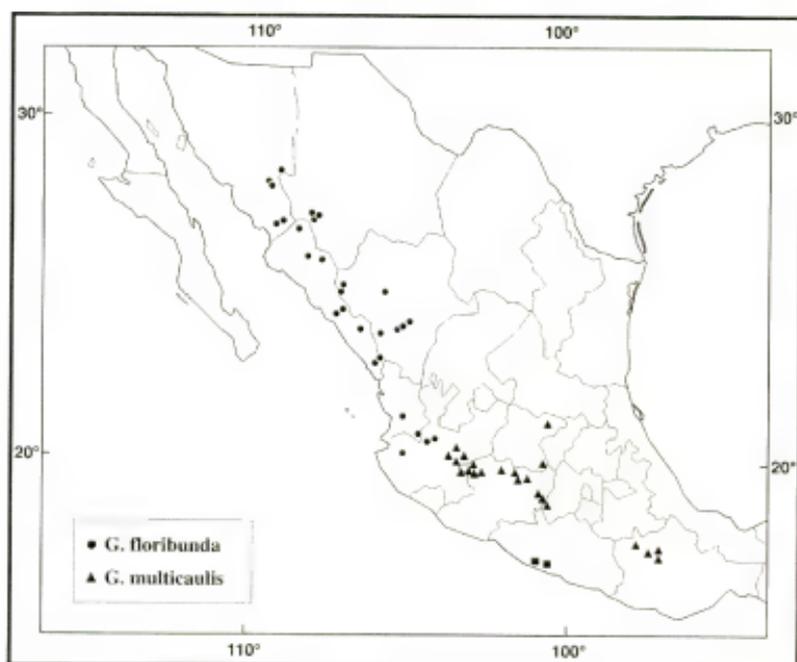


FIG. 30. Distribution of *Galphimia floribunda*, *G. hirsuta*, and *G. multicaulis*.

Barranca del Agua, en frente de Zapotitán de Hidalgo, *Machuca* N. 3551 (MICH, XAL); Mpio. Jocotepec, Cerro Viejo, ladera de exposición S. en frente de San Juan Cozala, 20°15'–30'N, 103°20'–40'W, *Machuca* N. 4412 (XAL); Sierra del Tigre, 3 mi S of Mazamilla, *McVaugh* 12988 (BM, G, MEXU, MICH, US); base of trail leading to hill towering behind Ixtlahuacán de los Membrillos, off Rt 35 to Chapala, *Norman* 661 (MICH); 5 km S of Quitupan, *Villarreal* 8215 (ENCB, MICH).—MEXICO: Valle de Bravo, *Lyonnet* s.n. (MEXU); 5 km N of Valle de Bravo, *Ripley & Barneby* 14869 (CAS, NY).—MICHOACÁN: Cerro de las Nalgas, vic. of Morelia, *Arsène* 2654 (MEXU, US); vicinity of Morelia, NW of Pungarato, *Arsène* 5164 (A, BM, MO, NY, US); Morelia, Pungarato, *Arsène* 8402 (GH, MICH, NY, UC); Mex hwy 15 at San José de Purua rd, *Barr & Barr* 64-554 (DS, UC); Mpio. Morelia, entre el Cerro Prieto y El Punhuato, *Díaz* B. 4760 (IEB, MICH); Mpio. Morelia, San José Coapa, *Escobedo* 1850 (GUADA, IEB, MICH, TEX); slopes of Cerro Santa María, 8–10 km SW of Jiquilpan, 5 km NE of Quitupan, *Feddema* 93 (DS, DUKE, ENCB, MICH, TEX); 8 mi S of Zitácuaro, *Jones* 40975 (MEXU, MO); Cerro Potrerillos, 5 mi N of Cotija, 22 mi S of Jiquilpan, *King & Soderstrom* 4671 (MICH, NY, TEX, UC, US); Mpio. Chilchota, 300 m al NE del pueblo Huancito, *Romero* B. 13 (IBUG); Mpio. Huaniqueo, 0.8 km al SW de Tendeparacua, centro NE de pedregal pequeño, *Silva-Sáenz* 139 (MICH).—OAXACA: Huauclilla, Nochistlán, *Conzatti & González* 1199 (GH); Cuesta de Huauclilla, Dto. Nochistlán, *Conzatti* 1881 (F, GH, MEXU); Mpio. Nochistlán, Huauclilla, *Conzatti* 3965 (MEXU); La Carbonera, Dto. Etla, *Conzatti* 4210 (MEXU, US); Nochistlán, Jun 1844, *Galeotti* s.n. (BR); without locality, *Jurgensen* 288 (DS, G, K); cuesta de San Juan del Estado, *Pringle* 4828 (A, BM, BR, F, G, GH, GOET, MEL, MEXU, MO, NY, S, UC, US, W); prope Oaxaca, *Seler & Seler* 98 (GH); mountains near San Juan del Estado, *Smith* 82 (GH).

*Galphimia multicaulis* is distinguished by its leaves and the crowded inflorescences. The petioles are very short (usually 3–8 mm long), and the leaf glands, borne on the margin and above the base of the elliptical to ovate laminae, vary from prominent to peglike (Fig. 29b–d). *Galphimia multicaulis* occurs in central Mexico and is also disjunct in northern Oaxaca, where this showy and distinctive species has been

collected only ten times, most recently in 1921 (*Conzatti 4210*). The Oaxacan collections differ only in that they have shorter peduncles (1.5–3 mm long; 0.1–0.4 times as long as pedicels) than specimens from elsewhere (3–6.5 mm long; 0.3–1.8 times as long as pedicels). All but one other species with which *G. multicaulis* is sympatric have well-developed petioles. In Oaxaca the distribution of *G. multicaulis* overlaps with the range of *G. sessilifolia*, a rarely collected species with deciduous petals and sessile to subsessile leaves.

Jussieu noted “v. s. herb. J. Gay” (now at K) in the protologue for *G. multicaulis*. Therefore, I consider the sheet at K from the Gay herbarium, which bears Jussieu’s annotation, the holotype; the duplicate at P-JU is an isotype.

*Galphimia multicaulis* was treated by Bartling (1840) under the name *G. glauca* and by Small (1910) under *Thryallis multicaulis*.

**23. *Galphimia paniculata*** Bartl., *Linnaea* 13: 556. 1840 [“1839”]. *Thryallis paniculata* (Bartl.) Kuntze, *Rev. gen. pl.* 1: 89. 1891.—TYPE: MEXICO. “In regno Mexicano,” *Hegewisch s.n.* (holotype: GOET!; isotype: NY!).

*Galphimia glandulosa* Cav. [var.]  $\alpha$  *ovalifolia* DC., *Prodr.* 1: 582. 1824.—TYPE: Sessé & Mociño drawing no. 0269, Torner Collection of Sessé and Mociño Biological Illustrations at the Hunt Institute for Botanical Documentation (holotype, digital image!; photos of Candolle copy of drawing at G: F! GH! GOET! MICH! MO!).

*Galphimia glandulosa* Cav. [var.]  $\beta$  *oblongifolia* DC., *Prodr.* 1: 582. 1824.—TYPE: Sessé & Mociño drawing no. 0148, Torner Collection of Sessé and Mociño Biological Illustrations at the Hunt Institute for Botanical Documentation (holotype, digital image!; photos of Candolle copy of drawing at G: F! GH! MICH! MO!).

*Galphimia latifolia* Bartl., *Linnaea* 13: 553. 1840 [“1839”]. *Thryallis latifolia* (Bartl.) Kuntze, *Rev. gen. pl.* 1: 89. 1891, non *Thryallis latifolia* Mart., 1829.—TYPE: Based on plants raised from seed sent by Hunnemann from Mexico in 1837 (holotype: unknown).—Specimen taken from the botanical garden at Göttingen in June, 1840, and preserved in the Bartling Herbarium (neotype, here designated).

*Galphimia humboldtiana* Bartl., *Linnaea* 13: 555. 1840 [“1839”]. *Thryallis humboldtiana* (Bartl.) Kuntze, *Rev. gen. pl.* 1: 89. 1891. *Galphimia paniculata* var. *humboldtiana* (Bartl.) Nied., *Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg* 5: 26. 1914.—TYPE: MEXICO. [Guerrero:] “inter Alto de los Caxones et Acaguisotla,” *Humboldt & Bonpland s.n.* (holotype: P-HBK, microfiche: MICH!, photo: MICH!; isotype: P!).

Fig. 31.

Large herb to shrub or treelet to 5 m; stems pubescent when young, soon glabrous. Vesture of all vegetative parts of subsessile, straight to crisped, reddish brown hairs 0.2–0.6 mm long. Laminas of the larger leaves 5–10 cm long, 2–6 cm wide, elliptical to ovate, apex rounded or apiculate, base attenuate, glabrous, secondary veins prominent abaxially; margin entire; petioles 1.5–3.5 cm long, glabrous; glands usually a pair borne at about the middle of the petiole, subopposite or up to 1 mm apart, sometimes with 1 (2) smaller gland(s) distally, each gland 1.5–2 mm in diameter, disklike and prominent; stipules 1–2 (–3) mm long, 0.5–1.5 mm wide, narrowly triangular, glabrous or with scattered hairs on the margin. Inflorescence usually a large panicle composed of racemes (in very young specimens a terminal raceme), the

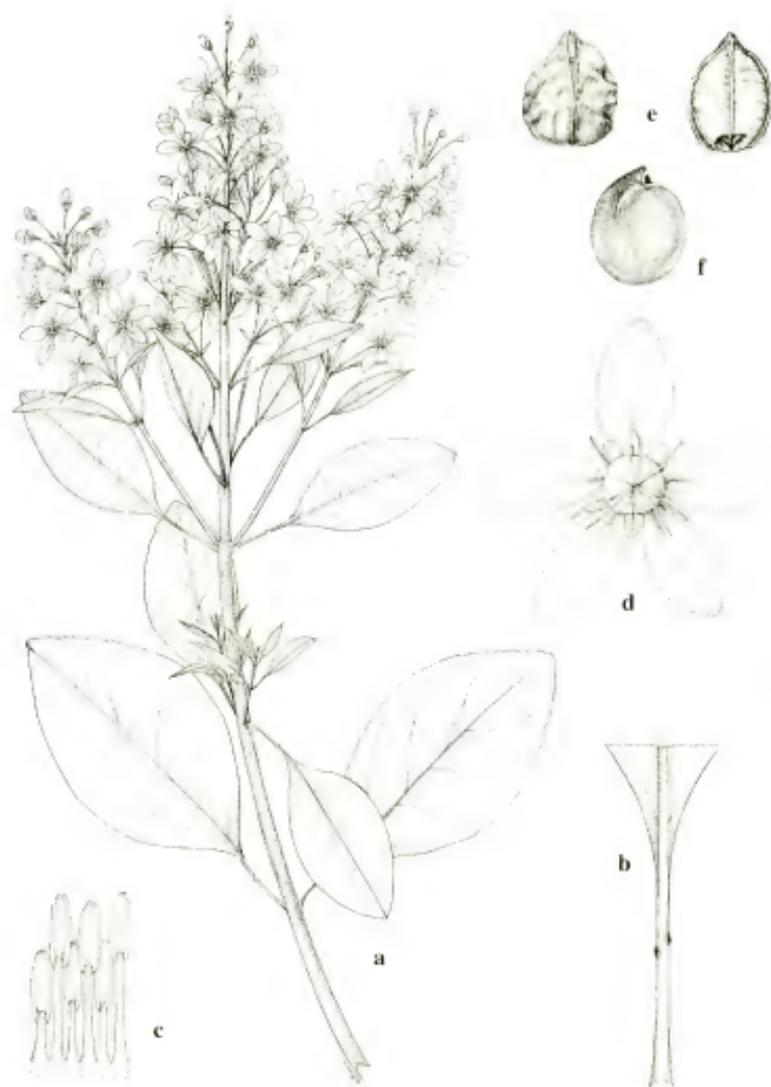


FIG. 31. *Galphimia paniculata*. a. Flowering branch. b. Petiole, adaxial view; note glands. c. Partial androecium laid out, abaxial view, the stamen at left opposite posterior petal. d. Fruit from above, with petals persistent, posterior petal uppermost. e. Cocci, abaxial view (left) and adaxial view (right). f. Seed. Scale bar: a, 4 cm; b, 1.3 cm; c, e, 4 mm; d, 1 cm; f, 2.7 mm. (Based on: a-c, *Machuca N. 5023*, MICH; d, *McVaugh 14237*, MICH; e, f, *González T. 9*, MICH.)

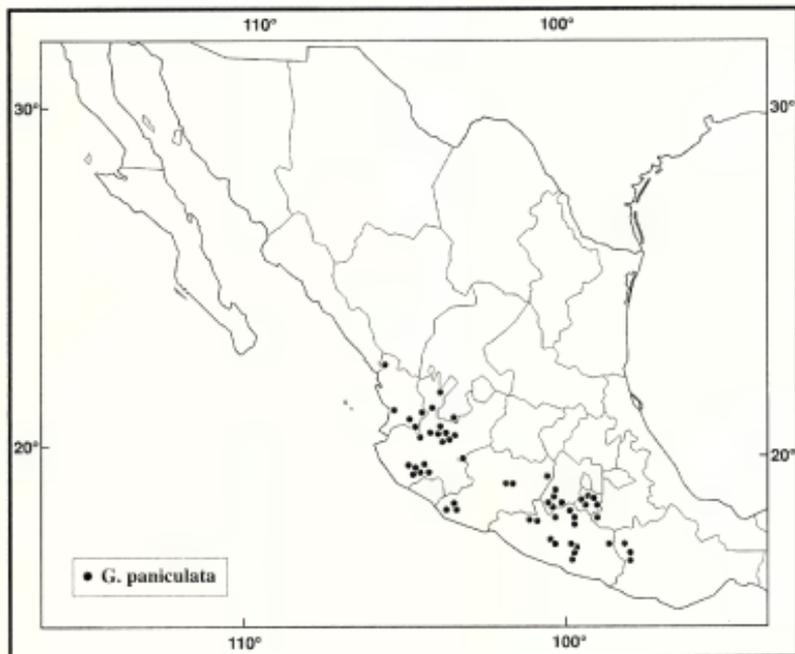


FIG. 32. Distribution of *Galphimia arenicola* and *G. paniculata*

axes pubescent; peduncles 3–7.5 mm long, pedicels (7.5–) 9–13 (–16.5) mm long, both sparsely pubescent to glabrous, peduncles 0.3–0.4 (–0.5) times as long as pedicels; bracts 1.4–3 (–5) mm long, 0.4–0.8 (–1) mm wide, linear, bracteoles 1–2 (–2.8) mm long, 0.3–0.6 mm wide, linear, bracts and bracteoles glabrous; bracteoles borne in the distal 1/4–1/2 of the peduncle, subopposite or up to 2 mm apart. Sepals 3.3–4.5 mm long, 1.4–2.5 mm wide, oblong or narrowly elliptical to linear-lanceolate, glabrous or with a few scattered hairs at base, margin irregularly denticulate-erose-ciliate; glands absent. Petals persistent, unequal, yellow, the claw and midrib often suffused with red, glabrous, margin irregularly finely denticulate; lateral petals: claw 1.3–2 mm long, ca. 0.5 mm wide, limb 8–11 mm long, 4.5–6.5 mm wide, elliptical or lanceolate, apex subacute to obtuse, base gradually attenuate; posterior petal: claw 2–3 mm long, 1.1–1.3 mm wide, limb 9–11 mm long, 6–8 mm wide, ovate or broadly elliptical, apex obtuse, base subacute. Stamens of unequal length; filament opposite anterior sepal 3.5–4.4 mm long, filaments opposite anterior-lateral petals (2–) 2.5–3.5 mm long, filaments opposite anterior-lateral sepals 3.3–4.4 mm long, filaments opposite posterior-lateral petals 1.5–2.5 (–3) mm long, filaments opposite posterior-lateral sepals 3.3–4.2 mm long, filament opposite posterior petal 2–2.8 mm long; anthers 2.3–2.8 mm long. Ovary glabrous; styles (4–) 5.2–6.7 mm long. Coccus 3–3.8 mm long, 2.4–2.7 mm in diameter; glabrous; areole 2.2–2.8 mm long, 1.9–2.5 mm wide; outer cotyledon ca. 3 mm long, inner cotyledon 2–2.5 mm long. Chromosome number unknown. Fig. 31.

Phenology. Collected in flower and fruit from August through April, sometimes also in May and June.

**Distribution** (Fig. 32). Mexico (Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, western Oaxaca, Puebla); tropical deciduous and subdeciduous forest, oak and pine-oak forest, pedregal, matorral, roadside, pasture; 700–2220 m.

**REPRESENTATIVE SPECIMENS.** **México.** GUERRERO: 10 km al NE de Iguala, La Cumbre, desv. a la Torre de Micro-ondas, *Díaz M. 241* (DS, ENCB, MICH, WIS); ca. 8 km (airline) SW of Nochipán, *Feddema 2773* (DUKE, ENCB, MICH, MO); Mançhón, *Hinton 11292* (BM, DS, F, G, GH, MICH, NY, UC, US); Mpio. Mina, Campo Morado, *Hinton et al. 14846* (GH, LL, MICH, NY, UC, US); Mpio. Chilpancingo, Salto de Valdez a 6 km al N de Mazatlán, *López H. 1030* (ENCB, MEXU); Mpio. Mina, Sierra Madre del Sur, Huenta Vieja, *Mexia 9010a* (GH, UC, US); Mpio. Alcozauca, Alcozauca, Las Mesitas, *Viveros S. & Casas 331* (ENCB, MEXU, MO).—**JALISCO:** 7 mi NE of Tecolotlán on road to Guadalajara, *Anderson 13564* (MICH); Mpio. Autlán, entre Tecapatlán y Manantlán, 19°37'10"N, 104°12'18"W, *Cárdenas T. et al. 28* (WIS); Mpio. Tequila, 2–3 km adelante de Tequila rumbo al cerro de Tequila, *Cházaro 4386* (IBUG, XAL, WIS); along Hwy 80, ca. 6 mi SW of Casimiro Castillo and ca. 41 mi NE of Cihuatlán, *Clarke et al. 1987-1* (MICH); Mpio. Ixtlahuacán del Río, Los Pitayitos, *González T. 9* (DS, ENCB, IBUG, MICH, TEX, WIS); Mpio. Villa Guerrero, 4 km al NE de El Refugio Bolaños y 26 km al SW de Villa Guerrero, *Lot 2120* (CHAPA, F, IEB, MEXU, MICH, XAL); Mpio. Acantlán de Juárez, "El Cuarenta" al NE de Acantlán, *Machuca N. 5023* (MICH); above Talpa de Allende, near rd to Mascota, *McVaugh 14237* (BM, MEXU, MICH, US); Mpio. Zapopan, cerca de las Timbres, brecha Sta. Lucía–Palo Gordo, *Navarro G. 195* (IBUG); Río Blanco, *Palmer 684* in 1886 (GH, MICH, NY, US); slopes of barranca near Guadalajara, *Pringle 1728* (A, BM, BR, F, G, GH, MO, NY, S, UC, US, W); barranca de Guadalajara, *Pringle 11391* (CAS, F, GH, L, MICH, MO, S, UC, US); Mpio. Toluimán, Puerto de Toxin, 6 km al S de San Pedro Toxin, *Ramírez S. et al. 208* (IBUG); rd between Bolaños and Guadalajara, *Rose 3021* (NY, US).—**México:** Bejuos, Temascaltepec, *Hinton et al. 2546* (A, G, NY, US); Cerro La Corona, Zacualpan, *Manula 30349* (MEXU); Tejuapilco, *Manula 27477* (MEXU); Mpio. Valle de Bravo, Cerito de Peña, *Manula 28046* (MEXU); Mpio. San Tomás, 2 km S of San Nicolás Tolentino, 8 km NE of Zuluapan, 19°09'N, 100°15'W, *Solheim & Benz 1064* (MEXU, XAL, WIS).—**MICHOACÁN:** Mpio. Villamar, Cerro de Cotijarán, *García 1272* (IEB); brecha a Dos Aguas, *González & Martínez 720* (ENCB, IBUG, MEXU); Mpio. Coalcomán, Coalcomán, *Hinton 12694* (G, LL, MICH, NY, S, UC, US); Mpio. Coalcomán, Aquila, *Hinton 16245* (ENCB, G, LL, MICH, NY, P, UC, S, W); Monte de Sta. Helena, *Langlissé 64* (G, GH, K, P, US); steep dry mountainsides ca. 8 km NW of Aguillita, rd to Aserradero Dos Aguas, *McVaugh 22665* (ENCB, MICH); Susupuato, *Ramos et al. 588* (MEXU, XAL); a 2 km al SW de Ario de Rosales, *Soto N. 580* (BM, ENCB, MEXU); 26 km al SW de Zitácuaro, entrando por la presa del Bosque, *Torres & Ramírez 13640* (ENCB, IEB, MICH).—**MORELOS:** Mpio. Xochicalco, zona arqueológica, 3 km al O de la carr. Fed. México–Acapulco, *Anaya R. 8* (CHAPA, F, XAL); Km 16 de la carretera Cuautla–Tepoztlán, *Arreguín 327* (CAS, CHAPA, ENCB, MEXU, NY); Mpio. Tepoztlán, 8 km después de Tepoztlán, rumbo a Sto. Domingo Ocotitlán, *Espejo 3426* (CHAPA, ENCB, MEXU, UAMIZ); Mpio. Yauatepec, 1 km al SE del poblado de La Joya, carr. Cuernavaca–Yauatepec, 18°52'15"N, 99°07'05"W, *Flores F. 366* (IEB, MEXU); entre Cuernavaca y el village de Sochil, *Ghesbreght 303* (K, P); Mpio. Tlaxiaca, near Tlaxiaca, rd to Oaxtepec, *Lot 247* (CHAPA); Xochitpec, *Lyonnet 1089* (MEXU); Km 16 carr. Cuautla–Tepoztlán, *Ordoñica 160* (CHAPA, ENCB, MEXU, XAL); Cuernavaca, *Pringle 7215* (GH, MICH, US).—**NAYARIT:** hills back of [town of] Jalisco, *Ferris 5943* (A, DS, US); mountains 20 mi SE of Ahuacatlán on rd to Barranca del Oro and Amatlán, *McVaugh & Koelz 847* (ENCB, G, MICH, NY, US); trail Yxtlán to Barranca del Oro, *Mexia 784* (A, BM, CAS, DS, F, G, GH, MICH, MO, NY, UC); Tepic, *Palmer 2030* in 1892 (BM, C, F, GH, MICH, NY, S, US); Mpio. Huajicócoro, Río de los Talladeros, *Soils 604* (ENCB, MEXU, MICH, NY, TEX); Mpio. La Yesca, 6.2 km al SE de Puente de Camotlán, camino a Huajimic, 21°36'N, 104°04'W, *Tenorio L. 16675* (IEB, MEXU).—**OAXACA:** Arroyo de la Pastor, S. Vicente, Putla, *MacDougal 11204* (NY); Mpio. San Juan Mixtepec, SW del Río Timbre, *Sánchez B. 41* (CAS, CHAPA, ENCB, IEB, MEXU, MO, NY); Mpio. San Juan Mixtepec, NW de Loma de Lobo, Dto. Juxtlahuaca, *Sánchez B. 66* (ENCB, IEB, MEXU); 25.5 km al N de Putla, carr. Putla–Huajuapán de León, Distr. Putla, *Torres C. 1956* (CAS, F, MEXU, MO); Mpio. Silacayoapan, Dto. Silacayoapan, 10 km al SE de San Martín del Estado, hacia Silacayoapan, 17°33'N, 98°07'W, *Torres C. 14143* (MEXU, MO, TEX).—**PUEBLA:** Mpio. Jolalpan, Ejido de Xochitpec, *Arreola et al. Xo-634* (CAS); Mpio. Jolalpan, 2 km al NW de San Pedro de las Palmas, *Rozo & García He-33* (IEB, MEXU).—**ZACATECAS:** 4 mi N of El Limón, 5.2 mi N of border of Jalisco, *Croat 45091* (MEXU, MO, NY); 8 mi S of Moyahua, *Webster 1081* (ENCB, MICH).

*Galphimia paniculata* is a coarse, showy species commonly collected in western Mexico from Nayarit to westernmost Oaxaca. It is distinguished by its large compound inflorescences and leaves that have the glands borne at the middle of the petiole; the laminae vary from elliptical to ovate. Collections of this species are often

misidentified as *G. glauca* (of eastern and central Mexico), which has smaller leaves with the glands borne on the margin of the lamina and also smaller flowers and fruits; the limb of the posterior petal is broadly triangular. *Galphimia paniculata* is at least partly sympatric with four species with persistent petals, but none have the leaf glands at the middle of the petiole. *Galphimia multicaulis* and *G. calliantha* bear leaf glands on the margin of the lamina well above the base; in addition, *G. multicaulis* differs in its very short petioles (less than 1 cm) and *G. calliantha* in its fringed sepals. *Galphimia floribunda* and *G. grandiflora* have the leaf glands at the base of the lamina or the apex of the petiole; especially in larger laminas, the base may be decurrent with the glands superficially appearing to be borne on the petiole, or the laminar tissue may be drawn out into a tooth terminating in a gland. *Galphimia floribunda* also differs from *G. paniculata* in its almost or completely glabrous inflorescences; *G. grandiflora* is named for its large petals (the limb of the lateral petals 11–15.5 mm long).

Bartling (1840) based his *G. paniculata* on a herbarium collection, but his *G. latifolia* on living plants of the same species with unusually broad laminas, which were grown at the botanical garden in Göttingen. The specimen here chosen as neotype of *G. latifolia* consists only of an inflorescence branch; it is the only specimen I have seen that may have been collected from the plants studied by Bartling, but it is not possible to ascertain whether it is part of the type material. Bartling also provided an additional synonym for *G. paniculata*. He realized that Kunth (1822) had misapplied the name *G. glandulosa* Cav. and provided the name *G. humboldtiana*, which is validated by Bartling's reference to Kunth's description and the *Humboldt & Bonpland* specimen; Bartling also gave a brief description but did not cite any other specimens.

Candolle's varieties of "*Galphimia glandulosa*" were based on drawings prepared for the Sessé and Mociño expedition. That of " $\beta$  *oblongifolia*" is clearly *G. paniculata*. The drawing of " $\alpha$  *ovalifolia*" is quite stylized and there is no specimen in the Sessé and Mociño herbarium (housed at MA); however, at G is a specimen of *G. paniculata* labeled, like the drawing "Tlaxacochitl" and said to be from "Hb. Pavon" (i.e., ex MA), which may be authentic material.

Small (1910) included *G. paniculata*, *G. latifolia*, and *G. humboldtiana* within his concept of *Thryallis glauca*.

**24. *Galphimia calliantha*** C. Anderson, sp. nov.—TYPE: MEXICO. Guerrero: 23–24 km E of Petatlán on rd to Tlapa ["Teapa" on label], Km 123–124, 2000 m, 12–13 Feb 1970, *Anderson & Anderson 5758* (holotype: MICH!; isotypes: DUKE! ENCB! SD!). Fig. 33.

Frutex vel arbor parva. Laminae foliorum majorum 3–6.5 cm longae, 1.6–3.5 cm latae, oblongae vel ellipticae vel ovatae vel anguste ovatae, glabrae, margine integra, glandulis ca. 0.5 mm diametro; petioli 0.8–1.8 cm longi. Inflorescentia racemosa, axibus tomentosis. Sepala margine ciliata. Petala persistentia; petala lateralia ungue ca. 1.5 mm longo, limbo 10–12 mm longo, 5.5–9.5 mm lato, ovato vel anguste ovato; petalum posticum ungue ca. 2 mm longo, limbo 10.3–12.5 mm longo, 6.5–11 mm lato, ovato-triangulari. Antherae 2.5–2.7 mm longae. Ovarium glabrum; styli 4.5–5.2 mm longi. Coccus ca. 4.5 mm longus, glaber.

Shrub or treelet to 3 m; stems densely tomentose when young, soon glabrous. Vesture of all vegetative parts of subsessile, crisped to curled, reddish brown hairs 0.5–1.5 mm long. Laminas of the larger leaves 3–6.5 cm long, 1.6–3.5 cm wide, oblong to elliptical or narrowly ovate, apex obtuse or apiculate, base acute, glabrous, secondary veins barely prominulous; margin entire; petioles 0.8–1.8 cm long, tomentose

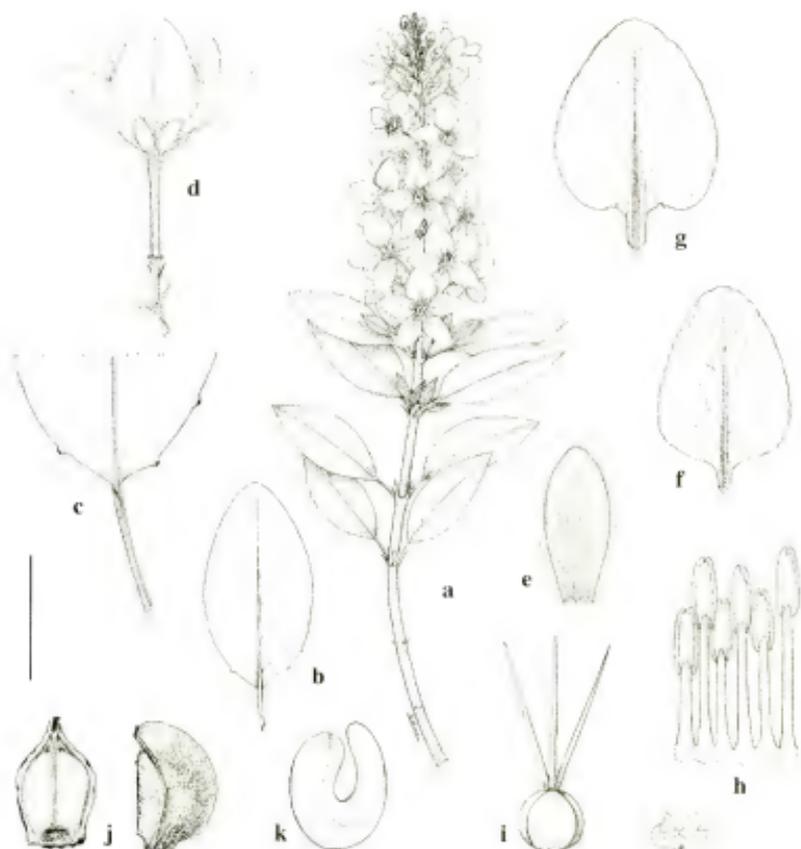


FIG. 33. *Galphimia calliantha*. a. Flowering branch. b. Leaf, abaxial view. c. Base of leaf, adaxial view; note glands on margin. d. Flower, side view. e. Sepal, abaxial view. f. Lateral petal, adaxial view. g. Posterior petal, adaxial view. h. Partial androecium laid out, abaxial view, stamen at left opposite posterior petal. i. Gynoeceum. j. Cocci, adaxial view (left) and lateral view (right). k. Embryo. Scale bar: a, b, 4 cm; c, f, g, 8 mm; d, 1.3 cm; e, h-j, 4 mm; k, 2 mm. (Based on: a, d-k, *Rzedowski 18095*, MICH; b, c, *Hinton 9848*, MO.)

when young, becoming glabrous; glands a pair borne on the margin of the lamina, commonly 0.5–1.5 cm above the base, each gland ca. 0.5 mm in diameter, prominent, often with additional glands along the margin, especially in the smaller leaves near the inflorescence; stipules 2.7–4 mm long, 0.8–1 mm wide, narrowly triangular, glabrous. Inflorescence a dense terminal raceme or a ternate panicle, the axes densely reddish tomentose; peduncles 2.5–7 (–9) mm long, pedicels 5–11 (–13) mm long, both tomentose, peduncles 0.3–0.7 (–0.9) times as long as pedicels; bracts 3–5.5 mm long, 0.5–0.8 mm wide, linear, bracteoles 1.6–3 mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles glabrous and with scattered hairs along the margin; bracteoles borne in the distal 1/4–1/2 of the peduncle, subopposite. Sepals 4–4.5 mm long, 1.6–2.2 mm wide, oblong to narrowly elliptical, glabrous or with scattered hairs in the proximal

1/3, margin fringed with reddish hairs to 0.2 (–0.3) mm long; glands absent. Petals persistent, unequal, yellow, the claw often suffused with red, glabrous, margin entire or finely erose; lateral petals: claw ca. 1.5 mm long, ca. 0.5 mm wide, limb 10–12 mm long, 5.5–9.5 mm wide, ovate or narrowly so, apex obtuse, base subacute; posterior petal: claw ca. 2 mm long, 1–1.2 mm wide, limb 10.3–12.5 mm long, 6.5–11 mm wide, triangular-ovate, apex obtuse, base slightly cordate. Stamens of unequal length; filament opposite anterior sepal 4.5–5 mm long, filaments opposite anterior-lateral petals 3.7–4.2 mm long, filaments opposite anterior-lateral sepals 4–4.8 mm long, filaments opposite posterior-lateral petals 3–3.5 mm long, filaments opposite posterior-lateral sepals 4–4.7 mm long, filament opposite posterior petal 3–3.2 mm long; anthers 2.5–2.7 mm long. Ovary glabrous; styles 4.5–5.2 mm long. Coccus ca. 4.5 mm long, ca. 3.5 mm in diameter, glabrous; areole ca. 3 mm long, ca. 2.2 mm wide; outer cotyledon ca. 2.7 mm long, inner cotyledon ca. 2 mm long. Chromosome number unknown.

**Phenology.** Collected in flower from September through March, in fruit from January through May.

**Distribution (Fig. 35).** Mexico (Guerrero and westernmost Oaxaca); in pine-oak forest on limestone; 1600–2200 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Mexico.** GUERRERO: Mpio. Tixtla de Guerrero, Atliaca, entre Acatempa y Atliaca, 17°38'02"N, 99°21'03"W, Hall 778 (MICH); Distr. Mina, Chiriagua, *Hinton* 9848 (BM, G, MO); Sierra Madre, *Langlassé* 780 (F, G, GH, K, NY, P, US); Mpio. Chichihualco, 2 km adelante de Cruz de Ocote, *Lozano V. 171* (ENCB); Mpio. Chilpancingo de los Bravos, a 2 km al E de Omiltemi, camino a Chilpancingo, *Martínez S. & Téllez* 285 (MBM, MEXU); Mpio. Chilapa de Alvarez, Km 72–73 de la carretera Chilapa–Tlapa, 17°35'53.1"N, 99°06'02.2"W, *Panero* 3912 (IEB, TEX); 11 km al W de Amojileca, camino Chilpancingo–Amojileca, *Rodríguez B. 65* (ENCB, MEXU, MO); Mpio. Chichihualco, Cruz de Ocote, 25 km al WSW de Camotla, *Rzedowski* 18095 (DS, ENCB, MICH); Mpio. Chilpancingo, La Simarora, 10 km al E de Omiltemi, *Rzedowski* 30261 (ENCB, SD); Mpio. Mochitlán, El Voladerito, cerca de Coxtlahuacán, *Rzedowski* 30290 (ENCB); Mpio. Chichihualco, Cruz de Ocote, sobre el camino de Xochipala al aserradero Agua Fría, *Rzedowski & McVaugh* 284 (ENCB, MICH); W of Chilpancingo, *Sharp* 441453 (GH); Hwy 134 between Zihuaquío and Ixtapa, crest of mts between Pacific and Río Balsas watersheds, 18°00'N, 101°13'W, *Soulé* 3228B (MO, TEX).—**OAXACA:** Mpio. Santiago Juxtlahuaca, Dto. Juxtlahuaca, El Manzanal, 17°13'13.20"N, 98°03'38.30"W, *Calzada* 21372 (CICY, MO).

*Galphimia calliantha* is a handsome shrub or treelet of the pine-oak forests of Guerrero and westernmost Oaxaca. Its large flowers are aggregated in dense racemes with reddish tomentose axes. It is the only species in which the sepals are fringed with reddish hairs along the margin (less obvious in older flowers). The laminae are often apically obtuse and bear the leaf glands on the margin; often several smaller glands are present in addition to the larger pair near the base. The only sympatric species with persistent petals is *G. paniculata*, which has the leaf glands at the middle of the petiole.

**25. *Galphimia grandiflora*** Bartl., *Linnaea* 13: 554. 1840 [“1839”]. *Thryallis grandiflora* (Bartl.) Kuntze, *Rev. gen. pl.* 1: 89. 1891. *Galphimia gracilis* var. *grandiflora* (Bartl.) Nied., *Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg* 5: 24. 1914.—**TYPE:** MEXICO. “In regno Mexicano,” *Hegewisch s.n.* (holotype: GOET!; isotype: NY!)

*Galphimia schiedeana* Nied., *Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg* 5: 28. 1914.—**TYPE:** MEXICO. [Michoacán:] pr. Ario, Dec 1829, *Schiede s.n.* (lectotype, here designated: NY!; fragments from specimen formerly at B, now destroyed; photos of *Schiede s.n.* syntype: F! GH! MICH! MO! NY!).

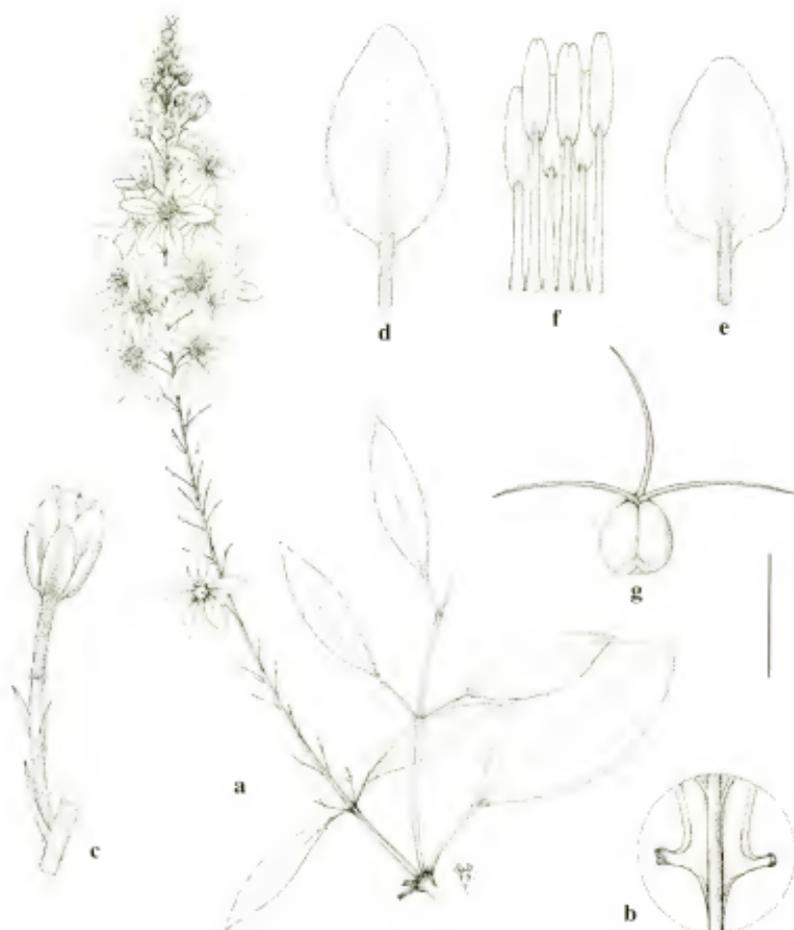


FIG. 34. *Galphimia grandiflora*. a. Flowering branch. b. Base of lamina, abaxial view, showing pair of marginal glands. c. Flower bud, borne on pedicel and peduncle with portion of inflorescence axis. d. Lateral petal. e. Posterior petal. f. Partial androecium laid out, abaxial view, the stamen at left opposite posterior petal. g. Gynoecium. Scale bar: a, 4 cm; b-e, 8 mm; f, g, 4 mm. (Based on: a, c-g, McVaugh 26100, MICH; b, Anderson & Anderson 5881, DUKE.)

Large herb, shrub, or treelet to 5 m tall; stems strigose to tomentulose when young, soon glabrous. Vestiture of all vegetative parts of subsessile, straight to crisped, reddish brown hairs 0.2-0.8 mm long. Laminas of the larger leaves 5-13.5 cm long, 2-7.3 cm wide, narrowly to broadly elliptic, ovate, oblanceolate, or rhombic, apex apiculate or rarely acute, base attenuate and often briefly decurrent, glabrous, secondary veins prominent or barely so abaxially; margin entire; petioles 1.5-5 cm long, sparsely strigose to glabrescent; glands a pair borne at the base of the lamina (if base decurrent, gland superficially appearing as borne on the petiole), often at the apex of a tooth of laminar tissue, sometimes on the margin just above the laminar base,

or sometimes one gland at the laminar base and the other at the apex of the petiole, sometimes with 1–2 additional smaller glands on the margin near the base, rarely with only 1 gland, each gland 0.6–1.3 mm in diameter, disklike and prominent, or peglike and up to 1.5 mm long; stipules 2–3.5 (–4.5) mm long, 0.5–1 (–1.5) mm long, linear or narrowly triangular, glabrous, the margin commonly ciliate. Inflorescence a dense terminal raceme or a panicle, the axes tomentulose, sparsely so in age; peduncles 6–11 mm long, pedicels 6–12 mm long, both tomentulose, peduncles (0.5–) 0.6–1 (–1.6) times as long as pedicels; bracts (3–) 4–6.7 mm long, 0.5–0.8 mm wide, linear, bracteoles 2–4 mm long, 0.3–0.5 mm wide, linear, bracts and bracteoles glabrous; bracteoles borne in the distal 1/3–1/2 of the peduncle, mostly subopposite or sometimes up to 1 mm apart. Sepals 4.2–5.5 mm long, 2–2.5 mm wide, elliptical or narrowly so or sometimes oblong, glabrous, margin entire; glands absent. Petals persistent, yellow, the claw often suffused with red, sometimes also the limb in age, the central vein often green, glabrous, margin denticulate; lateral petals: claw 1.8–2.5 mm long, 0.5–0.7 mm wide, limb 11–15.5 mm long, 6–9 mm wide, elliptical to lanceolate, apex subacute, base attenuate; posterior petal: claw 2–3 (–3.5) mm long, 1–1.5 mm wide, limb 11.5–15.5 mm long, 7–9 mm wide, ovate or broadly elliptical, apex subacute, base attenuate. Stamens of unequal length; filament opposite anterior sepal 4.3–5.5 mm long, filaments opposite anterior-lateral petals 3.5–4.3 mm long, filaments opposite anterior-lateral sepals 3.8–5 mm long, filaments opposite posterior-lateral petals 3–4 mm long, filaments opposite posterior-lateral sepals 4–5.2 mm long, filament opposite posterior petal 3–3.5 mm long; anthers (2–) 2.5–3.5 mm long. Ovary glabrous; styles 5.2–6 mm long. Coccus 3.1–3.6 mm long, 2.4–3 mm in diameter, glabrous; areole 2.5–2.7 mm long, 2–2.3 mm wide; outer cotyledon 2.3–2.5 mm long, inner cotyledon 1.8–2 mm long. Chromosome number unknown.

**Phenology.** Collected in flower from November through April, in fruit from January through April.

**Distribution (Fig. 35).** Mexico (Colima, Jalisco, México, Michoacán, Morelos); mostly in wet or humid places in forests dominated by pines, oaks, and firs, also at roadside; 1360–2800 m.

**REPRESENTATIVE SPECIMENS.** **MEXICO.** COLIMA: Mpio. Comala, fraccionamiento 5 km antes de llegar a San Antonio carr. Queseria–San Antonio, *Acevedo R. & López 1153* (IEB, MICH, TEX, WIS, XAL); Volcán de Colima, *Zepeda R. s.n.* (IBUG).—JALISCO: W slopes of Sierra de San Sebastián, 15–30 km (strt line) N of Mascota, rd to San Sebastián, *Anderson & Anderson 5962* (ENCB, MICH, SD); Sierra de Minatitlán above Haceradero [aserradero?], *Boutin & Kinnach 2960* (CAS, MEXU); Km 33 sobre la brecha a Talpa de Allende, entrando por la carr. Puerto Vallarta–El Tuito, *Campos V 4531* (MEXU, TEX); Mpio. Atengo, Vereda de Tacota a Rancho Viejo, *Cházaro B. et al. 6874* (IEB, MICH, TEX, XAL); Mpio. San Sebastián, 23.6 km from San Sebastián on rd to Talpa, *Cowan 4760* (NY, TEX); Estación de Micro-ondas, Volcán de Fuego, *Díaz L. 3125* (CAS, ENCB, GUADA); Mpio. Autlán, 16–17 km al SSE de Autlán, 4–5 km al S de Ahuacapan, Zacahuatlá, 19°37'43"N 104°19'00"W, *Guzmán & López 629* (MEXU, WIS, ZEA); Mpio. Venustiano Carranza, Cerro Viejo subida por Apango, *Huerta et al. 216* (MICH, TEX, XAL); 1.5–3 km al E de la Est. Biol. "Las Joyas," camino al Cerro El Almeal, 19°34'–35"N, 104°16'W, *Judziwicz & Cochran 4845* (IBUG, MEXU, WIS, ZEA); 12–15 km (strt line) SW of Bolaños, near summits along "Camino Viejo" to Berbería, *McVaugh 25894* (MICH); foothills of Sierra de Manantlán, along rd to summit-pass, 16–22 km S of El Chante, *McVaugh 26100* (MICH); from San Sebastián to Real Alto, *Mexia 1637-a* (A, CAS, GH, MICH, MO, UC, US); Km 36 de la carretera a Las Minas de Cuale, la cual comienza aproximadamente a 7–9 km al W de El Tuito, *Panero 2866* (TEX); Mpio. Guzman, faldas del Nevado de Colima, *Pérez A. 30* (IBUG); Mpio. Tolimán, 7–9 km al W de Los Sauces, camino a Terreros, El Terrero, *Vázquez & Guzmán 4154* (WIS, ZEA).—MEXICO: Mpio. Valle de Bravo, 3 mi NE de Temascaltepec, *Dunn & Dunn 18965* (ENCB, NY); Rancho San Lorenzo, near town of Valle de Bravo, *Gilly 2* (MICH, NY); Nanchititla, Temascaltepec, *Hinton 7364* (BM, F, MEXU, NY, S, US); Cañada de Nanchititla, *Mantada 38268* (LL, MEXU); 6 km E de Nanchititla, 30 km SW of Tejupilco, 18°50'N, 100°45'W, *Neill 5365* (MEXU, MICH, MO); Mpio. Tejupilco, Ocotepce, *Rzedowski 25296* (DS, ENCB, LL, MICH); ca. 15.5 mi N of Tejupilco, ca. 3.5 mi S of Temascaltepec on Hwy 134 to Toluca, 19°02'N, 100°03'W, *Woodruff 271* (F, MO, TEX).—MICHOCÁN:

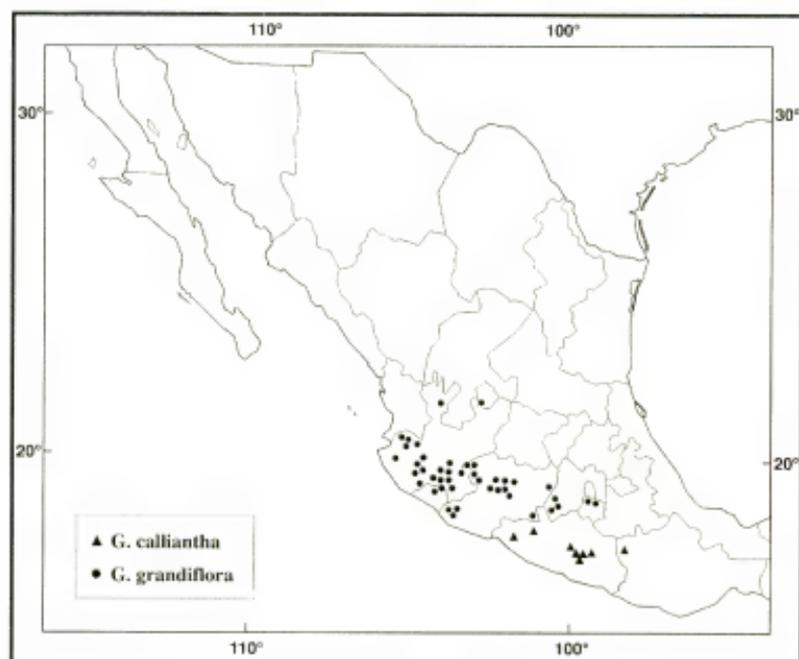


FIG. 35. Distribution of *Galphimia calliantha* and *G. grandiflora*.

mountains W of Aguililla, rd to Aserradero Dos Aguas, *Anderson & Anderson 5881* (DUKE, ENCB, MBM, MICH, SD); Los Cantiles, carr. Morelia, *Cedillo T. 974* (ENCB, LL, MEXU, MO); Mpio. Coahuacán, 20.9 km al W de Coahuacán hacia Coahuayana, *Cowan 4910* (MICH, TEX); Mpio. Uruapan, Presa Cupatitzio, Km 89 de la carr. Uruapan-Playa Azul, desviación a Matargarán, *Fernández N. 4939* (ENCB, IEB, MICH); Mpio. Jiquilpan, *García R. 825* (WIS); Mpio. Zitácuaro, Zitácuaro-Lomas, *Hinton et al. 13435* (BM, DS, F, GH, MEXU, MICH, NY, UC, US); Mpio. Uruapan, Tancitaro, *Hinton et al. 15684* (GH, LL, NY, TEX, US); S-facing slopes of mts between Río del Salto and La Polvilla, 18 mi E of Morelia, *King & Soderstrom 5098* (MEXU, MICH, NY, TEX, UC, US); 3-4 km al N de Tacámbaro, *Kishler 158* (MEXU, MO); Mpio. Zacapu, 5 km al S de Las Canoas, *Martínez L. 623* (ENCB, IBUG, IEB, MEXU); Mpio. Ziracuaretiro, 2 km al NE de San Andrés Corú, *Martínez L. 967* (ENCB, IEB, XAL); Mpio. Zinapécuaro, cerca de Santa Cruz, *Santos M. 1205* (CHAPA, ENCB, IBUG, IEB, MEXU); 3 km de la entrada a Tingambato, carr. a Huetamo, *Torres & Ramírez 13762* (ENCB, IEB, MEXU, MICH).—MORELOS: Tepoztlán, *Paray 1291* (ENCB, MEXU, MICH); above Cuernavaca, *Pringle 8036* (A, BM, BR, C, F, G, GH, GOET, L, MEXU, MO, NY, S, UC, US, W).

*Galphimia grandiflora* is named for its unusually large petals; at maturity, the limbs are up to 15.5 mm long and 9 mm wide. The laminae bear large, prominent to peglike glands at or near the base. This showy and attractive species is a common large herb or shrub, or even treelet, of western Mexico, and often has been confused with other partly sympatric species with persistent petals. Its leaves are similar to those *G. floribunda*, which is easily distinguished by its nearly to entirely glabrous inflorescences. *Galphimia multicaulis* differs in its very short petioles (mostly 3-8 mm long) and *G. paniculata* in having the leaf glands borne at the middle of the petiole.

Small (1910) included *G. grandiflora* in his broad circumscription of *Thryallis glauca*.

**26. *Galphimia floribunda*** C. Anderson, sp. nov.—TYPE: MEXICO, Sonora: Sierra La Chuna, Río Mayo, 27 Feb 1935, *Gentry 1372* (holotype: MICH!; isotypes: A! ECON! K! MEXU! MO! S! UC!). Fig. 36

Frutex. Laminae foliorum majorum 6–14.5 cm longae, 2.7–9 cm latae, ellipticae vel ovatae vel rhombicae, glabrae, margine integra, glandulis 0.5–1.5 mm diametro, sessilibus vel pedicellatis; petioli 2.4–6.5 cm longi. Inflorescentia paniculata, axibus glabris. Petala persistentia; petala lateralibus ungue (1.3–) 1.5–2.2 mm longo, limbo 7.5–10 mm longo, 4–6 mm lato, elliptico vel lanceolato; petalum posticum ungue 2.2–3.3 mm longo, limbo 8.5–12 mm longo, 6–8 mm lato, late elliptico vel ovato. Antherae 2.4–3.5 (–3.8) mm longae. Ovarium glabrum; styli 4.5–5.7 mm longi. Coccus ca. 3.8 mm longus, glaber.

Shrub to 4 m; plants entirely glabrous or with sparsely scattered hairs in the inflorescence; hairs 0.1–0.5 mm long, subsessile, straight or wavy to crisped, reddish. Laminae of the larger leaves 6–14.5 cm long, 2.7–9 cm wide, elliptical to ovate or rhombic, the larger leaves very broadly so, apex apiculate or acute, base attenuate, glabrous, secondary veins prominent abaxially; petioles 2.4–6.5 cm long, glabrous; glands a pair borne at base of blade or apex of petiole, each gland 0.5–1.5 mm in diameter, disklike and prominent, or peglike and up to 1 mm long; stipules 1.5–3.3 (–4) mm long, 0.8–1.5 mm wide, glabrous. Inflorescence a large panicle composed of racemes, the axes glabrous or with a few scattered hairs; peduncles (4–) 5–11 mm long, pedicels 4–8 (–12.5) mm long, peduncles 0.6–1.8 times as long as pedicels, both glabrous or with a few scattered hairs; bracts (1.7–) 2.5–4.5 (–6.2) mm long, 0.5–1 mm wide, linear to narrowly triangular, bracteoles 1.5–3.3 mm long, 0.5–0.7 mm wide, linear or sometimes narrowly triangular, bracts and bracteoles glabrous or sometimes with scattered hairs along the margin; bracteoles borne in the distal 1/4–1/2 of the peduncle, subopposite or up to 1.5 mm apart, the more distal inserted 0.7–4.5 mm below the apex of the peduncle. Sepals 3.5–5 mm long, 1.5–2.2 mm wide, elliptical to oblong, glabrous, margin entire; glands absent. Petals persistent, unequal, yellow, glabrous, margin finely denticulate; lateral petals: claw (1.3–) 1.5–2.2 mm long, 0.5–0.8 mm wide, limb 7.5–10 mm long, 4–6 mm wide, elliptical to lanceolate, apex subacute, base attenuate; posterior petal: claw 2.2–3.3 mm long, 0.8–1 mm wide, limb 8.5–12 mm long, 6–8 mm wide, broadly elliptical to ovate, apex obtuse, base attenuate. Stamens of unequal length; filament opposite anterior sepal (3.5–) 4.1–5.5 mm long, filaments opposite anterior-lateral petals 3.5–4.3 (–4.7) mm long, filaments opposite anterior-lateral sepals 3.5–4.5 (–5.2) mm long, filaments opposite posterior-lateral petals 2.7–4.2 mm long, filaments opposite posterior-lateral sepals 3–4.2 (–5.3) mm long, filament opposite posterior petal (1.7–) 2.2–2.7 (–3.5) mm long; anthers 2.4–3.5 (–3.8) mm long. Ovary glabrous; styles 4.5–5.7 mm long. Coccus ca. 3.8 mm long, 2.2 mm in diameter, glabrous; areole ca. 3 mm long, ca. 2.1 mm wide; outer cotyledon ca. 2.5 mm long, inner cotyledon ca. 1.7 mm long. Chromosome number:  $n=6$  (Seavey 1975, as "*G. glauca*").

Phenology. Collected in flower from late December through June (one collection from September, *Urbina* s.n. MEXU-16562), in fruit from January through June.

Distribution (Fig. 30). Mexico (Sonora, Chihuahua, Sinaloa, Nayarit, Durango, Jalisco); on dry slopes in deciduous forest, oak forest, and pine-oak forest; 500–1300 m.

REPRESENTATIVE SPECIMENS. Mexico. CHIHUAHUA: Mpio. Batopilas, barranca de Batopilas, vic. of Arroyo San Fernando, W of La Bufa, *Bye 3580* (TEX); Cumbres de Loreto, 26°50'N 107°35'W, *Hewitt 268* (GH); Río Batopilas bridge, 1.5 mi E of La Bufa, *Kinnach 904* (UC, MEXU); Río Urique Canyon,



FIG. 36. *Galphimia floribunda*. a. Flowering branch. b. Detached large leaf. c. Base of lamina. d. Opening flower, borne on pedicel and peduncle, with portion of inflorescence axis. e. Lateral petal. f. Posterior petal. g. Androecium laid out, abaxial view, the stamen at left opposite posterior petal. h. Gynoecium. i. Cocci, adaxial view (above) and lateral view (below). j. Embryo. Scale bar: a, b, 4 cm; c, e, f, 8 mm; d, 5.7 mm; g, i, 4 mm; h, j, 2.7 mm. (Based on: a, i, j, *Palmer 284* in 1890, US; b, c, *Rose 13095*, US; d-h, *Reina G. 97-338*, MICH.)

*Pennington 111* (TEX).—DURANGO: Mexico hwy 40, 6.8 mi E of El Palmito, ca. 53 mi E of Concordia, *Breedlove 4254* (DS, DUKE, MICH); near Chacala, *Goldman 326* (GH, NY, US); Mpio. Sianori, *González Ortega 5379* (DS, K, MEXU, US); San Ramón, *Palmer 101* in 1906 (CM, F, GH, K, MO, NY, UC, US).—JALISCO: rd from Tequila to micro-ondas on Volcán Tequila (Montana Azul), *Daniel 4791* (CAS, DUKE, MICH, NY); Mpio. Ixtlahuacán del Río, 30 km al N de Ixtlahuacán del Río, ejido Pitallitos, *Flores M. 549* (IBUG, MEXU); Mpio. Mascota, Cerro de la Barranca, *González T. 36* (ENCB, MICH).—NAYARIT: en la base del Cerro Sangangüey, a 20 km al SE de Tepic, 21°28'N, 104°43'W, *Téllez V. 10398* (MEXU, MO).—SINALOA: Mpio. Rosario, 4.9 mi E of Santa Lucía, ca. 23 mi E of Concordia on Mexico 40, *Breedlove 1663* (DS, DUKE, MICH); Mpio. San Ignacio, Balboa, San Javier, *González Ortega 5094* (MEXU, US); Mpio. Cosalá, La Copetona, arriba de Guadalupe de Los Reyes, *Tenorio L. 8358* (MEXU, MICH); Mpio. Concordia, carr. Mazatlán-Durango entre Km 240 al 256, entre Ojo de Agua y la Guayamera, *Vega 3617* (GUADA, MEXU).—SONORA: 5.1 mi E of Santa Rosa on old road to Yecora, *Goldberg 76-155* (ENCB); Sierra de los Alamos, *Palmer 284* in 1890 (GH, MICH, NY, US); Mpio. Yecora, Arroyo del Pilladito, near Tepoca, 28°26'20"N, 109°15'30"W, *Reina 97-338* (MICH); vicinity of Alamos, Sierra de Alamos, *Rose 12794, 13095* (NY, US).

*Galphimia floribunda* is a handsome shrub named for its unusually large, distally often nodding inflorescences, which are glabrous or have very few scattered hairs even in the youngest parts. In most species (except *G. glandulosa* and *G. sessilifolia*) the inflorescence axes are pubescent, the immature portions often densely so; the absence of such vestiture readily separates *G. floribunda* from *G. grandiflora* and *G. paniculata*, two other species with persistent petals with which it is sympatric in the southern part of its range. In *G. floribunda* the leaf glands are borne at the base of the lamina, often at the apex of a tooth (Fig. 36c) in larger leaves. *Galphimia grandiflora* may have similar leaf glands, but those of *G. paniculata* are placed at the middle of the petiole.

#### EXCLUDED NAMES

*Galphimia* sect. *Cosmogalphimia* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 5: 23. 1914.—Not validly published (ICBN Art. 22.2).

*Galphimia pubescens* (Adr. Juss.) Herter, Fl. illustr. Uruguay 14(11): 491. 1956.—Not validly published (ICBN Art. 33.3).

*Galphimia cauca* Spreng., Syst. veg. 2: 385. 1825. = *Caucanthus edulis* Forssk.

*Galphimia chrysophylla* (H. B. K.) Spreng., Syst. veg. 2: 385. 1825. = *Byrsonima chrysophylla* H. B. K.

*Galphimia longifolia* H. B. K., Nov. gen. sp. 5: 173. 1822 ["1821"]. = *Lophanthera longifolia* (H. B. K.) Griseb.

*Galphimia mollis* H. B. K., Nov. gen. sp. 5: 173. 1822 ["1821"]. = *Tetrapteryx cotoneaster* Adr. Juss.

*Thryallis hirsuta* Sessé & Mociño, Fl. mex. 119. 1894; ed. 2, 109. 1894.—The Sessé & Mociño herbarium (at MA) does not include a collection labeled with this name. Most likely, the description was based on a specimen of *Echinopteryx glandulosa* (Adr. Juss.) Small (W. R. Anderson, pers. comm.).

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## APPENDIX

## SPECIES OF GALPHIMIA OCCURRING IN MEXICO, LISTED BY STATE

- Aguascalientes: *G. glauca*
- Baja California Sur: *G. angustifolia*
- Chiapas: *G. speciosa*
- Chihuahua: *G. floribunda*, *G. vestita*
- Coahuila: *G. angustifolia*
- Colima: *G. grandiflora*, *G. langlassei*, *G. montana*, *G. tuberculata*
- Durango: *G. angustifolia*, *G. floribunda*, *G. montana*
- Guanajuato: *G. glauca*, *G. multicaulis*
- Guerrero: *G. calliantha*, *G. glandulosa*, *G. hirsuta*, *G. langlassei*, *G. mirandae*, *G. montana*, *G. paniculata*, *G. radialis*, *G. tuberculata*
- Hidalgo: *G. glauca*, *G. gracilis*
- Jalisco: *G. floribunda*, *G. glauca*, *G. grandiflora*, *G. langlassei*, *G. mexiae*, *G. montana*, *G. multicaulis*, *G. paniculata*, *G. tuberculata*
- México: *G. glandulosa*, *G. grandiflora*, *G. multicaulis*, *G. paniculata*
- Michoacán: *G. glandulosa*, *G. grandiflora*, *G. langlassei*, *G. montana*, *G. multicaulis*, *G. paniculata*
- Morelos: *G. grandiflora*, *G. paniculata*
- Nayarit: *G. floribunda*, *G. mexiae*, *G. montana*, *G. paniculata*, *G. tuberculata*, *G. vestita*

Nuevo León: *G. angustifolia*, *G. glauca*

Oaxaca: *G. arenicola*, *G. calliantha*, *G. elegans*, *G. multicaulis*, *G. oaxacana*, *G. paniculata*, *G. sessilifolia*,  
*G. speciosa*

Puebla: *G. gracilis*, *G. mirandae*, *G. paniculata*, *G. speciosa*

Querétaro: *G. glauca*, *G. gracilis*

San Luis Potosí: *G. angustifolia*, *G. glauca*, *G. gracilis*

Sinaloa: *G. angustifolia*, *G. floribunda*, *G. glandulosa*, *G. montana*, *G. tuberculata*, *G. vestita*

Sonora: *G. angustifolia*, *G. floribunda*, *G. vestita*

Tamaulipas: *G. angustifolia*, *G. glauca*, *G. gracilis*

Veracruz: *G. gracilis*, *G. speciosa*, *G. glandulosa* (?)

Zacatecas: *G. glauca*, *G. montana*, *G. paniculata*

## LECTOTYPIFICATION OF NAMES OF MALPIGHIACEAE—I

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**ABSTRACT.** Lectotypes are designated for the following names of Malpighiaceae: *Alcocceratothrix* Nied., *Alcocceratothrix rugosa* var. *minor* Nied., *Aspicarpa lanata* Rose, *Bunchosia costaricensis* Rose, *Bunchosia gaudichaudiana* Adr. Juss., *Bunchosia pallescens* Skottsb., *Bunchosia swartziana* Griseb., *Burdachia atracoides* Nied., *Byrsonima aerygo* Sagot, *Byrsonima altissima* var. *occidentalis* Nied., *Byrsonima basiloba* Adr. Juss., *Byrsonima biactininata* Rusby, *Byrsonima clausentiana* Adr. Juss., *Byrsonima ferruginea* var. *macrophylla* Benth., *Byrsonima grisebachiana* Nied., *Byrsonima lyonifolia* Nied., *Byrsonima oaxacana* Adr. Juss., *Byrsonima peruviana* Adr. Juss., *Camarea* sect. *Cryptolappa* Adr. Juss., *Caucanthus* sect. *Eriocaucanthus* Nied., *Clonodia mollis* Nied., *Diplopterys involuta* var. *ovata* Nied., *Fimbriaria elegans* Adr. Juss., *Gaudichaudia filipendula* Adr. Juss., *Heteropterys amplexicaulis* Morong, *Heteropterys angustifolia* f. *lancofolata* Nied., *Heteropterys beecheyana* var. *andina* Nied., *Heteropterys beecheyana* var. *guatemalensis* Nied., *Heteropterys chodatiana* Skottsb., *Heteropterys dusenii* Nied., *Heteropterys glazioviana* Nied., *Heteropterys hassleriana* Nied., *Heteropterys lonicerifolia* Triana & Planch., *Heteropterys metallochroa* Adr. Juss., *Heteropterys nudicaulis* S. Moore, *Heteropterys palmeri* Rose, *Heteropterys pieropetala* Adr. Juss., *Heteropterys subhelicina* Nied., *Heteropterys tomentosa* var. *minor* Nied., *Heteropterys trigonifolia* Adr. Juss., *Heteropterys umbellata* Adr. Juss., *Heteropterys venezolensis* Nied., *Hiraea chrysophylla* Adr. Juss., *Hiraea fagifolia* f. *laifolia* Nied., *Hiraea fagifolia* var. *candolleana* Nied., *Hiraea faginea* f. *glauca* Nied., *Hiraea multiflora* Miq., *Hiraea pauciflora* Adr. Juss., *Hiraea platytriphyllo* Hochr., *Hiraea polybotrya* Adr. Juss., *Hiraea salicifolia* Adr. Juss., *Hiraea salzmanniana* Adr. Juss., *Hiraea sepium* Adr. Juss., *Hiraea sericifolia* Adr. Juss., *Hiraea strigulosa* Rusby, *Hiraea transiens* Nied., *Jubelina riparia* Adr. Juss., *Mascagnia brevifolia* Griseb., *Mascagnia coratifolia* var. *cinerascens* Skottsb., *Mascagnia malmeana* Skottsb., *Mascagnia sepium* var. *glabrata* Nied., *Mascagnia sepium* var. *salzmanniana* Nied., *Mascagnia tenuifolia* Nied., *Mascagnia vacciniifolia* Nied., *Mascagnia vacciniifolia* var. *glabrata* Nied., *Mascagnia vacciniifolia* var. *hispidula* Nied., *Mezta araujoi* Nied., *Ptilochaeta elegans* Nied., *Ptilochaeta glabra* Nied., *Schwannia crassispula* Adr. Juss., *Tetrapterys alternifolia* Cuatrec., *Tetrapterys crebriflora* Adr. Juss., *Tetrapterys crispa* var. *ovata* Nied., *Tetrapterys globerrima* Benth., *Tetrapterys guillemianina* f. *martiana* Nied., *Tetrapterys guillemianina* f. *oblonga* Nied., *Tetrapterys jamesonii* var. *aequatorialis* Nied., *Tetrapterys jamesonii* var. *granatensis* Nied., *Tetrapterys longibracteata* Adr. Juss., *Tetrapterys lucida* f. *eglandulosa* Nied., *Tetrapterys mogorifolia* var. *platyptera* Adr. Juss., *Tetrapterys mucronata* f. *oblonga* Nied., *Tetrapterys mucronata* f. *ovalis* Nied., *Tetrapterys schiedeania* f. *primaeva* Nied., *Tetrapterys squarrosa* f. *lancofolata* Nied., *Tetrapterys squarrosa* f. *ovata* Nied., and *Tetrapterys styloptera* Adr. Juss.

### INTRODUCTION

Hundreds of names of Malpighiaceae were published before the Code of Nomenclature required the consistent designation of a single type, and many of those names require lectotypification. Designating lectotypes is not to be done mechanically, because one wants to be as sure as possible that the lectotype selected is the most appropriate one available. In the case of the Malpighiaceae, the process is complicated by the fact that many of Franz Niedenzu's types were lost when the Berlin herbarium burned. This paper is a first step toward the goal of stabilizing the nomenclature of the Malpighiaceae by designating lectotypes where necessary.

In some past publications, I and others have cited collections as "type" in what was then an effective lectotypification, but without designating a specific specimen as "type" or lectotype. This situation is now covered by article 9.15 of the Code of Nomenclature (McNeill et al. 2006), which provides for the narrowing of a lectotypification

from such a "first-step" designation of a gathering to a "second-step" designation of a single specimen. A number of such cases appear below. Such a narrowing is especially important for the types in the Muséum National d'Histoire Naturelle in Paris, because Adrien de Jussieu often had two or more sheets of the same gathering available for study, and simply saying that the type is a particular gathering by, for example, Saint-Hilaire in P is not adequate for narrowing the lectotype to a single specimen.

*Alcoceratothrix* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 1: 45. 1901.—LECTOTYPE, designated here: *Alcoceratothrix rugosa* (Benth.) Nied.

*Alcoceratothrix rugosa* var. *minor* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 1: 45. 1901.—LECTOTYPE, designated here: FRENCH GUIANA. *Sagot 1029* (lectotype: G!; isolectotypes: BM! K!).

*Aspicarpa lanata* Rose, Contr. U.S. Natl. Herb. 8: 49. 1903.—LECTOTYPE, designated here: MEXICO. Jalisco: near Guadalajara, 13 Jul 1893, *Pringle 4422* (lectotype: US!; isolectotypes: BR! F! G! GH! MEL! MEXU! MO! MSC! NY! UC!).

The type collection was cited in the protologue as *Pringle 4222*, but that was a typographical error for *Pringle 4422*. That was a mixed collection; each sheet contains flowering material collected on 13 July and fruiting material collected on 18 August. The flowering material is here designated lectotype.

*Bunchosia costaricensis* Rose in Pittier, Anales Inst. Fis.-Geogr. Nac. Costa Rica 9: 100. 1896.—LECTOTYPE, designated here: COSTA RICA. San José: San Francisco de Guadalupe, *Tonduz 8944* (lectotype: US 212775!; isolectotype: CR!).

*Bunchosia gaudichaudiana* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 324. 1840.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro: near Sebastianópolis [Rio de Janeiro], *Gaudichaud 145* (lectotype: P!, F neg. 35569; isolectotype: P-JU 11519!).

*Bunchosia pallescens* Skottsbl., Kongl. Svenska Vetenskapsakad. Handl. 35(6): 32, pl. 8 fig. 2. 1901.—LECTOTYPE, designated here: BRAZIL. São Paulo: Serra de Caracol, *Mosén 4044* (lectotype: S!).

*Bunchosia swartziana* Griseb., Fl. Brit. W.I. 115. 1860.—LECTOTYPE, designated here: JAMAICA. *March 1646* in 1858 (lectotype: K!).

*Burdachia atractoides* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 5: 59. 1914.—LECTOTYPE, designated here: BRAZIL. "Environs of Rio Janeiro, 1882" [probably actually from Amazonas], *Glaziou 13592* (lectotype: K!).

*Burdachia* does not grow anywhere near Rio de Janeiro, so this is undoubtedly one of the many collections from elsewhere in Brazil that Glaziou labeled as coming from near Rio (Wurdack 1970).

*Byrsonima aerugo* Sagot, Ann. Sci. Nat. Bot., Sér. 6, 12: 178. 1881.—LECTOTYPE: FRENCH GUIANA, Karouany, *Sagot 102* (lectotype, designated here: P!; isolecotypes: BM! G! K! MEL! MICH! NY!).

Anderson (1981, p. 89) designated *Sagot 102* the lectotype collection of this name, but failed to designate a specific sheet as lectotype; that is done here.

*Byrsonima altissima* var. *occidentalis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 1: 15. 1901.—LECTOTYPE, designated here: VENEZUELA ["BRITISH GUIANA"], Mt. Roraima, *Robert Schomburgk II 811* (lectotype: K!, the sheet from Bentham's herbarium; isolecotypes: NY! P! US!).

The same specimen is lectotype of *Byrsonima ferruginea* var. *macrophylla* Benth.

*Byrsonima basiloba* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 331. 1840.—LECTOTYPE, designated here: BRAZIL, Goiás: *Gardner 3617* (lectotype: G!, the sheet from Delessert's herbarium that was annotated by Jussieu; isolecotypes: G! K! P!).

*Byrsonima biacuminata* Rusby, Mem. Torrey Bot. Club 6: 13. 1896.—LECTOTYPE, designated here: BOLIVIA, Tipuani, *Bang 1643* (lectotype: NY 55549!; isolecotypes: G! GH! K! MO! NY! US!).

*Byrsonima clausseniana* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 332. 1840.—LECTOTYPE, designated here: BRAZIL, Minas Gerais: *Claussen s.n.* (lectotype: P!, the flowering specimen in the general herbarium annotated by Jussieu; isolecotypes: G! K!).

There are Claussen sheets in P and P-JU that are in fruit; they were probably not part of the lectotype collection and should be considered syntypes, not isolecotypes. The isolecotype in G has one piece with flowers and one with immature fruits.

*Byrsonima ferruginea* var. *macrophylla* Benth., London J. Bot. 7: 119. 1848.—LECTOTYPE, designated here: VENEZUELA ["BRITISH GUIANA"], Mt. Roraima, *Robert Schomburgk II 811* (lectotype: K!, the sheet from Bentham's herbarium; isolecotypes: NY! P! US!).

The same specimen is lectotype of *Byrsonima altissima* var. *occidentalis* Nied.

*Byrsonima grisebachiana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 1: 23. 1901.—LECTOTYPE, designated here: BRAZIL, Minas Gerais: Franca, *Lund s.n.* [VII 1834] (lectotype: K!).

*Byrsonima lyoniifolia* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 1: 38. 1901.—LECTOTYPE, designated here: BRAZIL, Minas Gerais: Serra do Lenheiro, *Glaziou 12480* (lectotype: G!; isolecotypes: K! NY! P!).

*Byrsonima oaxacana* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 332. 1840.—LECTOTYPE, designated here: MEXICO, Oaxaca: Guichilona, between Tehuantepec and Río Guazacualcos, *Andrieux 491* (lectotype: P!, F neg. 35551; isolectotypes: G! K! NY!).

*Byrsonima peruviana* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 333. 1840.—LECTOTYPE: PERU, Mozobamba, *Mathews 1460* (lectotype, designated here: G!, the sheet annotated by Jussieu; isotypes: CGE! G! P!).

Jussieu cited only one collection, but he cited specimens of it at both G and P; therefore, while it is not necessary to designate a lectotype collection, it is necessary to designate a lectotype sheet; the other sheets of *Mathews 1460* are all isotypes.

*Camarea* sect. *Cryptolappa* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 254. 1840.—LECTOTYPE, designated here: *Camarea affinis* A. St.-Hil.

*Caucanthus* sect. *Eriocaucanthus* Nied., Bull. Herb. Boissier, Sér. 2, 4: 1010. 1904.—LECTOTYPE, designated here: *Caucanthus argenteus* Nied.

*Clonodia mollis* Nied., Meded. Rijks-Herb. 19: 74. 1913.—LECTOTYPE, designated here: BOLIVIA, Sierra de Caipipendi, *Herzog 1231* (lectotype: L!).

*Diplopterys involuta* var. *ovata* Nied. in Engl., Pflanzenr. IV, 141: 227. 1928.—LECTOTYPE, designated here: PERU, Amazonas: Río Marañón, mouth of Río Santiago, Pongo de Manseriche [4° ca. 30'S, 77° ca. 35'W], *Tessmann 4564* (lectotype: G!),..

*Fimbriaria elegans* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 63, pl. 173. 1833 ["1832"].—LECTOTYPE, designated here: BRAZIL, Minas Gerais: S. João del Rei, *Saint-Hilaire Catal. D no. 411* (lectotype: P!, the sheet that has both Jussieu's annotation with his † symbol and also the printed label; isolectotype: P!).

*Gaudichaudia filipendula* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 252. 1840.—LECTOTYPE, designated here: MEXICO, Hidalgo: near Zimapán, *Galeotti 4349* (lectotype: P!).

*Heteropterys amplexicaulis* Morong, Ann. New York Acad. Sci. 7: 66. 1892.—LECTOTYPE, designated here: PARAGUAY, "Central Paraguay," *Morong 199* (lectotype: NY 00071261!; isolectotypes: GH! MICH! MO! US!).

*Heteropterys angustifolia* f. *lanceolata* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 21. 1903.—LECTOTYPE, designated here: PARAGUAY, Cordillera: valley of Río [Arroyo] Y-acá near Valenzuela, *Hassler 7000* (lectotype: G!).

*Heteropterys beechejana* var. *andina* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 55. 1903.—LECTOTYPE, designated here: BOLIVIA, Yungas, *Bang 2192* (lectotype: K!; isolectotypes: MICH! MO! NY! US!).

*Bang 2192* is also the type of *Banisteria sanguinea* Rusby.

*Heteropterys beecheyana* var. *guatemalensis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 5. 1903.—LECTOTYPE, designated here: GUATEMALA. Huehuetenango, *Seler & Seler 3092* (lectotype: GH!).

*Heteropterys chodatiana* Skottsbl., Kongl. Svenska Vetenskapsakad. Handl. 35(6): 21, pl. 4 fig. 2. 1901.—LECTOTYPE, designated here: BRAZIL. Mato Grosso: Cuiabá, 7 Feb 1894 fl, *Malme 1370* (lectotype: S!).

Malme assigned the number 1370 to two different gatherings, one with flowers made on 7 Feb 1894 and a second with immature fruits made on 20 Apr 1894; the flowering collection is here designated lectotype.

*Heteropterys dusenii* Nied. in Engl., Pflanzenr. IV, 141: 321. 1928.—LECTOTYPE, designated here: BRAZIL. Paraná: Serrinha, *Dusén 16271* (lectotype: G!).

*Heteropterys glazioviana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 27. 1903.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro: Petrópolis, *Glaziou 16730* (lectotype: G!; isolectotypes: K! P!).

*Heteropterys hassleriana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 25. 1903.—LECTOTYPE, designated here: PARAGUAY. *Hassler 8025* (lectotype: G!, the sheet in the Barbey-Boissier herbarium annotated by Niedenzu; isolectotypes: G!).

*Heteropterys lonicerifolia* Triana & Planch., Ann. Sci. Nat. Bot., Sér. 4, 18: 324. 1862.—LECTOTYPE, designated here: COLOMBIA. Caguzza, prov. Bogotá, 1790 m, *Triana [5575]* (lectotype: P!, F neg. 35588; isolectotypes: BM! G! K!).

*Heteropterys metallochroa* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 275. 1840.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro: Sebastianópolis [Rio de Janeiro], *Martius 569* (lectotype: P!; isolectotypes: K!).

*Heteropterys nudicaulis* S. Moore, Trans. Linn. Soc. London, Ser. 2 Bot., 4: 325. 1895.—LECTOTYPE, designated here: BRAZIL. Mato Grosso: Cuiabá, *Moore 16* (lectotype: BM!).

*Heteropterys palmeri* Rose, Contr. U.S. Natl. Herb. 1: 311. 1895.—LECTOTYPE, designated here: MEXICO. Sonora: Alamos, *Palmer 656* in 1890 (lectotype: US 41051!; isolectotypes: G! GH! K! MEXU! NY! US!).

*Heteropterys pteropetala* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 31, pl. 167. 1833 ["1832"].—LECTOTYPE, designated here: BRAZIL. Minas Gerais: near Penha (Minas Novas), *Laruotte s.n.* (lectotype: P!).

*Heteropterys subhelicina* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 8: 60. 1926.—TYPE: BRAZIL. Roraima ["Rio Branco"]: S. Marcos, *Ule 7808* (holotype: B†; lectotype, designated here: G!; isotype: K!).

*Heteropterys tomentosa* var. *minor* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 2: 17. 1903.—LECTOTYPE, designated here: BRAZIL. Mato Grosso: Corumbá, *Kuntze* in Aug 1892 (lectotype: F!).

The lectotype of this name is an isotype of *Heteropterys corumbensis* Kuntze.

*Heteropterys trigoniifolia* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 33. 1833 ["1832"].—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro: *Saint-Hilaire Catal. C' no. 7* (lectotype: P!, WRA negs. 81-27-18 & 19, MICH; isolectotype: P!).

*Heteropterys umbellata* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 25, pl. 166. 1833 ["1832"].—LECTOTYPE, designated here: BRAZIL. Minas Gerais: Santa Maria, *Saint-Hilaire s.n.* (lectotype: P!, the sheet annotated "holotype"; isolectotype: P!).

*Heteropterys venezolensis* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 8: 60. 1926.—TYPE: VENEZUELA. Sierra de la Guaira, *Fendler 186* (holotype: B†?; lectotype, designated here: GOET).

*Hiraea chrysophylla* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 258. 1840.—LECTOTYPE, designated here: BRAZIL. "Brésil (herb. Lusitan.)" in Jussieu's hand, "Leg. Ferreira Ex Herb. Lusit." in A. Lourteig's hand (lectotype: P!; isolectotype: P-JU 11734 p.p.!).

*Hiraea fagifolia* f. *latifolia* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1906/07: 14. 1906.—LECTOTYPE, designated here: SURINAME. *Hostmann 993* (lectotype: BM!; isolectotypes: K!).

*Hiraea fagifolia* var. *candolleana* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1906/07: 14. 1906.—LECTOTYPE, designated here: SURINAME. *Hostmann 494* (lectotype: U!; isolectotypes: K!).

*Hiraea faginea* f. *glandulifera* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1906/07: 16. 1906.—LECTOTYPE, designated here: VENEZUELA. Lower Orinoco, *Rusby [& Squires] 165* (lectotype: NY!; isolectotype: US!).

*Hiraea multiflora* Miq., Stirp. Surinam. Select. 83. 1851.—TYPE: SURINAME. Near Paramaribo, *Focke [1104]* (lectotype, designated here: K!, the sheet from Bentham's herbarium; isotype: K!, the sheet from Hooker's herbarium).

The holotype should be in U, but no such specimen was to be found there, or in L, in 1999, so it is necessary to designate a lectotype.

*Hiraea pauciflora* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 22. 1833 ["1832"].—TYPE: BRAZIL. Rio de Janeiro: Tijuca, near Sebastianópolis [Rio de Janeiro], *Saint-Hilaire Catal. A<sup>2</sup> 2<sup>o</sup> partie no. 1153* (lectotype, designated here: P!, WRA negs. 81-26-24 & 25, MICH; isotypes: P!).

There was only one type collection, but there are three sheets in P, all annotated by Jussieu, so it is necessary to designate one of them the lectotype.

*Hiraea platytriphyllo* Hochr., Bull. New York Bot. Gard. 6: 276. 1910.—TYPE: COLOMBIA. Magdalena, *Holton 802* (lectotype, designated here: NY!; isotype: K!).

There was only one type collection, but sheets were cited at both K and NY, so one of those needs to be designated the lectotype, which is done here.

*Hiraea polybotrya* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 260. 1840.—LECTOTYPE, designated here: MEXICO. *Andrieux* (lectotype: P!, the sheet with the number 495 and both flowers and fruits; isotypes: G! K! P!).

In G, K, and P there are *Andrieux* specimens with the numbers 168 or 495 or both. It is not clear to me whether those represent one gathering or two, but it seems best to designate one specimen as lectotype and to consider all the others probable isotypes.

*Hiraea salicifolia* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 18. 1833 ["1832"].—TYPE: BRAZIL. São Paulo: Rio Yapó, *Saint-Hilaire Catal. C<sup>2</sup> no. 14905* (lectotype, designated here: P!, F neg. 35634; isotype: P!).

*Hiraea salzmänniana* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 258. 1840.—TYPE: BRAZIL. Bahia: near Bahia [Salvador], *Salzmann s.n.* (lectotype, designated here: G!, F neg. 24272; isotypes: CGE! G! K! P!).

*Hiraea sepium* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 19, pl. 165. 1833 ["1832"].—TYPE: BRAZIL. Rio de Janeiro, *Saint-Hilaire Catal. C<sup>2</sup> 2<sup>o</sup> Partie no. 32* (lectotype, designated here: P!, F neg. 35635; isotypes: P!).

*Hiraea sericifolia* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 258. 1840.—LECTOTYPE, designated here: BRAZIL. Mato Grosso: near Cuiabá, *Martius 652* (lectotype: P!; isolectotypes: BM! BR? G! K! L! MO!).

*Hiraea strigulosa* Rusby, Bull. New York Bot. Gard. 8: 95. 1912.—LECTOTYPE, designated here: BOLIVIA. La Paz: Charopampa, *Williams 799* (lectotype: NY 71323!; isolectotypes: BM! K! NY! US!).

*Hiraea transiens* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1906/07: 8. 1906.—LECTOTYPE collection, designated by Cuatrecasas (1958, p. 406): COLOMBIA. Chocó: Isthmus de San Pablo, *Triana 3393/5579* (lectotype specimen, designated here: G!; isolectotypes: BM! COL! K! NY!).

*Jubelina riparia* Adr. Juss. in Deless., Icon. Sel. Pl. 3: 19, pl. 32. 1838 ["1837"].—TYPE: FRENCH GUIANA. Oyapok and Oyes Rivers, *Leprieur s.n.* (lectotype, designated here: P-JU 11739; isotypes: F! G! L! MICH! P!).

*Mascagnia brevifolia* Griseb., Abh. Königl. Ges. Wiss. Göttingen 24: 67. 1879.—LECTOTYPE collection, designated by O'Donnell & Lourteig (1943, p. 228): ARGENTINA. Salta: Oran, Oct 1870, *Lorentz & Hieronymus 424* (lectotype specimen, designated here: GOET; isolectotype: CORD).

O'Donnell and Lourteig (1943, pl. 1) showed a print of F neg. 12686, which was a photograph of the B sheet of *Lorentz & Hieronymus 424*, and called it "Tipo" in their caption, which effectively made that specimen the lectotype; because that sheet no longer exists it is necessary to designate a new lectotype.

*Mascagnia cordifolia* var. *cinerascens* Skottsbo., Kongl. Svenska Vetenskapskad. Handl. 35(6): 4. 1901.—LECTOTYPE, designated here: BRAZIL. Mato Grosso: Cuiabá, 7/2/1894, *Malme 1364 p.p.* (lectotype: S!, the sheet with both flowers and fruits; isolectotypes: S!).

*Mascagnia malmeana* Skottsbl., Kongl. Svenska Vetenskapsakad. Handl. 35(6): 6, pl. 1 fig. 2. 1901.—LECTOTYPE, designated here: PARAGUAY. Colonia Risso near Río Apa, *Malme 980* (lectotype: S; isolectotypes: G! US!).

*Mascagnia sepium* var. *glabrata* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 7. 1908.—LECTOTYPE, designated here: BRAZIL. Bahia: *Blanchet s.n.* (lectotype: G!).

The lectotype of this name is the holotype of *Hiraea bierosa* Adr. Juss.

*Mascagnia sepium* var. *salzmanniana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 6. 1908.—LECTOTYPE, designated here: BRAZIL. Bahia: *Salzmann 99* (lectotype: G!, the sheet annotated by Niedenzu and bearing the number 99; isolectotypes: G! P! W).

*Mascagnia tenuifolia* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 10. 1908.—LECTOTYPE collection, designated by W. R. Anderson (1981, p. 225): PERU. San Martín: Tarapoto, *Spruce 4958* (lectotype specimen, designated here: NY!, the fragments from Niedenzu's Herbarium; isolectotypes: CGE! G! K! MG! NY!).

*Mascagnia vacciniifolia* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 11. 1908.—LECTOTYPE, designated here: MEXICO. *Liebmann 39* [Mar 1842] (lectotype: C).

*Mascagnia vacciniifolia* var. *glabrata* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 11. 1908.—LECTOTYPE, designated here: MEXICO. *Liebmann 39* [Mar 1842] (lectotype: C).

The same specimen is designated lectotype of *M. vacciniifolia* and *M. vacciniifolia* var. *glabrata*.

*Mascagnia vacciniifolia* var. *hispidula* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 11. 1908.—TYPE: COSTA RICA. San Miguel, *Wendland [C. Hoffmann] 788* (holotype: B†; lectotype, designated here: NY!, fragment from Niedenzu's herbarium).

*Mezia araujo* Nied. in Engl. & Prantl, Nat. Pflanzenfam. III. 4: 58. 1890.—TYPE: BRAZIL. Minas Gerais: Rio Novo, *Araujo s.n.* (holotype: B†; lectotype, designated here: P†; isotypes: F! P!).

*Ptilochaeta elegans* Nied. in Chodat & Hassl., Bull. Herb. Boissier, Sér. 2, 7: 293. 1907.—TYPE: PARAGUAY. Near Concepción, *Hassler 7278a* (holotype: B†?; lectotype, designated here: G!, the sheet annotated by Niedenzu; isotypes: BM! G! K! MICH! MO! NY! P! US!).

*Ptilochaeta glabra* Nied., Bot. Jahrb. Syst. 14, Beibl. 30: 4. 1891.—LECTOTYPE, designated here: BRAZIL. Minas Gerais: "Environs de Rio Janeiro et d'Ouro Preto" [Caraça, ou Bom Jardim, Minas], 1883–84, *Glaziou 15446* (B†, F neg. 12847; lectotype: K!, K000253670; isolectotypes: P!).

*Schwannia crassistipula* Adr. Juss., Arch. Mus. Hist. Nat. 3: 610. 1843.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro, *Claussen 32* (lectotype: P!, the sheet annotated "Type"; isolectotypes: BR! L! P! P-JU 11755!).

*Tetrapteryx alternifolia* Cuatrec., Webbia 13: 435. 1958.—TYPE: COLOMBIA. Bolívar: between Cartagena and Turbaco, *Dugand & Jaramillo 2850* (lectotype, designated here: US!, the stem with flowers; isotype: COL).

The holotype is a mixed collection. The stem with alternate leaves, to which the epithet refers, is not Malpighiaceae; the flowering stem, which is designated here as lectotype, represents a species of *Tetrapteryx*.

*Tetrapteryx crebriflora* Adr. Juss. in A. St.-Hil., Fl. Bras. Merid. 3: 9. 1833 ["1832"].—LECTOTYPE, designated here: BRAZIL. Minas Gerais: Castas Altas, *Saint-Hilaire s.n.* (lectotype: P!, F neg. 35596; isolectotype: P!).

*Tetrapteryx crispa* var. *ovata* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunschweig 1909/10: 52. 1909.—LECTOTYPE, designated here: GUYANA. *Richard Schomburgk 1511* (lectotype: K!, the sheet from Hooker's herbarium; isolectotype: K!, the sheet from Bentham's herbarium).

*Tetrapteryx glaberrima* Benth., London J. Bot. 7: 134. 1848.—LECTOTYPE, designated here: GUYANA. Demerara, *Richard Schomburgk 1705* (lectotype: K!, the sheet from Bentham's herbarium, K000253668; isolectotype: K!, the sheet from Hooker's herbarium, K000253669).

In the protologue this collection was cited as 1765; that must have been a typographical error for 1705.

*Tetrapteryx guilleminiana* f. *martiana* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunschweig 1909/10: 25. 1909.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro, *Martius 1167* (holotype: B†, F neg. 12729; lectotype: NY!, the sheet stamped as having come from Bentham's herbarium; isolectotype: NY!).

*Tetrapteryx guilleminiana* f. *oblonga* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunschweig 1909/10: 25. 1909.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro, *Guillemin 85* (lectotype: P!).

*Tetrapteryx jamesonii* var. *aequatorialis* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunschweig 1909/10: 55. 1909.—LECTOTYPE, designated here: ECUADOR. Guayas: Guayaquil, *Hartweg 645* (lectotype: G!, the sheet in the general herbarium annotated by Niedenzu with this name and by Adrien de Jussieu with the name "*Tetrapteryx crotonifolia* Ad. Juss."; isolectotypes: BM! CGE! G! K! P!).

*Tetrapteryx jamesonii* var. *granatensis* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunschweig 1909/10: 55. 1909.—LECTOTYPE, designated here: COLOMBIA. "Fl. Magdalena et Cauca, prov. Margarita et Cauca," *Triana s.n.* (lectotype: G!; isolectotypes: BM! K! MO! NY! P!).

The collection designated lectotype here is also the type of *Tetrapteryx benthamii* Triana & Planch. (with its holotype in P), which will make this name a homotypic synonym of *T. benthamii*.

*Tetrapterys longibracteata* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 263. 1840.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro: near Sebastianópolis [Rio de Janeiro], *Gaudichaud 970* (lectotype: P!, the sheet annotated by Jussieu; isolectotypes: G! P! P-JU 11713!).

*Tetrapterys lucida* f. *eglandulosa* Nied. in Engl., Pflanzenr. IV, 141: 185. 1928.—LECTOTYPE, designated here: BRAZIL. Paraná: Volta Grande, *Dusén 743a* (lectotype: NY!).

*Tetrapterys mogoriifolia* var. *platyptera* Adr. Juss., Arch. Mus. Hist. Nat. 3: 533. 1843.—LECTOTYPE, designated here: BRAZIL. Rio de Janeiro: Sebastianópolis [Rio de Janeiro], *Gaudichaud 966ter* (lectotype: P!).

*Tetrapterys mucronata* f. *oblonga* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1909/10: 37. 1909.—LECTOTYPE, designated here: GUYANA. Demerara, *Richard Schomburgk 1705* (lectotype: K!, the sheet from Bentham's herbarium, K000253668; isolectotype: K!, the sheet from Hooker's herbarium, K000253669).

The lectotype of this name is also the lectotype of *Tetrapterys glaberrima* Benth.

*Tetrapterys mucronata* f. *ovalis* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1909/10: 36. 1909.—LECTOTYPE, designated here: SURINAME. *Kappler 2125* (lectotype: L!).

*Tetrapterys schiedeana* f. *primaeva* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1909/10: 38. 1909.—LECTOTYPE, designated here: MEXICO. Oaxaca: Monte Albán, *Pringle 4885* (lectotype: G!; isolectotypes: A! ENCB! GH! MEL! MEXU! MO! NY! UC! US!).

*Tetrapterys squarrosa* f. *lanceolata* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1909/10: 18. 1909.—LECTOTYPE, designated here: PERU. *Ule 6349* (lectotype: L!).

*Tetrapterys squarrosa* f. *ovata* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1909/10: 18. 1909.—LECTOTYPE, designated here: GUYANA. *Jenman 4973* (lectotype: K!).

*Tetrapterys styloptera* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 262. 1840. LECTOTYPE collection, designated by W. R. Anderson (1981, p. 256): PERU. Near Tarapoto, *Mathews 1464* (lectotype specimen, designated here: K!, the sheet from Hooker's herbarium annotated by Jussieu; isolectotype: K!, the sheet from Bentham's herbarium).

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## NOTES ON NEOTROPICAL MALPIGHIACEAE—IX

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**ABSTRACT.** Six new species of neotropical Malpighiaceae are named and described (*Banisteriopsis macedae* W. R. Anderson, *Byrsonima homeieri* W. R. Anderson, *Heteropterys colombiana* W. R. Anderson, *Mascagnia almedae* W. R. Anderson, *Mascagnia conformis* W. R. Anderson, and *Tetrapterys natans* W. R. Anderson), and two new combinations are proposed (*Mascagnia allopterys* (Moris) W. R. Anderson and *Mascagnia hirsuta* (Adr. Juss.) W. R. Anderson).

Although my colleagues and I have described many new species of Malpighiaceae over the last 32 years, we continue to encounter additional novelties as we study problematic groups and newly received gifts and loans. This paper deals with a few of those additions to the flora of the neotropics.

**Banisteriopsis macedae** W. R. Anderson, sp. nov.—**TYPE:** PERU. Madre de Dios: Manu Province, Puerto Maldonado, Los Amigos Biological Station, Madre de Dios River, ca. 7 km upriver from mouth of Río Los Amigos, orillas del Río Los Amigos, 19 May 2004 fl. A. P. Maceda 1391 (holotype: MICH!).

Liana lignosa, caulibus sericeis; lamina foliorum majorum 9.5–11.5 cm longa, 3.7–4.5 cm lata, apice acuminata, abaxialiter sparsim sericea utrinque 1–3 (4) glandulis peltatis instructa; petiolus 8–10 mm longus, sericeus, eglandulosus; bracteae bracteolaeque caducae; petala cremae, fimbriata; petalum posticum ungue apice constricto; antherae loculis piliferis, 5 anticae connectivo glanduloso-tumido (praecipue 3 sepalis anticis oppositae), 5 posticae connectivo loculos non vel vix superanti, anthera petalo postico opposita rudimentaria vel nulla; nux samarae aliquot alulis lateralibus instructa.

Woody vine; stems densely and persistently sericeous with long, whitish, strongly appressed hairs, glabrescent in age. Lamina of larger leaves 9.5–11.5 cm long, 3.7–4.5 cm wide, elliptical or widest slightly above the middle, cuneate at base, long-acuminate at apex with the acumen 1–1.5 cm long, initially loosely sericeous above but soon glabrate except often persistently sericeous on midrib and sometimes on major lateral veins, thinly but persistently sericeous below with the hairs dense on midrib and lateral veins, bearing 1–3 (4) peltate glands below on each side between midrib and margin on lateral veins in proximal 2/3, the principal lateral veins 5–7 on each side of midrib, the cross-veins strongly scalariform; petiole 8–10 mm long, densely and persistently sericeous, eglandular; stipules interpetiolar, distinct, 0.3–0.5 mm long, triangular or rounded, often hidden by hairs on stem. Inflorescences terminal and lateral, paniculate with the flowers in umbels of 4 (–6), the axes densely and persistently loosely sericeous or tomentose; bracts and bracteoles 1–1.5 mm long, 0.7–0.9 mm wide, triangular or ovate, abaxially densely tomentose, adaxially glabrous, caducous (mostly falling before anthesis); peduncle 0–1 mm long; pedicel 6–9 mm long, densely sericeous or appressed-tomentose. Sepals 3–4 mm long, 2.5–3.5 mm wide, elongate-triangular with the apex obtuse, distally reflexed in bud and open flower,

densely pilose or tomentose on both sides, all 5 biglandular with the glands borne on free part of sepal, the glands on 4 lateral sepals 2 mm long, those on anterior sepal 1–1.3 mm long. Petals cream-colored, glabrous; lateral petals reflexed, the claw 2 mm long, the limb 4.5–6 mm long and wide, deeply cup-shaped, fimbriate (especially the posterior-lateral pair) with the fimbriae eglandular; posterior petal erect, the claw 2.5 mm long, very broad and thick, constricted at apex, the limb 5–6 mm long, 5 mm wide, ovate, flat or shallowly concave, long-fimbriate with the fimbriae gland-tipped, especially those on proximal half of limb. Stamens strongly heteromorphic, the filaments glabrous and connate in proximal 1/4–1/2, the anther locules bearing a few hairs at apex and often at base as well; stamens opposite 3 anterior sepals with filament 1.5–2.5 mm long, the anther with locules 1 mm long and connective distally enormously glandular-swollen, overtopping locules by 1–1.5 mm; stamens opposite anterior-lateral petals with filament 1.5 mm long, the anther with locules 1 mm long and connective distally somewhat glandular-swollen, overtopping locules by 0.7 mm; stamens opposite posterior-lateral petals with filament 2–2.5 mm long, the anther with locules 0.8 mm long and connective not swollen and not or hardly exceeding locules; stamens opposite posterior-lateral sepals with filament 2.5 mm long, the anther with locules 0.3–0.5 mm long and connective not swollen and not or hardly exceeding locules; stamen opposite posterior petal with filament 2–2.3 mm long, the anther lacking or represented by a rudimentary connective ca. 0.3 mm long, without locules or bearing minute (sterile?) locules. Ovary 1–1.5 mm high, densely hirsute; styles hirsute on proximal 1/2–2/3, distally tapered to very small truncate or slightly capitate apical stigmas; anterior style 2.2–2.5 mm long, bowed back toward anterior sepal; posterior styles 3–3.3 mm long, thickened in proximal half, bowed toward posterior petal. Samara persistently sericeous, 35–45 mm long; dorsal wing 28–40 mm long, 13–18 mm wide; nut ca. 5–7 mm in diameter, glabrous inside locule, bearing on both sides several winglets 2–7 mm high, these mostly parallel to ventral areole and imbricated but some (the smallest, outermost winglets) sometimes radiating from areole; carpophore short and broad (ca. 0.5–1 mm long, 0.3–0.5 mm wide), probably non-functional; ventral areole 3–3.5 mm long, 2–2.5 mm wide, ovate.

ADDITIONAL COLLECTIONS EXAMINED. **Peru.** MADRE DE DIOS: Manu Province, Río Amiguellos, Aug fr, Maceda et al. 1533 (BRIT); Cocha Cashu, 400 m, Oct fr, Niñez 1926 (F).

This species is named for Abel Píher Maceda Chuan (b. 1973), who collected the holotype and one of the paratypes.

*Banisteriopsis macedae* can be compared to other species of the genus on the following bases: petioles eglandular, leaf glands peltate, bracts and bracteoles caducous, sepals elongated and triangular, petals cream-colored, posterior petal constricted at the apex of the claw, anthers pilose, and samara with several imbricated winglets on the sides of the nut and glabrous inside the locule. According to the treatment by Gates (1982), those characteristics suggest a relationship to *B. adenopoda* (Adr. Juss.) B. Gates, *B. membranifolia* (Adr. Juss.) B. Gates, or *B. pulchra* B. Gates. *Banisteriopsis adenopoda*, a species of southeastern Brazil, is eliminated by the fact that its lamina is velutinous on both surfaces. *Banisteriopsis membranifolia*, another species of southeastern Brazil, has glands on the petiole, rounded sepals, and the posterior petal without a constriction at the apex of the claw. *Banisteriopsis pulchra* agrees with *B. macedae* in having peltate leaf glands, deciduous bracts and bracteoles, the posterior petal constricted at the apex of the claw, pilose anthers, and the samara with well-developed lateral winglets on the nut. Moreover, it occurs as far west as Bolivia,

coming closer to southern Peru than any other close relative of *B. macedae*. *B. pulchra* var. *pulchra* has the petiole biglandular at the apex, the bracts and bracteoles persist longer than in *B. macedae*, the petals are pink, and the leaves are very densely sericeous below. In *B. pulchra* var. *glabrata* B. Gates (known only from a single collection from La Paz Province, Bolivia) the lamina is glabrate below, more like the thinly sericeous lamina of *B. macedae*, but Gates described it as having pink petals, not the cream-colored petals of *B. macedae*, which also differs in having all three of the posterior anthers much reduced. Indeed, in the type of *B. macedae* (the only collection seen with flowers), the anther opposite the posterior petal is rudimentary or lacking. *Banisteriopsis macedae* is also notable for having small glands on the anterior sepal. When more collections are known from western Bolivia and southern Peru it may become necessary to combine *B. macedae* and *B. pulchra* var. *glabrata*, but if so the former name should be adopted; I am satisfied that the plant described here deserves species status.

**Byrsonima homeieri** W. R. Anderson, sp. nov.—TYPE. ECUADOR, Zamora-Chinchipec: area of the Estación Científica San Francisco, road Loja–Zamora, ca. 35 km from Loja, 03°58' S, 79°04' W, montane tropical forest, 1880 m, 26 Aug 2005 fl, *Homeier 1566* (holotype: MICH!; isotypes: AAU! GOET, K! LOJA, MO, NY! QCNE). Fig. 1.

Arbor 7–12 m alta; lamina foliorum majorum 12.5–19 cm longa, 5.5–9.2 cm lata, coriacea, mox glabrata; petiolus 13–25 mm longus; stipulae omnino connatae, 3–5 mm longae; bracteae bracteolaeque 0.5–1.3 mm longae lataeque, ± persistentes; pedicellus 8–10 mm longus (fructu usque ad 17 mm), crassus, rectus in alabastro fructuque; sepala lutea aetate rubra, in fructu accrescentia; petala lutea; antherae glabrae, 1.7–1.9 mm longae, loculis connectivo non vel vix (usque ad 0.1 mm) superatis; ovarium sparsim sericeum; styli 2.2 mm longi, recti.

Tree 7–12 m tall; stems initially sericeous but soon glabrescent to glabrate. Lamina of larger leaves 12.5–19 cm long, 5.5–9.2 cm wide, elliptical or obovate, cuneate or gradually narrowed at base, obtuse or rounded at apex, coriaceous, initially thinly sericeous but at maturity glabrate or with a few appressed hairs on abaxial midrib, the 7–10 pairs of lateral veins ± prominent, the reticulum visible on both sides in dried leaves; petiole 13–25 mm long, sparsely sericeous to glabrate; stipules of each intrapetiolar pair completely and smoothly connate, the pair triangular, 3–5 mm long, abaxially sparsely sericeous (?) to glabrate, adaxially glabrous except at very base. Inflorescence 11–21 cm long, tightly brown-sericeous to glabrescent in age; flowers borne 1 per bract (a minute second bud often present but not developed); bracts and bracteoles 0.5–1.3 mm long and wide, ovate or triangular, sparsely sericeous or glabrate, mostly persistent through maturation of fruit, thereafter persistent or deciduous; peduncle absent or up to 0.7 mm long; pedicel 8–10 mm long in flower, up to 17 mm long in fruit, ± persistently sericeous, often relatively thick, straight in bud and fruit, turning red in age. Sepals yellow turning red in age, 1.5–2 mm long beyond glands, 2.5–3 mm wide, broadly triangular with obtuse or rounded apex, appressed, abaxially thinly sericeous, adaxially glabrous, accrescent to ca. 4–5 mm long and 5–6 mm wide in fruit, all biglandular, the glands yellow, 2.8–3.2 mm long, obovate. Petals yellow, glabrous; lateral petals spreading or reflexed, the claw 2–2.5 mm long, the limb 4.5–5.5 mm long, 4–6 mm wide, cordate, deeply cupshaped, erose or denticulate; posterior petal erect, the claw 2.5 mm long, thick, the limb 3.5 mm long and wide, broadly sagittate, corrugated, erose. Filaments 1.8–2 mm long, abaxially

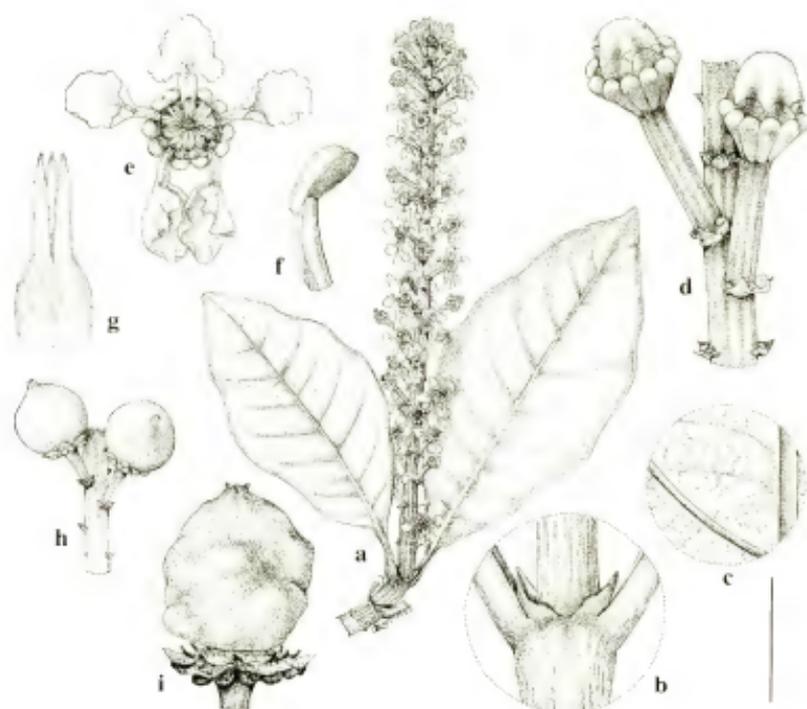


FIG. 1. *Byronnia homeieri*. a. Flowering branch. b. Node with connate intrapetiolar stipules. c. Lamina, adaxial surface. d. Portion of inflorescence with two flower buds. e. Flower, posterior petal uppermost. f. Stamen, lateral view. g. Gynoecium. h. Fruits, drawn from a photo taken before specimen was dried. i. Dried fruit. Scale bar equivalents: a, 4 cm; b, 8 mm; c, 4 mm; d, e, 8 mm; f, g, 2.7 mm; h, 4 cm; i, 8 mm. (Based on: a-g, *Homeier 1566*, MICH; h, *Homeier 1053*, MICH; i, *Neill 12631*, MICH.)

glabrous, adaxially hirsute at base; anthers glabrous, 1.7–1.9 mm long, subequal, the locules linear, not alate, rounded and attached at apex, not or hardly (up to 0.1 mm) exceeded by connective at apex. Ovary 1.5 mm high, very thinly scricoseous, all 3 locules fertile; styles 2.2 mm long, straight. Fruit yellow, glabrous, with bases of styles forming apical beaks, roughly globose (somewhat depressed to somewhat elongated), 18–23 mm in diameter before drying, 12–20 mm in diameter after drying, the stone with prominent swellings.

Distribution. Known only from montane tropical forest at 1880–2600 m in Zamora-Chinchipe, Ecuador [*Rubio et al.* 2256 was reported as coming from Loja Province, but with exactly the same geographical coordinates as all the other collections, which their collectors labeled as coming from Zamora-Chinchipe Province].

ADDITIONAL COLLECTIONS EXAMINED. **Ecuador.** ZAMORA-CHINCHIPE, same approximate locality as type: Oct fl, *Homeier 551* (MICH), Mar fr, *Homeier 1053* (MICH), Apr fr, *Neill 12631, 12632, 12633* (all MICH), Dec fr, *Rubio et al. 2256* (MICH). *Homeier 551* and *1053* were collected from the same tree as the type, *Homeier 1566*.

*Byrsonima homeieri* is named in honor of Dr. Jürgen Homeier (b. 1968), a plant ecologist at the University of Göttingen who has collected it several times during his studies in the San Francisco reserve in Ecuador.

The relationships of *Byrsonima homeieri* are to be sought among other species with yellow petals, smoothly connate stipules, and anthers with the connective not or hardly exceeding the locules, of which there are many. None of them, however, has the combination of characteristics that sets this species apart: thick, stiff, nearly glabrous leaves; very short, similar, persistent bracts and bracteoles; stout, straight pedicels that turn red in age and remain straight in fruit; sepals turning red in age and accrescent in fruit; and completely glabrous anthers. The pedicels are especially notable, because most yellow-flowered species of *Byrsonima* have slender pedicels that are often circinate in bud and decurved in fruit. The species most closely related to *B. homeieri* may be *B. hypoleuca* Turcz., a tree of montane Venezuela and Colombia. It has similar stipules, straight pedicels, yellow petals, and anthers with short connectives, but differs in having the leaves densely and persistently sericeous below, the bracts long, narrow, and deciduous, and the anthers sparsely sericeous.

**Heteropterys colombiana** W. R. Anderson, sp. nov.—TYPE. COLOMBIA. Cesar: 12 km N of Codazzi, edge of dry forest, 5 Sep 1938 fl, *Haught 2321* (holotype: MO!; isotypes: CAS! NY! US).

Frutex 2 m altus, caulibus dense velutinis; lamina supra verrucosa et velutina demum glabrescens, subtus dense et pertinaciter tomentosa, basi biglandulosa et interdum 2 glandulis minoribus super basim instructa; inflorescentia dense velutina, floribus in umbellis vel corymbis (2–) 4–6 (–8)-floris portatis; bracteolae prope medium pedunculi portatae; petala lutea, glabra; styli 1.4–2.3 mm longi, apice dorsaliter truncati.

Shrub ca. 2 m tall, described by Cuatrecasas as “± tortuoso, bejucoso” [± twisted, vinelike]; stems initially densely velutinous with the ferrugineous hairs fading in age, long-persistent but abraded from older stems (after the first year?); punctiform lenticels soon developed and prominent. Largest leaves, remote from inflorescence (only 1 seen), with lamina 14.7 cm long, 8.5 cm wide, broadly elliptical, rounded at base, obtuse at apex, the petiole 4 mm long; larger leaves on flowering stems with lamina 5–10 cm long, 3–5.5 cm wide, elliptical, cuneate or rounded at base, acute, abruptly acuminate, or obtuse at apex, velutinous above with broadly V-shaped hairs to belatedly glabrescent, verrucose, densely and persistently tomentose below, the hairs with a very short stalk and a long (0.8–1.6 mm) straight or sinuous crosspiece, usually bearing 1 large gland on each side of midrib at base and sometimes another smaller gland somewhat above base between midrib and margin; petiole 3–4 mm long, eglandular (rarely biglandular when glands from lamina are displaced downward); stipules lacking or 0.4–0.7 mm long, triangular, borne on base of petiole. Inflorescence elongated, paniculate, ferruginous-velutinous throughout, with the short, dense branches borne in axils of progressively smaller leaves, the flowers borne ultimately in umbels or tight corymbs of (2–) 4–6 (–8), on a stalk 3–10 mm long; bracts 1–2 mm long, 0.6–1 mm wide, narrowly elliptical, eglandular, abaxially tomentose, adaxially glabrous; peduncle 1.5–4 mm long; bracteoles like bracts but shorter (0.6–1 mm long), borne at or somewhat above middle of peduncle; pedicel 2.5–4 mm long, as long as peduncle or longer. Sepals 1.5–2 mm long beyond glands, 1.3–1.7 mm wide, elliptical or ovate with the apex obtuse or broadly rounded, appressed in anthesis, abaxially

densely appressed-tomentose with ferruginous hairs, adaxially glabrous, the anterior eglandular, the lateral 4 biglandular with the glands 1.5–2 mm long. Petals yellow, glabrous, abaxially smooth (i.e., not carinate or winged); lateral petals spreading or reflexed, the claw 1.2–1.8 mm long, the limb 3–3.8 mm long, 2.5–3.2 mm wide, obovate or rectangular, concave or flat with the margin often revolute, erose; posterior petal similar to lateral petals but erect, with a longer (1.5–2.5 mm) thicker claw. Stamens glabrous; filaments 2–3 mm long, longest opposite sepals and posterior-lateral petals, connate in proximal half, straight except the 2 opposite posterior-lateral sepals bent sideways away from posterior petal; anthers 0.9–1.2 mm long, subsimilar, the connective uniformly dark red or distally yellow. Ovary 1.5 mm high, densely hirsute; styles 1.4–2.3 mm long, similar but the anterior slightly shorter and slenderer than the posterior 2, hirsute on proximal half, nearly straight but the anterior leaning toward posterior petal and the posterior 2 diverging, terete or laterally flattened, dorsally truncate at apex, the stigma internal. Fruit unknown.

Distribution. Known only from Cesar, Colombia, on the lower western slopes of the Cordillera Oriental. [The NY sheet of *Haught* 2321 bears a printed label stating that it came from Los Llanos, Meta, but that is clearly the result of a clerical error, because the typed information on the specimen states that it came from north of Codazzi, which was formerly in Magdalena and is now in Cesar; the CAS and MO sheets have the same typed information, plus a printed label for Magdalena.]

ADDITIONAL COLLECTIONS EXAMINED. **Colombia.** CESAR: La Jagua, Magdalena Valley, forest, Sep fl. *Allen* 685 (MO); Cordillera Oriental, vertiente occidental, Quebrada del Gobernador (afluente del Río Peralonso), carretera de San Martín a Ocaña, Km 21–22, 700 m, Sep fl. *Cuatrecasas & Rodríguez* 27966 (K); Aguachica, 800 ft [240 m], *Schlim* 265 (G).

This species, which is named for the country where it is endemic, was treated by Cuatrecasas (1958) as *Heteropterys tomentosa* Adr. Juss., a species of south-central Brazil, Paraguay, and adjacent Bolivia. The Colombian plants are certainly referable to the complex of species containing *H. tomentosa*, but they most resemble *H. falcifera* Adr. Juss., a very similar species known only from Bolivia. The latter differs from *H. colombiana* in having a more twining habit, leaves smooth (not verrucose) above, a more open inflorescence, and the stems and inflorescence less exuberantly hairy. It remains to be seen whether *H. colombiana* will maintain its distinctness when the complex is better known, especially from Peruvian populations.

***Mascagnia allopterys*** (Moris) W. R. Anderson, comb. nov. *Tetrapterys allopterys* Moris, *Pianta malpigh.* 4. 1848.—TYPE: COLOMBIA, Bolívar; Mompos, *Bertero* in 1820 (lectotype, designated here, the specimen in fruit: TO).

*Mascagnia tenuis* Cuatrec., *Webbia* 13: 371. 1958.—TYPE: COLOMBIA, Cesar ["Magdalena"]; Gamarra, Río Magdalena, *Fosberg* 21399 (holotype: US!; isotype: NY!).

This species of *Mascagnia* is endemic to Bolívar and adjacent Cesar in northern Colombia. It is immediately recognizable in fruit because the lateral wings of the samara are mostly dissected irregularly into 3–5 narrowly rectangular segments, while the large dorsal crest is entire and extended beyond the nut (especially at the apex) like a prow. In his protologue, Moris (1848) provided a thorough description and excellent illustration, which leave me in no doubt as to the identity of his plant, even though I have not seen either of his syntypes (the second syntype was a flowering specimen, also collected by Bertero in 1820 at Mompos). Niedenzu (1928, p. 217) never

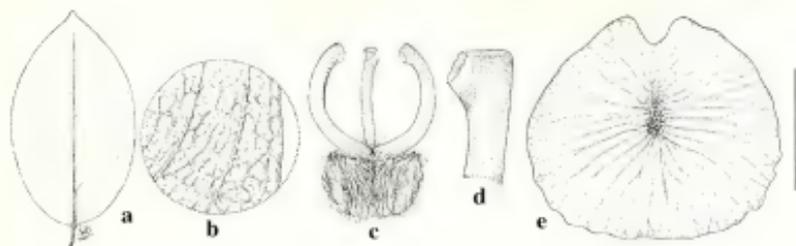


FIG. 2. *Mascagnia almedae*. a. Leaf, adaxial view. b. Enlargement of adaxial leaf surface. c. Gynoecium, anterior style in center. d. Apex of posterior style. e. Samara, abaxial view. Scale bar equivalents: a, 4 cm; b, 5 mm; c, 4 mm; d, 1.3 mm; e, 1.3 cm. (Based on: a, b, e, *Breedlove & Almeda 56949*, MICH; c, d, *Breedlove 48675*, MICH.)

saw specimens of this species and cited Moris's name among his "Species incertae mihi invisae" of *Tetrapteryx*. Cuatrecasas (1958) did not mention the Moris name or publication. If he had ever seen Moris's illustration he surely would have taken up his name and made the combination in *Mascagnia* instead of describing the plant again as *M. tenuis*.

***Mascagnia almedae*** W. R. Anderson, sp. nov.—TYPE: MEXICO. Chiapas: Mun. Angel Albino Corzo, above Finca Cuxtepec, montane rain forest, 1380 m, 10 Jan 1982 fr. *D. E. Breedlove & F. Almeda 56949* (holotype: MICH!; isotype: CAS!). Fig. 2.

*Mascagnia vacciniifoliae* affinis, sed caulibus sericeis vel glabratis, lamina foliorum majorum 6–7.3 cm longa et 4–4.5 cm lata, stipulis 0.7–1.1 mm longis, ovario dense piloso, stylis apice dorsaliter truncatis vel brevissime apiculatis, et samara 2.5–3 cm lato atque differt.

Woody vine; stems tightly sericeous to glabrate and sometimes bearing adventitious roots in vertical rows. Lamina of larger leaves 6–7.3 cm long, 4–4.5 cm wide, elliptical or somewhat ovate, rounded at base, rounded, obtuse, or abruptly short-acuminate at apex, initially thinly sericeous but soon glabrate, usually bearing 1 (2) small abaxial glands on each side of midrib between midrib and margin in proximal 1/4 or 1/3, the principal lateral veins 3–5 on each side of midrib, the reticulum prominent above in older leaves; petiole 6–8 mm long, sericeous to glabrate, eglandular or biglandular at or slightly below apex; stipules 0.7–1.1 mm long, triangular, sericeous or glabrate, soon deciduous and leaving prominent scars. Inflorescence a compact panicle 2–4 cm long borne on leafless stems of previous growing season, comprising 3 or 5 umbels or corymbs ca. 1 cm long, the middle pair of umbels often reduced to 1 flower each, the others containing 4–10 flowers each, the axis (including peduncles) loosely sericeous, glabrescent in age; bracts 0.5–1 mm long, triangular, eglandular, pilose, persistent; peduncle 2–4.5 mm long; bracteoles borne at very base of peduncle, 0.5–0.7 mm long, narrowly triangular, eglandular, pilose, persistent; pedicel 11–13 mm long, nearly glabrous except sparsely sericeous at apex. Sepals 1–1.5 mm long beyond glands, triangular, obtuse or rounded at apex, abaxially glabrous or with a few appressed hairs, ciliate on margin, adaxially glabrous; glands 2–2.4 mm long. Petals pink, glabrous, abaxially carinate proximally, the margin of limb entire or minutely denticulate; lateral petals with the claw 1–1.5 mm long, the limb 4.5–5 mm long,

3.5–4 mm wide, truncate at base; posterior petal with the claw thicker than in lateral petals and the limb longer (5.5–6 mm). Stamens glabrous; filaments connate at base, 2–3.5 mm long, strongly heteromorphic, longest opposite sepals, shortest opposite posterior petal, thickest opposite posterior-lateral petals; anthers 1–1.4 mm long,  $\pm$  alike. Ovary 1.5 mm high, densely pilose; styles glabrous; anterior style 3–3.5 mm long, slightly bowed, dorsally very slightly apiculate at apex; posterior styles 3.5–4 mm long, strongly bowed from the base, dorsally truncate at apex. Samara broadly triangular with rounded corners, 2.5–3 cm wide and high; lateral wing membranous, continuous at base and apex, cleft at apex up to halfway to nut, nearly glabrate at maturity; dorsal and ventral crests absent; nut inserted well above center of lateral wing, sparsely pilose; ventral areole ovate or elliptical, 2.5–3.5 mm high, 2–3 mm wide; disc below fruit with its 3 lobes extended upward to apex of a massive torus.

ADDITIONAL COLLECTION EXAMINED. **Mexico.** CHIAPAS: Same locality as type, 14 Dec fl. *Breedlove* 48675 (CAS, MICH).

I am happy to name this species for Frank Almeda (b. 1946), one of the collectors of the type, who has had an illustrious and productive career in systematic botany, specializing in the family Melastomataceae. *Mascagnia almedae* is closely related to *M. vacciniifolia* Nied. (Fig. 3), with which it shares at least three synapomorphies: adventitious roots on the stems, a samara completely devoid of a dorsal crest, and vertical extensions of the disc below the fruit to the top of the massive torus. The adventitious roots are unique not only in the genus, but (so far as I know) in the family; I do not know whether the stems can also twine, but the adventitious roots are formed on young stems, in the second season of growth in *M. almedae*. *Mascagnia vacciniifolia* differs from *M. almedae* in having  $\pm$  persistently velutinous or tomentose stems, stipules only 0.3–0.6 mm long, leaves with the lamina 2–4 (–6) cm long and 1.2–3 (–3.5) cm wide, the ovary glabrous or sparsely pilose to soon glabrate, the styles dorsally apiculate or hooked at apex, and the samara 1.3–2.3 cm wide and high.

***Mascagnia bierosa*** (Adr. Juss.) W. R. Anderson, comb. nov. *Hiraea bierosa* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 260. 1840. *Mascagnia sepium* subsp. *bierosa* (Adr. Juss.) Griseb. in Mart., Fl. Bras. 12(1): 96. 1858. *Mascagnia sepium* var. *glabrata* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 7. 1908.—TYPE: BRAZIL, Bahia, *Blanchet* (holotype: G!).

*Mascagnia sepium* var. *macrophylla* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 6. 1908.—SYNTYPES: BRAZIL, Minas Gerais: *Schwacke* 7356, 10847, and 11947, none seen.

*Mascagnia sepium* var. *salzmanniana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 6. 1908.—TYPE: BRAZIL, Bahia, *Salzmann* 99 (lectotype, designated by W. R. Anderson, 2007, p. 90: G!; isoelectotypes: G! P! W).

***Mascagnia leonii*** W. R. Anderson, Contr. Univ. Michigan Herb. 19: 381. 1993.—TYPE: BRAZIL, Minas Gerais: Carangola, *Leoni* [GFJP 1213] (holotype: GFJP!; isotype: MICH!).

*Mascagnia bierosa* is a species of eastern Brazil (Bahia, Espírito Santo, Minas Gerais, Distrito Federal, Goiás, and São Paulo). It is notable for its large glabrate leaves, carinate lateral petals, and especially the extraordinarily long stipules. After describing it as *M. leonii* (Anderson 1993) I realized that Jussieu had described in

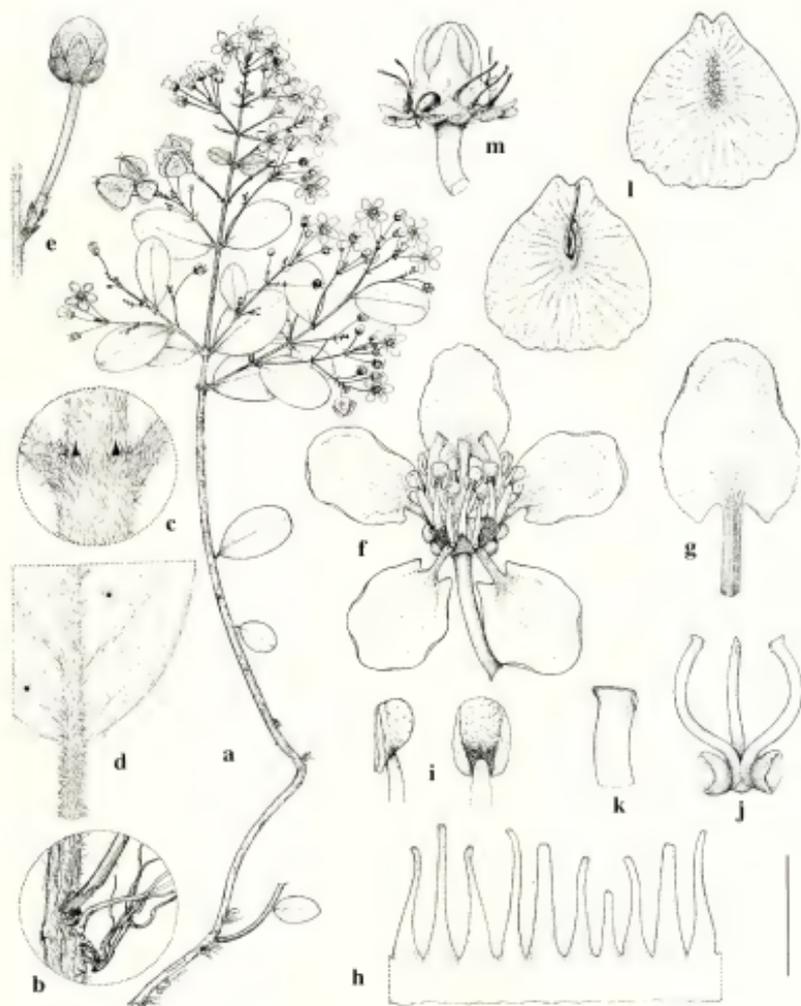


FIG. 3. *Mascagnia vacciniifolia*. a. Flowering and fruiting branch. b. Adventitious roots on stem. c. Node to show interpetiolar stipules. d. Abaxial surface of leaf. e. Flower bud. f. Flower, posterior petal uppermost. g. Posterior petal, adaxial view. h. Androecium laid out, adaxial view, anthers removed, shortest filament opposite posterior petal. i. Anthers, lateral view (left) and abaxial view (right). j. Gynoecium, anterior style in center. k. Apex of posterior style. l. Samaras, abaxial view (above) and adaxial view (below). m. Torus after removal of mature samaras. Scale bar equivalents: a, 4 cm; b, 8 mm; c, 4 mm; d, 5 mm; e, 8 mm; f, 5 mm; g, 3.3 mm; h, 2.7 mm; i, 1.6 mm; j, 4 mm; k, 1.3 mm; l, 1.3 cm; m, 2 mm. (Based on: a-k, *Utley* 5934, DUKE; l, m, *Lent* 2521, F.)

1840 and Niedenzu then described it three times as varieties of *M. sepium* (Adr. Juss.) Griseb. The following synoptical description is based on my 1993 publication plus the several specimens seen since.

Woody vine; stems tomentose or loosely sericeous to soon glabrate; stipules (1.5–) 2.5–6 mm long (but often broken off near base in age), tomentose to glabrate; petiole often 13–28 mm long, tomentose or loosely sericeous to soon glabrate, eglandular; lamina relatively large (often 9–18 cm long, 6–11.5 cm wide), broadly cuneate or rounded at base, initially tomentose or loosely sericeous on both sides but soon quite glabrate, often coriaceous at maturity, with a discolored margin ca. 0.5 mm wide, eglandular or with several glands in an abaxial row (but usually not at very base), usually biglandular near apex; inflorescence consisting of unbranched pseudoracemes axillary to full-sized or reduced leaves or a panicle of several such pseudoracemes, the flowers ± crowded distally, the axis (including peduncles and pedicels) tomentose or loosely sericeous to sometimes glabrescent; bracts 1.8–4 mm long, or longer at base of pseudoraceme; bracteoles borne from middle of peduncle to near apex, eglandular or usually 1 of each pair (occasionally both) bearing 1 gland; pedicel longer than, equal to, or occasionally shorter than peduncle; petals yellow, abaxially carinate or alulate; styles erect and straight or distally divergent, rounded or truncate dorsally at apex; samara tomentose at least on nut, continuous at base and apex, entire or notched at apex.

***Mascagnia conformis*** W. R. Anderson, sp. nov.—TYPE: BRAZIL, Pará: Santarém, estrada que liga Alter do Chão, capoeira baixa, terreno arenoso, 12 Dec 1978 fl/fr, Vilhena, Lobo & Ribeiro 251 (holotype: NY!; isotypes: MICH! NY!).

*Mascagnia cordifolia* var. *peruviana* J. F. Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser., 13: 787. 1950.—TYPE: PERU, Loreto: Mishuyacu, *Klug* 25 (holotype?: US!; isotype: NY!).

*Mascagniae schunkei* similis, sed petalis roseis vel lilacinis (vel albis?), bracteolis (una cujusque paris) plerumque glandula 0.5–1 mm diametro instructis, et lamina glandulis proximalibus grandis et distalibus minoribus instructa differt.

Woody vine, rarely described as a shrub up to 2.5 m tall; stem persistently brown-sericeous; lamina of larger leaves 7–16 (–21) cm long, 5–10 (–14.5) cm wide, ovate or elliptical, cuneate or rounded at base, mostly acuminate (sometimes abruptly so) at apex, initially sericeous on both sides but soon glabrescent to glabrate above or sericeous on midrib, ± persistently sericeous below with the straight sessile strongly appressed hairs denser on principal veins than between them or glabrescent in age but with some hairs persistent, especially on veins, usually bearing 1 or 2 glands 0.7–1.5 mm in diameter impressed in abaxial surface at or somewhat above base on each side of midrib and usually several similar or smaller glands in a distal row, often with a pair near the apex, the lateral veins 5–7 (–9) on each side of midrib; petiole 7–16 (–25) mm long, persistently sericeous, eglandular; stipules 1–2 mm long, narrowly triangular, sericeous, persistent or deciduous. Flowers borne in unbranched pseudoracemes 4–14 cm long, in axils of full-sized leaves; flowers (10–) 20–60 in each pseudoraceme, ± evenly distributed and soon horizontal, the axis tightly or loosely brown-sericeous or velutinous; bracts 1.3–3.5 mm long, very narrowly linear, eglandular, sericeous, persistent; peduncle 3–8.5 mm long, sericeous; bracteoles borne at or somewhat below apex of peduncle, 0.5–1.5 mm long, narrowly triangular, sericeous, persistent, both eglandular or (usually) 1 of each pair bearing 1 large bulging eccentric abaxial gland 0.5–1 mm in diameter, the glands occasionally 2 and occasionally

present on both bracteoles; pedicel 4–10 mm long, sericeous to glabrescent. Sepals 0.5–1.5 mm long beyond glands, ovate or triangular, obtuse or rounded at apex, abaxially sericeous, at least in center, adaxially glabrous, appressed in anthesis; glands 2–2.5 mm long, free at apex. Petals pink or lilac (or white?), glabrous, abaxially smooth or carinate on claw, the margin of limb irregularly denticulate or minutely erose; lateral petals with the claw 1–1.5 mm long, the limb 3.5–5.5 mm long, 2.5–4.2 mm wide, truncate at base; posterior petal like the lateral 4 or the limb narrower. Stamens glabrous; filaments 1.5–2 mm long,  $\pm$  alike or longer opposite sepals than opposite petals, distinct or connate at base, straight; anthers 1–1.5 mm long, alike. Ovary 1.5 mm high, densely hirsute; styles 1.3–2 mm long, glabrous, stout, originally erect and straight, often diverging distally in age and becoming somewhat recurved, the apex stigmatic on internal angle and dorsally rounded, truncate, or acute; anterior style somewhat shorter and slenderer than posterior 2. Samara orbicular or broadly ovate, 2–3.5 cm wide and high, sometimes wider than high; lateral wing membranous, thinly sericeous to glabrate, continuous at base and apex, shallowly to deeply cleft at apex (15–60% of the distance to the nut); dorsal crest 0.5–2.5 mm wide, prolonged upward toward apex of samara and confluent with lateral wing; ventral crest 0.5–1.5 mm wide, extending from apex of nut upward and confluent with lateral wing; nut inserted above center of lateral wing, persistently tomentose; ventral areole ovate or triangular, 3–5 mm high, 2–2.5 mm wide; fruit subtended by a high, smooth, reddish, 3-lobed disc.

Distribution. Forests of Amazonia from Peru and Bolivia in the west to French Guiana and Maranhão, Brazil, in the east.

ADDITIONAL COLLECTIONS EXAMINED. **Bolivia.** BENE junction of Rivers Beni and Madre de Dios, Aug fl, *Rusby 733* (F. MICH, NY, US); PROV. Vaca Díez, road to Cachuella Esperanza E of Riberalta, primary forest, 11°05'S, 65°50'W, 230 m, Sep fl, *Solomon 6161* (MICH, MO); same approx. loc., secondary forest, Sep fr, *Solomon 6278* (MICH, MO, NY).—PANDO: PROV. Manuripi, entre el campamento Bay y Curichón, monte alto, Oct, *Beck et al. 19517* (MICH, fr) & *19518* (MICH, fl). **Brazil.** ACRE: Boa Esperança, Abumam, Oct fr, *J. Kuhlmann 696* (CEPEC).—AMAPÁ: estrada do Igarapé Picoval, NE de Macapá, Nov fl, *Austin et al. 7380* (MICH, NY); road to Porto Terezinha, from junction with main road, Nov fl, *Cowan 38471* (NY); Mun. Mazagão, Macapá—Monte Dourado, vic. of Rio Preto, 0°06'S, 51°47'W, non-inundated moist forest, Dec fr, *Rabelo et al. 3070* (MICH, MO, NY).—MARANHÃO: Fazenda Bacaba, 5 km S of MA 119 from entrance 3 km NW of Lago do Junco, 4°26'S, 44°58'W, hilltop forest, Oct fr, *Daly et al. D495* (MICH).—MATO GROSSO: Mun. Alta Floresta, Hidrelétrica do Salto do Rio Apiacás, 10°15'S, 56°50'W, forest, Sep fr, *Cid Ferreira 6279* (MICH, MO, NY).—PARÁ: Tucuruí, thickets, Feb ster, *Anderson 13750* (MICH); IAN, Belém, Dec fr, *Archer 8080* (NY); Mun. Monte Alegre, Monte Alegre—Alenquer, 1°40'S, 54°31'W, forest, Nov fr, *Cid Ferreira 9446* (MICH, NY); Tucuruí, Oct fr, *Lima & Silva 100* (NY); Km 345 along Belém—Brasília Highway, Aug fl/fr, *Maguire et al. 56081* (MICH, NY); Peixe-Boi, forest, Oct fl, *Rodrigues [MG 8810]* (MICH).—RONDÔNIA: Km 79, Pôrto Velho—Cuiabá, edge of forest, Sep fr, *Duarte?164/Appa 513* (NY). **French Guiana.** Piste de Saint-Laurent vers Paul Isnard, Nov fl, *Billiet & Jadin 1698* (MICH). **Peru.** LORETO: PROV. Requena, Genaro Herrera, Río Ucayali below Requena, upland forest, Dec fl/imm fr, *Gentry et al. 21306* (MICH, MO); Nauta, Río Marañón above mouth of Río Ucayali, 4°30'S, 73°30'W, upland forest and second growth, Oct fr, *Gentry et al. 29961* (MO); Ramón Castilla, Pevás, 3°20'S, 71°50'W, bosque primario, Oct fr, *Vásquez & Jaramillo 9713* (MICH, MO). **Venezuela.** AMAZONAS: Depto. Atures 9–10 km después de Puerto Ayacucho, Caño Colombiano vía comunidad la Reforma, 6°25'N, 67°25'W, 37 m, Mar fr, *Castillo 766* (MICH); en el Gavilán 30 km al E de Pto. Ayacucho, Nov imm fr, *Fernández 2954* (F); Atures, cuenca del Río Cataniapo, desde el aeropuerto de Puerto Ayacucho hasta entrada a la comunidad de Las Pavas en la vía a Gavilán, 5°32'–40'N, 67°25'–37'W, Feb fl/fr, *Guanchez 1570* (MO).

*Mascagnia conformis* is very similar to *M. schunkei* (Fig. 4), and the epithet refers to that similarity. When I described *M. schunkei* (Anderson 1981), I mentioned my uncertainty about the color of the petals, and that uncertainty persisted in the recent treatment of the same Venezuelan flora (Anderson 2001). I now believe that two species are recognizable in the plants to which I have applied the name *M. schunkei*.

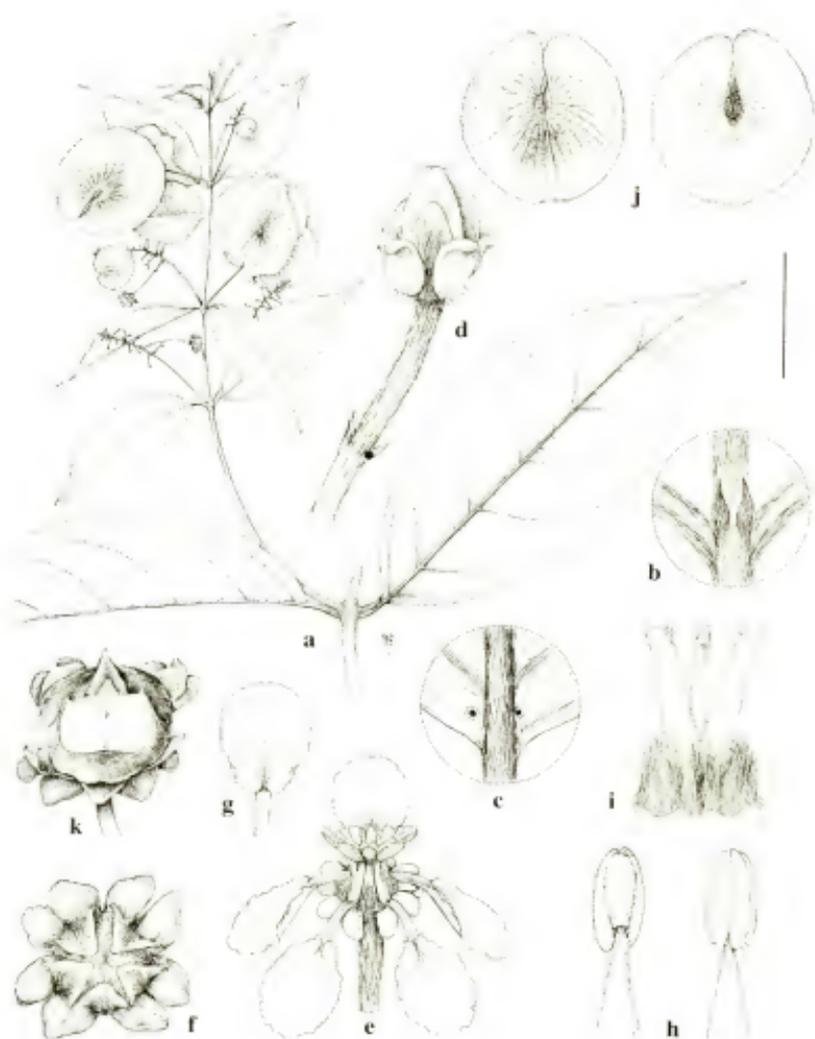


FIG. 4. *Mascagnia schunkei*. a. Fruiting branch. b. Node with interpetiolar stipules. c. Base of lamina, abaxial view. d. Flower bud. e. Flower, posterior petal uppermost. f. Calyx from above with eglandular anterior sepal at base. g. Posterior petal, adaxial view. h. Stamens, abaxial view (left) and adaxial view (right). i. Gynoecium. j. Samaras, abaxial view (left) and adaxial view (right). k. Old fruit after fall of samaras, showing torus surrounded by lobed disc. Scale bar equivalents: a, 4 cm; b-d, 4 mm; e, 5 mm; f, g, 4 mm; h, i, 2 mm; j, 2.7 cm; k, 4 mm. (Based on: a, j, k, *Schunke 6195*, F; b-i, *Schunke 7877*, MICH.) Modified from a drawing first published in *Mem. New York Bot. Gard.* 32: 223, 1981.

When the color of the petals is known, there is no difficulty—*M. schunkei* has yellow petals; *M. conformis* has pink or lilac petals (or white?; see below). When petals are absent or their color unknown, the best distinguishing character is the bracteoles, which are eglandular or bear at most a tiny gland in *M. schunkei*; in *M. conformis* one bracteole usually bears a large bulging eccentric gland. The leaf glands are also useful, because in *M. schunkei* they are absent or very small and limited to the base of the lamina, while in *M. conformis* they are larger and usually present distally as well as at the base.

The Venezuelan collections cited above are problematic. *Guanchez 1570* was said to have white petals, which are otherwise unknown in *M. conformis*. *Castillo 766* and *Guanchez 1570* have the bracteoles eglandular or a few have only a small gland, while *Fernández 2954* has many bracteoles with a large gland as in most populations of *M. conformis*. In other respects the plants accord with *M. conformis*; all three have the leaf glands of that species. There remains the possibility that the plants of Venezuela represent a white-flowered species that could be segregated from *M. conformis*, but for now I think it best to associate them with that species.

***Tetrapteryx natans*** W. R. Anderson, sp. nov.—TYPE: COLOMBIA. Caquetá: Araracuara, 0°37'S, 72°23'W, bosque secundario terrazas bajas, 3 Mar 1993 fr, *H. Vester 744* (holotype: MICH!). Fig. 5

Liana lignosa; lamina foliorum majorum (10–) 13–19 cm longa, 5–8.5 (–9.5) cm lata, mox glabrata, subtus (4–) 6–15 glandulis inter costam et marginem instructa; petiolus 5–8 (–10) mm longus; stipulae connatae 0.5–1.3 mm longae, 0.4–0.8 mm latae; inflorescentia multiflora paniculata floribus in umbellis 4-floris portatis, axibus albo-sericeis; petala lutea; stamina glabra; 2 styli postici crassi, stylus anticus gracilis; mericarpium alis lateralibus superioribus 3–9 (–15) mm longis, 6–8 (–12) mm latis, inferioribus 1–4 (–6) mm longis, 3.5–6 (–8) mm latis, alula dorsali 1.5–3 mm lata, 6–12 mm alta, discreta, nuce 9–12 mm diametro, inter alis lateralibus et dorsali laevi.

Woody vine; stems initially sericeous with very short white tightly appressed hairs, soon glabrate, smooth or eventually developing short to elongated lenticels. Lamina of larger leaves (10–) 13–19 cm long, 5–8.5 (–9.5) cm wide, elliptical or somewhat ovate, cuneate or rounded at base, acuminate at apex, initially thinly sericeous on both sides with very short white tightly appressed hairs but nearly or quite glabrate at maturity, bearing (4–) 6–15 small glands on each side of midrib, impressed in abaxial surface,  $\pm$  in one row midway between midrib and margin or scattered but not tracking the margin, up to 0.7 (–1.4) mm in diameter at base, 0.2–0.4 mm in diameter distally, the principal lateral veins 6–8 on each side of midrib, the cross-veins not horizontal or parallel, the fine reticulum often prominent on both sides; petiole 5–8 (–10) mm long, initially sericeous but soon nearly to quite glabrate, eglandular; stipules of opposite leaves connate in interpetiolar pairs, the stipule-pair 0.5–1.3 mm long, 0.4–0.8 mm wide, narrowly triangular, flat, mostly soon deciduous, leaving a scar 0.4–0.8 mm wide. Inflorescence large and many-flowered, paniculate with the branches dichasial, the flowers borne ultimately in umbels of 4; axes thinly sericeous with the white hairs short, straight, and  $\pm$  tightly appressed; reduced leaves in the inflorescence with petiole 0.5–3 mm long and lamina 4–25 mm long, 4–15 mm wide, ovate or orbicular, bearing 2–several large raised glands on abaxial surface between midrib and margin, often reddish, thin-textured, deciduous in fruit; liferiferous bracts 0.7–1.3 mm long and wide, ovate, eglandular, abaxially thinly sericeous, adaxially glabrous, persistent or deciduous; peduncle (2.5–) 4–7.5 mm long, sericeous like axis

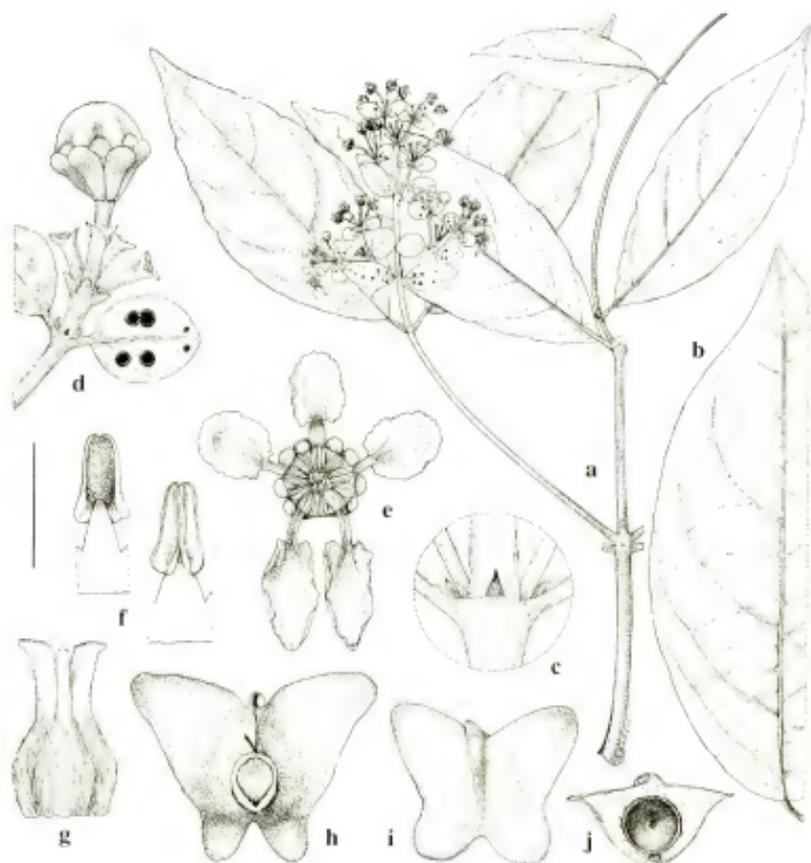


FIG. 5. *Tetrapteryx naions*. a. Flowering branch. b. Detached large leaf, adaxial view. c. Node with conate interpetiolar stipules. d. Umbel with one flower bud, the other three removed, subtended by reduced orbicular inflorescence leaves, the left showing adaxial surface, the right showing abaxial surface. e. Flower, posterior petal uppermost. f. Stamens, abaxial view (above) and adaxial view (right). g. Gynoecium, anterior style in center. h. Mericarp, adaxial view. i. Mericarp, abaxial view. j. Mericarp, cross-section, seed removed. Scale bar equivalents: a, b, 4 cm; c, 4 mm; d, e, 5.7 mm; f, g, 2 mm; h-j, 1.3 cm. (Based on: a, c-g, *Vester 700*, MICH; b, i, j, *Vester 744*, MICH; h, *Díaz et al. 211*, MO.)

of inflorescence; bracteoles like bracts but shorter and more rounded, borne at or slightly below apex of peduncle; pedicel 3–6 mm long, initially sericeous, often glabrescent and distally somewhat inflated in age. Sepals 1–1.5 mm long beyond glands, 1.3–2 mm wide, broadly triangular or rounded, abaxially thinly sericeous proximally and glabrous distally, adaxially glabrous, pressed against filaments in anthesis, the anterior eglandular, the lateral 4 biglandular with the glands 2.4–3.2 mm long, obovate, slightly detached and spreading at apex, the longest glands (the 2 adjacent to the posterior petal) slightly decurrent onto pedicel. Petals yellow, glabrous, the claw

1.2–2 mm long, the limb 4.2–5.5 mm long, 3–5 mm wide, obovate, truncate or slightly cordate at base; lateral petals spreading, erose or denticulate, the anterior-lateral pair larger and with longer claws than the posterior-lateral pair; posterior petal erect with the limb distally reflexed and often coarsely dentate, the claw about as long as in the anterior-lateral petals and thicker. Stamens glabrous; filaments 1.5 mm long, 1/3–1/2-connate, those opposite sepals wider and slightly longer than those opposite petals; anthers 1.2–1.5 mm long, alike, the connective somewhat swollen abaxially but not exceeding locules at apex. Ovary 1–1.5 mm high, sericeous; styles 1.3–1.5 mm long, glabrous except for sericeous base; 2 posterior styles stout, with a short blunt apical-dorsal projection, the stigmas linear and decurrent on inner face of style; anterior style slightly shorter and notably slenderer than posterior styles, truncate at apex, the stigma covering whole apex, not or hardly decurrent. Mericarp derived from a samara with 4 lateral wings through enlargement of the nut and reduction of the wings, densely and  $\pm$  persistently sericeous or appressed-tomentose with very short, sometimes fusiform hairs; upper lateral wings 3–9 (–15) mm long, 6–8 (–12) mm wide, broadly triangular or rounded; lower lateral wings 1–4 (–6) mm long, 3.5–6 (–8) mm wide, broadly triangular or rounded, sometimes quite distinct from upper wings, sometimes flowing into them without the indentation between them reaching nut; dorsal wing 1.5–3 mm wide at apex, 6–12 mm high, distinct from lateral wings, extending as a crest halfway down dorsal surface of nut or as far as base, sometimes extending between lateral wings at apex and continuing down ventral face of nut to areole; nut smooth between dorsal and lateral wings, 9–12 mm in diameter, spheroidal; ventral areole 5–9 mm high and wide, ovate or circular.

Distribution. Southeastern Colombia, northeastern Peru, and along the Rios Solimões and Amazonas in Brazil; lowland wet forests, both on terra firme and in periodically inundated places; 100–160 m.

ADDITIONAL COLLECTIONS EXAMINED. **Brazil.** AMAPÁ: entre Km 25 da BR 156 e Matapi, NW de Macapá, Nov fl, *Austin et al.* 7416 (MICH); Rio Matapi entre a estrada do Matapi e a foz do rio, Macapá, Mar fr, *Rabelo et al.* 1836 (MICH, NY) & 1859 (MICH, NY); Rio Pedreira, médio curso, Macapá, Apr fr, *Rabelo et al.* 2657 (MICH, NY).—AMAZONAS: Ega [Tefé], *Poeppig* 2820 (BM, G).—PARÁ: Mun. Barcarena, Ilha das Onças, 1°25'S, 48°27'W, *A. Anderson et al.* 1151 (MICH); south forest of the I.A.N., Belém, Dec fr, *Archer* 7937 (F, K, NY, US); Rivers Mojú and Acará, S of Belém ca. 1 mi downstream from Acará, Jun fr, *Austin & Cavalcante* 4123 (MG, MO); Rio Moções, 45 min. by boat below Frances, 0°45'S, 49°41'W, Nov fr, *Beck* 403 (MICH); São Miguel, beira do Rio Guamá, Jan fr, *Fróes* 20370 (MICH, NY); IPEAN Reserva Aurá, Oct imm fr, *Pires & Silva* 11190 (MICH); IPEAN, Sep fl, *Pires* 14868 (MICH); Cuanta do Anajás, Rio Anajás and Vista Alegre, 0°57'S, 49°48'W, Nov fl, *Prance* 30272 (MICH); 50 min. below Tauari, 0°48'S, 49°45'W, Nov fr, *Prance* 30415 (NY); on lands of Instituto Agronomico do Norte, Jan fr, *Silva* 44 (NY, US); Ilha de Marajó, Rio Pracuíba-mirim, ca. 1 hour upstream from São Sebastião de Boa Vista, Oct fl/imm fr, *Sobel et al.* 4742 (MICH); Ilha de Marajó, Cuantá acima de Anajás, Rio Anajás, 0°47'S, 49°48'W, Nov fl/fr, *Tavares* 318 (MICH). **Colombia.** CAQUETA: Araracuara, 0°37'S, 72°23'W, Dec fl, *Vester* 700 (MICH). **Peru.** LORETO: Rio Ampiacu, Sep fl, *Croat* 20692 (MICH); Maynas, riveras del Río Blanco (above Tamshiyacu), Mar fr, *Díaz et al.* 211 (INPA, MO); Rio Yaguasyacu, tributary of Río Ampiyacu, Nov fl, *Gentry & Revilla* 20517 (MICH, MO); Loreto, Pampa Hermosa and vicinity, Río Corrientes, 1 km S of junction with Río Macusari, 3°15'S, 75°50'W, Dec fl, *Lewis et al.* 10056 (MICH); Maynas, Indiana, Explorama Reserve, 3°28'S, 72°50'W, Oct fl, *Vásquez & Jaramillo* 12899 (MICH); Maynas, along Río Itaya, May fr, *L. Williams* 44 (F).

The epithet *natans* means swimming, and refers to the mericarp of this species, which is obviously derived from a tetrapteroid samara but has almost certainly abandoned dispersal by wind for dispersal by water—its nut is large and thick-walled, and its wings are much reduced. Occasional populations have relatively long wings, but even those have such a large nut that it seems most unlikely that the mericarp would

be carried far by wind. At the other extreme, some populations have the upper lateral wings very short and broadly rounded and the lower lateral wings reduced to little more than a broad thick rim; such fruits bear little resemblance to the samara of *Tetrapterys* and are easily mistaken for a species in another genus, such as *Callaeum antifibrile* (Griseb.) D. M. Johnson.

*Tetrapterys natans* belongs to sect. *Tetrapterys* (sect. *Lophogynixa* Nied. in the classification of Niedenzu, 1928), a large and difficult group. In Niedenzu's treatment this species would fall into his subsect. *Leiocarya* Nied., because the nut of the mericarp lacks outgrowths between the dorsal and lateral wings, and among the species he treats in that subsection this could be only *T. crispa* Adr. Juss. or *T. magnifolia* Griseb. The species described here is certainly not *T. crispa*, which is well known and has long chartaceous wings on its wind-dispersed samara, broader stipules, and longer petioles. *Tetrapterys magnifolia* is a more difficult problem. Grisebach cited two syntypes, Ruiz s.n. from Chicoplaya, Peru, and Poeppig 2820 from Ega [Tefé], Brazil. Poeppig 2820 represents *T. natans* and is cited above as this species. The B sheet of the Ruiz collection (F neg. 12736!), which was designated lectotype by Cuatrecasas (1958, p. 442), and which does seem to have been the principal basis for Grisebach's description, no longer exists, and the species seems to be extremely rare. I have seen one specimen that seems likely to represent *T. magnifolia* sens. str., Vásquez & Jaramillo 7218 from Maynas, Peru (MICH); it has the enormous leaf of the Ruiz specimen and wind-dispersed samaras with long chartaceous wings on the samara, which would exclude identity with *T. natans*. If a duplicate of the Ruiz type can be found, it should be designated the lectotype of *T. magnifolia*.

*Tetrapterys subaptera* Cuatrec. is a species of mangrove swamps on the Pacific coast of Colombia and adjacent Ecuador. Like *T. natans* it belongs to sect. *Tetrapterys*, and it too has lost the functional wings from its mericarps so that they are now dispersed by water, but the two species have disjunct distributions and differ in their morphology. The lamina in *T. subaptera* is usually narrower, up to 5.5 (–6) cm wide. The hairs of young stems and inflorescence axes are golden, and the inflorescence is smaller than in *T. natans*—shorter, less branched, with many fewer flowers. The filaments of *T. subaptera* are thinly sericeous on both sides in the proximal half. Most strikingly, the mericarps of *T. subaptera* are quite different from those of *T. natans*. The lower lateral wings of *T. subaptera* are completely absent, represented only by swellings near the base. The upper lateral wings are represented by very short, relatively thin winglets that extend upward beside the apical extension of the dorsal wing and are partially adnate to it. The nut of the mericarp is only about 7 mm in diameter. It is possible that *T. natans* and *T. subaptera* are sister species, descended from a common ancestor with reduced fruit wings, but it seems more probable that they evolved independently from ancestors with wind-dispersed samaras.

#### ACKNOWLEDGMENTS

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## PSYCHOPTERYS, A NEW GENUS OF MALPIGHIACEAE FROM MEXICO AND CENTRAL AMERICA

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**ABSTRACT.** The genus *Psychopterys* W. R. Anderson & S. Corso is proposed to accommodate eight species of Malpighiaceae of Mexico and Central America that are woody vines with eglandular sepals, white petals, and butterfly-shaped samaras. The genus is described, its morphology and relationships are discussed, a distribution map and key to the species are provided, and each species is treated taxonomically, with nomenclature, a description, notes on phenology and distribution, and citation of specimens studied; six species are illustrated. Four new combinations are proposed [*P. dipholiphylla* (Small) W. R. Anderson & S. Corso, *P. multiflora* (Nied.) W. R. Anderson & S. Corso, *P. polycarpa* (Brandege) W. R. Anderson & S. Corso, and *P. rivularis* (C. V. Morton & Standl.) W. R. Anderson & S. Corso] and four new species are described (*P. mcvaughii* W. R. Anderson & S. Corso, *P. ornata* W. R. Anderson & S. Corso, *P. pardalota* W. R. Anderson & S. Corso, and *P. psilocarpa* W. R. Anderson & S. Corso).

### INTRODUCTION

Several species of Malpighiaceae in Mexico and northern Central America are set apart from other vines of the region by their eglandular sepals and white petals. Their butterfly-shaped samaras resemble those of *Hiraea* Jacq. and several of the genera segregated from *Mascagnia* (Bertero ex DC.) Colla by Anderson (2006). For the last 70 years these plants have been treated as species of *Mascagnia*, but recently published phylogenetic trees based primarily on molecular sequences (Cameron et al. 2001; Davis et al. 2001, 2002) have placed the group in a clade with *Hiraea* and three other genera, far from *Mascagnia* as restricted by Anderson (2006). The distinctive morphology of the species in question makes it impossible to assign them to any of the published genera of the *Hiraea* clade. In this paper we propose a new genus, *Psychopterys*, to accommodate these white-flowered vines and provide a taxonomic treatment of all the known species.

### TAXONOMIC HISTORY, SYSTEMATIC POSITION, AND MORPHOLOGY OF PSYCHOPTERYS

*Psychopterys* is a genus of eight species, occurring in Mexico, Guatemala, and Belize (Fig. 1). In 1910 Small described the first species of *Psychopterys* as *Hiraea dipholiphylla*, and in 1924 Brandege described the second as *Mascagnia polycarpa*. Niedenzu described a single flowering specimen of *Psychopterys* as *Lasiocarpus multiflorus* in 1926. *Lasiocarpus* Liebm. is a Mexican genus of trees and shrubs with yellow petals and bristly fruits unlike those of any hiraecoid genus. Niedenzu probably

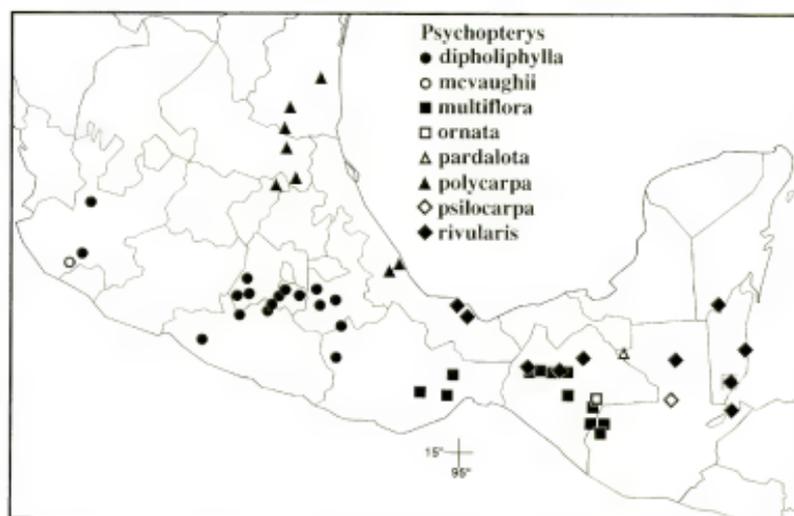


FIG. 1. Distribution of the species of *Psychopterys*.

assigned his specimen to *Lasiocarpus* because both *Lasiocarpus* and *Psychopterys* have eglandular sepals and nearly or quite radial corollas. In his 1928 treatment of the Malpighiaceae for *Das Pflanzenreich* Niedenzu did not mention *Mascagnia polycarpa*. He quoted the protologue of *Hiraea dipholiphylla* at the end of *Hiraea* (p. 144) under "Species incertae mihi non visae" [Uncertain species not seen by me] with the added note, "Num revera *Hiraea*?" [Surely not really *Hiraea*?]. In 1937 Bullock transferred *H. dipholiphylla* to *Mascagnia*, and in 1940 Morton and Standley described a fourth species of *Psychopterys*, as *Mascagnia rivularis* (Standley 1940). Since then, botanists have followed Brandegee, Bullock, Morton, and Standley in using the generic name *Mascagnia* for these plants.

In the phylogenetic trees for Malpighiaceae that have been published in recent years (Cameron et al. 2001; Davis et al. 2001, 2002), the genus *Psychopterys* [represented by *Mascagnia dipholiphylla* (Small) Bullock] was placed consistently in a clade with *Adelphia* W. R. Anderson [represented by *Mascagnia hippocrateoides* (Trinana & Planch.) Nied.], *Excentradenia* W. R. Anderson, *Hiraea*, and *Lophopterys* Adr. Juss. In Davis et al. (2002) that clade had 79% bootstrap support. Recently acquired and still unpublished data of C. Davis and W. R. Anderson continue to place those five genera together in what we are calling the *Hiraea* clade, with 75% bootstrap support (Fig. 2). For the purpose of this discussion we shall assume that *Psychopterys* is correctly placed in the *Hiraea* clade.

The plants of the *Hiraea* clade are all neotropical. They are mostly woody vines, they have short sepals that leave the petals exposed in bud, and most species have butterfly-shaped samaras (highly modified in *Lophopterys*; Anderson & Davis 2001) with many fine parallel veins in the chartaceous lateral wings. The same can be said, however, for other genera not in the *Hiraea* clade, such as *Amorimia* W. R. Anderson and *Carolus* W. R. Anderson (Anderson 2006), so these characters are probably all symplesiomorphic in the *Hiraea* clade. The stipules are not informative, because both

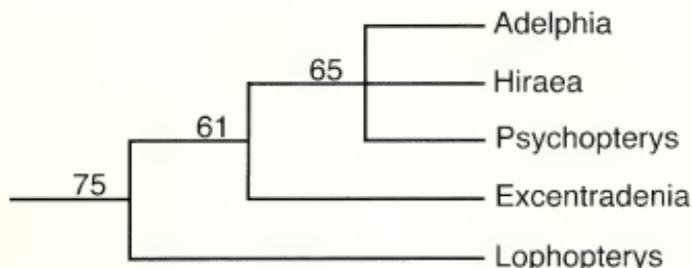


FIG. 2. Phylogenetic tree for the *Hiraea* clade. The parsimony tree shown here is extracted from a larger phylogenetic analysis of Malpighiaceae using combined DNA sequences from plastid *matK*, *ndhF*, and *rbcL*, nuclear *PHYC*, and morphology (C. Davis and W. R. Anderson, unpublished data). Bootstrap values are given above branches.

interpetiolar and epipetiolar stipules occur in this clade. The leaf glands are useful in the sense that, if they are present on the lamina, they are marginal; however, it is not yet clear whether that condition is derived in this clade or inherited from an ancestor with marginal glands. In short, there is no morphological character that we can cite as a certain synapomorphy demarcating the *Hiraea* clade.

On the other hand, *Psychopterys* is quite distinct from the other genera of the *Hiraea* clade (and from all other neotropical clades as well). The easiest way to make that comparison is with a couplet:

1. Corolla nearly radial; petals pure white, mostly strongly reflexed in anthesis (rarely only spreading); connective of anthers flat and narrowly linear, hardly or not at all swollen abaxially, probably concolorous with locules; carpels connate their whole length in ovary; styles slender; stigmas terminal or very slightly internal; cotyledons in embryo both straight or one bent slightly back distally. *Psychopterys*
1. Corolla strongly bilateral; petals yellow or yellow and red, spreading (never reflexed) in anthesis; connective of anthers abaxially broad and swollen, and often glandular-discolored; carpels distinct in ovary or nearly so; styles stout; stigmas on internal angle of style apex; cotyledons in embryo (one or, usually, both) folded strongly back on themselves distally. *Adelphia, Excentradenia, Hiraea, Lophopterys*

In terms of recognition in the field in Mexico and northern Central America, *Psychopterys* is distinctive because of its pure white petals that are usually strongly reflexed, its completely eglandular calyx, its nearly radial flowers, and its sessile pedicels. Most Malpighiaceae in that area have the petals yellow, pink, violet, or a combination of white and pink or white and violet. In the rare cases of other genera (*Malpighia* L. or *Mascagnia*) in which the petals may be reported as "white" (probably due to fading in age), the lateral four sepals will almost always bear 6–8 abaxial glands, the corolla will be strongly bilateral, the petals will be spreading, not reflexed, and the pedicels will be pedunculate.

The usually fragrant white flowers of *Psychopterys* are probably pollinated by some insect that collects pollen from the large spreading anthers; there is no other obvious reward for a pollinator.

The pollen of *Psychopterys* is different from that in the other four genera of the *Hiraea* clade, paralleling the macromorphological differences summarized in the couplet above. In *Adelphia*, *Excentradenia*, *Hiraea*, and *Lophopterys* the pollen

grains have both ectoapertures (colpi and rugae in the terminology of Lowrie, 1982) and endoapertures (ora, usually associated with some of the ectoapertures) (Lowrie 1982; Anderson & Davis 2001). In *Psychopterys*, the pollen has 6 (-8?) ora but completely lacks ectoapertures (Fig. 3). Lowrie (1982, p. 66) called this pollen type aspidopteroid because he found it mostly in the Old World genera *Aspidopterys* Adr. Juss., *Caucanthus* Forssk., *Hiptage* Gaertn., *Triaspis* Burch., and *Tristellateia* Thouars; to that list can be added the Malagasy genus *Rhynchophora* Arènes (Anderson 2001). Lowrie considered the pollen of *Psychopterys* (represented in his study by *Mascagnia dipholiphylla*) to be so anomalous that he advocated the exclusion of that species from *Mascagnia*, even in the broadest sense (p. 125). We certainly agree with Lowrie that *Psychopterys* is misplaced in *Mascagnia*, but it does not follow that the aspidopteroid pollen type evolved only once. If the genera in which Lowrie and Anderson found such pollen are mapped onto the tree in Davis et al. (2002), they occur in four clades: *Aspidopterys*, *Caucanthus*, *Rhynchophora*, and *Triaspis* in the *Malpighia* clade; *Hiptage* in the *Hiptage* clade; *Psychopterys* [as *Mascagnia dipholiphylla*] in the *Hiraea* clade; and *Tristellateia* in the *Bunchosia* clade. Apparently ectoapertures have been lost repeatedly in wing-fruited clades with globally symmetrical pollen.

*Psychopterys* is thus a highly derived genus embedded in the *Hiraea* clade, but with little similarity to the other genera of that clade except for its butterfly-shaped samaras. The name of the genus refers to those samaras with their two distinct lateral wings; it comes from the Greek words for butterfly (psyche) and wing (pteryx). The name is intentionally spelled -pterys, not -pteryx, to make it consistent with the names of many other wing-fruited genera of Malpighiaceae.

## TAXONOMY

***Psychopterys*** W. R. Anderson & S. Corso, gen. nov.—Type: *Psychopterys dipholiphylla* (Small) W. R. Anderson & S. Corso.

Lianae lignosae; lamina foliorum plerumque eglandulosa, raro basi in margine glandulis parvis instructa; petiolus plerumque 2 glandulis in dimidio distali instructus, interdum eglandulosus; stipulae parvae, basi petioli vel in caule juxta petiolum portatae, interdum nullae; pedicellus sessilis; sepala omnia eglandulosa; petala alba, subaequalia, patula vel (plerumque) valde reflexa per anthesin; stamina 10, subaequalia, filamentis longis gracilibusque, connectivo antherarum plano linearique; carpella in ovario omnino connata; styli aequales, graciles, stigmatibus terminali vel subterminali, parum capitato; samara 2 alis lateralibus distinctis instructa, ala dorsali parva vel nulla; cotyledones embryonis rectae vel fere rectae.

Woody vines, occasionally described as shrubs or small trees; older stems developing ± raised punctiform lenticels, these sometimes elongating; leaves decussate; lamina eglandular or rarely biglandular on margin at very base, the principal lateral veins 8–12 on each side; petiole occasionally eglandular but usually bearing 2 glands between middle and apex, the glands lateral to somewhat adaxial; stipules small, distinct, borne on petiole at or slightly above base or on stem beside base of petiole, occasionally absent. Inflorescences axillary and terminal, paniculate with the branches sometimes subtended by much-reduced leaves, open and many-flowered, the flowers ultimately borne in pseudoracemes; bracts and bracteoles eglandular; pedicels sessile. Flowers usually described as fragrant. Sepals all eglandular, leaving petals exposed in bud, erect or appressed in anthesis. Corolla nearly radially symmetrical, the petals subequal in size and shape but 1 with the claw wider than the other 4;

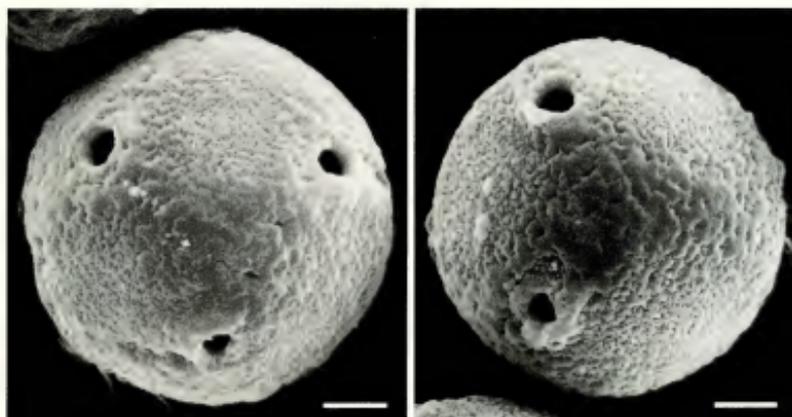


FIG. 3. Pollen of *Psychopterys dipholiphylla* (Anderson 13819). Scale = 5  $\mu$ m.

petals white, glabrous adaxially, glabrous or sericeous abaxially, somewhat concave to nearly flat, spreading to (usually) strongly reflexed during anthesis, eventually deciduous. Receptacle glabrous on both sides of filaments. Stamens 10; filaments glabrous, very slender, straight, erect and exerted, longer opposite sepals than opposite petals or subequal, very briefly connate at base; anthers mostly glabrous but rarely abaxially sparsely sericeous on connective, alike, elliptical with filament inserted at base, eventually deciduous, the connective flat and narrowly linear, hardly or not at all swollen abaxially. Gynoecium 3-carpellate; carpels all fertile, connate their whole length in ovary; styles distinct, alike or 1 shorter than the other 2, very slender, of uniform diameter, the stigma terminal or slightly internal, truncate or slightly capitate. Fruit dry, breaking apart into butterfly-shaped samaras with lateral wings dominant, the samaras not subtended by a fleshy disc and lacking a carpophore, separating from a pyramidal torus 1.2–2.5 mm high, with ovate faces; lateral wings trapezoidal to subelliptical, distinct at base and apex, chartaceous with many fine parallel veins; dorsal wing small to absent, when present distinct from lateral wings at base and apex; nut spheroidal, the ventral areole ovate to nearly circular. Embryo globose, ellipsoidal, or tear-shaped, the cotyledons thick and roughly semicircular in cross section, flat where they fit together or slightly bent around each other lengthwise such that the line of contact in cross section is curved or sigmoid, nearly equal and straight (i.e., neither folded upward at base, e.g., Fig. 9) or somewhat unequal with the larger bent slightly upward distally (e.g., Fig. 4).

#### KEY TO THE SPECIES OF PSYCHOPTERYS

1. Glands on petiole or base of lamina of full-sized leaves all or mostly 1 mm long or longer.
  2. Bracts deciduous during anthesis; petals brown-sericeous abaxially; filaments 3.3–4.8 mm long; styles 4–4.8 mm long; Jalisco, Mexico. 2. *P. mcvaughii*
  2. Bracts persistent during anthesis, persistent or deciduous in fruit; petals glabrous or white-sericeous abaxially; filaments up to 3.5 mm long; styles up to 3.6 mm long; southeastern Mexico, northeastern Guatemala, and Belize.
  3. Lamina usually decurrent at base; petiole soon glabrate; leaf glands mostly borne on decurrent tissue transitional between lamina and petiole; inflorescence tightly sericeous. 8. *P. rivularis*

3. Lamina cuneate or obtuse and not decurrent at base; petiole persistently sericeous or appressed-tomentose or only belatedly glabrescent; leaf glands borne on petiole at or below base of lamina; inflorescence velutinous, tomentose, or loosely sericeous.
4. Stems tightly sericeous with strongly appressed silver or whitish hairs; inflorescence axes with the hairs uniformly white or stramineous; anthers 1.1–1.5 mm long; sepals 1.3–1.5 mm long; tropical deciduous forest. 3. *P. multiflora*
4. Stems loosely sericeous with several layers of hairs, originally stramineous with patches of brown hairs but fading in age; inflorescence axes with a mixture of dark brown and stramineous hairs, darkest on the largest axes, lightest on the smallest axes; anthers 0.7–0.8 mm long; sepals 1.6–1.8 mm long; high forest. 5. *P. pardalota*
1. Glands on petiole or base of lamina mostly 0.3–0.8 mm long, or glands absent.
5. Samara completely lacking a dorsal wing; hairs on the inflorescence axes uniformly brown; Guatemala. 7. *P. psilocarpa*
5. Samara with a well-developed dorsal wing; hairs on the inflorescence axes brown, tawny, golden, silver, stramineous, or white, if brown usually with an underlayer of lighter hairs; Mexico, Guatemala, Belize.
6. Nut of samara bearing many parallel crests and winglets at right angles to lateral and dorsal wings, both outside lateral wings and between lateral and dorsal wings; lamina abaxially rather densely and persistently sericeous to belatedly glabrescent, with the hairs very short and strongly appressed. 4. *P. ornata*
6. Nut of samara smooth or nearly so between dorsal and lateral wings, usually smooth outside lateral wings but rarely bearing a few small crests or winglets; lamina abaxially ± persistently sericeous or nearly to quite glabrate at maturity.
7. Lamina abaxially persistently thinly sericeous or eventually glabrescent; nut of samara densely white-tomentose, the sinuous hairs + completely hiding epidermis; petals abaxially sericeous in center of limb; southwestern Mexico (Jalisco to Puebla and western Oaxaca). 1. *P. dipholophylla*
7. Lamina abaxially nearly or quite glabrate at maturity; nut of samara sericeous or subsericeous, the straight or sinuous hairs usually not dense enough to completely hide epidermis; petals mostly glabrous, occasionally abaxially sericeous in center of limb; eastern and southeastern Mexico, Guatemala, and Belize.
8. Lamina usually decurrent at base; petiole soon glabrate; leaf glands, when present, mostly borne on decurrent tissue transitional between lamina and petiole; stipules borne on stem beside axillary base of petiole; inflorescence tightly sericeous, the hairs golden or silver; dorsal wing of samara with its apex adnate to base of style; tall evergreen forest. 8. *P. rivalaris*
8. Lamina not decurrent at base; petiole persistently sericeous or only belatedly glabrescent; leaf glands borne on petiole at or below base of lamina; stipules borne on petiole at base or above; inflorescence velutinous, tomentose, or subsericeous, the hairs white, tawny, or stramineous; dorsal wing of samara with its apex not or hardly adnate to base of style; matorral and tropical deciduous and subdeciduous forest.
9. Dorsal wing of samara extending all the way around nut to its base; petiole glands (if present) 0.3–0.5 mm long; pedicels 2.7–3.6 mm long in flower, up to 6 mm long in fruit; filaments 1.5–1.9 mm long; eastern Mexico (Tamaulipas, San Luis Potosí, Querétaro, Veracruz). 6. *P. polycarpa*
9. Dorsal wing of samara extending down only 1/3–1/2 of nut, then represented by a ridge or absent; petiole glands (if present) (0.3–) 0.5–1.4 mm long; pedicels 3.5–8 mm long in flower and fruit; filaments (1.7–) 2.5–3 mm long; southeastern Mexico (southeastern Oaxaca and Chiapas) and adjacent Guatemala. 3. *P. multiflora*

**1. *Psychopterys dipholophylla*** (Small) W. R. Anderson & S. Corso, comb. nov. *Hiraea dipholophylla* Small, N. Amer. Fl. 25: 122. 1910. *Mascagnia dipholophylla* (Small) Bullock, Kew Bull. 1937: 300. 1937.—TYPE: MEXICO, MORELOS: near Cuernavaca, 5000 ft., 19 Mar 1899 fl./fr., Pringle 7730 (holotype: GH!; isotypes: CAS! F! MICH! UC! US!). Fig. 4.

Woody vine; stems persistently sericeous or appressed-tomentose with the hairs silver or, especially near the nodes, stramineous, eventually glabrescent. Lamina of larger leaves 7–14.1 cm long, 1.6–5.2 cm wide, mostly elliptical but occasionally

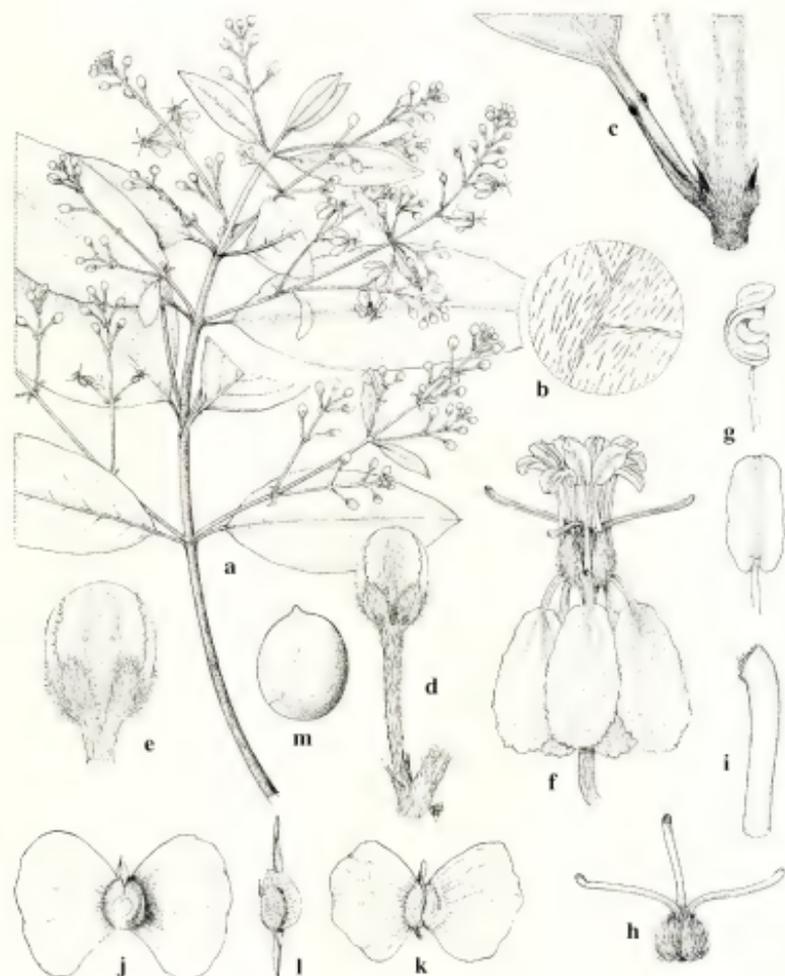


FIG. 4. *Psychopterys dipholiphylla*. a. Flowering branch. b. Enlargement of abaxial surface of lamina. c. Node and base of leaf. d. Flower bud with pedicel, bracteoles, bract, and portion of inflorescence axis. e. Enlarged flower bud. f. Flower. g. Abaxial view of young anther (below) and twisted old anther (above). h. Gynoecium. i. Distal portion of style and stigma. j. Samara, adaxial view. k. Samara, abaxial view. l. Samara with one lateral wing cut away, lateral view to show dorsal wing. m. Embryo. Scale bar equivalents: a, 4 cm; b, 2 mm; c, 8 mm; d, 5 mm; e, 3.3 mm; f, 5 mm; g, 2 mm; h, 5 mm; i, 1 mm; j-l, 2 cm; m, 8 mm. (Based on a-i, Anderson 13819, MICH; j, k, m, Hahn s.n., P; l, Hinton 7523, NY.)

somewhat ovate or obovate, usually eglandular but occasionally bearing 2 small glands on margin at base, cuneate to obtuse or rarely rounded (not decurrent) at base, acute to obtuse and sometimes rounded at apex, adaxially loosely sericeous or tomentose to soon glabrate or with some hairs persistent on midrib, abaxially densely to thinly sericeous, the hairs short, straight, evenly distributed, translucent, long-

persistent or eventually deciduous; petiole 5–17 mm long, tomentose or loosely sericeous with whitish or golden hairs, to glabrescent, bearing 2 glands between middle and apex with the glands adaxial or somewhat lateral, 0.3–0.8 (–1) mm long, often protuberant; stipules 0.5–1.2 mm long, bluntly triangular and loosely sericeous but commonly bearing a dark slender glabrous apical extension up to 0.4 mm long, borne on adaxial edge of petiole at base or up to 1.5 mm above, persistent, occasionally absent. Inflorescences with the ultimate pseudoracemes 0.4–4.5 (–7.5) cm long and containing 2–19 flowers, persistently tomentose or loosely sericeous, the hairs mostly whitish but sometimes with an overlay of scattered loose brown hairs; bracts and bracteoles abaxially loosely sericeous to glabrescent, adaxially sparsely sericeous or glabrous, the bracts 1–1.8 (–2.5) mm long, ovate or triangular, persistent in fruit, the bracteoles like bracts but shorter (0.5–1.3 mm long) and narrower, persistent or occasionally deciduous; pedicel (3.3–) 4.5–8.7 mm long in flower and fruit, 0.3–0.5 mm in diameter proximally and 0.7–0.9 mm in diameter distally during anthesis and in fruit, with vestiture like that of inflorescence to somewhat glabrescent in fruit. Sepals 1.3–2 mm long, 0.7–1.3 mm wide, elliptical or slightly ovate or obovate, obtuse to rounded at apex, abaxially appressed-tomentose with the hairs denser in the center and the tissue lighter-colored and membranous toward margin, ciliate on margin, adaxially thinly sericeous. Petals strongly reflexed in anthesis, abaxially silver-sericeous in center of limb; claw 0.7–1.7 mm long; limb elliptical or obovate or occasionally slightly ovate, broadly obtuse to rounded at apex, erose or denticulate to dentate, cuneate or truncate to auriculate at base, 4.1–5.8 (–6.5) mm long, 2.1–4 mm wide. Filaments (1.4–) 2–3.5 mm long; anthers 1.2–2.1 mm long, glabrous or occasionally sparsely sericeous abaxially on connective, the locules often sinuous or twisted in age. Ovary densely sericeous, 1.4–2 mm high; styles (2.7–) 3–4.6 mm long, subequal, glabrous, strongly spreading from base, nearly straight to strongly curved in age, with the very apex sometimes sharply bent inward (in age?). Samara densely and persistently white-tomentose or -sericeous on nut with the sinuous hairs so dense as to ± completely hide epidermis, thinly sericeous to glabrescent on wings; lateral wings 13–25 mm wide, (16–) 21–30 mm high, roughly trapezoidal or occasionally subelliptical, the distal margin coarsely erose to subentire; dorsal wing well developed, (3.5–) 5 (–6.8) mm wide, 11–16 mm high, undulate at margin with short rounded “teeth,” extended forward at apex, usually extending around nut to base and tapering gradually from apex to base, not projecting beyond base, the apex not or hardly adnate to base of style; nut 4.2–5.5 mm in diameter, smooth or slightly reticulate between dorsal and lateral wings and outside lateral wings or rarely bearing several small crests or winglets outside lateral wings, radiating from the areole, following the veins; ventral areole 2.5–3.6 mm high, (1.5–) 2.5–3.3 mm wide.

**Phenology.** Collected with flowers occasionally in November and December, mostly from January through March, and with fruits from February to May.

**Distribution** (Fig. 1). Southwestern Mexico from Jalisco to Puebla and western Oaxaca; open, seasonally dry habitats (matorral, selva baja caducifolia); (570–) 1000–2000 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Mexico.** GUERRERO: 20 km by road NW of Iguala on road to Taxco, *Anderson & Anderson 5770* (ENCB, MICH, MO, SD); Cañón de la Mano Negra 4–8 km N of Iguala, *Anderson & Anderson 5801* (ENCB, MICH, SD); Mpio. Iguala, Cañón de la Mano, 2–5 km W of Los Amates toward El Naranjo, narrow canyon with steep walls, *Anderson 13819* (CAS, HUMO, IBUG, IEB, MEXU, MICH, NY); 10.6 mi N of Iguala centro, *Freeland & Spetzman 60* (MEXU); Pilcaya, 3 km al NW del pueblo de Cacahuamilpa, camino a Toluca, *Martínez S. 79* (CAS, ENCB, MEXU, MO); Barranca Cacahuamilpa, *Miranda 1920* (MEXU), *Parry 1897* (ENCB); Achohla, *Roko 4934* (US); 12 km

al S de Taxco, carretera a Iguala, *Rzedowski 27067* (DS, ENCB, F, LL, US); Cañón de la Mano Negra, al N de Iguala, *Rzedowski 27088* (DS, ENCB, F, MO, SD); en El Cuandacito, 94 km al S de Cd. Altamirano, *Soto N. & Martínez S. 4994* (ENCB, MEXU, UAMIZ, XAL).—JALISCO: Mpio. Tequila, Barranca de los Tanques, 3 km N of Tequila-Magdalená hwy from a junction ca. 3 km W of Tequila, *Anderson 13816* (MICH); *Villarreal 6122* (IBUG, MICH); foothills of the Sierra de Manantlán, 5 km W of Tuxcacuesco, *Cochrane 11647* (F, MICH, MO, ZEA).—MEXICO: Bejuocos, Tejuipilco, *García R. 107* (MEXU); Mpio. Temascaltepec, Pungaranchito, *Hinton 3147* (A, NY), Guayabal, *Hinton 3370* (A, NY) & *7523* (ENCB, F, LL, NY, US), Limones, *Hinton 5569* (F, MICH), Chorrera, *Hinton 5744* (A, F, NY, US) & *7513* (F, MICH, NY, US), Ixtapan, *Hinton 7498* (A, LL, NY, US); Mpio. Malpais, San Nicolás, 2.5 km al SW de Valle de Bravo, *Matuda 27409* (CAS, ENCB, MEXU, MICH, MO); Santa Bárbara, *Matuda 28061* (MEXU).—MORELOS: Mpio. Yecapixtla, carretera Cuautla-Izúcar, *Flores C. 1677* (MICH); Xochicalco, *Hahn s.n.* (P); Cañón de Lobos, *Vázquez S. 1844* (MEXU); Tezcal, Tejalpa, *Vázquez S. 2116* (MEXU).—OAXACA: Mpio. Santos Reyes Tepejillo, Distr. Santiago Juxtlahuaca, vec. de Santos Reyes Tepejillo, *Calzada 19716* (MICH) & *Calzada 20901* (MO); carretera Huajuapán de León-Juxtlahuaca, Distr. Juxtlahuaca, *Tenorio L. 3630* (MEXU, MO, XAL).—PUEBLA: Road from Huajuapán de León, Oax., to Izúcar de Matamoros, 4 km from Oax.-Pue. border, ca. Km 293, *Anderson & Anderson 5642* (ENCB, MICH, MO, SD); Puente de Dios, cerca de Molexaxac, *Boege 3055* (CAS, ENCB, MEXU, NY); Mpio. Atoyatempan, 9 km al SE de Tepeyahualco, *Fernández N. 2628* (ENCY, MICH, NY, TEX); Cañada de Mamacla, Dpto. Tepeji de Rodríguez 12 km al W de Moxcaxac, *González Medrano 12364* (MEXU); Atlaychualco cerca Atlisco, *Lyonnet 3099* (US); Matamoros, *Miranda 2435* (MEXU); C. Agua Fría, *Miranda 2590* (MEXU); Chila, *Saunders s.n.* (ENCB, US); Mpio. Molexaxac, Molexaxac, Puente Natural del Río Atoyac, *Weber 144* (ENCB).

*Psychopterys dipholiphylla* is distinguished by its more or less persistently thinly sericeous lamina that is acute to obtuse at the apex, the small petiole glands, the whitish inflorescence hairs, the sericeous petals, the relatively long anthers, and the large samara with a tomentose nut and a well-developed dorsal wing reaching the base of the nut and distinct from the style at the apex. *Psychopterys dipholiphylla*, *P. multiflora*, and *P. polycarpa* constitute a complex of similar taxa, all adapted to the seasonally dry woodlands that are widespread in southern Mexico. They are geographically disjunct (Fig. 1), but considered together their ranges cover much of southern Mexico, plus a small part of adjacent Guatemala. It could be argued that they should be treated as three varieties or subspecies of one species, but we feel that the morphological differences between them, and their non-overlapping distributions, justify treating them as distinct species.

One occasionally encounters collections of this species (e.g., *Boege 3055*) in which many flowers have two or all three styles coherent in their distal half. They are not fused, as they can be separated easily and do separate in some flowers. This phenomenon is interesting because of its rarity in the Malpighiaceae. Something quite similar happens in the Mexican genus *Echinopterys* Adr. Juss., which is not closely related to *Psychopterys*.

**2. *Psychopterys mcvaughii* W. R. Anderson & S. Corso, sp. nov.**—TYPE: MEXICO. Jalisco: South-facing foothills of Sierra de Manantlán [ca. 40 km SE of Autlán], 2–3 km above the abandoned site of Durazno, along lumber-road between El Chante and Cuzalapa, 19°32'N, 104°14'W, 24 Mar 1965 fl, *McVaugh 23243* (holotype: MICH!; isotypes: CAS! ENCB! IBUG! IEB! K! MEXU! MO! NY! US! WIS!).

Lamina foliorum majorum 14.5–20 cm longa, 5.5–8.2 cm lata; petiolus foliorum maturorum apice vel sub apice biglandulosus glandulis plerumque 1.1–2 (–2.5) mm longis; stipulae in caule juxta petiolum portatae; bractee per anthes deciduae; inflorescentiae axes sericei et pilis dispersis stipitatis fuscis fusiformibus instructi; petala abaxialiter fuscosericea.

Woody vine; stems densely silver-sericeous with somewhat sinuous hairs plus an overlayer of short-stalked brown irregularly fusiform hairs giving the stem a scurfy brownish aspect; older stems glabrescent. Lamina of larger leaves 14.5–20 cm long, 5.5–8.2 cm wide, elliptical, eglandular, truncate or abruptly cuneate (not decurrent) at base, rounded to acuminate at apex with the acumen often 10–15 mm long, initially thinly white-sericeous on both sides, especially on midrib, the abaxial midrib and principal lateral veins bearing scattered short-stalked brown fusiform hairs, both sides eventually glabrate; petiole 6–15 mm long, loosely silver or golden-sericeous with an overlayer of short-stalked brown fusiform hairs, eventually glabrate, biglandular at or just below apex, the glands slightly adaxial, 1.1–2 (–2.5) mm long on most full-sized leaves, not protuberant; stipules 0.7–1 mm long, triangular, sericeous to glabrate, borne on stem near adaxial edge of petiole, eventually deciduous. Inflorescences with the ultimate pseudoracemes 0.8–3.7 cm long and containing 4–12 flowers, persistently loosely golden- and silver-sericeous with an admixture of short-stalked brown fusiform hairs, especially proximally; bracts and bracteoles abaxially loosely sericeous, adaxially glabrous, the bracts 1.2–1.7 mm long, triangular, deciduous during anthesis, the bracteoles like bracts but shorter (0.9–1.3 mm long), narrower, and longer persistent; pedicel 4–9 mm long in flower, 0.4–0.6 mm in diameter proximally and 1–1.2 mm in diameter distally during anthesis, loosely sericeous with the hairs persistent during anthesis. Sepals 2.1–2.5 mm long, 0.7–1 mm wide, narrowly ovate, rounded or broadly obtuse at apex, abaxially loosely sericeous with the hairs denser in the center and the tissue lighter-colored and membranous toward margin, ciliate on margin, adaxially glabrous. Petals strongly reflexed in anthesis, abaxially loosely sericeous with brown hairs from base of limb nearly to apex but not to margins; claw 1.1–1.5 mm long; limb elliptical or obovate, broadly rounded at apex, crose, truncate at base, 5–6.2 mm long, 2.3–3.4 mm wide. Filaments 3.3–4.8 mm long; anthers 1.3–1.6 mm long, glabrous, the locules sometimes twisted in age. Ovary densely sericeous, 1.2–1.4 mm high; styles 4–4.8 mm long, subequal, glabrous, spreading from base, nearly straight or slightly incurved distally. Fruit unknown.

*Psychopterys mcvaughii* is known only from the type, which was abundant in "tropical subdeciduous forest in steep valley of rapid stream, with *Quercus*, *Juglans*, *Fraxinus*, *Magnolia*, *Prunus*" at 1250 m.

This species is distinguished by the scattered stalked brown fusiform hairs present (at least initially) on the stems, leaves, and inflorescence axes, and by the large leaves, long petiole glands, interpetiolar stipules, deciduous floriferous bracts, relatively large petals bearing brown hairs, and long filaments and styles. Its relatively mesic habitat is also unusual, although not unique, in the genus.

*Psychopterys mcvaughii* is named in honor of Rogers McVaugh (b. 1909), mentor, friend, and student of the flora of western Mexico.

3. *Psychopterys multiflora* (Nied.) W. R. Anderson & S. Corso, comb. nov. *Lasio-carpus multiflorus* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 8: 62. 1926.—TYPE: MEXICO, Chiapas: Mpio. Tuxtla Gutiérrez, Hacienda Arenal, 23 Feb 1896 fl. *Seler & Seler 1974* (holotype: B†, photo: F neg. 12831!, fragments NY!; isotype: GH!). Fig. 5.

Woody vine, rarely described as a shrub or treelet; stems persistently tightly sericeous with very short, strongly appressed, silver or whitish hairs, eventually glabrescent. Lamina of larger leaves 6.2–13 cm long, 2–4.8 cm wide, mostly elliptical but occasionally somewhat ovate or obovate, eglandular, cuneate or obtuse (not

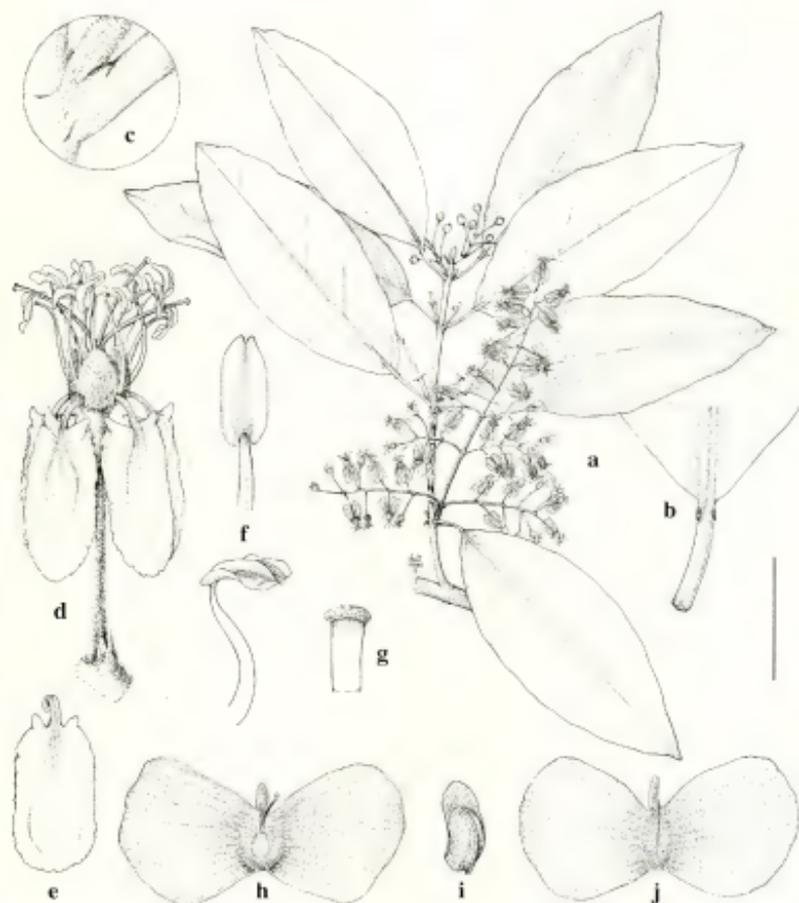


FIG. 5. *Psychopterys multiflora*. a. Flowering branch. b. Petiole and base of lamina, adaxial view. c. Base of petiole to show epipetiole stipule. d. Flower. e. Petal, adaxial view. f. Abaxial view of young anther (above) and twisted old anther (below). g. Distal portion of style with apical stigma. h. Samara, adaxial view. i. Nut of samara with lateral wings cut away, lateral view to show dorsal wing. j. Samara, abaxial view. Scale bar equivalents: a, 4 cm; b, 1.3 cm; c-e, 4 mm; f, 2 mm; g, 0.7 mm; h-j, 1.3 cm. (Based on: a-g, *Breedlove 50224*, CAS; h-j, *Nelson 2563*, NY.)

decurent) at base, acute to abruptly short-acuminate or rarely obtuse at apex, adaxially loosely sericeous to glabrate at maturity, abaxially sericeous at first to nearly or quite glabrate at maturity; petiole 9–16 (–19) mm long, persistently densely sericeous with whitish or golden hairs, to belatedly glabrescent, biglandular with the glands adaxial or lateral and borne at or somewhat below apex, (0.3–) 0.5–1.4 mm long, not at all to moderately protuberant, occasionally absent; stipules (0.2–) 0.4–0.9 mm long, usually triangular but occasionally falcate, sericeous like the petiole, borne on adaxial edge of petiole at very base or slightly above, persistent, rarely absent. Inflorescences

with the ultimate pseudoracemes (0.2–) 0.5–5 cm long and containing 1–14 flowers, velutinous, tomentose, or subsericeous, the hairs uniformly white or stramineous; bracts and bracteoles abaxially sericeous, adaxially glabrous or sparsely hairy, the bracts 0.8–1.8 mm long, ovate or triangular, persistent during anthesis and mostly persistent in fruit, the bracteoles like bracts but shorter (0.4–1 mm long) and narrower, mostly persistent; pedicel 3.5–8 mm long in flower and fruit, 0.2–0.5 mm in diameter proximally and 0.4–0.9 mm in diameter distally during anthesis and in fruit, persistently sericeous or subtomentose or somewhat glabrescent in fruit. Sepals 1.3–1.5 mm long, 0.8–1 mm wide, elliptical to obovate, obtuse to rounded at apex, abaxially densely sericeous with the hairs uniformly distributed or sparser toward margin, ciliate on margin, adaxially thinly sericeous. Petals strongly reflexed in anthesis, mostly glabrous but occasionally abaxially sparsely white-sericeous in center of limb; claw 0.8–1.5 mm long; limb obovate to elliptical or occasionally ovate, broadly obtuse to rounded at apex, erose or denticulate, mostly auriculate but occasionally truncate at base, 3.4–4.5 (–5) mm long, 2–3 mm wide. Filaments (1.7–) 2.5–3 mm long; anthers 1.1–1.5 mm long, glabrous, the locules often twisted in age. Ovary densely sericeous, 1.2–1.5 mm high; styles 2.3–3 (–3.5) mm long, subequal, glabrous or bearing a few hairs at base, strongly spreading from base, nearly straight to strongly curved in age. Samara persistently loosely sericeous on nut with the straight or sinuous hairs not dense enough to completely hide epidermis, thinly sericeous to glabrescent on wings; lateral wings 9–19 mm wide, 9–23 mm high, roughly trapezoidal or occasionally subelliptical, the distal margin subentire; dorsal wing well developed, 1.1–4.5 (–6) mm wide, 2.9–9.5 (–15) mm high, undulate at margin, extended forward at apex and usually extending down only about 1/3–1/2 of nut, then represented by a ridge continuing as far as the ventral areole or less, the apex not or hardly adnate to base of style; nut 3.9–5 mm in diameter, smooth or slightly reticulate between dorsal and lateral wings and outside lateral wings or rarely bearing several small crests or winglets outside lateral wings, radiating from the areole, following the veins; ventral areole 2–3.8 mm high, 1.1–2.5 mm wide.

**Phenology.** Collected with flowers in February and March, with fruits from February to May.

**Distribution** (Fig. 1). Southeastern Mexico (southeastern Oaxaca and Chiapas) and adjacent Guatemala; tropical deciduous forest (selva baja caducifolia); (550–) 680–1200 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Guatemala.** HUJUTENANGO: Nueva Catarina, Jacaltenango, *Cas-tillo 1721* (F); between San Ildefonso Ixtahuacán and Cúicco, *Sieyermark 50696* (F, US). **Mexico.** CHIAPAS: Frontera Comalapa, 2 mi N of Ciudad Cuauhtémoc, *Breedlove 24446* (DS, ENCB, F, MEXU, MICH, MO, NY, TEX); Mpio. Chiapa de Corzo, above El Chorreadero, *Breedlove 50153 & 50184* (CAS); Mpio. Tzimol, 15 km S of Comitán on road to Tzimol and Tuxtla Gutiérrez, *Breedlove 50224* (CAS); Mpio. La Trinitaria, 18 km S of La Trinitaria on Hwy 190, *Breedlove 50341* (CAS), 22 km S of La Trinitaria on Hwy 190, *Breedlove 50372* (CAS); Mpio. Ocozocoautla de Espinosa, steep-walled canyon at head of Río de la Venta at the Chorreadero near Derna, *Breedlove 50476* (CAS); Mpio. Berriozábal, fluts near Berriozábal, *Breedlove 50621* (CAS); Mpio. Tzimol, 15 km S of Comitán on road to Tzimol and Tuxtla Gutiérrez, *Breedlove 51026* (CAS); Mpio. Ixtapa, near Escopatazo, *Breedlove 60972* (CAS); El Aguacero, 13 km al NW de Ocozocoautla, *Cabrera 7855* (MEXU, MICH); Mpio. Ocozocoautla, Rancho La Cruz, camino para Rancho Corocito, Reserva del Ocote, *Calzada 9839* (XAL); Mpio. Chiapa de Corzo, El Chorreadero 5.6 mi E of Chiapa de Corzo, Hwy 190, *Laughlin 198* (DS, F); Mpio. San Fernando, Cañón del Sumidero, Mirador "Manos que Imploran," *Martínez S. 22323* (MICH) & *22326* (MICH), *Samana M. & Ferrara S. 7887* (MICH); Mpio. Tuxtla Gutiérrez, Cañada Pistimbak-Coatis, *Miranda 6027 & 6079* (MEXU); vicinity and E of Ocozocoautla, *Moore 2523* (GH); Cañón del Sumidero National Park, near Mirador La Ceiba, Km 7 of Sumidero Road, *Neill 5319* (MEXU, MICH); Mpio. Ocozocoautla, canyon of Río de la Venta at

Cascada El Aguacero, *Neill 5571* (MEXU, MICH); Mpio. Tuxtla Gutiérrez, El Zapotal, al SE de Tuxtla Gutiérrez, *Palacios E. 1417* (CAS, IBUG); Mpio. Comitán, Comitán, 5 km al E de Tzimol, *Ramamoorthy 1966* (MEXU); Mpio. Tzimol, 5 km al SW de Tzimol, *Reyes G. 306 & 321* (MICH); Mpio. Venustiano Carranza, above Finca Carmen, along road from Acala to Pugitlik, *Ton 3726* (DS, ENCB, F, LL, MEXU, MICH); Mpio. Tenejapa, Arroyo Jeshap, *Ton 5693 & 5865* (MICH); Mpio. Ixtapa, cruceo en carretera de Chiapa de Corzo a Cala, *Ton 8796* (CAS, CHAPA, GH).—OAXACA: Mpio. Lachiguirí, 5 km al NW de Lachiguirí, brecha a Lachivixa, Dto. Tehuantepec, *Campos V. 3617* (MEXU); Tehuantepec, Guiengola, *MacDougall s.n.* (NY, SD); Mena, *Mell 2247* (NY, US); between San Carlos and San Bartolo, *Nelson 2563* (NY, US); Cerro Guiengola, al N de Tehuantepec, *Torres C. 4894* (MEXU, MICH); Mpio. Tehuantepec, Cerro San Pedro, al NW de Tehuantepec, entrando por Hierba Santa, *Torres C. 8296* (MEXU).

The most distinctive characteristic of this species is the dorsal wing of the samara, which exceeds the apex of the nut but extends only about halfway or less down the nut. It is also notable for its glabrate laminae, mostly glabrous petals, and relatively long petiole glands and pedicels. When samaras are not present the usually glabrous petals help to distinguish it from *P. dipholiphylla*, but in a few populations the petals are sparsely sericeous; in those cases, one has to rely on the glabrate leaves.

Several populations of *P. multiflora* from the Tehuantepec region (e.g., *MacDougall s.n.*, *Torres C. 4894*) have two of the three styles coherent in many flowers, as in some populations of *P. dipholiphylla*; see the discussion under that species.

*Breedlove 50341*, which is cited above as this species, has a samara that is most atypical. The dorsal wing extends around the nut to its base, and the nut bears several small crests outside the lateral wings. These characteristics suggest *P. ornata*, but in other respects the specimen does not match that species. Its inflorescence bears the loose white hairs of *P. multiflora*, and the lamina is glabrate at maturity. Moreover, *50341* was collected in tropical deciduous forest, while the type of *P. ornata* was collected in montane rain forest. For now, at least, it seems best to consider *Breedlove 50341* an anomalous representative of *P. multiflora*.

#### 4. *Psychopterys ornata* W. R. Anderson & S. Corso, sp. nov.—TYPE: MEXICO. Chiapas:

Mpio. La Trinitaria, E of Laguna Tzikaw, Monte Bello National Park, 1300 m, 13 May 1973 fr., *Breedlove 35105* (holotype: MICH!; isotypes: DS! ENCB! MEXU! MO! NY! TEX! US!). Fig. 6.

*Psychopterys rivularis affinis* sed caulibus, petiolis, et laminis ± pertinaciter sericeis, lamina basi cuneata vel truncata, et samara ala dorsali stylo non adnata et nucis multis cristis alutisque instructa differt.

Woody vine; stems persistently brown- or whitish-sericeous, eventually glabrescent. Lamina of larger leaves 10–17 cm long, 4–7 cm wide, ovate or elliptical, eglandular, cuneate to truncate (not decurrent) at base, acute to acuminate at apex, adaxially thinly sericeous to glabrate, abaxially ± densely and persistently sericeous to eventually glabrescent, the hairs very short, straight, strongly appressed, evenly distributed, white; petiole 8–14 mm long, densely and tightly sericeous with brown or whitish hairs, to eventually glabrescent, mostly eglandular but occasionally bearing 1 or 2 glands at apex, the glands when present lateral, 0.4–0.7 (–1) mm long, slightly protuberant; stipules ca. 0.3 mm long, triangular, sericeous to glabrate, borne on an interpetiolar ridge beside base of petiole, persistent, sometimes apparently absent. Inflorescences with the ultimate pseudoracemes 1.5–5 cm long and containing 2–12 flowers, densely, tightly, and persistently sericeous, the hairs (in fruit) stramineous or whitish; bracts and bracteoles abaxially loosely sericeous, adaxially glabrous, persistent in fruit at nodes bearing fruits but elsewhere deciduous, the bracts 0.8–1.3 mm



FIG. 6. *Psychopterys ornata*. a, Fruiting branch. b, Enlargement of abaxial surface of lamina. c, Node to show petioles and minute stipules. d, Abaxial view of samara. e, Adaxial view of samara. f, Samara with one lateral wing cut away, lateral view to show dorsal wing. Scale bar equivalents: a, 4 cm; b, 1.3 cm; c, 8 mm; d–f, 2 cm. (Based on *Breedlove 35105*, MICH.)

long, narrowly ovate, the bracteoles like bracts but shorter (0.5–0.7 mm long) and narrower; pedicel 7–8.5 mm long in fruit, 0.4–0.7 mm in diameter proximally and 0.8–1 mm in diameter distally, with vesture like that of inflorescence but somewhat glabrescent in fruit. Sepals in fruit ca. 1.5 mm long, 0.8 mm wide, narrowly elliptical, obtuse or rounded at apex, abaxially thinly sericeous, ciliate on margin, adaxially glabrous. Petals, stamens, and gynoecium not seen. Samara thinly sericeous on nut with the straight hairs not dense enough to hide epidermis, thinly sericeous to glabrescent on wings; lateral wings 15–20 mm wide, 22–30 mm high, roughly trapezoidal, the distal margin undulate; dorsal wing well developed, 4–5 mm wide, 10–14 mm high, undulate at margin, extended forward at apex, extending around nut to base and often of roughly equivalent width throughout its length (or widest at apex), not or hardly projecting beyond base, the apex not adnate to base of style; nut 5–8 mm in diameter, bearing many crests and winglets between dorsal and lateral wings and outside lateral wings radiating from areole, following the veins, the crests and winglets (0.5–) 1–3 mm wide, parallel, those between dorsal and lateral wings often interconnected; ventral areole circular, 2.5–3 mm in diameter.

This species is known only from the type, which was collected in fruit on slopes with montane rain forest containing *Liquidambar*, *Magnolia*, and *Vochysia*. The epithet *ornata* (meaning embellished) refers to the many crests and winglets found on the nut of the samara; that is the most distinctive characteristic of the species. *Psychopterys ornata* is probably most closely related to *P. rivularis*, but that species, in addition to having the nut of its samara smooth or at most reticulate on the nut of the samara, also differs in having its stems, petioles, and laminae soon glabrescent to quite glabrate, the lamina decurrent at base onto the petiole, and the dorsal wing of the samara adnate at its apex to the base of the style.

**5. *Psychopterys pardalota* W. R. Anderson & S. Corso, sp. nov.**—TYPE: GUATEMALA.

Petén: Lacandón, 9 Mar 1962 fl. *Contreras 3493* (holotype: MICH!; isotypes: BM! CAS! CHAPA! LL! MEXU! MO!).

Liana lignosa; caules et axes inflorescentiae laxe sericei pilis multistratis stratis basalibus stramineis strato externo in maculis brunneo; lamina abaxialiter pertinaciter sericea demum glabrescens; glandulae petioli (0.8–) 1–1.7 mm longae; sepala abaxialiter dense appresso-tomentosa; petala abaxialiter sericea; antherae 0.7–0.8 mm longae.

Woody vine; stems persistently loosely sericeous with several layers of hairs, the hairs of outer layers short-stalked, originally stramineous with patches of brown hairs but fading in age. Lamina of larger leaves 8–13.3 cm long, 3–5 cm wide, elliptical or somewhat ovate, eglandular, cuneate (not decurrent) at base, acute or obtuse at apex, adaxially loosely sericeous to soon glabrate, abaxially sericeous to glabrescent but with the midrib  $\pm$  persistently loosely sericeous or scurfy-sericeous and some appressed hairs often persisting on lamina near midrib, the hairs white or stramineous, the midrib often with patches of brown hairs proximally; petiole 12–18 mm long, densely and  $\pm$  persistently appressed-tomentose to eventually glabrescent, biglandular on adaxial margin at or somewhat below apex, the glands (0.8–) 1–1.7 mm long, not or hardly protuberant; stipules 0.3–0.7 mm long, triangular, sericeous, borne on stem beside base of petiole, persistent. Inflorescences with the ultimate pseudoracemes 0.2–4 cm long and containing 2–20 flowers, persistently loosely sericeous with several layers of hairs, the hairs of outer layer short-stalked, dark brown on largest axes to stramineous on smallest axes with the vesture on intermediate axes consisting

of stramineous lower layers and patches of dark brown hairs; bracts and bracteoles abaxially sericeous, adaxially glabrous, persistent, the bracts 0.9–1.5 mm long, ovate, the bracteoles like bracts but shorter (0.5–0.7 mm long) and narrower; pedicel 5–6 mm long, 0.3–0.5 mm in diameter proximally and 0.7–0.9 mm in diameter distally, loosely but densely and persistently sericeous or appressed-tomentose. Sepals 1.6–1.8 mm long, 0.7–0.9 mm wide, elliptical, obtuse or rounded at apex, abaxially densely and evenly appressed-tomentose, ciliate on margin, adaxially glabrous. Petals spreading to reflexed in anthesis, abaxially loosely white-sericeous in center of limb; claw ca. 1 mm long; limb obovate, rounded at apex, entire or erose, cuneate or truncate at base, 3.5–4 mm long, 2–2.2 mm wide. Filaments 2.5–3.5 mm long; anthers 0.7–0.8 mm long, glabrous, the locules often sinuous or twisted in age. Ovary densely sericeous, 1 mm high; styles 3–3.5 mm long, 1 shorter than the other 2, hirsute at base and distally glabrous, ascending to spreading. Fruit unknown.

This species is known only from the type, which was collected with flowers in high forest. The epithet *pardalota*, which means "spotted like a leopard," refers to the curious multilayered vesture of the younger stems and inflorescence axes, with a base of stramineous hairs and patches of dark brown hairs above. It is also notable for its more or less persistent leaf hairs, long petiole glands, densely appressed-tomentose sepals, sericeous petals, and tiny anthers, the smallest in the genus. It is probably most closely related to *P. dipholiphylla* and *P. multiflora*.

**6. *Psychopterys polycarpa*** (Brandegee) W. R. Anderson & S. Corso, comb. nov. *Muscagnia polycarpa* Brandegee, Univ. Calif. Publ. Bot. 10: 409. 1924. *Hiraea polycarpa* (Brandegee) Standl., Contr. U.S. Natl. Herb. 23: 1668. 1926.—TYPE: MEXICO. Veracruz: Remudadero, Apr 1923 fr, *Purpus* 9019 (holotype: UC!; isotypes: F! GH! MO! NY! US!). Fig. 7.

Woody vine, occasionally shrubby; stems persistently sericeous with the hairs silver or slightly stramineous and all sessile and tightly appressed, eventually glabrescent. Lamina of larger leaves 7.7–13 cm long, 3–6.3 cm wide, elliptical to somewhat ovate, eglandular, cuneate to nearly truncate (not decurrent) at base, acute or abruptly short-acuminate at apex with the acumen up to 12 mm long, sometimes broadly obtuse to nearly rounded, initially sparsely sericeous on both sides with short straight appressed hairs but soon glabrate or with some hairs persistent, especially on and near midrib; petiole 6–11 mm long, densely and persistently silver-sericeous to eventually glabrescent, biglandular at or more commonly somewhat below the apex, the glands adaxial or somewhat lateral, 0.3–0.5 mm long, not or only slightly protuberant, sometimes absent; stipules 0.2–0.5 mm long, bluntly triangular, sericeous, borne on adaxial edge of petiole at very base, persistent, sometimes apparently absent. Inflorescences with the ultimate pseudoracemes 1–5 cm long and containing 5–20 flowers, persistently loosely sericeous or appressed-tomentose, the hairs mostly whitish or tawny and mostly straight and ± appressed, often with an admixture of brown hairs especially toward base and at nodes; bracts and bracteoles abaxially loosely sericeous to glabrescent, adaxially glabrous, the bracts 0.9–1.7 mm long, ovate or triangular, persistent in fruit, the bracteoles like bracts but shorter (0.5–0.8 mm long) and narrower, persistent or occasionally deciduous; pedicel 2.7–3.6 mm long in flower, up to 6 mm long in fruit, 0.3–0.4 mm in diameter proximally and 0.5–0.6 mm in diameter distally during anthesis, up to 1 mm in diameter at apex in fruit, loosely sericeous to somewhat glabrescent in fruit. Sepals 1.3–1.6 mm long, 0.7–0.8 mm wide, elliptical or ovate, rounded at apex, abaxially sericeous with the hairs denser in the center and

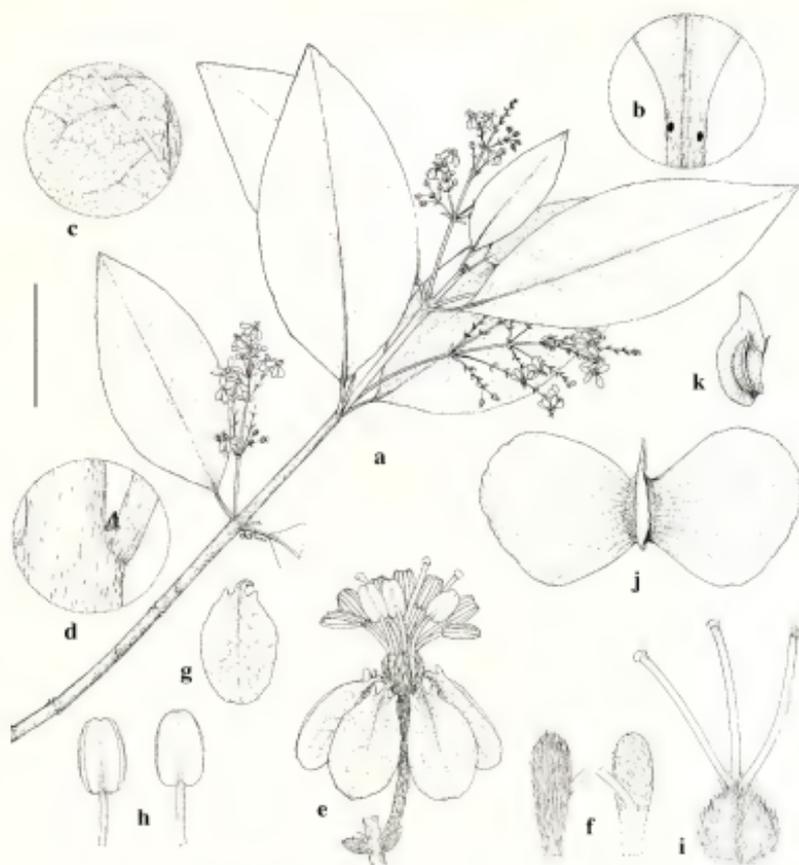


FIG. 7. *Psychopterys polycarpa*. a. Flowering branch. b. Apex of petiole, adaxial view, to show glands. c. Enlargement of abaxial surface of lamina. d. Base of petiole, to show stipule. e. Flower. f. Sepals with bases of attached filaments, abaxial view (left) and adaxial view (right). g. Petal, adaxial view. h. Anthers, adaxial view (left) and abaxial view (right). i. Gynoeccium. j. Samara, abaxial view. k. Nut of samara with lateral wings cut away, lateral view to show dorsal wing. Scale bar equivalents: a, 4 cm; b–e, 4 mm; f, 2 mm; g, 4 mm; h, i, 2 mm; j, k, 1.3 cm. (Based on: a–d, *Ventura A. 3035, MICH*; e–i, *Ventura A. 7345, MICH*; j, k, *Martínez S. 3846, MICH*.)

the tissue lighter-colored and membranous toward margin, ciliate on margin, adaxially very sparsely sericeous in center. Petals strongly reflexed in anthesis, glabrous; claw 0.9–1.4 mm long; limb obovate, rounded at apex, erose, auriculate to truncate at base, 3–4.1 mm long, 2–3.3 mm wide. Filaments 1.5–1.9 mm long; anthers 1–1.2 mm long, glabrous, the locules often sinuous in age. Ovary densely appressed-tomentose, 1.2–1.4 mm high; styles 2.2–2.7 mm long, subequal, glabrous, strongly spreading from base, straight or distally curving upward and inward. Samara thinly sericeous to glabrescent on nut with the short, straight or slightly sinuous, appressed hairs not dense enough to completely hide epidermis, sparsely sericeous to glabrate on wings; lateral

wings (9-) 13-15 mm wide, (10-) 16-18 mm high, roughly trapezoidal, the distal margin subentire or sinuate, occasionally slightly erose; dorsal wing well developed, (1.2-) 2-3.5 mm wide, 9-13 mm high, sinuate, extending from style around nut to ventral areole, with a prominent roughly triangular projection at apex and a short rounded projection at base, the apex not or hardly adnate to base of style; nut (2.5-) 3-4.5 mm in diameter, smooth or reticulate between dorsal and lateral wings and outside lateral wings; ventral areole 1.5-2.5 mm high, 1-1.7 mm wide.

Phenology. Collected with flowers from November to February, and with fruits from February to May, and in August.

Distribution (Fig. 1). Lowlands of eastern Mexico (Tamaulipas, San Luis Potosí, Querétaro, and Veracruz); matorral and tropical deciduous and subdeciduous forest; 120-600 (-1100) m.

ADDITIONAL SPECIMENS EXAMINED. **Mexico.** QUERÉTARO: Mpio. Attoyó Seco, 6-7 km río abajo de El Trapiche, Río Jalpan, *Carranza 1534* (MICH); Mpio. Jalpan, 6 km de Tancoyol, camino a Soyapilca, *Carranza 1591* (MICH); Mpio. Landa, 1 km al SE de El Naranjo, *Rubio 2235* (MICH).—SAN LUIS POTOSÍ: Mpio. Ciudad Valles, Río Mesillas, just upstream from Rancho Pugo-Pugo, 3-4 mi W of Chontal, *Fryxell & Anderson 3519* (CAS, CHAPA, ENCB, IBUG, IEB, MEXU, MICH, MO, NY, TEX); mountains along gravel road to Jalpan ca. 9 mi NE of Xilitla, *King 4424* (MICH, TEX, UC, US).—TAMAULIPAS: 20 km al SW de Soto La Marina, *González Medrano 2153* (MEXU); Mpio. Nuevo Morelos, 3 km al E de Nuevo Morelos, *González Medrano 12199* (MEXU); Mpio. Gómez Farías, 7 km al NW de Gómez Farías, *Martín & Saravia 1161* (ENCB, MICH), 1.5 km al E de Gómez Farías, ladera W en la Sierra Chiquita, *Martínez S. 3846* (MEXU, MICH).—VERACRUZ: Mpio. Actopan, Cerro de La Mesa, Sierra Manuel Díaz, *Acosta P. 275* (XAL); Mpio. Emiliano Zapata, Arroyo del Chino, 2 km al NE de La Balsa, *Vázquez B. 435* (XAL); Mpio. Dos Ríos, Palo Gacho, carretera Jalapa-Veracruz, *Ventura A. 3035* (ENCB, MICH, NY), 7345 (CICY, ENCB, MICH) & 10744 (ENCB, MICH).

*Psychopterys polycarpa* is distinguished by its glabrate leaves, small petiole glands, small glabrous petals, short styles, and small samaras with the nut thinly sericeous to glabrescent and the dorsal wing extending beyond the nut at both apex and base, the apical projection roughly triangular.

This is not the species that was treated as *Mascagnia polycarpa* by Standley and Steyermark in the *Flora of Guatemala* (1946). The specimens cited by those authors actually represent *Carolus sinemariensis* (Aubl.) W. R. Anderson sens. lat.

## 7. *Psychopterys psilocarpa* W. R. Anderson & S. Corso, sp. nov.—TYPE: GUATEMALA,

Alta Verapaz: Cerro Chinajá, between Finca Yalpemech and Chinajá, above source of Río San Diego, 150-700 m, 1-2 Apr 1942 fr, *Steyermark 45617* (holotype: F!; isotypes: A! NY!). Fig. 8.

*Psychopteridis rivularis* affinis sed pilis brunneis, foliis lamina 6-10.4 cm longa et 2-3.5 cm lata et glandulis marginalibus, pedicellis 3.5-5 mm longis, sepalis 1-1.2 mm longis et 0.5-0.6 mm latis, petalis limbo 3-3.5 mm longo et 2 mm lato, filamentis 1.8-2.2 mm longis, antheris 1 mm longis, stylis 2.1-2.7 mm longis, et samaris sine ala dorsali et alis lateralis 9 mm latis et 14 mm altis differt.

Woody vine (?); stems initially thinly sericeous with hairs brown, straight, strongly appressed, soon glabrate. Lamina of larger leaves 6-10.4 cm long, 2-3.5 cm wide, narrowly ovate, eglandular or biglandular on margin at base, cuneate and often somewhat decurrent onto petiole at base, gradually narrowed distally to an acute or acuminate apex, glabrate on both sides or bearing scattered hairs below, the hairs short, straight, strongly appressed, brown, soon deciduous; petiole 6-9 mm long, thinly sericeous with brown hairs to soon glabrate, eglandular (the glands then just above

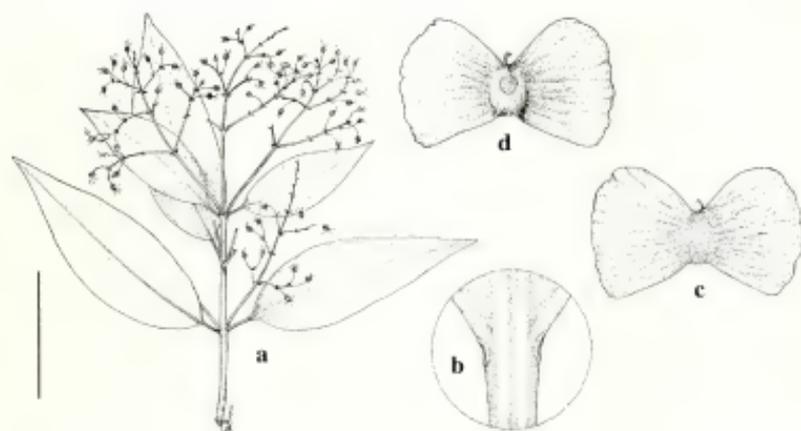


FIG. 8. *Psychopterys psilocarpa*. a. Branch with old flowers. b. Apex of petiole to show glands. c. Samara, abaxial view. d. Samara, adaxial view. Scale bar equivalents: a, 4 cm; b, 4 mm; c, d, 1.3 cm. Based on Steyermark 45617, F.

petiole on base of lamina) or biglandular at apex, the glands lateral, 0.5–0.6 mm long, slightly protuberant to somewhat sunken; stipules 0.1–0.2 mm long, triangular, borne on stem beside petiole, persistent or deciduous. Inflorescences with the ultimate pseudoracemes 0.5–3 cm long and containing 4–13 flowers, persistently brown-sericeous to eventually glabrescent; bracts and bracteoles abaxially sericeous, adaxially glabrous, persistent in fruit, the bracts 0.7–0.8 mm long, ovate, the bracteoles like bracts but shorter (0.3–0.5 mm long) and narrower; pedicel 3.5–5 mm long, 0.2–0.3 mm in diameter proximally and 0.4–0.5 mm in diameter distally, thinly sericeous to unevenly glabrescent. Sepals 1–1.2 mm long, 0.5–0.6 mm wide, elliptical, rounded at apex, abaxially sericeous in center, ciliate on margin, adaxially glabrous. Petals spreading to reflexed in anthesis, glabrous; claw ca. 0.8 mm long; limb obovate, broadly rounded at apex, crose or denticulate, short-auriculate at base, 3–3.35 mm long, 2 mm wide. Filaments 1.8–2.2 mm long; anthers 1 mm long, glabrous, the locules not twisted in age. Ovary densely sericeous, 1 mm high; styles 2.1–2.7 mm long, subequal, glabrous, spreading from base and then  $\pm$  straight. Samara sparsely sericeous to glabrate on nut and wings, the hairs on nut not hiding epidermis; lateral wings ca. 9 mm wide, ca. 14 mm high, trapezoidal, the distal margin entire or sinuate; dorsal wing completely absent; nut ca. 4.5 mm in diameter, smooth between and outside lateral wings; ventral areole circular, ca. 2 mm in diameter.

The type and only known collection of *P. psilocarpa* was found with old flowers and fruits, growing "along knife-edge of a limestone ridge." Steyermark described it as a "tree 40 ft. tall," but we expect it to prove to be a woody vine growing high in the forest; see the discussion under *P. rivularis*. The epithet *psilocarpa* (smooth-fruited) refers to the fact that the samara bears no trace of a dorsal wing, a unique condition in this genus (insofar as fruits are known). In other characters *P. psilocarpa* resembles *P. rivularis*, but that species has golden, silver, or translucent hairs on its stems, leaves, and inflorescences, its leaves are usually larger and have their glands slightly adaxial, its pedicels are longer, and its flowers are usually larger in all their parts. The samaras of *P. psilocarpa* are among the smallest in the genus.

8. *Psychopterys rivularis* (C. V. Morton & Standl.) W. R. Anderson & S. Corso, comb. nov. *Mascagnia rivularis* C. V. Morton & Standl. in Standl., Publ. Field Mus. Nat. Hist., Bot. Ser., 22: 148. 1940.—TYPE: GUATEMALA. Izabal: Río Dulce, 27 Mar 1939 fl/imm fr, *Wilson 375* (holotype: F!; isotype: US!). Fig. 9.

Woody vine, occasionally described as a tree; stems initially golden-sericeous with the hairs all sessile and tightly appressed, soon glabrescent to quite glabrous. Lamina of larger leaves (8.5–) 11–18 cm long, 3.2–7 cm wide, narrowly elliptical or elliptical or somewhat ovate, usually decurrent at base with 2 glands borne on adaxial surface of decurrent tissue, abruptly to gradually acuminate at apex with the acumens often 15 mm long, initially sparsely sericeous on both sides, especially on midrib, the hairs very short, straight, appressed, translucent, soon glabrate; petiole 9–16 mm long, golden-sericeous to soon glabrate, mostly biglandular, the glands when present borne adaxially on tissue transitional between lamina and petiole, 0.5–2 mm long, slightly protuberant to somewhat sunken; stipules 0.2–0.3 (–0.5) mm long, triangular, sericeous to glabrate, borne on stem beside adaxial edge of petiole, persistent, sometimes apparently absent. Inflorescences with the ultimate pseudoracemes (0.5–) 2–4 (–6) cm long and containing 2–15 flowers, persistently tightly golden-sericeous or golden- and silver-sericeous; bracts and bracteoles abaxially sericeous, adaxially glabrous, persistent in anthesis, persistent in fruit or irregularly deciduous, the bracts 0.6–1.9 (–2.5) mm long, ovate or triangular, the bracteoles like bracts but shorter (0.4–1 mm long) and narrower; pedicel 5–7 mm long in flower, up to 10 mm long in fruit, 0.2–0.3 mm in diameter proximally and 0.4–0.6 mm in diameter distally during anthesis, slightly thicker in fruit, persistently sericeous or partially glabrescent in fruit. Sepals 1.5–1.9 mm long, 0.8–1.2 mm wide, ovate or elliptical, obtuse or rounded at apex, abaxially evenly sericeous, ciliate on margin, adaxially glabrous. Petals spreading to reflexed in anthesis, glabrous or rarely very sparsely white-sericeous abaxially in center of limb; claw 0.6–1.2 (–1.4) mm long; limb obovate, broadly rounded at apex, entire to erose, truncate or with tiny lobes at base, 3.5–5.4 mm long, (1.7–) 2–4 mm wide. Filaments (1.7–) 2–3.5 mm long; anthers 1.1–1.3 mm long, glabrous, the locules often twisted in age. Ovary densely sericeous, 1–1.3 mm high; styles 2.7–3.6 mm long, equal or subequal, glabrous or sericeous in the proximal third, usually lyrate, i.e., strongly spreading from base and then curving upward and inward, occasionally spreading from base and then straight. Samara ± densely sericeous on nut but the hairs not completely hiding epidermis, sparsely sericeous on wings; lateral wings (9–) 14–21 mm wide, (12–) 16–28 mm high, mostly trapezoidal, the distal margin entire or sinuate to erose; dorsal wing well developed, (2.3–) 4.3–7 mm wide, 8–12 mm high, sinuate at margin, extended forward at apex and there adnate to base of style, extending downward the whole length of nut to its base; nut 3–6 mm in diameter, smooth or reticulate between dorsal and lateral wings and outside lateral wings; ventral areole ovate to nearly circular, (1.5–) 2–2.7 mm high, (1.1–) 1.7–2.5 mm wide.

Phenology. Collected with flowers from January through April, and with fruits from March through May.

Distribution (Fig. 1). Southeastern Mexico (Veracruz, Chiapas, and Quintana Roo), northeastern Guatemala, and Belize; tall evergreen forest; from near sea level to 660 m.

ADDITIONAL SPECIMENS EXAMINED. **Belize.** BELIZE: Mullins River road, *Schipp 5-293* (F).—CAYO: Grano de Oro Camp, *Whiteford 9228* (BM, K).—TOLIDO: Bolo Camp, upper reach of Golden Stream, *Gentle 4535* (CHAPA, CAS, MEXU, LL, MICH, MO); beyond Manga Camp, Edwards Road, beyond

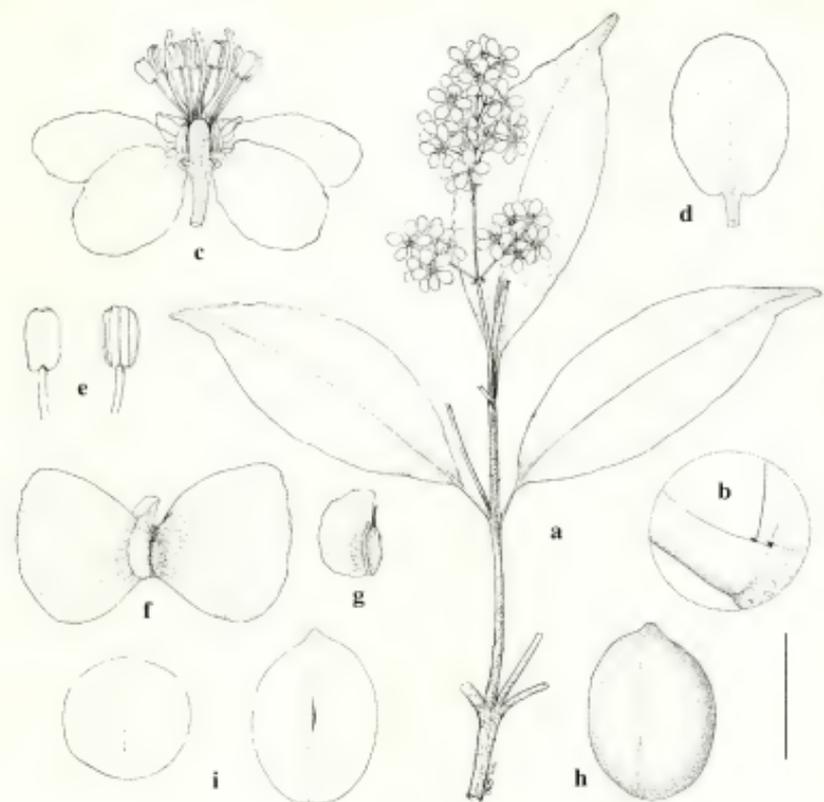


FIG. 9. *Psychopterys rivularis*. a. Flowering branch. b. Base of petiole to show stipules. c. Flower. d. Petal laid flat, adaxial view. e. Anthers, abaxial view (left) and adaxial view (right). f. Samara, abaxial view. g. Nut of samara with lateral wings cut away, lateral view to show dorsal wing. h. Intact embryo. i. Embryos in cross section (left) and longitudinal section (right). Scale bar equivalents: a, 4 cm; b, 4 mm; c, 5 mm; d, 4 mm; e, 2 mm; f, g, 2 cm; h, i, 5 mm. (Based on: a–c, *Sinaca C. 57*, WIS; f, g, *Ibarra M. 603*, MICH; h, i, *Ibarra M. 3388*, TEX.)

Columbia, *Gentle 6513* (CAS, CHAPA, LL, MICH, MO, NY, XAL). **Guatemala.** IZABAL: Río Dulce, between Livingston & 6 mi upriver, *Steyermark 39455* (F).—PETEN: Remate, on high mountain NE of the village, on Tikal Road, *Contreras 769* (CAS, MEXU, LL, MICH, MO). **Mexico.** CHIAPAS: Mpio. Ocozacoautla, Rancho La Cruz, camino para Rancho Corocito, Reserva del Ocote, *Calzada 9861* (XAL); Mpio. Ocosingo, en el vértice del Río Chikoy a 90 km al S de Boca Lacantum, camino a Chajul, *Martinez 18330* (CAS, CHAPA, CICY, IBUG, IEB, MEXU, MICH, MO).—QUINTANA ROO: 15 km al N de La Unión, por camino a Aserradero, Km 71, *Téllez 1994* (BM, CAS, MEXU, UAMIZ).—VERACRUZ: Mpio. Soctepan, 1 km al W de Magallanes, *Acosta P. 1119* (TEX, WIS, XAL), 2 km al E de Magallanes, *Vázquez T. 3339* (MICH, MO, XAL); Mpio. San Andrés Tuxtla, Est. Biol. de Los Tuxtlas, UNAM, and vicinity, *Calzada 775* (F, MEXU), Laguna Escondida, *Ibarra M. 603* (ENCB, MEXU, MICH, MO, NY), *Sinaca C. 57* (ENCB, F, MO, TEX, WIS, XAL) & *610* (ENCB, XAL), *Villegas H. 85* (F, IEB, MEXU, MICH, MO, NY), Cerro Lázaro Cárdenas, *Ibarra M. 3388* (IEB, TEX, XAL) & *Sinaca C. 512* (MEXU), camino a Ejido Lázaro Cárdenas, *Sinaca C. 1510* (MEXU, XAL); Mpio. Mecayapan, Los Tuxtlas range, very steep river gorges dissecting the slopes of Volcán Santa María, *LaFrankle 1272* (GH, TEX).

The lamina of *P. rivularis* is often relatively long, narrow, and long-acuminate, which gives the leaves a characteristic appearance. Other diagnostic characteristics are the soon-glabrate lamina and petiole, the decurrent base of the lamina bearing the glands on its adaxial surface, the very short stipules borne on the stem rather than the petiole, and the dorsal wing of the samara adnate at its apex to the base of the style.

*Psychopterys rivularis* is usually a woody vine, but three of the collections cited above were described by their collectors as trees up to 25 m tall. Lianas in tall forests are sometimes mistaken for trees, and that may explain this inconsistency, but it is not unknown for woody malpighiaceae vines to adopt an arborescent habit. For example, *Heteropterys laurifolia* (L.) A.D.R. Juss. is usually a woody vine but not rarely described as a shrub or small tree, while its sister-species *H. lindeniana* A.D.R. Juss. is usually a shrub or tree but occasionally a woody vine. Therefore, we feel it best to reserve judgement on this matter until *Psychopterys rivularis* can be studied in the field by collectors who are aware of the problem.

There is one collection, not cited above, about whose relationship to *P. rivularis* we are unsure. That is *Ton 7308* (MEXU, MICH, MO), collected with flowers in February at Cueva Yashanal in Mpio. Tenejapa, Chiapas, Mexico. In most characters the plant fits *P. rivularis*, which has been collected not very far away in Mpio. Ocozacoautla, and there is certainly no other described species to which *Ton 7308* could be assigned. However, all of its petals are abaxially densely sericeous, whereas other collections of the species have the petals glabrous or rarely very sparsely sericeous. The plant is also peculiar in having large glands at a few nodes of the inflorescence, presumably derived from petiole glands on rudimentary leaves. While we hesitate to describe *Ton 7308* at this time, it may represent yet another species of the *P. rivularis* complex. It should be sought again in the area of Tenejapa, in April or May when it is likely to bear fruits.

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## GENERIC ADJUSTMENTS IN NEOTROPICAL MALPIGHIACEAE

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**ABSTRACT.** The genera *Bronwenia* W. R. Anderson & C. Davis and *Callicola* W. R. Anderson & C. Davis are proposed to accommodate species segregated from *Banisteriopsis* and *Mascagnia*, respectively, and *Cotsia* Dubard & Dop is resurrected for the North American species formerly assigned to *Janusia*. All three genera are described, their morphology and relationships are discussed, and keys to the species are provided, with nomenclature for each species. For *Callicola* and *Cotsia* distribution maps and descriptions of species are provided. The genus *Clonodia* is placed in synonymy under *Heteropterys*, with discussion of relationships, a key to clonodioid species, and nomenclature and a diagnostic description for each species. One new species is described [*Bronwenia peckoltii* W. R. Anderson & C. Davis] and 19 new combinations are proposed [*Bronwenia acapulcensis* (Rose) W. R. Anderson & C. Davis, *B. acapulcensis* var. *ilanensis* (B. Gates) W. R. Anderson & C. Davis, *B. brevipedicellata* (B. Gates) W. R. Anderson & C. Davis, *B. cinerascens* (Benth.) W. R. Anderson & C. Davis, *B. cornifolia* (H. B. K.) W. R. Anderson & C. Davis, *B. cornifolia* var. *maracaybensis* (Adr. Juss.) W. R. Anderson & C. Davis, *B. cornifolia* var. *standleyi* (B. Gates) W. R. Anderson & C. Davis, *B. ferruginea* (Cav.) W. R. Anderson & C. Davis, *B. longipilifera* (B. Gates) W. R. Anderson & C. Davis, *B. mathiasiae* (W. R. Anderson) W. R. Anderson & C. Davis, *B. megaptera* (B. Gates) W. R. Anderson & C. Davis, *B. wurdackii* (B. Gates) W. R. Anderson & C. Davis, *Callicola parvifolia* (Adr. Juss.) W. R. Anderson & C. Davis, *C. sericea* (Nied.) W. R. Anderson & C. Davis, *Cotsia californica* (Benth.) W. R. Anderson & C. Davis, *C. gracilis* (A. Gray) W. R. Anderson & C. Davis, *C. linearis* (Wiggins) W. R. Anderson & C. Davis, *Heteropterys complicata* (H. B. K.) W. R. Anderson & C. Davis, and *H. ovata* (Nied.) W. R. Anderson & C. Davis]. Ten species are illustrated.

### INTRODUCTION

Phylogenetic studies of Malpighiaceae published in recent years (Cameron et al. 2001; Davis et al. 2001, 2002), and our recently acquired unpublished data, have revealed a number of genera that need to be divided or combined with other genera to produce a more nearly monophyletic classification. The purpose of this paper is to deal with four of those problems.

Although we give many synonyms below, we are omitting some of the less important infraspecific names; complete synonymy can be obtained by consulting the nomenclatural database on the Malpighiaceae website at <http://herbarium.lsa.umich.edu/malpigh>.

### BANISTERIOPSIS AND BRONWENIA

In her monograph of *Banisteriopsis* C. B. Rob. and *Diplopterys* Adr. Juss., Gates (1982) recognized three subgenera in *Banisteriopsis* and considered *Diplopterys* a separate genus resembling *Banisteriopsis* subg. *Pleiopterys* (Nied.) B. Gates. Anderson

and Davis (2006) reported that *Banisteriopsis* sensu Gates is not monophyletic, and that *Diplopterys* is nested within *Banisteriopsis* subg. *Pleiopterys*. We resolved that problem by transferring all the species of *Banisteriopsis* subg. *Pleiopterys* to *Diplopterys*. The remaining two subgenera of Gates, however, require further taxonomic elucidation.

Some clarification of the subgeneric nomenclature is in order. Gates assumed that the earliest designation of a lectotype for *Banisteriopsis* was that of Cuatrecasas (1958, p. 486), who treated *B. cornifolia* (H. B. K.) C. B. Rob. as the "type" [lectotype]. On that basis Gates used the name subg. *Banisteriopsis* for the group of eight species containing *B. cornifolia*. The other two, much larger, subgenera she called subg. *Hemiramma* (Griseb.) B. Gates and subg. *Pleiopterys*. We now know, however, that there was an earlier designation of a lectotype for *Banisteriopsis* by Morton (1931), *B. argentea* (H. B. K.) C. B. Rob. [*B. muricata* (Cav.) Cuatrec.]. *Banisteriopsis muricata* belongs to the very large subgenus *Hemiramma*, so that has to become subg. *Banisteriopsis* and the generic name *Banisteriopsis* will remain (fortunately) with that largest group of species. The other, small subgenus that Gates called subg. *Banisteriopsis* is the subject of these notes. Our preliminary phylogenetic results (C. Davis & W. R. Anderson, unpubl.) indicate that the species assigned by Gates to her subg. *Banisteriopsis* do not form a clade with the greatly expanded subg. *Banisteriopsis*, and thus should not be retained in *Banisteriopsis* sens. str. (see Fig. 1, where the species in question are in boldface under the new name *Bronwenia*). We here segregate the eight species treated by Gates as *Banisteriopsis* subg. *Banisteriopsis* as a new genus, and include two additional ones not mentioned in her monograph.

**Bronwenia** W. R. Anderson & C. Davis, gen. nov.—TYPE: *Bronwenia ferruginea* (Cav.) W. R. Anderson & C. Davis.

*Banisteria* sect. *Monocentia* Nicd., Ind. Lect. Lyc. Reg. Hos. Brunsberg, p. hiem. 1900–1901: 4. 1900.—LECTOTYPE, designated by Gates, 1982, p. 41: *Banisteria maracaybensis* Adr. Juss. [*Bronwenia cornifolia* var. *maracaybensis* (Adr. Juss.) W. R. Anderson & C. Davis].

Lianae lignosae vel frutices; petiolus eglandulosus vel prope apicem biglandulosus; lamina eglandulosa vel margine glandulis instructa; stipulae interpetiolares, distinctae; inflorescentia paniculata vel dichasialis, floribus in pseudoracemis 6–45-floris portatis; pedicelli sessiles vel brevipedunculati; glandulae calycinae pro parte maxima infra sepala affixae; petala lutea, plerumque glabra; antherarum connectivum loculus non superans; stigmata terminalia; samarae nux in lateribus laevis vel 1 crista vel alula instructa, ala dorsali elongata, adaxialiter incrassata; carpophorum nullum vel usque ad 1.5 mm longum, 1–2 mm latum.

Woody vines or shrubs, when shrubby the branches often twining. Leaves decussate; lamina with glands none or usually marginal (but see *B. peckoltii*), sessile, the distal glands (if present) minute, the 2 most proximal glands usually enlarged; petiole eglandular or biglandular at or somewhat below apex; stipules usually present, interpetiolar, distinct, triangular, minute (0.2 mm long) or small (up to 1.5 mm long). Inflorescence axillary or terminal, paniculate or dichasial, the flowers borne in short, usually dense pseudoracemes of 6–45; bracts and bracteoles eglandular, persistent; pedicels sessile or short-pedunculate. Flowers bilaterally symmetrical in calyx and corolla, and sometimes in androecium. Sepals leaving petals exposed during enlargement of bud, the lateral 4 bearing large paired abaxial glands and the anterior eglandular, the glands attached for most of their length below free part of sepal. Petals

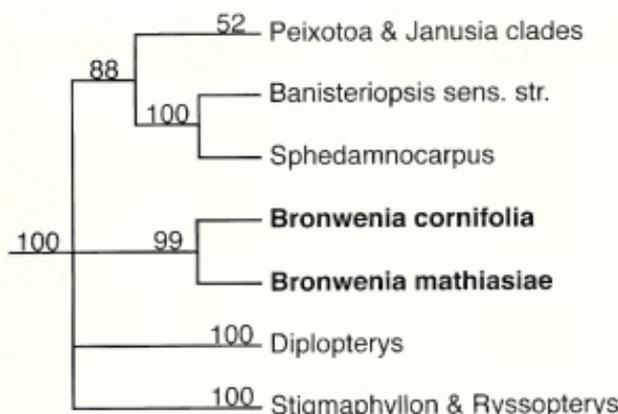


FIG. 1. Phylogenetic tree showing position of *Bronwenia* in the *Stigmaphyllon* clade of Malpighiaceae. Bootstrap values are given above branches. The reduced strict consensus tree shown here is extracted from a larger phylogenetic analysis of Malpighiaceae using combined DNA sequences from plastid *matK*, *ndhF*, and *rbcL*, nuclear *PHYC*, and morphology; all genes were sequenced for all taxa (C. Davis & W. R. Anderson, unpubl.). Vouchers for species of *Bronwenia* sequenced: *Bronwenia cornifolia*: Clark 1, MICH; *Bronwenia mathiasiae*: Nelson et al. 518, MICH.

yellow, glabrous (very rarely sericeous on abaxial midrib), the posterior petal different in size, shape, and stance from the lateral 4, and its margin often more deeply divided with the divisions (especially proximally)  $\pm$  glandular-thickened. Receptacle glabrous on both sides of filaments. Stamens 10, all fertile; anthers glabrous or pilose, the connective not or hardly exceeding locules at apex. Gynoecium 3-carpellate, the carpels 1 anterior and 2 posterior, all fertile; styles 3, distinct, mostly  $\pm$  alike; stigmas terminal, truncate or capitate. Fruit dry, breaking apart at maturity into 3 samaras (or fewer by abortion) separating from a low pyramidal torus; dorsal wing of samara well developed, elongated, thickened on the adaxial edge with the veins bending toward the thinner abaxial edge, a shallow triangular or rounded appendage usually present on adaxial edge at base; nut of samara smooth-sided or bearing a single ridge or winglet on each side parallel to areole; locule of nut glabrous within; carpophore absent or present but short (up to 1.5 mm long), broad (1–2 mm wide), and non-functional. Chromosome number:  $n = 10$  (in *B. acapulcensis* var. *llanensis* [Gates 1982]).

*Bronwenia* is notable for its leaf glands usually marginal (if present), flowers borne in short dense pseudoracemes, calyx glands attached below the free part of the sepals, yellow, usually glabrous petals, and samaras with the sides of the nut smooth or bearing a single ridge or winglet parallel to the areole and the carpophore absent or short, broad, and apparently non-functional. Of the ten species recognized here, the eight that were treated in the same subgenus by Gates are morphologically coherent and readily recognized by their small petals. For descriptions of those species and their varieties, see Gates (1982). The two additional species of *Bronwenia* (*B. mathiasiae* and *B. peckoltii*) have much larger petals and other characteristics that set them apart from their congeners. For a description of *B. mathiasiae*, see its protologue (cited below), and for a discussion of its generic position see below. *Bronwenia peckoltii* is described below as new and its assignment to *Bronwenia* is discussed as part of its protologue.

The name *Bronwenia* honors Bronwen Elizabeth Gates (b. 1945), who was W. R. Anderson's first doctoral student and published an excellent monograph of *Banisteriopsis* and *Diplopterys*, a major contribution to the taxonomy of the Malpighiaceae.

The key that follows is modified from those in Gates (1982), with many of the data taken from her descriptions.

#### KEY TO THE SPECIES OF BRONWENIA

1. Lamina at least initially tomentose or appressed-tomentose below with the hairs loose or twisted, sometimes glabrescent at maturity.
  2. Styles 2–2.4 mm long, diverging from the base and  $\pm$  inflexed at apex; Bolivia, Amazonian Brazil (Roraima), and Guyana. *B. cinerascens*
  2. Styles 1.4–1.8 mm long, straight and parallel or diverging at apex; Mexico, Central America, Colombia, and Venezuela. *B. acapulcensis*
1. Lamina at least initially densely to thinly sericeous below with the hairs straight and strongly appressed, sometimes glabrescent at maturity.
  3. Lamina densely and persistently silver-sericeous below; Rio de Janeiro, Brazil. *B. peckoltii*
  3. Lamina sparsely sericeous to glabrate below at maturity; Mexico, Central America, and South America.
    4. Limb of lateral petals 7.5–11 mm long, 6–11 mm wide; glands on petiole 1.5–2.8 mm long; nut of samara without lateral winglets, smooth on the sides or at most with a low ridge up to 0.5 mm wide; Amazonian Peru, Bolivia, and Brazil, and Guyana. *B. mathiasiae*
    4. Limb of lateral petals 2.5–5.5 (–7) mm long, 2–4.5 (–5) mm wide; glands on petiole or base of lamina up to 2 mm long, mostly shorter; nut of samara with or without lateral winglets; Mexico, Central America, and South America.
      5. Styles 2–2.6 mm long, diverging from the base and  $\pm$  inflexed at apex; filaments of 3 anterior stamens free almost to base, those of stamens opposite anterior-lateral sepals flexuous and bent toward posterior petal; Panama and northern and western South America, as far east and south as French Guiana, central Brazil (Pará, Tocantins, Mato Grosso) and Bolivia. *B. wurdackii*
      5. Styles 1–2 mm long, straight and parallel or diverging throughout their length or at apex only; stamens subequal, erect, all their filaments somewhat connate at base; Mexico, Central America, and South America.
        6. Ultimate branches of inflorescence bearing 25–45 flowers
          7. Lamina of larger leaves 13–15.4 cm long, 6–8.6 cm wide; pedicels 2–5 mm long; westernmost Amazonas, Brazil. *B. brevipedicellata*
          7. Lamina of larger leaves 4.5–11 cm long, 3–4.5 cm wide; pedicels 7–10 mm long; eastern Brazil, from Bahia to Paraná. *B. ferruginea*
        6. Ultimate branches of inflorescence bearing up to 24 flowers
          8. Petiole biglandular at or somewhat below apex, the glands sometimes partly on margin of very base of lamina and partly on adjacent petiole.
            9. Pedicels 5–6 mm long; styles 1–1.2 mm long; samara with lateral winglets 2–6 mm wide, confluent at base below nut, the hairs on dorsal wing 1–1.5 mm long, stiff; Mato Grosso do Sul, Brazil. *B. longipilifera*
            9. Pedicels 7–12 mm long; styles 1.6–1.8 mm long; samara with lateral winglets absent or represented by a ridge up to 1 mm wide, not confluent below nut, the hairs on dorsal wing 0.2–0.7 mm long, soft; eastern Brazil (Piauí and Ceará to Rio de Janeiro). *B. megaptera*
          8. Petiole eglandular, the leaf glands wholly on margin of lamina near base.
            10. Petiole of larger leaves 8–20 mm long; nut of samara 9–11  $\times$  7–9 mm, the lateral winglets absent or represented by a ridge up to 1 mm wide; eastern Brazil (Piauí and Ceará to Rio de Janeiro). *B. megaptera*
            10. Petiole of larger leaves 6–10 (–15) mm long; nut of samara 5–8  $\times$  4–6 mm, usually bearing on each side a lateral winglet 1–5 mm wide; Mexico, Central America, northern South America (Colombia and Venezuela), and eastern Brazil (Bahia to Paraná).
              11. Lamina of larger leaves 5–10 (–13.5) cm long, 3.3–4.5 (–5.5) cm wide, mostly obtuse or truncate at base; styles 1.2–1.6 mm long; eastern Brazil (Bahia to Paraná). *B. ferruginea*

11. Lamina of larger leaves 10–14.5 (–17.9) cm long, 4–6.7 (–8.8) cm wide, mostly cuneate at base; styles 1.6–1.8 mm long; Mexico, Central America, and northern South America (Colombia and Venezuela). *B. cornifolia*

- Bronwenia acapulcensis** (Rose) W. R. Anderson & C. Davis, comb. nov. *Heteropterys acapulcensis* Rose, Contr. U.S. Natl. Herb. 5: 139. 1897. *Banisteria maracaybensis* var. *leiocarpa* Nied., Ind. Lect. Lyc. Reg. Hos. Brunsberg, p. hiem. 1900–1901: 6. 1900. *Banisteriopsis acapulcensis* (Rose) Small, N. Amer. Fl. 25: 132. 1910. *Banisteria cornifolia* var. *leiocarpa* (Nied.) Nied. in Engl., Pflanzenz. IV, 141: 405. 1928. *Banisteriopsis cornifolia* var. *leiocarpa* (Nied.) Cuatrec., Webbia 13: 496. 1958.—TYPE: MEXICO. Guerrero: near Acapulco, *Palmer 219* in 1894 (holotype: US!; isotypes: A! F! GH! MO! NY! UC! US!). [The lectotype of *Banisteria maracaybensis* var. *leiocarpa* is the NY specimen of *Palmer 219* in 1894 that came from Niedenzu's herbarium; it was designated by B. Gates, 1982, p. 44.]
- Banisteria guatemalensis* Nied., Ind. Lect. Lyc. Reg. Hos. Brunsberg, p. hiem. 1900–1901: 6. 1900. *Banisteriopsis guatemalensis* (Nied.) C. B. Rob. in Small, N. Amer. Fl. 25: 132. 1910.—TYPE: GUATEMALA. Llano Grande, Salamá, *Seler & Seler 2428* (holotype: B†, F neg. 12811, fragment NY!).
- Banisteriopsis dugandii* Cuatrec., Webbia 13: 496. 1958.—TYPE: COLOMBIA. Bolívar, *Dugand & Jaramillo 3335* (holotype: US!).

Fig. 2.

Gates (1982, pp. 45–48) recognized two varieties of this species, var. *acapulcensis* and var. *llanensis*, and we are doing the same. See her treatment for a key to the varieties.

- Bronwenia acapulcensis** var. **llanensis** (B. Gates) W. R. Anderson & C. Davis, comb. nov. *Banisteriopsis acapulcensis* var. *llanensis* B. Gates, Fl. Neotrop. Monogr. 30: 46. 1982.—TYPE: VENEZUELA. Guárico: E of Calabozo, *Gentry 10294* (holotype: MICH!; isotypes: MEXU! MO! NY!).
- Bronwenia brevipedicellata** (B. Gates) W. R. Anderson & C. Davis, comb. nov. *Banisteriopsis brevipedicellata* B. Gates, Fl. Neotrop. Monogr. 30: 50. 1982.—TYPE: BRAZIL. Amazonas: Mun. São Paulo de Olivença, *Krukoff 8758* (holotype: MO!; isotypes: A! G! K! MICH! NY! US!).
- Bronwenia cinerascens** (Benth.) W. R. Anderson & C. Davis, comb. nov. *Heteropterys cinerascens* Benth., London J. Bot. 7: 131. 1848. *Banisteria cinerascens* (Benth.) Griseb., Linnæa 22: 18. 1849. *Banisteriopsis cinerascens* (Benth.) B. Gates, Brittonia 31: 108. 1979.—TYPE: BRAZIL [“BRITISH GUIANA”]. Roraima: Cotinga/Suruma rivers, *Robert Schomburgk II 488/Richard Schomburgk 773* (holotype: K!; isotypes: BM [488]! F [488]! G [488]! GOET [773]! K [773]! NY [773]! P [488]! W [488]!).
- Banisteriopsis subluclida* Rusby, Bull. New York Bot. Gard. 8: 96. 1912. *Banisteria subluclida* (Rusby) Nied. in Engl., Pflanzenz. IV, 141: 452. 1928.—TYPE: BOLIVIA. La Paz: Apolo, *Williams 102* (holotype: NY!; isotype: US!).
- Banisteria cinerascens* var. *platyphylla* Nied. in Engl., Pflanzenz. IV, 141: 1928.—TYPE: BOLIVIA. Santa Cruz: *Steinbach 3260* (holotype: B†; lectotype, designated by Gates (1982, p. 54): NY!; isolectotypes: F! G! GH! MO! S!).

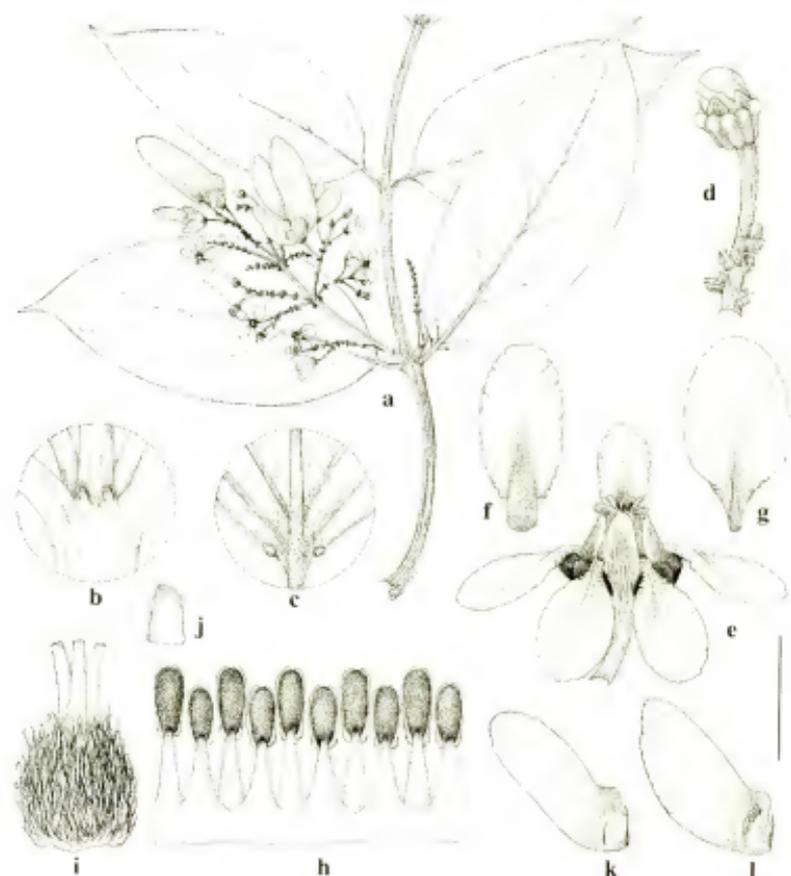


FIG. 2. *Bronwenia acapulcensis* var. *acapulcensis*. a. Branch with flowers and fruits. b. Node with interpetiolar stipules. c. Base of lamina, abaxial view. d. Flower bud and portion of inflorescence axis. e. Flower, posterior petal uppermost. f. Posterior petal, abaxial view. g. Lateral petal, abaxial view. h. Androecium laid out, abaxial view, stamen above letter "h" opposite posterior petal. i. Gynoecium. j. Apex of style. k. Samara with crest on side of nut. l. Samara with winglet on side of nut. Scale bar equivalents: a, 4 cm; b, 4 mm; c, d, 8 mm; e, 5.7 mm; f, g, 4 mm; h, i, 2 mm; j, 1 mm; k, l, 2 cm. (Based on: a, e-k, Burnham 977, MICH; b-d, Burnham 976, MICH; l, Almeda 3983, MICH.)

***Bronwenia cornifolia*** (H. B. K.) W. R. Anderson & C. Davis, comb. nov. *Heteropterys cornifolia* H. B. K., Nov. Gen. Sp. 5 [quarto ed.] 165. 1822 ["1821"]. *Banisteria cornifolia* (H. B. K.) Spreng., Syst. Veg. 2: 388. 1825. *Banisteria maracaybensis* var. *cornifolia* (H. B. K.) Nied., Ind. Lect. Lyc. Reg. Hos. Brunnsberg, p. hiem. 1900-1901: 5. 1900, nom. superfl. *Banisteriopsis cornifolia* (H. B. K.) C. B. Rob. in Small, N. Amer. Fl. 25: 132. 1910.—TYPE: COLOMBIA, Tolima; near Ibaguá, Humboldt & Bonpland (holotype: P-HBK!).

Gates (1982, pp. 42–44) recognized three varieties of this species, var. *cornifolia*, var. *elliptica* [=var. *maracaybensis* here], and var. *standleyi*; we are doing the same. See her treatment for a key to the varieties.

We are following Gates in recognizing both *B. cornifolia* and *B. ferruginea*, but we are somewhat skeptical about the distinctions between those two species; eventually they may have to be combined under the older name, *B. ferruginea*.

***Bronwenia cornifolia* var. *maracaybensis*** (Adr. Juss.) W. R. Anderson & C. Davis, comb. nov. *Banisteria maracaybensis* Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 285. 1840. *Banisteria maracaybensis* var. *elliptica* Nied., Ind. Lect. Lyc. Reg. Hos. Brunsberg. p. hiem. 1900–1901: 5. 1900, nom. superfl. *Banisteria cornifolia* var. *elliptica* Nied. in Engl., Pflanzenz. IV, 141: 405. 1928, nom. superfl. *Banisteriopsis cornifolia* var. *elliptica* B. Gates, Fl. Neotrop. Monogr. 30: 42. 1982, nom. superfl. *Banisteriopsis cornifolia* var. *maracaybensis* (Adr. Juss.) W. R. Anderson, Contr. Univ. Michigan Herb. 20: 15. 1995.—TYPE: VENEZUELA ["COLUMBIA"]. Zulia: Maracaibo, *Plée* (holotype: P!; isotypes: BR! F! P! P-JU!).

***Bronwenia cornifolia* var. *standleyi*** (B. Gates) W. R. Anderson & C. Davis, comb. nov. *Banisteriopsis cornifolia* var. *standleyi* B. Gates, Fl. Neotrop. Monogr. 30: 44. 1982.—TYPE: GUATEMALA. Retalhuleu: vicinity of Retalhuleu, *Standley* 88835 (holotype: F!; isotype: US!).

***Bronwenia ferruginea*** (Cav.) W. R. Anderson & C. Davis, comb. nov. *Banisteria ferruginea* Cav., Diss. 9: 424, pl. 248. 1790. *Triopterys brasiliensis* Poir. in Lam., Encycl. 8: 105. 1808, nom. superfl. *Banisteriopsis ferruginea* (Cav.) B. Gates, Fl. Neotrop. Monogr. 30: 48. 1982.—TYPE: BRAZIL. Rio de Janeiro, *Commer-son* (holotype: P-JU!; isotypes: C! MA! P! P-LAM! R!).

*Banisteria unialata* Vell., Fl. Flumin. 190; icones 4: pl. 157. 1829.—TYPE: Unknown.

***Bronwenia longipilifera*** (B. Gates) W. R. Anderson & C. Davis, comb. nov. *Banisteriopsis longipilifera* B. Gates, Fl. Neotrop. Monogr. 30: 56. 1982.—TYPE: BRAZIL. Mato Grosso do Sul: E of Aquidauana, *Krapovickas & Schinini* 32897 (holotype: MICH!; isotypes: CTES! MBM!).

***Bronwenia mathiasiae*** (W. R. Anderson) W. R. Anderson & C. Davis, comb. nov. *Stigmaphyllon mathiasiae* W. R. Anderson, Bol. Mus. Bot. Munic. (Curitiba) 43: 3. 1981. *Banisteriopsis mathiasiae* (W. R. Anderson) W. R. Anderson, Contr. Univ. Michigan Herb. 20: 15. 1995.—TYPE: PERU. Ucayali: W of Tournavista, *Mathias & Taylor* 6078 (holotype: MICH!; isotypes: COL! F! LA! MBM! MO! NY! RB! U! US! USM!).

*Banisteria cornifolia* var. *seibertii* J. F. Macbr., Field Mus. Publ. Bot. 13(3): 826. 1950.—TYPE: PERU. Madre de Dios: Iberia, *Seibert* 2122 (holotype: US!; isotype: MO!).

Fig. 3.

Anderson originally described this species in *Stigmaphyllon* because of its dichasial inflorescence, which makes it look rather different from other species of *Bronwenia*, but in 1995 he transferred it to *Banisteriopsis* because by then he had become

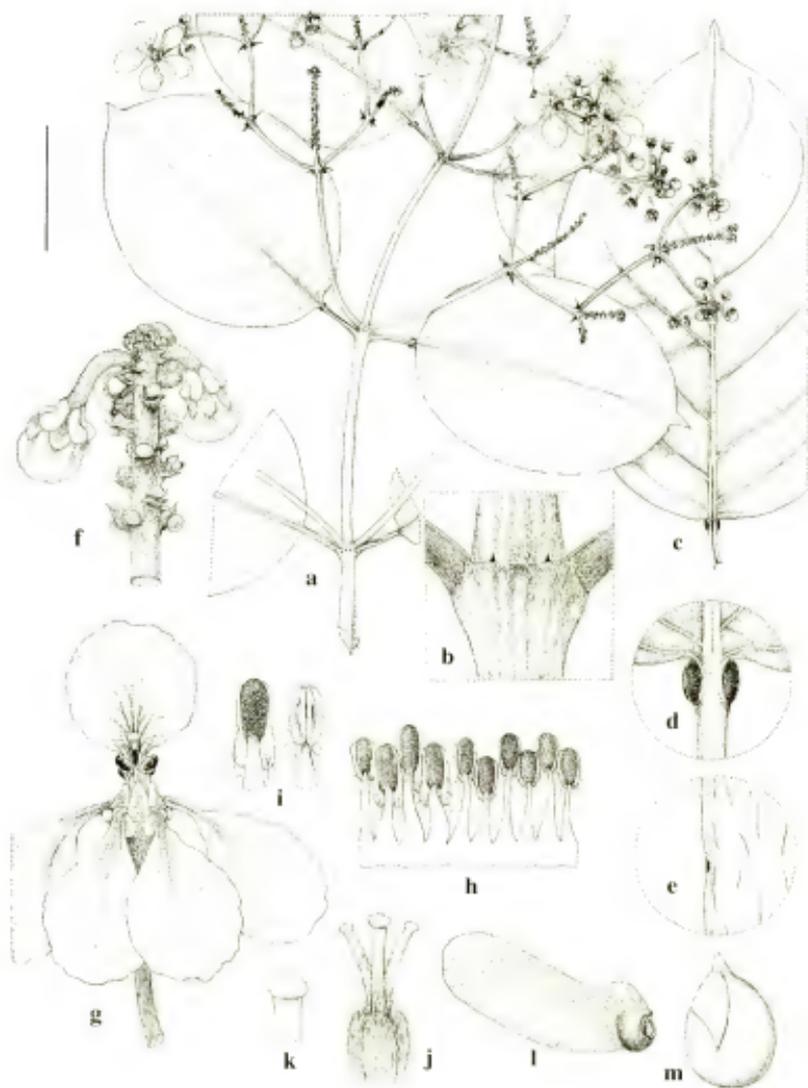


FIG. 3. *Bromewenia mathiasiae*. a. Flowering branch. b. Node with tiny interpetiolar stipules. c. Detached large leaf, adaxial view. d. Apex of petiole, abaxial view. e. Margin of lamina, abaxial view, to show tiny gland. f. Distal portion of inflorescence with flower buds. g. Flower, posterior petal uppermost. h. Androecium laid out, abaxial view, stamen third from right opposite posterior petal. i. Anthers: abaxial view of anther opposite anterior sepal (left) and adaxial view of anther opposite posterior petal (right). j. Gynoecium, the anterior style in center. k. Apex of anterior style. l. Samara. m. Embryo. Scale bar equivalents: a, 4 cm; b, 6.7 mm; c, 4 cm; d, 8 mm; e, 2 mm; f, g, 8 mm; h, 2.7 mm; i, 2 mm; j, 2.7 mm; k, 1.3 mm; l, 2.7 cm; m, 8 mm. (Based on: a, *Nelson et al. 518, MICH, and Stannard & Arrais 637, MICH*; b, *Gentry & Diaz 58617, MICH*; c, d, *Cid & Nelson 2680, MICH*; e, *Nelson et al. 518, MICH*; f-k, *Stannard & Arrais 637, MICH*; l, m, *Miliken 171, MICH*.)

convinced that its relationships lie with the species included here in *Bronwenia*. Our new data pair this species with *B. cornifolia* with 99% bootstrap support (Fig. 1), thus confirming its placement in *Bronwenia*, in spite of its dichasial inflorescence, large petals, and large petiole glands.

***Bronwenia megaptera*** (B. Gates) W. R. Anderson & C. Davis, comb. nov. *Banisteriopsis megaptera* B. Gates, Fl. Neotrop. Monogr. 30: 49. 1982.—TYPE: BRAZIL, Minas Gerais: S of Itaobim, Anderson 11734 (holotype: BM!; isotypes: CAS! CTES! MICH! MO! NY!).

*Banisteria ovata* Nied., Ind. Lect. Lyc. Reg. Hos. Brunsberg. p. hiem. 1900–1901: 407. 1928, non *B. ovata* Cav., 1790.—TYPE: BRAZIL, Minas Gerais (fide Niedenzu 1928): *Glaziou 12492* (holotype: B†, F neg. 12821, fragment NY!; isotypes: BR! C! G! NY! P! S!).

***Bronwenia peckoltii*** W. R. Anderson & C. Davis, sp. nov.—TYPE: BRAZIL, Rio de Janeiro: Cantagalo, Jun fl/imm fr, *Peckolt 266* (holotype: W!; isotypes: F! W!).

Liana; lamina foliorum majorum 12–16.5 cm longa, 5–9 cm lata, abaxialiter dense et pertinaciter sericea; petiolus 22–30 mm longus, apice biglandulosus glandulis 1.5–3 mm longis; inflorescentia paniculata floribus in pseudoracemis 6–14-floris portatis; pedunculi 1–3.5 mm longi; pedicelli 10–27 mm longi; petala lutea, glabra; petala lateralia limbo 6–7 mm longo, 6–6.5 mm lato; petalum posticum limbo 4.5 mm longo, 3 mm lato; stamina glabra.

Woody vine; stems initially sericeous, glabrescent in age. Lamina of larger leaves 12–16.5 cm long, 5–9 cm wide, broadly elliptical, cuneate at base or somewhat decurrent onto petiole, rounded, obtuse, or abruptly short-acuminate at apex, initially thinly and loosely sericeous above but soon glabrate, densely and persistently silver-sericeous below with the hairs short, straight, and tightly appressed, eglandular (but see below under petiole), the principal lateral veins 5–6 on each side; petiole 22–30 mm long, thinly persistent or eventually glabrescent, bearing at apex (or on abaxial surface of decurrent base of lamina) 2 large bulging glands 1.5–3 mm long; stipules minute (0.2–0.4 mm long), often hidden under hairs, or apparently lacking. Inflorescence a terminal or axillary panicle, the axis thinly sericeous, the ultimate pseudoracemes 1.5–3 cm long, containing 6–14 flowers; bracts ovate or lanceolate, 1–2 (–3) mm long, 0.8–1 mm wide, abaxially sericeous, adaxially glabrous, eglandular but abaxially callose at base, appressed or somewhat spreading, persistent; peduncle 1–3.5 mm long, sericeous; bracteoles like bracts but smaller, borne at or slightly below apex of peduncle; pedicel 10–27 mm long, sericeous. Sepals 1–1.5 mm long and wide beyond glands, triangular, rounded at apex, abaxially sericeous proximally and glabrous distally, adaxially glabrous, the glands 2.5–3 mm long, obovate. Petals yellow, glabrous, entire or erose; lateral petals with limb 6–7 mm long, 6–6.5 mm wide, the claw 2 mm long; posterior petal with limb 4.5 mm long, 3 mm wide, the claw 2 mm long. Stamens glabrous; filaments 1.5–2 mm long, longer opposite sepals than opposite petals, connate at base; anthers 0.9–1.2 mm long, alike, the connective red, not exceeding locules. Ovary 1.5 mm high, densely sericeous; styles ca. 1.5 mm long, glabrous, stout, erect and straight or diverging distally, alike or the anterior slightly longer than the posterior 2 and more strongly divergent, the stigma terminal and capitate. Mature fruit unknown; very immature developing fruit with one elongating dorsal wing on each carpel and no lateral wings, but with a low ridge on each side parallel to areole.

Known only from the type collection; Peckolt's handwritten label has what is probably a more detailed locality, but we cannot decipher it.

This species is named in honor of the collector of the type, Theodor Peckolt (1822–1912), a botanist and pharmacist who was German by birth and training but spent most of his life (65 years) in his adopted country of Brazil. Peckolt collected extensively in the state of Rio de Janeiro and lived for 17 years in Cantagalo; it was probably during those years that he collected the plant described here (Ihering 1914).

The generic placement of this species is somewhat problematic. With its large flowers, long petioles, and huge petiole glands it bears little resemblance to other species in the genus except *B. mathiasiae*. Its metallic-sericeous leaves are unique in *Bronwenia*. In the enlarging fruits the carpels are clearly connate their whole length in the nut, whereas in most species (and indeed in most species of *Banisteriopsis* sensu Gates) the carpels are nearly distinct in the ovary. However, in specimens of *B. megaptera* with enlarging fruits the carpels show connation similar to that of *Peckolt 266*, which suggests that the usual condition of distinct carpels is not found consistently in *Bronwenia*. Even more worrisome is the fact that when the leaf glands are on the decurrent base of the lamina in this species, they are on the abaxial surface, not on the margin as in all other species. On the other hand, there are good reasons for placing this species in *Bronwenia*. The interpetiolar stipules, paniculate inflorescence with flowers ultimately disposed in short pseudoracemes, calyx glands attached mostly below the free part of the sepals, androecium of similar stamens with the connective not exceeding the locules, stout styles with a large terminal stigma, and glabrous yellow petals combine to say that if this plant belongs anywhere in *Banisteriopsis* sensu Gates, it must go among the species we are transferring here to *Bronwenia*. While the enlarging fruits are very young on this specimen, they suggest strongly that each samara at maturity will have one dominant dorsal wing with the lateral wings represented at most by a single ridge, which agrees with other samaras in *Bronwenia*. For these reasons we have decided to go ahead and describe this enigmatic species in *Bronwenia*, but its position should be re-evaluated when more and better specimens, especially ones with larger fruits, are available for study.

***Bronwenia wurdackii*** (B. Gates) W. R. Anderson & C. Davis, comb. nov. *Banisteriopsis wurdackii* B. Gates, *Brittonia* 31: 109. 1979.—TYPE: VENEZUELA. Bolívar: Río Villacoa (Río Auyacoa), *Wurdack & Monachino 41145* (holotype: MICH!; isotypes: NY! VEN!).

*Banisteria cinerascens* var. *glabrescens* Nied. in Engl., *Pflanzenr.* IV, 141: 406. 1928.—TYPE: BRAZIL. Amazonas: Seringal São Francisco, Rio Acre, *Ule 9477* (holotype: B†; lectotype, designated here: G!; isotypes: L! MG!).

Fig. 4.

## CALCICOLA AND MASCAGNIA

*Mascagnia* (Bertero ex DC.) Colla, as recognized by Niedenzu (1928), was an exceedingly polyphyletic genus (Anderson 1981, 1988, 2001a, 2001b; Cameron et al. 2001; Davis et al. 2001, 2002). Most of the segregates necessary to correct this problem have been described (Anderson 2006), but our recent work has uncovered a pair of species that will have to be removed from *Mascagnia* sens. str. (C. Davis & W. R. Anderson, unpubl.). They are *Mascagnia parvifolia* (Adr. Juss.) Nied. and *M. sericea*

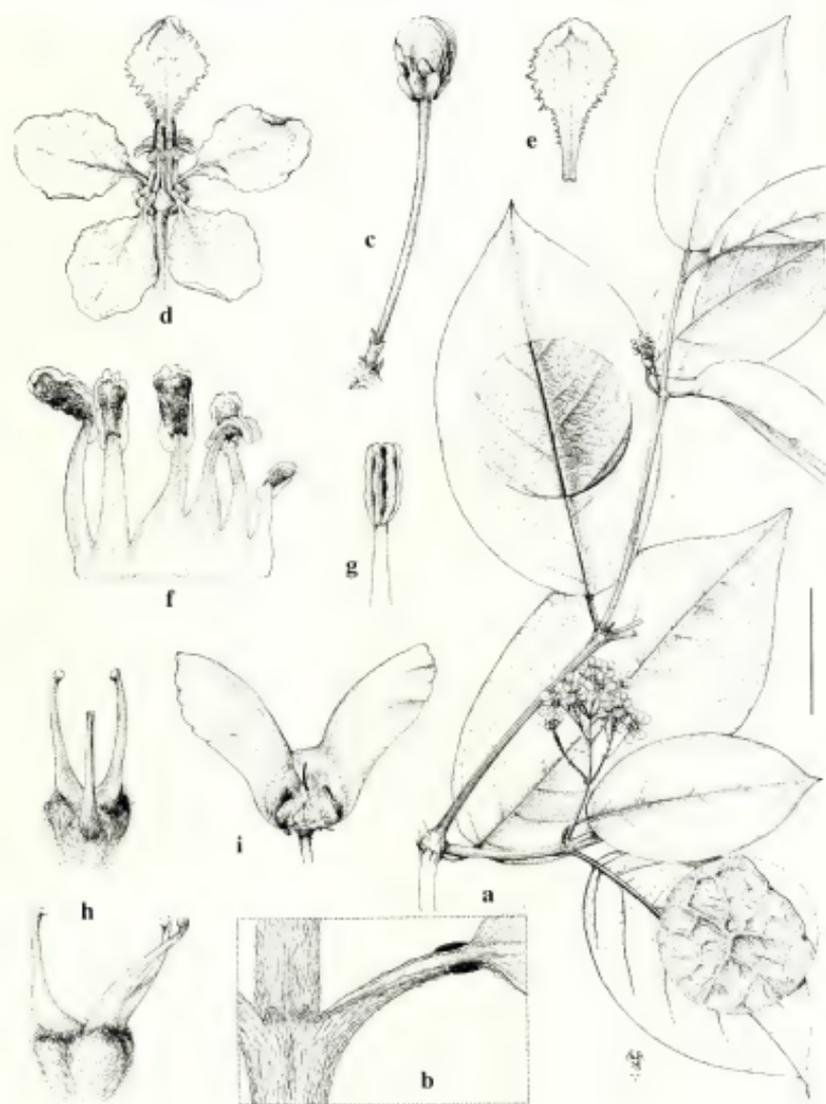


FIG. 4. *Bronwenia wurdackii*. a. Flowering branch, with enlargement of adaxial surface of lamina (above) and abaxial surface showing tiny marginal glands (below). b. Node and base of leaf to show interpetiolar stipules and petiole glands. c. Flower bud. d. Flower, posterior petal uppermost. e. Posterior petal, adaxial view. f. Portion of androecium laid out, abaxial view, stamen to right opposite posterior petal. g. Anther, adaxial view. h. Gynoecium, with anterior style in middle (above) and with anterior style to left (below). i. Fruit with two samaras developed. Scale bar equivalents: a, 4 cm (upper circle 2 cm, lower circle 4 mm); b, 4 mm; c–e, 5.7 mm; f–h, 2 mm; i, 2.7 cm. (Based on: a, *Wurdack & Monachino 40976*, MICH; b, *Murray & Johnson 1545*, MICH; c–h, *Pena 474*, IAN; i, *Wurdack & Monachino 41145*, MICH.) Modified from a drawing first published in *Mem. New York Bot. Gard.* 32: 156. 1981.

Nied., which form a well-supported clade and are more closely related to *Malpighia* and the Old World malpighioids than they are to *Mascagnia* (and *Triopteris*); see Fig. 5, where the species in question are in boldface under the name *Calpicola*. Those two species are segregated here as a new genus.

***Calpicola*** W. R. Anderson & C. Davis, gen. nov.—TYPE: *Calpicola parvifolia* (Adr. Juss.) W. R. Anderson & C. Davis.

Frutices; folia petiolis eglandulosis, laminis eglandulosis vel margine glandulis parvis cylindricis instructis; stipulae nullae vel interpetiolares; flores axillares, singulares vel in umbella 2–4-flora portatae; petala plerumque lilacina, caerulea, vel purpurea, interdum atrorosea; carpella stylique 2 vel 3; samara ala laterali orbiculari, membranacea, basi continua, apice continua vel usque ad nucem incisa.

Shrubs 0.3–2 (–3) m tall, occasionally described as small trees. Leaves decussate; lamina eglandular or bearing 1–5 small cylindrical glands on margin on each side of proximal half; petiole eglandular; stipules lacking or interpetiolar (borne on stem beside petioles), very small, distinct, triangular. Flowers borne singly or in umbels of 2–4 in axils of full-sized leaves; bracts and bracteoles eglandular, persistent, the bracteoles borne at or below apex of a well-developed peduncle. Flowers bilaterally symmetrical in calyx, corolla, and androecium. Sepals leaving petals exposed during enlargement of bud, the lateral 4 bearing large paired abaxial glands and the anterior eglandular. Petals mostly described as lilac, blue, or purple, sometimes as dark rose, sometimes with white or yellowish tints, glabrous, entire, erose, or dentate, abaxially smooth or carinate on claw, the posterior petal somewhat different in size, shape, and stance from the lateral 4. Receptacle glabrous on both sides of filaments. Stamens 10, all fertile, glabrous; filaments slightly connate at base, shortest opposite posterior petal; anthers subequal or larger opposite posterior-lateral petals, the connective not exceeding locules at apex. Gynoecium 2- or 3-carpellate, the carpels (when 3) 1 anterior and 2 posterior, all fertile, connate their whole length in ovary; styles 2 or 3, distinct, the anterior style shorter than the posterior 2; stigmas internal or nearly terminal. Fruit dry, breaking apart at maturity into 2 or 3 samaras separating from a high pyramidal torus; samara orbicular with the lateral wing well-developed, membranous with a prominent reticulum of arching anastomoses, continuous at base, the dorsal wing very small or absent or large and resembling one side of the lateral wing; fruit subtended by a fleshy 3-lobed disc or the disc rudimentary or lacking.

*Calpicola* resembles *Mascagnia* in a number of characters, especially its mostly lilac, blue, or purple petals and its orbicular samaras with the wings membranous with reticulate venation. In several other respects, however, *Calpicola* differs from all species of *Mascagnia*. Both species are shrubs that never climb, while most species of *Mascagnia* are twining woody vines. The leaf glands of *Calpicola*, if any, are cylindrical and located on the margin of the lamina; in *Mascagnia* the glands are flat and borne in the abaxial surface between the midrib and the margin, sometimes lying very near the margin. The other significant difference is the inflorescence in the two genera. In *Mascagnia* the flowers are borne in pseudoracemes, sometimes crowded distally into corymbs or umbels. In *Calpicola* the flowers are borne singly or in umbels of 2–4 in the axils of full-sized leaves. That is especially interesting given the fact that an identical inflorescence is found in many species of *Malpighia*; note that *Calpicola* and *Malpighia* are in the same clade in our phylogenetic tree, with the Old World malpighioids (Fig. 5).

This genus is endemic to Mexico (Fig. 6), where both species grow on calcareous soils; the generic name *Calpicola*, which means lime-dweller, refers to that habitat.

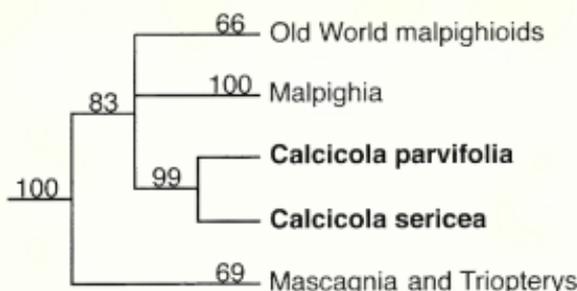


FIG. 5. Phylogenetic tree showing position of *Calcicola* in the *Malpighia* clade of Malpighiaceae. Bootstrap values are given above branches. The reduced strict consensus tree shown here is extracted from a larger phylogenetic analysis of Malpighiaceae using combined DNA sequences from plastid *matK*, *ndhF*, and *rbcL*, nuclear *PHYC*, and morphology; all genes were sequenced for all taxa (C. Davis & W. R. Anderson, unpublished data). Vouchers for species of *Calcicola* sequenced: *Calcicola parvifolia*: Salinas T. 5444, MICH; *Calcicola sericea*: Tenorio 6356, MICH.

#### KEY TO THE SPECIES OF CALCICOLA

- Lamina of leaves elliptical, ovate, or orbicular, 1–1.7 times as long as wide, densely velutinous above and lanate below; petiole (1–) 2–4 (–6) mm long; samara with lateral wing continuous at both base and apex, the dorsal crest lacking or very small. *C. parvifolia*
- Lamina of leaves narrowly elliptical or lanceolate, 2.4–5 times as long as wide, loosely sericeous on both sides or sometimes glabrescent above; petiole 0.5–1 mm long; samara with lateral wing continuous at base and cleft to nut at apex, the dorsal wing similar in size and shape to each side of the lateral wing or slightly smaller. *C. sericea*

***Calcicola parvifolia*** (Adr. Juss.) W. R. Anderson & C. Davis, comb. nov. *Malpighia parvifolia* Adr. Juss., Arch. Mus. Hist. Nat. 3: 268. 1843. *Mascagnia parvifolia* (Adr. Juss.) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 4: 5. 1912.—TYPE: MEXICO. Oaxaca: Galeotti 4327 (holotype: P!; isotypes: G! K! P-JU!).

*Mascagnia seleriana* Loes., Bull. Herb. Boissier 2: 543. 1894.—TYPE: MEXICO. Oaxaca: Tlacolula, near Mitla, Seler & Seler 120 (holotype: B!; lectotype, designated here: G!; isotypes: GH! US!).

*Hiraea parviflora* Rose, Contr. U.S. Natl. Herb. 5: 139. 1897. *Mascagnia pringlei* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 9. 1908, nom. superfl.—TYPE: MEXICO. Puebla: Near Tehuacán, Pringle 6274 (holotype: US!; isotypes: CAS! CM! F! G! GH! K! MEXU! MO! NY! UC!).

Fig. 7.

Shrub 0.3–2 (–3) m tall, occasionally described as a small tree. Lamina of larger leaves 10–55 mm long, 8–40 mm wide, elliptical, ovate, or orbicular, 1–1.7 times as long as wide, rounded or cordate at base, eglandular or bearing 1–5 small cylindrical glands on margin on each side of proximal half, densely and persistently velutinous above and lanate below; petiole (1–) 2–4 (–6) mm long. Flowers borne singly or (usually) in umbels of 2–4 on a common stalk. Petals mostly described as lilac, blue, or purple, with white or yellowish tints, occasionally as deep pink. Carpels 3; styles 3, dorsally truncate or slightly apiculate at apex, the stigma internal. Samara 15–22 (–28) mm in diameter, the lateral wing continuous at base and apex, entire or emarginate at

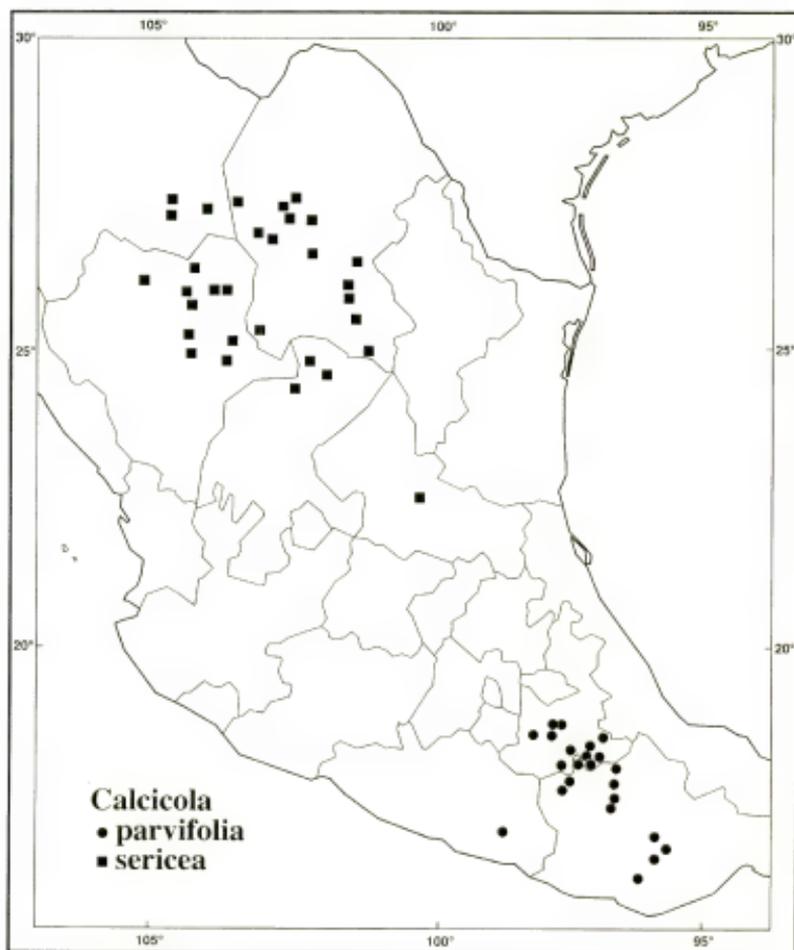


FIG. 6. Distribution of the species of *Calicicola*.

apex; dorsal crest lacking or very small, with small irregular horizontal winglets often developing on sides of dorsal crest; disc below fruit well developed.

Southeastern Mexico (Puebla and Oaxaca, with one outlier population known from Guerrero) (Fig. 6). Low open deciduous woods or thorn-scrub on limestone slopes, 700–2000 m; collected with flowers and fruits in all months, but most often Jun–Nov.

*Purpus* 5913 (F, GH, MO, NY, US) and *Purpus* 5919 (UC) were purportedly collected at Misantla, Veracruz, in June 1912, but that is probably not correct. Misantla (19°56'N, 96°52'W) is in tropical lowlands far from any known population of *Calicicola* or suitable habitat for *Calicicola*. *Purpus* is known to have collected in the vicinity of Tehuacán, Puebla, in 1912 before going to Misantla (Souza S. 1969, pp. 6–7), and that was surely the source of these two collections.

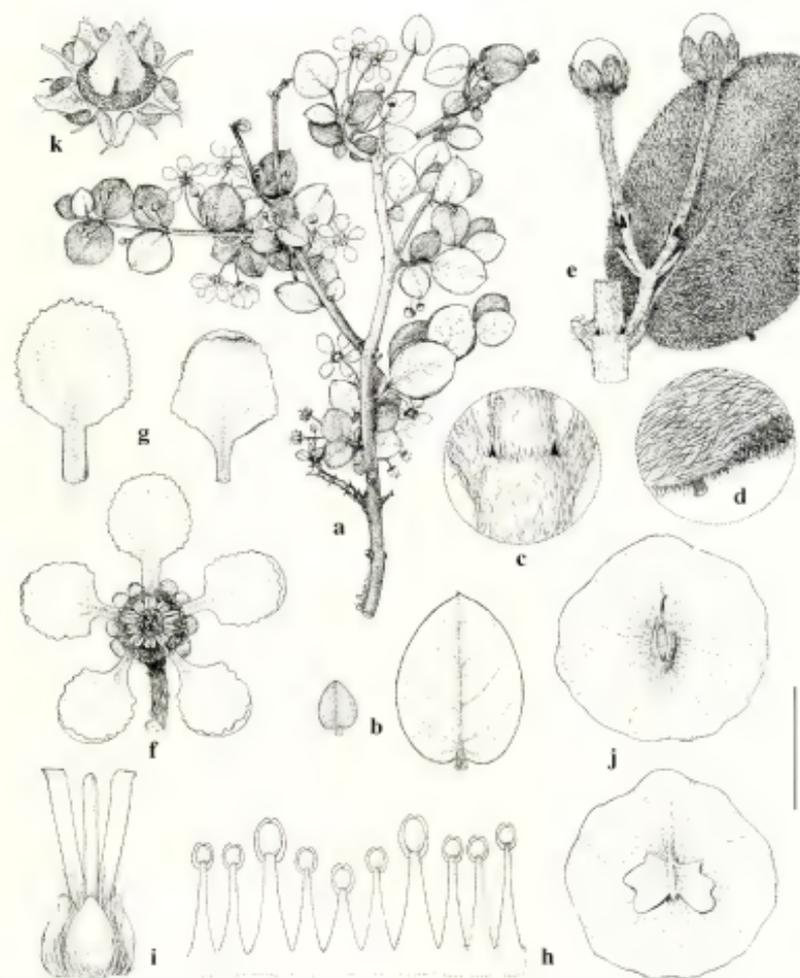


FIG. 7. *Calcolica parvifolia*. a. Flowering branch. b. Leaves to show range in size, adaxial view (left) and abaxial view (right). c. Node with interpetiolar stipules. d. Edge of lamina with marginal gland, abaxial view except where turned to show adaxial vestiture. e. Node and leaf (adaxial view) with axillary inflorescence. f. Flower, posterior petal uppermost. g. Posterior petal (left) and lateral petal (right), adaxial views. h. Androecium laid out, abaxial view, the shortest stamen opposite posterior petal. i. Gynoecium, anterior style in center. j. Samaras, adaxial view (above) and abaxial view (below). k. Old fruit after fall of samaras. Scale bar equivalents: a, b, 4 cm; c, d, 4 mm; e, f, 8 mm; g, 5.7 mm; h, 2.7 mm; i, 2 mm; j, 1 cm; k, 4 mm. (Based on: a, e–i, Breckon *et al.* 2343, MICH; b (left), Rzedowski 28187, MICH; b (right), k, McVaugh 24000, MICH; c, d, Schoenweter JSOX-91, MICH; j, Garcia M. 3297, MICH.)

The leaves in this species are exceedingly variable in size, probably reflecting availability of water in different populations, but the many collections seen clearly represent only one species (Anderson 1993b, p. 383).

**Callicola sericea** (Nied.) W. R. Anderson & C. Davis, comb. nov. *Mascagnia sericea* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 29, 1908. *Hiraea sericea* Engelm. in A. Gray, Pl. Wright. 1: 37, 1852, non *H. sericea* Adr. Juss. *Mascagnia cana* Small, N. Amer. Fl. 25: 120, 1910, nom. superfl.—TYPE: MEXICO, Durango: Cadena, *Wizlizenus* 277 (lectotype, designated by Small in protologue of *M. cana*: MO!).

Fig. 8.

Shrub 0.4–1.5 (–3) m tall. Lamina of larger leaves 6–25 mm long, 2–9 mm wide, narrowly elliptical or lanceolate, 2.4–5 times as long as wide, narrowly to broadly cuneate or rounded at base, eglandular or bearing 1 (2) tiny cylindrical glands on margin on each side of proximal half, persistently loosely sericeous on both sides (or sometimes glabrescent above), the vestiture much denser below than above; petiole 0.5–1 mm long. Flowers borne singly or in umbels of 2 (3) on a common stalk. Petals mostly described as purple, sometimes as dark rose. Carpels 2 or 3; styles 2 or 3, dorsally rounded at apex, the stigma internal or nearly terminal. Samara 14–24 mm in diameter, the lateral wing continuous at base, cleft to nut at apex; dorsal wing similar in size and shape to each side of lateral wing or slightly smaller, usually confluent with lateral wing at base; small outgrowths sometimes present between dorsal and lateral wings; disc below fruit rudimentary or lacking.

North-central Mexico (Chihuahua, Coahuila, Durango, and Zacatecas, with one outlier population known from San Luis Potosí) (Fig. 6). Open desert scrub on dry rocky or sandy limestone slopes and flats, 1200–2200 m; collected with flowers and fruits May–Nov, most often Jul–Sep.

## CLONODIA AND HETEROPTERYS

*Clonodia* Griseb. is a small group of riverine woody vines with lenticellate stems, an elongated pseudoraceme, alate pink or pink and white petals, and mericarps that have had all the wings of their samaras reduced to dissected winglets or crests, probably as an adaptation for dispersal by water. Niedenzu (1928) treated *Clonodia* in his subtribe Thryallidinae Nied., which was a mixture of disparate elements. He included three species, *C. ovata* Nied., *C. racemosa* (Adr. Juss.) Nied., and *C. sessilis* Nied.; the latter is now considered a synonym for *Niedenzuella stannea* (Griseb.) W. R. Anderson (Anderson 2006). Anderson (1981) added *C. complicata* (H. B. K.) W. R. Anderson, which Niedenzu (1928) had treated in *Mascagnia* under three different names [*M. complicata* (H. B. K.) Nied., *M. lehmanniana* Nied., and *M. nitida* (H. B. K.) Nied.]. As Anderson noted (1981), *Clonodia* is difficult to place with confidence, because its peculiar fruit is so reduced. If *Clonodia* is allied to *Mascagnia* sens. str., it could only be to the species with alate pink petals, like *M. cordifolia* (Adr. Juss.) Griseb., but this similarity is not convincing (see Anderson & Davis 2005). In particular, the three-lobed disc subtending the fruit that is always present in *Mascagnia* is lacking in *Clonodia*, and the carpels are only basally connate, whereas in most species of *Mascagnia* they are connate for their whole length. Anderson (1981) instead thought that the morphology was more supportive of a relationship to *Heteropterys* H. B. K. ser. *Rhodopetalis* Nied., in which one finds some species with the same punctiform lenticels, minute stipules on or beside the base of the petiole (or stipules lacking),

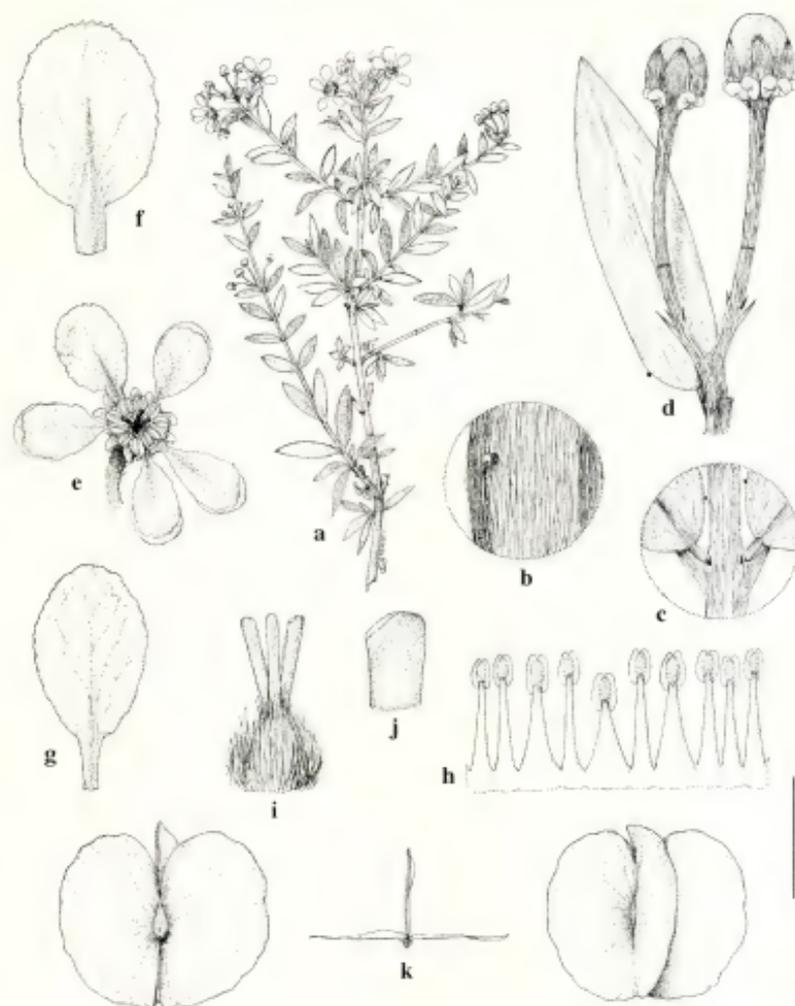


FIG. 8. *Calicicola sericea*. a. Flowering branch. b. Abaxial surface of lamina, showing cylindrical gland on revolute margin. c. Node showing interpetiolar stipules. d. Axillary pair of flower buds. e. Flower, posterior petal at upper left. f. Posterior petal, abaxial view. g. Lateral petal, abaxial view. h. Androecium laid out, abaxial view, the shortest stamen opposite posterior petal. i. Gynoecium. j. Enlarged stigma. k. Samaras, adaxial view (left), cross-section with dorsal wing uppermost (center), abaxial view (right). Scale bar equivalents: a, 4 cm; b, 2 mm; c, d, 4 mm; e, 8 mm; f, g, 4 mm; h, i, 2.7 mm; j, 0.8 mm; k, 1.6 cm. (Based on Johnston 7761, GH.)

a row of glands on the abaxial surface of the lamina between midrib and margin, winged pink or pink and white petals, carpels connate only at the base, and samaras with crests and winglets on the sides of the nut. That morphological argument still seems compelling to us, and we now have support for that placement from DNA

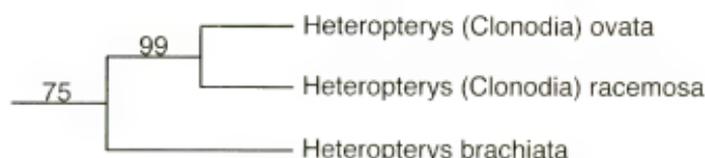


FIG. 9. Phylogenetic tree for three species of Malpighiaceae representing *Heteropterys* in the sense adopted in this paper (*Heteropterys* plus *Clonodia*). The parsimony tree shown here is extracted from a larger phylogenetic analysis of Malpighiaceae using combined DNA sequences from plastid *matK*, *ndhF*, and *rbcL*, nuclear *PHYC*, and morphology; all genes were sequenced for all taxa (C. Davis & W. R. Anderson, unpubl.). Bootstrap values given above branches. Vouchers for species sequenced: *H. brachiata*: FTG PRC-105, MICH; *H. ovata*: Beck 15105, MICH; *H. racemosa*: Rabelo et al. 3685, MICH.

sequences. Our data show that *Clonodia* is nested deep within *Heteropterys*, with its closest sister among the sampled species being *Heteropterys brachiata* (L.) DC., a pink-flowered species in Niedenzu's ser. *Rhodopetalis* (C. Davis & W. R. Anderson, unpubl.; Fig. 9). We are therefore including *Clonodia* in *Heteropterys*, proposing the necessary new combinations, and providing a key to the three species, synonymies, and brief synopses. Note that Jussieu originally described *Clonodia racemosa* in *Heteropterys*; we are not the first to recognize the similarity of these groups. The drawing we include here (Fig. 10) compares *Clonodia complicata* to another species of *Heteropterys* ser. *Rhodopetalis*, *H. alata* (W. R. Anderson) W. R. Anderson.

Cuatrecasas described these plants twice as new genera. One was *Atopocarpus* Cuatrec., Webbia 13: 454. 1958; type: *A. papillosus* Cuatrec. [*Heteropterys racemosa* Adr. Juss.]. The other was *Skoliopterys* Cuatrec., Webbia 13: 451. 1958; type: *S. lehmanniana* (Nied.) Cuatrec. [*Heteropterys complicata* (H. B. K.) W. R. Anderson & C. Davis]. Neither name ever gained any currency and both now become synonyms of *Heteropterys*.

Characteristics common to all three clonodioid species of *Heteropterys*: woody vines, sometime shrubby; stems with many punctiform lenticels; lamina bearing an abaxial row of impressed glands between midrib and margin; inflorescence simple or compound, with the flowers borne in an elongated pseudoraceme; sepals leaving petals exposed during enlargement of bud; petals pink or pink and white, the lateral 4 abaxially alate, the posterior carinate or alulate; mericarp without well-developed wings, only winglets or crests.

#### KEY TO THE CLONODIROID SPECIES OF HETEROPTERYS

1. Lamina abaxially densely tomentose to eventually glabrescent, the hairs stalked with the cross-piece sinuous to twisted. *H. ovata*
1. Lamina abaxially sericeous or soon glabrate, the hairs when present sessile, straight,  $\pm$  appressed.
  2. Lamina of larger leaves (9-) 11-16.5 cm long, 4-9 cm wide, persistently sericeous below or eventually glabrate; petiole biglandular at or somewhat above base; mericarp with the nut 7 mm in diameter, bearing thick, often much-dissected winglets or crests with rounded edges and the veins obscure or invisible; most inflorescence hairs with a bulbous stalk and distally short-bifurcate; petals all papillose or verrucose adaxially. *H. racemosa*
  2. Lamina of larger leaves (5.5-) 7.5-11.5 (-13) cm long, (3-) 4-6 (-7) cm wide, soon nearly or quite glabrate; petiole eglandular or biglandular, often near middle; mericarp with the nut 4-5 mm in diameter, bearing thin winglets with clearly visible veins; inflorescence hairs with a slender stalk and long crosspiece at right angles; petals adaxially smooth or (especially the posterior) papillose. *H. complicata*



FIG. 10. *Heteropterys*. a–c, *H. alata*. a. Flowering branch. b. Cluster of flowers. c. Flower, posterior petal at upper right. d. Gynoecium, anterior style in center. e. Fruit, with only one samara developed. f–k, *H. complicata*. f. Branch with flowers and fruits. g. Flower bud. h. Flower, posterior petal at upper right. i. Posterior petal, showing papillose adaxial surface. j, k. Fruits, each with only one mericarp developed. Scale bar equivalents: a, 4 cm; b, 8 mm; c, 5.7 mm; d, 2 mm; e, 1.3 cm; f, 4 cm; g, 4 mm; h, 5.7 mm; i, 4 mm; j, k, 5 mm. (Based on: a–d, Wurdack & Monachino 39811, MICH; e, Wurdack & Monachino 39816, MICH; f–j, Breteleur 4829, US; k, Cardona 822, NY.) Drawing first published in Mem. New York Bot. Gard. 32: 207. 1981.

**Heteropterys complicata** (H. B. K.) W. R. Anderson & C. Davis, comb. nov. *Hiraea complicata* H. B. K., Nov. Gen. Sp. 5 [quarto ed.]: 171. 1822 ["1821"]. *Mascagnia complicata* (H. B. K.) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 4. 1908. *Clonodia complicata* (H. B. K.) W. R. Anderson, Mem. New York Bot. Gard. 32: 206. 1981.—TYPE: VENEZUELA, Bolívar: Río Orinoco near Carichana, *Humboldt & Bonpland* (holotype: P-HBK!).

*Hiraea nitida* H. B. K., Nov. Gen. Sp. 5 [quarto ed.]: 171. 1822 ["1821"]. *Mascagnia nitida* (H. B. K.) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 3: 4. 1908.—TYPE: VENEZUELA, Amazonas: near Santa Bárbara, Alto Orinoco, *Humboldt & Bonpland* (holotype: P-HBK!).

*Clonodia racemosa* var. *orinocensis* Nied. in Engl., Pflanzenr. IV, 141: 580. 1928.—TYPE: VENEZUELA, Delta Amacuro: Manoa, *Rusby [ & Squires] 166* (holotype: B†?; isotypes: G! NY!).

*Mascagnia lehmanniana* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 8: 59. 1926. *Skoliopterys lehmanniana* (Nied.) Cuatrec., Webbia 13: 452. 1958.—TYPE: COLOMBIA, Río Meta, *Lehmann 8766* (holotype: B†, F neg. 12689, fragment NY!; isotype: K!).

Fig. 10f-k.

Lamina of larger leaves (5.5–) 7.5–11.5 (–13) cm long, (3–) 4–6 (–7) cm wide, originally sericeous below with sessile, straight, ± appressed hairs but soon nearly or quite glabrate; petiole eglandular or biglandular, the glands often near middle. Inflorescence hairs with a slender stalk and long crosspiece at right angles. Petals adaxially smooth or (especially the posterior) papillose. Mericarp with the nut 4–5 mm in diameter, bearing thin winglets with clearly visible veins. Southern Venezuela and eastern Colombia.

**Heteropterys ovata** (Nied.) W. R. Anderson & C. Davis, comb. nov. *Clonodia ovata* Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 8: 62. 1926.—TYPE: BRAZIL, Rondônia ["Matto Grosso"]: Rio Guaporé, *Comm. Rondon 2429* (holotype: B†?).

Lamina of larger leaves 4–11.7 cm long, 2.6–6.8 cm wide, densely tomentose to eventually glabrescent below, the hairs stalked with the crosspiece sinuous to twisted; petiole biglandular near middle. Inflorescence hairs various but the stalk not bulbous. Petals all papillose or verrucose adaxially. Mericarp with the nut 3–4 mm in diameter, the crests few, thick, low. Southwestern Brazil ("Mato Grosso," probably now Rondônia) and Beni, Bolivia.

**Heteropterys racemosa** Adr. Juss., Ann. Sci. Nat. Bot., Sér. 2, 13: 274. 1840. *Clonodia racemosa* (Adr. Juss.) Nied., Arbeiten Bot. Inst. Königl. Lyceum Hosianum Braunsberg 5: 13. 1914.—TYPE: BRAZIL, Amazonas: Coari, *Martius* (lectotype, designated by Cuatrecasas, Webbia 15(2): 397. 1960; M, F neg. 19403).

*Clonodia verrucosa* Griseb. in Mart., Fl. Bras. 12(1): 26. 1858.—LECTOTYPE collection, designated by W. R. Anderson, 1981, p. 205; BRAZIL, Amazonas: near Barra [Manaus], Dec–Mar 1850–51, *Spruce 1094* (BM! CGE! G! K! NY! P!).

*Clonodia racemosa* var. *mattogrossensis* Nied. in Engl., Pflanzenr. IV, 141: 581. 1928.—TYPE: BRAZIL, Mato Grosso: Rio Arinos, *Kuhlmann [Comm. Rondon 538]* (holotype: B†?).

*Atopocarpus papillosus* Cuatrec., Webbia 13: 454. 1958.—TYPE: COLOMBIA, Vaupés: Río Inirida, *Fernández 2202* (holotype: COL!).



FIG. 11. Phylogenetic tree showing position of *Cottisia* (the North American species traditionally assigned to *Janusia*) as sister to the rest of the *Janusia* clade of Malpighiaceae. Bootstrap values are given above branches. The reduced strict consensus tree shown here is extracted from a larger phylogenetic analysis of Malpighiaceae using combined DNA sequences from plastid *matK*, *ndhF*, and *rbcL*, nuclear *PHYC*, and morphology; all genes were sequenced for all taxa (C. Davis & W. R. Anderson, unpubl.). Vouchers for species of *Cottisia* sequenced: *Cottisia californica*: Anderson 12539, MICH; *Cottisia linearis*: Anderson 12540, MICH.

Lamina of larger leaves (9–) 11–16.5 cm long, 4–9 cm wide, usually persistently sericeous below with sessile, straight, appressed hairs or eventually glabrate; petiole biglandular at or somewhat above base. Inflorescence hairs mostly with a bulbous stalk and distally short-bifurcate. Petals all papillose or verrucose adaxially. Mericarp with the nut 7 mm in diameter, bearing thick, often much-dissected winglets or crests with rounded edges and the veins obscure or invisible. Amazonian Colombia and Brazil.

#### COTTISIA AND JANUSIA

*Janusia* Adr. Juss. and its close relatives form a subclade within the larger stig-maphylloid clade (Davis et al. 2001); the *Janusia* clade continues to be strongly supported (C. Davis & W. R. Anderson, unpubl.; Fig. 11). The janusioids are distinguished by the loss of four or all five of the stamens opposite the petals, and most have only one style, borne on the anterior carpel. The type of *Janusia* is *J. guaranitica* (A. St.-Hil.) Adr. Juss., a widespread weedy herbaceous vine of southern South America. In the expanded sense of Anderson (1982, 1987) *Janusia* in South America comprises approximately 13 species. In northwestern Mexico and adjacent southwestern United States (Fig. 12) there is a small group of similar species that has traditionally been assigned to *Janusia*, although their differences have been recognized by the erection of sect. *Metajanusia* Nied. to accommodate them (Nieden-zu 1928). Our data now show that the North American species of *Janusia* form a clade that is sister to the rest of the janusioids (Fig. 11, where the species in question are in boldface under the name *Cottisia*). The only way to maintain the North American species in the same genus as the South American species would be to treat the whole janusioid clade as one genus (in which case the name would have to be *Aspicarpa*), but we have rejected that course, so we are forced to take up the only generic name available for the North American species of *Janusia*, which is *Cottisia* Dubard & Dop.

***Cottisia*** Dubard & Dop, Rev. Gén. Bot. 20: 359. 1908.—TYPE: *Cottisia scandens* Dubard & Dop [= *Cottisia californica* (Benth.) W. R. Anderson & C. Davis].

*Janusia* Adr. Juss. sect. *Metajanusia* Nied., Verz. Vorles. Königl. Lyceum Hosianum Braunsberg 1912–1913: 50. 1912. *Gaudichaudia* H. B. K. sect. *Erostratae* Chodat, Bull. Soc. Bot. Genève, Sér. 2, 9: 100. 1917, nom. superfl. *Aspicarpa* Rich. subsect. *Metajanusia* (Nied.) Hassl., Annuaire Conserv. Jard. Bot. Genève 20: 212. 1918.—LECTOTYPE, designated here: *Janusia gracilis* A. Gray [= *Cottisia gracilis* (A. Gray) W. R. Anderson & C. Davis].

Slender twining vines from a woody base, sometimes seeming shrubby when grazed; stems densely and persistently sericeous, eventually glabrescent. Leaves decussate; lamina eglandular on surface, sometimes eglandular on margin but usually bearing a pair of stalked glands or eglandular processes near base; petiole sericeous or glabrescent, eglandular; stipules borne on stem beside petiole, 0.1–0.8 mm long, triangular or subulate, glabrous or sericeous. Inflorescence sericeous or glabrescent, the flowers borne in umbels of 2–4 terminating lateral shoots; bracts 0.5–1.8 mm long, narrowly triangular or subulate, eglandular, persistent; peduncle (1–) 2–13 mm long; bracteoles like bract but usually smaller, borne at or somewhat below apex of peduncle, eglandular or one sometimes bearing a small stalked abaxial gland, persistent. Flowers all chasmogamous, bilaterally symmetrical in all whorls or the calyx radially symmetrical. Sepals leaving petals exposed during enlargement of bud, flat and appressed in anthesis, the glands 0.6–1.1 mm long, elliptical or obovate, detached and often reflexed distally, well separated on the sepal. Petals lemon-yellow, glabrous or bearing a few straight appressed hairs abaxially on claw or midrib, with the limb flat, the lateral 4 widely spreading, the posterior more erect, with a longer claw and a differently shaped limb. Receptacle glabrous on both sides of filaments. Fertile stamens 2, opposite posterior-lateral sepals, glabrous, nearly or quite distinct, erect and pressed against style, alike; staminodes (rudimentary filaments without anthers) 0–3, when present opposite anterior and anterior-lateral sepals; very rarely one of the filaments opposite an anterior-lateral sepal bearing an anther. Gynoecium 3-carpellate; carpels all fertile, 1 anterior and 2 posterior, connate their whole length in ovary; ovary 1–1.5 mm high, densely sericeous; style 1, borne on anterior carpel, straight and erect, the stigma terminal, truncate or capitate. Fruit dry, breaking apart at maturity into 3 samaras (or fewer by abortion) borne on a pyramidal torus 1.2–2 mm high, with each face of torus elliptical or obovate; samara 9–15 (–17) mm long, sericeous proximally; dorsal wing well developed, elongated, 7–12 (–15) mm long, 4–6 mm wide, thickened on the adaxial edge with the veins bending toward the thinner abaxial edge; nut 1.5–2.5 mm high, 3–4.5 mm long, without lateral wings but reticulate and often parallel-rugose on sides, flared and rounded at base and emarginate below to form a shallow groove to accommodate the short but functional carpophore 1–2 mm long, the nut usually forming a spur 0.2–0.5 mm long at end of carpophore; ventral areole 1–2 mm high, 0.8–1.3 mm wide, deeply concave. Embryo with the cotyledons subequal, flattened, folded back in the distal third.

The name *Cottisia* is based on an anagram of "Scott." Dubard and Dop (1908) coined it to honor George Francis Scott Elliot (1862–1934), a Scottish botanist who collected plants in Madagascar in the late 1880s (Elliot 1891). They did that because their type, a single specimen in P, bore a label saying it was collected in Madagascar by Scott Elliot. Dubard and Dop recognized that the plant they were describing resembled the New World genera *Aspicarpa* and *Janusia*, and was unlike anything known from Madagascar, but apparently it did not occur to them that perhaps the specimen did not really come from Madagascar. Arènes (1943) argued that *Cottisia* should be considered a synonym of *Janusia* and transferred *Cottisia scandens* Dubard & Dop to *Janusia*, sect. *Metajanusia*, but did not question the unlikely disjunction from northwestern Mexico to Madagascar. In 1948 Arènes disclosed that the specimen in question is not from Madagascar after all; it is a mislabeled sheet of *Palmer 263* in 1887, from Sonora, Mexico. Arènes still insisted that it could not be a described species, but in fact *Palmer 263* in 1887 is a typical representative of *Janusia californica* Benth.

It is not surprising that the North American plants treated here as *Cottisia* have traditionally been placed in *Janusia*, because they are similar in a number of characteristics to the type species, *J. guaranitica*: herbaceous habit, flowers borne in umbels terminating short lateral shoots, five stamens opposite the sepals, one style on the anterior carpel, a terminal capitate stigma, and a small samara with a well-developed dorsal wing and a short but functional carpophore. The inflorescence, stigma, and samara characters are probably symplesiomorphies from a common ancestor of the stigmaphylloid clade, and the single style is probably a synapomorphy of the entire janusoid clade, which is found in all janusoids except for one small group of derived Mexican species that have reverted to three styles. In several important respects, however, *Cottisia* differs from *Janusia guaranitica*. Its petals are lemon-yellow, not carrot-yellow; the three anterior stamens lack anthers; its filaments are distinct even at the base; the carpels are connate their whole length in the ovary; the samara lacks a lateral winglet; and there are no cleistogamous flowers. The latter fact is especially interesting, because very specialized cleistogamous flowers are found in some species of all other genera in the janusoid clade (Anderson 1980). From a geographic perspective the simplest way to explain the North American distribution of *Cottisia* would be to suggest that it shares a more recent common ancestor with the North American janusoids than with those from South America, but this conclusion is not supported by our phylogenetic data. Moreover, if that were so one might expect to find cleistogamous flowers in *Cottisia*.

The very reduced androecium of *Cottisia* is intriguing, because some closely related species of *Camarea* and *Janusia* maintain six stamens, i.e., they have not lost the stamen opposite the posterior petal as in *Cottisia*. Moreover, in all cases studied the single stamen in cleistogamous flowers is the sixth stamen that has been lost in flowers with only five stamens (Anderson 1980), which argues for the evolution of cleistogamy in South American plants with six stamens. Another problematic feature of *Cottisia* is that its base chromosome number is  $n = 10$ , as is found in members representing more basal lineages of the stigmaphylloid clade, while the other janusoid genera have a base number of 20 pairs or a number aneuploid from 20 (17 or 19; Anderson 1993a). The low chromosome number and lack of cleistogamous flowers, taken in combination with the phylogenetic tree shown in Fig. 11, suggest that the ancestor of *Cottisia* diverged from the lineage leading to the remainder of the janusoids before doubling of the chromosomes and the origin of cleistogamy, and lost the sixth stamen (the one opposite the posterior petal) independently of the other janusoid species that lack it, such as *Janusia guaranitica*. If so, it must have reached northwestern Mexico independently of the migration of the ancestor of *Aspicarpa* north from South America. It seems clear that *Cottisia* occupies an enigmatic position in the family, and a better understanding of the sequence of events leading to its reduced morphology and isolated distribution will require further study.

Two other aspects of *Cottisia* merit comment. One is the fact that *C. linearis* usually has all five sepals biglandular, and that condition occurs sometimes in the other two species as well. Almost all other species in the more inclusive stigmaphylloid clade have the four lateral sepals biglandular and the anterior sepal eglandular (W. R. Anderson, unpublished data), so the condition in *C. linearis* must be a reversal to the ancestral condition of having five biglandular sepals (Anderson 1990). Even more interesting is the habitat of *Cottisia*. All three species grow in true desert. It is not rare for neotropical Malpighiaceae to grow in open more or less xeric places, but very few can survive in a place as hot and dry as the Sonoran desert; that is surely a derived adaptation of this genus.

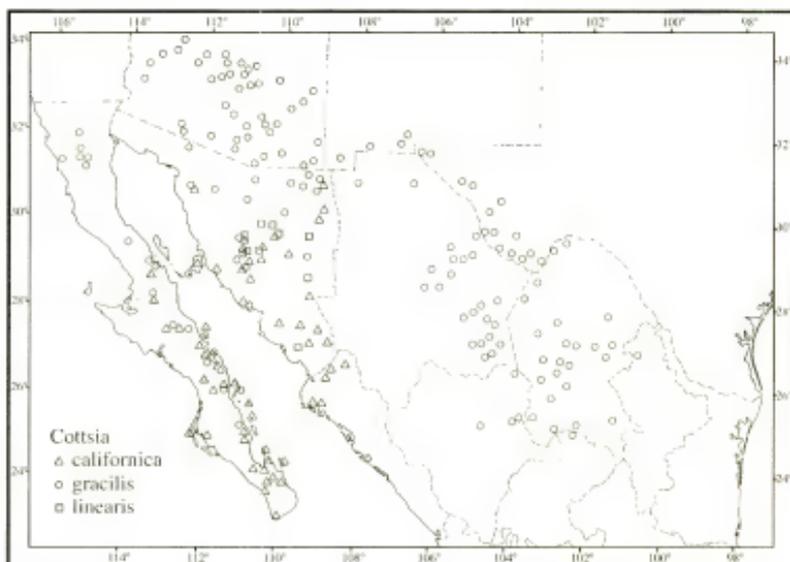


FIG. 12. Distribution of the species of *Cottisia*; *C. gracilis* may occur somewhat farther north in Arizona than shown here. Modified from a map first published in *Contr. Univ. Michigan Herb.* 19: 347, 1993.

The three species of *Cottisia* are sympatric in Sonora, Mexico (Fig. 12), where W. R. Anderson has collected them growing together, all flowering at the same time (*Anderson 12551, 12552, and 12553, MICH*). They represent two morphologically extreme species that have a chromosome number of  $n = 10$  and an intermediate species with  $n = 20$ . Anderson (1993a) hypothesized that the intermediate species, *C. gracilis*, is an allotetraploid derived, possibly repeatedly, from hybridization between the diploids, *C. californica* and *C. linearis*, followed by doubling of the chromosome number. See the discussion below under *C. californica*.

#### KEY TO THE SPECIES OF *COTTISIA*

- Lamina of larger leaves 1.2–10 times as long as wide, ovate to narrowly lanceolate or elliptical, flat at margin and very often bearing few to many marginal cilia or toothlike projections distal to basal pair; petiole 1–18 mm long; flowers 9–14 (–16) mm in diameter; lateral 4 sepals usually biglandular, the anterior sepal usually eglandular; style 1.5–2.3 mm long, the stigma usually borne at about the same height as anthers or slightly higher.
- Lamina of larger leaves (6–) 9–36 (–47) mm wide, 1.2–2.2 (–2.5) times as long as wide, ovate, rounded or cordate at base; petiole 3–18 mm long; sepals adaxially glabrous; style 1.5–1.7 (–1.9) mm long. *C. californica*
- Lamina of larger leaves (1.5–) 3–7 (–9) mm wide, 4–10 times as long as wide, narrowly lanceolate or elliptical, cuneate at base; petiole 1–3 (–5) mm long; sepals usually sericeous adaxially at base; style 1.9–2.3 mm long. *C. gracilis*
- Lamina of larger leaves 12–40 times as long as wide, linear, moderately to strongly revolute at margin and without marginal cilia or teeth distal to basal pair of cilia or stalked glands; petiole 1–2 mm long; flowers 14–17 mm in diameter; all 5 sepals biglandular; style 2.1–3 mm long, the stigma usually borne well above anthers. *C. linearis*

**Cottsia californica** (Benth.) W. R. Anderson & C. Davis, comb. nov. *Janusia californica* Benth., Bot. Voy. Sulph. 8, pl. 4. 1844. *Gaudichaudia californica* (Benth.) Chodat, Bull. Soc. Bot. Genève, Sér. 2, 9: 100. 1917. *Aspicarpa californica* (Benth.) Hassl., Annuaire Conserv. Jard. Bot. Genève 20: 212. 1918.—LECTOTYPE, designated here: MEXICO. Baja California Sur: Magdalena Bay, *Hinds 1841* (lectotype: K!).

*Cottsia scandens* Dubard & Dop, Rev. Gén. Bot. 20: 359. 1908. *Janusia scandens* (Dubard & Dop) Arènes, Notul. Syst. (Paris) 11: 84. 1943. TYPE: MEXICO. Sonora: Guaymas, *Palmer 263* in 1887 (holotype: P!; isotypes: C! GH! NY! UC! US!).

Fig. 13a–f.

Leaves quite variable in size, the largest often on sterile shoots not represented in herbarium collections; lamina of larger leaves 15–55 mm long, (6–) 9–36 (–47) mm wide, 1.2–2.2 (–2.5) times as long as wide, ovate, rounded or cordate at base, flat at margin, obtuse, rounded, or slightly retuse and mucronate or apiculate at apex, initially densely sericeous on both sides but at maturity often thinly sericeous to glabrescent, very often bearing few to many distal cilia or toothlike projections along margin, the lateral veins and reticulum generally visible on both sides; petiole 3–18 mm long. Pedicel 3–7 (–9) mm long, 0.4–1.4 (–2) times as long as peduncle. Flowers 9–14 (–16) mm in diameter. Sepals 1.7–2.5 mm long, 1–1.4 mm wide, ovate or elliptical, acute, obtuse, or rounded at apex, abaxially sericeous to glabrate, adaxially glabrous, the anterior usually eglandular (occasionally bearing 1 or 2 glands), the lateral 4 usually biglandular (occasionally 1 or 2 of the most anterior glands lacking). Lateral petals with claw 1–2 mm long, the limb subtrotund, hardly decurrent, 3–5 (–6) mm long, 2.5–5 (–6) mm wide; posterior petal with claw 1.3–1.7 mm long, the limb 2.5–4.5 mm long, 2.2–5.5 mm wide. Fertile filaments 1.7–2.4 mm long; anthers 0.5–0.9 mm long; staminodes 1–3, 0.7–1.7 mm long. Style 1.5–1.7 (–1.9) mm long, glabrous or sericeous only at very base, the stigma usually borne at same height as anthers and with anthers pressed against it. Chromosome number:  $n = 10$  (Anderson 1993a).

Endemic to northwestern Mexico (Sonora and adjacent Sinaloa, Baja California Sur and adjacent Baja California Norte) (Fig. 12). Thorn-scrub on gravelly plains and rocky hillsides, and in other xeric habitats, 10–1400 m; collected with flowers and fruits in most months, but most commonly Feb–Mar and Aug–Oct.

The leaves of this species are extremely variable in size and shape. When large leaves are present on the specimen it is usually easy to distinguish between *C. californica* and *C. gracilis*, because as the lamina gets larger it tends to become relatively broad in the former or relatively long in the latter. When all the leaves are very small, as they may be under some environmental conditions or in specimens where the collector failed to include leaves from stems below the inflorescence, the distinction between the two species can be difficult and the decision is sometimes arbitrary. Such apparently intermediate populations tend to be from western Sonora or Baja California Sur, where the two species are sympatric (Fig. 12), which suggests that the intermediate plants may represent backcrosses from *C. gracilis* to *C. californica*. If that is the case, and if the plants in question are fertile, they indicate that there may exist diploid populations of *C. gracilis*, in addition to the tetraploid populations sampled by Anderson (1993a). This problem merits further study by someone who has access to mixed populations in that area.



FIG. 13. *Cottisia*. a-l, *C. californica*. a. Fruiting branch. b. Base of leaf, abaxial view. c. Flower bud. d. Petals, adaxial view, posterior (left) and lateral (right). e. Androecium and gynoecium, lateral view, the two fertile stamens posterior. f. Anterior carpel. g-l, *C. linearis*. g. Flowering branch. h. Base of leaf, abaxial view. i. Flower bud. j. Petals, adaxial view, posterior (left) and lateral (right). k. Androecium and gynoecium, lateral view, the two fertile stamens posterior. l. Anterior carpel. Scale bar equivalents: a, g, 4 cm; b, 8 mm; c, i, 6.7 mm; d, j, 5.7 mm; e, k, 2.9 mm; f, h, l, 2 mm. (Based on: a-l, Anderson 12536, MICH; g-l, Anderson 12551, MICH.)

**Cottisia gracilis** (A. Gray) W. R. Anderson & C. Davis, comb. nov. *Janusia gracilis* A. Gray, Pl. Wright. 1: 37. 1852. *Gaudichaudia gracilis* (A. Gray) Chodat, Bull. Soc. Bot. Genève, Sér. 2, 9: 100. 1917. *Aspicarpa gracilis* (A. Gray) Hassl., Annuaire Conserv. Jard. Bot. Genève 20: 212. 1918. TYPE: U.S.A. Texas: mountains east of El Paso, Aug 1849, *Wright 96* (holotype: GH!; isotypes: G! GH! K! NY! US!). Fig. 14.

Lamina of larger leaves 12–40 (–50) mm long, (1.5–) 3–7 (–9) mm wide, 4–10 times as long as wide, very narrowly lanceolate or elliptical, cuneate or rounded at base, flat at margin, acute, obtuse, or occasionally rounded at apex, persistently sericeous on both sides or sometimes glabrescent, very often bearing few to many distal cilia or toothlike projections along margin, the lateral veins and reticulum visible on both sides in wider leaves; petiole 1–3 (–5) mm long. Pedicel 4–8 mm long, 0.7–1.8 times as long as peduncle. Flowers 10–14 mm in diameter. Sepals 2–2.5 mm long, 1–1.6 mm wide, ovate or triangular, acute, obtuse, or rounded at apex, abaxially sericeous, adaxially usually sericeous proximally and glabrous distally, the anterior usually eglandular (occasionally bearing 1 or 2 glands), the lateral 4 usually biglandular (occasionally 1 or 2 of the most anterior glands lacking). Lateral petals with claw (1.3–) 1.5–2 mm long, the limb trapezoidal to nearly round or somewhat oblate, decurrent or not at base, (2.5–) 3.5–5 mm long, 3–4.5 mm wide; posterior petal with claw 1.8–2.5 mm long, the limb usually oblate, (2.5–) 3–4.3 mm long, 3.6–5.2 mm wide. Fertile filaments 2.1–2.6 mm long; anthers 0.8–1 mm long; staminodes (2) 3, 1–2.5 mm long. Style 1.9–2.3 mm long, sparsely sericeous in proximal 1/3–2/3, the stigma borne at same height as anthers and with anthers pressed against it, or up to 0.3 (–0.5) mm above them. Chromosome number:  $n = 20$  (Anderson 1993a).

Widespread in northern Mexico and extending into adjacent Texas, New Mexico, and Arizona (Fig. 12). Thorn-scrub and other xeric types of vegetation on diverse soils, 80–1900 m; collected with flowers and fruits in most months, but most commonly Apr–May and Jul–Oct.

See discussion above under *C. californica*. This species, one of only six Malpighiaceae native to the United States, occurs farther north than any other New World species.

**Cottisia linearis** (Wiggins) W. R. Anderson & C. Davis, comb. nov. *Janusia linearis* Wiggins, Contr. Dudley Herb. 3: 69. 1940. TYPE: MEXICO. Sonora: 18 mi S of Moctezuma, *Wiggins 7438* (holotype: DS!; isotypes: A! MICH! US!).

Fig. 13g–i.

Lamina of larger leaves 20–72 mm long, 1–5.5 mm wide, 12–40 times as long as wide, linear, cuneate at base, moderately to strongly revolute at margin, acute at apex, persistently sericeous on both sides or eventually glabrescent above, without distal cilia or teeth on margin, the lateral veins and reticulum not visible on either side; petiole 1–2 mm long. Pedicel (4–) 6–15 mm long, mostly 1.1–2.2 times as long as peduncle. Flowers 14–17 mm in diameter. Sepals 2.5–3 mm long, 0.9–1.5 mm wide, ovate or narrowly lanceolate, acute at apex, abaxially densely sericeous, adaxially sericeous proximally and glabrous distally, all biglandular. Lateral petals with claw 1–1.5 mm long, the limb trapezoidal, decurrent at base, 5–7.5 mm long, 4–6 mm wide; posterior petal with claw 1.5–2 mm long, the limb usually oblate, 4.5–5.5 mm long, 5.5–6.5 mm wide. Fertile filaments 2–2.7 mm long; anthers 0.6–0.8 mm long; staminodes 0–2, 1–1.8 mm long. Style 2.1–3 mm long, sericeous in proximal 1/2–3/4, the stigma usually borne well above anthers. Chromosome number:  $n = 10$  (Anderson 1993a).



FIG. 14. *Cottisia gracilis*. a. Flowering branches. b. Base of leaf (abaxial view) and adjacent stem to show stipule and marginal processes. c. Detached, relatively broad leaf, adaxial view. d. Flower, posterior petal uppermost. e. Androecium and gynoecium, with two fertile posterior stamens and three anterior staminodes. f. Fertile stamen, adaxial view. g. Anterior carpel. h. Fruit. i. Fruit base and torus with one samara attached by carpophore. j. Seed (left) and nut of samara in longitudinal section with seed removed (right). k. Embryos. Scale bar equivalents: a, 4 cm; b, 4 mm; c, 4 cm; d, 5.7 mm; e, 2.9 mm; f, g, 2 mm; h, 1 cm; i, 5.7 mm; j, k, 4 mm. (Based on: a, b, *Monson 8*, CAS; c-g, *Anderson 12552*, MICH; h-k, *Anderson & Laskowski 3520*, MICH.)

Endemic to the Sonoran Desert of central Sonora, Mexico (Fig. 12). Thorn-scrub on gravelly plains and rocky hillsides, 200–700 m; collected with flowers and fruits Feb–Apr and Jul–Nov.

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**SOUTHERN ECUADOR AS A HOTBED OF SPECIES  
EVOLUTION IN FUCHSIA (ONAGRACEAE):  
FUCHSIA AQUAVIRIDIS, A NEW SPECIES IN THE  
FUCHSIA LOXENSIS SPECIES GROUP**

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**ABSTRACT.** A new species of *Fuchsia* section *Fuchsia* (Onagraceae) from the Andes of southern Ecuador is described and illustrated. *Fuchsia aquaviridis* P. E. Berry is known from upper elevation cloud forests in and around Podocarpus National Park in Loja Province, where several other rare species of *Fuchsia* also occur. It is part of the *Fuchsia loxensis* species group and is differentiated by its narrowly elliptic and narrowly acute leaves, the apiculate sepals considerably longer than the petals, the canescent young growth, and the erect disposition of the young leaves and buds. Its occurrence and apparent restriction to Loja Province points to this area as a hotbed of evolution in Andean fuchsias.

Studies and collections of plants from southern Ecuador have increased dramatically in the past decade, and many novel plants or new distribution records have been made there. This paper describes a new species of *Fuchsia* that occurs in upper elevation cloud forests in Podocarpus National Park and on the slopes of Cerro Toledo, in Loja Province. Four other species of *Fuchsia* that are endemic to southern Ecuador are also known from this area: *F. campii* P. E. Berry, *F. scherffiana* André, *F. steyermarkii* P. E. Berry, and *F. summa* P. E. Berry (Berry 1982, 1995). All of these taxa belong to the largest section of the genus, section *Fuchsia*, which now includes 65 species. These findings point to the cloud forests of Loja Province as a hotbed of speciation in *Fuchsia* and one of the areas of highest diversity in the genus.

***Fuchsia aquaviridis*** P. E. Berry, sp. nov.—TYPE: ECUADOR. Loja: roadside thicket in cloud forest, road from Yangana to Cerro Toledo, 3000 m, 13 Nov 1988, P. E. Berry & L. Brako 4641 (holotype: MICH!; isotypes: MO! QCA! US!).

Fig. 1.

Frutex 80–120 cm altus, foliis oppositis vel 3–4-verticillatis anguste ellipticis, 3–12 × 1.5–4 cm, margine denticulato, apice anguste acuto, innovationibus canescentibus, stipulis subulatis persistentibus, floribus axillaribus, alabastris erectis, tubo florali 20–30 mm longo, sepalis apiculatis 9–15 mm longis, petalis late ellipticis 8–11 mm longis, 6–9 mm latis.

Well-branched shrub 0.8–1.2 m tall; branches leafy along most of the stem, internodes 5–20 (–60) mm long, lower stems with somewhat protruding leaf scars, young growth conspicuously canescent-strigose. Leaves opposite, 3- or occasionally 4-whorled; blade membranous, elliptic to narrowly elliptic, 30–60 (–120) mm long, (15–) 20–25 (–40) mm wide, acute to narrowly acute at the apex, acute at the base, with whitish strigose trichomes loosely dispersed along the veins on both surfaces, upper surface lustrous dark green, lower surface paler green; margin gland-denticulate with trichomes between the teeth; secondary nerves 7–10 (–12) on either side of

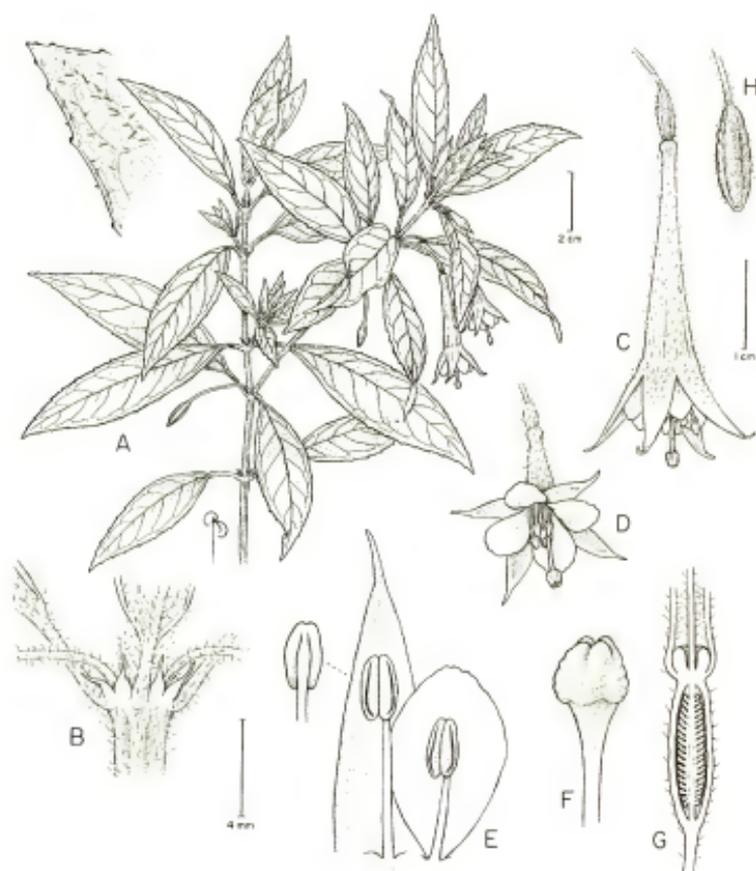


FIG. 1. *Fuchsia aquaviridis*. A. Habit and detail showing distal portion of a leaf. B. Node with a pair of stipules. C. Flower at anthesis. D. Flower shown at an angle from below to show position of petals and sepals at anthesis. E. Enlargement of a sepal, a petal, and stamens opposing them. F. Distal portion of style and stigma. G. Longitudinal section of the ovary and lower portion of the floral tube. (Based on *Berry & Brako 4641*, dried specimens and photographs of living plants).

the midvein; petiole 5–13 (–20) mm long; stipules awl-shaped, 2–2.5 mm long, 0.3–0.5 mm wide, persistent, drying dark. Flowers axillary and pendent in the upper leaf axils, uniformly red, 2 or 3 per node, the young buds canescent and usually held erect by the emerging leaves; pedicel 15–30 mm long; floral tube narrowly funnelform, 20–25 (–30) mm long, 2–2.3 mm wide and slightly bulbous at the base, 4–6 mm wide at the rim, 4- or 8-angled in cross-section, loosely strigose outside, villous in lower half inside; nectary a doughnut-shaped ring ca. 1.5 mm high and 2 mm wide at the base of the tube surrounding the style; ovary lightly 4- or 8-angled, 5–6 mm long, 2–3 mm thick,



FIG. 2. Distribution of *Fuchsia aquaviridis* in southern Ecuador.

strigose; sepals narrowly lanceolate, apiculate, (9–) 12–15 mm long, 3–5 mm wide at the base, strigose on the outside; petals broadly elliptic to suborbicular, spreading at anthesis, 8–11 mm long, 6–9 mm wide, rounded to mucronate at the apex, cuneate at the base; style red, 28–36 mm long, villous in lower half, stigma whitish pink, capitate, slightly 4-cleft at the apex, ca. 2 mm high by 2 mm wide; filaments 5–6 mm and 3–4 mm long, anthers broadly oblong, ca. 2 mm long and 1.5 mm wide, pollen white at dehiscence. Fruit somewhat 4- or 8- angled before fully mature, ellipsoid, 10–13 mm long, 7–8 mm thick; seeds flattened, semilunar in outline, 1.4–1.7 mm long, ca. 1 mm wide.

Distribution (Fig. 2). In moist thickets in cloud forests, on humid slopes of Cerro Toledo east of Yangana and east of the Nudo de Cajanuma in Parque Nacional Podocarpus, Loja Province, Ecuador; 2850–3100 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Ecuador.** LOJA: road from Yangana to Cerro Toledo, 3030 m, 13 Nov 1988, *Berry & Brako 4642* (MO, MICH, OCA); 13.5 km from Yangana on road to Cerro Toledo, 2835 m, 16 Sep 1988, *Green & Waters 1061* (MICH); Parque Nacional Podocarpus, above Cajanuma, 2900–3100 m, 19 Jan 1989, *Madsen 85575* (AAU, MO); Parque Nacional Podocarpus, south of Loja, east of Nudo de Cajanuma, 2850–2950 m, 21–22 Feb 1985, *Øilgaard et al. 57879* (AAU); Parque Nacional Podocarpus, above Nudo de Cajanuma, around “Centro de Información,” 2800–3000 m, 14–15 May 1988, *Øilgaard et al. 74117* (AAU).

*Fuchsia aquaviridis* is found quite locally in openings of upper elevation cloud forest in moist substrates. It belongs to the *Fuchsia loxensis* species group (Berry et al. 1982), which is characterized by its short-tubed, axillary flowers and rounded petals. Although this is a complex and variable group that will require further study, *F. aquaviridis* is sufficiently well characterized from related species to justify its separate

recognition. Characters that help separate it from other members of its species group (*F. loxensis* Kunth, *F. hypoleuca* I. M. Johnst., *F. scabriuscula* Benth., *F. steyermarkii* P. E. Berry, and *F. summa* P. E. Berry) include its typical narrowly elliptic and narrowly acute leaves, the apiculate sepals considerably longer than the petals, the canescent young growth, and the erect disposition of the young leaves and flower buds.

The specific epithet is derived from the Latin *aqua* (water) and *viridis* (green), in recognition of a pair of avid *Fuchsia* enthusiasts who also found this species in the wild, namely, Dave Green and Eileen Waters of London, U.K.

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**NEW SYNONYMY IN CROTON SECT. GEISELERIA  
(EUPHORBIACEAE) FROM THE CARIBBEAN AND A NEW  
SUBSPECIES OF CROTON GUILDINGII FROM VENEZUELA**

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**ABSTRACT.** Analysis of the *Croton guildingii* species complex in sect. *Geiseleria* leads to the synonymy of several formerly obscure species names of *Croton* in Venezuela and adjacent islands of the Lesser Antilles. *Croton guildingii* subsp. *riinensis* from the Interior Coastal Range of northern Venezuela is newly described and illustrated. This subspecies occurs in a small region of serpentine outcrops and is one of the first examples of adaptation to serpentine soils in the genus outside of Cuba.

*Croton* L. is the second largest genus in the Euphorbiaceae, with 1,223 species recognized at the time by Govaerts et al. (2000). Webster (1993) divided the genus into 40 sections, and the first molecular study of the genus by Berry et al. (2005) provided support for some of those sections, but showed others to be polyphyletic. Since then, molecular sampling in the genus has increased substantially, and studies of particular groups are emerging or should soon be published (Riina 2006; Van Ee 2006; Van Ee et al., in press).

One group currently under revision by the second author is sect. *Geiseleria* (Kl.) Baill. It was characterized by Webster (1993) as consisting of monoecious herbs or small shrubs with stellate indumentum; alternate, dentate leaves with petiolar glands; entire stipules; terminal inflorescences with lower pistillate flowers and upper staminate ones; reduced petals in the pistillate flowers; entire, unequal sepals; and bifid styles. Additional characters we have found to be diagnostic of most species in the section include persistent linear-curved bracteoles on the male flowers even after the flowers have dehisced; the presence of stalked glands in some or all of the sinuses of the leaf margin; and a generally persistent pistillate calyx that emerges from a distinctive, smooth, cup-shaped receptacle that is most readily observed once the fruit has dehisced (see Fig. 1C).

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Our study began with the ecological analysis by the junior author of the vegetation on a small serpentine soil outcrop in the Interior Coastal Range of northern Venezuela (Barreto & Casale 2002). A series of collections was made of a *Croton* that was not matched to any species present in the National Herbarium (VEN). We initially intended to describe these gatherings as a new species, but upon closer examination of other specimens on loan for the revision of sect. *Geiseleria*, we discovered that they formed part of a species complex ranging across the northern coast of South America and into the Lesser Antilles.

***Croton guildingii*** Griseb., Fl. Brit. West Indies 38. 1859.—TYPE: ST. VINCENT AND THE GRENADINES. St. Vincent, 1822, *Rev. L. Guilding s.n.* (holotype: K!).

*Croton wulfschlaegelianus* Muell. Arg., Flora 55: 10. 1872.—TYPE: GRENADA. 1847, *H. R. Wulfschlägel 1004* (holotype: M!).

*Croton guaricensis* Croizat, Mem. Soc. Cien. Nat. La Salle (Caracas) 10(26): 125. 1950.—TYPE: VENEZUELA. Guárico: Distrito Infante, inmediaciones del Río Perro a unos 20 km al norte de Espino, en selva veranera en las márgenes de la carretera, 2 Apr 1950, *L. Croizat s.n.*, (holotype: CAR #830!; isotype: F!).

*Croton novaespariae* Croizat, Mem. Soc. Cien. Nat. La Salle (Caracas) 10(26): 124. 1950.—TYPE: VENEZUELA. Nueva Esparta: Isla Margarita, planicie entre San Juan y La Asunción, común en lugares áridos, Sep 1948, *L. Croizat s.n.* (holotype: CAR #838!; isotype: F!).

*Croton larensis* Steyerl., Fieldiana, Bot. 28(2): 314. 1952.—TYPE: VENEZUELA. Lara: dry chaparral between Trujillo-Lara boundary and Carora, 305 m, 28 May 1944, *J. A. Steyerl. 58606* (holotype: F!).

As recognized here, *Croton guildingii* is a widespread species known from the Windward Islands of the Lesser Antilles (Grenada, Martinique, St. Lucia, and St. Vincent), the Venezuelan island of Margarita, the northern coastal region of Venezuela from Estado Sucre in the east to Estado Zulia in the west, and probably into northeastern Colombia as well. A closely related, but larger and more robust species appears to be *C. juitapensis* Croizat, from Guatemala, Honduras, Nicaragua, and Costa Rica. All of the names listed here in synonymy clearly apply to *C. guildingii*, except that the type of *C. guaricensis* has very few diagnostic floral characters available. Nonetheless, it is unambiguously a member of sect. *Geiseleria*, with the stipitate leaf sinus glands, one or two pairs of stalked petiolar glands, and the persistent, curved male bracteoles with distinctive glands at the base. It furthermore has the typical ochraceous pubescence of *C. guildingii* and appears to have regular dichotomous branching.

Diagnostic characters of *C. guildingii* include the golden young pubescence, the relatively low number of secondary veins (3–7 per side of the midvein), the small bottle-shaped glands at the base of the bracts, the unequal sepals, vestigial pistillate petals, the fairly regular presence of stalked marginal glands in at least some of the leaf sinuses, the presence of 1 to 3 pairs of stalked petiolar glands, and the conspicuous floral receptacle after fruit dehiscence. Distinctive populations of *C. guildingii* that we deem worthy of separate taxonomic status are described below as a new subspecies.

***Croton guildingii*** subsp. ***tiarensis*** P. E. Berry & R. Riina, subsp. nov.—TYPE: VENEZUELA. Aragua: Loma de Hierro, Km 15 antes de la mina de níquel, laderas con sabana de *Trachypogon* con arbustos bajos dispersos y algunos parches de

*Agave*, 10°80'50"N, 63°55'W, 1200 m, 1 Aug 2001, R. Riina, P. E. Berry & C. Reyes 1274 (holotype: MICH!; isotypes: F! GH! NY! US! VEN! WIS!).

*Croton lagunillae* Croizat, Mem. Soc. Cien. Nat. La Salle (Caracas) 10(26): 122, 1950.—TYPE: VENEZUELA. Mérida: Región xerófila en las inmediaciones de Lagunillas, 1949, G. Marcuzzi s.n. (holotype: CAR # 837!; isotype: F!).

*Croton marcuzzianus* Croizat, Mem. Soc. Cien. Nat. La Salle (Caracas) 10(26): 123, 1950.—TYPE: VENEZUELA. Mérida: Región xerófila en las inmediaciones de Lagunillas, 1949, G. Marcuzzi s.n. (holotype: CAR #836!; isotype: F!).

Fig. 1.

Frutex 0.5–2.5 m altus sectio *Geiseleria pertinens*, ab *Croton guildingii* tipico foliis dense aureo-pubescentibus rigidis, inflorescentia 1.5–3.5 cm longa, habito fortiter dichotomo, in terra ophiolithica crescenti differt.

Loosely and strongly dichotomously branched shrub 0.5–2.5 m tall, monoecious; young stems densely golden-stellate, older stems reddish to greyish, glabrate, and lenticellate, to 8 mm in diameter; no latex noted when stems were freshly cut. Leaves elliptic-ovate, firmly membranous and rigid, 3–5 × 1.1–3 cm, apex acute to subrounded, base rounded to cuneate, margin coarsely dentate, often with subsessile to stipitate glands present in the sinuses, venation parallel with 3–6 secondary veins on either side of the midvein, upper surface pale to golden-green with a dense covering of porrect-stellate trichomes, but the leaf surface still visible underneath, lower surface paler and with a denser, whiter covering of stellate trichomes, the ones on the main veins larger than the trichomes on the surface in between; petiole 5–10 mm long, densely stellate-pubescent, with 1 (–3) pairs of subsessile to shortly stipitate, saucer-shaped glands 0.7–1 mm in diameter positioned laterally between the two surfaces of the adjacent leaf blade, the surface yellow-lustrous when fresh; stipules filiform, stellate-pubescent, caducous, 2–3 mm long. Inflorescences terminal, erect, sometimes a fruit remaining in the axil of two younger dichotomous flowering branches, 1.5–3.5 (–4) cm long, 1–5 pistillate flowers towards the base, numerous staminate flowers towards the tip, rachis densely golden stellate-pubescent. Staminate flowers with a thin, persistent pedicel 1.5–2 mm long with scattered porrect-stellate trichomes and persistent bottle-shaped glands at the base; sepals 5, valvate, elliptic, acute, 2–3 × 1.5–2.5 mm, villous on the inner surface, stellate-pubescent on the outer surface, whitish; petals 5, elliptic, ovate, 2–3 × 1.5–2.5 mm, villous on both surfaces, white; stamens 10–11, filaments inflexed in bud, 2–3 mm long at anthesis, the receptacle villous; anthers 0.8 × 0.3–0.4 mm. Pistillate flowers with pedicel 0.5–2.5 mm long, subtended by a densely pubescent filiform bract 3–6 mm long; sepals 5, oblong to narrowly obovate, 3–5 × 1.5–2.5 mm, apex rounded, densely stellate-pubescent on the outer surface, well separated from each other at anthesis, slightly unequal in size; petals 2–3 mm long, filiform, pubescent; ovary spheroid, ca. 5 mm in diameter, densely covered by golden-stellate trichomes 1–1.5 mm long; styles bifid, basally pubescent, suberect, 3–5 mm long. Capsules ca. 6 mm in diameter, with a conspicuous receptacle ca. 2 mm in diameter visible after dehiscence, the perianth and columella persistent. Seeds broadly oblong, 4 mm long, 3 mm wide, 2.5 mm thick, surface smooth to slightly longitudinally striate, light tan, carunculate, the caruncle yellowish white, 2.5 mm wide, 1 mm high, thicker in the middle.

Distribution (Fig. 2). Mainly restricted to the Serranía del Interior of the Venezuelan Cordillera de la Costa, along south-facing slopes of Loma de Hierro north of Tiara in Estado Aragua and in adjacent parts of Estado Miranda, Venezuela, from 1000 to 1250 m elevation. Also present near Lagunillas, Estado Mérida, in a semi-arid interandean valley at 800 to 900 m elevation.

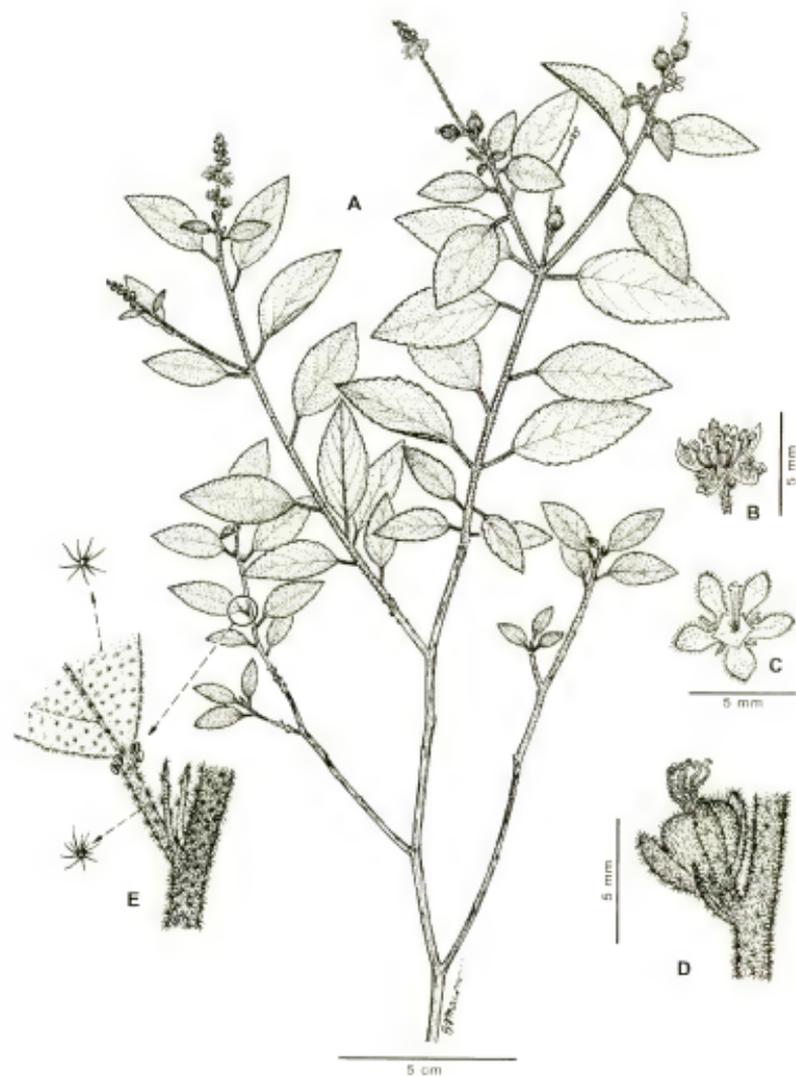


FIG. 1. *Croton guilingii* subsp. *tiarensis*. A. Habit. B. Male flower at anthesis. C. Pistillate perianth remaining after fruit dehiscence; note the spatulate sepals, the filiform petals and the persistent columella. D. Pistillate flower at anthesis, with filiform bract. E. Detail of a leaf base, petiolar glands, stipules, and stellate trichomes. (Based on Rima et al. 1274.)



FIG. 2. Distribution of *Croton guildingii* subsp. *tiarensis* in Venezuela.

ADDITIONAL SPECIMENS EXAMINED. **Venezuela.** ARAGUA: Cerros arriba de Tiara, 24 Jul 1952, *Schnee 1072* (F).—ARAGUA-MIRANDA: Loma de Hierro, en sabana de *Trachypogon*, 24 Mar 2000, *Barreto & Casale 84* (MICH, VEN), *Barreto & Casale 100* (MICH, VEN), *Barreto 109* (MICH), 10 May 2000, *Barreto 139* (MICH), 5 Oct 2000, *Barreto & Casale 138* (MICH, VEN), *Barreto & Casale 169* (MICH, VEN).

An unusual feature of this new subspecies is that it is one of the first taxa of *Croton* in South America that is largely restricted to serpentine outcrops, which are rare there. Serpentine outcrops are well known for their high levels of plant endemism, due in part to the toxicity of heavy metals, such as nickel, chromium, cobalt, and manganese (Kruckeberg 1986). On the Caribbean island of Cuba, there are large areas of serpentine outcrops scattered across the country, and these areas account for much of the species-level and genus-level endemism in Cuba (Borhidi 1985, 1996). Several species of *Croton* sect. *Cascarilla* Griseb. are restricted to serpentine outcrops on Cuba, as well as five of the six species of sect. *Moacroton* (Van Ee et al., in press). Outside of Cuba and Hispaniola, we have found no reliable records of *Croton* species known to be restricted to serpentine barrens and, indeed, no records to date of any member of sect. *Geiseleria* growing in serpentine areas.

*Croton guildingii* subsp. *tiarensis* is the dominant shrub where it occurs locally on rocky, serpentine outcrops covered mainly by *Trachypogon* grasses and occasional *Agave* plants. The shrubs are scattered in a predominantly herbaceous vegetation cover and occur both on open slopes and in more protected gulleys. Depending on the exposure and the microsite, mature plants vary from 0.5 to 2.5 m high. Towards the larger end of this scale, the shrubs are loosely and dichotomously branched. This area is one of the main nickel-producing regions in Venezuela, and, indeed, there is a large mining operation centered downslope towards the town of Tiara and operated by the company Cerro de Niquel. *Croton guildingii* subsp. *tiarensis* appears to be locally restricted to this serpentine outcrop, which forms a narrow east-west band 60 km long in easternmost Aragua State and westernmost Miranda State (Beck 1986). This outcrop is known as the Tiara Formation and is of volcanic origin during the middle Cretaceous (Smith 1952). Barreto and Casale (2002) used the semiquantitative

dimethylglyoxime method to test for the presence of nickel in the plant tissue of species occurring in this serpentine area of northern Venezuela, and *C. guildingii* subsp. *tiarensis* tested positive for nickel accumulation.

Nuclear ITS and plastid *trnL-trnF* intron and spacer DNA sequence data from Riina *et al.* 1274 (Berry *et al.* 2005) places *C. guildingii* subsp. *tiarensis* squarely within section *Geiseleria* and most closely allied to *C. glandulosus* L. and *C. martinianus* V. M. Steinm. The former is a widespread, weedy, and semiherbaceous species, and the latter is a Mexican endemic, but neither is known to be associated with serpentine substrates. Subspecies *tiarensis* differs from the nominate subspecies of *C. guildingii* in its stiffer, generally smaller, and more densely pubescent leaves, the nearly equal sepals, its strongly dichotomous branching pattern, shorter inflorescences, and its propensity for inhabiting unusual substrates, such as serpentine barrens and sodium bicarbonate deposits.

Both of the names here listed in synonymy have been virtually ignored until now, because they apply to taxa known only from their rather meager type specimens, collected at the same locality by the same collector, for which the sectional placement was not ascertained by Croizat (1950). Examination of the types shows that they both possess characters diagnostic of *C. guildingii*, but they approach subsp. *tiarensis* more in their rigid, densely pubescent leaves, dense golden pubescence on young growth, and sepals that are nearly equal in size. The area where they were collected in the Andes near Lagunillas, Estado Mérida, is characterized as an unusual "semi-arid enclave" caused by a rain shadow between the tall mountain ranges on either side of the Río Chama valley (Naranjo *et al.* 2003); the lagoons after which Lagunillas was named are major deposits of sodium calcium carbonate, which may also restrict the kinds of plants that can occur there in the surrounding thorn scrub vegetation.

The epithet of the new subspecies refers to the town of Tiara, Estado Aragua, which is the village closest to the type locality. It also acknowledges our co-collector Carlos Reyes, since his surname as well as the name of the town both have connotations of royalty.

#### ACKNOWLEDGMENTS

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## NEW TAXA OF JUSTICIA (ACANTHACEAE) FROM SOUTHERN MEXICO AND GUATEMALA

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**ABSTRACT.** Four new taxa of *Justicia* (Acanthaceae) are described from southern Mexico and adjacent Guatemala: *J. cymulifera* from the Uxpanapa region of Veracruz with an unusual inflorescence, *J. karsticola* from the Uxpanapa region with heteromorphic floral bracts, *J. maya* from Chiapas consisting of plants that were previously included in *J. herpetacanthoides*, and *J. campechiana* subsp. *vestita* from Chiapas and Guatemala that differs from the nominate subspecies primarily by pubescence characters. Images and maps accompany the descriptions and discussions of these taxa.

*Justicia* L. is the largest genus of Acanthaceae with more than 700 species currently recognized worldwide. These include some 100 species from Mexico (Daniel, unpubl.). Recent studies of Acanthaceae, especially from southern Mexico, continue to reveal undescribed taxa in this remarkably species-rich genus (e.g., Daniel 1999, 2002, 2003; Daniel et al. 2005). In fact, 22 species of *Justicia* were described from Mexico between 1995 and 2006 (IPNI 2006), and at least 10 others await publication. Four additional taxa of *Justicia* are herewith proposed from southern Mexico and Guatemala.

***Justicia cymulifera*** T. F. Daniel, sp. nov.—**TYPE:** MEXICO, Veracruz: Mpio. Minatitlán, 2 km N de Uxpanapa (Pob. 12) sobre camino al Pob. 13, 17°14'N, 94°13'W, 130 m, arroyo seco en selva alta perennifolia perturbada, 17 May 1983, T. Wendt et al. 4103 (holotype: CAS!; isotype: CHAPA). Fig. 1.

Herbae perennes vel frutices. Folia petiolata; laminae anguste ellipticae vel oblanceolatae, 100–265 mm longae, 23–71 mm latae, 3–5.5-plo longiores quam latiores. Thyrsi vel thysorum paniculae cymuliferae; cymulae 1–3 in axillis bractearum, pedunculatae; cymulae bracteolae externae deltatae vel cordatae, 10–20 mm longae, 7–14 mm latae. Calyx 5–5.2 mm longus. Corolla aurantiaca-rubra, 33–35 mm longa, extus pubescens trichomatibus eglandulosis. Stamina thecis 1.9–2.2 mm longis, impariter insertis, theca supra dorsaliter pubescenti, theca inferna basi calcarata; pollinis grana 3-aperturata. Capsula ignota.

Perennial herbs to shrubs to 3 m. Young stems subterete to quadrate-sulcate, ± scurfy (or the epidermis becoming ± scaly), apparently devoid of trichomes. Leaves petiolate, petioles to 20 mm long, blades narrowly elliptic to oblanceolate, 100–265 mm long, 23–71 mm wide, 3–5.5 times longer than wide, acuminate at apex, attenuate at base, surfaces lacking trichomes but ± scurfy, margin entire to subsinuate. Inflorescence of axillary (or terminal) pedunculate thyrses or panicles of thyrses to 220 mm long (excluding flowers) bearing cymules (with 2 inner and 2 outer bracteoles forming an involucre at base of flower), peduncles to 95 mm long, bifariously pubescent with erect to flexuose to retrorse eglandular trichomes 0.1–0.3 mm long, rachis pubescent like peduncles; bracts caducous, subfoliose, lance-ovate, 13–16 mm long,

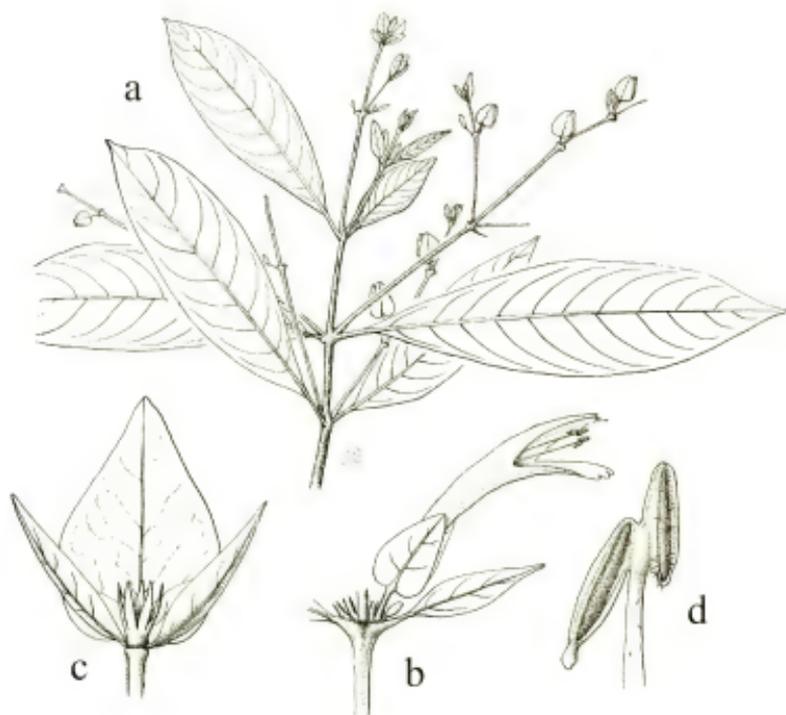


FIG. 1. *Justicia cymulifera*. a. Habit (Wendt *et al.* 4170),  $\times 0.4$ . b. Inflorescence node with flower (Wendt *et al.* 4103),  $\times 1.2$ . c. Cymule with one outer bracteole removed, showing adaxial surface of the other outer bracteole, inner cymule bracteoles, and calyx (Wendt *et al.* 4103),  $\times 1.9$ . d. Distal portion of stamen with anther (Wendt *et al.* 4103),  $\times 10.7$ .

3–5 mm wide, abaxial surface  $\pm$  scurfy, lacking trichomes; cymules opposite at bracteal nodes, 1–3 per axil, pedunculate, peduncles 3–13 mm long, pubescent like rachis; outer cymule bracteoles deltate to cordate, 10–20 mm long, 7–14 mm wide, subcordate to cordate at base, abaxial surface glabrous; inner cymule bracteoles lance-ovate, 6.5–14 mm long, 2–4.5 mm wide, abaxial surface glabrous. Flowers 1 per cymule, sessile. Calyx 5-lobed, 5–5.2 mm long, tube 0.6–1 mm long, lobes lanceolate, 4–4.6 mm long, 1–1.1 mm wide, abaxially glabrous. Corolla orange-red, 33–35 mm long, externally pubescent with erect to flexuose eglandular trichomes 0.1–0.2 mm long, tube 20 mm long,  $\pm$  gradually expanded from base, upper lip 14–15 mm long, 2-lobed at apex, lobes to 0.3 mm long, lower lip 12 mm long, lobes 1.3–1.5 mm long, 1 mm wide. Stamens 13–15 mm long, filaments pubescent with eglandular trichomes, thecae 1.9–2.2 mm long, subequal (lower theca slightly longer than upper theca), subperpendicular to parallel, unequally inserted (overlapping by 1 mm), upper theca dorsally pubescent with eglandular trichomes, lower theca with a blunt basal appendage 0.2–0.3 mm long; pollen (Fig. 2a–d) 3-aperturate, apertures flanked on each side by 1 row of insulae (in various stages of distinctness), exine reticulate. Style 35 mm long, glabrous distally, stigma 0.2 mm long. Capsules not seen.

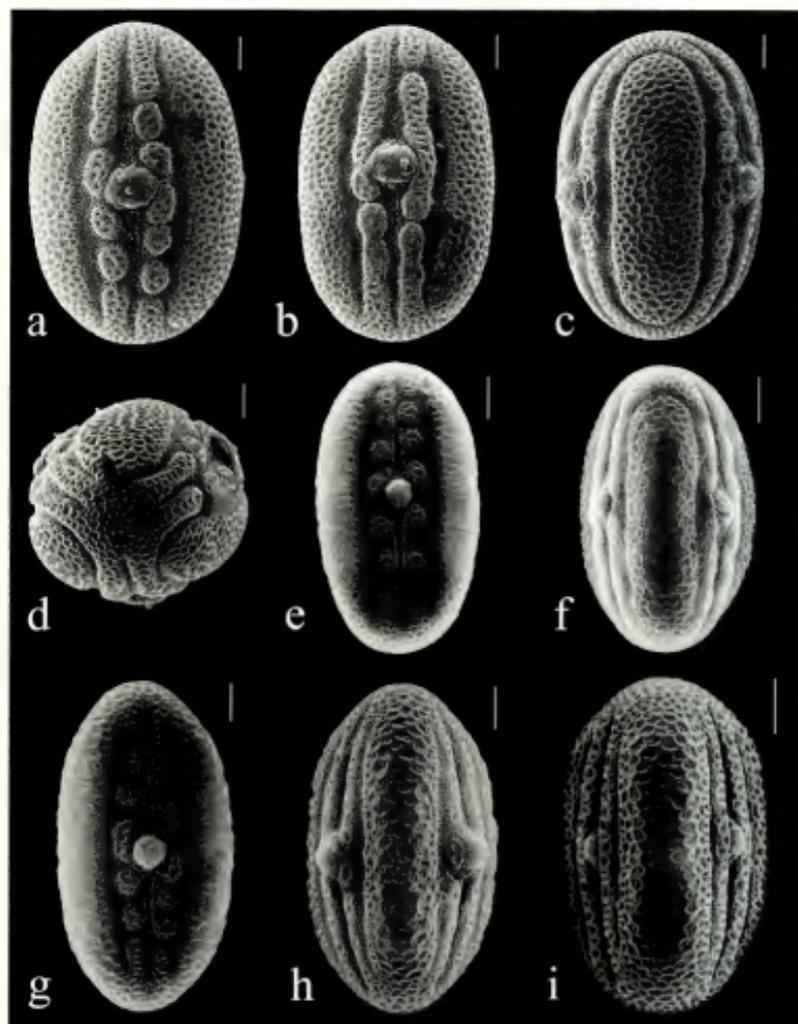


Fig. 2. Scanning electron micrographs of pollen. a–d. *Justicia cymulifera* (Wendt et al. 4103). a. Apertural view with  $\pm$  discrete insulae. b. Apertural view with “coalesced insulae.” c. Interapertural view. d. Polar view. e–f. *Justicia campechiana* subsp. *vestita* (Miranda 5860). e. Apertural view. f. Interapertural view. g–h. *Justicia maya* (Breedlove & Daniel 71004). g. Apertural view. h. Interapertural view. i. *Justicia karsticola* (Wendt et al. 2994), interapertural view. Scales = 5  $\mu$ m.

Phenology. Flowering: May; fruiting: unknown.

Distribution (Fig. 3). Known only from southern Veracruz where plants occur in lowland rain forests of the Uxpanapa region at elevations of 130 to 450 m.

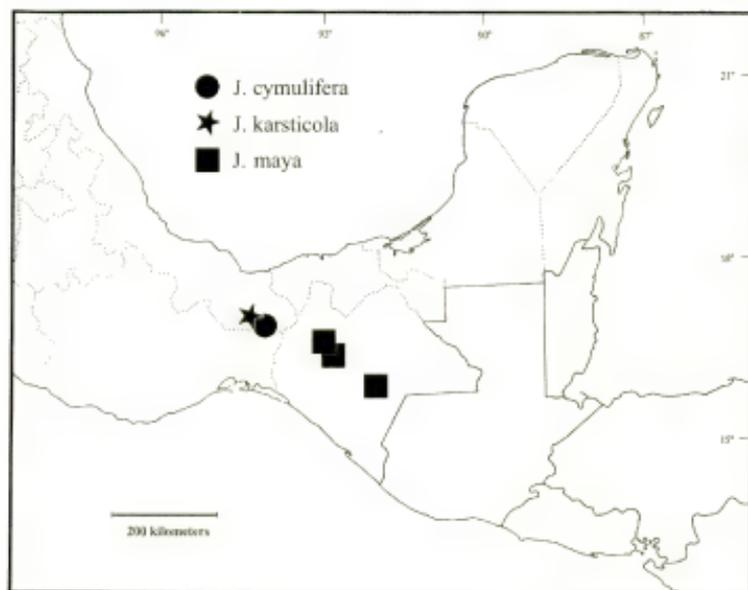


FIG. 3. Distribution of *Justicia cymulifera*, *J. karsticola*, and *J. maya*.

PARATYPE. **Mexico.** VERACRUZ: Mpio. Minatitlán, Cerro Blanco, ca. 7 km NE de Uxpanapa en el camino a Pob. 15, 17°14'N, 94°09'W, T. Wendt et al. 4170 (CAS).

*Justicia cymulifera* can be distinguished from other species of *Justicia* in Mexico by its pedunculate cymules (with the outer cymule bracteoles deltate to cordate) bearing relatively long, orange-red corollas. Superficially it resembles several species of *Dicliptera* due to the presence of similar cymules. It can be distinguished from species of that genus by its young stems, which are subterete to quadrate-sulcate (vs. generally hexagonal in *Dicliptera*), lower theca with a conspicuous basal appendage (vs. basal appendages absent in *Dicliptera*), and pollen with insulae present (vs. insulae absent in *Dicliptera*). Although capsules remain unknown for *J. cymulifera*, in capsules of *Justicia* the placentas do not separate from the inner capsule wall as they do in *Dicliptera*. A morphologically similar species that occurs at higher elevations (ca. 1200 m) in Guatemala, *J. pedicellata* D. N. Gibson, also has similar cymules, 3-aperturate pollen (with apertures flanked by a single row of insulae on each side), and relatively long, red corollas. Capsules are known for that species, and they resemble those found in other species of *Justicia* rather than those of *Dicliptera*. These two cymule-bearing species of *Justicia* from northern Latin America can be distinguished by the following couplet.

Inflorescence of pedunculate cymules in axils of leaves or clustered at distalmost node; leaves sessile or with petioles to 5 mm long, blades 30–62 mm long, 12–21 mm wide; peduncles of cymules glabrous; calyx 7–8 mm long; outer surface of corolla pubescent with mostly retrorse eglandular trichomes and sometimes with erect glandular trichomes as well; filaments distally glabrous; plants of Guatemala (Alta Verapaz). *J. pedicellata*

Inflorescence of axillary or terminal pedunculate thyrses or panicles of thyrses bearing pedunculate cymules; leaves with petioles to 20 mm long, blades 100–265 mm long, 23–71 mm wide; peduncles of cymules bifariouly pubescent; calyx 5–5.2 mm long; outer surface of corolla pubescent with erect to flexuose eglandular trichomes; filaments distally pubescent; plants of Mexico (Veracruz).

*J. cymulifera*

The presence of cymules in *Justicia* similar to those of *Dicliptera* and its relatives (e.g., *Hypoestes*) is not surprising considering the close phylogenetic relationship among these genera as shown by McDade et al. (2000). Indeed, that study revealed *Dicliptera* and its relatives (subtribe *Diclipterinae*) to be nested between Old World and New World species of *Justicia*. The presence of cymules among Old World species of *Justicia* was noted by Champluvier (2002) in *J. scutifera* Champ.

***Justicia karsticola*** T. F. Daniel, sp. nov.—TYPE: MEXICO, Veracruz: Mpio. Minatitlán, 13.7 km E de La Laguna, sobre terracería a Uxpanapa, luego 7.2 km N a Belisario Domínguez, 17°20.5'N, 94°23'W, 120 m, área kárstica en selva perennifolia, 5 Mar 1981, T. Wendt et al. 2994 (holotype: CAS!; isotype: CHAPA). Fig. 4.

Herbae perennes usque ad 6 dm altae. Folia petiolata, laminae ovatae vel ovato-ellipticae, 67–77 mm longae, 25–38 mm latae, 1.9–3.1-plo longiores quam latiores. Inflorescentia floribus in paniculis spicatis. Bractee florales heteromorphae, oppositae; bractee fertiles late ellipticae vel subcirculares, 4–5 mm longae, 2.3–3.6 mm latae; bractee steriles lineares vel oblanceolatae, 2–3.5 mm longae, 0.2–0.5 mm latae. Calyx 5-lobus, 3–3.3 mm longus, lobis homomorphis. Corolla flavovirens labiis purpureo-notatis, 8.5–9.3 mm longa, extus pubescens trichomatibus eglandulosis. Stamina thecis 1.1–1.3 mm longis, impariter insertis, pubescentibus, theca inferna basi calcarata. Capsula ignota.

Perennial herbs to 6 dm tall; young stems subterete to subquadrate, 2-fariouly pubescent with (flexuose to) antrorse eglandular trichomes 0.3–0.5 mm long, septae of trichomes conspicuou and purplish. Leaves petiolate, petioles to 32 mm long, blades ovate to ovate-elliptic, 68–77 mm long, 25–38 mm wide, 1.9–3.1 times longer than wide, acute to subacuminate at apex, acute to subattenuate at base, adaxial surface glabrous, abaxial surface pubescent along midvein with antrorse eglandular trichomes, margin entire to coarsely angulate. Inflorescence of terminal pedunculate panicles to 15 cm long (including peduncle and excluding corollas) and 15 mm in diameter, peduncles to 20 mm long, pubescent with cauline type trichomes ± concentrated in 2 lines, rachis ± evenly pubescent (or trichomes concentrated in 2 lines) with cauline type trichomes, lateral branches of panicles consisting of short spikelike axes (= modified dichasia?) to 13 mm long, sessile to subsessile (peduncles to 1 mm long), mostly 3–5-flowered; inflorescence bracts (i.e., bracts along main panicle rachis subtending lateral spikelike branches) petiolate, ovate to lanceolate to elliptic, 5–8 mm long, 1–2.5 mm wide (or proximalmost pair often larger, to 15 × 4 mm). Bracts of lateral spikelike axes (= floral bracts) opposite, those of a pair heteromorphic with fertile bracts much larger than sterile bracts; fertile bracts petiolate, broadly elliptic to subcircular, 4–5 mm long, 2.3–3.6 mm wide, abaxial surface pubescent with erect eglandular and glandular (sometimes ± inconspicuous) trichomes 0.05–0.2 mm long and often with longer antrorse eglandular trichomes along midvein, margin conspicuously ciliate with erect to flexuose eglandular trichomes 0.3–1.2 mm long; sterile bracts sessile, linear to oblanceolate, 2–3.5 mm long, 0.2–0.5 mm wide, abaxial surface and margin pubescent with flexuose eglandular trichomes to 0.7 mm long. Bracteoles

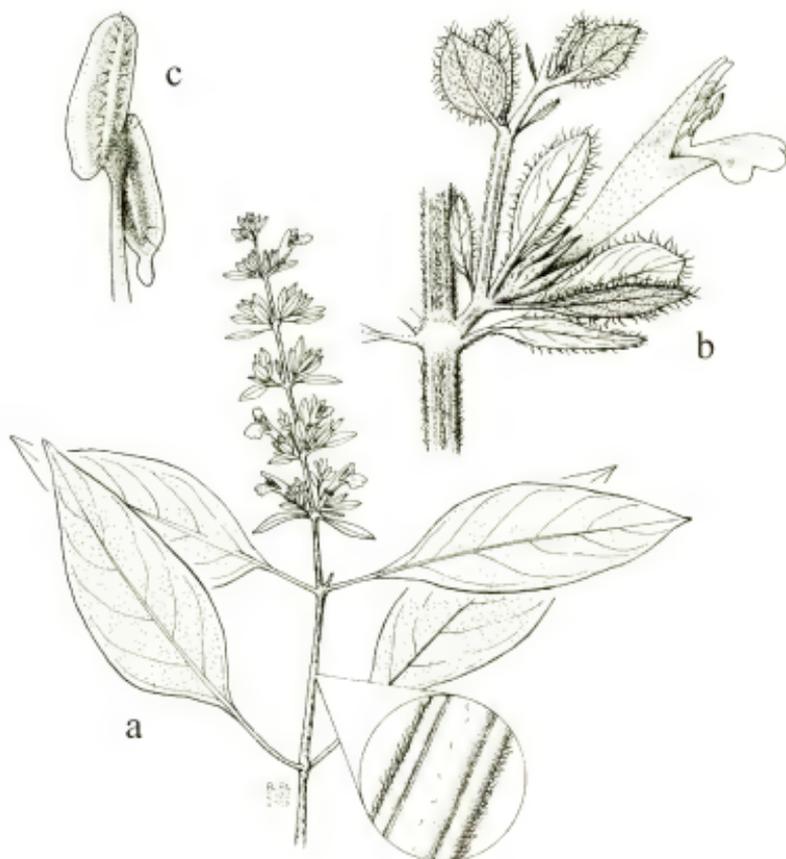


FIG. 4. *Justicia karsticola* (Wendt et al. 2994). a. Habit ( $\times 0.8$ ) with enlargement of vegetative internode ( $\times 7$ ). b. Inflorescence node with spikelike branch (= modified dichasium?) bearing a flower,  $\times 5$ . c. Distal portion of stamen with anther,  $\times 19$ .

obovate, often asymmetric, 4–5.2 mm long, 1–1.8 mm wide, abaxial surface and margin pubescent like fertile bracts. Flowers alternate (i.e., one per node), sessile to subsessile (pedicels to 0.5 mm long). Calyx 5-lobed, 3–3.3 mm long, lobes  $\pm$  equal, lanceolate, 2.3–2.6 mm long, 0.4–0.6 mm wide, abaxially pubescent with antrorse to flexuose eglandular trichomes 0.1–0.2 mm long. Corolla yellowish green with maroon markings on lips, 8.5–9.3 mm long, externally pubescent with erect to flexuose to retrorse eglandular trichomes 0.05–0.2 mm long, tube 5–5.5 mm long, slightly gradually expanded distally but lacking a distinct throat, 1.6–1.8 mm in diameter near midpoint, upper lip 3–4.2 mm long, emarginate at apex with lobes 0.2–0.3 mm long, lower lip 3.5–4 mm long, lobes 1.2–1.7 mm long, 1.2–2 mm wide. Stamens 4–4.2 mm long, inserted near apex of corolla tube, exerted from mouth of corolla but not extending beyond upper lip, filaments glabrous, thecae maroon, 1.1–1.3 mm long, subequal

in length (lower longer), parallel to subparallel, unequally inserted (overlapping by 0.3 mm), dorsally pubescent with eglandular trichomes, lower theca with a spurlike basal appendage 0.2–0.3 mm long; pollen (Fig. 2i) 3-colporate, 6-pseudocolpate, exine reticulate. Style 6.5–7 mm long, exerted from mouth of corolla but not extending beyond upper lip, proximally pubescent with eglandular trichomes; stigma asymmetrically funnelliform, 0.2 mm long, lobes not evident. Capsule and seeds not seen.

Phenology. Flowering: March.

Distribution (Fig. 3). Known only from southern Veracruz where plants occur on karst (limestone) in lowland rain forests of the Uxpanapa region at elevations of 120 m.

*Justicia karsticola* is known only from the moist Uxpanapa lowlands of Veracruz. This region of high precipitation and diverse rain forests in southeastern Veracruz and adjacent Oaxaca is a center for endemic and disjunct taxa (Wendt 1987, 1997). With the recognition of both *J. cymulifera* and *J. karsticola* from the Uxpanapa region, at least 13 species of the genus are known there [also: *J. ardens* T. F. Daniel, *J. borraeae* (Hemsl.) T. F. Daniel, *J. fimbriata* (Nees) V. A. W. Graham, *J. kanal* T. F. Daniel, *J. lindeniana* (Nees) J. F. Macbr., *J. neulingii* Wassh. & T. F. Daniel, *J. pectoralis* Jacq., *J. spicigera* Schldl., *J. uxpanapensis* T. F. Daniel, *J. valvata* T. F. Daniel, and *J. wendtii* T. F. Daniel]. Four of these, *J. cymulifera*, *J. karsticola*, *J. uxpanapensis*, and *J. wendtii*, appear to be endemic to the region. *Justicia ardens* is known only from the Uxpanapa lowlands and the adjacent (and generally somewhat higher in elevation) Chimalapa region in Oaxaca. Several of these species of *Justicia* occur on, or are restricted to, the weathered limestone (karst) that characterizes large portions of this region.

The short lateral branches in the inflorescence of *J. karsticola* appear as spikes. Whether they are true spikes (with indeterminate growth) or modified dichasia that exhibit sympodial growth resulting in spikelike elongations is not known. Like several other species from the New World, *J. karsticola* has floral bracts heteromorphic at a node. Dimorphic bracts were noted by Graham (1988) in a Brazilian species, *J. scansilis* (Rizzini) V. A. W. Graham, of her sect. *Orthotactus* (Nees) V. A. W. Graham. In that species, however, the sterile bracts are broadly ovate to cordate and the fertile ones are narrowly ovate to lanceolate. *Justicia karsticola* differs from Graham's (1988) circumscription of sect. *Orthotactus* by its compound inflorescence, bracts not ovate, and pollen with three apertures. Wasshausen and Daniel (1995) and Daniel (2002) discussed several heteromorphically bracteate species from Mesoamerica. Mexican species of *Justicia* with heteromorphic bracts include: *J. caudata* A. Gray, *J. chol* T. F. Daniel, *J. karsticola*, *J. neulingii* Wassh. & T. F. Daniel, *J. tuxtensis* T. F. Daniel, *J. uxpanapensis* T. F. Daniel, and *J. wendtii* T. F. Daniel. *Justicia karsticola* appears florally and palynologically similar to *J. wendtii*; indeed, both species were collected by Wendt from the same locality. They can be distinguished by the characters in the following couplet.

- Young stems pubescent with retrorsely appressed trichomes; lateral branches of panicles consisting of pedunculate (peduncles 2–40 mm long) and unilateral spikes; bracts subopposite to alternate, sometimes ± heteromorphic, obovate to oblanceolate, 1–2.5 mm wide, margin ciliate with trichomes up to 0.3 mm long; corolla 7–8.5 mm long, externally pubescent with glandular and eglandular trichomes; style 4.5–5 mm long. *J. wendtii*
- Young stems pubescent with (flexuose to) antrorse trichomes; lateral branches of panicles consisting of sessile to subsessile (i.e., peduncles to 1 mm long) and multilateral spikelike axes (= modified dichasia?); bracts opposite, conspicuously heteromorphic, fertile bracts broadly elliptic to subcircular, sterile bracts linear to oblanceolate, 2.3–3.6 mm wide, margin ciliate with trichomes 0.3–1.2 mm long; corolla 8.5–9.3 mm long, externally pubescent with eglandular trichomes; style 6.5–7 mm long. *J. karsticola*

**Justicia maya** T. F. Daniel, sp. nov.—TYPE: MEXICO. Chiapas: 3 km S of Tuxtla Gutiérrez on road to Suchiapa, 700 m, slope with tropical deciduous forest, 3 Nov 1988, *D. Breedlove & T. Daniel 71004* (holotype: CAS!; isotypes: ENCB! MICH! MO! US!).

Herbae perennes vel frutices. Folia petiolata, laminae ovatae, 23–88 mm longae, 10–51 mm latae, 1.4–2.3-plo longiores quam latiores. Spicae dichasiaetae dense bracteatae. Bracteeae quadrifariae, late ovatae, 8–12 mm longae, 5–9 mm latae. Bracteolae lineari-ellipticae vel oblanceolatae, 5.5–9 mm longae, 1.2–2.2 mm latae. Calyx 5-lobus, 3–5.5 mm longus, lobis aequalibus. Corolla alba labio supero viridulo et labio infero purpureo-notato, 10.5–15 mm longa, extus pubescens trichomatibus eglandulosis. Stamina thecis 1.2–2 mm longis, impariter insertis, dorsaliter pubescentibus, theca inferna basi calcarata; pollinis grana 3-aperturata. Capsula 7–8.5 mm longa, pubescens trichomatibus eglandulosis. Semina 2.3–2.5 mm longa, minute papillosa.

Phenology. Flowering: October–January; fruiting: October–January.

Distribution (Fig. 3). Endemic to Chiapas; plants occur on rocky slopes in regions of evergreen seasonal forest and tropical deciduous forest at elevations of 700 to 850 m.

PARATYPES. **Mexico.** CHIAPAS: Mpio. Soconlango, 30 km ESE of Pugilic on rd. to Comitán, *D. Breedlove 53666* (CAS), *D. Breedlove & F. Almeda 56879* (CAS); Mpio. Tuxtla Gutiérrez, 2 mi S of Tuxtla Gutiérrez, *D. Breedlove & P. Raven 13364* (DS, F, MICH, US); between S. Fernando and Chacona, W of Tuxtla Gutiérrez, *J. Langman 3836* (PH, US); Mpio. Tuxtla Gutiérrez, El Zapotal, SE de Tuxtla Gutiérrez, 16°43'N, 93°06'W, *E. Palacios E. 2011* (CAS).

A detailed description in English and an illustration of this species were provided by Daniel (1995: 66–67, Fig. 17) under *Justicia herpetacanthoides*. At that time I enumerated several differences between Chiapan collections and those resembling the type of *J. herpetacanthoides* from Yucatán. Further, I indicated that the Chiapan plants might represent a species other than *J. herpetacanthoides*, but that further studies of that taxon and several others, including *Beloperone blechioides* Leonard, would be necessary prior to making such a determination. Recent studies of Acanthaceae in Honduras (Daniel 2005) and the Yucatan Peninsula (Daniel, unpubl.) reveal that *B. blechioides* corresponds to a Guatemalan and Honduran species that is now known as *J. ciriloi* T. F. Daniel, and that *J. herpetacanthoides* is not distinct from *J. lundellii* Leonard. Plants from Chiapas are here treated as a distinct species endemic to that state and differ from the Yucatan Peninsular endemic *J. lundellii* by the characters in the following couplet.

Young stems evenly pubescent; bracts sessile, 5–9 mm, wide; calyx 3–5.5 mm long; corolla 10.5–15 mm long; stamens 6.3–6.5 mm long, filaments glabrous; pollen apertures flanked on each side by 1 row of insulae (Fig. 2g, h); capsule 7–8.5 mm long; seeds 2.3–2.5 mm long, surfaces minutely papillose. *J. maya*

Young stems bifariously pubescent; bracts narrowed proximally and ± petiolate, blades 3.5–5.5 mm wide; calyx 2.5–3 mm long; corolla 7–9 mm long; stamens 4–4.3 mm long, filaments pubescent; pollen apertures flanked on each side by a pseudocolpus (insulae generally absent); capsule 5.8–6 mm long; seeds 1.5–1.9 mm long, surfaces irregularly bacculate. *J. lundellii*

Although both of these species occur in similar vegetation types, *J. lundellii* occurs at lower (5–225 m) elevations.

**Justicia campechiana** Standl. ex Lundell subsp. **vestita** T. F. Daniel, subsp. nov.—TYPE: MEXICO. Chiapas: Mpio. Ocosingo, 70 km SW of Palenque toward Ocosingo, along Jol Uk'um, 550 m, lower montane rain forest, 12 Apr 1981, *D. Breedlove 50937* (holotype: CAS!). Fig. 5.

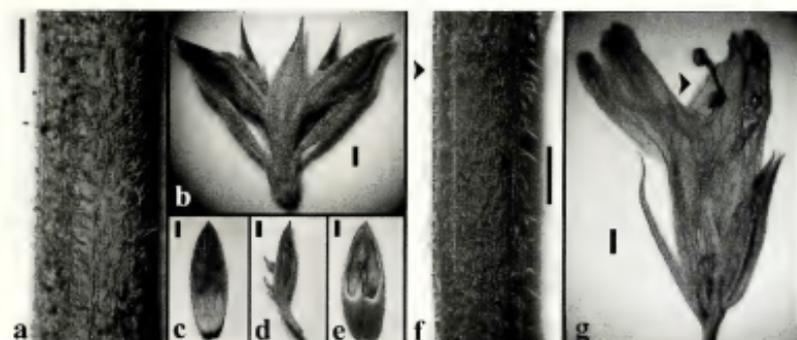


FIG. 5. *Justicia campechiana* subsp. *vestita* (a–e, Breedlove 50937) and subsp. *campechiana* (f–g). a. Young stem with evenly disposed trichomes. b. Calyx and capsule. c. Capsule valve (exterior view). d. Capsule valve (side view showing retinacula). e. Capsule valve (interior view). f. Young stem with arrows indicating two vertical rows of trichomes (Álvarez & Jiménez 3110). g. Flower with arrow indicating widely displaced thecae of one anther (Cabrera C. 9938). All scales = 1 mm.

Differt a subsp. *campechiana* caulibus juvenibus aequaliter pubescentibus, et foliis, bracteis, bracteolis, et calycibus pubescentibus.

Phenology. Flowering: December–January; fruiting: April.

Distribution (Fig. 6). Southern Mexico (Chiapas) and Guatemala (Alta Verapaz); plants occur in lower montane rain forest and montane rain forest at elevations of 550 m and higher.

PARATYPES. **Mexico.** CHIAPAS: Berriozábal–Las Vistas, *Enriquez 6839* (MEXU), *F. Miranda 5860* (MEXU).

A detailed description in English of this subspecies was provided by Daniel (1995: 57–58; as *J. campechiana*), who noted the distinctions between Chiapan plants and those from the Yucatan Peninsula that resemble the type. At that time, the species was insufficiently known to me from throughout its range to determine whether the more pubescent plants from Chiapas (and Guatemala) represented a geographically circumscribable population or not. Recent studies of this species from the Yucatan Peninsula reveal that plants from each region indeed comprise morphologically, geographically, and ecologically distinct components of the species, both of which are here accorded subspecific status. Figure 5 illustrates some of the morphological distinctions between the subspecies, and Fig. 6 shows their respective distributions; the following couplet summarizes some of their differences.

Young stems bifariously pubescent with antrorse trichomes; leaf surfaces, abaxial surface of bracts and bracteoles, and calyx glabrous; plants of the Yucatan Peninsula (Mexico: Campeche, Yucatán, Quintana Roo; Belize: Corozal; Guatemala: Petén), occurring in evergreen seasonal forest and tropical subdeciduous forest at elevations from sea level to 240 m.

*J. campechiana* subsp. *campechiana*

Young stems evenly pubescent with flexuose to antrorse trichomes; leaf surfaces, abaxial surface of bracts and bracteoles, and calyx pubescent; plants occurring to the south of the Yucatan Peninsula (Mexico: Chiapas; Guatemala: Alta Verapaz) in lower montane rain forest and montane rain forest at elevations above 500 m.

*J. campechiana* subsp. *vestita*

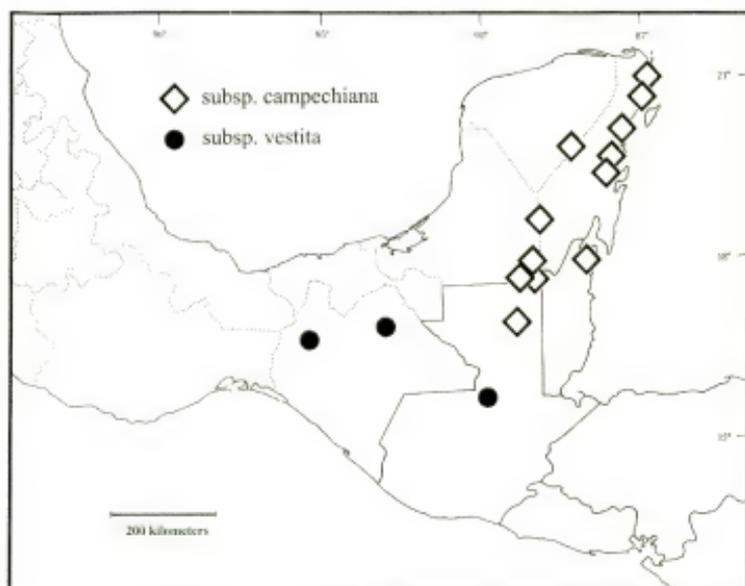


FIG. 6. Distribution of *Justicia campechiana* subsp. *campechiana* and subsp. *vestita*.

Pollen of *J. campechiana* subsp. *vestita* (Fig. 2c–f) is 3-aperturate with one row of insulae on each side of the aperture. In palynological features, it resembles the nominate subspecies.

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## ARTIFICIAL INTERSPECIFIC HYBRIDIZATION OF TWO MEXICAN SPECIES OF RUELLIA (ACANTHACEAE)

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**ABSTRACT.** Artificial crosses between two morphologically similar, allopatric species of Mexican *Ruellia* (*R. californica* and *R. hirsutoglandulosa*) produced vigorous F<sub>1</sub> hybrids with greatly reduced pollen stainability. Morphological characters of the hybrids are unique, intermediate between the parents, or similar to those of a single parent. Results of infrageneric artificial hybridizations among species of *Ruellia* and among other genera of Acanthaceae do not appear to be routinely phylogenetically informative. Crossability of species in these genera is posited to be symplesiomorphic.

### INTRODUCTION

The ability of distinct taxa of *Ruellia* L. to hybridize naturally or to be artificially crossed has been documented between 60 pairs of some 24 taxa (Long 1961, 1964, 1966a, 1966b, 1966c, 1973, 1975, 1976a, 1976b). Hybridization within other genera of Acanthaceae has also been documented in nature (e.g., *Carlownrightia* A. Gray, cf. Daniel 1983) or demonstrated under artificial conditions (e.g., *Carlownrightia*, Daniel 1983; *Anisacanthus* Nees, Daniel 1984; *Tetramerium* Nees, Daniel 1986). Long's work over many years involving artificial crosses between taxa of *Ruellia* provides the most comprehensive record to date of infrageneric hybridizations, and their possible systematic implications, in the family.

*Ruellia* (Acanthoideae: Ruellieae) consists of between 250 and 300 species and occurs in temperate and tropical regions of both the Old World and the New World. In this study the results of artificial hybridizations between two species of *Ruellia*, *R. californica* (Rose) I. M. Johnst. and *R. hirsutoglandulosa* (Oerstr.) Hemsl., are described. Neither of these Mexican endemics was studied by Long. *Ruellia californica* consists of shrubs with blue-purple, trumpet-shaped flowers; it occurs in northwestern Mexico (Baja California, Baja California Sur, and Sonora) where plants grow in Sonoran desertscrub and thornscrub (Daniel 1997, 2004). Two subspecies of *R. californica* are recognized (Daniel 1997); plants used here represent the nominate subspecies. *Ruellia hirsutoglandulosa* consists of perennial herbs and shrubs with (white to) blue-purple, trumpet-shaped flowers; it occurs in eastern and southern Mexico (Guanajuato, Hidalgo, Oaxaca, Puebla, Querétaro, and Veracruz) where plants grow in thornscrub and tropical deciduous forest (Daniel 1999; Daniel & Acosta C. 2003). The geographic ranges of these two Mexican endemics do not overlap; however, the species are remarkably similar in numerous morphological characteristics including: vegetative vesture (glandular-pubescent), odor of vegetative organs (mephitic), leaf shape and size (blades mostly ovate to elliptic, 6–55 × 3–33 mm, and 1.1–2.6 times longer than wide), inflorescence type (axillary pedunculate dichasia with subfoliose to foliose bracteoles), and floral form (e.g., corollas blue-purple and trumpet-shaped).

They can be distinguished by the characters in the following couplet:

1. Branched eglandular trichomes present on abaxial surface of leaves and bracteoles; anther thecae pubescent with eglandular trichomes; capsule pubescent with dense eglandular trichomes and very sparse glandular trichomes (sometimes restricted to apex). *R. hirsutoglandulosa*
1. Branched trichomes absent from abaxial surface of leaves and bracteoles; anther thecae glabrous; capsule pubescent with sparse glandular trichomes only. *R. californica*

In order to ascertain fertility between these allopatric but morphologically similar species artificial cross-pollinations between them were attempted.

## MATERIALS AND METHODS

Seeds from field-collected plants of both *R. californica* (Daniel 204; Baja California Sur: Mpio. Santa Rosalía, Bahía Coyote, ca. 26°42'N, 111°55'W) and *R. hirsutoglandulosa* (Daniel 379; Querétaro: Mpio. Cadereyta, 8.7 mi N of Vizarrón, ca. 20°53'N, 99°45'W) were grown in a greenhouse at the Matthaei Botanical Gardens of the University of Michigan between 1978 and 1980. Floral life cycles were noted on the resulting mature plants: 8 flowers of *R. hirsutoglandulosa* and 5 flowers of *R. californica* were tagged and monitored. Fruit formation was also noted on mature plants of each species during periods of both open greenhouse conditions (when various local pollinating insects, including bees, were active in the experimental area) and closed greenhouse conditions (local pollinators excluded). For the interspecific hybridizations, 10 crosses and 10 reciprocal crosses were attempted. Cross pollinations were effected by: 1) removing unopened anthers from 10 mature flower buds in each species, and 2) dusting stigmas of ovule parent with pollen from detached and dehiscent anthers of pollen parent at about 1 hour after the corollas opened. For the reciprocal crosses, the species of the pollen and ovule parents were reversed. The manipulated flowers were tagged and subsequently monitored for fruit-set. Resulting  $F_1$  seeds were germinated and the  $F_1$  plants were grown to maturity. Eight morphological characters were scored for parental plants and hybrids. Characters associated with the inflorescence were based on structures associated with mature flowers only. Stainability of pollen from five flowers from plants of each parental species and from five  $F_1$  flowers was determined by placing pollen in aniline blue in lactophenol for 24 hours. All pollen grains encountered in three sweeps of a slide at fixed coordinates were scored for stainability. The greenhouse studies were terminated prior to any possible fruit-set among hybrid plants. Vouchers of the field-collected plants, the greenhouse-grown parental plants, and the resulting  $F_1$  hybrids are deposited at MICH.

## RESULTS

*Floral life cycle of parental species.* Most flowers observed in greenhouse-cultivated *R. californica* and *R. hirsutoglandulosa* were chasmogamous. Occasional cleistogamous flowers were present on plants of *R. hirsutoglandulosa*; the budlike, non-opening corollas of these flowers were whitish and 5–9 mm long. Under open greenhouse conditions unmanipulated and mature flowers of *R. hirsutoglandulosa* persisted (from opening to dehiscence/falling of the corolla) for 24 hours (or less) to 48 hours. Corollas lasting for 24 hours or less were all noted to be pollinated following floral dehiscence; it is not known whether pollination was due to local floral visitors or autogamy. Corollas of *R. californica* persisted between 36 and 48 hours. Four

TABLE 1. Results of artificial interspecific hybridization between *Ruellia californica* (Daniel 204) and *R. hirsutoglandulosa* (Daniel 379), and pollen stainability of parental plants. Artificial self-pollinations were not attempted for parental plants (see text).

Cross/taxon	No. fruits set/ no. attempts	Percent	No. stained pollen grains/no. grains counted	Percent
204 (♀) × 379 (♂)	10/10	100	167/556	30%
379 (♀) × 204 (♂)	10/10	100	104/472	22%
204	—	—	578/674	86%
379	—	—	453/487	93%

of five flowers were observed to be pollinated following floral dehiscence; some were pollinated as the corolla with the epipetalous stamens fell (i.e., autogamous), which movement brought the anthers and stigma into contact. The following observations were noted in both taxa: 1) the anthers dehisced just prior to or within 30 minutes following the opening of the corolla, 2) the proximal end of the stigma extended 1–4 mm beyond the anthers of the distal pair of stamens when the corolla was fully open, and 3) the stigma lobes separated from one another within 30 minutes after opening of the corollas and the longer lobe progressively recoiled with age of the flower. Numerous fruits developed in the absence of manual self-pollinations on the greenhouse-grown plants of each species under both open and closed greenhouse conditions.

*Interspecific hybridizations.* Fruit-set and pollen stainability of the artificial hybridizations are summarized in Table 1. Pollen stainability in the parental plants is also provided in Table 1. All crosses resulted in seed-set.  $F_1$  hybrids from both crosses and reciprocal crosses produced vigorous plants that flowered prior to termination of the study. Crosses and reciprocal crosses are equally capable of setting fruits with seeds; the resulting hybrid plants are morphologically similar to one another; and all  $F_1$  hybrids have greatly reduced pollen stainability compared to the parental plants. Non-stained pollen was clearly differentiated from stained grains (Fig. 1); non-stained grains did not take up blue pigment, were usually between  $\frac{1}{2}$  and  $\frac{3}{4}$  the diameter of stained grains, and were sometimes misshapen or collapsed. Partially stained grains (e.g., Fig. 1C) were counted as stained even if reduced in size or misshapen. Morphological characters scored for parental plants and  $F_1$  hybrids are noted in Table 2.

## DISCUSSION

Floral form, floral life cycle, and the breeding system of *R. hirsutoglandulosa* and *R. californica* are similar to those reported for most other species of *Ruellia* by Long (e.g., 1966a: 919): flowers are 1) large with trumpet-shaped, bluish corollas and included stamens and stigma, 2) relatively ephemeral, 3) self-compatible, and 4) at least partially autogamous. Although Long (1966a) indicated that species of *Ruellia* are protogynous, he provided no data to document this; indeed, the onset and duration of stigma receptivity, as well as pollen longevity, have yet to be adequately determined for most species of *Ruellia*. Daniel (1993) noted that experimental studies of 51 species in 16 genera of Mexican Acanthaceae reveal that most are self-compatible and at least partially autogamous. Long (e.g., 1966a) documented self-compatibility

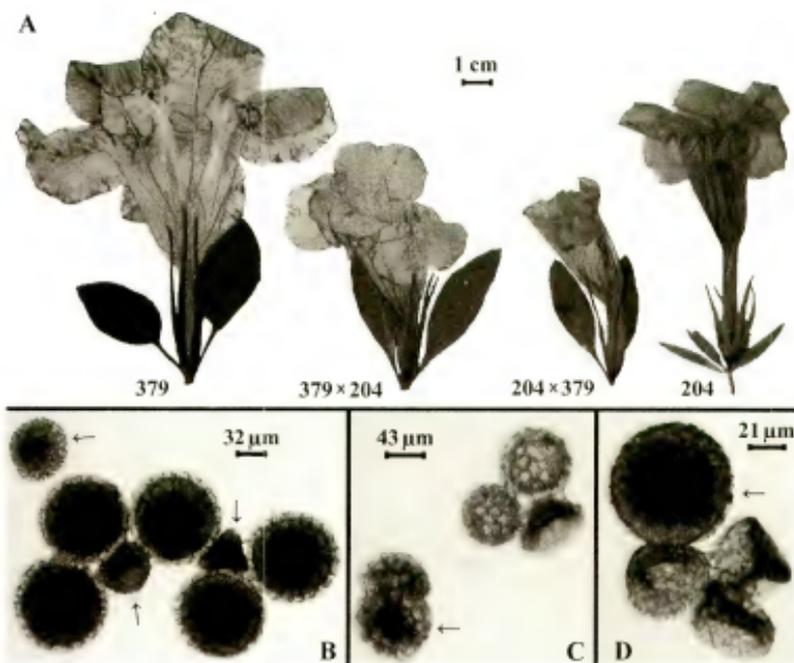


FIG. 1. *Ruellia californica* (Daniel 204), *R. hirsutoglandulosa* (Daniel 379), and their  $F_1$  hybrids (female parent listed first in crosses). A. Flowers and bracteoles from greenhouse-grown plants. B. Pollen stained in aniline blue in lactophenol from parental plant of *R. californica* (arrows indicate non-stained grains). C. Pollen stained in aniline blue in lactophenol from  $F_1$  hybrid (379  $\times$  204; arrow indicates partially stained grain). D. Pollen stained in aniline blue in lactophenol from  $F_1$  hybrid (204  $\times$  379; arrow indicates stained grain).

and noted autogamy for 12 species of *Ruellia*. Although self-compatibility/autogamy/agamospermy tests (e.g., Daniel 1986, 1990) were not conducted on either *R. californica* or *R. hirsutoglandulosa*, both appear to be self-compatible on the basis of frequent fruit formation and viable seed-set from unmanipulated flowers on single, isolated plants of each when grown under greenhouse conditions; autogamy was observed in some flowers of *R. californica* and undoubtedly occurs to some extent in *R. hirsutoglandulosa* as well.

$F_1$  hybrids in *Ruellia* are generally morphologically intermediate between the parental taxa (e.g., Long 1966a, 1970, 1973). Table 2 reveals that  $F_1$  hybrids of *R. californica* and *R. hirsutoglandulosa* are intermediate between the parental plants with respect to length of the bracteole stalks, bracteole shape, bracteole width, and calyx length; however, the hybrids lack any of the branched trichomes characteristic of *R. hirsutoglandulosa*. Like the latter species, anther thecae of the hybrids are dorsally pubescent, but the eglandular trichomes tend to be sparser (i.e., fewer in number) than those of parental plants of *R. hirsutoglandulosa*; thus, the density of pubescence of the thecae in hybrids could be interpreted as intermediate between the parental plants. Corollas of the hybrid plants are generally smaller than those of either parental species (Fig. 1A). Thus, the  $F_1$  hybrids exhibit a complex pattern of characters with

TABLE 2. Morphological comparison of *Ruellia californica* (Daniel 204), *R. hirsutoglandulosa* (Daniel 379), and their F<sub>1</sub> hybrids (female parent listed first in crosses).

	204	204×379	379×204	379
Branched eglandular trichomes on abaxial surface of leaves and bracteoles	absent	absent	absent	present
Peduncle length	2.5–4 mm	2–2.5 mm	4 mm	14–38 mm
Bracteole stalk length	0–1.5 mm	1.5–5 mm	3–3.5 mm	3–6 mm
Bracteole blade shape	linear to lanceolate to narrowly elliptic to oblanceolate	narrowly elliptic to elliptic	elliptic	ovate to ovate-elliptic
Bracteole width	0.9–2.5 mm	3–6 mm	5–7.5 mm	4.5–11 mm
Calyx length during anthesis	10–16 mm	11–19 mm	12–19 mm	19–27 mm
Corolla length	(36–) 42–56 mm	(21–) 31–36 mm	(16–) 24–39 mm	(32–) 46–57 mm
Pubescence of anther thecae	glabrous	sparsely pubescent with eglandular trichomes	sparsely pubescent with eglandular trichomes	pubescent with eglandular trichomes

respect to the parental plants, involving intermediacy (e.g., calyx length), attributes characteristic of only one parent (e.g., lack of branched trichomes), and characters found in neither parent (e.g., corolla size). Assuming that pollen stainability is correlated with pollen fertility (Radford et al. 1974), the vigorous and floriferous hybrid plants exhibit greatly reduced pollen fertility with respect to the parental plants. Because seed set was not determined in the hybrids, their overall fertility remains unknown.

There appear to be no morphological or genetic barriers to the production of F<sub>1</sub> hybrids between *R. californica* and *R. hirsutoglandulosa*. Although these species have allopatric distributions and natural hybridization between them would be unlikely, both share several morphological attributes that suggest either some degree of phylogenetic relatedness or adaptive convergence. Phylogenetic studies of *R. hirsutoglandulosa* indicate affinity to a diverse assemblage of morphologically dissimilar species from southern Mexico, including *R. bourgaei* Hemsl., *R. conzattii* Standl., *R. fruticosa* Sessé & Moc., *R. jaliscana* Standl., *R. pringlei* Fern., and *R. speciosa* (Nees) Lindau (Tripp, in press); phylogenetic studies of *R. californica* have yet to be conducted. Character convergence of shared traits might result from adaptations to similar pollinators and/or to similar arid environments in which they grow. The blue, trumpet-shaped flowers of both species are suggestive of pollination by medium- to large-sized bees/flies (and probably also secondary visitation by hummingbirds and lepidopterans; cf. Long 1966c, 1971; Freeman 1986); the prominent glandular trichomes and relatively small leaves are possible adaptations to their occurrence in desert and thornscrub habitats.

Long (1970, 1975) equated degree of fertility as demonstrated by artificial interspecific hybridizations with evolutionary relationship (i.e., phylogenetic affinity). Recent phylogenetic studies within *Ruellia* based on molecular sequence data

(Tripp, in press) reveal that Long's interspecific hybridizations represent crosses both within and between major lineages of the genus. In some cases, hybrids between species from different lineages (e.g., *R. tuberosa* L.  $\times$  *R. inundata* H. B. K., cf. Long 1976b) exhibited fertility equal to or greater than that of interspecific hybrids within a lineage (e.g., *R. tuberosa*  $\times$  *R. nudiflora* (Engelm. & A. Gray) Urb., cf. Long 1976; *R. coerulescens* Morong  $\times$  *R. nudiflora*, cf. Long 1966b [as *R. brittoniana* Leonard  $\times$  *R. occidentalis* (A. Gray) Tharp & F. A. Barkley]). Thus, a correlation between interspecific fertility and infrageneric phylogenetic affinity is not necessarily warranted. Likewise, artificial crosses among species of *Carlowrightia* (Daniel 1983) and *Tetramerium* (Daniel 1986) and the relative fertilities of their hybrids do not always correlate with phylogenetic distance (Daniel et al., in press). Instead, a relatively high degree of crossability might be symplesiomorphic for a taxon or lineage, and lack of crossability might result from either simple morphological differences unrelated to phylogenetic distance (cf. Daniel 1984; Ornduff 1969) or apomorphic genetic alterations that preclude successful hybridizations with some or all other taxa.

Artificial crosses can provide evidence of the role that interspecific hybridization has played (or might play) in the evolution of genera such as *Ruellia*. Natural hybridization of taxa in *Ruellia* is known (e.g., Long 1970), and the morphology of some species (e.g., *R. purshiana* Fern., *R. malacosperma* Greenm.) has led to speculation that they likely are of hybrid origin (Long 1966b, 1970). Natural hybridization can cause intergradation of sympatric species, as suggested for *R. caroliniensis* (Walt.) Steud. and *R. humilis* Nutt. by Long (1970), who successfully hybridized these species. Hybridization between species of *Ruellia* also has practical implications. Many species of *Ruellia* are horticulturally significant. *Horus Third* (L. H. Bailey Hortorium 1976) lists 23 species of the genus as cultivated in the United States and Canada. Because of the relatively high fertility of crosses demonstrated between many species of *Ruellia*, including phylogenetically distant pairs of taxa, interspecific hybridizations have the potential to produce desirable characteristics for new horticultural offerings in this morphologically and ecologically diverse genus.

#### ACKNOWLEDGMENTS

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## TWO NEW SPECIES OF JUSTICIA (ACANTHACEAE) FROM THE RÍO BALSAS BASIN OF MICHOACÁN, MEXICO

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**ABSTRACT.** Two new species of *Justicia*, *J. huacamensis* and *J. lucindae*, are described from the Infernillo region of the Río Balsas basin in southern Michoacán. Brief discussions about Acanthaceae in the Balsas basin and putative relatives of these species are provided.

The drainage basin of the Río Balsas in southern Mexico comprises approximately 112,320 square kilometers in the states of Guerrero, Jalisco, México, Michoacán, Morelos, Oaxaca, Puebla, and Tlaxcala. It is an east-west oriented region located between the crest of the Transvolcanic Axis to the north and the crest of the Sierra Madre del Sur to the south. Due to high levels of diversity and endemism, Rzedowski (1978) treated the lower elevations of this area as the Balsas Depression Floristic Province. Fernández et al. (1998) applied a strictly geographical definition for this region that included the entire watershed of the Río Balsas. They listed 4,442 vascular plants as occurring there. These included 79 species of Acanthaceae. Some of the names on their list refer to species that likely do not occur in the region (e.g., *Aphelandra madrensis* Lindau, *Jacobinia leucothamna* Standl., *Justicia alopecuroidea* T. F. Daniel, and *Louteridium rzedowskii* T. F. Daniel) or are synonymous with other names listed (e.g., *Henrya ortegana* Happ = *H. insularis* Nees ex Benth., *Tetramerium hispidum* = *T. nervosum*, *Ruellia occidentalis* = *R. nudiflora*, and *Carlowrightia costaricana* Leonard = *C. arizonica* A. Gray). Numerous other species have been reported from the region (e.g., *Aphelandra lineariloba* Leonard, *Carlowrightia hintonii* T. F. Daniel, *C. mcvaughii* T. F. Daniel, *Henrya tuberculosperra* T. F. Daniel, *Holographis hintonii* (Leonard) T. F. Daniel, *Justicia brandegeana* Wash. & L. B. Sm., *J. hilsenbeckii* T. F. Daniel, *Odontonema cuspidatum* (Nees) Kuntze, *Poikilacanthus capitatus* (Leonard) Ramamoorthy, *Ruellia chilpancingana* T. F. Daniel, *R. guerrerensis* T. F. Daniel, *R. pringlei* Fernald, *Stenostephanus harleyi* (Wassh.) T. F. Daniel, *Tetramerium langlassei* Happ, *T. tenuissimum* Rose). Although a thorough study of Acanthaceae in the Balsas basin has yet to be completed, the total number of species there likely approaches 100.

Rodríguez-Jiménez et al. (2005) listed 337 species of vascular plants as endemic to the Balsas basin, including three acanths: *Aphelandra verticillata* Nees ex Hemsl., *Justicia zopilotensis* Henr. & Hiriart, and *Ruellia fruticosa* Sessé & Moc. In fact, at least nine additional species of Acanthaceae are endemic there: *Holographis argyrea* (Leonard) T. F. Daniel, *Ruellia cedilloi* Ramamoorthy, *Stenandrium manchonense* T. F. Daniel, *Tetramerium butterwickianum* T. F. Daniel, *T. emilyanum* T. F. Daniel, *T. glutinosum* Lindau, *T. ochoterennae* (Miranda) T. F. Daniel, and the two species described

below. If the revised numbers for Acanthaceae suggested here are representative of other large families, then the numbers of species both present in and endemic to the region are higher than previously reported.

The hottest and driest portion of the Balsas basin occurs in the Infiernillo region of southern Michoacán and adjacent Guerrero. This region is centered around the Presa Infiernillo, a reservoir resulting from the damming of the Río Balsas just downstream from its confluence with the Río Tepalcatepec. A general description of the area is provided by Guevara-Fefer and Rzedowski (1980), who note that it is a particularly important center of endemism within the Balsas basin. Due to access limitations, the portion in Guerrero has been almost completely ignored with regard to biological exploration; however, the portion in Michoacán is better known. It is particularly rich in Acanthaceae; we have documented 35 species there. Five of these appear to be endemic to the Infiernillo region: the two species of *Justicia* herewith described, *Tetramerium butterwickianum*, an undescribed species of *Justicia*, and an undescribed species of *Tetramerium*. This number represents nearly one-half of Acanthaceae endemic to the entire Balsas basin. Other recent and significant collections of Acanthaceae from this region include *Holographis hintonii* (Leonard) T. F. Daniel and *Ruellia pringlei* Fernald (Daniel 2005), as well as *Poikilacanthus novogalicianus* T. F. Daniel (*Steinmann 3408* at CAS), a species previously known only from the type locality in Colima.

The two species described below appear to be related to a group of taxa from western and southern Mexico with red, conspicuously funnelliform, and moderately long (20–45 mm long) corollas. This assemblage includes *Justicia candicans* (Nees) L. D. Benson, *J. palmeri* Rose, and *Jacobinia roseana* Leonard (a combination for this species in *Justicia* has not been proposed; indeed, it remains unclear whether it should be treated as distinct from *J. candicans*). All of these taxa also have five more or less equal calyx lobes and glabrous capsules 7–16 mm long. A larger group of *Justicia* with similar corollas, but with variation in the number and/or relative sizes of the calyx lobes and in the length and pubescence of the capsules includes: *J. adenothyrsa* (Lindau) T. F. Daniel, *J. cuicatana* T. F. Daniel, *J. hians* (Brandege) Brandege, *J. novogaliciana* T. F. Daniel, *J. oaxacana* (Greenm.) T. F. Daniel, *J. paucifolia* T. F. Daniel, and *J. stellata* (B. L. Rob. & Greenm.) T. F. Daniel. Like both species described below, all other species in this larger assemblage have 2-aperturate pollen with two or three rows of insulae on each side of the aperture. Species in this assemblage have been affiliated with Graham's (1988) related sections *Plagiacanthus* (Nees) V. A. W. Graham (e.g., *J. candicans*) and *Sarotheca* (Nees) Benth. (e.g., *J. hians*). Putative phylogenetic relationships among these species are not yet known, and the extent to which some or all of them comprise one or more monophyletic lineages within *Justicia* probably will be addressed most effectively by molecular phylogenetic studies.

***Justicia huacanensis*** T. F. Daniel & V. W. Steinm., sp. nov.—TYPE: MEXICO, Michoacán: Mpio. La Huacana, along MEX 37, 5.2 km SE of Cupuancillo, above highway on SW slopes of Mesa La Lima, ca. 18°48'00"N, 102°05'00"W, 450 m, tropical deciduous forest, 24 Nov 2002, V. Steinmann 3024 (holotype: IEB!; isotype: CAS!). Fig. 1.

Frutices usque ad 2 m alti. Folia petiolata, laminae ovatae vel ovato-ellipticae, 15–75 × 10–33 mm. Dichasia pedunculata e foliorum axillis orta. Bracteolae deltatae vel cordatae, 10–22 × 10–18 mm. Calyx 5-lobus, lobis lineari-ellipticis vel oblanceolatis, 4–4.5 mm longis. Corolla coccinea, 24–35 mm longa, extus pubescens trichoma-



Fig. 1. *Justicia huacanenensis* (Steinmann 3024). a. Node with pedunculate dichasia, bracteoles, and a flower,  $\times 1.6$ . b. Calyx,  $\times 5$ . c. Anther,  $\times 12.5$ . d. Capsule,  $\times 3.4$ . e. Seed,  $\times 4.5$ .

tibus eglandulosus. Stamina thecis 2–2.3 mm longis, subparallelis, subpariter insertis, basi calcaratis vel inconspicuo calcaratis. Capsula 10–13 mm longa, glabra. Semina laevia.

Shrubs to 2 m tall. Young stems subterete to quadrate, nearly glabrous to 1- or 2-fariously pubescent, trichomes retrorse or antrorse, 0.2–0.6 mm long. Leaves petiolate, petioles to 8 mm long, blades ovate to ovate-elliptic, 15–75 mm long 10–33 mm wide, 1.8–2.3 times longer than wide, (acute to) acuminate at apex, subattenuate to rounded-acute at base, margin entire, surfaces nearly glabrous to pubescent with eglandular trichomes (mostly or entirely along major veins). Inflorescence of prominently bracteolate dichasia in leaf axils; dichasia alternate or opposite at nodes, 1–3 per axil, 1–2 (or more?)-flowered, pedunculate, peduncles 4–20 mm long,  $\pm$  2-fariously or evenly pubescent with flexuose to antrorse to retrorse eglandular trichomes 0.1–0.2 mm long. Bracteoles ovate to deltate to cordate, 10–22 mm long, 10–18 mm wide, abaxial surface pubescent with antrorse to antrorsely appressed eglandular trichomes 0.1–0.2 mm long, trichomes concentrated along (or restricted to) proximal portion of midvein, secondary bracteoles (if present) much reduced. Flowers subsessile. Calyx 5-lobed, 5.5–6 mm long, lobes linear-elliptic to oblanceolate, narrowed basally, 4–4.5 mm long, 1–1.5 mm wide, abaxially sparsely pubescent with antrorse to antrorsely appressed eglandular trichomes 0.05–0.2 mm long. Corolla scarlet-red, 24–35 mm long, externally pubescent with erect to flexuose to retrorse eglandular trichomes 0.1–0.4 mm long, tube 15–23 mm long, 2.5–3 mm in diameter near midpoint, gradually expanded distally from near base, upper lip 9–13.5 mm long, apically 2-lobed, lower lip 12–13.5 mm long, lobes 5–6 mm long, 3.5–4.4 mm wide. Stamens 13.5–18 mm long, filaments puberulent proximally and glabrous distally, thecae 2–2.3 mm long, equal in size, subparallel, subequally inserted, glabrous, lacking basal appendages or with an inconspicuous basal appendage to 0.1 mm long; pollen (Fig. 2) 2-aperturate, apertures flanked on each side by 2 rows of insulae, exine reticulate. Style 23–25 mm long, glabrous; stigma 0.2 mm long, lobes not evident. Capsule 10–13 mm long, glabrous, head

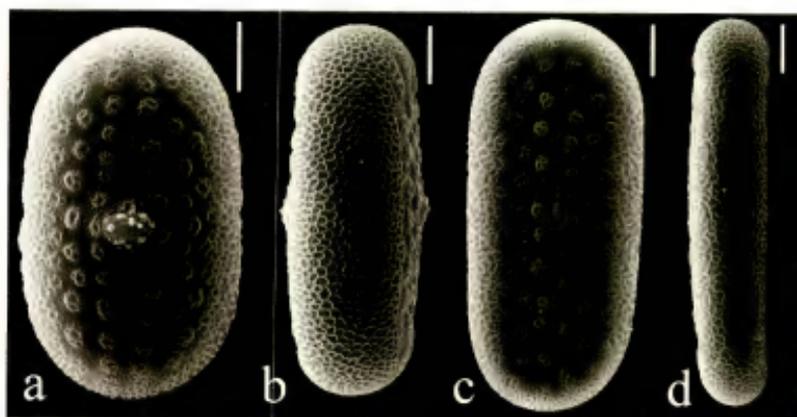


Fig. 2. Scanning electron micrographs of pollen. a–b. *Justicia huacanensis* (Steinmann 3024). a. Apertural view. b. Interapertural view. c–d. *Justicia lucindae* (Steinmann 1699). c. Apertural view. d. Interapertural view. Scales = 10  $\mu$ m.

subspheric to subellipsoid, stipe 5 mm long. Seeds plano-convex to concavo-convex, sublenticular, 2.6–3 mm long, 2.8–3 mm wide, surface smooth, lacking trichomes.

Phenology. Flowering: July–November; fruiting: November.

Distribution (Fig. 3). Known only from south-central Michoacán where plants occur in tropical deciduous forest at elevations from 300 to 750 m.

**PARATYPEs.** **Mexico.** MICHOCÁCN: Mpio. La Huacana, Jabalín, Los Ciriancitos (Ejido Lázaro Cárdenas), 18°42'52"N, 101°58'57"W, *H. Rendón C. 151* (IEB); Mpio. La Huacana, ca. 3.5 km WSW of Los Ranchos, ca. 18°41'30"N, 102°02'40"W, 300 m, 8 Nov 2003, *V. Steinmann 3865* (IEB, CAS); Mpio. La Huacana, ca. 2 km ENE of Los Ranchos, along ridge top of Cerro El Barril, 18°42'35"N, 102°00'00"W, 750 m, 27 Sep 2003, *V. Steinmann & E. Carranza 3557* (IEB, CAS).

This species appears to have affinities with Graham's (1988) section *Plagiacanthus*. The most conspicuous and distinctive feature of *J. huacanensis* is the presence of large, ovate to deltate to cordate bracteoles that subtend the flowers. Variation among the known collections is rather minimal.

The specific epithet refers to the municipality of La Huacana in Michoacán, where all of the collections have been made.

**Justicia lucindae** T. F. Daniel & V. W. Steinm., sp. nov.—**TYPE:** MEXICO. Michoacán: Mpio. Arteaga, along road to Infiernillo, 17.5 km SE of jct. with Mex. 37, 18°25'32"N, 101°54'30"W, ca. 325 m, tropical deciduous forest, 24 Jun 2001, *V. Steinmann 1699* (holotype: IEB!; isotype: CAS!). Fig. 4.

Frutices usque ad 2 m alti. Folia sessilia vel subsessilia (petioli usque ad 0.5 mm longi), laminae ovatae vel ovato-ellipticae vel subcordatae, 9–39  $\times$  8–27 mm. Dichasia sessilia e foliorum vel bractearum axillis orta, spicam terminalem usque ad 20 mm longam formantes. Bracteolae lineares, 4.7–6.5  $\times$  0.5–0.7 mm. Calyx 5-lobus, lobis lineari-ellipticis, 4–4.9 mm longis. Corolla roseo-rubra, 25–30 mm longa, extus pubescens trichomatibus eglandulosis et glandulosis. Stamina thecis 1.3–1.6 mm longis, subparallelis, subpariter insertis, basi ecalcaratis vel inconspicuo calcaratis. Capsula 8–9.5 mm longa, glabra. Semina tuberculata.

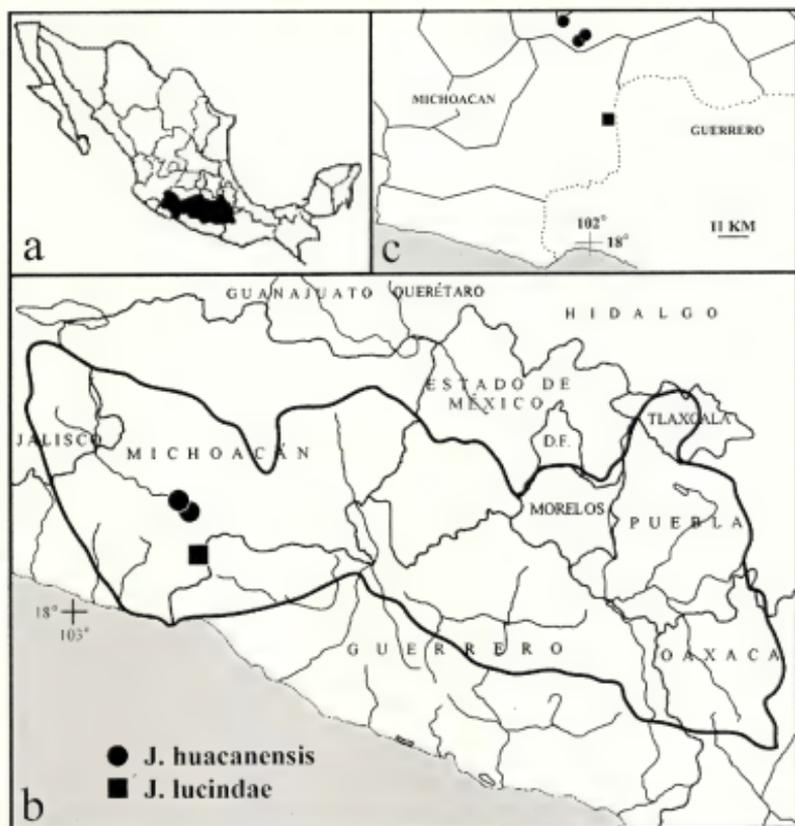


Fig. 3. Río Balsas Basin and distributions of *J. huacanensis* and *J. lucindae*. a. Mexico showing location of drainage basin of the Río Balsas (based on Fernández et al. 1998). b. Outline of the Balsas Basin (based on Fernández et al. 1998) with species distributions. c. Portion of southern Michoacán (showing boundaries of municipalities) and western Guerrero with species distributions.

Shrubs to 2 m tall. Young stems subterete to subquadrate, internodes glabrous or (evenly to) 2-fariously pubescent with erect to flexuose eglandular trichomes 0.5–1 mm long and branched (often arachnoid) eglandular trichomes 0.1–0.5 mm long, trichomes (if present) sometimes restricted to distal portion of internodes, nodes pubescent with straight to flexuose eglandular trichomes to 1.2 mm long. Leaves sessile to subsessile, petioles to 0.5 mm long, blades ovate to ovate-elliptic to subcordate, 9–39 mm long, 8–27 mm wide, 1.1–1.9 times longer than wide, rounded to subacute at apex, rounded to truncate to subcordate and sometimes  $\pm$  amplexicaulis at base, margin entire, adaxial surface glabrous or sparsely pubescent with branched-arachnoid trichomes along midvein, abaxial surface sparsely to densely pubescent with cauline type trichomes along midvein (and sometimes along secondary veins as well). Inflorescence of relatively short sessile to pedunculate terminal dichasiate spikes to 20 mm long (including peduncle, if present), peduncles (if present) to 8 mm long, glabrous, rachis glabrous, often without significant internodal elongation; dichasia

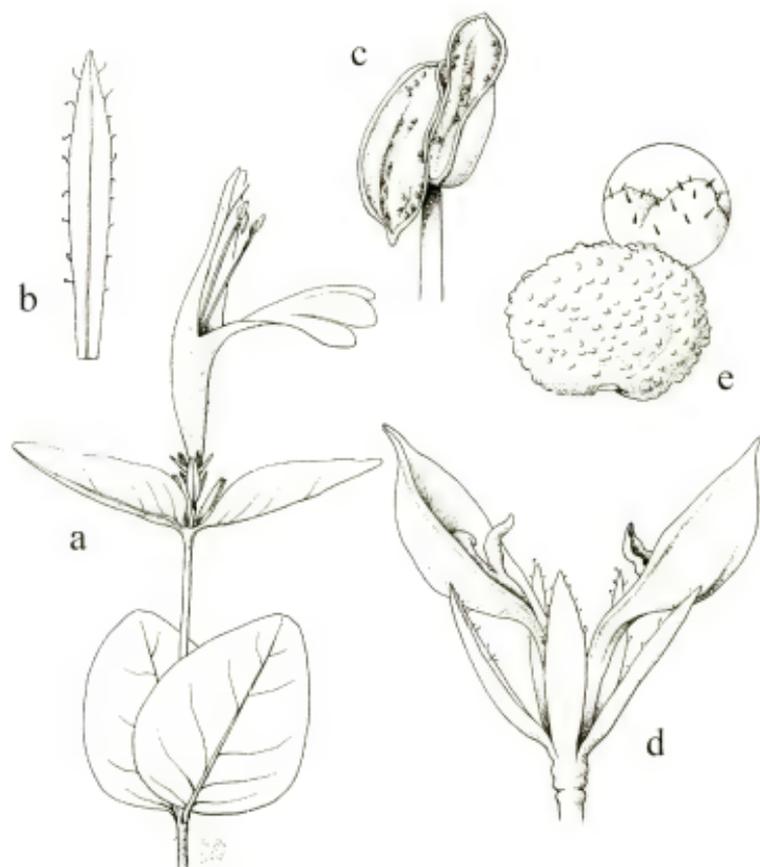


Fig. 4. *Justicia lucindae* (Steinmann 1699). a. Distal portion of shoot with inflorescence and flower,  $\times 1.9$ . b. Bracteole,  $\times 8.3$ . c. Distal portion of stamen with anther,  $\times 20$ . d. Calyx and capsule,  $\times 6$ . e. Seed ( $\times 10.9$ ) with enlargement of tubercle ( $\times 98$ ) showing trichome-like projections.

opposite, sessile, 1-flowered, 1 per axil, subtended by a leaf (i.e., proximalmost pair of dichasia sometimes subtended by distalmost pair of leaves, and thus spikes sessile) or bract. Bracts elliptic to linear-elliptic to oblanceolate, 6.5–9 mm long, 1.1–3 mm wide, abaxial surface glabrous or very sparsely pubescent with glandular trichomes like those along margin, margin ciliate with erect to flexuose glandular trichomes 0.1–0.9 mm long (glandular-pubescent). Bracteoles linear (to linear-oblanceolate), 4.7–6.5 mm long, 0.5–0.7 mm wide, abaxial surface glabrous or pubescent like bracts. Flowers sessile to subsessile. Calyx 5-lobed, 5–6.5 mm long, lobes linear-elliptic, 4–4.9 mm long, 1–1.5 mm wide, abaxial surface glabrous (rarely with few scattered glandular trichomes), margin glandular-pubescent (and often with an understorey of eglandular to subglandular trichomes to 0.05 mm long as well). Corolla pink-red, 25–30 mm long, externally pubescent with flexuose eglandular and glandular trichomes 0.1–0.4 mm

long, tube 15–19 mm long, gradually expanded distally, 2–2.6 mm in diameter near midpoint, upper lip 11–15 mm long, apically 2-lobed, lower lip 10–12 mm long, lobes 6.5–7 mm long, 2.2–3.7 mm wide. Stamens 11–13 mm long, filaments glabrous, thecae 1.3–1.6 mm long, equal to subequal in size, subparallel, subequally inserted (overlapping by 1–1.2 mm), glabrous, lacking basal appendages (or with inconspicuous basal appendages to 0.1 mm long); pollen (Fig. 2) 2-aperturate, apertures flanked on each side by 2 rows of insulae, exine reticulate. Style 24–29 mm long, glabrous; stigma 0.2 mm long, lobes not evident. Capsule 8–9.5 mm long, glabrous, head subspheric to subellipsoid, stipe 3.5–4 mm long. Seeds sublenticular, 2.5–3.2 mm long, 2.5–3 mm wide, surfaces covered with subconic tubercles (especially along margin), tubercles covered with minute trichomelike projections.

Phenology. Flowering: June; fruiting: June.

Distribution (Fig. 3). Known only from a single locality in southeastern Michoacán where a few dozen plants occur along a small ravine in tropical deciduous forest at an elevation of about 325 m.

This species appears to have affinities with Graham's (1988) section *Plagiacanthus*, from which it differs most noticeably by its tuberculate (vs. smooth in sect. *Plagiacanthus*) seeds. Among Mexican *Justicia*, *J. lucindae* can be distinguished by the combination of its sessile to subsessile leaves, linear bracteoles 4.7–6.5 mm long, pink-red corollas, and minute trichomelike projections on the seminal tubercles.

The epithet of this species honors Lucinda McDade (b. 1953), our friend, colleague, and first teacher of systematic botany (Steinmann). Her molecular studies of Acanthaceae have greatly advanced our understanding of relationships in the family.

#### ACKNOWLEDGMENTS

We are grateful to Alan Chou for preparing the illustrations of species and Scott Serata for assistance with scanning electron microscopy. Steinmann's studies were supported by a grant from the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad to the Instituto de Ecología, A.C. (account number 902-03).

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## **XYLOPIA DECORTICANS (ANNONACEAE), A NEW CAULIFLOROUS SPECIES FROM BRAZIL**

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**ABSTRACT.** *Xylopia decorticans*, a new species described from moist lowland forest localities in Espírito Santo, Brazil, is remarkable among Annonaceae for the reddish brown exfoliating bark of its twigs and its cauliflory. It is related to a group of Neotropical *Xylopia* species characterized by relatively broad and flat petals, and most closely resembles another southeastern Brazilian species, *X. lanceolata* R. E. Fries, which in contrast has smooth twigs, axillary inflorescences, shorter petals, and shorter leaves with ascending secondary veins.

**RESUMO.** *Xylopia decorticans*, uma nova espécie descrita nas localidades de floresta úmida de baixada do Espírito Santo, Brasil, destaca-se entre as Annonaceae pela casca dos ramos marrom avermelhada esfoliante e cauliflora. A espécie é relacionada à um grupo neotropical de espécies de *Xylopia* com pétalas largas e planas e se assemelha à outra espécie do sudeste brasileiro, *X. lanceolata* R. E. Fries, porém essa tem ramos lisos, inflorescências axilares, pétalas menores e folhas menores com nervuras secundárias ascendentes.

Approximately 150 species of *Xylopia* are distributed across both the New World and Old World tropics, a broad distribution unique in the family Annonaceae. All species of this genus are trees or shrubs, the Neotropical species often with a distinctive pyramidal habit and downswept branches. The flowers, which have pointed petals, are usually borne in axillary inflorescences and are only rarely borne on the trunk. *Xylopia* is one of the few genera of Annonaceae with dehiscent fruits: the individual monocarps of the aggregate fruits open to display seeds with either fleshy seed coats or arils against a brightly colored fruit interior.

In the Neotropics there are about 60 species of *Xylopia*, these most recently enumerated by Fries (1959). Within the Neotropical group Fries distinguished several species characterized by relatively short broad buds and petals, these occurring either in the coastal forests of eastern and southeastern Brazil (*X. laevigata* (Mart.) R. E. Fries, *X. lanceolata* R. E. Fries, *X. langsdorfiana* A. St.-Hil. & Tul., and *X. ochrantha* Mart.) or in the upper Amazon River basin (*X. cuspidata* Diels, *X. longicuspis* R. E. Fries, *X. peruviana* R. E. Fries, *X. platypetala* R. E. Fries, and *X. poeppigii* R. E. Fries). Since Fries's 1959 monograph *Xylopia involucreta* Dias & Kinoshita has been described from eastern coastal Brazil, but it differs from those species mentioned above because of its larger broad leathery leaves and copious brown indumentum of the leaves and twigs (Dias & Kinoshita 1998).

Recent collecting in the state of Espírito Santo in southeastern Brazil has revealed a species of the broad-petaled group remarkable among Annonaceae for the reddish brown flaking bark of its twigs. It is furthermore distinctive in its cauliflorous habit, with short-pedicelled flowers arising from tubercles that develop on the

trunk and leafless branches, a relatively uncommon characteristic within the genus but a condition found in several species of this group of xylopias.

**Xylopia decorticans** D. M. Johnson & Lobão, sp. nov.—TYPE: BRAZIL. Espírito Santo: Mpio. Santa Teresa, Nova Lombardia, Reserva Biológica Augusto Ruschi, trilha da Tronqueira, 8 Oct 2002, R. R. Vervloet, E. Bausen & W. Pizziolo 1172 (holotype: MBML!; isotypes: RB!). Fig. 1.

Species petalis latis planis et foliis elongato-lanceolatis longioribus minimum 12 cm longis Xylopiæ lanceolatae similis, sed ramunculis decorticantibus cortice rufa et inflorescentiis in trunco vel ramis post lapsum foliorum portatis differens.

Tree or treelet 2–11 m tall, with a DBH of 5–11 cm; bark longitudinally furrowed. Twigs with reddish brown flaking bark (Fig. 1A, B), initially sparsely appressed golden-pubescent, soon glabrate, the hairs 0.2–0.3 mm long, lenticellate. Lamina of larger leaves 9–24 cm long, 2–4.8 cm wide, concolorous, chartaceous to subcoriaceous with a thickened yellow margin, lanceolate to oblong-lanceolate or rarely ovate, cuneate to broadly cuneate at the base, acute to attenuate at the apex, occasionally acuminate or rounded, glabrous above, sparsely pubescent at the base and along the midrib but otherwise glabrous below; midrib impressed to slightly impressed above, raised below; secondary veins 15–25 per side, at midpoint of leaf diverging at 70–100° from the midrib, brochidodromous, intersecondaries occasionally strong; secondary and higher-order veins raised on both surfaces, the higher-order veins forming a conspicuous reticulum. Petiole 3–8 mm long, 1–2 mm thick, shallowly canaliculate adaxially, sparsely appressed golden-pubescent to glabrate. Inflorescences of 1–5 flowers, arising from tubercles on the trunk or on leafless branches; pedicels 4.7–10 mm long, densely appressed-pubescent; bract solitary, clasping the pedicel, 1.5–2 mm long, 2.2–4 mm wide, ovate, obtuse or occasionally bilobed, appressed-pubescent. Buds broadly lanceolate, obtuse. Sepals green *in vivo*, free to short-connate at the base, reflexed at anthesis (Fig. 1D), 1.8–4 mm long, 3.3–5 mm wide, crescent-shaped, rounded at the apex, appressed-pubescent. Petals red to pale pink *in vivo*, fleshy; outer petals 16–22 mm long, 5–8 mm wide at base, 3.5–6 mm wide at midpoint, lanceolate, acute at apex, keeled externally, concavity extending nearly to apex internally (keeled for 1–2 mm at tip), appressed-pubescent inside but with a glabrous patch at base (Fig. 1E), golden appressed-pubescent externally; inner petals 8–18 mm long, 3.3–6 mm wide at base, 1.7–2.0 mm wide at midpoint, lanceolate, keeled externally, keeled from midpoint to apex internally, proximally giving way to a groove that widens into the basal concavity, densely pubescent on both surfaces except at the base. Stamens ca. 120, 1–1.3 mm long, narrowly oblong; anthers septate at anthesis, with 6–8 locules; apex of connective 0.1–0.2 mm long, flattened, overhanging anther thecae, minutely papillate; outermost stamens staminodial (Fig. 1H), 1.0–1.3 mm long, clavate to quadrate; staminal cone 2.1–2.4 mm in diameter, 0.3–0.8 mm high. Carpels ca. 17, 5–6 mm long; ovaries 1.1–1.5 mm long, oblong, densely pubescent; stigmas coherent into a conelike mass, each stigma 4.0–4.2 mm long, linear, pubescent and minutely verrucose; ovules ca. 2 in a single row. Torus ca. 3 mm in diameter, glabrous. Fruit of 8–13 monocarps borne on a pedicel 10–15 mm long, 1.7 mm thick at midpoint, with the bark reddish brown and flaking off much as on the twigs; torus of fruit 4–5 mm in diameter, 2–3 mm high; monocarps pink to red *in vivo*, dehiscent at maturity (Fig. 1L), 1.7–2.2 cm long, 0.5–1.0 cm wide, 0.2–0.5 cm thick, oblong-falcate, compressed laterally, sparsely pubescent, contracted into a stipe 3–7 mm long; apex rounded, apiculate. Seeds 2–4, oblique to perpendicular to long axis of monocarp, ca. 10 mm long, ca. 6 mm in diameter, ellipsoid, arillate.

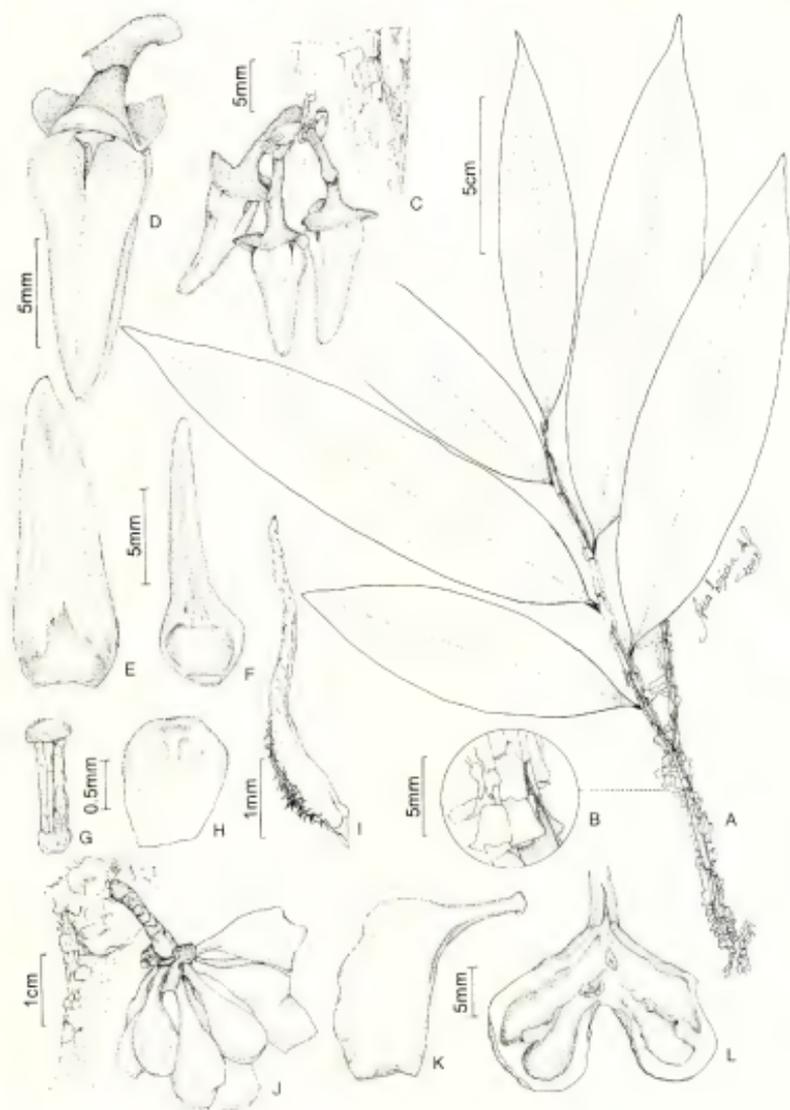


FIG. 1. *Xylopia decorticans*. A. Habit. B. Close-up of twig, showing exfoliating bark. C. Cauline inflorescence. D. Individual flower. E. Outer petal, inner surface. F. Inner petal, inner surface. G. Stamen. H. Staminode. I. Carpel. J. Fruit. K. Individual monocarp, longitudinal view. L. Open monocarp. (Based on: A, B, J, Lobão 1283, RB; C, Vervloet et al. 1640, MBML; D–I, Boone 1016, MBML; K, Demuner et al. 15, MBML; L, Demuner & Bausen 537, MBML.)

**Phenology.** Collected with flowers from January to March and from August to November, and with fruits from January to May and August to October.

**Distribution.** Known only from Santa Maria de Jetibá and Santa Teresa municipalities in Espírito Santo, Brazil (the majority of collections from two Conservation Units, Santa Lúcia Biological Station and Augusto Ruschi Biological Reserve, in Mountain Atlantic Forest); frequent; 600–850 m.

**ADDITIONAL SPECIMENS EXAMINED.** **Brazil.** ESPÍRITO SANTO: Mpio. Santa Maria de Jetibá: Rio das Pedras, propriedade de Emílio Feich, 23 Mar 2007 (fl, fr), *Fontana et al. 3150* (MBML, RB); Mpio. Santa Teresa: morro da estação repetidora de TV, 13 Jan 1986 (fl), *Boone 1016* (MBML, MO, RB); mata do Museu de Biologia Mello-Leitão, 5 Jan 2000 (fr), *Demuner & Bausen 456* (MBML, RB); Mata Fria, terreno de Clério Loss (lado esquerdo), 13 Jan 2000 (fl, fr), *Demuner & Bausen 537* (MBML); Estação Biológica de Santa Lúcia, trilha do Sagüi, na A3P16, 22 Sep 1999 (fr), *Demuner et al. 15* (MBML, RB); Mata Fria, terreno de Clério Loss, 28 Oct 1998 (fl), *Kollmann et al. 842* (MBML, RB); Aparecidinha, Terreno de Luiz Bringhentí, 9 Nov 1998 (fl), *Kollmann et al. 896* (SPF); Estação Biológica de Santa Lúcia, trilha para o túmulo do Augusto Ruschi, 9 Aug 2005 (fl, fr), *Lobão 1283* (RB); Mata Fria, 19 May 1999 (fr), *Lopez et al. 740* (MBML, RB); Estação Biológica de Santa Lúcia, 19°58'S, 40°32'W, 16 Feb 1999 (yg fr), *Moas et al. 8834* (MBML, OWU, U); Estação Biológica de Santa Lúcia, margem direita do Rio Timbuá, 12 Feb 1999 (fr), *Mello-Silva 1557* (SPF); estrada para João Neiva, limite norte da Estação Biológica de Nova Lombardia, Sítio do Sr. Waldir, 13 Feb 1999 (fl), *Mello-Silva 1571* (K, SPF); Estação Biológica de Santa Lúcia, 18 Jun 1995 (fl), *Thomas 787* (MBML, RB, SPF); Estação Biológica Santa Lúcia, 22 Sep 1993 (fl), *Thomas 812* (MBML, RB); Nova Lombardia, Reserva Biológica Augusto Ruschi, estrada João Neiva, final da reserva, próximo a represa Tracomal, 30 Apr 2002 (fr), *Vervloet et al. 220* (MBML, RB); Nova Lombardia, Reserva Biológica Augusto Ruschi, 9 Oct 2002 (fr), *Vervloet et al. 1188* (MBML); Nova Lombardia, Reserva Biológica Augusto Ruschi, estrada para João Neiva, parte inicial, 8 Jun 2003 (fl), *Vervloet et al. 1640* (MBML).

*Xylopia decorticans* is named for the exfoliating bark of the twigs. In the key of Fries (1930), it would be identified as *X. lanceolata* because of its flat broad petals and elongate-lanceolate leaves with the blade exceeding 12 cm in length. The outer petals of the new species, however, are 16–22 mm long, as opposed to 12–15 mm in *X. lanceolata*, and the leaves reach an even greater length (maximum of 24 cm vs. 18 cm). *Xylopia lanceolata* is described as having the bark of the twigs reddish and cracked (“vetustioribus cortice rufo rimuloso obtectis”) but not peeling and flaking, as in *X. decorticans*. *Xylopia lanceolata* differs further from the new species in having the secondary veins of the leaves more ascending than perpendicular, and in having the flowers borne in leaf axils rather than on the trunk.

Cauliflory is relatively rare among Neotropical species of *Xylopia*, but occurs in the widespread *X. benthamii* R. E. Fries, in *X. longicuspis* and close relative *X. cuspidata*, and occasionally in *X. ochrantha*. *Xylopia benthamii* further resembles the new species in occasionally having a pink or salmon-colored hue to its flowers, an uncommon petal color in a genus where the flowers are usually white or cream colored, with at most a purple blotch on the inner surface of the petals toward the base. *Xylopia benthamii* has much smaller leaves (blade 9–12 cm long), and its twigs are slender and distinctly pilose, with no trace of exfoliating bark. In members of the *X. cuspidata/longicuspis* group the flowers are larger than those of *X. decorticans*, and the pale yellow petals are covered with a silvery or gray indumentum. The leaves of *X. ochrantha* are considerably smaller than those of *X. decorticans*, and the smooth twigs are persistently ferruginous-pubescent.

While the eastern Brazilian Mountain Atlantic Forest in which *X. decorticans* occurs is a threatened ecosystem, the species does occur in large populations within two legally protected conservation areas, and we judge that it best be placed in the

LR (lower risk) category of the IUCN Red List (<http://www.iucn.org/themes/ssc/redlist.htm>). Other Annonaceae of restricted distribution also occur at the two sites, namely *Annona acutiflora* Mart., *Guatteria pogonopus* Mart., *Guatteria sellowiana* Schtdl., and an undescribed species of *Unonopsis*.

#### ACKNOWLEDGMENTS

We thank the curators of K, MBML, MO, OWU, RB, SPF, and U for making specimens available for study; William R. Anderson, Nancy Murray, Claudio Nicoletti de Fraga, Mariana Machado Saavedra, and Richard Saunders for comments on the manuscript; and André Paviotti Fontana and Renato Mello-Silva for information on specimens in the MBML and SPF herbaria. Ana Lucia Souza prepared the finely rendered illustration.

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**MYRIOGRAMME MELANESIENSIS AND M. HETEROSTROMA  
(DELESSERIACEAE, RHODOPHYTA), TWO NEW SPECIES  
FROM THE SOLOMON ISLANDS AND VANUATU**

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**ABSTRACT.** Two new species of the red algal genus *Myriogramme*, *M. melanesiensis* and *M. heterostroma*, are described from subtidal habitats in the Solomon Islands and Vanuatu, South Pacific. *Myriogramme melanesiensis* is characterized by a tristromatic thallus with layers composed of subrectangular cells of approximately equal height, smooth margins lacking any spines or proliferations, and multiple ovoid to elongate two-layered, submarginal tetrasporangial sori. *Myriogramme heterostroma* is distinguished by its tri- to pentastromatic thallus, with a single large layer of clear medullary cells and smaller pigmented cortical cells, and tetrasporangia occurring in single, large, median sori.

Previous published records of the marine algal flora of the Solomon and Vanuatu Islands are few and scattered. From the Solomon Islands, the most comprehensive work to date is that of Womersley and Bailey (1970), listing some 233 species. To our knowledge there are no previously published records of the marine algae of Vanuatu, although some seven species were seen by the first author in collections of the Natural History Museum, London (BM); this Vanuatu material is poorly documented and very old. A few anonymous and undated collections of *Halimeda* from Vanuatu are recorded in Hillis-Colinvaux's monograph (Hillis 1959).

The Solomon Islands occupy a total land area of 27,556 km<sup>2</sup> spread over 992 islands aligned over more than 1,500 km in the southwestern Pacific Ocean, encompassing coral reefs amongst those with the highest global biodiversity (Lovell et al. 2004; Payri et al. 2004). Vanuatu is an archipelago of some 93 islands with a total land area of over 14 765 km<sup>2</sup> aligned over 800 km, located 100 km to the southeast of the Solomon Islands. Recent collections from the Solomon Islands and Espiritu Santo, the largest island of Vanuatu, sampled by the third author from June to July 2004 and August 2006, respectively, have yielded many new records from previously unexplored habitats (Payri et al. 2004, unpubl.).

The genus *Myriogramme* was erected by Kylin (1924) and currently comprises some 28 species. In this paper we report two new, locally abundant, subtidal benthic marine species based on collections from the Solomon Islands and Vanuatu.

## MATERIALS AND METHODS

*Collection and analysis.* Material was collected by SCUBA; part was stored in 5% buffered Formalin in seawater, and the rest was dried as herbarium specimens. Dried material was re-hydrated in weak detergent solution prior to sectioning with a freezing microtome. Sections were stained using 1% aniline blue in 60% clear corn syrup, and made permanent if necessary by adding more 60% clear corn syrup and allowing to dry.

*Photography.* Macrophotographs were taken with a Nikon E-995 digital camera (Nikon Corporation, Tokyo, Japan). Photomicrographs were obtained using an Olympus BH2 compound microscope fitted with an Olympus C-5050 digital camera (Olympus Optical Co. Ltd., Tokyo, Japan), and the resulting files processed into figures by computer software.

*Herbarium specimens.* Voucher specimens have been deposited in the herbaria of PC, NOU-IRD (Phycological Herbarium, Institut de Recherche pour le Développement, Nouméa, New Caledonia), and MICH. Herbarium abbreviations are in accordance with Holmgren et al. (1990). Accession numbers preceded by the letter 'S' refer to microscope slide collections.

## RESULTS

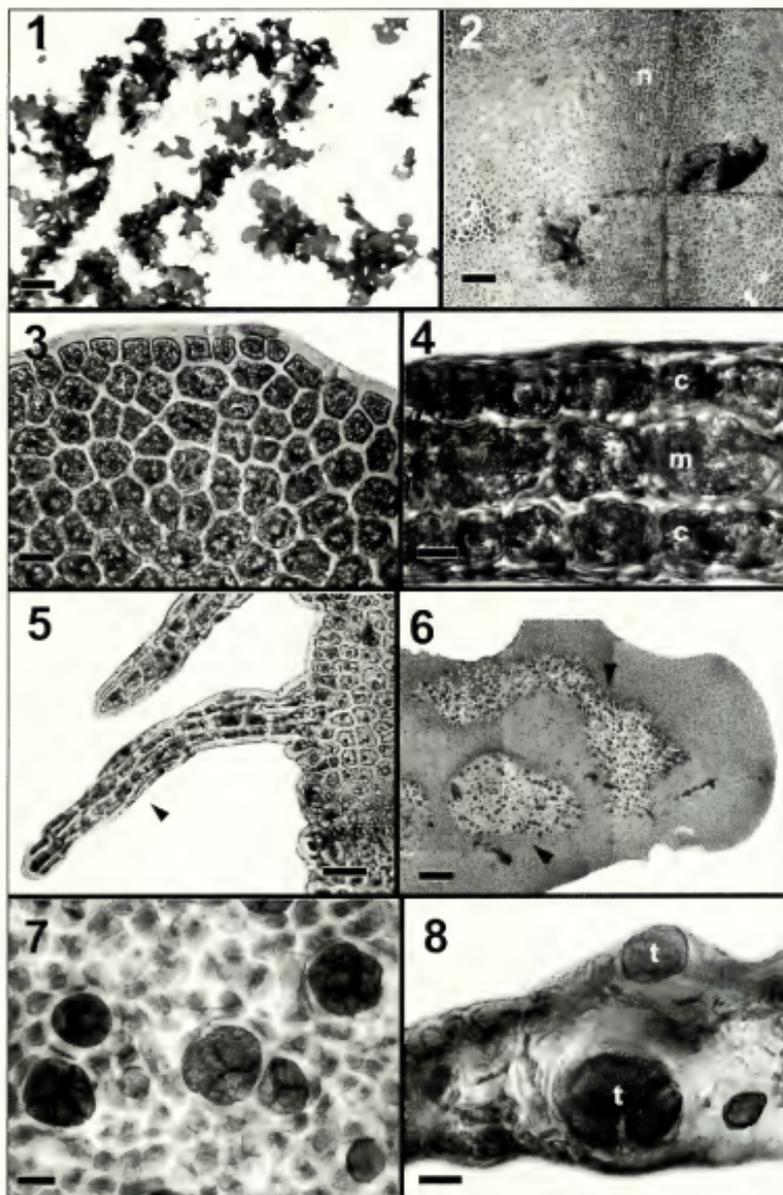
## CERAMIALES: DELESSERIAEAE

***Myriogramme melanesiensis*** N'Yeurt, M. J. Wynne & Payri, sp. nov.—TYPE: SOLOMON ISLANDS, Nggela Sule, Mbugana Island, 09°11.05'S, 160°11.982'E, -10 m, 11 Jul 2004, C. E. Payri (holotype: PC 0062772, tetrasporangial; isotype: NOU-IRD S483, tetrasporangial). Figs. 1–8.

Thallus 5–15 mm altus, roseus, irregulariter lobatus. Laminae 75–80 µm in crassitudine, tristomaticae, stratis cellularum crassitudine circa aequalibus. Cellulae rectangulares-subquadratae in sectione transversali, circa 25 × 50 µm. Margines laminarum laeves; partes distales clavatae-rotundatae, sine dentibus; partes proximales ligulatae vel irregulariter dichotomae. Rhizoidea marginalia 90–100 µm diametro et 1.0–1.2 mm longa, ex 6–7 filis multicellularibus fasciculatis constantia, secus peripheriam thalli dispersa. Chloroplasti peripherales et numerosi. Tetrasporangia divisa crucialiter, 60–90 µm diametro, in soris dispersis ovalibus vel elongatis taeniformibusque, monostromaticis vel distromaticis, 0.5–1.0 mm latis et 1.8–4.0 mm longis, in partibus distalibus laminae dispositis.

Thallus 5–15 mm high, pinkish red, irregularly lobed. Blades 75–80 µm thick, tristromatic, with cell layers of approximately equal thickness. Cells rectangular to subquadrate in transverse section, ca. 25 × 50 µm. Margins of blades smooth, distal

FIGS. 1–8. *Myriogramme melanesiensis* (PC 0062772 except where otherwise stated). 1. Habit of holotype; scale = 10 mm. 2. Proximal region of older blade from Vanuatu (C. E. Payri (NOU-IRD 1396), showing 'nerve' region (n) [the cross-like runner on the nerve is an epiphytic bryozoan]; scale = 200 µm. 3. Surface view of cortical cells; scale = 50 µm. 4. Transverse section of the thallus, showing the medullary layer (m) of the same height as cortical layers (c); scale = 25 µm. 5. Detail of multicellular marginal rhizoids (arrow); scale = 100 µm. 6. Detail of fertile submarginal region of blade, showing elongate, ribbon-like to ovoid tetrasporangial sori (arrows); scale = 700 µm. 7. Detail of tetrasporangia; scale = 50 µm. 8. Cross section of a two-layered tetrasporangial sorus (t); scale = 50 µm.



portions clavate–rounded, without dentations; proximal portions strap–shaped to irregularly dichotomous. A median ‘nerve’ region 400–600 µm wide present in proximal areas of some larger, older thalli, consisting of large cells 70–100 µm in diameter. Marginal rhizoids 90–100 µm in diameter, 1.0–1.2 mm long, composed of 6–7 bundled multicellular filaments, scattered along periphery of thallus. Chloroplasts peripheral and numerous. Tetrasporangia cruciately divided, 60–90 µm in diameter, in scattered oval to ribbon-like, elongate 1- to 2-layered sori 0.5–1.0 mm wide, 1.8–4.0 mm long, in distal portions of blade.

Distribution. Solomon Islands and Vanuatu; at depths of 3–35 m on coastal reef slopes, nested amidst branched corals.

PARATYPE. **Solomon Islands**, Makaira, San Cristobal Island, 20 Jul 2004, –12 m, *C. E. Payri* (NOU-IRD 5482).

ADDITIONAL SPECIMENS EXAMINED. **Solomon Islands**, Hele Passage, Vangunu Island, 04 Jul 2004, –3 m, *C. E. Payri* (NOU-IRD 478, 477); Kolo Lagoon, New Georgia Island, 8 Jul 2004, –20 m, *C. E. Payri* (NOU-IRD 474, 475; SUVA-A); Nugu Matthews Shoal, Guadalcanal, 10 Jul 2004, –35 m, *C. E. Payri* (NOU-IRD 481); Nggela Island, 12 Jul 2004, –0.8 m, *C. E. Payri* (NOU-IRD 476). **Vanuatu**, Espiritu Santo, 24 Aug 2006, *C. E. Payri* (NOU-IRD 1396, tetrasporic).

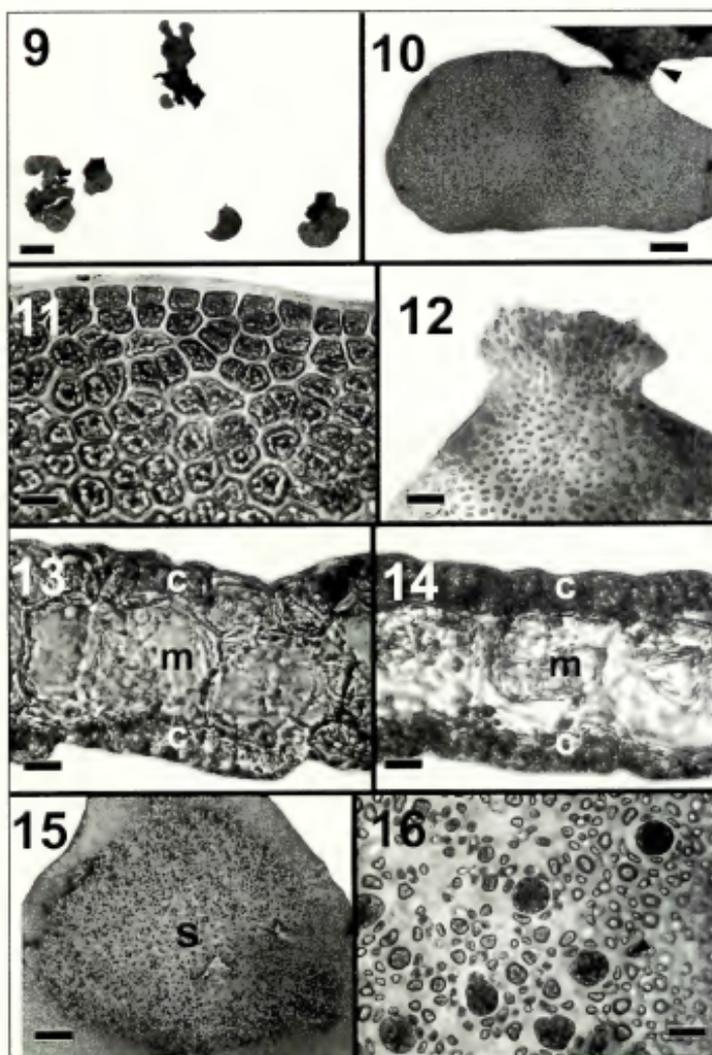
The specific epithet refers to Melanesia, the region where this species has been collected.

**Myriogramme heterostroma** N’Yeurt, M. J. Wynne & Payri, sp. nov.—TYPE: SOLOMON ISLANDS, Tanavula Point, Nggela Sule, 09°02.804’S, 160°03.711’E, 11 Jul 2004, –10 m, *C. E. Payri* (holotype: PC 0062773, tetrasporangial). Figs 9–16.

Thallus 3–12 mm altus, iridescens, roseus, irregulariter lobatus vel ligulatus anastomosibus frequentibus. Laminae 70–80 µm in crassitudine, ex 3–5 stratis cellularum inaequaliter altis constantes. Stratum medullosum singulare, ex cellulis magnis subquadratis hyalinis constans; cortex ex 1–2 stratis cellularum pigmentiferarum gradatim minorum 5–18 µm diametro constans. Cellulae extimae parvae, subsphaericae, 5–7 µm diametro, dense pigmentiferae. Cellulae corticales interiores sparsae, 7.5–18.0 µm diametro, gangliiformes, numerosis conjunctionibus secundariis instructae. Margines laminarum laeves; partes distales lobatae, sine dentibus. Rhizoidea marginalia nulla; thallus affixus per haptera dispersa lata marginalia. Chloroplasti peripherales et numerosi. Tetrasporangia divisa crucialiter, 18–20 µm diametro, in sori magnis, distromaticis, singularibus, medianis 1500–1800 µm diametro, in partibus distalibus laminae dispositis.

Thallus 3–12 mm high, slightly iridescent pinkish red in color, irregularly lobed to strap-shaped, with frequent anastomoses. Blades 70–80 µm thick, composed of 3–5 cell layers, of unequal height. Medullary layer single, of large subquadrate hyaline cells 40–42 µm in diameter; cortex composed of 1–2 layers of progressively smaller pigmented cells 5–18 µm in diameter. Outermost cells small, subspherical, 5–7 µm in diameter, densely pigmented. Inner cortical cells sparse, 7.5–18.0 µm in diameter, ganglionic, with multiple secondary pit connections. Margins of laminae smooth, distal portions lobed, without dentations. Marginal rhizoids absent; attachment via scattered broad marginal haptera. Chloroplasts peripheral and numerous. Tetrasporangia cruciately divided, 18–20 µm in diameter, in large, single, median 2-layered sori 1500–1800 µm in diameter, in distal portions of blade.

Distribution. Solomon Islands; at depths of 6 to 20 m on vertical reef slopes, nested amidst branched coral.



FIGS. 9–16. *Myriogramme heterostroma* (PC 0062773). 9. Habit of holotype; scale = 5 mm. 10. Detail of thallus, showing dense layer of small outer cortical cells and blade anastomosis (arrow); scale = 1 mm. 11. Surface view of cortical cells; scale = 20  $\mu\text{m}$ . 12. Detail of a marginal attachment pad; scale = 20  $\mu\text{m}$ . 13, 14. Transverse sections in two different regions of the thallus, showing a large, clear single medullary layer (m) and a much smaller, pigmented cortical layers (c); scale = 10  $\mu\text{m}$ . 15. Detail of a large median tetrasporangial sorus (s); scale = 200  $\mu\text{m}$ . 16. Detail of tetrasporangia (arrow); scale = 20  $\mu\text{m}$ .

PARATYPE. **Solomon Islands.** Anuta Paina Island, Malaita, 18 Jul 2004, C. E. Payri (NOU-IRD S484, tetrasporangial).

ADDITIONAL SPECIMENS EXAMINED. **Solomon Islands.** Rendova Island, New Georgia, ~20 m, 5 Jul 2004, C. E. Payri (SUVA-A); Honiara, Guadalcanal Island, 9 Jul 2004, ~20 m, C. E. Payri (NOU-IRD 480).

The specific epithet refers to the different sizes of the cells of the medullary layer and the cortical layers.

## DISCUSSION

Probably more than any other genus in the Delesseriaceae, *Myriogramme* has long served as a "catch-all" genus, to which many disparate species have been assigned. As Wynne (1983) stated, the ill-defined circumscription of this genus resulted from Kylin's (1924) basing much of his account of *Myriogramme* on *M. minuta* Kylin, a Mediterranean species, yet designating *M. livida* (J. D. Hook. & Harv.) Kylin, a species from the Falkland Islands, as the type of the genus. Kylin (1924) assigned a total of 18 species to his new genus, and the forms of the thalli expressed in these species show much variation, including very small to large, robust habit, veinless blades to blades with pronounced nerves, and great variability in the position of tetrasporangial sori. Where known, the cystocarps in species of *Myriogramme* were said to produce carposporangia in chains. Wynne (1983) noted that critical examination of the type species is necessary for a proper circumscription of *Myriogramme*. Such a study of *M. livida* was undertaken by Hommersand and Fredericq (1997a), and follow-up publications (Hommersand & Fredericq 1997b; Lin et al. 2001) contributed to elucidating the characters of sometimes similar-appearing genera. In addition, over the years a number of species formerly assigned to *Myriogramme* have been transferred other genera, as the circumscription of *Myriogramme* became more precisely drawn. Such attrition has been carried out by Zinova (1981), who based *Haraldiophyllum* on *Myriogramme bonnemaisionii* Kylin and *Hideophyllum* on *M. yezoensis* Yamada & Tokida (Yamada 1935). Maggs and Hommersand (1993) transferred *M. minuta* and *Haraldiophyllum heterocarpum* [= *Myriogramme versicolor*] to Ernst and Feldmann's (1957) genus *Drachiella*. *Myriogramme erosa* (Harvey) Kylin was transferred to *Haraldiophyllum* by Millar and Huisman (1996). When Lin et al. (2004) erected *Augophyllum*, they included in it *Myriogramme marginifracta* R. E. Norris & M. J. Wynne (1987). Womersley (2003) based his new genus *Nitospinosa* on *Myriogramme pristoidea* (Harv.) Kylin. Despite this ongoing "cleansing" of the genus, there still remain a number of poorly known species assigned to *Myriogramme*.

The tri- to pentastromatic nature of the blades and the rare presence of a basal nerve in specimens of *M. melanesiensis* and *M. heterostroma* are among the features that led us to conclude that these two relatively commonly found algae in the Solomon and Vanuatu Islands belong to undescribed species. We are able to exclude the great majority of species of *Myriogramme* (and some related genera) fairly easily, in particular, those species with blades bearing pronounced nerves throughout their thalli. In *M. melanesiensis*, the presence of a median "nerve" region appears to be a relatively rare feature strongly dependent on age and maturity of the thallus and is more pronounced in proximal areas of some larger plants. The majority of plants in a given population do not show any clear nerves or veins. We have compared the two new species with a group of somewhat similar species in Table 1, where we list important morphological traits.

TABLE I. Comparison of *Myriogramme melanesiensis*, *M. heterostroma*, and related species.

SPECIES AND REFERENCE	TYPE LOCALITY	HABIT	CELL LAYERS	MARGINS	IRIDESCENCE	TETRASPORANGIAL SORI
<i>M. melanesiensis</i> (this study)	Mbugana Island, Solomon Islands	simple to irregularly lobed blades, to 15 mm tall	3, of equal height	smooth	absent	submarginal, multiple, elongate to ovoid
<i>M. heterostroma</i> (this study)	Nggela Sule, Solomon Islands	simple to irregularly lobed blades, to 12 mm tall	3-5, of unequal height	smooth	slight	median, single, ovoid, large
<i>M. afflicta</i> (P. Crouan & H. Crouan) Athanasiadis, 1996	Rade de Brest, Brittany, France	lobed, divided blade, 30-60 mm tall	3	smooth	absent	apparently 2-layered (Magne 1959)
<i>M. carilaginea</i> (Harvey) Womersley, 2003	Garden Island, Western Australia	irregularly alternately branched complanate thallus, to 80 mm tall	2-4, usually 3	crispate or with short dentations	absent	scattered
<i>M. distromatica</i> Boudouresque, 1971	Port Mahon, Minorca, Balearic Island	lobed, irregularly divided blade 10-15 mm in diameter	2	smooth	absent	unknown
<i>M. goensis</i> V. Krishnamurthy & K. Varadarajan, 1990	Calangute, Goa, India	linear, deeply divided blades, 20-30 mm tall	3	occasional teeth, numerous marginal rhizoids	absent	scattered small sori in median region
<i>M. prostrata</i> E. Y. Dawson, Neushul & Wildman) M. J. Wynne, 1990	Islas San Benitos, Baja California, Mexico	lobed blades to 35 mm wide, 25 mm long	1	with small dentations	present	in large scattered sori near blade margins
<i>M. quilonensis</i> Anil Kumar & Panikkar, 1993	Thirumullavaram, Kerala, India	small lobed thallus to 15 mm tall	2	with small dentations	absent	in large sori
<i>M. repens</i> Hollenberg, 1945	Point Vicente, California, USA	simple blade to 8 mm tall	1, 3 in fertile regions	smooth	absent	in small scattered sori
<i>M. variegata</i> Yamada, 1944	Sagami Bay, Japan	thin blade to 15 mm tall, 3-4 mm wide	1	smooth or minutely dentate	absent	in small scattered sori
<i>Nitophyllum tristromaticum</i> Rodriguez ex Mazza, 1903	Port Mahon, Minorca, Balearic Islands	lobed blade to 5 mm wide	3, one large central and two small cortical	smooth	absent	unknown
<i>Drachiella minuta</i> (Kyllin) Maggs & Hommersand, 1993	Naples, Italy	lobed, irregularly divided thallus 25-30 (-50) mm tall	1-3	smooth	present	unknown

<sup>1</sup>This species has scattered transversely dividing initials along the margins and likely belongs to *Polyneura*, not *Myriogramme*.

*Myriogramme alliacea* (P. Crouan & H. Crouan) Athanasiadis, a species occurring on the coast of Brittany, France (Crouan & Crouan 1851), has a distinctive rose-wine color in well-preserved samples. The blades have smooth margins and are tristromatic for almost all of their length. The cells in cross section are of uniform size. Tetrasporangia are arranged in small sori over the central part of the thallus (Magne 1959); however, thalli are taller (3–6 cm) than those in the new species, and they release of the odor of onions when thalli are immersed in fresh water and then emersed, a distinctive feature of *M. alliacea* (Crouan & Crouan 1851).

Another species of *Myriogramme* with a tristromatic organization is *M. goaensis* V. Krishnamurthy & Varadarajan (in Krishnamurthy 1992), described from India. Only tetrasporangiate thalli were described, and the tetrasporangia were said to be in scattered, small sori (Krishnamurthy & Varadarajan 1990), but their Fig. 13 depicts a blade with only a single large sorus. Also, although the thalli were said to be “stipitate, deeply divided into small, sinuate, linear to lanceolate blades,” the blades in Fig. 13 appear to be simple. The presence of marginal teethlike projections with transversely dividing apical cells would separate this Indian species from both new species from the Solomon Islands and Vanuatu.

Another species from India is *Myriogramme quiloneensis* Anil Kumar & Panikkar (1993). Thalli are essentially distromatic throughout, and the blade margins bear short spine-like projections as well as tufts of rhizoidal initials for attachment purposes, which distinguished it from the new species.

*Myriogramme repens*, known from the Pacific coast of North America (Hollenberg 1945) has a rhizome bearing simple blades less than 10 mm in height and with very small, scattered sori of tetrasporangia. These features as well as the monostromatic nature of the blades distinguish it from the new species.

*Myriogramme prostrata* was originally described as *Haraldia prostrata* from Pacific Mexico (Dawson et al. 1960), but was later reported from the tropical-subtropical western Atlantic (Wynne 1990; Littler & Littler 2000; Ballantine et al. 2004), the South Pacific (Skelton & South 2002; South & Skelton 2003). Littler and Littler (2000) described the blades as exhibiting a “blue-green sheen,” thus somewhat iridescent like *M. heterostroma*. *Myriogramme prostrata* was also reported, but with a query, from Kwazulu-Natal, South Africa (De Clerck et al. 2005), but that plant, with a mottled, strongly iridescent aspect and with numerous marginal teeth, seems unlike genuine *M. prostrata*, which is basically a prostrate alga with frequent marginal rhizoids for attachment. A monostromatic, marginally dentate blade arising from a prostrate axis, with marginal rhizoids, and bearing large scattered tetrasporangial sori was reported and illustrated from Fiji in the South Pacific, at first as *Myriogramme* sp. (South et al. 1993) and later as *M. prostrata* (South & Skelton 2003), and also from Samoa (Skelton & South 2002). The occasional small marginal dentations, the monostromatic nature of the blades, as well as the presence of scattered large tetrasporangial sori confined to marginal regions all distinguish *M. prostrata* from the new species.

*Myriogramme cartilaginea* (Harvey) Womersley is a little-known species occurring in Western Australia (Harvey 1855), but cystocarpic plants have not yet been observed and the assignment to *Myriogramme* uncertain (Womersley 2003). Its thalli are 4–8 cm tall and with abundant irregularly alternate branching, often with crispate margins and a cartilaginous texture. The blades become tristromatic and later become polystromatic in the central regions. These features easily separate it from the new species.

*Myriogramme variegata* Yamada, with a type locality of Sagami Bay, Japan (Yamada 1944), has also been reported from California (Abbott & Hollenberg 1976). It consists of a discoid base giving rise to stipitate simple, or rarely divided, small blades reaching only 1.5 cm in height. The blades are monostromatic and were said to have margins both entire and minutely dentate. Tetrasporangial sori are small and produced on the leafy parts of the blade (Yamada 1944). The monostromatic nature of the blade and the minute marginal teeth distinguish *M. variegata* from the new species.

*Myriogramme distromatica* Boudouresque was based on material in the Thuret-Bornet Herbarium in Paris bearing the manuscript name "*Nitophyllum distromaticum* Rodriguez." The type was a Rodriguez collection of May, 1897, from a submarine cave at a depth of 90 m off Port Mahon, Minorca, Balearic Islands, in the western Mediterranean. This species has also been reported from deep waters off the coast of North Carolina and South Carolina (Schneider & Searles 1991). The small (to 15 mm across) prostrate blades are consistently distromatic, with the ventral layer of cells larger than those of the surface layer. Multicellular rhizoids are frequent on the undersurface and attach the blade to the substratum. Reproduction is not known in this species. The single parietal fenestrate chloroplast per cell clearly indicates that this species does not belong to *Myriogramme* (Hommersand & Fredericq 1997a).

*Nitophyllum tristromaticum* Rodriguez ex Mazza (Mazza 1903) bears discussion in that Boudouresque et al. (1984) intended to transfer it to *Myriogramme*, but their combination was not validly published (Greuter et al. 2000). This Mediterranean species, described from Minorca, Balearic Islands (Mazza 1903), has a tristromatic organization, and there is a central layer of relatively large cells and cortical layers of smaller cells, as occurs in *M. heterostroma*. According to Gómez Garreta et al. (2001), the cells bear a single parietal, platelike chloroplast per cell, a feature that precludes placing this species within either *Nitophyllum* or *Myriogramme*.

*Schizoseris bombayensis* (Børgesen) Womersley is another small Delesseriacean species with a wide range in tropical and warm temperate waters of the Pacific Ocean, including the South Pacific (Millar & Kraft 1993; Abbott 1999; Littler & Littler 2003; Lobban & N'Yeurt 2006). The blades in this species are usually 1–2 (–5) cm high, irregularly to dichotomously branched, with median macroscopic nerves usually coursing from the base to distal regions of the thallus (Abbott 1999; Womersley 2003). The blades are monostromatic in most regions of the thallus between the nerves (Børgesen 1931; Segawa 1941, as *Myriogramme subdichotoma*; Dawson 1950, as *S. pygmaea*) but may become distromatic in older regions (Børgesen 1931). The chloroplasts have been shown to be dissected and ribbon-like (Lobban & N'Yeurt 2006), and the species has never been reported as iridescent. These differences distinguish this species from the new species of *Myriogramme*.

Another Delesseriacean alga with superficial resemblance to *Myriogramme melanesiensis* and *M. heterostroma* is *Drachiella minuta* (Kylin) Maggs & Hommersand. Based on a collection from the vicinity of Naples, Italy (Kylin 1924), this species was described as non-stipitate small blades, 1–2 cm tall, irregularly sinuate or lobed, distally monostromatic, but tristromatic below, and lacking veins. Tetrasporangial sori are small and scattered in the distal portions of the blades, and the tetrasporangia are produced in two layers. Magne (1956, 1957) provided detailed observations on the distinctive cellular organization of this species and its distinctive process of many chloroplasts undergoing a fusion process to form a single lobed chloroplast. Maggs and Hommersand (1993) described specimens to be of rare occurrence in southwestern England

and the Channel Islands, where they form thalli 5 cm high and 5 cm wide. The thalli become decumbent and at times show a strong blue iridescence. The blade in cross section shows the cell layers to be of uniform size. Tetrasporangia are produced in sori directly on the primary blade in this species, quite unlike the production of small specialized tetrasporophylls in *Drachiella spectabilis* Ernst & Feldmann (1957), the type of the genus *Drachiella*. This led Wynne (1994) to express doubt of the placement of *M. minuta* in *Drachiella*. It seems that the primary justification for the proposed transfer by Maggs and Hommersand (1993) is the presence, as in *D. spectabilis*, of one large ribbon-like to convoluted chloroplast per cell rather than many small discoid chloroplasts per cell. This caution led Gómez Garreta et al. (2001) to retain *M. minuta* in *Myriogramme*. This species differs from both new species in its different cellular organization.

*Myriogramme melanesiensis* and *M. heterostroma* increase our knowledge of algal diversity in this region of the world, and enrich the Delesseriaceae from the Solomon Islands, for which Womersley and Bailey (1970) had not reported the genus *Myriogramme* among the six taxa listed for this family.

#### KEY TO THE SPECIES OF MYRIOGRAMME FROM THE SOLOMON ISLANDS AND VANUATU

1. Medullary layer of approximately same dimensions as cortical layers; attachment via marginal rhizoids; tetrasporangia in multiple irregular marginal sori. *M. melanesiensis*
1. Medullary layer much larger than cortical layers; attachment via marginal haptera; tetrasporangia in large, single median sori. *M. heterostroma*

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## CAREX MICHOCANA, A NEW SPECIES OF CAREX SECTION OVALES (CYPERACEAE) FROM MEXICO

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**ABSTRACT.** *Carex michoacana* is described as new from Michoacán, Mexico. It is most similar morphologically to *C. tetrastachya* from the southern United States, but differs in having smaller perigynia with narrower achenes. It differs from all other species in the *Carex brevior* group with similarly large perigynia in having staminate and pistillate scales with a scabrous awn formed by the excurrent midvein and perigynia nerveless over the achene adaxially. From a molecular phylogenetic standpoint, the position of this species is equivocal, but the more conclusive of the two nuclear ribosomal DNA datasets utilized supports the morphological evidence suggesting that it is a member of the *Carex brevior* group. The names *C. tetrastachya* and *C. brittoniana* are typified.

### CAREX MICHOCANA

*Carex* sect. *Ovales* is a large and difficult section of ca. 90 species that is predominantly North American, but with a number of species also in mountainous areas of the neotropics (Hipp et al. 2006). The group is complex, but relatively well understood in Mexico, with 13 species recognized by Reznicek (1993). Field work for the Flora del Bajío area has disclosed an unusual new species of sect. *Ovales*, known only from a single collection. It is morphologically most similar to *C. tetrastachya* of the southern United States, but quite distant geographically; the type locality in Michoacán is ca. 900 km southwest of the nearest occurrence of *C. tetrastachya*.

***Carex michoacana*** Reznicek, Hipp & S. González, sp. nov.—**TYPE:** MEXICO, Michoacán: Mpio. Angamacutiro, lugares cercanos a la cortina de la presa El Rosario, 1750 m, 8 May 2005, *Rzedowski 54150* (holotype: IEB!; isotypes: CIIDIR! MICH!). Fig. 1.

Plantae laxae caespitosae; culmi fertiles 55–83 cm alti. Folia 5–8; laminae 2–30 cm longae, 1.5–3.1 mm latae; vaginae ca. 3–8 mm longae, ventraliter albido-hyalinae, glabrae; ligulae 3.2–6.8 mm longae. Inflorescentiae 2.5–3.8 cm longae; spicae gynaeandreae, ovoideae, 9–14 mm longae, 8.5–11.5 mm latae. Squamae pistillatae anguste ovatae, albo-hyalinae, 1-nervatae, 3.8–4 mm longae, 1.5–1.7 mm latae, aristatae costa

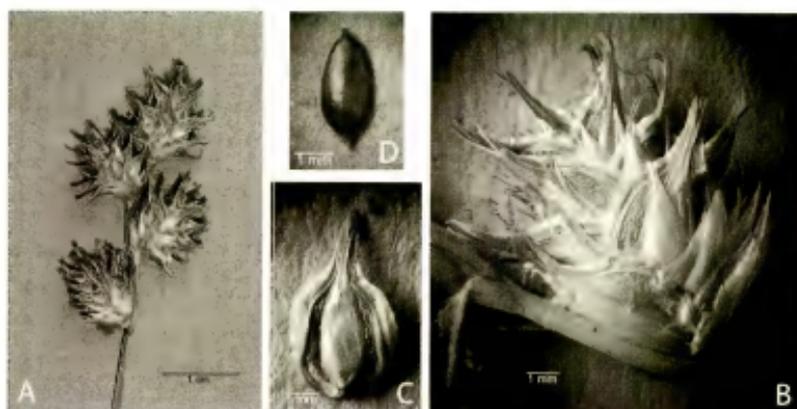


FIG. 1. *Carex michoacana*. A. Inflorescence. B. Spike. C. Perigynium. D. Achene.

excurrenti, aristae 0.1–0.6 mm longae. Perigynia 5.2–5.8 mm longa, 2.9–3.5 mm lata, 1.6–1.8 plo longiora quam latiora, patentia, planoconvexa, corporibus late ellipticis vel orbiculatis, 3.6–4 mm longis, 1–1.2 plo longioribus quam latioribus, in rostrum serrulatum 1.4–1.9 mm longum contracta. Achenium 2.4–2.7 mm longum, 1.1–1.35 mm latum, biconvexum. Styli marcescentes; stigmata 2. Antherae 3, ca. 1.5–2.2 mm longae.

Loosely cespitose in small clumps from short, thick, woody rhizomes; rhizomes elongating with age; fertile culms ca. 55–83 cm tall, erect, trigonous, sometimes flattened below, sparsely scabrous-angled below inflorescence; bladeless basal sheaths dark brown, disintegrating into short fibers. Leaves 5–8, on the lower 2/5–1/2 of the culm; blades 2–30 cm long, 1.5–3.1 mm wide, plicate or flat, glabrous, the margins and midrib antrorsely scabrous distally; leaf sheaths ca. 3–8 cm long, tightly enveloping culms, smooth, green, larger sheaths with the intervenal areas pale whitish green with scattered, more or less horizontal green septae on the upper portion; the inner band of sheaths glabrous, green with a prominent whitish hyaline zone, the apex concave, more or less equaling the base of the blade, whitish hyaline; ligules 3.2–6.8 mm long, obtuse, the free portion entire to finely erose and up to 0.4 mm long. Vegetative culms annual, few, fully developed only after perigynia are largely shed, ca. 12–15 cm tall with ca. 5–9 leaves mostly clustered near the summit of the culm. Inflorescences ca. 2.5–3.8 cm long, erect, the spikes overlapping or the lowermost slightly separate, the lowest spikes ca. 7–12 mm distant, spikes single at nodes, sessile; lowermost bracts bristle-like, ca. 0.8–5.4 cm long, often inconspicuous, sheathless, upper bracts much reduced; spikes 3–4 (5), gynecandrous, orbicular to ovoid with rounded bases or the uppermost with a short-clavate base, 9–14 mm long, pistillate portion 8–11 × 8.5–11.5 mm, ca. 20–40-flowered, staminate portion 1–3 × 1.5–2 mm, ca. 3–6-flowered. Pistillate scales 3.8–4 × 1.5–1.7 mm, ± reaching the base of the beak, narrowly ovate, acute, the midvein excurrent as a scabrous awn 0.1–0.6 mm long, whitish hyaline with a pale brown or stramineous, 1-veined center. Staminate scales ca. 3.8–4.4 × 1.6–2 mm, ovate, acute, the midvein excurrent as a scabrous awn 0.2–1.2 mm long, whitish hyaline with a pale brown or stramineous, 1-veined center. Perigynia glabrous, sessile, ca. 5.2–5.8 × 2.9–3.5 mm wide, 1.6–1.8 times as long as wide, ± spreading, herbaceous, ± translucent

over achene; bodies broadly elliptic or  $\pm$  orbicular, 3.6–4 mm long, 1–1.2 times as long as wide, 1.9–2.7 times as long as the beak, and widest 1.6–2 mm above base, broadly thin-winged with wings 0.8–1.2 mm wide, finely serrulate-margined above the middle, contracted into a beak, yellowish green to stramineous with paler margins, nerveless adaxially and abaxially over the achene, 1–2-nerved in the wings; beaks 1.4–1.9 mm long, strongly flattened and serrulate-margined to apex, the apex bidentate with scabrous-margined teeth 0.6–1.1 mm long. Achenes 2.4–2.7  $\times$  1.1–1.35 mm, 1.8–2.5 times as long as wide, biconvex, narrowly ovate to narrowly oblong, pale brown to brown, short-stipitate at base, apiculum 0.4–0.5 mm long; style straight; stigmas 2. Anthers 3, ca. 1.5–2.2 mm long.

With its very large perigynia with  $\pm$  orbiculate bodies, *C. michoacana* resembles no known Mexican species of *Carex* sect. *Ovales* (except for *C. tetrastachya* Scheele, recently discovered in Coahuila; Mora-Olivo, unpubl.). In overall appearance, this species closely resembles a small individual of *C. tetrastachya*, and the details of vegetative features and perigynia and scales also are similar (sheaths smooth, with a prominent hyaline zone on the inner band, staminate and pistillate scales with a scabrous awn formed by the excurrent midvein, and very broad,  $\pm$ orbicular perigynium bodies nerveless over the achene on both faces); however, *C. michoacana* has smaller, especially narrower, perigynia only 5.2–5.8 mm long and 2.9–3.5 mm wide, versus 5.5–8 (–8.7) mm long and 3.5–6 mm wide in *C. tetrastachya* and also distinctly narrower achenes 2.4–2.7 long, 1.1–1.35 mm wide, and 1.8–2.5 times as long as wide versus achenes 2–2.8 mm long, 1.4–2.2 mm wide, and 1–1.8 times as long as wide in *C. tetrastachya*. *Carex michoacana* differs from all other species in the *C. brevior* group of sect. *Ovales* (as used by Rothrock & Reznicek, 2001; see also Hipp et al., 2006) with large perigynia (routinely longer than 5 mm and with wide bodies) and smooth sheaths with which it might be confused (*C. opaca* (F. J. Herm.) P. Rothr. & Reznicek, *C. missouriensis* P. Rothr. & Reznicek, *C. shinersii* P. Rothr. & Reznicek, and *C. hyalina* Boott) in having staminate and pistillate scales with a scabrous awn formed by the excurrent midvein, perigynia nerveless over the achene adaxially, and narrow achenes (except for *C. hyalina*, which has achenes 1.6–2 times as long as wide but only 0.9–1.2 mm wide).

From a molecular phylogenetic standpoint, placement of this species is equivocal. Total genomic DNA was extracted from one individual of *C. michoacana* (Rzedowski 54150, MICH) and sequenced for the nuclear ribosomal DNA external transcribed spacer (ETS; GenBank accession EF635436) and internal transcribed spacer (ITS; GenBank accession EF635435) regions. A new ETS sequence was also generated for *C. tetrastachya* (Reznicek 10411; GenBank accession EF681761). Sequences were analyzed in conjunction with previously published sequences for sect. *Ovales* using the Bayesian method implemented in MrBayes 3.0b4 (Huelsenbeck & Ronquist 2001). Taxa analyzed included all members of the eastern North American clade identified in previous research on the group (Hipp et al. 2006) and a subsample of western North American taxa.

Sequence data from the ETS region place *C. michoacana* within a strongly supported clade composed of *C. brevior* (Dewey) Mack. ex Lunell, *C. hyalina*, *C. molestiformis* Reznicek & P. Rothr., *C. reniformis* (L. H. Bailey) Small, *C. shinersii*, and *C. tetrastachya* (posterior probability = 0.97; Fig. 2). The sequence for *C. michoacana* differs from that of all other species in the clade by at least three base pairs, and in fact the sequence is less similar to *C. tetrastachya* than *C. tetrastachya* is to *C. reniformis* and *C. molestiformis*. Likewise, the ITS sequence for *C. michoacana* differs from all other ITS sequences analyzed by at least nine base pairs; however, ITS data

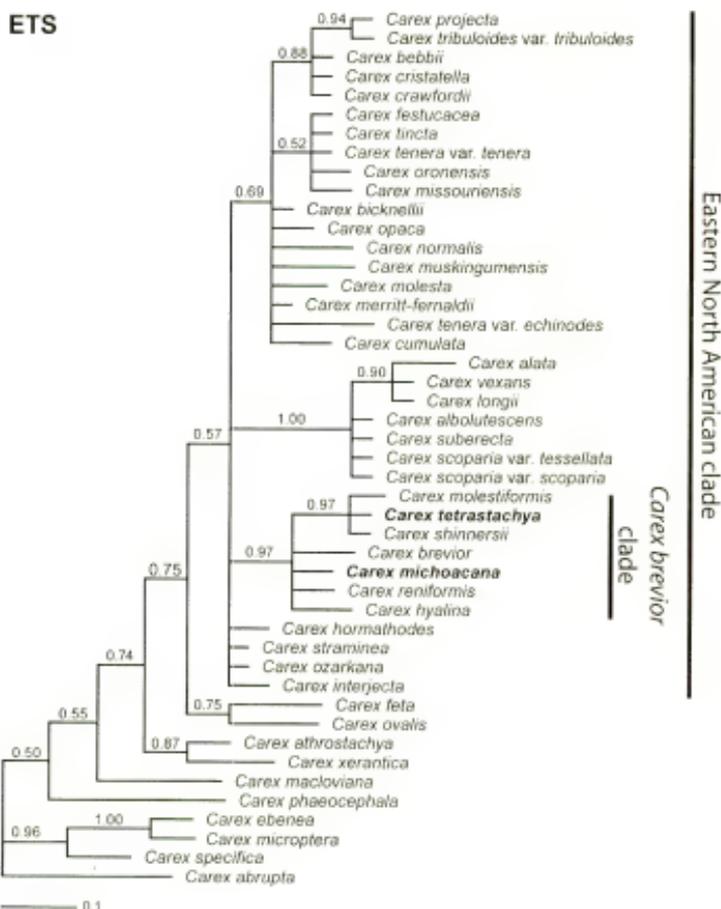


FIG. 2. Majority-rule consensus of trees retained in Bayesian analysis of the external transcribed spacer region of nuclear ribosomal DNA. Posterior probability estimates are indicated above the branches.

suggest a phylogenetic position for this species outside of the well supported core group of eastern North American taxa ("ENA I," posterior probability = 1.00; Fig. 3) that includes the *Carex brevior* clade. Combined analysis of the two datasets with *C. michoacana* included (not shown) breaks up the *Carex brevior* clade, places *C. michoacana* sister to ENA I, and embeds the western North American and Eurasian taxa *C. feta* L. H. Bailey and *C. ovalis* Gooden, within the broader eastern North American clade. These rearrangements stand at odds with previous, strongly supported results (Hipp et al. 2006). Incongruence between ITS and ETS is not uncommon in much of *Carex* subg. *Vignea* (Ford et al. 2006), but it is rare in sect. *Ovales*. Pending further study, the best estimate of the phylogenetic position of *C. michoacana* is within the *Carex brevior* clade, based both on morphology and the ETS tree.

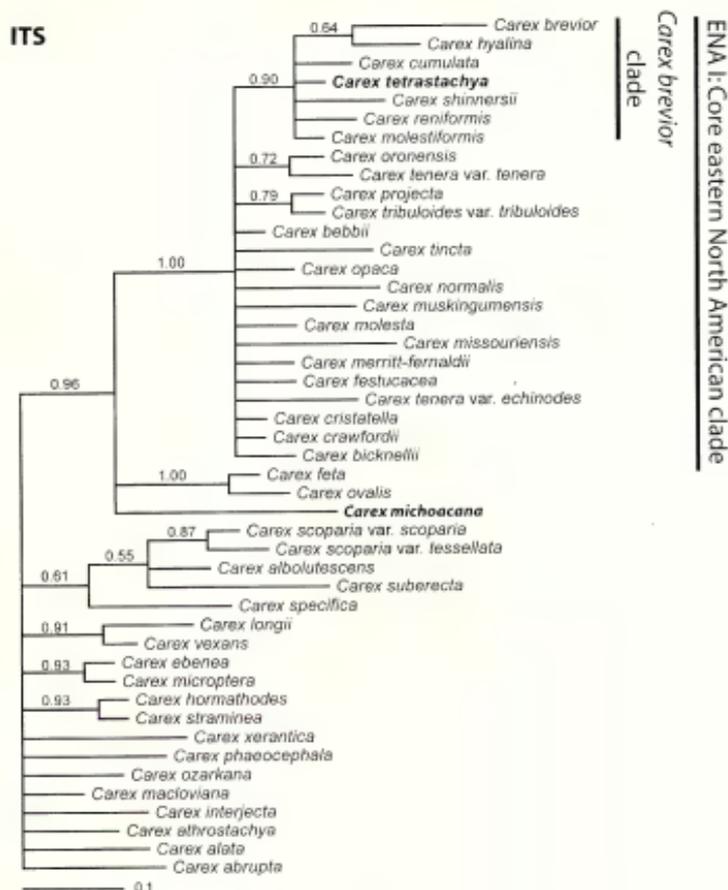


FIG. 3. Majority-rule consensus of trees retained in Bayesian analysis of the internal transcribed spacer region of nuclear ribosomal DNA. Posterior probability estimates are indicated above the branches.

### NEOTYPIFICATION OF CAREX TETRASTACHYA

The name *Carex tetrastachya* was published by Scheele based on a collection that Carl Ferdinand von Roemer gathered near New Braunfels, Comal County, Texas. The whereabouts of Scheele's herbarium is unknown, and inquiries to find original Roemer material have been fruitless. Although the specimen Scheele saw was obviously very immature, he clearly described diagnostic features of *C. tetrastachya*, including the typically four spikes, the whitish hyaline, 1-veined scales, and the awn formed by the excurrent midvein. The application of the name is clear, and it has been used in *Flora of North America* (Mastrogiuseppe et al. 2002), *Illustrated Flora of East Texas* (Diggs et al. 2006), and a number of recent papers.

*Carex tetrastachya* ranges from southwestern Louisiana to west-central and southernmost Texas, and easternmost Coahuila, Mexico, north to southernmost Oklahoma. Stanley D. Jones (pers. comm.) noted that *C. tetrastachya* is variable. Material from the western, drier portion of its range tends to have more spreading perigynia at maturity, with longer beaks, and more eastern material has shorter, more appressed beaks. Preliminary study of this variation is consistent with it being clinal, but it only seems prudent to select a neotype from the western portion of the range of the species, where New Braunfels is located, and which clearly shows the awned scales and typically four spikes, matching the protologue.

**Carex tetrastachya** Scheele, *Linnaea* 22: 347. July 1849, non *Carex tetrastachya* Traunst., *Flora* 33(23): 366. 21 June 1850.—TYPE: U.S.A. Texas: McCulloch Co., 3.1 mi WSW on FR 2028 (W 17<sup>th</sup> St.) from its jct. with US 87 in Brady, 1700 ft, 7 May 1993, S. D. Jones 10008 with J. K. Wipff & S. D. Hatch (neotype, here designated: MICH!; isoneotypes: GH! NY! TEX!).

*Carex brittoniana* L. H. Bailey in J. M. Coulter, *Contr. U.S. Natl. Herb.* 2(3): 484. 1894. *Carex straminea* var. *maxima* L. H. Bailey, *Proc. Amer. Acad. Arts* 22: 150. 1886.—TYPE: U.S.A. Texas. "Collected in expedition from western Texas to El Paso, New Mexico, May–October 1849," C. Wright 719 (lectotype, here designated: GH! barcode 00027497; probable isolectotype: GH! barcode 00027496).

*Carex straminea* var. *prorepens* Kük., *Das Pflanzenreich* IV, 20(Heft 38): 208. 1909.—TYPE: U.S.A. Texas, *Lindheimer* (holotype: B, destroyed; isotypes not located).

Note: *Wright 719* was also the collection upon which the *nomen nudum* *Carex wrightii* S. T. Olney was based (not *C. wrightii* Dewey ex Torr., *Bot. Mex. Bound.* 232. 1859, nor *C. wrightii* Franchet, *Bull. Soc. Philom. Paris* 7:47. 1895).

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## EUPHORBIA JABLONSKII (EUPHORBIACEAE), A NEW SPECIES FROM BRAZIL

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**ABSTRACT.** *Euphorbia jablonskii* (Euphorbiaceae) is described and illustrated. This species is known from two collections made on limestone rocks in the Federal District of Brazil. It is best accommodated within subgenus *Agaloma* sect. *Alectoroctonum* and appears to be related to the recently described *Euphorbia estevesii*, which occurs in the adjacent state of Goiás.

Brazil probably possesses the greatest diversity of angiosperm species on earth, and *Euphorbia* L. (Euphorbiaceae) is one of the largest genera worldwide; however, *Euphorbia* is relatively poorly represented in Brazil, and Govaerts et al. (2000) report only 53 of its nearly 2,000 species as native there. This figure contrasts, for example, with 111 species in the continental United States and 240 species in Mexico. Although *Euphorbia* is not particularly diverse in Brazil, about 60% of the species occurring there are endemic, and many phylogenetically important lineages are present. *Euphorbia jablonskii* represents an additional narrowly endemic Brazilian species.

***Euphorbia jablonskii*** V. W. Steinm., sp. nov.—TYPE: BRAZIL. Distrito Federal: Brasília, córrego Maranhão, zona do calcáreo, 27 Apr 1963, J. M. Pires, N. T. Silva & R. Souza 9481 (holotype: UB!). Fig. 1.

Frutex 1–2 m altus, deciduus, latice albo; caules articulati, glabri, teretes, internodiis 1–4 cm longi; folia ternata, petiolis 0.6–1.1 cm longis, glabris, laminis elliptico-oblongis vel ovatis, 1.6–3.4 cm longis, 0.9–1.6 mm latis, membranaceis, penninervis, apice obtusis, mucronatis, basi rotundatis, margo integris; inflorescentia axillaris; pedunculi 3–7 mm longi, puberuli; involucra campanulata vel obconica, 1.6–2.3 mm longa, 2.4–3.9 mm lata, puberula; glandulae 5, oblongae vel ovae, 0.9–1.1 mm longae (radialiter), 1.7–2.3 mm latae (tangentialiter); appendices divisae, segmentis triangularibus vel subulatis, albis; flores staminati ca. 30–40; ovarium subglobosum, puberulum, trilobatum, stylis 3, liberis, 0.9–1.1 mm longis, bipartitis, puberulis; capsula trilobata, 3.9–4.2 mm longa, 4.8–5.1 mm lata, puberula; semina 2.6–2.9 mm longa, 1.3–1.7 mm lata, sine caruncula.

Shrub 1 to 2 m tall, drought-deciduous, latex white. Stems articulate, terete, glabrous, internodes 1–4 cm long, striate upon drying, slightly constricted at the nodes, older branches with reddish bark with a dense wax covering which exfoliates in small flakes. Leaves ternate, stipules represented by broadly triangular glandular thickenings, 0.3–0.4 mm long, 0.4–1.1 mm wide at the base; petioles 0.6–1.1 cm long, glabrous; blades elliptic-oblong to ovate, 1.6–3.4 cm long, 0.9–1.6 cm wide, membranaceous, pinnately veined with 7–9 faint secondary veins, apex of the young leaves acute, with maturity obtuse with a minute mucro 0.2–0.3 mm long, base rounded, margin entire, continuous across the adaxial side of the petiole. Cyathia solitary in the axils or more commonly in leafless, relatively congested axillary clusters up to 1 cm long, these

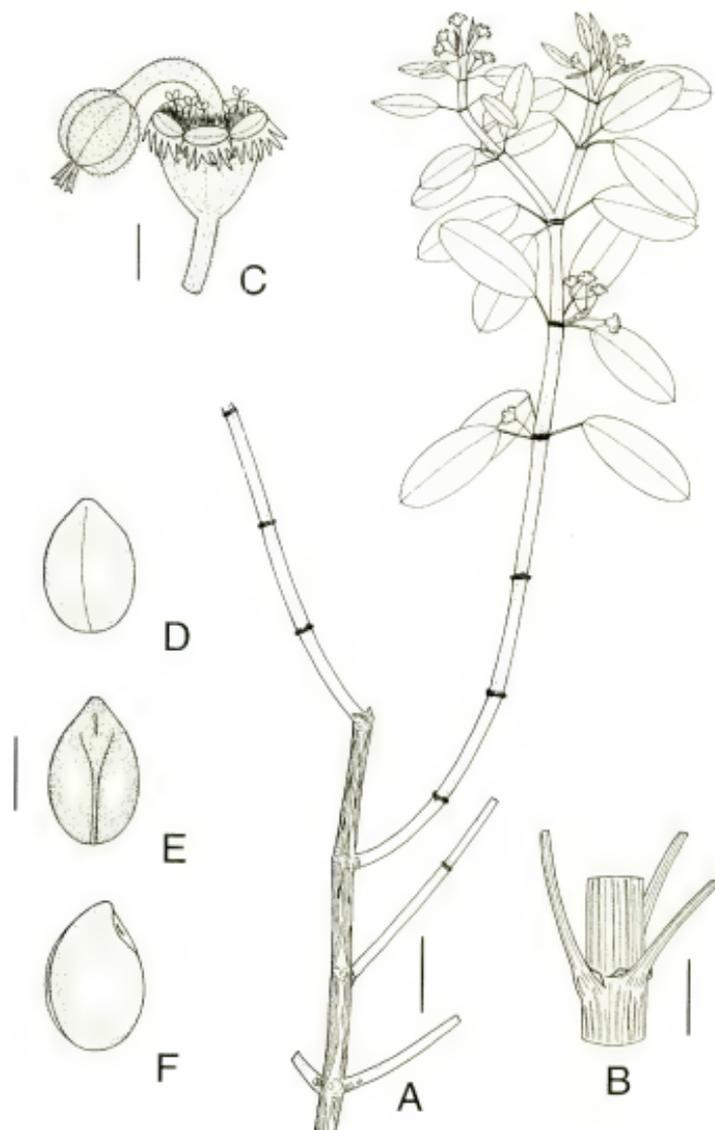


FIG. 1. *Euphorbia jablonskii*. A. Habit. B. Node of young stem, showing stipules. C. Cyathium. D. Seed, adaxial view. E. Seed, abaxial view. F. Seed, lateral view. Scale bars: A, 1.9 cm; B, 3 mm; C, 2mm; D-F, 1.5 mm.

containing up to 9 cyathia; peduncles 3–7 mm long, puberulent with white hairs up to 0.2 mm long. Involucres broadly obconic to campanulate, 1.6–2.3 mm long, 2.4–3.9 mm wide below the glands, outer surface with pubescence like that of the peduncles, inner surface glabrous except for just below the rim; lobes prominent, 0.6–0.9 mm long, 0.8–1.2 mm wide, lacinate margined; glands 5, oblong to oval, 0.9–1.1 mm long (radially), 1.7–2.3 mm wide (tangentially), plicate when dried; appendages 0.4–0.7 mm long (radially), 1.8–2.6 mm wide (tangentially), divided nearly to the base into 7–9 triangular to subulate divisions, white. Staminate flowers ca. 30–40; bracteoles numerous, plumose. Gynophore exerted 2.5–4.7 mm long, puberulent; ovary subglobose, 3-lobed, puberulent; styles 3, bifid, 0.9–1.1 mm long, puberulent. Capsule depressed-globose, strongly 3-lobed, 3.9–4.2 mm long, 4.8–5.1 mm wide, puberulent; columella 2.9–3.2 mm long. Seeds 2.6–2.9 mm long, 1.3–1.7 mm wide, 1.9–2.2 mm from front to back, apex with a nipple-like protuberance, base rounded, chalky white to light tan, smooth to lightly rugose, microreticulate-cellular under high magnification; ecarunculate.

ADDITIONAL SPECIMEN EXAMINED. **Brazil.** DISTRITO FEDERAL: Fercal, sobre o rochedo calário, 24 Jun 1965, D. Sucre & E. P. Heringer 608 (UB).

*Euphorbia jablonskii* is known from only two collections. The holotype is a leafy plant just beginning to flower (collected in April), and the paratype is a leafless specimen with fruits (collected in June). Both collections were initially misdetermined as *Euphorbia phosphorea* Mart., but *E. phosphorea* is an essentially aphyllous shrub with strongly ribbed stems, and it has little in common with the new species. Instead, the affinities of *E. jablonskii* appear to be with the recently described *E. estevesii* N. F. A. Zimm. & P. J. Braun, which occurs in the adjacent state of Goiás (Zimmerman & Braun 2000). Both taxa are relatively small, drought-deciduous shrubs with articulated stems and whorled leaves; the cyathia are in axillary clusters and bear involucrel appendages. Their herbage is glabrous, and pubescence is restricted to the cyathia. Although I have not examined material of *E. estevesii*, the description is sufficiently detailed to permit a good comparison between these two species. The two species are similar in many features, but *E. jablonskii* is distinguished by involucrel appendages that are divided into 7–9 triangular to subulate divisions and leaves that are ternate at each node. In contrast, the involucrel appendages of *E. estevesii* are entire or slightly undulate, and the leaves are verticillate in two sets of three at each node.

In the broader scheme of *Euphorbia* classification, both species are best accommodated within subgenus *Agaloma* House sect. *Alectoroctonum* (Schltdl.) Baill. As traditionally circumscribed (e.g., Boissier 1862), this section is defined by articulated branches, ternate or verticillate leaves, glanduliform stipules, cyathia in axillary or terminal cymes, involucrel appendages present, and minutely pitted, ecarunculate seeds. Park (1996), in a phylogenetic study based on morphology, found that this section was monophyletic, but results from a molecular analysis (Steinmann & Porter 2002) indicate otherwise, and it appears that this group represents a polyphyletic assemblage of various lineages. Besides *E. estevesii*, there are no other native Brazilian species of *Euphorbia* that could be assigned to sect. *Alectoroctonum*, but there are many species that belong to other sections of subg. *Agaloma*. At this time I am uncertain whether *E. jablonskii* and *E. estevesii* are related to species treated in sect. *Alectoroctonum* that occur outside Brazil, or whether they are derived from some other Brazilian members of subg. *Agaloma* and that their morphological similarity to members of sect. *Alectoroctonum* is a result of convergence.

*Euphorbia jablonskii* was collected on limestone rocks. Presumably the surrounding vegetation is xerophytic forest, but this remains to be confirmed. It is worth noting that *E. estevesii* is also reported from limestone outcrops. Because *E. jablonskii* has been collected only twice, over 40 years ago, in the now densely populated Federal District of Brazil, I believe it is at risk and measures should be considered for its conservation.

The specific epithet honors Eugene Jablonski (1892–1975), who began his studies of Euphorbiaceae under the tutelage of the renowned euphorbiologist Ferdinand Pax. His first publications date from the early 1900's; after a long hiatus from botany he resumed research on the family in the 1960's and 1970's. Among his most important contributions are treatments of Euphorbiaceae for the Guayana Highland (1965, 1967) and his "Catalogus Euphorbiarum" (1973, 1974).

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## TAXONOMIC AND NOMENCLATURAL CHANGES IN AMERICAN EUPHORBIACEAE SENSU LATO

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**ABSTRACT.** Name changes of species in genera of Euphorbiaceae sensu lato affected by revisions of genera and suprageneric taxa are documented. The genus *Reverchonnia* (Phyllanthoideae-Phyllanthaceae) is reduced to a section of *Phyllanthus*, and a new name, *Phyllanthus warnockii*, is provided for *Reverchonnia arenaria*. In the Acalyphoideae-Plukenetaceae, the genus *Bia* is recognized as separate from *Tragia*, with two sections, *Bia* and *Zuckerlii*; several new combinations are proposed: *Bia coriata*, *B. fullax*, and *B. fendleri*. In the Crotonoideae-Codiaeae, *Anomalocalyx* is reduced to a synonym of *Dodecastigma*, and its single species is now named *Dodecastigma uleana*. In the Euphorbioideae-Hurereae, *Tetraplandra* is accommodated in *Algernonia* as subgenus *Tetraplandra*, and the species are transferred to *Algernonia*: *Algernonia amazonica*, *A. bahiensis*, *A. dimitrii*, *A. kuhlmannii*, *A. leandrii*, and *A. riedelii*.

During a review of the genera and suprageneric taxa of Euphorbiaceae sensu lato it has become evident that a large number of taxonomic and nomenclatural changes are necessary. These changes, which include both the relegation and resurrection of genera, necessitate new combinations or new names for species in some of the genera affected. The sequence of genera follows that of Webster (1994).

### PHYLLANTHOIDEAE-PHYLLANTHACEAE

**Phyllanthus** section **Reverchonnia** (A. Gray) G. L. Webster, stat. nov. *Reverchonnia* A. Gray, Proc. Amer. Acad. Arts 16: 107, 1880.—TYPE: *Reverchonnia arenaria* A. Gray [= *Phyllanthus warnockii* G. L. Webster].

In his description of *Reverchonnia*, Gray (1880) noted “The relationship of this plant to *Phyllanthus* is so close that were it not for a combination of characters, it might be taken for aberrant *Phyllanthus*.” Johnston and Warnock (1963) were emphatic in questioning its generic distinctness. In the same year, Webster and Miller (1963) published a detailed study of *Reverchonnia* and noted a number of morphological similarities to *Phyllanthus*. We pointed out in particular that the basic chromosome number of 8 suggested an affinity with *Phyllanthus* subg. *Isocladus*. Although I previously (Webster 1994) maintained *Reverchonnia* as distinct, because “it would appear excessively foreign if placed in that genus,” further consideration leads me to conclude that maintaining it as a distinct genus would make *Phyllanthus* even more paraphyletic than it already is. In addition, molecular phylogenetic studies clearly demonstrate that *Reverchonnia* is nested within *Phyllanthus* (Kathriarachchi et al. 2005; Kathriarachchi et al. 2006).

**Phyllanthus warnockii** G. L. Webster, nom. nov. *Reverchonnia arenaria* A. Gray, Proc. Amer. Acad. Arts 16: 107, 1880, non *Phyllanthus arenarius* Beille, 1927.—TYPE: U.S.A. Texas: Baylor Co., Sep 1879, *Reverchon* 876 (lectotype, designated by Webster and Miller, 1963: GH; isolectotypes: F, MO).

<sup>1</sup>The manuscript for this article was found among unpublished work by the late Grady Webster; it was revised and submitted for publication by Victor W. Steinmann.

It is appropriate to name this species in honor of Barton Warnock (1911–1998), an outstanding authority on the plants of the Texas Big Bend country, who doubtless was familiar with the species during his decades of botanical rambling.

ACALYPHOIDEAE—PLUKENETIEAE

**Bia** Klotzsch, Arch. Naturg. 7(1): 189. 1841.—TYPE: *Bia sellowiana* Klotzsch ex Baill. [= *Bia alienata* Didr.].

This neotropical genus of five species, although not recognized as generically distinct from *Tragia* by Pax and Hoffmann (1919) or recent authors (e.g., Múlgara de Romero & Gutiérrez de Sanguinetti 1989), appears distinct in its larger stamen number (8–40) and distinctive bifurcate inflorescences with staminate and pistillate flowers on different axes. Furthermore, a preliminary analysis based on DNA sequence data suggests that *Bia*, as represented by *T. fallax* Müll. Arg., is not sister to the remaining species of *Tragia* included (Wurdack et al. 2005). I propose two sections that are distinguished on the basis of differences in the staminate flower and pollen morphology (see Gillespie 1994); one occurs in South America and the other in Mexico and Central America.

**1. Bia** section **Bia**.—TYPE: *Bia sellowiana* Klotzsch ex Baill. [= *Bia alienata* Didr.].

Staminate flowers with a dissected disk; stamens 8–20, anthers mucous; pollen spheroidal to ellipsoid-spheroidal, inaperturate; South America.

**1. Bia alienata** Didr., Kjöb. Vidensk. Meddel. (1857): 131. 1857. *Tragia alienata* (Didr.) Múlgara & Gutiérrez, Candollea 46: 523. 1991.—TYPE: BRAZIL. São Paulo: Hytú [Itú], Feb 1834, *Lund s.n.* (holotype: C).

*Bia sellowiana* Klotzsch ex Baill., Étude Gén. Euphorb. 502. 1858. *Tragia sellowiana* (Klotzsch ex Baill.) Müll. Arg., Linnaea 34: 178. 1865.—TYPE: BRAZIL. Rio de Janeiro: *Sellow s.n.* (lectotype, here designated: G).

Although *Tragia sellowiana* has been generally used as the name for this species, it was published by Klotzsch as a nomen nudum, and Baillon's validation was preempted by the earlier name of Didrichsen.

**2. Bia fallax** (Müll. Arg.) G. L. Webster, comb. nov. *Tragia fallax* Müll. Arg., Linnaea 34: 179. 1865.—TYPE: PERU. *Pavón s.n.* (holotype: G).

*Tragia japurensis* Müll. Arg., Fl. brasil. 11(2): 404. 1874.—TYPE: BRAZIL. Rio Negro: "ad Maribi in ditone Japurensi," *Martius s.n.* (holotype: M?).

**3. Bia fendleri** (Müll. Arg.) G. L. Webster, comb. nov. *Tragia fendleri* Müll. Arg., Linnaea 34: 179. 1865.—TYPE: VENEZUELA. Aragua: Biscaina, 3000 feet, *Fendler 1208* (holotype: G).

**4. Bia lessertiana** Baill., Étude Gén. Euphorb. 502. 1858 [as "*lessertiana*"]. *Tragia lessertiana* (Baill.) Müll. Arg., Linnaea 34: 178. 1865.—TYPE: BRAZIL. Without locality or collector (holotype: G).

- II. *Bia* section *Zuckertia*** (Baill.) G. L. Webster, stat. nov. *Zuckertia* Baill., Étude Gén. Euphorb. 495. 1858. *Tragia* section *Zuckertia* (Baill.) Müll. Arg., Linnaea 34: 178. 1865.—TYPE: *Zuckertia cordata* Baill. [= *Bia cordata* (Baill.) G. L. Webster].

Staminate flowers without a disk; stamens 30–40, anthers apiculate; pollen oblate-spheroidal, tricolpate; Central America and Mexico.

- 5. *Bia cordata*** (Baill.) G. L. Webster, comb. nov. *Zuckertia cordata* Baill., Étude Gén. Euphorb. 496, t. 10, figs. 10–13. 1858. *Tragia bailloniana* Müll. Arg., Linnaea 34: 178. 1865.—TYPE: MEXICO. Tabasco: Teapa, *Linden s.n.* (holotype: P).

#### CROTONOIDEAE—CODIAEAE

- Dodecastigma*** Ducke, Notizbl. Bot. Gart. Berlin 11: 343. 1932.—TYPE: *Dodecastigma amazonicum* Ducke.

*Anomalocalyx* Ducke, Notizbl. Bot. Gart. Berlin 11: 344. 1932.—TYPE: *Anomalocalyx uleanus* (Pax & K. Hoffm.) Ducke [= *Dodecastigma uleanum* (Pax & K. Hoffm.) G. L. Webster].

Ducke (1932, 1933) recognized two species of *Dodecastigma*: *D. amazonicum* Ducke and *D. integrifolium* (Lanjouw) Lanjouw & Sandwith. In the same publications, he created the monotypic genus *Anomalocalyx*. Both genera were accepted by Secco (1990) in his thorough revision of South American Crotonoideae. In Webster (1994), *Anomalocalyx* was even placed in a separate tribe (Aleuritideae) because of its characteristic staminate flowers with sepals fused in the bud; however, further study of flower structure in Crotonoideae suggests that fusion of staminate sepals may well be a homoplasious character. Although the plants also differ in pubescence, styler configuration, and foliar glands, they agree in other characters (malpighiaceae trichomes, connate staminate sepals, numerous stamens with introrse anthers, and woody capsular walls). *Anomalocalyx* could be treated as a subgenus of *Dodecastigma*, but there seems little point in recognizing subgenera in a genus of only three species.

- Dodecastigma uleanum*** (Pax & K. Hoffm.) G. L. Webster, comb. nov. *Cunuria uleana* Pax & K. Hoffm., Pflanzenz. IV. 147. XIV. Additamentum VI (Heft 68): 51. 1919.

#### EUPHORBOIDEAE—HUREAE

- Algernonia*** Baill., Ann. Sci. Nat., sér. 4, 9: 198. 1858; Étude Gén. Euphorb. 546. 1858.—TYPE: *Algernonia brasiliensis* Baill.

Baillon described *Algernonia* and *Tetraplandra* as distinct genera, and both were recognized by Müller (1866). Bentham (1878) pointed out that the distinction between the two genera made by Müller was based on a fictitious interpretation of the androecium, and in *Genera plantarum* (1880), he unequivocally demoted *Tetraplandra* to a synonym of *Algernonia*. Pax and Hoffmann (1912) admitted that the

two genera were very close, but retained *Tetraplandra* as a distinct genus, a decision followed by Emmerich (1981) in her critical revision of Hureae in Brazil. Taxonomic inertia has so far kept *Tetraplandra* afloat, and it was still maintained in Webster (1994). Yet, there is clearly no significant gap between the two, and it is now clear that recognition of two separate genera can no longer be supported, although I believe that they warrant recognition as subgenera.

### I. *Algernonia* subgenus *Algernonia*.

Filaments of the stamens free; styles connate halfway or more.—Subgenus *Algernonia* includes six species: *Algernonia brasiliensis* Baill., *A. gibbosa* (Pax & K. Hoffm.) Emmerich, *A. glaziovii* Emmerich, *A. obovata* (Müll. Arg.) Müll. Arg., *A. pardina* Croizat (a dubious species), and *A. paulae* Emmerich.

### II. *Algernonia* subgenus *Tetraplandra* (Baill.) G. L. Webster, stat. nov. *Tetraplandra* Baill., Ann. Sci. Nat., sér. 4, 9: 200. 1858; Étude Gén. Euphorb. 549. 1858.—TYPE: *Tetraplandra leandrii* Baill. [= *Algernonia leandrii* (Baill.) G. L. Webster].

Filaments of the stamens connate; styles connate less than halfway.—The six species of subgenus *Tetraplandra*, all from Brazil, are enumerated below.

1. *Algernonia amazonica* (Emmerich) G. L. Webster, comb. nov. *Tetraplandra amazonica* Emmerich, Arq. Mus. Nac. Rio de Janeiro 56: 95. 1981.
2. *Algernonia bahiensis* (Emmerich) G. L. Webster, comb. nov. *Tetraplandra bahiensis* Emmerich, Arq. Mus. Nac. Rio de Janeiro 56: 95. 1981.
3. *Algernonia dimitrii* (Emmerich) G. L. Webster, comb. nov. *Tetraplandra dimitrii* Emmerich, Arq. Mus. Nac. Rio de Janeiro 56: 96. 1981.
4. *Algernonia kuhlmannii* (Emmerich) G. L. Webster, comb. nov. *Tetraplandra kuhlmannii* Emmerich, Arq. Mus. Nac. Rio de Janeiro 56: 96. 1981.
5. *Algernonia leandrii* (Baill.) G. L. Webster, comb. nov. *Tetraplandra leandrii* Baill., Étude Gén. Euphorb. 550. 1858.
6. *Algernonia riedelii* (Müll. Arg.) G. L. Webster, comb. nov. *Tetraplandra riedelii* Müll. Arg., Fl. bras. 11(2): 534. 1874.

Emmerich (1981) relegated to a dubious status two species, *Algernonia pardina* Croizat and *Tetraplandra anomala* Pax & K. Hoffm. There appears to be no further evidence to determine whether either taxon is a species of *Algernonia*, and I have refrained from proposing a new combination for *Tetraplandra anomala*.

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## RHODYMENIA COCCOCARPA, A NEW COMBINATION BASED ON PHYLLOPHORA COCCOCARPA MONT.

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**ABSTRACT.** The new combination *Rhodymenia coccoarpa* (Mont.) M. J. Wynne, based on *Phyllophora coccoarpa* Mont., is proposed; it takes precedence over the nomen novum *Rhodymenia subantarctica* Ricker.

The red alga *Phyllophora coccoarpa* was described by Montagne (1852b) on the basis of a d'Urville collection from the Strait of Magellan. The alga was described as a stipitate frond, with a bare, terete or broadened stipe expanding into flattened cuneate blades proximally and having linear bifid enervate apical portions, with rotund lobes. Cystocarps were said to be on the distal segments, sessile and globose, with the center (in the dried state) depressed, acorn-shaped and ostiolate. According to Montagne, part of his earlier concept (Montagne 1845) of *Rhodymenia palmetta* (J. V. Lamour.) Grev. [current name: *Rhodymenia pseudopalmetata* (J. V. Lamour.) P. C. Silva] belonged within his new species *Phyllophora coccoarpa*. Montagne (1854) later repeated his description of *P. coccoarpa* and also provided a single figure of its habit. In all of his accounts of this species, Montagne (1852b, 1854, 1856) described his material as fertile, referring to cystocarps ["conceptaculis"]; indeed that is what he depicted in the habit illustration (Montagne, 1854, pl. 16, fig. 1), which is reproduced here as Fig. 1. Yet, according to Hariot (1889) Montagne's Herbarium (in PC) contains a single non-reproductive specimen of original material of *Phyllophora coccoarpa*, which Hariot treated as *Epymenia membranacea* Harv., currently known as *Rhodymenia obtusa* (Grev.) Womersley (Womersley 1996).

I asked Dr. Bruno de Reviere to check on authentic material of *Phyllophora coccoarpa* in PC. He kindly informed me that he located in the Montagne herbarium two elements belonging to the protologue: a single specimen of the holotype (PC 0060225; MA 4824) (Fig. 2) and an original and unpublished sketch of the anatomy (MS 434, p. 4809) (Fig. 3); scanned images of these elements were provided to me. He did not find any additional specimen in any place in PC. It is clear that the holotype corresponds perfectly to Montagne's (1854) plate 16, fig. 1, except that the specimen does not show any cystocarps. Figure 4 is a closer view of distal regions of the holotype showing the absence of cystocarps. This observation confirms that Hariot was correct but renders doubtful Montagne's description of the cystocarps. It is possible that Montagne had another, small, fertile specimen that he used for adding the observations on cystocarps, but there is no evidence of such material.

The sketch (Fig. 3), which is very faint, is accompanied by the following notations: "Phyllophora coccoarpa Montg.", "Rhodymenia palmetta olim", "Magellan", "D'Urville" and "Hb. de C. Montagne." The sketch is of a portion of a cross section, showing cortical, subcortical and medullary cells, an organization that conforms to the anatomy of *Rhodymenia*.

In addition to the more usual pattern of dichotomous to irregular branching and marginal proliferation, a distinctive mode of producing new branches from a thickened

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Fig. 1. Reproduction of Montagne's (1854) pl. 16, fig. 1, of *Phyllophora coccoarpa* [= *Rhodymenia coccoarpa* (Mont.) M. J. Wynne].

midrib region of proximal portions of blades can be observed in the holotype (both in the specimen and the figure) and in specimens assigned to this species by Taylor (1939). These collections, in MICH, are the following: CHILE. Punta Arenas Magallanes Prov., 4 Feb 1927, *Waldo L. Schmitt* 315; FALKLAND ISLANDS. Stanley Harbor, East Falkland Island, without date, *Waldo L. Schmitt* 98. This occasional production of new branches from the face of a parent blade was pointed out by Taylor (1939).

An annotation label is attached to the holotype of *Phyllophora coccoarpa*, dated December 13, 1985 with the determination "*Dendrymenia skottsbergii*" by Maria Emiliana Ramírez. This name is based on *Rhodymenia skottsbergii* Dawson (1941), a species transferred to *Dendrymenia* by Levring (1960); however, such a determination is not admissible, because the name *P. coccoarpa* predates *R. skottsbergii*. *Rhodymenia skottsbergii* is a currently recognized species, which is endemic to the



Fig. 2. Holotype specimen of *Phyllocarpa coccocarpa* Mont.; PC 0060225.

temperate west coast of South America (Hoffmann & Santelices 1997). It has a distinctive manner of producing lateral fronds, which arise spirally within the funnel-shaped region at the base of the parent frond. New blades continue to be sympodially developed with an amplexicaul structure in the region of each new branch (Dawson 1941). According to Hoffman and Santelices (1997), *R. skottsbergii* is unique in the order Rhodymeniales in having this developmental mode. Clearly, the determination of the holotype of *Phyllophora coccocarpa* as *Rhodymenia* [*Dendrymenia*] *skottsbergii* is incorrect.

When Skottsberg (1923) distinguished his new genus *Dendrymenia* from *Rhodymenia* Grev., he based the genus on the single species *D. flabellifolia* (Bory) Skottsberg [basonym: *Sphaerococcus flabellifolius* Bory (1828)]. As pointed out by Dawson (1941), it has been recognized that the material Skottsberg "had in hand" was not taxonomically identical to Bory's species, and he published the new species *Rhodymenia skottsbergii*, with the type from Concepcion Bay, Chile. At the same time Dawson (1941) demonstrated that genuine *Rhodymenia flabellifolia* (Bory) Montagne, which also occurs on the west coast of southern South America, lacks the amplexicaul character present in *R. skottsbergii*. Although some authors (e.g., Taylor, 1945 1947; Kylin 1956; Levring 1960; Santelices 1989) have recognized *Dendrymenia* as distinct from *Rhodymenia* on the basis of its sympodial development, other authors (e.g., Dawson 1941; Sparling 1957; Ramírez & Santelices 1991; Hoffmann & Santelices 1997; Saunders et al. 1999) have not. The critical point is that the type of a genus, namely, *Dendrymenia*, is a species (Art. 10.1 of the ICBN), and, as noted above, *D. flabellifolia* [*Sphaerococcus flabellifolius* Bory] lacks the critical diagnostic trait of *Dendrymenia* as conceived by Skottsberg, the sympodial development; therefore, *Dendrymenia* must be regarded as congeneric with *Rhodymenia*.

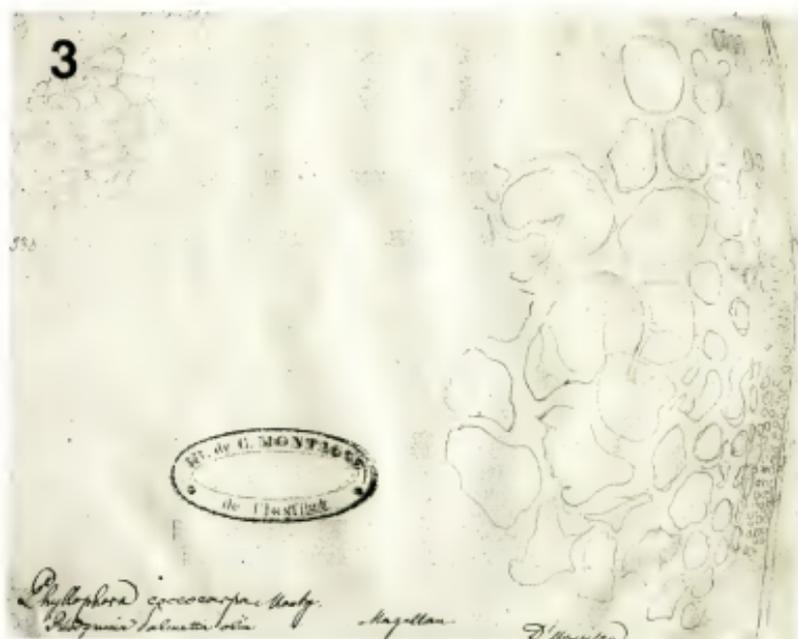


Fig. 3. Original sketch (in PC; MS 434, p. 4809).

*Phyllophora cuneifolia* J. D. Hooker & Harvey (1845) was described with a type locality in the Falkland Islands. One of the two original Hooker specimens (K in BM) was depicted by Cotton (1915, pl. 7). According to Ricker (1987), the lectotype for *Phyllophora cuneifolia* [K in BM] was collected by J. D. Hooker on 1 April 1842 from St. Salvador Bay, East Falkland Islands (selected by A. Gepp and J. H. Price). While reporting on new collections of this species from the Falkland Islands and southern Chile, Taylor (1939) transferred *P. cuneifolia* to *Rhodymenia*, but in so doing, he created a later homonym of *R. cuneifolia* Okamura (1934), the latter name now treated as *Gracilaria cuneifolia* (Okamura) I. K. Lee & Kurogi (1977), a species recognized from Japan, China, and Korea (Yoshida 1998; Zhang & Xia 1994; Kim et al. 2006). In the belief that the name of a taxonomic synonym was not available, Ricker (1987) proposed the new name *Rhodymenia subantarctica*, and that name has been used in contemporary literature (Wiencke & Clayton 2002; Graeve et al., 2002). The name of a synonym, however, is available, namely, *Phyllophora coccocarpa* Montagne (1852b), and the transfer to *Rhodymenia* is proposed here. This disposition, which was first proposed by Kylin and Skottsberg (1919), has been accepted by Papenfuss (1964), Ramírez & Santelices (1991), and by AlgaeBase (Guiry 2006).

***Rhodymenia coccocarpa*** (Mont.) M. J. Wynne comb. nov. *Phyllophora coccocarpa* Mont. Ann. Sci. Nat., Bot. sér. 3, 18: 318. 1852. *Membranifolium coccocarpum* (Mont.) Kuntze, Rev. gen. pl. 1891: 903.



Fig. 4. Detail of distal portion of holotype.

*Phyllophora cuneifolia* Hook. f. & Harvey, London J. Bot. 4: 260. 1845. *Rhodymenia cuneifolia* (Hook. f. & Harvey) W. R. Taylor Papers Mich. Acad. Sci., Arts & Letters 24: 147, 1939, non *Rhodymenia cuneifolia* Okamura, 1934. *Rhodymenia subantarctica* Ricker, Taxonomy and Biogeography of Macquarie Island Seaweeds: 215. 1987.

In addition to Montagne's illustration (1854, pl. 16, fig. 1), *Phyllophora coccocarpa* has been depicted by Cotton (1915, pl. 7), Kylin & Skottsberg (1919, fig. 10, as "*Rhodymenia corallina*"), Ricker (1887, fig. 90, as *Rhodymenia subantarctica*), and Wiencke and Clayton (2002, pl. 16, figs 4-5, as *Rhodymenia subantarctica*).

This species has been reported (sometimes under the names *Epymenia membranacea* and *Rhodymenia corallina*) from the Strait of Magellan and Tierra del Fuego (Piccone 1886; Hariot 1889; Skottsberg 1923), southern Chile (Hariot 1895; Kylin & Skottsberg 1919; Taylor 1939; Levring 1960), Easter Island and Juan Fenandez Island (Levring 1941; Etcheverry 1960), southern Argentina (Hariot 1895), the Falkland Islands (Hooker & Harvey 1845; Hooker 1846-1847; Cotton 1915; Taylor 1939), Îles Kerguelen (Hooker 1846-1847; Dickie 1876; Askenasy 1888; Zinova 1973), Macquarie Island (Ricker 1987), and Antarctica (namely, King George Island and Palmer Station of the Antarctic Peninsula) (Clayton et al. 1997; Wiencke & Clayton 2002). Taylor (1939) explained that while Skottsberg's (1923) concept of *Rhodymenia corallina* conformed to *Phyllophora coccocarpa*, Kylin's (1931: 21, pl. 8, fig. 20) concept did not.

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