
Volume 98
Number 2
2011

Annals
of the
Missouri
Botanical
Garden



A TAXONOMIC REVISION OF
GOUANIA (RHAMNACEAE) IN
MADAGASCAR AND THE OTHER
ISLANDS OF THE WESTERN
INDIAN OCEAN (THE COMORO
AND MASCARENE ISLANDS, AND
THE SEYCHELLES)¹

Sven Buerki,² Peter B. Phillipson,^{3,4} and Martin
W. Callmander^{3,5}

ABSTRACT

A taxonomic revision of the genus *Gouania* Jacq. (Rhamnaceae) is presented for Madagascar and the other western Indian Ocean islands. Seventeen species are recognized, of which nine are described and published as new (all endemic to Madagascar): *G. ambrensis* Buerki, Phillipson & Callm., *G. callmanderi* Buerki, *G. cupreifolia* Buerki, Phillipson & Callm., *G. cupuliflora* Buerki, Phillipson & Callm., *G. gautieri* Buerki, Phillipson & Callm., *G. perrieri* Buerki, Phillipson & Callm., *G. phillipsonii* Buerki, *G. taolagnarensis* Buerki, Phillipson & Callm., and *G. zebriifolia* Buerki, Phillipson & Callm. Sixteen species occur in Madagascar, of which 13 are endemic and three are common to Madagascar and one or more of the smaller Indian Ocean islands. The latter include *G. laxiflora* Tul., a species which is also present on mainland Africa. One species, *G. mauritiana* Lam., is endemic to Réunion Island. We recognize two subspecies within *G. scandens* (Gaertn.) R. B. Drum.: *G.*

¹ We would like to thank Professor Philippe Küpfer (Neuchâtel) and Nicolas Fumeaux (Genève) for helping S.B. during his Master's degree studies; Roger Lala Andriamiarisoa (Antananarivo) for his fine illustrations; Philippe Chassot (Neuchâtel) and Roy Gereau (St. Louis) for assistance with the Latin diagnoses; and the curators of the following herbaria for making material available for this study: G, K, MO, P, TAN, TEF, TUB, and WAG. Fieldwork was conducted under collaborative agreements between the Missouri Botanical Garden and the Parc Botanique et Zoologique de Tsimbazaza and the Direction de la Recherche Forestière et Piscicole, FOFIFA, Antananarivo, Madagascar. Financial support was provided to S.B. by the Fonds Wütrich in Neuchâtel, to P.B.P. and M.W.C. by the Andrew W. Mellon Foundation and the U.S. National Science Foundation (grant #0743355), and to M.W.C. by the National Institutes of Health, the U.S. National Science Foundation, and the U.S. Department of Agriculture under Cooperative Agreement U01 TW000313 with the International Cooperative Biodiversity Groups (ICBG). We also express our gratitude to our many friends and colleagues who have collected *Gouania* in Madagascar, and to Zachary Rogers, Laurent Gautier, an anonymous reviewer, and the Scientific Editor for providing valuable comments on the manuscript we originally submitted.

² Institut de Botanique, Université de Neuchâtel, Emile-Argand 11, CH-2009 Neuchâtel, Switzerland. Current address: Molecular Systematics Section, Jodrell Laboratory, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3DS, United Kingdom. s.buerki@kew.org.

³ Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

⁴ Département de Systématique et Evolution, Muséum National d'Histoire Naturelle, Case Postale 39, 57 rue Cuvier, 75231 Paris CEDEX 05, France.

⁵ Conservatoire et Jardin botaniques de la Ville de Genève, Ch. de l'Impératrice 1, 1292 Chambésy, Switzerland.
doi: 10.3417/2007075

scandens subsp. *scandens* and *G. scandens* subsp. *glandulosa* (Boivin ex Tul.) Buerki, Phillipson & Callm., the latter transferred from *G. glandulosa* Boivin ex Tul. Past confusion about the identity of this species is discussed. Five names are lectotypified: *G. aphrodes* Tul., *G. glandulosa* [= *G. scandens* subsp. *glandulosa*], *G. laxiflora*, *G. lineata* Tul., and *G. tiliifolia* Lam. Both lectotype and epitype are designated for *G. mauritiana*. Conservation assessments are provided for all species within their primary areas of occurrence.

Key words: Africa, Comoro Islands, *Gouania*, IUCN Red List, Madagascar, Mascarene Islands, Rhamnaceae, Seychelles.

The family Rhamnaceae is composed of 52 genera and 900 to 950 species (Medan & Schirarend, 2004). It comprises trees, shrubs, lianas, and a small number of herbs. Members of the family are easily recognized by their simple, alternate stipulate leaves that are often toothed and frequently possess strong parallel secondary veins and scalariform tertiary venation, and their small, (3 to)4- to 5(to 6)-merous flowers, which are haplostemonous with the stamens opposite the often clawed petals. The flowers possess a hypanthium with a nectary disc inside and have valvate calyx lobes that are ridged down the middle on the inner surface.

The pantropical genus *Gouania* Jacq. is comprised of 50 to 70 lianescent species (Mabberley, 2008). It is clearly separated from other genera of Rhamnaceae by the combination of the lianescent habit and the dry 3-winged schizocarp that separates into three 2-winged indehiscent mericarps (Medan & Schirarend, 2004). A recent phylogenetic analysis of Rhamnaceae based on *rbcL* and *trnL-F* sequences confirmed the monophyly of the tribe Gouanieae, and identified *Helinus* E. Mey. ex Endl. as the sister-group of *Gouania* (Richardson et al., 2000a, 2000b). The name *Gouania* commemorates Antoine Gouan (1733–1821), who was a professor at the University of Montpellier (France).

The taxonomy of the genus *Gouania* in the islands of the western Indian Ocean (Madagascar, the Comoro and Mascarene Islands, and the Seychelles) has not received much attention. Two species were described by Lamarck (1789), both from the Mascarene Islands, and later Tulasne (1857) described six species from Madagascar. The most recent treatment of *Gouania* for Madagascar and the Comoro Islands was published by Perrier de la Bâthie (1950). In this treatment, he recognized five species, three of which were subdivided into subspecies and varieties, and he placed three of Tulasne's Malagasy species in synonymy under *G. mauritiana* Lam. His treatment was based on less than 100 collections, all that were available at the time. Later, Guého (1979) recognized a new species on Rodrigues Island, bringing the total species count for the Mascarenes to three (Guého, 1997).

We present a taxonomic revision of the genus *Gouania* for the region, in which we recognize 17 species, nine of which are described as new. The classification proposed here relies essentially on the morphology of the plants, but it also presents a set of taxa with coherent distribution patterns, since biogeography and ecology play a vital role in speciation. It is one in a series of articles that will contribute to the Catalogue of Vascular Plants of Madagascar Project of the Missouri Botanical Garden (Phillipson et al., 2006; Madagascar Catalogue, 2010).

Madagascar is considered to be among the world's most critical biodiversity hotspots, and is thus a global priority for conservation (Myers et al., 2000). It has currently one of the world's highest rates of humid tropical forest deforestation (Achard et al., 2002; Brooks et al., 2002). Successful conservation strategies are dependent on sound taxonomy that provides critical data on threatened and endangered species. These data enable areas of high plant diversity and endemism to be identified, and serve to focus conservation efforts on priority targets (Hunter & Webb, 2002; Callmender et al., 2005, 2007). However, new taxonomic revisions are required for many plant groups in Madagascar, because the available treatments are based on old data and outdated species concepts and are inevitably misleading. Our revision of *Gouania* provides a good example of this, providing a very different vision of biodiversity patterns and conservation priorities for the genus than is available from existing literature. Furthermore, we have provided conservation assessments for all species (at least for their primary country of occurrence, and provided information on the known occurrence of each species in a protected area (PA). It is important to note that the PA network is currently in a state of flux in Madagascar, with the addition of new sites to the network and an increase in the total surface area of certain existing sites. Furthermore, changes are being made to the protection status of some sites; for example, numerous former Réserves Naturelles Intégrales are now classified as National Parks. Up-to-date information about the the PAs in Madagascar and their current

status can be obtained from the web site of Madagascar National Parks (2010).

MORPHOLOGY OF *GOUANIA*

The morphological characters that have been used in previous treatments of *Gouania* (notably Perrier de la Bâthie, 1943) have formed a firm foundation for our work. However, coupled with these are new observations made in the herbarium and in the field. Patterns of morphological variation and ecogeographic distribution were compared in order to circumscribe what we believe are biologically coherent taxa. A detailed discussion of the important morphological characters is given below. A key to the species allowing the determination of either flowering or fruiting specimens is provided.

LEAVES AND STIPULES

Perrier de la Bâthie (1943, 1950) placed considerable emphasis on leaf morphology. We have investigated this in greater detail and conclude that variation in leaf shape, texture, color (in dried specimens), margin type, the abaxial surface indument, and type of venation are particularly important. Most species of *Gouania* have ovate leaves, but exceptions include: *G. callmanderi* Buerki (elliptic to ovate-elliptic), *G. humbertii* H. Perrier (orbicular), *G. mauritiana* (lanceolate to deltoid), and *G. laxiflora* Tul. (cordate). The majority of the species have subcoriaceous leaf blades, but *G. cupuliflora* Buerki, Phillipson & Callm. has distinctly thicker, more rigid coriaceous blades, while *G. zebriifolia* Buerki, Phillipson & Callm. has thinner, more flexible membranous blades. Leaves of most species are more or less concolorous when dried but are notably discolored in others (e.g., *G. phillipsonii* Buerki). Leaf margins are generally entire, but some taxa have denticulate (*G. ambrensis* Buerki, Phillipson & Callm.) or serrate (*G. mauritiana*) margins. The abaxial surface of immature leaves usually possesses some kind of indument, but this is often caducous, giving rise to glabrous mature leaves. In other species the indument is persistent and sometimes very dense, variously distributed and composed of trichomes that differ in color, length, and orientation. The presence of strong tertiary veins arising from the secondary veins is also a valuable taxonomic character. Most of the species have at least one well-developed tertiary vein arising from the lowest pair of secondary veins (in addition to the fine reticulate network of tertiary veins that is present throughout the leaf), whereas only two species (*G. humbertii* and *G. lineata* Tul.)

completely and consistently lack conspicuous tertiary veins. Among all the taxa present in the region, *G. taolagnarensis* Buerki, Phillipson & Callm. has particularly well-developed venation, with even some conspicuous quaternary veins present arising from the first pair of tertiary veins. In this species the venation is more developed on one side of the leaf, causing the leaf base to be asymmetric. The reticulation is noticeably scalariform in most species; however, this pattern is inconspicuous in some taxa (e.g., *G. pannigera* Tul.). A dark brown triangular marking at the base of the stipule has been noted only in *G. ambrensis*.

FLOWERS AND INFLORESCENCE

Perrier de la Bâthie (1943) made extensive use of the shape of the hypanthium and the form of the nectary disc in delimiting taxon. Our studies confirm the importance of these characters and have revealed other variations in these organs of which Perrier de la Bâthie was apparently unaware, that we believe are also taxonomically useful. Most species have an obconic hypanthium, but *Gouania cupuliflora* Buerki, Phillipson & Callm., *G. gautieri* Buerki, Phillipson & Callm., and *G. humbertii* have a cupulate hypanthium. The nectar disc is always lobed, but the relative length of the lobes is highly variable. At one extreme, short lobes occur in *G. aphrodes* Tul. that reach only about one sixth of the length of the sepals, and at the other extreme the lobes of *G. laxiflora* are as long as or longer than the sepals. Moreover, the lobes of the disc within a single flower are markedly unequal in length in *G. scandens* (Gaertn.) R. B. Drumm. subsp. *glandulosa* (Boivin ex Tul.) Buerki, Phillipson & Callm. All species appear to have 3-lobed stigmas except those of *G. cupuliflora*, which are 2-lobed. The flowers may be sessile or pedicellate and grouped in either sessile or pedunculate glomerules, and the indument of the peduncles and pedicels is variable.

INFRUCTESCENCE AND FRUITS

In this study, several characters based on the infructescence were used to circumscribe taxa, notably the distribution of the fruits that develop to maturity, the type and color of the fruit indument, and the immature fruit shape. In most species, the fruits are equally distributed along the infructescence (e.g., *Gouania ambrensis*, *G. gautieri*), whereas in *G. perrieri* Buerki, Phillipson & Callm. they are often aggregated in the proximal part and in *G. laxiflora* they are concentrated in the distal part. Furthermore, *G. laxiflora* is the only species having a pyriform

immature fruit; the others have globose immature fruits. The indument color of the fruits may change at maturity. This is the case in *G. pannigera*, for instance, which has whitish trichomes that become reddish, and in *G. phillipsonii*, which has pale yellow to orange trichomes that become brown. In some species, for example *G. mauritiana*, the fruit indument is caducous. Unfortunately, the fruit morphology is inadequately known for several taxa, for example only mature fruits of *G. cupreifolia* and only immature fruits of *G. zebriifolia* are known.

MATERIALS AND METHODS

We have examined all available material of *Gouania* at G, K, MO, P, TAN, TEF, TUB, and WAG (herbarium acronyms follow Holmgren et al., 1990), representing in total more than 550 collections. Many of the species have been observed and collected by the authors in the field. Older herbarium collections lacking geographic coordinates were post facto georeferenced as far as possible using the "Gazetteer to Malagasy Botanical Collecting Localities" (Schatz & Lescot, 2005) and other sources, and these data are surrounded by square brackets in the citation of material examined in the taxonomic treatment that follows. Species distribution maps were created using ESRI ArcView 3.3 (Redlands, California, U.S.A.). Distributions were mapped on the five bioclimatic zones of Madagascar (after Cornet, 1974; modified by Schatz, 2000). The conservation status of each species was assessed using the current IUCN Red List Categories and Criteria version 3.1 (2001). The area of occupancy (AOO), extent of occurrence (EOO; based on a grid cell size of 3 × 3 km), and calculations of the number of subpopulation are based on methods presented in Callmänder et al. (2007).

TAXONOMIC TREATMENT

Gouania Jacq., *Select. Stirp. Amer. Hist.* 263. 1763.

TYPE: *Gouania tomentosa* Jacq., *Select. Stirp. Amer. Hist.* 263. 1763 (lectotype, designated by Pfeiffer [1871–1875: 1488]).

Woody lianas to 20 m; stems pale to dark green, drying gray, brown, ferruginous, or blackish, with ± 6 paler ridges, glabrous or pubescent; lateral branches terminating in a spikelike inflorescence, often producing a coiled tendril in the axil of the upper leaf; stipules glabrous to densely pubescent, usually ± caducous; tendrils puberulous to villous, sometimes glabrescent. Leaves cordate to orbicular, blade subcoriaceous, rarely coriaceous (*Gouania cupreifolia*), sometimes rather membranous (*G. gautieri*, *G.*

zebriifolia), petiolate; secondary veins alternate, often reaching the margin or curving upward and adjacent; conspicuous tertiary veins usually present (lacking in *G. humbertii* and *G. lineata*), arising along the lower edge of the lower secondary veins usually, conspicuous quaternary veins also present in *G. taolagnanensis*; scalariform reticulation usually visible; abaxial surface glabrous to densely pubescent, generally longer trichomes on the veins; midrib, secondary veins, and tertiary veins usually prominent; adaxial surface generally darker than the abaxial surface, glabrous to densely pubescent, venation not prominent; margin entire or toothed, flat or slightly recurved; base rounded to cordate; apex acute to rounded; glands present at the top of the petiole on the upper surface, at the base of the upper surface of the blade, and on marginal teeth. Inflorescences lax or congested, consisting of glomerules subtended by stipulelike bracts, flowers usually developing ± synchronously throughout the inflorescence; glomerules sessile or pedunculate, 3- to 20-flowered; bracts triangular or sometimes triangular-lanceolate or lanceolate, small, glabrous to densely pubescent, mostly caducous; flowers shortly pedicellate or sessile, pedicels glabrous or pubescent. Hypanthium most often obconic but occasionally cupulate; sepals 5, triangular, outer lamina generally pubescent, inner surface glabrous; petals 5, clawed, expanded section wrapped around the immature stamen; stamens 5, generally slightly longer than the petal blades, with a pale yellow filament and a pale yellow, globose anther; disc flat, 5-lobed; lobes alternating with the sepals, emarginate or somewhat truncate, very short to as long as sepals (sometimes variable in a single flower); stigma usually with 3 linear lobes, but occasionally 2-lobed (*G. cupuliflora*), style protruding from the disc. Infructescence lax or congested, bearing few to many fertile glomerules, with few to many sterile glomerules often also present. Fruits a dry 3-seeded schizocarp, globose when immature, 3-winged at maturity, dehiscent from the base into 3 valves; usually deeply emarginate at the apex and cordate at the base; seeds pale or dark brown, shiny, ovoid and slightly flattened on the inner surface, rounded on the outer surface.

KEY TO THE SPECIES OF *GOUANIA* IN MADAGASCAR AND THE WESTERN INDIAN OCEAN ISLANDS

1. Secondary veins simple, unbranched; prominent tertiary veins absent (tertiary veins comprising only a fine tertiary reticulum); both surfaces of the leaves completely glabrous 2
- 1'. Secondary veins branched, at least the basal pair giving rise to 1 or more prominent and conspicuous tertiary veins; adaxial surface of young leaves pubescent, at least on the veins 3

2. Leaf blades ovate to elliptic, not usually conduplicate, with 6 to 7 pairs of secondary veins; hypanthium obconic; lobes of the disc as long as the sepals; widespread in western Madagascar 9. *G. lineata*
- 2'. Leaf blades orbicular, often conduplicate, with 4 to 5 pairs of secondary veins; hypanthium cupulate; lobes of the disc 2/3 or as long as the sepals; confined to Analamerana and Daraina (northwestern Madagascar) 7. *G. humberitii*
3. Glomerules all clearly pedunculate at flowering and fruiting time; peduncles more than 1.5 mm long 4
- 3'. Glomerules mostly sessile or shortly pedunculate at flowering and fruiting time; peduncles mostly less than 1 mm (sometimes the basal glomerules have longer peduncles). Note that in *G. ambrensis* and *G. callmanderi* the pedicels, but not the peduncles, are relatively long (2–5 mm) 7
4. Inflorescence axes (1.5–)2 mm diam., with a brown or a reddish indument 5
- 4'. Inflorescence axes to 1 mm diam., puberulous or glabrescent with a whitish indument 6
5. Leaf elliptic or ovate, colorless, glabrous on both surfaces, margin entire; hypanthium cupulate; lobes of the disc 2/3 as long as the sepals; fruits oblong (ca. 1.5 × 1 cm); seeds 7 × 4 × 0.5 mm; confined to secondary forests near Manongarivo (northwestern Madagascar) ... 6. *G. gautieri*
- 5'. Leaf broadly ovate, discolorous, abaxial surface densely pubescent with a reddish indument, margin sparsely denticulate; hypanthium obconic; lobes of the disc 1/4 as long as the sepals; fruits spheroid (ca. 0.8 × 0.8 cm); seeds 3 × 2 × 1 mm; widespread in mid-elevation humid forest in eastern Madagascar 14. *G. philipsonii*
6. Abaxial surface of young leaf glabrous on the secondary veins and midrib; leaf margin shallowly crenate; lobes of the disc emarginate, 1/3 as long as the sepals; immature fruits winged; northwestern Madagascar (Sambirano region and Ankarana) 13. *G. perrieri*
- 6'. Abaxial surface of young leaf puberulent; leaf margin denticulate; lobes of the disc rounded, as long as or longer than the sepals; immature fruits pyriform, unwinged at first, the wings developing late during maturation; widespread in western and southwestern Madagascar, also on Mayotte, Aldabra, and Rodrigues 8. *G. laxiflora*
7. Leaf abaxially glabrous to sparsely hirsute with buff to ferruginous trichomes on veins; mature stems glabrous 8
- 7'. Leaf abaxially densely pubescent to villous with a whitish, grayish, or beige indument covering the limb and veins; mature stems with an evident indument 10
8. Inflorescence congested; fruits small, spheroid (ca. 0.6 × 0.6 cm); lobes of the disc 1/6 as long as the sepals; leaves somewhat discolorous, tending to dry dark brown adaxially; widespread in eastern Madagascar 11. *G. myriocarpa*
- 8'. Inflorescence lax; fruits large, oblong (ca. 1 × 0.7 cm); lobes of disc more than 1/3 as long as the sepals; leaves hardly discolorous, tending to dry greenish on both surfaces; Madagascar, Comoro Islands, Mauritius, and Réunion Island ... 9
9. Lobes of the disc 1/4 to 2/3 as long as the sepals, often very variable on the same flower; fruits large, markedly wider than long (1–1.5 × ca. 2 cm), glabrous, concentrated on the distal part of the infructescence; pedicels of immature fruits often arcuate; stems and petioles dark brown; widespread in low to mid-elevation forest (0–1100 m) in eastern Madagascar, and in Mauritius 15. *G. scandens*
- 9'. Lobes of the disc 2/3 as long or as long as the sepals; fruits small, slightly wider than long (ca. 1 × 0.7 cm), pubescent with brown trichomes, sparsely distributed over the infructescence; pedicels of immature fruits not arcuate; stems and petioles gray; from scattered localities in mid- to high-elevation forest (800–1400 m) in eastern Madagascar 4. *G. cupreifolia*
10. Leaf blades orbicular or reniform, membranous, pubescent with white trichomes between the veins and brown trichomes on the veins; reticulation conspicuous, scalariform, dark; margin crenulate; recorded only from Daraina and Sahafary (northwestern Madagascar) 17. *G. zebriifolia*
- 10'. Leaf blades ovate or elliptic, subcoriaceous to coriaceous, pubescent not as above; reticulation inconspicuous; margin entire or sparsely denticulate; Madagascar, Comoro Islands, and Réunion Island 11
11. Flowers cupulate; lobes of the disc 2/3 as long as the sepals; flowers and fruits sessile ... 5. *G. cupuliflora*
- 11'. Flowers obconic; lobes of the disc up to 1/2 as long as the sepals; flowers and fruits pedicellate (sometimes shortly so) 12
12. Lobes of the disc 1/2 as long as the sepals; pedicels in flowers and fruits 3–5 mm long 13
- 12'. Lobes of the disc to 1/4 as long as the sepals; pedicels in flowers and fruits up to 1 mm long ... 14
13. Leaf blades ovate; inner surface of the stipule with a dark brown triangle at the base; inflorescence ± congested; immature fruits with a silvery indument; fruits slightly wider than long (ca. 1.2 × 1.4 cm), sparsely pubescent with silver trichomes; known only from Montagne d'Ambre (Madagascar) 1. *G. ambrensis*
- 13'. Leaf blades elliptic; inner surface of the stipule without triangle on the basal part; inflorescence lax; immature fruits with a yellow indument; fruits as long as wide (ca. 0.8 × 0.8 cm), puberulous at maturity; western and southwestern Madagascar 3. *G. callmanderi*
14. Fruits glabrous or glabrescent with beige trichomes at maturity; apex of leaf blade acuminate or sometimes acute 15
- 14'. Fruits densely pubescent with reddish or brown trichomes at maturity; apex of leaf blade rounded or subacute 16
15. Leaf blades lanceolate; veins of the abaxial surface covered with a reddish indument; tertiary veins abundant, arising from the lowest secondary veins; glomerules compact, subtended by a persistent large bract; lobes of the disc distinctly thinner than the disc, emarginate, 1/4 as long as the sepals; only known with certainty from Réunion Island 10. *G. mauritiana*
- 15'. Leaf blades elliptic to ovate; veins of the abaxial surface covered with beige trichomes, somewhat

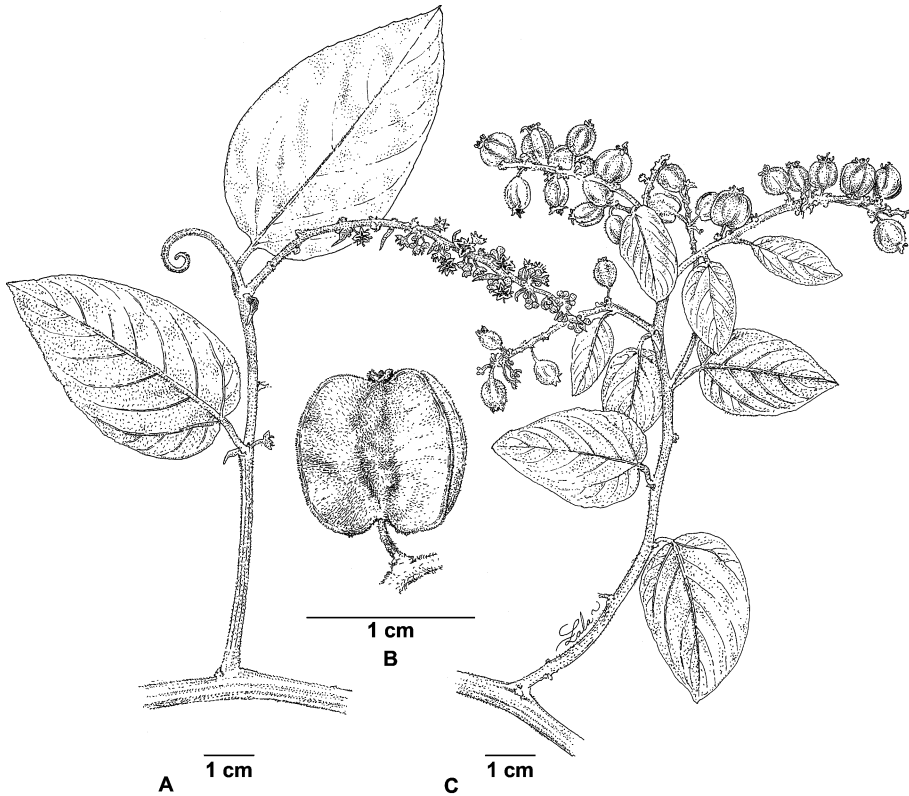


Figure 1. *Gouania ambrensis*. —A. Flowering branch, showing the disc lobes of the flowers, which reach halfway along the sepals. —B. Fruit, showing its sparse pubescence. —C. Fruiting branch, showing the even distribution of fruits throughout the infructescence. A drawn from *van Nek 1904* (TAN); B, C drawn from *van Nek 1901* (TAN).

- glabrescent; tertiary veins few, arising generally from the second pair of secondary veins; glomerules lax, subtended by a caducous small bract; lobes of the disc thicker than the disc, truncate, 1/6 as long as the sepal; northern Madagascar and the Comoro Islands. 2. *G. aphrodes*
16. Leaf blades ovate, base cordate with asymmetric lobes; leaf margin slightly crenulate near the apex; veins of the abaxial surface not reddish when dried, quaternary veins present on the larger lobe of the blade; reticulation apparent; inflorescence with a brownish indument; immature fruits covered with a yellow indument, fruits generally concentrated in the distal part of the infructescence; southeastern Madagascar (near Taolagnaro or Fort Dauphin) 16. *G. taolagnarensis*
- 16'. Leaf blades ovate, base rounded, symmetrical; leaf margin of the apex entire; veins of the abaxial surface reddish when dried, quaternary veins absent; reticulation conspicuous; inflorescence with a reddish indument; immature fruits covered with a whitish indument, fruits sparsely distributed within the infructescence; central Madagascar 12. *G. pannigera*

1. *Gouania ambrensis* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Antsirana: à 7 km O du village de Bobakilandy, 12°35'17"S,

49°02'13"E, 379 m, 12 Sep. 1995 (fl.), *O. Andrianantoanina* & *R. Bezara 864* (holotype, MO!; isotypes, P!, TAN!). Figure 1.

Gouania mauritiana Lam. var. *latiloba* H. Perrier, Notul. Syst. (Paris) 11: 34. 1943, nom. nud.

Haec species a congeneris madagascariensibus stipulis dense pubescentibus pagina interna ad partem basalem triangulo atrofusco ornatis, foliis ovatis abaxialiter indumento lanato albedo obtectis, floribus indumento argenteo vestitis, disci lobis longitudine 1/2 sepalorum partem attingentibus atque fructibus paullo latoribus quam longioribus secus infructescentiam aequaliter dispositis facile distinguitur.

Woody liana; stems dark green, drying brownish, densely pubescent with a pale brown indument on fertile shoots and with a ferruginous indument on vegetative shoots; stipules densely pubescent with a brownish indument on both surfaces, (4-)5(-6) × ca. 2 mm, inner surface with a dark brown triangular mark basally; tendrils pubescent. Leaves ovate; petioles (8-)10(-15) mm, pubescent with ferruginous or brownish trichomes; leaf blades (4-)4.5-5(-7.5) × (2-)2.5-3(-5) cm, concolorous; secondary veins alternate, 6 to

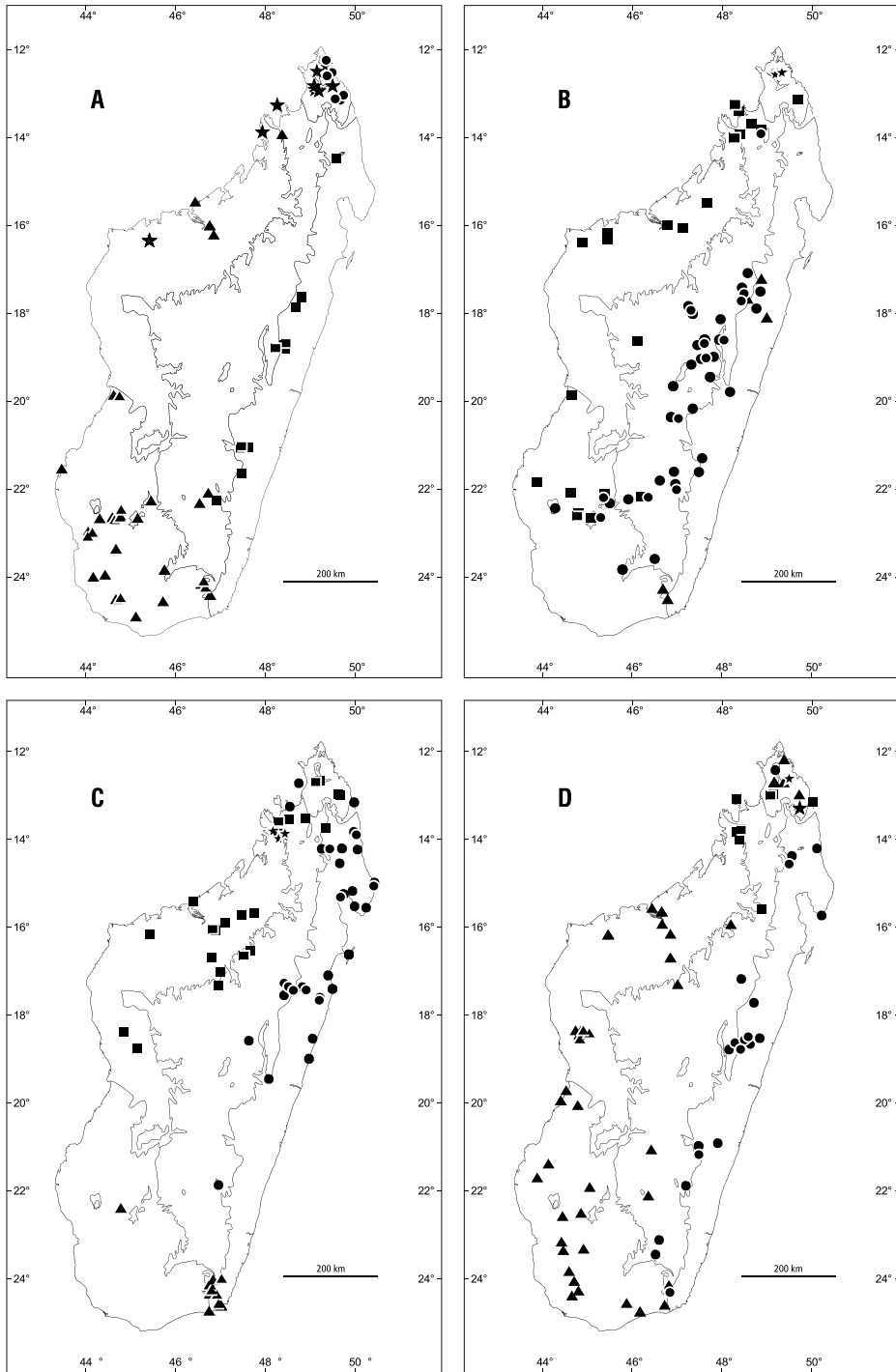


Figure 2. Distribution of *Gouania* species occurring in Madagascar, mapped on the bioclimatic zones (after Cornet, 1974; adapted by Schatz, 2000). —A. *G. callmanderi* (triangle), *G. perrieri* (star), *G. phillipsonii* (square), and *G. zebrifolia* (circle). —B. *G. ambrensis* (star), *G. cupreifolia* (triangle), *G. lineata* (square), and *G. pannigera* (circle). —C. *G. cupuliflora* (square), *G. gautieri* (star), *G. taolagnarensis* (triangle), and *G. scandens* subsp. *glandulosa* (circle). —D. *G. aphrodes* (square), *G. humbertii* (star), *G. laxiflora* (triangle), and *G. myriocarpa* (circle).

7 pairs, not reaching the margin but following it; tertiary veins apparent, 4 to 6 pairs, arising near the base of the lowest secondary veins, reticulation obscure; abaxial surface lanate with whitish trichomes; midrib, secondary veins, and tertiary veins prominent; adaxial surface pubescent with appressed whitish trichomes; margin of the young leaf blades entire, becoming sparsely denticulate with visible glands; base rounded, sometimes slightly truncate; apex generally acute, sometimes apiculate. Inflorescences \pm congested, densely pubescent with a whitish indument, (5–)7–8(–12) cm, consisting of glomerules subtended by stipulelike bracts; glomerules sessile, to 10-flowered; bracts densely pubescent on both surfaces with brownish trichomes, \pm persistent, (2–)3 \times ca. 1 mm; flowers pedicellate, pedicels (3–)4–5 mm, densely pubescent with long silver trichomes. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 2 \times 0.75 mm, pale yellow, outer surface densely pubescent with silver trichomes, inner surface glabrous; petals ca. 1.25 \times 0.25 mm, whitish; stamens with a pale yellow filament and a pale yellow, globose, ca. 0.2 \times 0.2 mm anther; disc flat, ca. 3 mm diam.; lobes ca. 1 mm, truncate or somewhat emarginate, 1/2 as long as the sepals or slightly shorter; stigma with 3 linear lobes ca. 0.25 mm, style 0.1 mm. Fruits no more than 1 developing on each glomerule, oblong (ca. 1.2 \times 1.4 cm), sparsely pubescent with brown to silver trichomes, equally distributed throughout the infructescence; valves ca. 12 \times 7 mm; immature fruits globose, pubescent with brown to silver trichomes; seeds pale brown, ovoid and slightly flattened, ca. 4 \times 2.5 \times 1 mm.

Distribution and ecology. *Gouania ambrensis* is endemic to Montagne d'Ambre in the north of Madagascar (Fig. 2B). This species grows on basement rocks in the transitional zone between humid and dry forest at an elevational range of 400 to just over 1000 m.

IUCN Red List category. *Gouania ambrensis* has an EOO of 14 km² and an AOO of 27 km², and consists of two known subpopulations, one of which occurs in a protected area. It is therefore assigned a preliminary status (IUCN, 2001) of Endangered (EN B2ab[ii]).

Phenology. This species has been collected in flower in October, with immature fruit in October and mature fruit in November.

Etymology. The epithet of the new species refers to its endemic locale, on Montagne d'Ambre in Antsiranana Province.

Discussion. Perrier de la Bâthie recognized this taxon as *Gouania mauritiana* var. *latiloba*, affiliated with *G. mauritiana* subsp. *aphrodes* (Tul.) H. Perrier, both infraspecies mentioned by him in 1943. The varietal name was not accompanied by a Latin description or diagnosis and is therefore not validly published, according to the *International Code of Botanical Nomenclature* (ICBN; McNeill et al., 2006: Art. 36.1). In this study we consider it to be a distinct species distinguished from others in the region by the combination of the following characters: ovate leaves; the presence of the dark brown, triangular mark on the basal part of the stipule inner surface (absent in all other species); the whitish indument on its inflorescence axes; the densely silvery-pubescent flowers; the lobes of its floral disc, which are one half as long as the sepals; and its mature fruits that are covered with a silver to whitish indument.

Paratypes. MADAGASCAR. **Antsiranana:** Montagne d'Ambre, versants est, 12°34'S, 49°13'E, S. M. Trigui, M. H. Razanajatovo & S. D. Ramandimbimanana 332 (G, K, MO, P, TEF); Près d'Ambavahibe, H. Perrier de la Bâthie 17700 (K, P); Montagne d'Ambre PA, rd. to Joffreville, 12°31'S, 49°10'E, F. I. van Nek 1819 (TAN, WAG); Montagne d'Ambre PA, NNW of Les Roussettes, 12°28'S, 49°10'E, F. I. van Nek 1901 (TAN, WAG); Montagne d'Ambre PA, F. I. van Nek 1904 (TAN); Montagne d'Ambre PA, along rd. N of Joffreville, 12°29'S, 49°12'E, F. I. van Nek 1939 (TAN, WAG).

2. *Gouania aphrodes* Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 132. 1857, as "*Guania*." *Gouania mauritiana* Lam. subsp. *aphrodes* (Tul.) H. Perrier, Notul. Syst. (Paris) 11: 34. 1943. TYPE: Madagascar. Antsiranana: Hellville, Nov. 1847 (fr.), L.-H. Boivin 2171 (lectotype, designated here, P!; isotype, G[2!]). Figure 3A.

Gouania eriocarpa Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 133. 1857, as "*Guania*." TYPE: Comoro Islands. Grande Comore: au-dessus de Vouini, Mai 1850 (fr.), L.-H. Boivin s.n. (holotype, P!; isotype, G!).

Gouania pannigera Tul. f. *macrophylla* Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 134. 1857, as "*Guania*" and "*macrophyllam*." TYPE: Comoro Islands. Grande Comore: au-dessus de Vouini, Mai 1850 (fr.), L.-H. Boivin s.n. (holotype, P!).

Woody liana; stems dark green, drying brown to ferruginous, finely pubescent to villous with somewhat caducous beige trichomes; stipules finely pubescent with beige trichomes, 2(–3) \times ca. 0.75 mm; tendrils pubescent. Leaves ovate; petioles (5–)10–15(–25) mm, pubescent with beige trichomes; leaf blades (4–)5.5(–8.5) \times (2–)3.5(–5) cm, discolorous; secondary veins alternate, 6 to 7(to 10) pairs, not reaching the margin but following it; tertiary veins apparent, arising

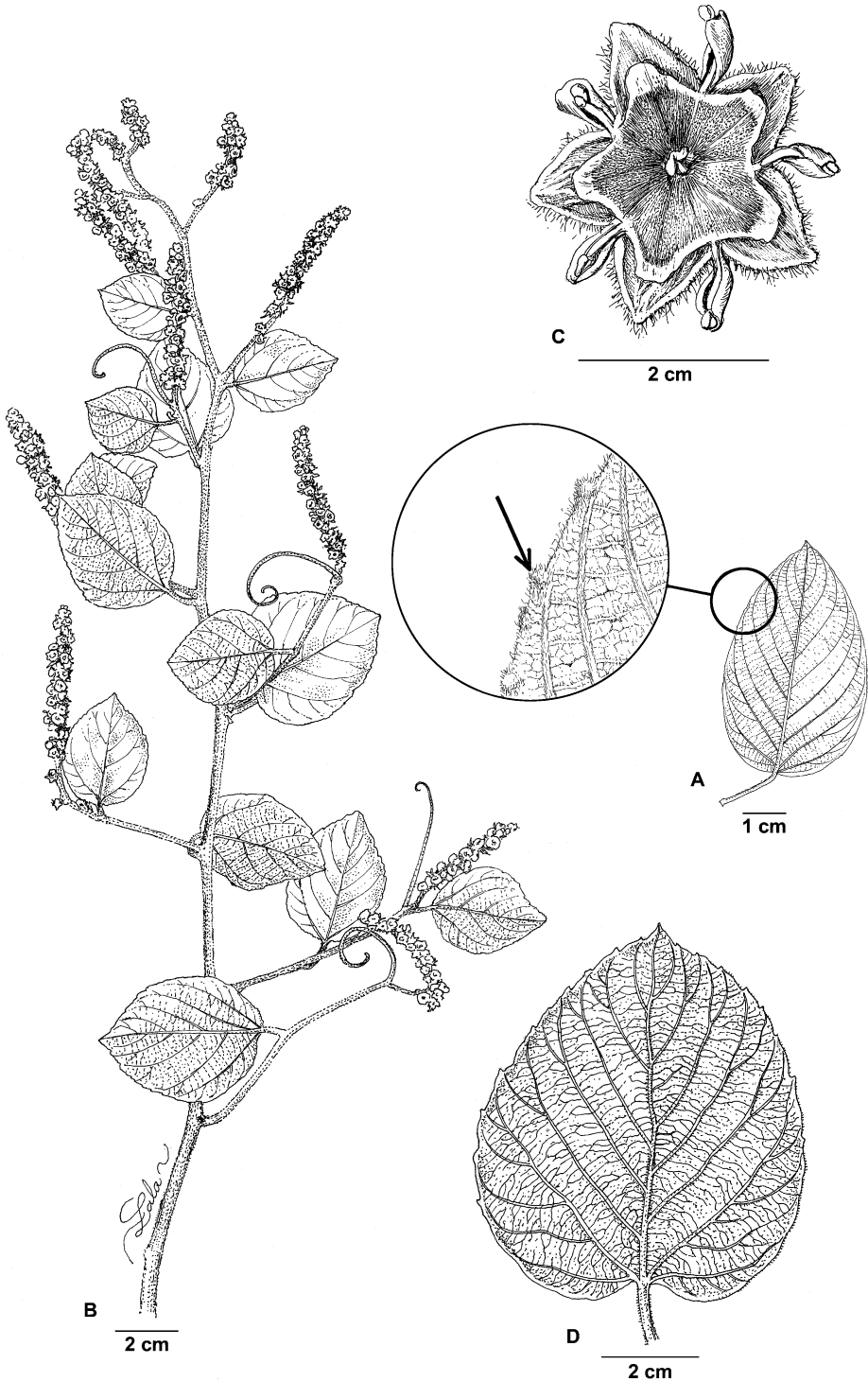


Figure 3. —A. *Gouania aphrodes*, leaf with detail of the margin. B–D. *Gouania zebrifolia*. —B. Habit. —C. Flower, showing the lobes of the disc reaching halfway along the sepals. —D. Leaf, showing its denticulate margin. A drawn from *Centry 11892* (TAN); B–D from *Gautier et al. 4263* (TEF).

generally only from the second or third secondary veins, reticulation scalariform; abaxial surface densely pubescent to villous with beige trichomes, somewhat glabrescent (Malagasy specimens have a denser indument than those from the Comoro Islands); midrib, secondary veins, and tertiary veins slightly prominent; adaxial surface glabrescent; margin denticulate near the apex, every sinus with an apical tuft of beige trichomes; base rounded and sometimes shallowly cordate; apex acuminate. Inflorescences congested, covered with an indument similar to stems, (7–)13(–17) cm; glomerules sessile, (4 to)5- to 6-flowered; bracts densely pubescent on both surfaces with a beige indument, caducous, (2–)3 × ca. 1 mm; flowers and fruits pedicellate, pedicels to 1 mm, densely pubescent with white trichomes. Hypanthium broadly obconic, becoming subglobose as the capsule develops; sepals triangular, ca. 1.3 × 1 mm, brown to reddish when dried, outer surface densely pubescent, inner glabrous; petals ca. 1 × 0.5 mm, white; stamens slightly longer than petals, with a pale brown filament and a pale brown globose anther ca. 0.1 × 0.1 mm; disc flat, shallowly 5-lobed, ca. 3 mm diam.; lobes ca. 0.2 mm, thickened, truncate, 1/6 as long as the sepals; stigma with 3 linear lobes, those ca. 0.8 mm, style ca. 1 mm. Fruits 0 or 1 developing on each glomerule, spheroid (ca. 0.8 × 0.8 cm), glabrescent to glabrous, equally distributed throughout the infructescence; valves ca. 9 × 5 mm; seeds brown, shiny, ovoid, and slightly flattened, ca. 3 × 2 × 1 mm.

Distribution and ecology. *Gouania aphrodes* occurs in northern Madagascar and the Comoro Islands (Anjouan, Mayotte, and Mohéli) (Fig. 2D). It grows on margins of evergreen lowland forest at an elevational range from sea level to 500 m.

IUCN Red List category. Within Madagascar, *Gouania aphrodes* has an EOO of 30,560 km², an AOO of 81 km², and six known subpopulations, one of which occurs in a protected area (Manongarivo). Based on IUCN Red List criteria (IUCN, 2001), we assign a preliminary status of Vulnerable (VU B2ab[ii]) for this species in Madagascar. Its conservation status in the Comoro Islands has not been assessed.

Phenology. This species has been collected in flower in May and in fruit in August.

Discussion. *Gouania aphrodes* was based on four syntypes: *Boivin* 2171, *Boivin* 2646, *Pervillé* 339, and *Richard* 133 (Tulasne, 1857). A syntype at P bears a single label with the two collection numbers *Boivin* 2646 and *Richard* 133 written on it; the origin of this collection is unclear and therefore would not be a

suitable choice as lectotype. We select *Boivin* 2171 as lectotype over *Pervillé* 339, because it is in better condition, and two duplicates are present at G.

Perrier de la Bâthie (1943) regarded this taxon as a subspecies of *Gouania mauritiana*. He also recognized two other subspecies of *G. mauritiana* from Madagascar: *G. mauritiana* subsp. *pannigera* (Tul.) H. Perrier and *G. mauritiana* subsp. *myriocarpa* (Tul.) H. Perrier. We treat these three infraspecific taxa as separate species, distinct from *G. mauritiana*. Furthermore, Perrier de la Bâthie (1943) recognized three varieties within his *G. mauritiana* subsp. *aphrodes*: the typical variety, as well as two others (*G. mauritiana* var. *angustiloba* H. Perrier, *G. mauritiana* var. *latiloba*). Neither varietal name was validly published by Perrier de la Bâthie, and in our opinion these taxa also merit recognition at the species level. They are described herein as *G. ambrensis* and *G. cupuliflora*.

Gouania aphrodes can be easily distinguished from *G. pannigera* (to which it is most similar) by its leaves, which are acuminate (vs. rounded to subacute in *G. pannigera*), having a fine, light brown indument on the abaxial surface (vs. a reddish brown indument) and denticulate margins (vs. entire or sometimes with one or two teeth near the teeth), and also by its small (ca. 0.8 × 0.8 cm), glabrescent or glabrous fruits (vs. larger, ca. 1 × 1.4 cm, sparsely reddish pubescent fruits). Furthermore, *G. aphrodes* grows in evergreen lowland forests at elevations of 0–500 m in northern Madagascar and the Comoro Islands, while *G. pannigera* colonizes the evergreen montane forests and disturbed areas at 800–1500 m in the central highlands of Madagascar.

Additional specimens examined. COMORO ISLANDS. s. loc., fr., *Boivin* s.n. (G, P); fl., *Humblot* 25 (K). ANJOUAN: Anjouan, s.d., *Boivin* s.n. (P); Johanna Island, *Meller* s.n. (K). MAYOTTE: Grande Terre, Ouangani, Hachike, *Barthelat* & *M'Changama* 428 (G, K, MO, P); Grande Terre, Ouangani, Coconi, carrefour d'Hachike, *Barthelat et al.* 882 (G, K, P); s. loc., fl., *Boivin* 3366 (G, K); Forêt de Mazé Mont Bini, *Humblot* 1025, 1029 (P); Coconi, secondary thicket behind Director of Agriculture's residence, *Lorence* 2891 (P); Sohoa, *Pascal* 557 (G, K, MO, NY, P, TEF, WAG); Coconi, *Tingy* 796 (P). MOHÉLI [Mohéli]: inful. Mohely, s.d., *Boivin* s.n. (P); Nioumachoua, Mtrawia, *Labat et al.* 3740 (G, K, MO, P). MADAGASCAR. s. loc., "Central Madagascar," fr., *Baron* 302 (K); fr., *Baron* 6521 (K). ANTSIRANANA: Ambilobe, *Decary* 14789 (P); W base of Manongarivo Massif, *Gentry* 11892 (K, MO, P, TAN); A'Mananjeba (Nord), Sambirano, *Perrier de la Bâthie* 6019 (P); Massif du Manongarivo, *Perrier de la Bâthie* 6040 (P); Nosy Be, *Pervillé* 339 (K, P); Ambonitohaka, *Réerves Naturelles* 12657-RN (TAN); Vohémar, *Richard* 133 (P). MAHAJANGA: Vallée de l'Antsahakolany, *Decary* 2160 (G, P); Bejofo, *Decary* 2202, 2208 (P); Mandritsara, *Hb. Jard. Bot. Tananarive* 16 (P); bassin moyen du Bemarivo (Boina), *Perrier de la Bâthie* 6038 (P).

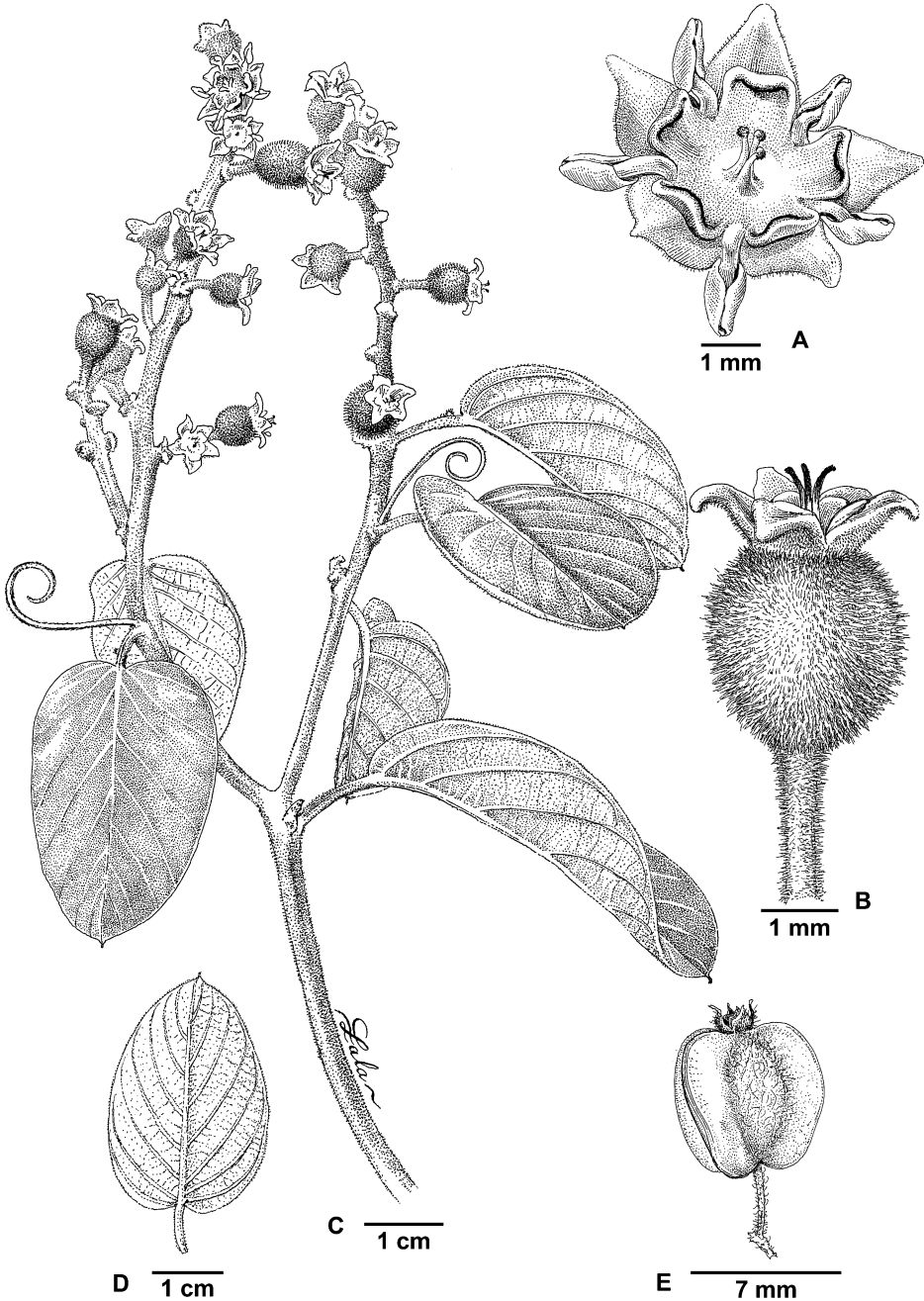


Figure 4. *Gouania callmanderi*. —A. Flower, showing the lobes of the disc reaching one fourth of the way along the sepals. —B. Immature fruit covered by a yellow indument. —C. Habit, showing the long pedicels. —D. Leaf, showing the lack of visible tertiary veins. —E. Fruit. A, D drawn from the holotype Buerki et al. 61 (MO); B, C from Buerki et al. 55 (TAN); E from Bosser 28 (TAN).

3. *Gouania callmanderi* Buerki, sp. nov. TYPE: Madagascar. Toliara: 17 km de Sakaraha, bord de la RN7, 22°53'23"S, 44°40'43"E, 763 m, 19 Mar. 2005 (fl., imm. fr.), S. Buerki, P. B. Phillipson & C. Rakotovoao 61 (holotype, MO!; isotypes, BR!, G!, K!, P!, S!, TAN!, US!, WAG!). Figure 4.

Haec species a congeneris madagascariensibus foliis parvis ellipticis usque ovato-ellipticis abaxialiter indumento albido obtectis, floribus pedicellis longis insidentibus, disci lobis longitudine 1/4 sepalorum partem attingentibus atque fructu juvenili indumento luteo obtecto facile distinguitur.

Woody liana climbing to 8 m; stems dark green, drying brown, finely pubescent to villous with brown to whitish trichomes; stipules ca. 1×0.25 mm, densely villous with brown trichomes; tendrils villous or pubescent. Leaves elliptic to ovate-elliptic; petioles (9–)10(–16) mm, pubescent to villous with brown trichomes and sometimes also white trichomes; leaf blades (3.5–)4.5–5(–7) \times (2–)2.5–4.5(–5) cm, discolorous; secondary veins alternate, 7 to 8 pairs, reaching and following the margin; tertiary veins apparent, 1 or 2 pairs, sometimes arising near the base of the lowest secondary vein, reticulation obscure; abaxial surface pale green, villous with white trichomes, and with occasional long brown trichomes present on the midrib and on the secondary veins, margin entire; midrib and secondary veins prominent; adaxial surface finely and sparsely villous, with longer white trichomes on veins; margin entire; base rounded; apex acute to shortly attenuate, with a short apiculus bearing a tuft of long trichomes. Inflorescences somewhat lax, pubescent with whitish trichomes, (4.5–)6–8(–14) cm, consisting of glomerules subtended by stipulelike bracts; glomerules generally pedunculate, (1–)4 mm, sometimes sessile, white-villous, 4- to 8-flowered; bracts densely pubescent on the outer surface with pale brown trichomes, glabrous on the inner surface, caducous, (1–)2 \times ca. 0.5 mm; flowers apparently protandrous, borne on (2–)3(–4) mm, villous pedicels. Hypanthium broadly obconic, ca. 1×1.5 mm, becoming subglobose as the capsule develops; sepals ca. 1×1 mm, pale yellow, outer surface villous, inner glabrous; petals ca. 1×0.25 mm, white; stamens slightly longer than petal, with a pale yellow filament and a pale yellow anther ca. 0.3×0.2 mm; disc flat, ca. 3 mm diam.; lobes ca. 0.25 mm, slightly recurved, rounded to shallowly emarginate or somewhat truncate, 1/4 as long as the sepals, young disc yellow, becoming pale yellow; stigma with 3 linear lobes, those ca. 0.4 mm, style ca. 0.5 mm. Fruits 0 to 2 developing on each glomerule, small (ca. 0.8×0.8 cm), spheroid, puberulous, equally distributed throughout the infruc-

tescence; valves ca. 8×4 mm; immature fruits with a yellow indument; seeds brown, shiny, ovoid and slightly flattened, ca. $3 \times 2 \times 1.5$ mm.

Distribution and ecology. *Gouania callmanderi* grows in western and southwestern Madagascar (Fig. 2A). The new species can be found in semi-deciduous, deciduous, and xerophytic vegetation on limestone and sand at an elevation range from sea level to 1300 m.

IUCN Red List category. With an EOO of 296,807 km², an AOO of 279 km², and 22 known subpopulations, five of which occur within protected areas (Ampijoroa, Andohahela, Isalo, Manongarivo, Zombitsy), *Gouania callmanderi* is assigned a preliminary status of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. This species has been observed flowering from October to March and fruiting from April to August.

Etymology. The species epithet was chosen by the first author in honor of Martin W. Callmander (1975–), Swiss botanist and co-author of this article, who introduced Sven Buerki to the Malagasy flora and supervised his M.Sc. dissertation, and in appreciation of his valued collaboration on numerous projects.

Discussion. This species is closest to *Gouania ambrensis* in the length of the pedicels and the whitish color of the inflorescence indument, but differs most notably in having elliptic to ovate-elliptic, discolorous leaves (vs. ovate, concolorous in *G. ambrensis*), lobes of the disc about one fourth as long as the sepals (vs. lobes about one half as long), immature fruits with a yellow indument (vs. a brown to silver indument), and small fruits (ca. 0.8×0.8 cm vs. ca. 1.2×1.4 cm). Furthermore, *G. callmanderi* occurs throughout the west of Madagascar and is especially abundant in the southwest, whereas *G. ambrensis* is endemic to the Montagne d'Ambre in the extreme north of the island.

Paratypes. MADAGASCAR. **Antsiranana:** Manongarivo/Ambongo, [13°59'24"S, 48°22'12"E], H. Perrier de la Bâthie 6026 (P). **Fianarantsoa:** Vestiges forestiers à l'entrée d'Ihoso, 22°18'15"S, 46°16'43"E, S. Buerki, P. B. Phillipson & C. Rakotovoao 55 (K, MO, P, TAN); Ihoso, [22°23'S, 46°07'E], J. Peltier & M. Peltier 2725 (TAN); rd. from Ihoso to Farafangana (9 km before Ihoso), 22°33'02"S, 46°32'36"E, P. De Block 1954 (BR, MO, P). **Mahajanga:** Antsianitia, 15°34'54"S, 46°25'14"E, M. W. Callmander & Phillipson 687 (G, K, MO, P, TAN); Ampijoroa, 16°19'S, 46°49'E, Phillipson 1929 (K, P, TAN, WAG); vic. of Lac Ampijoroa, [16°11'S, 47°06'E], A. Gentry 11456 (K, MO, P, TAN, WAG), Gentry 11487 (MO, P, TAN). **Toliara:** Forêt

de Marosalaza, 50 km N de Morondava, [20°02'S, 44°33'E], *J. P. Abraham 115 part A* (K, P); Manasoa Tanosy, *K. R. Afzelius s.n.* (P); Lambomakondra, [22°42'S, 44°42'E], *J. Bosser 28* (TAN); Masokara, plateau Mahafaly, Ankairano, [20°02'S, 44°33'E], *Bosser 14282* (TAN); Zombitsy PA, 22°52'43"S, 44°42'51"E, *Buerki, Phillipson & Rakotova* 59 (BR, G, K, MO, P, S, TAN, US, WAG); Rte. d'Anjamala, [23°11'30"S, 43°57'30"E], *F. Chauvet 441* (P, TEF); Zombitsy PA, [22°49'48"S, 44°41'24"E], *T. B. Croat 30711* (MO, TAN); 23–43 km E of Tulear along rd. to Andranovory, [23°19'S, 43°56'E], *Croat 31027* (MO, TAN, WAG); SW of Ampanihy on rte. to Androka betw. Ampanihy & PK 10, [24°45'S, 44°41'E], *Croat 31392* (MO, TAN); Sakaraha, [22°54'S, 44°32'E], *R. Decary 14104* (P); Morombe, [21°44'S, 43°21'E], *Decary 18758* (P); Beroroha, [22°53'S, 44°14'E], *Decary 18857* (P); Lambomakandro, [22°42'S, 44°42'E], *Decary 18904* (P); Ranohira, [22°29'S, 45°24'E], *Decary 18921* (P); Environs d'Ihosy, *B. Descoings 2173* (TAN); Mandrare moyen, environs de Beza Esiva (Sud), [24°25'S, 46°32'E], *Descoings 2741* (MO, TAN); ca. 20 km W of Ampanihy on rte. to Androka, 24°46'S, 44°36'E, *D. J. Du Puy, J.-N. Labat & Phillipson MB610* (TAN); Zombitsy PA, off RN7, 22°52'S, 44°40'E, *Du Puy, Labat & B. Rakouth MB654* (TAN); Vallée de la Manambolo, (bassin du Mandrare) au NW de Maroaomby (Betsioky), [24°21'20"S, 46°34'30"E], *H. Humbert 12789* (G, P); Vallée de la Manambolo, rive droite (bassin du Mandrare) aux environs d'Isomono (confluent de la Sakamali), [24°30'S, 46°37'E], *Humbert 12985* (K, P, TAN); haute vallée de la Menarahaka à l'Est d'Ihosy, [22°32'30"S, 46°29'50"E], *Humbert 28553* (P); Environs d'Antanimora (Androy), 30–35 km au N d'Ambia, [24°49'S, 45°40'E], *Humbert 28814* (P); SW de Betsioky près du village d'Ankairano, [24°13'S, 44°17'E], *M. Keraudren 825* (P); RN7 at 15 km NE of Sakaraha, [22°06'S, 44°36'E], *D. H. Lorence 1904* (K, MO); 54 km SW of Tulear, 23°13'S, 44°03'E, *J. S. Miller & A. Randrianasolo 6169* (K, MO, P, TAN); Zombitsy PA, [23°53'00"S 44°40'00"E] *P. Morat 680* (TAN); Plateau Mahafaly au NW d'Ejeda, [24°15'S, 44°05'S], *Morat 4344* (P, TAN); 55 km NE of Morondava via rte. 8, 20°04'S, 44°40'E, *R. D. Noyes, D. K. Harder, E. A. Rakotobe, T. G. Razafindrabeaza & J. P. Abraham 1051* (MO, P, WAG); bords de la Mahavavy/Ambongo, *Perrier de la Bâthie 6024* (P); Zombitsy PA, 22°52'S, 44°31'E, *Phillipson 3090* (K, MO, P, TAN, WAG); Ranobe Forest, 22°56'50"S, 43°41'08"E, *P. B. Phillipson, R. Ranivojoana, N. M. Andrianjafy & R. A. Lubke 5900* (G, K, MO, P, TAN, WAG); 5 km N of Beloha on RN10 to Ampanihy, 25°07'S, 45°06'E, *P. B. Phillipson & J. R. Milijaona 3627* (G, K, MO, P, TAN, WAG); Andohaëla PA, [24°40'12"S, 46°44'24"E], *Réserves Naturelles 5201* (P, TAN), *Réserves Naturelles 5949* (P, TAN); Environs d'Ampandrandava, [24°05'S, 45°42'E], *A. Seyrig 214 B* (P); Ampandrandava, *Seyrig 369* (P).

4. *Gouania cupreifolia* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Toliara: Vallée de la Manambolo, rive droite (bassin du Mandrare) aux environs d'Isomono (confluent de la Sakamali), Mont Morahariva (Mahamena-Marovato), 1000–1400 m, Dec. 1933 (fl.), *H. Humbert 13288* (holotype, P!; isotype, G!). Figure 5.

Haec species a congeneris madagascariensis foliis in sicco abaxialiter cupreis ad marginem leviter recurvatis, disci lobis sepalis paullo brevioribus vel ea aequantibus atque fructibus parvis pubescentibus secus inflorescentiam sparsim dispositis facile distinguitur.

Woody liana climbing to 15 m; stems pale to dark green, drying gray, partially glabrescent with brown trichomes persisting on the ridges, young shoots sparsely pubescent with brown trichomes; stipules glabrate, (1–)2 × ca. 0.75 mm; tendrils pubescent. Leaves ovate, coriaceous; petioles gray, 12–15(–20) mm, sparsely pubescent with brown trichomes; leaf blades (4–)4.5–5.5(–7) × (3–)3.5(–5) cm; secondary veins alternate, 5 to 6 pairs, not reaching the margin but following it; tertiary veins apparent, arising near the base of the lowest secondary veins, sometimes absent, reticulation scalariform; abaxial surface glabrous, sparsely pubescent on the veins, a distinct coppery color when dried; midrib, secondary veins, and tertiary veins prominent; adaxial surface glabrous; margin entire, slightly recurved; base rounded to shallowly cordate; apex acute. Inflorescences ± lax, pubescent with a brownish indument, (4.5–)5.5–6(–8) cm, consisting of glomerules subtended by stipulelike bracts; glomerules sessile, shortly pedicellate, up to 1.5 mm long at the base of the inflorescence, 5- to 6-flowered; bracts small, densely pubescent on the outer surface with reddish trichomes, glabrous on the inner surface, (0.5–)1 × ca. 0.25 mm; flowers pedicellate, pedicels (1–)2 mm, covered with a whitish indument. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 1.25 × 0.75 mm, pale brown, outer surface sparsely pubescent, inner glabrate; petals ca. 0.75 × 0.2 mm, pale brown, sometimes yellow; stamens slightly longer than the petal blades, with a pale brownish filament and a pale yellow, globulose anther ca. 0.2 × 0.2 mm; disc flat, ca. 2 mm diam.; lobes ca. 0.8 mm, triangular-lanceolate, 2/3 or as long as the sepals; stigma with 3 linear lobes, those 5–8 mm, style ca. 3 mm. Fruits solitary on the glomerule, small, oblong (ca. 0.7 × 1 cm), pubescent with brown trichomes, scattered throughout the infructescence; valves ca. 7 × 5 mm; immature fruits not seen; seeds brown, shiny, pyriform, and slightly flattened, ca. 2.5 × 2 × 0.5 mm.

Distribution and ecology. *Gouania cupreifolia* grows on the eastern escarpment of Madagascar (Fig. 2B). It can be found in sclerophyllous and deciduous vegetation at elevations of 800–1400 m.

IUCN Red List category. With an EOO of 37,956 km², an AOO of 45 km², and only five subpopulations, two of which occur within protected areas

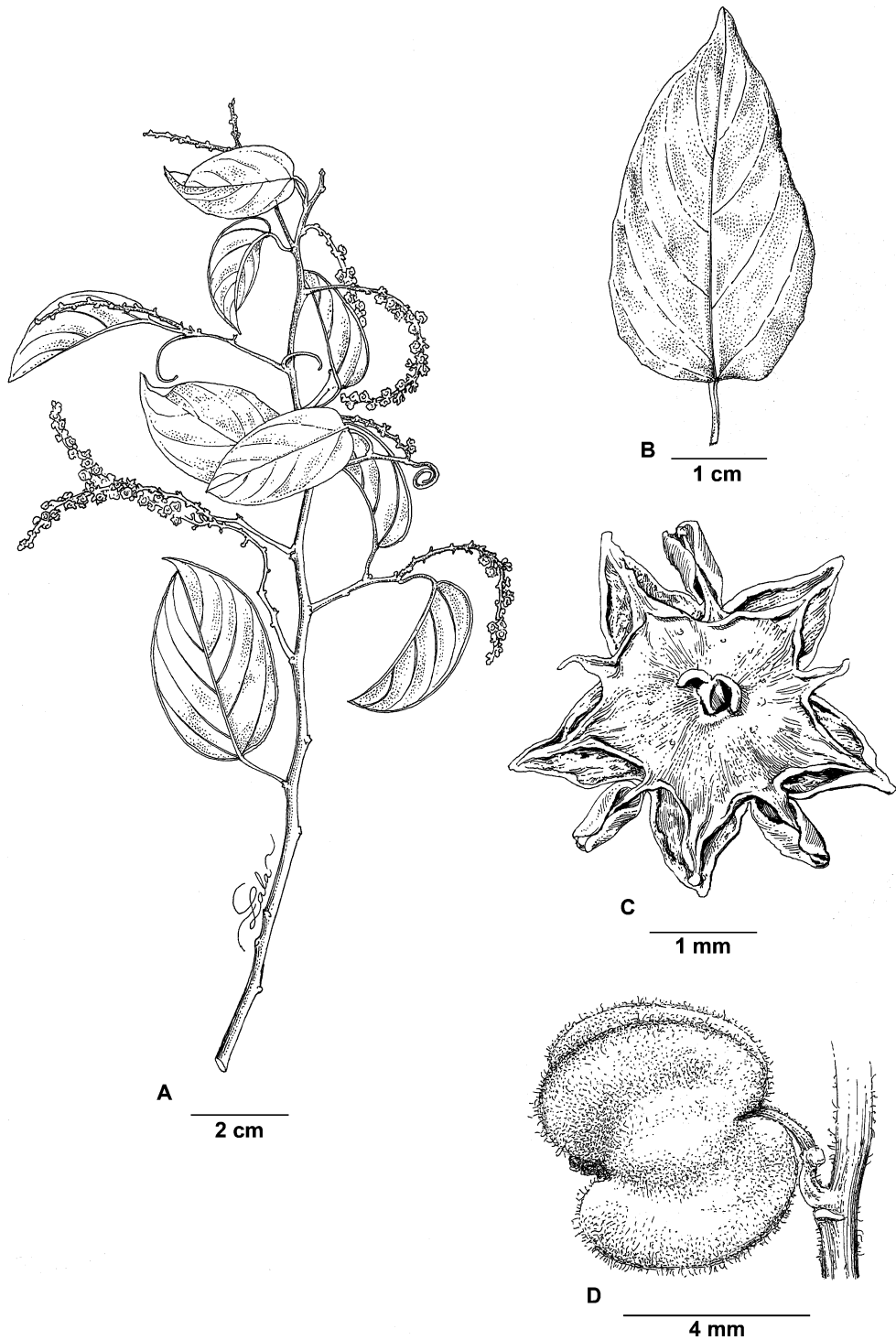


Figure 5. *Gouania cupreifolia*. —A. Habit. —B. Leaf. —C. Flower, showing the lobes of the disc slightly shorter than or as long as the sepals. —D. Fruit. A–C drawn from the type *Humbert 13288* (P); D from *Homolle 2595* (P).

(Andohahela National Park, Betampona Nature Reserve), *Gouania cupreifolia* is assigned a preliminary status of Vulnerable (VU B2ab[ii]) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Gouania cupreifolia* has been observed flowering from December to January and fruiting in January.

Etymology. The new species epithet refers to the unusual, somewhat coppery color of the undersurface of the dried leaves.

Discussion. *Gouania cupreifolia* differs from all Malagasy species by the abaxial surface of its leaves drying to an unusual, somewhat coppery color, and the slightly recurved margins of the blade. Based on floral morphology, it appears to be most closely related to *G. laxiflora*, having the lobes of the discs slightly shorter than or as long as the sepals (ca. 0.8 mm long).

Paratypes. MADAGASCAR. **Toamasina:** Ankaroka, [17°48'S, 48°32'E], *G. Cours 234* (P); Forêt d'Ankiribiry, *Cours 2598* (P); Betampona PA, Anjoro en descendant le ruisseau, Ranomena, [17°55'S, 49°13'E], *A. M. Homolle 2595* (P). **Toliara:** bassin de réception de la Mananara, affluent du Mandrare, pentes occidentales des montagnes entre l'Andohahela et l'Elakelaka, mont Apiky au-dessus de Mahamavo, [24°45'30"S, 46°43'30"E], *H. Humbert 13855* (P); Ampandrandava, [24°05'S, 45°42'E], *A. Seyrig 369* (P), *369 bis* (P).

5. *Gouania cupuliflora* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Antsiranana: Ambanja, Ramena River, Chute d'Ambobaka, 13°44'48"S, 48°31'37"E, 40 m, 28 Feb. 2005 (fl.), *S. Buerki* & *S. Wohlhauser 29* (holotype, MO!; isotypes, G!, K!, P!, TEF!). Figure 6D–G.

Gouania mauritiana Lam. var. *angustiloba* H. Perrier, Notul. Syst. (Paris) 11: 34. 1943, nom. nud.

Haec species a congeneris madagascariensibus glomerulis sessilibus inter se distantibus ex floribus sessilibus cupulatis constantibus, disci lobis longitudine 2/3 sepalorum partes attingentibus, stigmatibus lobis duobus linearibus atque fructu oblongo pubescente facile distinguitur.

Woody liana climbing to 3 m; stems dark green, drying blackish, densely pubescent with hirsute ferruginous trichomes; stipules densely pubescent with reddish brown trichomes, 2–3(–4) × ca. 0.75 mm; tendrils pubescent. Leaves ovate; petioles (5–)10–15(–20) mm, pubescent with ferruginous trichomes; leaf blades (3.5–)5.5(–6) × (1.5–)3 cm; secondary veins alternate, 7 to 9 pairs, reaching and following the margin; tertiary veins apparent, arising near the base of the lowest secondary veins, reticulation scalariform; abaxial surface sparsely

pubescent with white trichomes; midrib, secondary veins, and tertiary veins prominent; adaxial surface sparsely pubescent with a fine white indument; margin entire; base rounded; apex acute to shortly attenuate. Inflorescences lax, pubescent with a brownish indument, (7–)11(–15) cm, consisting of well-spaced glomerules subtended by stipulelike bracts; glomerules sessile or shortly pedunculate, (3 to)8-flowered; bracts small, densely pubescent on the outer surface with a brownish indument, glabrous on the inner surface, caducous, (1–)2 × ca. 0.5 mm; flowers sessile, with a reddish indument. Hypanthium cupulate; sepals ca. 0.8 × 1 mm, whitish to pale yellow, the outer surface densely pubescent with reddish trichomes, the inner glabrous; petals ca. 1 × 0.5 mm, white; stamens slightly longer than the petal blades, with a pale yellow filament and a pale yellow, globulose anther ca. 0.2 × 0.2 mm; disc flat, ca. 3 mm diam.; lobes ca. 0.5 mm, emarginate or somewhat truncate, 2/3 as long as the sepals; stigma with 2 linear lobes, ca. 0.2 mm, style ca. 0.4 mm. Fruits 0 or 1 developing on each glomerule, oblong, ca. 1.1 × 1 cm, pubescent to puberulent with a brownish indument, equally distributed throughout the infructescence; valves ca. 10 × 4 mm, shallowly emarginate at the apex and the base; immature fruits globose, with a dense, pale yellow indument; seeds brown, shiny, ovoid and slightly flattened, ca. 5 × 3 × 1 mm.

Distribution and ecology. Endemic to northwestern Madagascar (Fig. 2C), *Gouania cupuliflora* occurs on sandy substrates and on limestone at elevations between 30 and 500 m, mainly in evergreen lowland rainforest, or in dry forest along rivers.

IUCN Red List category. *Gouania cupuliflora* has an EOO of 121,012 km² and an AOO of 207 km², with 20 known subpopulations, six of which occur within protected areas (Ampijoroa, Ankarafantsika, Ankarana, Bemaraha, Manongarivo, Namoroka). It is thus assigned a preliminary status of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Gouania cupuliflora* has been observed in flower from January to April and in fruit from May to November.

Etymology. The new species is named for its markedly cupulate flowers.

Discussion. Perrier de la Bâthie referred material of this species to *Gouania mauritiana* var. *angustiloba* in his 1943 revision for the family (mentioned under *G. mauritiana* subsp. *aphrodes*). The varietal name was not accompanied by a Latin description or diagnosis and is therefore not validly published,

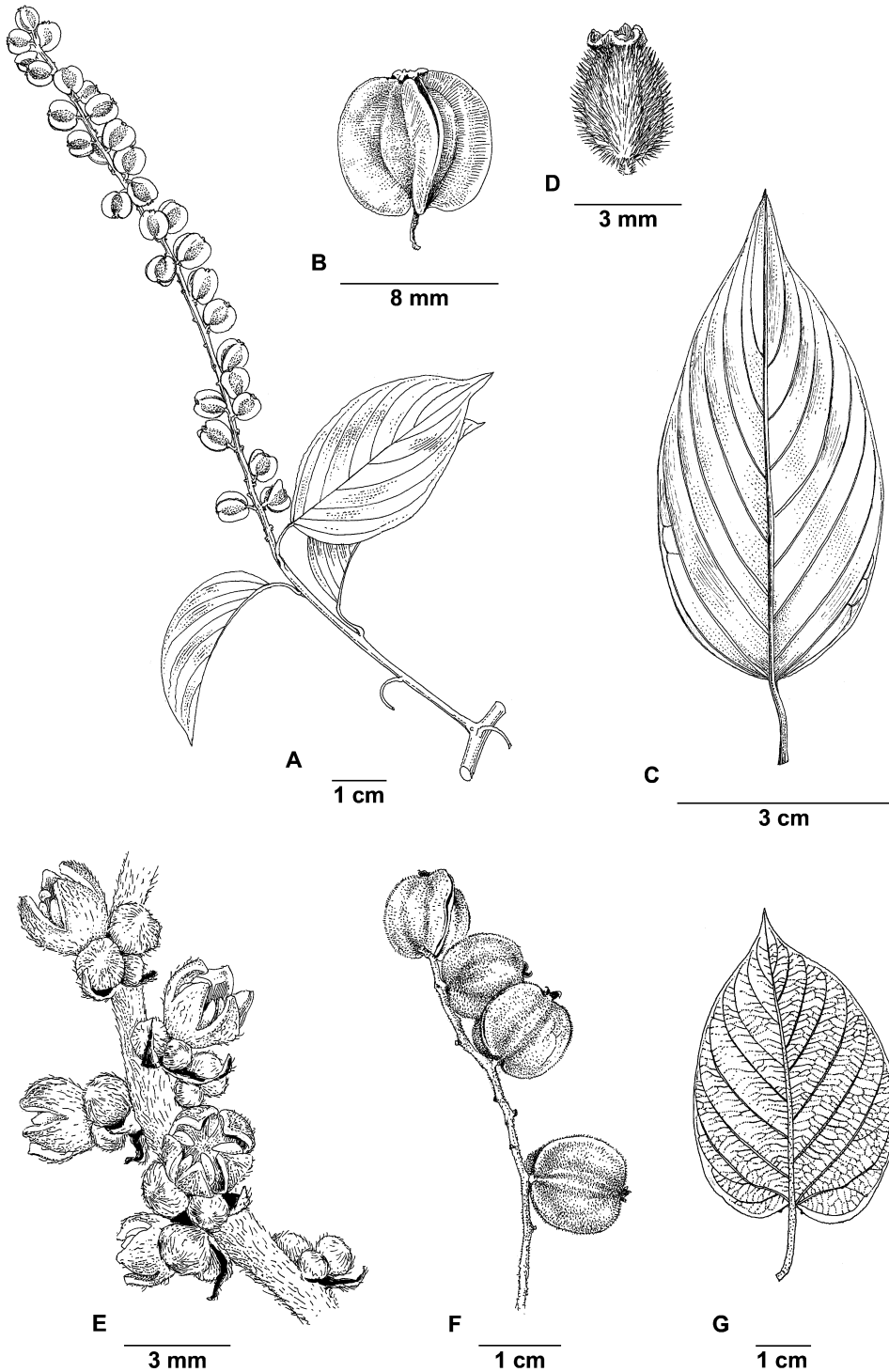


Figure 6. A–C *Gouania lineata*. —A. Fruiting branch showing the dense infructescence of small fruits. —B. Fruit. —C. Leaf showing the lack of conspicuous tertiary veins. D–G. *Gouania cupuliflora*. —D. Young pyriform fruit. —E. Inflorescence showing the sessile glomerules composed of sessile cupulate flowers, and the lobes of the disc reaching two thirds the length of the sepals. —F. Infructescence. —G. Leaf, abaxial surface. A drawn from *Morat 4454* (TAN); B, C from *Gentry 11471* (TAN); D from *Perrier de la Bâthie 6015* (TAN); E from the holotype *Buerki & Wohlhauser 29* (MO); F, G from *Derleth 62* (TAN).

according to the ICBN (McNeill et al., 2006: Art. 36.1). The varietal epithet chosen by Perrier de la Bâthie (1943) refers to narrow lobes of the disc relative to the other elements he included in *G. mauritiana*, but this name is not particularly appropriate in the context of the genus as a whole. We regard the taxon as a distinct species that we name *G. cupuliflora* in reference to its cupulate hypanthium. *Gouania cupuliflora* is allied to *G. ambrensis*, but differs by its sessile flowers covered outside by a ferruginous indument (vs. pedicellate flowers covered by silver trichomes in *G. ambrensis*), the cupulate hypanthium (vs. obconic hypanthium), the lobes of the disc reaching two thirds as long as the sepals (vs. lobes of the disc reaching one half of the sepals), and the stigma with two linear lobes (vs. the stigma 3-lobed).

Paratypes. MADAGASCAR. s. loc., fl., *R. Baron 4680* (K, P); fl., *R. Rakoto 18* (TAN); fl., *Service Forestier 13* (P). **Antsiranana:** Ankarana, *M. Bardot-Vaucaulon 1537* (K, MO, P, TAN); Chute d'Ambobaka, affluent de la Ramena, 13°44'50"S, 48°31'36"E, *M. W. Callmander 286* (G, K, MO, P, TEF); entre Vohémar et Ambilobe, *R. Decary 14659* (P); Besinkara, chemin d'Ambodisakoana à Ambalafary, *P. Derleth 62* (G, K, MO, P, TAN); Daraina, forêt d'Ambilondomba, 13°10'S, 49°39'E, *L. Gautier 4269* (G); Besinkara, Ambalafary, 14°04'S, 48°17'E, *Gautier & S. T. Be 2883* (G, K, TAN, TEF); 3–5 km E of Diego-Suarez-Ambilobe Rd., 7 km N of Ambilobe, [13°11'30"S, 49°03'30"E], *A. Gentry 11917* (MO, P, TAN); Ankarana PA, ca. 5 km NW of Park Village near Besaboba Stream, 12°51'16"S, 49°17'30"E, *D. K. Harder, M. C. Merello, S. G. Razafimandimbison & T. G. Razafinrabaeza 1762* (MO, P, TAN, WAG); Tsaratanana, région O de Majunga, *R. P. Heydel s.n.* (P); Vallée de Sambirano, *H. Perrier de la Bâthie 6015* (P, TAN); Ambohimarina, plaine du Sambirano, 13°54'21"S, 48°29'21"E, *Wohlhauser 60006* (G, TEF); Bassin versant de rano Bemahalegny, moyen Ambahatra, cours moyen du bassin-versant rano Ambahatra, 13°57'51"S, 48°26'56"E, *Wohlhauser 60046* (G, MO, TEF). **Mahajanga:** Analafaly, Fokontany Bemanevika, Analafaly forest, 6 km E of Marotaolana, 17°13'10"S, 46°59'42"E, *C. Birkinshaw & N. M. Andrianjafy 1500* (MO, P, TAN); Ouest environs de Maevatanana, près d'Ambodiroka, pont de la Betsiboka, [17°01'S, 47°45'E], *B. Descouings 3301* (TAN); Ampijoroa STF, ca. 3 km N d'Andranofasika, 16°20'S, 46°51'E, *L. G. Dorr & L. Koenders 3014* (K, P, TAN, WAG); Mailaka, région du Cap St. André, *H. L. Douillot s.n.* (P); Bemaraha massif, base of escarpment, ca. 10 km W of Marerano on Manambolo River, 19°04'S, 45°04'E, *B. Du Puy, D. Du Puy, J. Andrianatina & B. Carlson MB730* (MO, P, TAN); Ampijoroa, 16°19'S, 46°49'E, *Gentry & G. E. Schatz 62101* (TAN); Vallée de la Betsiboka, en amont de Maevatanana, [16°57'S, 46°50'E], *H. Humbert 4442 bis* (P); 10 km E Antsalova, at edge of the Tsingy of Bemaraha, [18°39'S, 44°37'E], *J. Klackenberg 93.03.11–9* (MO, P); Bemaraha PA, [18°39'S, 44°37'E], *J. D. Leandri 861* (P); Ambodiriana (Antsiafabositra), [15°55'S, 47°29'E], *J. Peltier & M. Peltier 5183* (P); Ambrovy, [15°39'30"S, 46°20'30"E], *Peltier & Peltier 5297* (P); Morofotra, rive gauche de l'Ikopa en face de Maevatanana, *Perrier de la Bâthie 6025* (P); moyen bassin

du Bemarivo, Boina, [15°55'S, 47°40'E], *Perrier de la Bâthie 6045* (P); Ampasimatera, bassin moyen de Bemarivo (Boina), [15°56'S, 47°44'E], *Perrier de la Bâthie 6052* (P); Boina, *Perrier de la Bâthie 14647* (P, TAN); Marosakoana, *Réserves Naturelles 5* (P); Namoroka PA, [16°29'S, 45°22'E], *Réserves Naturelles 5094* (P), *Réserves Naturelles 6385* (P, TAN), *Réserves Naturelles 6416* (P, TAN); Canton Andranomavo, distr. Soalala, *Réserves Naturelles (Randriamera) 10144* (P, TEF); Ankarafantsika PA, *Service Forestier 6* (P); Ampijoroa, [16°18'S, 46°49'E], *Service Forestier 29760* (TEF).

6. *Gouania gautieri* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Antsiranana: Besinkara, chemin entre Ambalafary et Ambodisakoana, 14°04'S, 48°17'E, 350 m, 26 Mar. 1996 (fl.), *L. Gautier & S. T. Be 2904* (holotype, G!; isotypes, K!, P!, TAN!, TEF!). Figure 7.

Haec species a congeneris madagascariensibus foliis glabris membranaceis ellipticis usque ovatis, inflorescentia trichomatibus brunneis hirsuta, glomerulorum pedunculis saepe dichotomis, floribus cupulatis subsessilibus, disci lobis longitudine 2/3 sepalorum partes attingentibus, fructu magno trichomatibus brunneis hirsuto atque semine ovoideo pallide brunneo facile distinguitur.

Woody liana climbing to 8 m; stems dark green, drying dark green to gray, glabrescent, young shoots pubescent, with brown trichomes; stipules glabrous, 2(–3) × ca. 0.75 mm; tendrils glabrescent. Leaves elliptic to ovate, blade rather membranous; petioles (7–)10–12(–20) mm, glabrous; leaf blades (5.5–)6.5–7(–11) × (2–)3.5(–5.5) cm; secondary veins alternately arranged, 4 to 5 pairs, not reaching the margin but following it; tertiary veins apparent, arising near the base of the lowest secondary veins, reticulation scalariform; abaxial surface glabrous; midrib, secondary veins, and tertiary veins slightly prominent; adaxial surface glabrous; margin entire; base rounded; apex acute. Inflorescences lax, (3–)4–5(–8) cm, pubescent with brown hirsute trichomes, consisting of glomerules subtended by stipulelike bracts; glomerules with a thick, often dichotomously branched peduncle, up to 3 mm, 4(to 8)-flowered; bracts caducous, (1–)2 × ca. 0.25 mm, puberulous on both surfaces with brownish caducous trichomes; flowers shortly pedicellate, pedicels ca. 1 mm, pubescent with brown trichomes. Hypanthium cupulate; sepals ca. 3 × 1 mm, pale yellow to brown, outer surface pubescent, inner glabrous; petals ca. 1 × 0.5 mm, pale yellow; stamens completely included in the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 5 mm diam.; lobes ca. 2 mm, acute, 2/3 as long as the sepals; stigma with 3 short linear lobes, style ca. 0.5 mm. Fruits 0 to 2

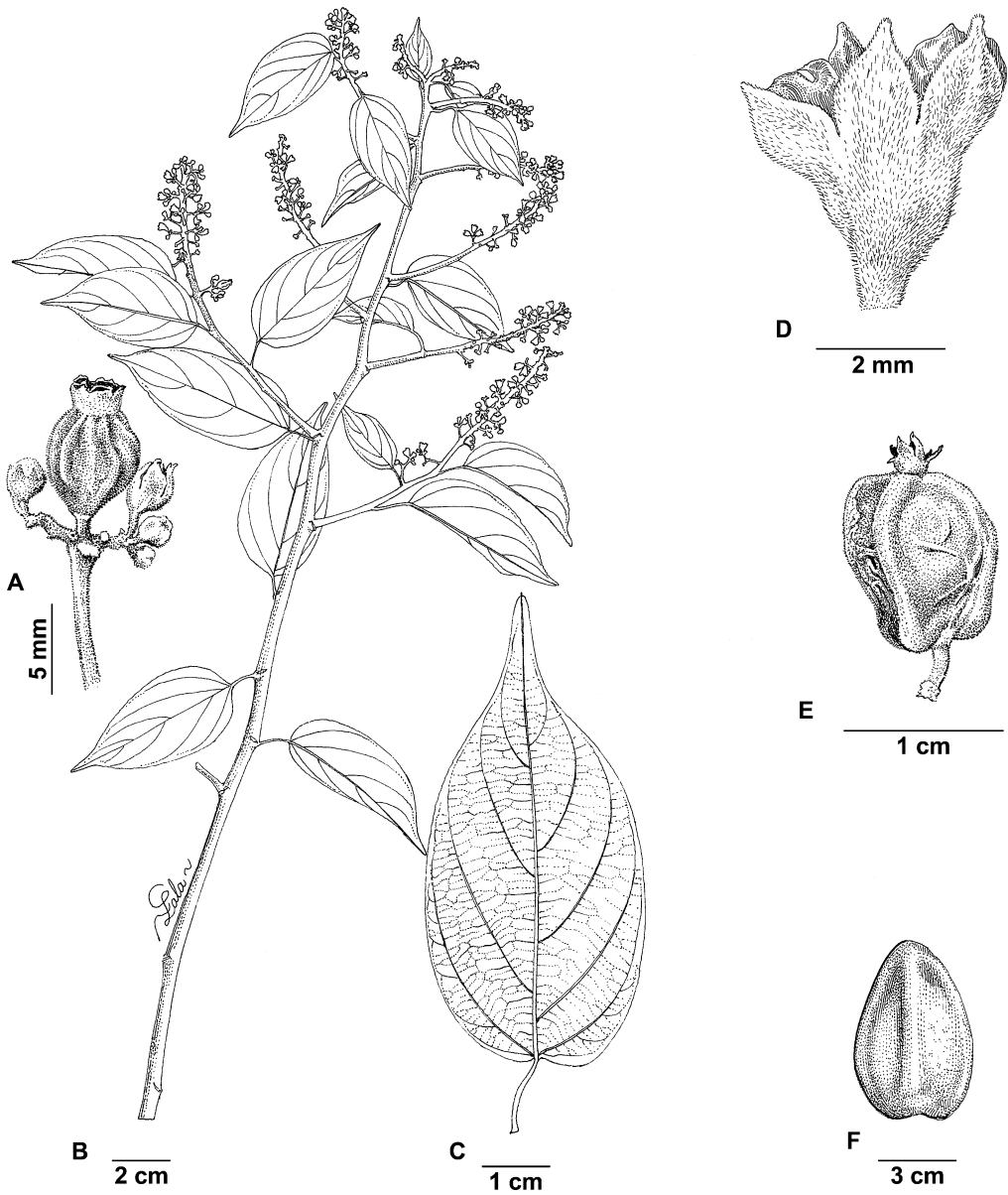


Figure 7. *Gouania gautieri*. —A. Immature fruits. —B. Habit. —C. Elliptic, glabrous leaf. —D. Flower, showing its cupulate form and the lobes of the disc reaching two thirds the length of the sepals. —E. Fruit, showing hirsute indumentum. —F. Seed. A–D drawn from Rabenantoandro *et al.* 197 (P); E, F from Gautier & Chatelain 2647 (TAN).

developing on each glomerule, oblong, large (ca. 1.5×1 cm), with a pale brown indument, equally distributed throughout the infructescence; valves ca. 15×3 mm; immature fruits globose, with a pale brown indument; seeds pale brown, ovoid, emarginate at apex, hardly flattened, recurved with a line on the inner surface, ca. $7 \times 4 \times 0.5$ mm.

Distribution and ecology. *Gouania gautieri* is endemic to the Manongarivo massif, northwestern

Madagascar (Fig. 2C), at an elevational range of 350–1300 m. This species seems to be restricted to degraded forest.

IUCN Red List category. With an EOO of less than 227 km^2 , an AOO of 27 km^2 , and two subpopulations, one of which occurs within a protected area (Manongarivo PA), *Gouania gautieri* is assigned a preliminary status of Endangered (EN

B1ab[ii]; B2ab[ii] according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Gouania gautieri* is known in flower from September to March, and in fruit at the beginning of April.

Etymology. The new species is named in honor of Laurent Gautier (1960–), Swiss botanist, who has greatly contributed to the knowledge of the flora of the Manongarivo massif and who collected the type specimen.

Discussion. *Gouania gautieri* resembles *G. cupuliflora* in having a cupulate hypanthium and the lobes of the disc two thirds as long as the sepals, but differs most notably in having elliptic to ovate, membranous, glabrous leaves (vs. ovate, subcoriaceous, pubescent with ferruginous trichomes in *G. cupuliflora*); a congested inflorescence (vs. lax); glomerules often with dichotomously branched peduncles (vs. unbranched peduncles); and hirsute pale brown indument on the fruits (vs. pubescent to puberulent with a darker brown indument).

Paratypes. MADAGASCAR. **Antsiranana:** Fiv. Ambanja, Fir. Ambodimanga-Ramena, 13°48'49"S, 48°47'22"E, J. Rabenantoandro, C. Birkinshaw, B. Razafindrazaka, P. Antilahimena & F. Adamainty 197 (G, K, P, MO); Besinkara, au-dessous d'Ambalafary, 14°04'S, 48°17'E, L. Gautier & C. Chatelein 2647 (G, K, P, TAN); Manongarivo PA, Antsatroto, 14°05'S, 48°23'E, S. Malcomber, P. J. Rakotomalaza & J. Raharilala 2287 (MO).

7. *Gouania humbertii* H. Perrier, Notul. Syst. (Paris) 11: 29. 1943. TYPE: Madagascar. Antsiranana: collines et plateaux calcaires de l'Analamerana, 50–400 m, Jan. 1938 (fl.), H. Humbert 19233 (holotype, P!; isotypes, G!, TAN!).

Woody liana; stems dark green, drying blackish, glabrous, rather spindly; stipules glabrous, 2.5(–3) × ca. 1 mm; tendrils puberulent with caducous ferruginous trichomes. Leaves orbicular, often conduplicate; petioles to 12 mm, glabrous at maturity; leaf blades (2.5–)3(–3.5) × (2–)3(–3.5) cm; secondary veins alternate, 4 to 5 pairs, not reaching the margin but following it; conspicuous tertiary veins absent, reticulation scalariform; abaxial surface glabrous; midrib and secondary veins slightly prominent; adaxial surface glabrous; margin entire, slightly recurved; base rounded; apex acute. Inflorescences congested, puberulent, spindly, (2.5–)3(–4.5) cm, consisting of glomerules subtended by stipulelike bracts; glomerules shortly pedunculate, to 1 mm, 3(to 5)-flowered; bracts small, glabrous on

both surfaces, (0.5–)1 × ca. 0.2 mm; flowers pedicellate up to 1 mm, glabrous at maturity. Hypanthium cupulate; sepals ca. 1.5 × 0.75 mm, pale brown, outer surface puberulent, inner glabrous; petals ca. 1 × 0.2 mm, pale yellow to brown; stamens slightly longer than the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 2 mm diam.; lobes ca. 1.25 mm, rounded, generally 3/4 or as long as the sepals; stigma with 3 linear lobes, ca. 0.2 mm; style ca. 0.2 mm. Fruits not known.

Distribution and ecology. *Gouania humbertii* is endemic to the semi-deciduous to deciduous forests of northern Madagascar. It has not been recollected at the type locality, Analamerana PA (formerly known as Analamera), but was recently discovered at Daraina (about 50 km to the southeast) (Fig. 2D). The taxon grows on limestone or granitic rocks at an elevational range of 50–400 m.

IUCN Red List category. With only two collections and an AOO of 18 km², *Gouania humbertii* is regarded as Endangered (EN B2ab[ii]), according to IUCN Red List criteria (IUCN, 2001).

Phenology. This species has been collected in flower during January.

Discussion. *Gouania humbertii* shares a lack of conspicuous tertiary veins with *G. lineata* and a cupulate hypanthium with *G. cupuliflora* and *G. gautieri*. Nevertheless, this species can be distinguished from these two and all other Malagasy species by its orbicular, often conduplicate, glabrous leaves and the lobes of the disc reaching three fourths or as long as the sepals. *Gouania humbertii* is the only species known from semi-deciduous to deciduous forests of the Plateau d'Analamerana and is unlikely to be confused with other species occurring in the Daraina forests.

Additional specimen examined. MADAGASCAR. **Antsiranana:** Daraina, partie sud de la forêt de Bekaraoka, 13°11'S, 49°42'E, Nusbaumer 2050 (G).

8. *Gouania laxiflora* Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 130. 1857, as "*Guania*." TYPE: Madagascar. Antsiranana: Ling-Vatou, s.d. (fr.), A. Bernier 207 (lectotype, designated here, P!). Figure 8A, B.

Gouania comorensis Engl., Veg. Erde 9: 315. 1921, nom. nud., in obs.

Gouania glandulosa Boivin ex Tul. var. *longiloba* H. Perrier, Notul. Syst. (Paris) 11: 31. 1943, nom. nud.

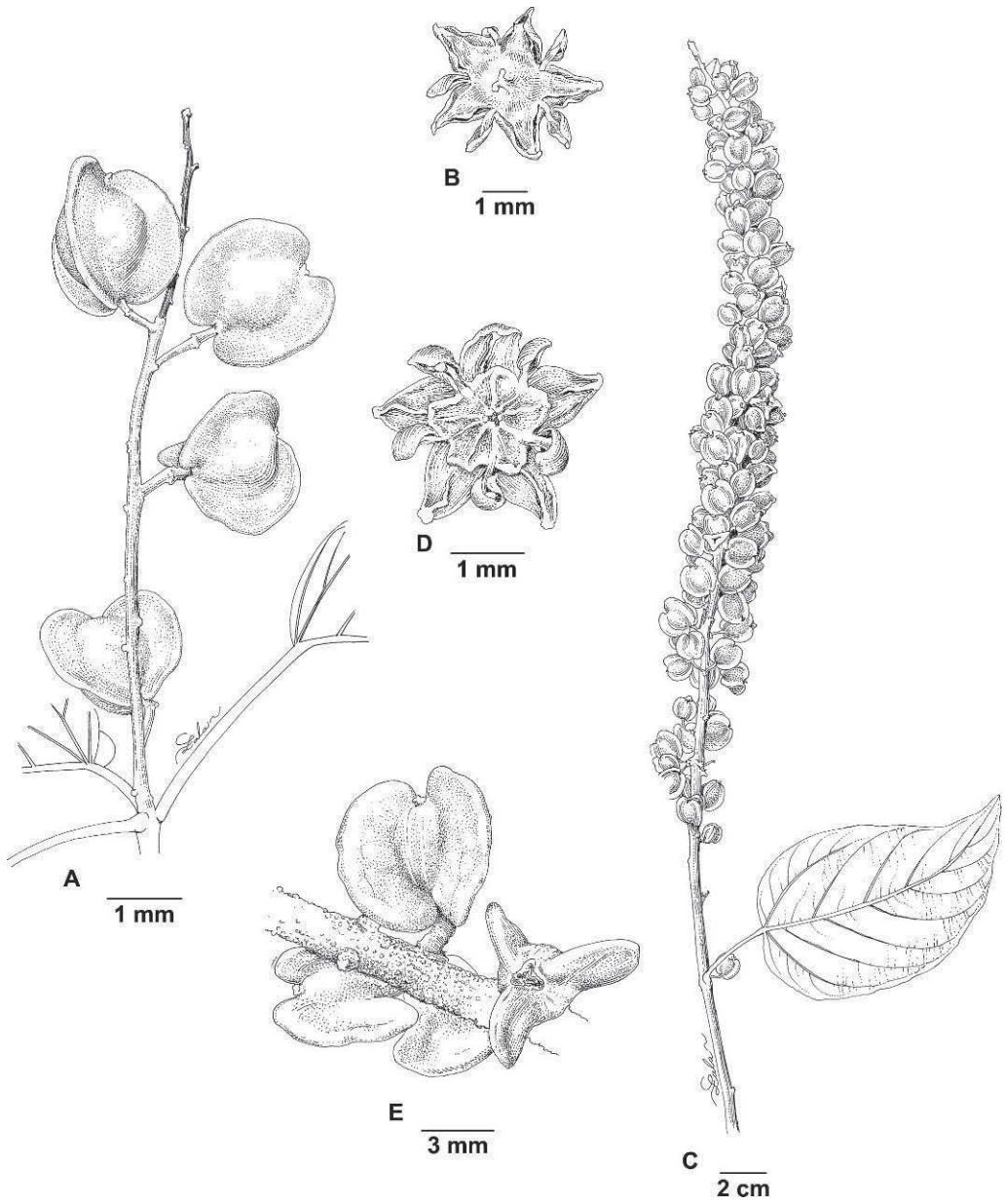


Figure 8. A, B. *Gouania laxiflora*. —A. Fruiting branch showing the infructescence with glabrous fruits concentrated at the base. —B. Flower showing the lobes of the disc reaching or extending beyond the sepals. C–E. *Gouania myriocarpa*. —C. Fruiting branch showing the infructescence with dense small fruits. —D. Flower showing the lobes of the disc reaching one sixth the length of the sepals. —E. Fruits. A drawn from Buerki et al. 63 (TAN); B from Perrier de la Bâthie 6030 (P); C from the type Goudot s.n. (G); D from Humbert 7021 (P); E from Buerki et al. 46 (TAN).

Gouania lineata Tul. var. *recurviloba* H. Perrier, Notul. Syst. (Paris) 11: 30. 1943, nom. nud.

Gouania leguatii J. Guého, Adansonia 18(4): 483. 1979, syn. nov. TYPE: Rodrigues Island, Cascade Victoire, Feb. 1941 (fl.), R. Jauffret 129 (holotype, MAU not seen; isotype, P!).

Gouania mozambicensis M. L. Green, Bull. Misc. Inform. Kew 1916: 199. 1916, syn. nov. TYPE: Mozambique, Chupanga, 1860 (fr), Kirk s.n. (holotype, K!).

Woody liana climbing to 4 m; stems dark green, drying brown, glabrescent, young shoots pubescent with ferruginous trichomes; stipules glabrous, 1(–1.5) × ca. 0.25 mm; tendrils pubescent with caducous ferruginous trichomes. Leaves ovate with a cordate or rounded base; petioles (15–)25(–35) mm, sparsely pubescent with caducous ferruginous tri-

chomes; leaf blades (4.5–)6(–7.5) × (3–)4.5(–5.5) cm; secondary veins alternate, 5 to 8 pairs, not reaching the margin but following it; tertiary veins apparent, arising near the base of the lowest secondary veins, reticulation scalariform; abaxial surface glabrescent, veins puberulous with brown trichomes; midrib, secondary veins, and tertiary veins prominent; adaxial surface glabrous; margin entire to slightly denticulate; base cordate or sometimes rounded; apex acute. Inflorescences spindly, lax, puberulous with pale brown trichomes, (5.5–)10–13(–15) cm, consisting of glomerules subtended by stipulelike bracts, proximal hermaphrodite flowers developing before the distal male flowers; glomerules pedunculate, puberulent with caducous, pale brown trichomes, accrescent, (1–)3 mm, 3- to 5-flowered; bracts small, glabrous on both surfaces, caducous, (0.5–)0.8 × ca. 0.2 mm; flowers pedicellate, pedicels accrescent, (1–)3.5 mm, puberulent with caducous, pale brown trichomes. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 2 × 0.75 mm, pale yellow to brown, outer surface puberulent, inner glabrous; petals ca. 1 × 0.5 mm, white; stamens slightly longer than the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 4 mm diam.; lobes 2–2.2 mm, rounded, generally longer or as long as the sepals; stigma with 3 linear lobes, those ca. 0.2 mm, style ca. 2 mm. Fruits 0 to 2 developing on each glomerule, spheroid (ca. 1.5 × 1.5 cm), glabrous, concentrated in the basal part of the infructescence; valves ca. 15 × 4 mm; immature fruits pyriform, glabrous; seeds brown, shiny, and slightly flattened on the inner surfaces, ca. 4 × 3 × 1 mm.

Distribution and ecology. *Gouania laxiflora* is found in mainland Africa (Mozambique and Tanzania) (Drummond, 1966; Johnston, 1972: under *G. scandens*, see discussion below), the Mascarenes (Rodrigues Island), the Seychelles (Aldabra, Île Picard, Cosmoledo), the Comoro Islands (Mayotte), and western Madagascar (Fig. 2D). The species grows in semi-deciduous, deciduous, gallery, and secondary forests, generally on limestone, but sometimes on sand and gneiss at an elevational range from sea level to 350 m.

IUCN Red List category. Within Madagascar, *Gouania laxiflora* has an EOO of 430,841 km², an AOO of 360 km², and 33 subpopulations, 13 of which occur within protected areas (Andohahela, Ankarana, Bemaraha, Beza Mahafaly, Namoroka, Tampoketsa d'Analaimaitso, Zombitsy). It is thus assigned a preliminary status of Least Concern (LC) in Mada-

gascar, according to IUCN Red List criteria (IUCN, 2001). We have not assessed its conservation status for other countries within its range.

Phenology. This species has been collected in flower from November to March and in fruit in March and May.

Discussion. Tulasne (1857) designated two syntypes of *Gouania laxiflora*, *Boivin 3366* and *Bernier 207*. The sheet labeled *Boivin 3366* at P is a collection of this species, while sheets with the same collection number at G and K bear material of *G. aphrodes*. To avoid possible confusion, we have lectotypified this species on *Bernier 207*, even though material of this collection is only known to be present at P.

After careful study, we are convinced that this plant is conspecific with *Gouania leguatii* described from Rodrigues Island (Guého, 1997). Material referred to this species has similar cordate leaves, pubescent with caducous ferruginous trichomes, the disc lobes generally as long as or longer than the sepals, and the fruits glabrous and generally concentrated in the basal part of the infructescence. The same is true for the specimens cited in *Flora Zambesiaca* (Drummond, 1966) and in *Flora of Tropical East Africa* (Johnston, 1972) under *G. scandens* from the African mainland (see also discussion under *G. scandens*). *Gouania longipetala* Hemsl. was described for an African species, based on two syntypes from Equatorial Guinea or Gabon (*Mann 17* from Bioko Island “Fernando Po” and *Mann 1813* from Muni River “Kongui River”) and one, *Kirk s.n.*, from Chupanga, Mozambique (Hemsley, 1868). Green (1916) realized that this material represents two different species and described *G. mozambicensis* to accommodate the East African entity based on the Kirk specimen, while retaining the name *G. longipetala* for the Central African species. Later Hallé (1962) designated *Mann 17* from Bioko as the “Type,” thus effecting lectotypification of *G. longipetala*. Kirk’s specimen from Mozambique is a specimen of *G. laxiflora*, and we include *G. mozambicensis* in the synonymy of this species. *Gouania laxiflora* is the only species shared between mainland Africa and Madagascar.

Gouania laxiflora differs from *G. perrieri*, to which it is most similar, by its slightly denticulate leaf margin (vs. shallowly crenate margin in *G. perrieri*), lobes of the disc as long as or longer than the sepals (vs. lobes of the disc reaching one fourth of the sepals), and its immature pyriform fruits (vs. immature fruits winged).

Additional specimens examined. COMORO ISLANDS. s. loc., fl. & imm. fr., *Boivin s.n.* (K). **Mayotte:** Grande Terre, Mtsamboro, Ilot Mtsamboro, *Barthelat et al.* 198 (P); Grande Terre, Mamoudzou, Ilt Bouzi, *Barthelat et al.* 355 (G, K, MO, P); Boeni, *Boivin* 3366 (P); Coconi, *Lorence* 2818 (MO); Chissioi Caroni (islet off SW coast), *Lorence & Rouleau* 2814 (MO); Dapani, *Pascal* 568 (P); Chissious Mtsamboro, près du sommet, *Pignal & Pibot* 1183 (K, P); Baie de Langoni, *Tinguy* 1019 (P). MADAGASCAR. s. loc., “Central Madagascar,” fl., *Baron* 3532 (K), fl., *Baron* 4815 (K), fr., *Baron* 4819 (K, P); fl., *Baron* 4823 (K); fl., *Grevé* 107 (G, P). **Antsiranana:** Ankarana PA, campement des anglais, *Andrianantoanina et al.* 841 (P); Ankarana PA, Matsaborimanga, piste Grim, *Bardot-Vaucaulon et al.* 1170 (K, MO, P, TAN); Ankarana PA, *Bardot-Vaucaulon* 1549 (K, MO, P, TAN); Daraina, Forêt de Bekaraoka, *Gautier et al.* 4368 (G); Collines et Plateaux calcaires de l’Ankarana, *Humbert* 18822 (P), *Humbert* 18907 (G, P, TAN), *Humbert* 32437 (P); Ankarana PA, near Campement des Anglais, *Lewenberg et al.* 14329 (K, MO, P, TAN, WAG); Montagne d’Ambre, versants ouest, *Gautier et al.* 5251 (G, K, MO, P, TEF); Montagne d’Ambre, *Razanajatovo et al.* 30 (G, K, MO, P, TEF); Montagne des Français, *Perrier de la Bâthie* 17523 (P); Ankarana PA, *Randriambololona et al.* 36 (P). **Fianarantsoa:** Rte. Ihoay-Ivohibe, Km 40, *Peltier & Peltier* 5585 (P). **Mahajanga:** Sakoany, *Callmander & Phillipson* 697 (G, K, MO, P, TAN, US, WAG); Forêt d’Ambanjabe, *Cours* 3951 (P, TAN); Plateau d’Ankaro, *Descoings* 3368 (TAN); Morondava, *Grevé s.n. comm. Dr Baillon* (K); Forêt d’Ambanjabe, Mont Marovoay, *Herb. Inst. Sci. Madag.* 3951 (TAN); Rte. d’Ambato-Boeni, *Jacquemin* 912 (P); Forêt d’Analamaitso, *Keraudren* 1703 (P); Bemaraha PA, *Leandri* 576 (P); Bemaraha PA, *Leandri* 580 (P), *Leandri* 863 (P), *Leandri* 932 (MO, P), *Leandri* 940 (P), *Leandri* 968 (P), *Leandri s.n.* (P); Vers Ambodiriana, *Leandri* 2704 (P); Rte. de Majunga, P.K. 538, *Morat* 2719 (P, TAN); Namoroka PA, *Morat* 4809 (P, TAN); Amdriba (RN27), *Peltier & Peltier* 5755 (P); Bois le long du Jabohazo, Antrihitra près de Mont Tsitondraina, *Perrier de la Bâthie* 1590 (K, P); Marofotra, rive gauche de l’Ikopa en face de Maevatanana, *Perrier de la Bâthie* 6027 (P), *Perrier de la Bâthie* 6029 (P); Mariarana près du Mont Tsitondroina (Boina), *Perrier de la Bâthie* 6028 (P); environs d’Amboina près de Majunga, *Perrier de la Bâthie* 6030 (P); en chemin de Maevatanana, *Perrier de la Bâthie* 6039 (P); Boina, *Perrier de la Bâthie* 14647 (P); Antsalova, *Réserves Naturelles* 11107 (P); Soalala, *Réserves Naturelles* 2138 (P, TAN); Namoroka PA, *Service Forestier 11-SF* (P); environs de Berivotra, *Service Forestier (Capuron)* 162 (P); Antsalova, *Service Forestier 19840* (TEF); Berano, *Service Forestier* 26518 (P, TEF); Amboina, *Sol* 34 (P); 14 km E of Antsalova, *Villiers et al.* 4777 (K); 12 km ESE Ankilimotsy, 26 km SE Antsalova, *Villiers et al.* 4997 (K, P). **Toliara:** Manasoa Mahafaly, *Afzelius s.n.* (MO, P); S of Andranovory, betw. Ambatry & Toboky Mitsy, *Anderberg, Smedmark, Axelius, Manns & Englund* 166 (P, S); [25 km NE of] Andranovory, *Andriamahay et al.* 560 (K); Mahabo, *Andriamahay et al.* 820 (P); Befandiana-Sud, *Appert* 68 (K, WAG); Ankilizato (Mont Mahabo), *Bosser* 4611 (TAN); après Mahaboboka en allant à Toliara, *Buerki et al.* 63 (K, MO, P, TAN); 23–43 km E of Tulear along rd. to Andranovory, *Croat* 31059 (K, MO); Rte. Nationale 10 betw. Tongobory & Betsioky, *Croat* 31232 (MO); RN10 betw. Ejeda & Ampanihy, betw. PK 200 & 250, *Croat* 31339 (MO, TAN); 1–4 km W of Etrobecke, *Croat* 31448 (MO, TAN); along Rte. 13 from Ambovombe to Antanimora, *Croat* 32015 (MO, TAN); Ambovombe (Mont

Angavo), *Decary* 8610 (P); ferme de Mahabo, *Dequaire* 27034 (P, TAN); Sud Ambovombe, *Descoings* 1464 (MO, TAN); Manombo, *Douliot s.n.* (P); 12 km SW of Ampanihy on rte. to Androka, *Du Puy & Du Puy* MB579 (TAN); Mahafaly plateau, ca. 7 km S of Beahitse on RN10, *Du Puy et al.* MB36 (TAN); ca. 17 km N of Ejeda on Rte. Nationale 10, *Du Puy et al.* MB608 (TAN); Fiherenena, *Geay* 3345 (P); Morondava, *Grevé* 111 (K, P, TAN); Gorges du Fiherenena entre Beantsy et Anjamala, *Humbert* 19909 (P); de la vallée de la Sakamena à la vallée de la Sakoa (bassin de l’Onilahy), *Humbert* 29409 (P); RN7 at 98 km NE of Tulear, 400 m, *Lorence* 1920 (TAN); Rte. Ankazoabo, *Morat* 2908 (TAN); Piste Ankazoabo après le village de Laborano, *Morat* 3580 (P, TAN); 55 km NE of Morondava via rte. 8, Kirindy Forest, *Noyes et al.* 1052 (P, WAG); Beza Mahafaly PA, parcelle 1, *Phillipson* 1687 (K, MO, P, TAN); 64 km along RN55 from Morombe, Mangoky valley, *Phillipson et al.* 4140 (P); Analamaiiky, *Rakotondranony et al.* 212 (K); Ranobe Forest, *Phillipson et al.* 5880 (G, K, MO, P, TAN, WAG); Andohahela PA, parcelle 3, *Randriamampionona* 272 (P, WAG); Andohahela PA, parcelle 1, *Randriamampionona* 808 (P). MASCARENE ISLANDS. **Rodrigues Island:** *Balfour s.n.* (K, P), *Jauffret* 105 (P); Cascade Momoac, *Lesouef s.n.* (P). (African specimens examined are not listed). SEYCHELLES. **Aldabra. West Island (Île Picard):** back of settlement, 2–3 m, *Fosberg* 48699 (K, MO), *Fosberg* 48806 (MO), *Fosberg* 48831 (K, MO), *Fosberg* 49499 (MO); coast N of settlement just S of Anse Var, *Fosberg* 49484 (K); settlement, *Renvoize* 715 (K); near settlement, *Stoddart* 967 (K); 50 m E of laboratory, *Wood* 1610 (K); no precise locality, *Abbott s.n.* (K), *Dupont* 12 (K), *Dupont* 129 (K), *Fryer* 76 (K), *Renvoize* 1362 (K), *Thomasset* 231 (K). **Cosmoledo:** *Thomasset s.n.* (K).

9. *Gouania lineata* Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 131–132. 1857, as “*Guania*.” TYPE: Madagascar. Antsiranana: Nosy Be, Lokobe, (“Nossibé, Forêt de Loucoubé”), [13°25’S, 48°19’E], Dec. 1850 (fr.), *L. H. Boivin* 2171/2b (lectotype, designated here, P 00386419!; isotype, P 00386420!). Figure 6A–C.

Woody liana climbing to 4 m; stems green, drying dark brown, glabrescent, young shoots puberulous with pale trichomes; stipules glabrous, 2(–3) × ca. 0.75 mm; tendrils puberulous. Leaves ovate to elliptic; petioles (5–)10–15(–20) mm, glabrous; leaf blades (4–)5.5(–12) × (2–)3.5(–6) cm; secondary veins alternate, 6 to 7 pairs, not reaching the margin but following it; conspicuous tertiary veins absent, reticulation scalariform; abaxial surface glabrous, veins puberulous with pale trichomes; midrib and secondary veins prominent; adaxial surface glabrous; margin entire, slightly recurved; base rounded; apex acute. Inflorescences congested, pubescent with a white indument, (5.5–)8.5(–12) cm, consisting of glomerules subtended by stipulelike bracts; glomerules sessile, sometimes shortly pedunculate at the base of the inflorescence, 2(to 5)-flowered; bracts

pubescent with pale trichomes on the outer surface, glabrous on the inner surface, caducous, (1.5–)2 × ca. 0.5 mm; flowers pedicellate, pedicels accrescent, (1–)2.5 mm, pubescent with whitish trichomes. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 1.5 × 0.5 mm, pale yellow, outer surface pubescent, inner glabrous; petals ca. 1 × 0.5 mm, pale yellow; stamens slightly longer than the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 3 mm diam., pale yellow to white; lobes ca. 0.5 mm, acute to slightly truncate, 1/3 as long as the sepals; stigma with 3 linear lobes, those ca. 15 mm; style ca. 2 mm. Fruits 1 to 2 developing on each glomerule, small, oblong (ca. 0.5 × 1 cm), glabrous, densely arranged throughout the infructescence; valves ca. 5 × 5 mm; immature fruits globose, puberulous with whitish trichomes; seeds brown, shiny, ovoid to pyriform and slightly flattened, ca. 3 × 2 × 0.5 mm.

Distribution and ecology. *Gouania lineata* occurs in western and northern Madagascar (Fig. 2B) in evergreen, semi-deciduous forests and secondary vegetation on sand or limestone at an elevational range from sea level to 900 m.

IUCN Red List category. Based on an EOO of 309,667 km², an AOO of 207 km², and 21 subpopulations, eight of which occur within protected areas (Ankarafantsika, Isalo, Manongarivo, Namoroka, Tsaratanana, Zombitsy), we assign *Gouania lineata* a preliminary status of Least Concern (LC), according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Gouania lineata* is known in flower from January to May and in fruit from June to January.

Discussion. *Gouania lineata* is based on multiple syntypes with specimens only known to be present at P. One of these collections, *Pervillé 617*, is represented by two sheets, and the other, *Boivin 2171/2*, is represented by three sheets. The *Pervillé* collection from “Ambongo” is dated 15 February 1841 and clearly represents a single gathering, both sheets bearing specimens with similar very young inflorescences with no open flowers or fruits. The three *Boivin* sheets represent two separate gatherings, presumably put together later under a single number (possibly explaining the dual number “2171/2” that appears on each of the sheets, but see the note below about *Boivin 2171*). The first of the sheets (P 00386418) bears a flowering specimen and an original label with the information: “Nossi-Cumba. juill. 1850. fr. / Nossibé, Forêt de Loucoubé, mars

1851. fl.,” together with a Paris Herbarium label with the printed information “Madagascar, Voyage de M. Boivin, 1847–1852,” on which the name *G. lineata*, the reference to the Tulasne (1857) publication, and the collection number are handwritten. The other two sheets of *Boivin 2171/2* each bear similar Paris Herbarium labels bearing exactly the same printed and handwritten information as the first sheet, but lack original labels with the collection locality or date. One of these sheets (P 00386418) bears a specimen with mature fruits and old infructescences; the second (P 00386420) bears a specimen that is almost sterile, bearing no fruits and just a few flowers on a highly reduced inflorescence. We conclude that these flowering and fruiting specimens correspond to the two gatherings noted on the original label that is present on the first sheet. To distinguish the gatherings, we designate the fruiting collection (“fr.”) from Nossi Kumba (“Nossi-Cumba”) as *Boivin 2171/2a* and the flowering collection (“fl.”) from Lokobe Forest on Nosy Be (“Nossibé, Forêt de Loucoubé”) as *Boivin 2171/2b*. We select the better of the two Nosy Be specimens, which bears the original label, as the lectotype. It should be noted that Boivin also collected the type specimen of *G. aphrodes* at Nosy Be under the number 2171.

Gouania lineata is morphologically most similar to *G. myriocarpa* Tul.; both species possess small glabrous fruits congested along the entire infructescence. However, *G. lineata* can be distinguished from *G. myriocarpa* by the lack of conspicuous tertiary veins on its leaves and by the lobes of the disc reaching one third of the sepals (vs. lobes of the disc reaching one sixth of the sepals). Furthermore, while *G. lineata* is widespread in western Madagascar, *G. myriocarpa* is confined to the eastern escarpment and the central plateau.

Additional specimens examined. MADAGASCAR. s. loc., fl., *Boivin s.n.* (K); fl., *Service Forestier 9* (P, TAN). **Antananarivo:** forest remnant betw. Ambaranala & Tsiroanomandidy, *Barnett et al. 399* (K, P, TAN); Rebord occidental Bongolava, O Tsiroanomandidy, *Morat 4597* (P, TAN). **Antsiranana:** Mandrizavona, Antsahafaly River, *Antilahimena 419* (G, MO, P, TAN); Nosy Kumba (“Nossi-Cumba”), *Boivin 2171/2a* (P); Andranosavony, *Buerki & Wohlhauser 34* (K, MO, P, TEF); Besinkara, *Gautier et al. 2401* (G, K, TAN); Saharenana, Sadjoavato, Forêt de Sahafary, *Hongwa et al. 205* (Centre National d’Application de Recherche Pharmaceutique [CNARP], MO, P); Ambilobe, Ambakirano, Behefaka, Anjahana, forêt de Belifilelatra, *Hongwa et al. 309* (CNARP, MO, P, TAN); Ambilobe, Forêt Ambohibe, *Leopold et al. 120* (MO, P, TAN); Massif du Manongarivo, *Perrier de la Bâthie 1552* (P), *Perrier de la Bâthie 6042* (P); Daraina, Forêt d’Antsahabe-nord, *Ranirison 767* (G, MO); Bemanevoka, Ambobaka, *Ratovoson et al. 193* (G, MO, P, TAN); Ambodisakoana, *Totozafy Be 552* (G, P). **Fianarantsoa:** Isalo, *Homolle 1462* (P); environs

d'Ihosy, *Humbert 14464* (P); Ihosy, *Peltier & Peltier 4887* (P). **Mahajanga:** Antsianitia, *Callmänder & Phillipson 677* (G, K, MO, P, TAN, US); Namoroka PA, *Decary 18981* (P); vic. of Lac Ampijoroa, *Gentry 11471* (K, P, TAN); Bongolava de Port Bergé, *Morat 4454* (P, TAN); Boïna, *Perrier de la Bâthie 6037* (P); Ankarafantsika PA, *Perrier de la Bâthie 14694* (K, P, TAN); Vallon de Mangotroky, près Soalala (Ambongo), *Perrier de la Bâthie 1552 bis* (P); Ambongo, *Pervillé 617* (P); Namoroka PA, *Réserves Naturelles 8648* (P, TEF); Lac Ampijoroa, *Service Forestier (Raveohitra) 29773* (TEF). **Toliara:** Zombitsy PA, *Allorge 2110* (P); Zombitsy PA, *Croat 30720* (MO, TAN); E of Tulear betw. 45 & 55 km E of Tulear on rd. to Andranovory, *Croat 31070* (MO, TAN); Plateau gréseux à l'Est de la vallée Sikily au NW d'Ankazoabo, *Humbert 29725* (P); Forêt de Marosalaza, *Petter 30, 32* (P); Zombitsy PA, *Randrianaivo et al. 305* (P).

10. *Gouania mauritiana* Lam., *Encycl.* 3: 5. 1789.

TYPE: Mauritius (cultivated). Cultivée au Jardin du Roi, s.d. (st.), *Herbier Lamarck s.n.* (lectotype, designated here, P-LA!). EPITYPE: Réunion. Mare sèche, Cilaos, 24 Jan. 1983, *T. Cadet 6500* (epitype, P 00386378!).

Gouania incisa Vahl, *Symb. Bot.* (Vahl) 3: 101. 1794, nom. superfl.

Gouania sericea Hils. ex C. Presl, *Abh. Königl. Böhm. Ges. Wiss.*, ser. 5 39, 1844, nom. superfl.

Gouania sericea Sieber ex Tul., *Ann. Sci. Nat., Bot. sér.* 4, 8: 134. 1857, nom. inval. (ICBN, Art. 34.1a).

Woody liana; stems dark green, drying brown to ferruginous, densely lanate with ferruginous trichomes; stipules pubescent with a ferruginous indument on the upper surface and glabrous on the inner surface, (4–)5(–6) × ca. 3 mm; tendrils pubescent. Leaves lanceolate to deltoid; petioles (8–)10(–15) mm, densely pubescent with a ferruginous trichome; blade (3.5–)4.5–5(–6) × (2.5–)3.5(–4) cm; secondary veins alternate, (5 to)6(to 7) pairs, reaching and following the margin; tertiary veins apparent, 5(to 7) pairs, arising near the base of the lowest secondary veins, fine reticulation obscure; abaxial surface lanate with whitish trichomes on the limb, and ferruginous trichomes on the midrib, secondary veins, and tertiary veins; adaxial surface pubescent with appressed whitish trichomes; margin serrate; base rounded to shallowly cordate; apex acuminate. Inflorescences ± lax, densely pubescent with a reddish indument, (5.5–)6–7(–8) cm, consisting of compact glomerules subtended by stipulelike bracts; glomerules sessile, up to 15-flowered, glomerules at the base of the inflorescence; bracts triangular-lanceolate, densely pubescent with reddish trichomes on the outer surface and glabrous on the inner, ± persistent, (5–)6 × ca. 2 mm; flowers shortly pedicellate, pedicels ca. 1.5 mm, covered by a whitish indument. Hypanthium obconic, becoming subglobose as the capsule develops; sepals

ca. 1.5 × 2 mm, pale yellow, outer surface densely pubescent with whitish trichomes at the base and reddish trichomes at the apex, inner glabrous; petals ca. 1 × 0.25 mm, whitish; stamens partially included in the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 2.5 mm diam.; lobes ca. 0.4 mm, slightly emarginate, 1/4 as long as the sepals; stigma with 3 linear lobes, those ca. 0.75 mm, style ca. 1 mm. Fruits 1 developing on each glomerule, oblong (ca. 1 × 1.2 cm), glabrous, densely arranged; valves ca. 10 × 5 mm; immature fruits globose, with a whitish indument, becoming reddish when mature; seeds pale brown, ovoid and slightly flattened, ca. 3.5 × 2 × 0.5 mm.

Distribution and ecology. Endemic to Réunion Island, *Gouania mauritiana* is found in humid, evergreen montane rainforest and secondary vegetation at an elevational range of ca. 1000 m.

IUCN Red List category. *Gouania mauritiana* has only been collected at one locality (Cilaos) on Réunion Island in the past 100 years, and only one older collection can be accurately georeferenced. Neither locality is in a protected area, so with an AOO of 18 km² the species is regarded as Endangered (EN B2ab[iii]), according to IUCN Red List criteria (IUCN, 2001).

Phenology. This species has only been collected in fertile condition (flower and fruit) in January.

Discussion. *Gouania mauritiana* was described by Lamarck based on a plant cultivated in the Jardin du Roi in Mauritius. However, when he chose the epithet he had not seen specimens from Réunion Island where the species is native, and he was apparently unaware that the plant did not originate from Mauritius. Although there can be no doubt about the identity of the type specimen, it is sterile; we, therefore, select a modern specimen, *Cadet 6500*, which bears both flowers and fruit, to serve as an interpretative epitype.

In this treatment we adopt a much narrower concept of *Gouania mauritiana* than Perrier de la Bâthie (1943, 1950). Herein we limit *G. mauritiana* to the typical subspecies and recognize the three other subspecies (*G. mauritiana* subsp. *aphrodes*, *G. mauritiana* subsp. *myriocarpa*, and *G. mauritiana* subsp. *pannigera*) at the rank of species, as established by Tulasne in 1857. *Gouania mauritiana* differs from these species by its lanceolate to deltoid leaves (vs. ovate in the other three), the abaxial surface covered by woolly whitish trichomes (vs. a beige indument in *G. aphrodes*, but glabrescent in *G. myriocarpa*, and whitish or grayish indument in *G.*

pannigera), its disc lobes reaching one fourth of the length of the sepals (vs. lobes of the disc reaching one sixth of the sepals in *G. aphrodes*, *G. myriocarpa*, and *G. pannigera*). Furthermore, *G. mauritiana* appears to be endemic to Réunion Island, whereas *G. aphrodes* occurs in Madagascar and the Comoro Islands, and *G. pannigera* and *G. myriocarpa* are endemic to Madagascar.

Additional specimens examined. RÉUNION ISLAND. s. loc., *Barclay s.n.* (K); fl. & imm. fr., *Boivin 1383* (P); fl., *Boivin s.n.* (K); fr., *Commerson s.n.* (K, P); fl., *De L'Isle 605* (P); fl., *Du Petit Thouars s.n.* (P); fl., *Herb. Colonial ministère de la marine s.n.* (P); fl., *Hilsenberg s.n.* (K); fl., *Richard s.n.* (P); Crête gauche du Bulon, au-dessus de Dattier, *Boivin 1383/2* (G, K, P); Cilaos, *Cadet 724* (P), *Cadet 1831* (P).

11. *Gouania myriocarpa* Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 132. 1857, as "*Guania*." *Gouania mauritiana* Lam. subsp. *myriocarpa* (Tul.) H. Perrier, Notul. Syst. (Paris) 11: 33. 1943. TYPE: Madagascar. Toamasina: Ambanivoules, côte orientale, s.d. (fr.), *J. P. Goudot s.n.* (holotype, G!; isotype, G!). Figure 8C–E.

Gouania glandulosa Boivin ex Tul. var. *breviloba* H. Perrier, Notul. Syst. (Paris) 11: 32. 1943, nom. nud.

Woody liana climbing to 10 m; stems dark green, drying dark brown to black, tomentose with rather caducous ferruginous trichomes; stipules glabrous, 3(–4) × ca. 0.75 mm; tendrils pubescent. Leaves ovate; petioles (5–)10–15(–20) mm, pubescent with ferruginous trichomes; leaf blades (4.5–)5.5–6(–7) × (2.5–)3(–4) cm; secondary veins alternate, 4 to 5 pairs, not reaching the margin but following it; tertiary veins conspicuous, arising near the base of the lowest secondary veins, reticulation scalariform; abaxial surface glabrescent, pubescent with ferruginous trichomes on the veins; midrib, secondary veins, and tertiary veins prominent; adaxial surface glabrous; margin shallowly crenulate; base rounded, sometimes shallowly cordate; apex acute. Inflorescences congested, pubescent with hirsute ferruginous trichomes, (8–)12(–25) cm, consisting of glomerules subtended by stipulelike bracts; glomerules sessile or shortly pedunculate, (2 to)4-flowered; bracts scarious, small, glabrous on both surfaces, ± persistent, (1–)2 × ca. 0.5 mm; flowers with a spindly pedicel (1–)1.5(–2) mm, covered by a whitish indument. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 1.5 × 0.5 mm, reddish, outer surface pubescent to glabrous, inner glabrous; petals ca. 0.75 × 0.25 mm, reddish; stamens slightly longer than the petal blades, with a pale red filament and a pale red, globulose anther ca. 0.2 × 0.2 mm; disc flat, ca. 2 mm diam.; lobes ca. 0.25 mm,

truncate or slightly emarginate, 1/6 as long as the sepals; stigma with 3 linear lobes, those ca. 0.8 mm; style ca. 1 mm. Fruits 1 or 2 developing on each glomerule, small, spheroid (ca. 0.6 × 0.6 cm), glabrous, densely arranged throughout the infructescence; valves ca. 6 × 4 mm; seeds brown, shiny, ovoid, ca. 2 × 1 × 0.3 mm.

Distribution and ecology. *Gouania myriocarpa* occurs in eastern Madagascar (Fig. 2D) in evergreen montane rainforest and secondary forests on basaltic rocks, gneiss, and laterite soils at an elevational range of (500–)800–100(–1400) m.

IUCN Red List category. With an EOO of 164,280 km², an AOO of 216 km², and 17 subpopulations, seven of which occur within protected areas (Andohahela, Anjanaharibe-Sud, Analamazoatra-Perinet, Marojejy, Masoala, Montagne d'Ambre, Ranomafana), *Gouania myriocarpa* is thus assigned a preliminary status of Least Concern (LC), according to IUCN Red List criteria (IUCN, 2001).

Phenology. This species is known in flower from November to February and in fruit from March to July.

Discussion. Tulasne described *Gouania myriocarpa* together with six other species of *Gouania* in his treatment of the Rhamnaceae for *Flora Madagascarensis* (Tulasne, 1857). Later, adopting broad species concepts, Perrier de la Bâthie (1943) reduced three of these species (*G. aphrodes*, *G. myriocarpa*, and *G. pannigera*) to subspecies of *G. mauritiana*. We agree with Tulasne's narrower delimitation and these taxa are again recognized at the species level.

Furthermore, Perrier de la Bâthie did not examine the type specimen of *Gouania myriocarpa*, citing "Ambanivola, Goudot (in Herb. Delessert, non *vu*)" (Perrier de la Bâthie, 1950: 46), and, as a result, he completely misinterpreted this taxon. In his treatments for *G. mauritiana* subsp. *myriocarpa* (Perrier de la Bâthie, 1943: 33; 1950: 46), he included specimens that we now refer to *G. phillipsonii*, which we describe as new below. On the other hand, he referred specimens of true *G. myriocarpa* to his new variety, *G. glandulosa* var. *breviloba* (Perrier de la Bâthie, 1943: 32; 1950: 43), a name that was not validly published.

Gouania myriocarpa is morphologically most similar to *G. lineata*, both having glabrous fruits congested along their entire infructescences (see *G. lineata* for further comparison). *Gouania myriocarpa* can, however, be recognized easily among the Malagasy species by the presence of the ferruginous trichomes on the petioles, along the veins of the abaxial leaf surface, and the inflorescence. The lobes

of its floral disc are one sixth as long as the sepals, and the glabrous fruits are densely arranged on the infructescence.

Additional specimens examined. MADAGASCAR. s. loc., fl., *Baron 239* (K, P). **Antsiranana:** Montagne d'Ambre PA, SE du Lac Texier, *Debray H1341D* (P); Anjanaharibe-Sud PA, *Rasoavimbahoaka & Ravelonarivo 215* (P, TAN); Marojejy PA, *Rasoavimbahoaka 566* (K, P, TAN); Anjanaharibe-Sud PA, *Ravelonarivo & Rasovimbahoaka 74* (P, TAN, WAG); Montagne d'Ambre PA, *Schledl 167* (TAN). **Fianarantsoa:** Iakora, forêt de Sakalava, *Andrianjafy et al. 982* (MO, P, TAN); Ranomafana, bord de la route nationale, *Buerki et al. 46* (BR, G, K, MO, P, TAN, US, WAG); Ambohimotombo, *Forsyth-Major s.n.* (G); haute vallée de la Rienana (bassin du Matitanana), *Humbert 3626* (P, TAN); massif de l'Ivakoany, *Humbert 7021* (P); Ranomafana PA, parcelle 3, *Rakoto 392* (P); Analamanavaona, proche Vohimary, *Rakotovo 652* (P); Andrambovato, *Service Forestier (Capuron) 265* (P, TEF). **Toamasina:** Moramanga, Ambatovy, *Antilahimena et al. 5297* (MO, P, TAN, TEF), *Antilahimena et al. 5375* (MO, P, TAN, TEF), *Antilahimena et al. 6085* (MO, P, TAN, TEF); Andranobe, SO du lac Alaotra, 1100 m, *Bosser 19865* (MO, P, TAN); Ambatoharanana near Antsevabe, *Cours 4050* (P, TAN); Bemainty, vers 850 m, *Cours 4205* (P, TAN); Perinet PA, *Cremers 1492* (P, TAN); along Rte. 2 betw. Perinet & Beforona, *Croat 32330* (K, P, TAN); S de Moramanga, *Decary 6911* (K, P); S de Moramanga, *Decary 7123* (P, TAN); RN2 at 15 km W of Perinet, *Lorence 2013* (P, TAN); Analamazoatra-Perinet PA, 1040 m, *Lowry & Schatz 4304* (K, P, TAN, WAG); Ambohilero, logging rd. from Antserabe, 1120 m, *Lowry et al. 6615* (MO, P, TAN); vic. of 13 km marker on mine rd. to Tsaravoniana encampment, *Noyes et al. 990* (P, WAG); bords de Mangoro entre Beparasy et Moramanga, *Perrier de la Bâthie 17199* (P); Rivière Sahanana, barrière du Sakaleony, *Perrier de la Bâthie 6014* (P); Antananarivo on rd. to Perinet, *Phillipson 1624* (K, P, TAN, WAG); Ambatovy, *Rakotomalaza 1160* (P); Betampona PA, *Réserves Naturelles 3672* (MO, P, TAN); Ambohitralanana, *Réserves Naturelles 8814* (P, TAN); Perinet PA, *Service Forestier 1422-SF* (P, TAN, TEF); Ambodilongotra, Moramanga, *Service Forestier 26772* (P, TEF); 12 km bifurcation entre rte. de Lakanto et Moramanga, *Service Forestier 29722* (TEF). **Toliara:** Vohifeno, *Beaujard 375* (P); montagnes gneissiques entre le col du Kalambatritra et la vallée de la Manambolo, affluent de l'Ionaivo, *Humbert 12099* (P); Andohahela PA, Euanihilia, *Réserves Naturelles 5157* (P).

12. *Gouania pannigera* Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 134. 1857, as "*Guania*." *Gouania mauritiana* Lam. subsp. *pannigera* (Tul.) H. Perrier, Notul. Syst. (Paris) 11: 33. 1943. TYPE: Madagascar. Antananarivo: bois aux environs de Tananarive, s.d. (fl. & imm. fr.), *J. P. Goudot s.n.* (holotype, G!; isotype, G[2]!). Figure 9E–H.

Woody liana climbing to 10 m; stems dark green, drying blackish, densely pubescent with a red-brown indument; stipules densely pubescent on the 2 surfaces with reddish brown trichomes, 2(–3) × ca.

1 mm; tendrils pubescent. Leaves ovate, discolorous when dried; petioles (6–)10(–15) mm, pubescent with a reddish brown trichome; leaf blades (3–)4–5(–7) × (2–)3(–3.5) cm, discolorous; secondary veins alternate, sometimes subalternate, 5 to 6 pairs, reaching and following the margin; tertiary veins apparent, 2(to 4) pairs, arising generally from the first pair of secondary veins, sometimes from the second, fine reticulation obscure; abaxial surface lanate with whitish or grayish indument; midrib, secondary veins, and tertiary veins covered by a whitish indument that becomes reddish when dried; adaxial surface pubescent with brown trichomes; margin entire, sometimes with 1 or 2 teeth near the base; base rounded; apex rounded or subacute. Inflorescences congested, densely pubescent with a reddish indument, (4–)7–8(–12) cm; glomerules shortly pedunculate, peduncles up to 1.5 mm, 10-flowered; bracts densely pubescent, persistent, (2–)3 × ca. 1 mm; flowers and fruits shortly pedicellate, pedicels up to 1 mm, covered by a reddish indument. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 2 × 1 mm, pale yellow to whitish, outer surface densely pubescent, inner glabrous; petals ca. 1 × 0.25 mm, whitish; stamens totally included in the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 3 mm diam.; lobes ca. 0.3 mm, truncate or somewhat emarginate, 1/6 as long as the sepals; stigma with 3 linear lobes, those ca. 0.75 mm, style ca. 1 mm. Fruits 0 to 1 developing on each glomerule, oblong (ca. 1 × 1.4 cm), sparsely pubescent with reddish trichomes, equally distributed throughout the infructescence, only the distal flower of each glomerule develops to a fruit, the others falling and leaving conspicuous scars; valves ca. 10 × 7 mm; immature fruits globose, with a whitish indument that becomes reddish; seeds pale brown, ovoid and slightly flattened, ca. 4 × 3 × 1 mm.

Distribution and ecology. *Gouania pannigera* is distributed in central Madagascar (Fig. 2B) in evergreen montane rainforest and secondary forest on quartzite, sand, and basalt rocks at an elevational range of 800–1500 m.

IUCN Red List category. With an EOO of 215,709 km², an AOO of 360 km², and 34 subpopulations, six of which occur within five protected areas (Ambohitantely, Andringitra, Isalo, Tsaratanana, Zahamena), *Gouania pannigera* is thus assigned a preliminary status of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. This species has been collected in flower from January to April and fruiting at the end of April.

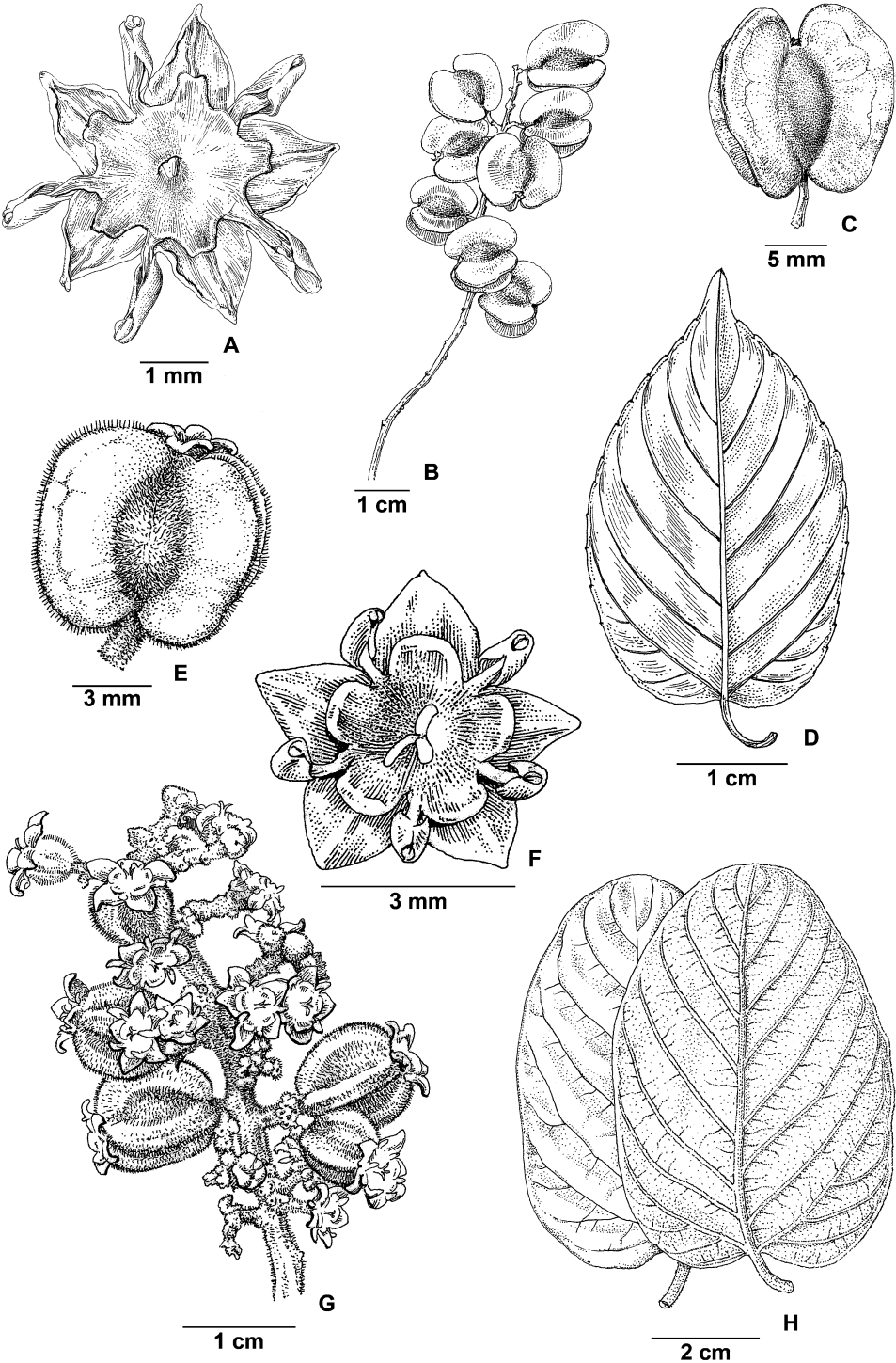


Figure 9. A–D. *Gouania perrieri*. —A. Flower showing the lobes of the disc reaching one fourth of the way along the sepals. —B. Inflorescence showing the glabrous fruits concentrated at the base. —C. Fruit. —D. Leaf, abaxial surface. E–H. *Gouania pannigera*. —E. Fruit. —F. Flower showing the lobes of the disc reaching one fourth of the way along the sepal. —G. Inflorescence. —H. Leaf, abaxial surface (in front), adaxial surface (behind). A drawn from *Hildebrandt 3001* (P); B, C from *Hildebrandt 3017* (P); D from *Réserves Naturelles 4228* (P); E–H from *Buerki & Phillipson 35* (TAN).

Discussion. *Gouania pannigera* is morphologically most similar to *G. aphrodes*, *G. mauritiana*, *G. phillipsonii*, and *G. taolagnarensis*, all of which possess leaves with a dense indument and conspicuous tertiary venation on the adaxial surface, and most of which have sessile or shortly pedunculate flowering glomerules. However, *G. pannigera* is distinguished by its ovate leaves, the abaxial surface covered by a whitish or grayish indument and a reddish indument on the veins after drying; peduncle scars left by the flowers; and the presence of glomerules at the base of its infructescence. Furthermore, *G. pannigera* is distributed in the forests and disturbed areas in central Madagascar, whereas *G. aphrodes* is distributed in the north, *G. phillipsonii* is principally distributed in the eastern part of the island, and *G. taolagnarensis* in the southeast.

Perrier de la Bâthie (1943, 1950) treated *Gouania pannigera* as a subspecies of *G. mauritiana* allied to *G. mauritiana* subsp. *aphrodes* (see discussion under *G. aphrodes*) and *G. mauritiana* subsp. *myriocarpa* (see also discussion under *G. myriocarpa*), but we believe that the distinctive suite of characters demonstrated by *G. pannigera*, together with its coherent biogeography and ecological preferences, justify its reinstatement to species rank. *Gouania pannigera* was cited by Engler (1895: 265) from Gorongosa in Mozambique. We have not been able to trace the corresponding herbarium material, but we believe that this was simply a misidentification of a specimen of *G. longispicata* Engl., a form of which is found in that region with a particularly dense indument that resembles that of *G. pannigera*.

Additional specimens examined. MADAGASCAR. **Antananarivo:** Ifaty, *Alleizette* 607 (P), *Alleizette* 1204 (P); Central Madagascar, *Baron* 3971 (K); Tampoketsa d'Ankazobe, PK 120, *Bosser* 7808 (TAN); Ambohimanga, *Bosser* 12600 (TAN); Soarina, PK 22 rte. de Tananarive, *Bosser* 13802 (TAN); Ambohimanga, Colline royale, *Buerki* & *Phillipson* 35 (BR, G, K, MO, NY, P, TAN, US, WAG), 36 (G, K, MO, P, TAN, US, WAG); Ambohimanga, Colline royale, *Buerki* & *Phillipson* 37 (K, MO, P, TAN); Amboasary, bas de la montagne Behenjy, *Buerki* et al. 43 (BR, G, K, MO, NY, P, TAN, US, WAG); Ambohimanga, *Decary* 667 (P), *Decary* 6154 (P), *Decary* 6216 (G, P); Anosivato, *Decary* 6280 (P); Nord d'Ankazobe, *Decary* 7434 (P); Tampoketsa d'Ankazobe, *Decary* 19281 (P); Ambohimanga, *Dequaire* 27701 (P, TAN); Près d'Amboitromby, *Descoings* 3158 (TAN); Rocher d'Iaranandriana, *Dorr* et al. 2888 (K, MO, P, TAN, WAG); environs d'Antananarivo, *Goudot* s.n. (G); Ambohimanga, *Herb. Jard. Bot. Tananarive* 3262 (P); environs d'Andramasina, *Leandri* 3079 (P); Tampoketsa d'Ankazobe, près port forestier de la Manankaza, *Keraudren* 1153 (K); Ambohimanga, *Parker* s.n. (K); environs de Betafo, *Perrier de la Bâthie* 6013 (P); Ambohimanga, *Perrier de la Bâthie* 7057 (P); Mois-Chaîne de Betafo, 1300 m, *Perrier de la Bâthie* 13085 (K, P); Forêt d'Ampatsakandrainivavy, *Randrianaivo* et al. 518 (MO, P);

Ambohitantely PA, *Réserves Naturelles* 1222 (P, TAN); Tampoketsa-Ankazobe, *Schatz* et al. 3949 (P, TEF); Tsinjoarivo, *Service Forestier (Capuron)* 4 (TEF); Andramasina, *Service Forestier* 67 (P); Ambohimanga, *Waterlot* 57 (P); Ankaratra, *Waterlot* 690 (P). **Antsiranana:** Tsaratanana PA, *Réserves Naturelles (Rababoto)* 5988 (P). **Fianarantsoa:** Andringitra, N-facing mtn. slopes in N part of Natl. Park, *A. Anderberg*, *J. Smedmark*, *B. Axelius*, *U. Manns* & *M. Englund* 65 (MO, P, S); Soaindrana, *Buerki* et al. 49 (BR, G, K, MO, P, S, TAN, US, WAG); Iaritseana, *Buerki* et al. 50 (BR, G, K, MO, NY, P, TAN, US, WAG); portion de 5 km anciennement goudronnée en face de la brioche, après Mahaso, *Buerki* et al. 54 (BR, G, K, MO, NY, P, TAN, US, WAG); montée vers le plateau d'Horombe, *Buerki* et al. 56 (K, MO, P, TAN); PK 45 rte. Ivato à Ambatofinandrahana, *Cremers* 2062 (G, P, TAN); Inselbergs W of Ambalavao, at PK 475 near base of rock formation along creek, *Croat* 30187 (MO, TAN, WAG); environs Ambatofinandrahana, *Decary* 13172 (P); environs Ambatofinandrahana, *Decary* 13260 (P); RN5, Canton Sandrisoa, distr. Ambalavao, *Henri* 5532-RN (P); massif de l'Ivakoany, *Humbert* 7037 (P); Ihoisy, base de la montée sur l'Horombe, *Jacquemin* 1261 (P); Isalo, rivière Sakamalio en aval de l'ancien village, *Jacquemin* H352J (P); Sandrandahy, bassin de la Mania, *Peltier* & *Peltier* 2196 (P); Antanifotsy, forêt de Ramiova et Ambodirina, *Razafindrambao* 745 (P); Ambalavao, *Réserves Naturelles (Rabevazaha)* 10382 (P); Ranohira, *Service Forestier* 13896 (P). **Toamasina:** Menaloha, *Cours* 680 (P); Ambatondrazaka, *Decary* 16441 (P); rte. de Vohidiale, *Dequaire* 27782 (P); ca. 9.5 km au NNW de Didy S rte. Ambatondrazaka, *Gereau* et al. 5763 (MO, P); Anony, *Hb. Jard. Bot. Tananarive* 2958 (P); Lac Alaotra, *Homolle* 580 (P); Ankazotokana, *Réserves Naturelles (Ramanatsoavina)* 1954 (P, TAN); Zahamena PA, *Réserves Naturelles* 3766 (P); Ankosy, *Rakotovo* 11039 (P). **Toliara:** Analavelona, *Andriamihajarivo* et al. 1656 (MO, P, TAN); limite est de Zombitsy, bord de la Rte. Nat. 7, *Buerki* et al. 60 (K, MO, P, TAN); SE, *Descoings* 494 (TAN); Forêt d'Analavelona, *Humbert* 14231 (P).

13. *Gouania perrieri* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Antsiranana: Ankarana PA, 12°56'S, 49°07'E, 100–300 m, 17–24 June 1993 (fr.), *O. Andrianantoanina* & *R. Bezara* 180 (holotype, MO!; isotypes, P!, TAN!), Figure 9A–D.

Gouania glandulosa Boivin ex Tul. var. *sambiranensis* H. Perrier, *Nutl. Syst.* (Paris) 11: 32. 1943, nom. inval.

Haec species a congeneris madagascariensibus foliis glabris cordatis usque deltatis ad marginem leviter crenatis, floribus pedicellis longis (3–7 mm) insidentibus, disci lobis longitudine 1/4 sepalorum partem attingentibus atque fructu magno (ca. 1.5 × 1.5 cm) glabro facile distinguitur.

Woody liana; stems dark green, drying brownish to blackish, glabrous; stipules glabrous, 1(–1.5) × ca. 0.25 mm; tendrils glabrescent. Leaves cordate to deltoid; petioles 10(–20) mm, glabrous; leaf blades (4.5–)5.5(–6) × (3–)4.5 cm; secondary veins alternate, 5 to 6 pairs, not reaching the margin but

following it; conspicuous tertiary veins absent or 2 to 3 pairs present but discrete, arising near the base of the lowest secondary veins, reticulation scalariform discrete; abaxial surface glabrous; midrib, secondary veins, and tertiary veins slightly prominent; adaxial surface glabrous; margin shallowly crenate; base cordate; apex acute to rounded. Inflorescences spindly, lax, glabrescent with hirsute pale trichomes, (3–)7(–9) cm, consisting of glomerules subtended by stipulelike bracts, the proximal flowers developing before the distal flowers; glomerules pedunculate, peduncles accrescent, (1–)3 mm, 2(–4)-flowered; bracts small, densely pubescent on the outer surface with reddish trichomes, glabrous, with a black line on the inner surface, caducous, 0.5(–1) × ca. 0.25 mm; flowers pedicellate, pedicels (3–)4(–7) mm, glabrescent at maturity. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 2 × 0.6 mm, pale yellow, outer surface puberulent, inner glabrous; petals ca. 1 × 0.5 mm, white; stamens slightly longer than the petal blades, with a pale yellow filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 3 mm diam.; lobes ca. 0.5 mm, emarginate, 1/4 as long as the sepals; stigma with 3 very short linear lobes, style ca. 0.2 mm. Fruits 1 or 2 developing on each glomerule, spheroid, large (ca. 1.5 × 1.5 cm), glabrous, sometimes crenulate on the wings, often aggregated in the proximal part of the infructescence; valves ca. 15 × 10 mm; immature fruits globose, puberulent; seeds brown, shiny, ovoid to pyriform and slightly flattened, ca. 3 × 2 × 0.5 mm.

Distribution and ecology. *Gouania perrieri* occurs in northern and western Madagascar, notably in the Sambirano region (Fig. 2A) in semi-deciduous and evergreen lowland forests on Tsingy limestone and basaltic rocks at an elevational range of 50–500 m.

IUCN Red List category. Based on an EOO of 59,374 km², an AOO of 700 km², and seven subpopulations, four of which occur within protected areas (Ankarana, Montagne d'Ambre, Namoroka), *Gouania perrieri* is thus assigned a preliminary status of Vulnerable (VU B1ab[iii]+2ab[ii]), according to IUCN Red List criteria (IUCN, 2001).

Phenology. The new species has been collected in flower from June to October and in fruit from February to May.

Etymology. This species is named in honor of Joseph Marie Henry Alfred Perrier de la Bâthie (1873–1958), French botanist, geologist, and outstanding explorer of Madagascar for over 30 years.

Discussion. Perrier de la Bâthie (1943) recognized this plant as a variety of *Gouania glandulosa*

[= *G. scandens* subsp. *glandulosa*], but it differs by the crenulate margins of its leaves, the flowers with long pedicels (vs. sessile), the lobes of the disc reaching one fourth as long as the sepals (vs. the lobes longer, one third to two thirds as long as the sepals), and the large (ca. 1.5 × 1.5 cm) fruits, which are often aggregated on the basal part of the infructescence (vs. ca. 1 × 2 cm and more apically developed). Contrasting also in their distribution, *G. perrieri* is confined to semi-deciduous forest in northern and western Madagascar, while *G. scandens* subsp. *glandulosa* is typical of the humid forest of the east coast. The varietal name provided by Perrier de la Bâthie (1943) was not accompanied by a Latin description or diagnosis and was therefore not validly published according to the ICBN (McNeill et al., 2006: Art. 36.1).

Gouania perrieri is closest to *G. laxiflora* in the size and distribution of the fruits on the infructescence, but can be easily distinguished by the shallowly crenate leaf margins, the long pedicels, the lobes of the disc one fourth as long as the sepals, and its 3-winged immature fruits. It can be distinguished from other species in *Gouania* by its cordiform to deltoid, glabrous leaves with shallowly crenate margins; flowers with long pedicels; the lobes of the disc reaching one fourth as long as the sepals; and the large glabrous fruits concentrated on the basal part of the infructescence. This distinctive suite of characters justifies raising it to species rank.

Paratypes. MADAGASCAR. **Antsirana:** Ankarana PA, 12°56'S, 49°07'E, *O. Andrianantoanina* & *R. Bezara 180* (MO, P, TAN); Montagne des Français, 12°19'28"S, 49°20'28"E, *M. Bardot-Vaucaulon 1776* (K, MO, P, TAN); Montagne d'Ambre PA, bord chemin proche camp des Roussettes, 12°31'28"S, 49°10'20"E, *S. Buerki, M. W. Callmänder & S. Wohlhauser 1* (MO, P); Bord de la rte. Sambava-Vohemar, PK 53, 13°40'33"S, 50°03'45"E, *Callmänder & Wohlhauser 249* (G, K, MO, P, S, TEF); Ankarana PA, 12°51'01"S, 49°13'30"E, *D. K. Harder, M. C. Merello, S. G. Razafimandimbison & T. G. Razafindrabaza 1750* (MO, TAN); Nosy Be, *J. M. Hildebrandt 3001* (G, P); Norontsanga, [13°55'S, 47°55'E], *J. M. Hildebrandt 3017* (K, P); Ankarana PA, 12°51'S, 49°05'E, *M. Nicoll & J. P. Abraham 678* (K, MO, TAN, WAG); Montagne des Français, [12°20'S, 49°21'E], *H. Perrier de la Bâthie 16322* (P); Amjiabe (Nosy Be), 13°04'50"S, 49°54'07"E, *D. Rabehevitra, R. Razakamalala & T. Rakotomamonjy 226* (MO, P, TEF). **Mahajanga:** Namoroka PA, [16°29'S, 45°20'E], *Réserves Naturelles 4228* (P), *Réserves Naturelles 5620* (P, TAN); Namoroka PA, [16°29'S, 45°20'E], *Service Forestier 3* (P).

14. *Gouania phillipsonii* Buerki, sp. nov. TYPE: Madagascar. Antananarivo: near Mahasoa, at the base of the Mandraka River, track to the E, 18°55'35"S, 47°55'50"E, 1060 m, 11 Nov. 2001

(fl.), *P. B. Phillipson & G. E. Schatz 5344* (holotype, MO!; isotypes, G!, GRA!). Figure 10.

Haec species ad *Gouaniam pannigeram* Tul. et *G. taolagnarensis* Buerki, Phillipson & Callm. maxime accedit, sed ab eis foliis parvis basaliter rotundatis margine subdenticulato ac venarum secundariorum paribus primo secundoque manifeste separatis, disci lobis longitudine 1/4 sepalorum partem attingentibus atque fructu juventute indumento luteo usque aurantiaco denso maturitate brunneo oblecto distinguitur.

Woody liana climbing to 15 m; stems dark green, drying brown to dark gray, densely pubescent with hirsute reddish brown trichomes; stipules densely pubescent on the 2 faces with reddish brown trichomes, 3(–4) × ca. 1 mm, ± persistent; tendrils pubescent. Leaves broadly ovate; petioles (5–)10–15(–20) mm, pubescent with brown trichomes; leaf blades (2.5–)3.5–4 × (1.5–)2.5 cm, discolored; secondary veins alternate, the first pair oppositely arranged, 4 to 5 pairs, not reaching the margin but following it, with a larger space between the first and the third pairs, the second pair often reduced; tertiary veins apparent, (3 to)4(to 5) pairs, arising only from the first secondary veins, reticulation scalariform; abaxial surface densely villous with ferruginous to brown trichomes, ± uniform on the limb, midrib, and veins; midrib, secondary veins, tertiary veins, and reticulation prominent; adaxial surface sparsely puberulous with pale brown trichomes, finely bullate resembling reptile skin; margin sparsely denticulate, teeth with a reddish tuft of trichomes; base rounded; apex rounded or subacute. Inflorescences congested, densely pubescent with a reddish indument, (3–)4–7(–12) cm, consisting of glomerules subtended by stipulelike bracts; glomerules pedunculate, peduncles up to 3 mm, (4 to)8-flowered; bracts densely pubescent on both surfaces, persistent, (3–)4 × ca. 2 mm; flowers shortly pedicellate, pedicels up to 1.5 mm, covered by a brown indument. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 2.5 × 1.5 mm, pale yellow, outer surface densely pubescent, inner glabrous; petals ca. 1.5 × 0.75 mm, pale yellow; stamens totally included in the petal blades, with a white filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 4 mm diam., pale yellow to white; lobes ca. 0.6 mm, thicker than the disc, truncate or somewhat emarginate, 1/4 as long as the sepals; stigma with 3 linear lobes, those ca. 0.3 mm, style ca. 1 mm. Fruits 0 or 1 developing on each glomerule, spheroid (ca. 0.8 × 0.8 cm), covered by a dense brown indument, equally distributed on the infructescence; valves ca. 8 × 4 mm; immature fruits globose, with a dense, pale

yellow to orange indument that becomes brown as the fruit matures; seeds pale brown, ovoid and slightly flattened, ca. 3 × 2 × 1 mm.

Distribution and ecology. *Gouania phillipsonii* grows on the eastern escarpment of Madagascar (Fig. 2A) in evergreen montane rainforest, on limestone and lateritic soils at an elevational range of 800–1100 m.

IUCN Red List category. Based on an EOO of 19,298 km², an AOO of 135 km², and nine subpopulations, seven of which occur within protected areas (Andringitra, Anjanaharibe-Sud, Mantadia, Perinet, Ranomafana, Zahamena), *Gouania phillipsonii* is thus assigned a preliminary status of Vulnerable (VU B1ab[ii]+2ab[iii]), according to IUCN Red List criteria (IUCN, 2001).

Phenology. The new species has been noted as flowering from May to November and fruiting from January to March.

Etymology. The species epithet was chosen by the first author in honor of Peter Phillipson (1957–), British botanist and co-author of this article, who made many important collections and observations of Malagasy *Gouania* since his first visit to Madagascar over 20 years ago. He was the co-supervisor of Sven Buerki's M.Sc. research program.

Discussion. Perrier de la Bâthie (1943) was certainly familiar with this plant. He collected it himself at three different localities, citing these together with four other specimens under his *Gouania mauritiana* subsp. *myriocarpa* (Perrier de la Bâthie, 1943: 46). However, he did not see the type specimen, and it is clear that he completely misinterpreted Tulasne's original description of *G. myriocarpa* (see discussion above under *G. myriocarpa*). No existing name is available for the species, which we describe here as new.

Gouania phillipsonii can be distinguished easily by its small broadly ovate leaves, the large space between the first and second pair of secondary veins, the slightly denticulate margin, the abaxial leaf surface with a rather uniform ferruginous to brown indument, and the adaxial surface that is finely bullate, giving it a distinctive aspect reminiscent of reptile skin. The lobes of the disc reach one fourth as long as the sepals, and the immature fruits have a dense yellow indument that becomes brown as the fruits mature.

Gouania phillipsonii is probably most closely related to *G. aphrodes*, *G. pannigera*, and *G. taolagnarensis*, which all have flowers with short disc lobes (less than one fourth the length of the

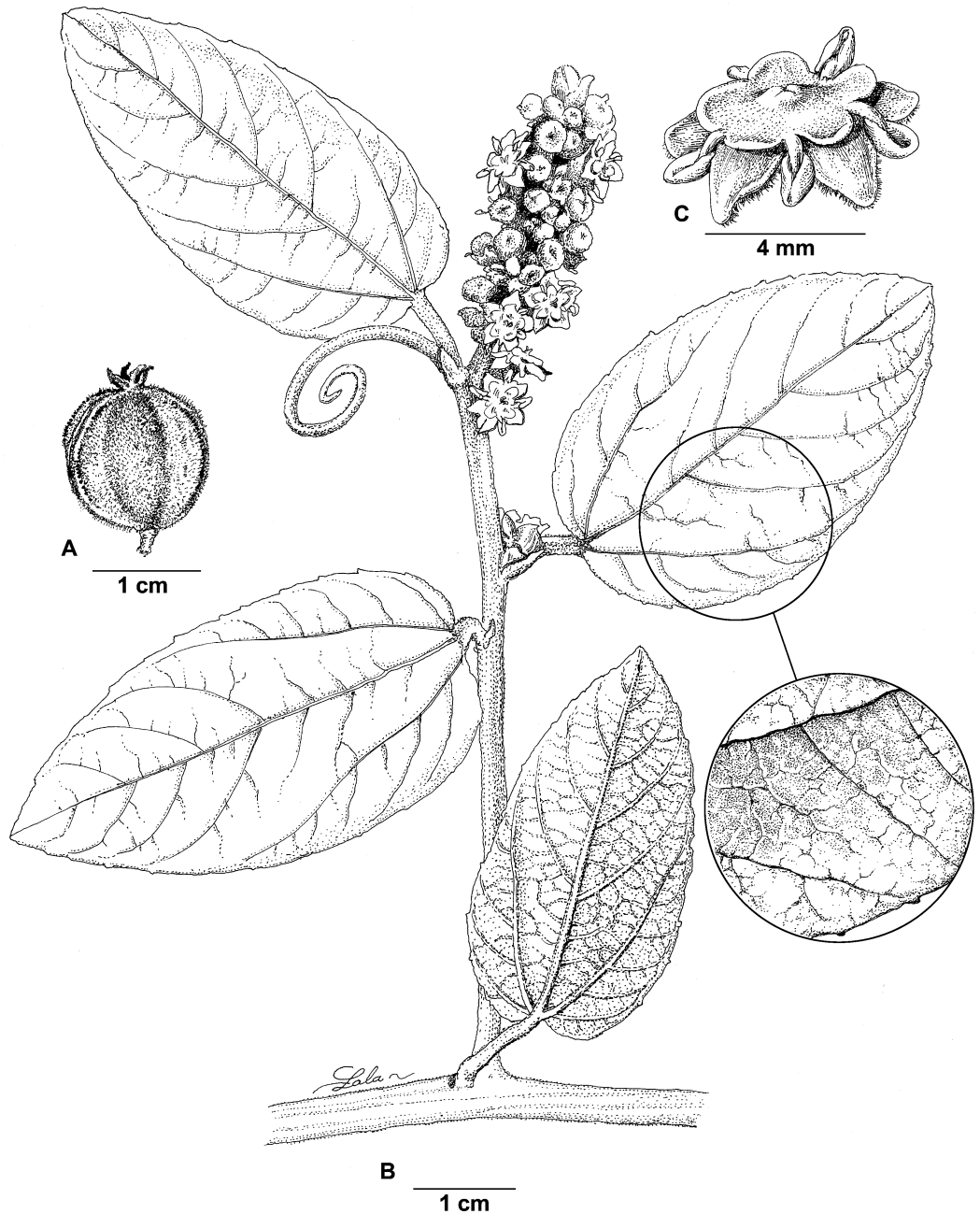


Figure 10. *Gouania phillipsonii*. —A. Fruit. —B. Flowering branch showing the broadly oval leaves with the first and second pairs of secondary veins widely spaced and the reptilian aspect of the adaxial surface. —C. Flower (lobes of the disc reaching one fourth of the way along the sepals). A drawn from Buerki et al. 42 (TAN); B, C from the type Phillipson & Schatz 5344 (MO).

sepals) and a relatively dense indument on their leaves. However, despite the diagnostic characters listed above, these species are not sympatric. *Gouania phillipsonii* occurs in forest mainly at mid-elevations on the eastern escarpment of Madagascar,

whereas *G. aphrodes* occurs in the north at lower elevations, *G. pannigera* is known from the central region (often in degraded areas), and *G. taolagnarensis* is narrowly endemic to the region of Taolagnaro (Fort Dauphin) in the southeast.

Paratypes. MADAGASCAR. **Antsiranana:** Anjanaharibe-Sud PA, 14°32'45"S, 49°35'15"E, *D. Ravelonarivo* 195 (MO, P, TAN). **Fianarantsoa:** Ranomafana, en face du centre VALBIO, 21°15'14"S, 47°25'18"E, *S. Buerki*, *P. B. Phillipson* & *C. Rakotovoao* 47 (G, K, MO, P, TAN); massif de l'Ikongo, [21°51'30"S, 47°26'30"E], *R. Decary* 5618 (P); Est Ivohibe, [22°29'S, 46°53'E], *H. Humbert* 3383 (G, K, P, TAN); Ranomafana PA, 21°15'S, 47°27'E, *S. Malcomber*, *A. Leeuwenberg*, *C. Rakotomazaza*, *H. L. Raharijaona* & *G. Rahajasoa* 1006 (G, K, MO, P, TAN, WAG); haute Rienana, bassin du Matitana, [22°13'29"S, 46°58'24"E], *H. Perrier de la Bâthie* 6022 (P); Ranomafana PA, just S of Namorona River, 21°16'S, 47°25'E, *G. E. Schatz* & *J. S. Miller* 2436 (K, P, TAN, WAG). **Toamasina:** Moramanga, [18°56'S, 48°12'E], *K. R. Afzelius* s.n. (MO, P); Moramanga, Ambatovy, Andasibe, Menalamba, Berano village, 18°50'45"S, 48°15'45"E, *P. Antilahimena* & *F. Edmond* 3956A (MO, P, TAN); Moramanga, Ambatovy, Andasibe, Menalamba, Ambovy forest, 18°51'38"S, 48°17'28"E, *Antilahimena* & *Edmond* 4088 (MO, P, TAN); Moramanga, Andasibe, Menalamba, rd. Analamay-Ambatovy, 18°50'24"S, 48°19'23"E, *Antilahimena*, *J. Razanatsoa* & *Edmond* 4219 (MO, P, TAN); Moramanga, Andasibe, Menalamba, Ambatovy forest, 18°51'29"S, 48°18'10"E, *Antilahimena*, *M. Rabarimanarivo*, *Razanatsoa* & *Edmond* 4303 (MO, P, TAN); Analamazaotra-Perinet PA, [18°56'S, 48°26'E], *R. Benoist* 1507 (P, TAN); Ambatovy, 18°52'10"S, 48°19'09"E, *Buerki*, *Phillipson* & *Rakotovoao* 42 (BR, G, K, MO, P, TAN, WAG); Ambatoharanana, [18°00'S, 48°40'E], *G. Cours* 4118 (P); Sahamalaza, près du lac Alaotra, *J.-M. Dequaire* 27976 (P); La Mandraka, *Hb. Jard. Bot. Tananarive* 4468 (P); entre Mandritsara et Andilamena, *Humbert* 18059 (P); Analamazaotra-Perinet PA, [18°56'S, 48°26'E], *M. Keraudren* & *G. G. Aymonin* 25384 (P); near Andasibe, forest of Mantadia, 18°55'S, 48°25'E, *G. McPherson* & *H. van der Werff* 16486 (G, K, MO, P, TAN); forest N of Andasibe, 18°56'S, 48°25'E, *Miller*, *J. Bradford*, *F. Rakotonasolo* & *A. Randrianasolo* 8750 (TAN, WAG); River Anove, *H. Perrier de la Bâthie* 6016 (K, P, TAN); Analamazaotra-Perinet PA, [18°56'S, 48°26'E], *Perrier de la Bâthie* 6055 (K, P, TAN); Antsangimaso, Fokontany Ampitambe, Ambatovy, commune rurale Ambohibary, 18°51'05"S, 48°18'13"E, *Razanatsoa*, *Antilahimena* & *Edmond* 536 (MO, P, TAN); Moramanga, Ambohibary, Ampitambe, Forêt d'Ambohitavolo, 18°50'49"S, 48°17'17"E, *Razanatsoa*, *Antilahimena* & *Edmond* 162 (MO, P, TAN); Distr. Moramanga, Commune: Ambohibary, Fokontany: Ampitambe, Ambatovy, environ 22 km NE de Moramanga, 18°51'30"S, 48°18'16"E, *Rakotovoao*, *R. Razafindasy* & *Edmond* 1443 (MO, TAN); Varaina, Réserves Naturelles 1593 (P); Forêt de Mantadia, 18°52.2'S, 48°29.8'E, *F. L. van Nek* 2015 (TAN, WAG).

15. *Gouania scandens* (Gaertn.) R. B. Drumm., *Fl. Zambes.* 2: 435. 1966. Basionym: *Retinaria scandens* Gaertn., *Fruct. Sem. Pl.* 2: 187, tab. 120, fig. 4. 1791. *Retinaria volubilis* Gaertn., *Fruct. Sem. Pl.* 2: 187, tab. 120, fig. 4. 1791. nom. superfl. *Gouania retinaria* DC., *Prod. (DC.)* 2: 40. 1825, nom. superfl. TYPE: [Mauritius.] Tab. 120, fig. 4 in Gaertner, 1791: 187 (lectotype, designated by Drummond [1966: 435, tab. 120, fig. 4] in Gaertner [1791: 187]).

Gouania tiliifolia Lam., *Encycl. (Lamarck)* 3: 5. 1789, as "tiliaefolia," non *Gouania tiliifolia* Rottb. ex DC., 1825, nec *Gouania tiliifolia* Roxb., 1795 [= *Gouania microcarpa* DC.]. TYPE: [Réunion Island.] Île Bourbon, s.d. (fl. & fr.), *Commerson* s.n. (lectotype, designated here, P-LA!; isotype, G!).

Woody liana climbing to a height of 15 m; stems dark green, drying brown to blackish, young shoots puberulent to pubescent with brown or red-brown trichomes, glabrous at maturity; stipules triangular to triangular-lanceolate, blackish, glabrous, ca. 3(–4) × (0.75–)2 mm, ± persistent or early caducous; tendrils sparsely pubescent, glabrescent. Leaves ovate to cordate; petioles dark brown, (8–)12–15(–20) mm, hirsute with caducous trichomes; leaf blades (4–)5–6(–8) × (2–)3(–4.5) cm; secondary veins alternately arranged, except the first pair opposite, 4 to 5 pairs, not reaching the margin but following it; tertiary veins apparent, 2 to 5 pairs, reticulation scalariform, conspicuous or not; abaxial surface glabrous or hirsute and glabrescent; adaxial surface glabrous; margin crenulate or entire; base rounded to shallowly cordate; apex acute to subacute. Inflorescences congested, puberulous or hirsute-glabrescent, (5–)7–14(–19) cm; glomerules sessile, lowest glomerules sometimes pedunculate; bracts triangular or lanceolate, glabrous or sparsely pubescent; flowers pedicellate, pedicels 3–5 mm. Hypanthium obconic, becoming subglobose as the capsule develops; sepals 2–2.5 × 0.8–2 mm, puberulent to glabrous outside, glabrous inside; petals 1–1.5 × ca. 0.5 mm, white to pale yellow; stamens about as long as the petals, pale yellow, with globose anther ca. 0.2 × 0.2 mm; disc flat, 3–4 mm diam.; lobes 0.5–1.5 mm, truncate to emarginate, 1/4 to 2/3 as long as the sepals; stigma with 3 linear lobes, 0.2–0.4 mm, style protruding from the disc. Fruits 0 or 1 developing on each glomerule, oblong (1–1.5 × ca. 2 cm), glabrous, with a curved pedicel; seeds pale to medium brown, ovoid and slightly flattened, 3–4 × 2–3 × ca. 0.5 mm.

Distribution and ecology. *Gouania scandens* occurs in Mauritius, Réunion Island, and Madagascar (east coast and Sambirano regions). It grows in evergreen lowland and montane rainforest, on limestone, sand, gneiss, and lateritic soils at an elevational range from sea level to 1100 m.

IUCN Red List category. Within Madagascar, *Gouania scandens* has an EOO of 148,427 km², an AOO of 306 km², and 27 subpopulations, eight of which occur encompassed within protected areas (Andringitra, Anjanaharibe-Sud, Betampona, Marojejy, Masoala, Zahamena). It is thus assigned a preliminary status of Least Concern (LC), in Madagascar according to IUCN Red List criteria

(IUCN, 2001). We have not assessed its conservation status for other countries in which it occurs.

Discussion. Gaertner's (1791) protologue for *Retinaria scandens* consists of no more than the description and illustration of the fruits of a plant collected by P. Hermann in Mauritius. Gaertner's fruits correspond well to those of *Gouania tiliifolia*, but we have failed to find a corresponding specimen in Gaertner's herbarium at TUB and so we have not been able to confirm other characters of the specimen. When Drummond (1966) made the combination *G. scandens*, he lectotypified his new combination on the illustration in Gaertner (Pl. 2: 187, tab. 120, fig. 4. 1791) and included material from mainland Africa. However, we believe that the African material he associated with the name *G. scandens* is conspecific with *G. laxiflora*. The latter is the only known species of *Gouania* shared between mainland Africa and the Indian Ocean islands (see discussion under *G. laxiflora*); *G. scandens* does not occur in mainland Africa.

Gouania scandens is a common species in eastern Madagascar. This species can be confused with *G. myriocarpa*, with which it is partially sympatric and vegetatively similar. However, characters of the flower and fruit allow us to easily distinguish these two species. *Gouania scandens* is characterized by its glabrescent inflorescence (vs. pubescent with hirsute ferruginous trichomes in *G. myriocarpa*) and its rather lax infructescence with large oblong fruits, ca. 2 cm diam. (vs. a condensed infructescence with smaller spheroid fruits, ca. 0.6 cm diam.).

KEY TO THE SUBSPECIES OF *GOUANIA SCANDENS*

- 1. Leaf generally cordiform or sometimes ovate; margins crenulate; stipules triangular, ± persistent; lobes of the disc highly variable on a single flower (varying from 1/4 to as long as the sepals); Mauritius and Réunion Island 15a. *G. scandens* subsp. *scandens*
- 1'. Leaf ovate; margins entire, sometimes sparsely crenulate; stipules triangular-lanceolate, early caducous; lobes of the disc only slightly variable on a single flower (varying from 1/3 to 2/3 as long as the sepals); eastern Madagascar 15b. *G. scandens* subsp. *glandulosa*

15a. *Gouania scandens* (Gaertn.) R. B. Drum.
subsp. ***scandens*.**

Woody liana; stipules triangular, 3(–4) × ca. 2 mm, ± persistent; tendrils sparsely pubescent at maturity. Leaves ovate to cordate; petioles dark brown, (10–)15(–20) mm, hirsute with caducous ferruginous trichomes; leaf blades (4.5–)5.5(–8) × (2.5–)3(–4.5) cm; tertiary veins few, arising only from the first secondary veins, reticulation not conspicu-

ous; abaxial surface pale green, glabrous; midrib, secondary veins, tertiary veins, and reticulation slightly prominent; margin crenulate, teeth with a black gland; base rounded; apex acute to subacute. Inflorescences hirsute-glabrescent with ferruginous trichomes, (9–)12–14(–16) cm; glomerules pedunculate at the base, becoming sessile near the apex; bracts triangular, sparsely pubescent with pale ferruginous trichomes on the outer surface and glabrous on the inner surface, 1(–2) × ca. 0.5 mm; pedicels 3–4(–4.5) mm, densely pubescent with ferruginous trichomes. Sepals ca. 2 × 0.75 mm, pale yellow, outer surface puberulent; petals ca. 1 × 0.5 mm; disc ca. 3 mm diam.; lobes truncate or somewhat emarginate, 1/4 or as long as the sepals; stigma lobes ca. 0.4 mm, style ca. 1 mm. Fruits ca. 1.5 × 2 cm, equally distributed on the infructescence; valves ca. 15 × 10 mm; seeds pale brown, ca. 3 × 2 × 0.5 mm.

Distribution and ecology. *Gouania scandens* subsp. *scandens* occurs on Mauritius and Réunion in evergreen lowland rainforest at an elevational range of 200–600 m.

Phenology. This subspecies has been recorded in flower in January, May, and July and in fruit in April.

Discussion. *Gouania scandens* subsp. *scandens* is endemic to the Mascarenes. It is probably the only *Gouania* native to Mauritius. On Réunion it can easily be distinguished from *G. mauritiana* by its glabrous or at most sparsely pubescent vegetative parts (vs. densely pubescent). Furthermore, *G. scandens* subsp. *scandens* can be recognized by its cordiform, glabrous leaves, the crenulated margins with a black gland at the apex of every crenation, the lobes of the disc from 1/4 to as long as the sepals on the same flower, and the fruits with an arcuate pedicel, which tend to be rather equally distributed on the infructescence.

Additional specimens examined. MAURITIUS. s. loc., Ayres s.n. (K); Bojer s.n. (K); Commerson 626 (P); Commerson s.n. (K, P); Sieber fl. Mixta 208 (P); Sieber s.n. (G); forêts du quartier du grand Port, Boivin s.n. (P); Grand Port, and along the way to Vacoas, Bouton 5 (K); Long Montane, Bouton 65 (K); Piton du Fougé, mtn. range (E foot hills of ridge running toward Baie du cap), Guého 17901 (K, P); Perrier Natl. Reserve near Mare aux Vacoas, Lorence 2343 (K, MO, P); Bel Ombre Forest above Bon Courage, Lorence et al. 4494 (MO). RÉUNION ISLAND: s. loc., Commerson s.n. (G), Pourret s.n. (P), Richard s.n. (K). Ville Bague, Commerson s.n. (G, P).

15b. *Gouania scandens* subsp. *glandulosa* (Boivin ex Tul.) Buerki, Phillipson & Callm., comb. et stat. nov. *Gouania glandulosa* Boivin ex Tul.,

Ann. Sci. Nat., Bot. sér. 4, 8: 129. 1857, as "*Guania*." TYPE: Madagascar. Toamasina: Sainte-Marie, 1834 (fr.), A. Bernier 239 (lecto-type, designated here, P!).

Gouania madagascariensis Rich. ex Tul., Ann. Sci. Nat., Bot. sér. 4, 8: 129. 1857, as "*Guania*," nom. inval. (ICBN, Art. 34.1a).

Gouania sulcata Bojer, Hortus Maurit. 71. 1837, nom. nud.

Woody liana; stipules triangular-lanceolate, 3(–4) × ca. 0.75 mm, early caducous; tendrils sparsely glabrous at maturity. Leaves ovate; petioles dark brown, (8)–12–15(–20) mm, hirsute with caducous brown trichomes; leaf blades (4)–5–6(–7) × (2)–3–3.5 cm; tertiary veins apparent, arising near the base of the lowest secondary veins, scalariform reticulation conspicuous; abaxial surface green to dark green, hirsute (and rough to the touch), glabrescent; midrib, secondary veins, and tertiary veins hardly prominent; margin generally entire, sometimes sparsely crenulate near the base and the apex; base rounded to shallowly cordate; apex acute. Inflorescences puberulous with pale panose trichomes, (5)–7–9(–19) cm; glomerules sessile; bracts lanceolate, glabrous on both surfaces, (2)–2.5 × ca. 0.5 mm; pedicels up to 5 mm, densely puberulent with pale trichomes. Sepals ca. 2.5 × 2 mm, pale yellow to brown, outer surface puberulent to glabrous; petals ca. 1.5 × 0.5 mm, pale yellow; disc ca. 4 mm diam.; lobes emarginate or somewhat truncate, 1/3 to 2/3 as long as the sepals; stigma lobes ca. 0.2 mm, style ca. 3 mm. Fruits ca. 1 × 2 cm, mainly developed at the apex of the infructescence; valves ca. 10 × 10 mm; seeds brown, ca. 4 × 3 × 0.5 mm.

Distribution and ecology. *Gouania scandens* subsp. *glandulosa* occurs in eastern Madagascar and the Sambirano region (Fig. 2C). It grows in evergreen lowland rainforest, on limestone, sand, gneiss, and lateritic soils at an elevational range of (0)–300–800(–1100) m.

Phenology. *Gouania scandens* subsp. *glandulosa* has been noted as flowering from November to April and fruiting from May to October.

Discussion. *Gouania scandens* subsp. *glandulosa* was treated by Tulasne (1857) and Perrier de la Bâthie (1943) as a distinct species, but we consider the similarity of this plant to typical *G. scandens* to be such that they should be regarded as conspecific. After examining the copious amounts of material available for both taxa, we have concluded that the small differences that do exist in the leaves and stipules and the slight differences in the variability in the size of the lobes of the disc are consistently

correlated to geographic distribution. The Malagasy specimens can be distinguished from the Mascarene specimens on the basis of these characters, and we believe that subspecies rank is justified for these two allopatric taxa. *Gouania scandens* subsp. *glandulosa* can be distinguished easily from other species in Madagascar by its ovate leaves covered by hirsute caducous trichomes, a dark reticulation on the abaxial surface, the lobes of the disc one fourth to as long as the sepal on the same flower, and large, glabrous fruits concentrated at the apex of the infructescence.

The name *Gouania madagascariensis* appears on labels accompanying Richard's specimens 186 and 335 from Madagascar. It was cited as a synonym of *G. glandulosa* by Tulasne (1857) but was never published as an accepted name, and is therefore nomenclaturally invalid. *Gouania sulcata* was published by Bojer (1837: 71), based on a Boivin collection from Madagascar, but the name lacks an adequate diagnostic description and is regarded as a nomen nudum. We include the Richard and Boivin specimens in question in *G. scandens* subsp. *glandulosa*.

Additional specimens examined. MADAGASCAR. s. loc., fl. & imm. fr., Baron 1114 (K, P); fl. & imm. fr., Baron 1443 (K, P); fl., Baron 2357 (K, P); imm. fr., Baron 2576 (K, P); "Central Madagascar," Baron 2713 (K); fl., Boivin s.n. (P); fr., De Lastelle s.n. (P), 1833, Goudot s.n. (G); fl. & imm. fr., Petit Thouars s.n. (P); Humblot 188 (K, P); fl. & fr., Richard 519 (P). **Antsiranana:** Masoala PA, Sahamalaza-Anovandrano, Bernard 137 (MO); massif of Tsihomanaomby, Birkinshaw 731 (P); Masoala PA, Cours 2199 (P, TAN); Daraina, forêt de Antsahabe, Gautier 4743 (G, MO); Baie de Diego-Suarez, Goudot s.n. (G); Vallée de la Lokoho (Nord-Est), Humbert 23243 (P); Vallée de l'Antsahabe, Humbert 23322 (P); Marojejy PA, Miller & Lowry 3892 (K, MO, P, TAN); Nossy-Mitsiou, Perrier de la Bâthie 18786 (P); Ambato, Rabenantoandro & Antilahimena 19 (P); Embouchure d'Ambohitralanana, presqu'île de Masoala, Rahajaoa 304 (P, WAG); Andapa, Anjiavabe, Rakotavao 3722 (MO, P, TAN); Marojejy PA, Rasoavimba-hoaka 345 (K, MO, P, TAN); Anjanharibe-Sud PA, Ravelonarivo et al. 776 (P, TAN); Ambondrobo, Razakamalala 1033 (P); Sambava, Bevontro, Tsaratanana, Morafeno, Forêt d'Antsahandroboka, Razakamalala et al. 3095 (MO, P, TAN); Marojejy PA, Réserves Naturelles 3954bis-RV (TAN); Ambohitralana, distr. Antalaha, Masoala PA, Réserves Naturelles 4446-RN (P, TEF); Vohehar, Richard 251 (P), Richard 335 (G, P); Marojejy PA, Service Forestier 17698-SF (P, TEF); Anjanharibe-Sud PA, Tosh et al. 364 (G, BR, MO). **Fianarantsoa:** Mananjary, Geay 7234 (P), Geay 7366 (P, TAN), Geay 7367 (P), Geay 7368 (P), Geay 7694 (P), Geay 7723 (K, P); Ambalavao, Réserves Naturelles 8123-RN (P, TAN). **Toamasina:** Maraontsetra: Ambanizana, Antilahimena et al. 1079 (MO, P, TAN); St-Marie, Bernier 268 (P), Boivin 1881 (P); PK 23 rte. de Tamatave, Bossier 13760 (MO, TAN); Fotimavo, Buerki 130 (G, K, MO, P, TAN); Nosy Mangabe, Carlson 180 (K, P, TAN); Antokazo, Cours 288 (P); Forêt d'Ambatosoratra, Cours 3375 (P, TAN); Brickaville, D'Arcy 15281 (K, MO); Fenerive, Decary 3907 (P, TAN); Ambila, Decary 6310

(K, P), *Decary* 6397 (P); Zahamena PA, *Decary* 16798 (P); Mangabe, *Decary* 16872 (K, P); Mahavelona (Foulepointe), *Decary* 16969 (P), *Decary* 16983 (P); Lac Alaotra, *Herb. Jard. Bot. Tananarive* 4307 (P); Rendrirendry, 17°55'S, 049°13'E, *Iambana et al.* 137 (P); Maroantsetra, *Leeuwenberg* 13941 (MO, P, TAN, WAG); Masoala PA, *Nicoll et al.* 554 (K, MO, P, TAN, WAG); St-Marie, *Pervillé* 231 (P); environs du confluent de l'Onive et du Mangoro, *Perrier de la Bâthie* 17150 (P); bord de l'Onive près Antanandavohily-Antalaha, *Rakotozafy* 517 (TAN); Zahamena PA, *Réserves Naturelles* 4947-RN (P), *Réserves Naturelles* 7260-RN (P), *Réserves Naturelles* 10663-RN (P), *Réserves Naturelles* 10881-RN (P); Betampona RN, *Réserves Naturelles* 3954-RN (P, TAN); Fenerive, *Réserves Naturelles* 7840-RN (P); Sahamalaza, *Réserves Naturelles (Laibosaka)* 12603-RN (TAN); Androrangabe, *Réserves Naturelles (Laibosaka)* 12614-RN (TAN); St-Marie, Antongil, *Richard comm.* 186 (P); Ambahy Forest, ca. 20 km S of Nosy Varika, *Rogers* 283 (MO, P). **Toliara:** Prov. Tuléar, *Poisson* 180 (P); entre le rite de l'homme et Fort-Dauphin, *Rabevoitra* 2230 (K, MO, P, TAN).

16. *Gouania taolagnarensis* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Toliara: Com. Manambaro, 3 km O de Manambaro, bord de la RN13, 25°01'44"S, 46°46'51"E, 14 m, 23 Mar. 2005 (fl. & imm. fr.), S. Buerki & P. B. Phillipson 68 (holotype, MO!; isotypes, BR!, G!, K!, NY!, P!, TAN!, US!, WAG!). Figure 11.

Haec species a congeneris madagascariensibus foliis ovatis usque cordatis ad basem asymmetricis venulis quaternariis praeditis, inflorescentia floribusque indumento pallide fusco obtectis atque fructibus secus inflorescentiam ad partem distalem congestis juventute indumento pallide luteo vestitis deinde rubescentibus quaque ala in centro lineis transversalibus duabus vel tribus notata facile distinguitur.

Woody liana climbing to 10 m; stems dark green, drying brown, densely pubescent with a brown indument; stipules pubescent on the 2 faces with brownish trichomes, (2-)3(-4) × ca. 1 mm, caducous; tendrils pubescent. Leaves ovate to cordate; petioles (8-)10-15 mm, densely pubescent with a brown trichome; leaf blades 4-5(-6) × (2.5-)3-3.5 cm, discolorous; secondary veins alternate, 6 to 7 pairs, reaching and following the margin; tertiary veins apparent, 4 to 7 pairs, arising near the base of the lowest secondary veins and sometimes in the upper part, quaternary veins arising from the first tertiary veins, reticulation scalariform; abaxial surface villous with whitish to pale brown trichomes; midrib, secondary, tertiary, and quaternary veins prominent; adaxial surface sparsely pubescent with pale brown to whitish trichomes; margin sparsely crenulate from the base to the apex; base of the young leaves rounded, cordate and asymmetric on mature leaves; apex

generally rounded, sometimes subacute. Inflorescences ± congested, densely pubescent with a pale brownish indument, (6-)10-15(-20) cm, accrescent, the proximal flowers developing before the distal flowers; glomerules generally sessile, basally pedunculate, up to 5-flowered; bracts lanceolate, densely pubescent on both surfaces with a brownish indument, ± persistent, 3(-4) × ca. 1 mm; flowers shortly pedicellate, pedicels up to 1 mm, pubescent with brownish to silver trichomes. Hypanthium obconic, becoming subglobose as the capsule develops; sepals ca. 1.25 × 1 mm, pale yellow, outer surface densely pubescent with silver trichomes, inner glabrous; petals ca. 1 × 0.2 mm, white; stamens totally included in the petal blades, with a white filament and a pale brown, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 2 mm diam., yellow becoming white with age; lobes ca. 0.2 mm, thicker than the disc, truncate, 1/6 as long as the sepals; stigma with 3 linear lobes, those ca. 0.5 mm, style ca. 1.5 mm. Fruits 0 or 1 developing on each glomerule, spheroid (ca. 1.2 × 1.2 cm), densely pubescent with reddish trichomes, which become brownish after drying, those reaching maturity mainly distributed in the distal part of the infructescence; valves ca. 1.2 × 1.2 cm; immature fruits globose, with a pale yellow indument, with 2 or 3 transverse lines on the center of the wing; seeds pale black, ovoid and slightly flattened on the inner surfaces, ca. 4 × 2.5 × 1 mm.

Distribution and ecology. *Gouania taolagnarensis* is restricted to southeastern Madagascar in the Taolagnaro region (Fort Dauphin) (Fig. 2C). It grows in evergreen lowland to montane rainforest, sometimes in the transition to xerophytic vegetation and in secondary forest on granite, gneiss rock types, and on lateritic soils at an elevational range from sea level to 1000 m.

IUCN Red List category. With an EOO of about 12,719 km², an AOO of 108 km², and only seven subpopulations, three of which occur within protected areas (Andohahela, Zombitsy), *Gouania taolagnarensis* is thus assigned a preliminary status of Vulnerable (VU B1ab[ii]+2ab[ii]), according to IUCN Red List criteria IUCN, 2001).

Phenology. The new species has been collected in flower from October to January and in fruit in February and March.

Etymology. The epithet of the new species refers to its endemic locale, in the forests around Taolangaro, Toliara Province.

Discussion. *Gouania taolagnarensis* can be easily distinguished from other species by its ovate to

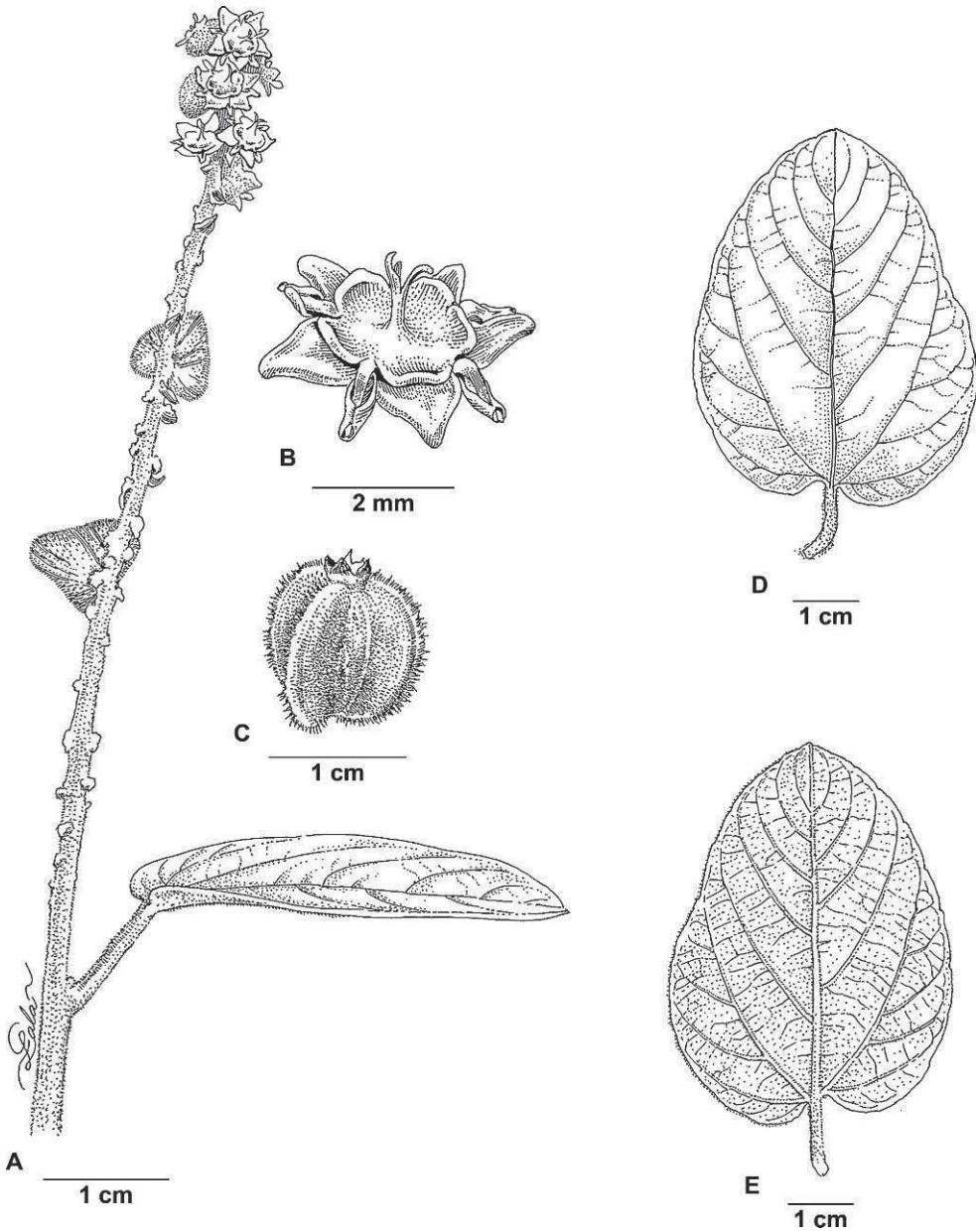


Figure 11. *Gouania taolagnarensis*. —A. Fruiting branch showing immature fruits concentrated mainly in the distal part of the infructescence. —B. Flower showing the lobes of the disc reaching one sixth of the length of the sepals. —C. Fruit showing the two or three transversal veins on the center of each wing. —D. Leaf, adaxial surface. —E. Leaf, abaxial surface, showing the asymmetric limb and the quaternary veins that are particularly well developed on the larger lobe. A–E drawn from *Buerki & Phillipson 64* (TAN).

cordate leaves, the asymmetric base of the blade, the presence of quaternary veins, the pale brown indument that covers the inflorescence and the flowers, immature fruits with a pale yellow indument that reddens with maturity, fruits with two or three transverse lines on the center of the wings, and the

fruits concentrated at the distal part of the infructescence.

Gouania taolagnarensis is morphologically most similar to *G. pannigera* in the length of the lobes of the disc and the size and pubescence of the fruits, but differs in having ovate to cordate leaves, the margin of

the apex slightly crenulate, an asymmetric blade, quaternary veins well developed in the asymmetric portion, the inflorescence with a brownish indument, the immature fruits with a yellow indument, those reaching maturity becoming reddish mainly distributed in the distal part of the infructescence. Furthermore, *G. taolagnarensis* appears to be endemic to the region near Taolagnaro (southeastern Madagascar), whereas *G. pannigera* is confined to the forests and disturbed areas of central Madagascar.

Paratypes. MADAGASCAR. **Toliara:** Ambinanibe, 25°02'31"S, 46°55'31"E, S. Buerki & P. B. Phillipson 64 (BR, G, K, MO, NEU, P, TAN, US, WAG); Fort-Dauphin, Vahapinsouran, J. Cloisel 94 (P); Chaîne Anosyennes from Fort-Dauphin to Ranamafona, [24°25'S, 46°58'30"E], T. B. Croat 31765 (MO, TAN, WAG); Col de Maningotry, [26°42'S, 46°44'30"E], N. Dumetz 1275 (MO, P, TAN); Andohahela PA, 24°47'S, 46°52'E, J. J. Floret, P. P. Lowry II, A. M. J. Leeuwenberg & R. Rajemsa 1968 (MO, P [2]); bassin de réception de la Mananara, pentes occidentales des montagnes entre Andohahela et l'Elakelaka, [24°45'S, 46°44'E], H. Humbert 13949 (P); Forêt de Manantantely, [24°59'S, 46°55'E], Humbert 20368 (P); Baie des Galions (Ranofotsy), [25°09'S, 46°43'E], Humbert 28976 (P); RN7 at 15 km NE of Sakaraha, [22°56'S, 44°33'E], D. Lorence 2098 (K, MO); Andohahela PA, 24°38'S, 46°46'E, S. T. Malcomber, H. van der Werff, C. Hemingway, M. van Bergen, S. Rapanarivo, P. J. Rakotomalaza, O. Andrianantoanina & B. Randriamampionona 2184 (P, TAN); Manasoa, M. Ramarokoto 2100-RN (P, TAN); Andohahela PA, [24°40'S, 46°48'E], Ramarokoto 5018-RN (P, TAN); Andohahela PA, 24°40'S, 46°48'E, B. Randriamampionona 14 (MO, P, TAN, WAG); Andohahela PA, parcelle 1, 24°40'S, 46°48'E, Randriamampionona 92 (MO, P, TAN, WAG); Fort-Dauphin, W. Rauh 1265 (TAN); Distr. Fort-Dauphin, Réserves Naturelles 8584 (P, TAN); Fort Dauphin, M. Scott-Elliott 2568 (K, P).

17. *Gouania zebrifolia* Buerki, Phillipson & Callm., sp. nov. TYPE: Madagascar. Antsiranana: Sahafary, 12°34'42"S, 49°27'16"E, 215 m, 22 Feb. 2006 (fl.), C. Birkinshaw, M. Andrianjafy & R. Guittou 1563 (holotype, MO!; isotypes, CNARP!, K!, P!, TAN!). Figure 3B–D.

Haec species a congeneris madagascariensibus foliis membranaceis orbicularibus usque reniformibus abaxialiter indumento tenui albo vestitis, venis tertiariis atris crassis reticulum scalariforme formantibus, margine denticulato quoque dente in caespitem trichomatium brunneolorum desinente atque disci lobis longitudine 1/2 sepalorum partem attingentibus facile distinguitur.

Woody liana climbing to 15 m; stems drying brown, finely pubescent to villous with brownish trichomes; stipules villous with brownish trichomes on the upper surface and glabrous on the inner surface, 3(–4) × ca. 1 mm; tendrils pubescent. Leaves orbicular to reniform; petioles (5–)10(–15)

mm, pubescent with brownish trichomes; leaf blades 3.5–4.5(–6) × 3.5(–5) cm, membranous; secondary veins alternate to subalternate, 6 to 7 pairs, reaching and following the margin; conspicuous tertiary veins apparent, arising near the base of the lowest secondary veins, this reticulation scalariform, blackish; abaxial blade surface pubescent with fine white trichomes; midrib, secondary, and tertiary veins prominent; adaxial surface sparsely pubescent with white trichomes; margin denticulate to crenulate, with a tuft of brownish trichomes on every tooth; base rounded to shallowly cordate; apex rounded to acute. Inflorescences ± congested, villous with brownish trichomes, (3–)4–4.5(–5.5) cm, consisting of glomerules subtended by stipulelike bracts; glomerules sessile, 4- to 5(to 8)-flowered; bracts triangular-lanceolate, densely pubescent with villous brownish trichomes on the outer surface, glabrous on the inner, ± persistent, (3–)4.5 × ca. 0.5 mm; flowers shortly pedicellate, pedicels to ca. 1 mm, pubescent with villous whitish indument, apparently protandrous. Hypanthium broadly obconic, becoming subglobose as the capsule develops; sepals ca. 0.8 × 0.5 mm, reddish to brown, outer surface villous, inner glabrous; petals ca. 0.75 × 0.2 mm, brownish; stamens slightly longer than the petal blades, with a pale brown filament and a pale yellow, globose anther ca. 0.2 × 0.2 mm; disc flat, ca. 2 mm diam., dark blue when dry; lobes ca. 0.4 mm, thinner than the disc, emarginate or somewhat truncate, 1/2 as long as the sepals; stigma with 3 linear lobes, those ca. 0.4 mm, style ca. 0.6 mm. Immature fruits globose, villous with brownish trichomes; mature fruit not seen.

Distribution and ecology. *Gouania zebrifolia* is endemic to northeastern Madagascar and only known from a few localities in Antsiranana: Loky-Manambato (Daraina), Sahafary, and Montagne des Français (Fig. 2A). The new species grows in semi-deciduous forest at an elevational range of 50–300 m.

IUCN Red List category. With an EOO of about 631 km², an AOO of 36 km², and only three subpopulations, none of which occur within a protected area, *Gouania zebrifolia* is assigned a preliminary status of Endangered (EN B1ab[ii]+2ab[ii]), according to IUCN Red List criteria (IUCN, 2001).

Phenology. This species has been collected in flower and with immature fruits in March.

Etymology. This species is named for the unusual dark patterning of darker stripes on a pale

blade background formed by the blackish reticulation of the tertiary veins.

Discussion. *Gouania zebriifolia* can be recognized easily by its orbicular to reniform, membranous leaves covered by fine white indument on the abaxial surface, which contrasts with the conspicuous blackish scalariform reticulation, with a tuft of brown trichomes on each marginal tooth, and the immature fruits villous with brown trichomes. The taxon shares with *G. ambrensis* the character of disc lobes that are about one half as long as the sepals.

Paratypes. MADAGASCAR. **Antsiranana:** Montagne des Français, 12°19'27"S, 49°20'16"E, *M. Bardot-Vaucoulon* & *G. Véné* 1635 (K, MO, P, TAN); Daraina, forêt d'Ambilondamba, 13°09'S, 49°39'E, *L. Gautier*, *S. Wohlhauser* & *L. Nusbaumer* 4263 (Herbier de Recherche de Daraina, G, K, MO, P, TEF); Forêt de Sahafary entre Diego et Anivorano, [12°33'S, 49°28'E], *M. Keraudren* 1667 (P); Daraina, forêt de Bekaraoka, 13°11'S, 49°42'E, *P. Ranirison* & *Nusbaumer* 957 (Herbier de Recherche de Daraina, G, K, MO, P, TEF); Andriafiabe Commune, Sahafary Forest, ca. 6 km W of Saharenana, Sahafary, 12°35'S, 49°26'59"E, 222 m, *J. Wen*, *J. Razafitsalama* & *H. Tombondray* 9557 (MO, US).

Literature Cited

- Achard, F., H. D. Eva, H.-J. Stibig, P. H. Mayaux, J. Gallego, T. Richards & J.-P. Malingeau. 2002. Determination of deforestation rates of the world's humid forest. *Science* 297: 999–1002.
- Bojer, W. 1837. Hortus Mauritianus: Ou Énumération des Plantes, Exotiques et Indigènes, Qui Croissent à l'Île Maurice, Disposées d'après la Méthode Naturelle. Imprimerie d'Aimé Mamarot et Compagnie, Mauritius.
- Brooks, T. M., R. A. Mittermeier, C. G. Mittermeier, G. A. B. Da Fonseca, A. B. Rylands, W. R. Konstant, P. Flick, J. Pilgrim, S. Oldfield, G. Magin & C. Hilton-Taylor. 2002. Habitat loss and extinction in the hot spots of biodiversity. *Conservation Biol.* 16: 909–923.
- Callmander, M. W., G. E. Schatz & P. P. Lowry II. 2005. IUCN Red List assessment and the global strategy for plant conservation: Taxonomists must act now. *Taxon* 54: 1047–1050.
- Callmander, M. W., G. E. Schatz, P. P. Lowry, M. O. Laivao, J. Raharimampionona, S. Andriambolololona, T. Raminosoa & T. Consiglio. 2007. Application of IUCN Red List criteria and assessment of priority areas for plant conservation in Madagascar: Rare and threatened Pandanaceae indicate new sites in need of protection. *Oryx* 41(2): 168–176.
- Cornet, A. 1974. Essai de Cartographie Bioclimatique à Madagascar. Notice Explicative ORSTOM No. 55. Paris.
- Drummond, R. B. 1966. Rhamnaceae. Pp. 419–439 in A. W. Exell, A. Fernandes & H. Wild (editors), *Flora Zambesiaca*, Vol. 2(2). Crown Agents for Overseas Governments and Administration, London.
- Engler, A. 1895. Die Pflanzenwelt Ost-Afrikas, Theil C. Dietrich Reimer, Berlin.
- Gaertner, J. 1791. De Fructibus et Seminibus Plantarum, Vol. 2: 187. Academiæ Carolinae, Stuttgart.
- Green, M. L. 1916. The African Species of *Gouania*. Bull. Misc. Inform. Kew 1916(8): 197–200.
- Guého, J. 1979. Une nouvelle espèce de *Gouania* (Rhamnaceae) endémique de l'Île Rodrigues aux Mascareignes. *Adansonia* 18(4): 483–486.
- Guého, J. 1997. Rhamnaceae. In J. Bosser (editor), *Flore des Mascareignes: La Réunion, Maurice, Rodrigues. Mauritius Sugar Industry Research Institute, Mauritius.*
- Hallé, N. 1962. Rhamnaceae. Pp. 49–71 in *Flore du Gabon*, Vol. 4. Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, Paris.
- Hemsley, W. B. 1868. XLII. Rhamneae. Pp. 377–385 in D. Oliver (editor), *Flora of Tropical Africa*, Vol. 1. L. Reeve and Co., London.
- Holmgren, P. K., N. H. Holmgren & L. C. Barnett. 1990. Index Herbariorum. Part I: The Herbaria of the World. New York Botanical Garden, Bronx.
- Hunter, M. L. Jr. & S. L. Webb. 2002. Enlisting taxonomists to survey poorly known taxa for biodiversity conservation: A lichen case study. *Conservation Biol.* 16: 660–665.
- IUCN. 2001. IUCN Red List Categories and Criteria, Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.
- Johnston, M. C. 1972. Rhamnaceae. In E. Milne-Redhead & R. M. Polhill (editors), *Flora of Tropical East Africa. Crown Agents for Overseas Governments and Administration, London.*
- Lamarck, J. B. A. P. M. 1789. Encyclopédie Méthodique Botanique, Vol. 3. Agasse, Paris.
- Mabberley, D. J. 2008. Mabberley's Plant-Book: A Portable Dictionary of Plants, Their Classification and Uses, 3rd ed. Cambridge University Press, Cambridge.
- Madagascar Catalogue. 2010. <<http://www.efloras.org/madagascar>>, accessed 25 March 2011.
- Madagascar National Parks. 2010. <<http://www.parcs-madagascar.com/index.php>>, accessed 25 March 2011.
- McNeill, J., F. R. Barrie, H. M. Burdet, V. Demoulin, D. L. Hawksworth, K. Marhold, D. H. Nicolson, J. Prado, P. C. Silva, J. E. Skog, J. H. Wiersma & N. J. Turland (editors). 2006. International Code of Botanical Nomenclature (Vienna Code). Regnum Veg. 146.
- Medan, D. & C. Schirarend. 2004. Rhamnaceae. Pp. 320–338 in K. Kubitzki (editor), *The Families and Genera of Vascular Plants*, Vol. 4. Springer-Verlag, Berlin.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. Da Fonseca & J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
- Perrier de la Bathie, H. 1943. Révision des Rhamnaceae de Madagascar et des Comores. *Notul. Syst. (Paris)* 11: 12–35.
- Perrier de la Bathie, H. 1950. Rhamnaceae. In H. Humbert (editor), *Flore de Madagascar et des Comores. Imprimerie Officielle, Tananarive.*
- Pfeiffer, L. 1871–1875. *Nomenclator Botanicus*, Vols. 1–4. Theodor Fisher, Kassel, Germany.
- Phillipson, P. B., G. E. Schatz, P. P. Lowry II & J.-N. Labat. 2006. A catalogue of the vascular plants of Madagascar. Pp. 613–627 in S. A. Ghazanfar & H. J. Beentje (editors), *Taxonomy and Ecology of African Plants, Their Conservation and Sustainable Use. Proceedings of the 17th Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale Congress, Addis Ababa. Royal Botanic Gardens, Kew, Richmond.*

-
- Richardson, J. E., M. F. Fay, Q. C. B. Cronk, D. Bowman & M. W. Chase. 2000a. A phylogenetic analysis of Rhamnaceae using *rbcL* and *trnL-F* plastid DNA sequences. *Amer. J. Bot.* 87: 1309–1324.
- Richardson, J. E., M. F. Fay, Q. C. B. Cronk & M. W. Chase. 2000b. A revision of the tribal classification of Rhamnaceae. *Kew Bull.* 55: 311–340.
- Schatz, G. E. 2000. Endemism in the Malagasy tree flora. Pp. 1–9 in W. R. Lourenço & S. M. Goodman (editors), *Diversity and Endemism in Madagascar*. Mémoires de la Société de Biogéographie, Muséum national d'Histoire Naturelle and Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris.
- Schatz, G. E. & M. Lescot. 2005. Gazetteer to Malagasy Botanical Collecting Localities. Missouri Botanical Garden web site <<http://www.mobot.org/MOBOT/Research/madagascar/gazetteer/>>, accessed 7 September 2010.
- Tulasne, L.-R. 1857. *Florae Madagascariensis* (Rhamneae). *Ann. Sci. Nat., sér. 4*, 8: 116–142.