

New taxa of Coleeae (Bignoniaceae) from Madagascar. I. A collection from Masoala Peninsula

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As a precursor to a revision of Malagasy endemic tribe Coleeae (Bignoniaceae), eleven species are described from the Masoala Peninsula as new (*Colea resupinata*, *C. gentryi*, *C. ramiflora*, *C. rosea*, *C. sytsmae*, *Ophiocolea vokoanensis*, *Phyllarthron nocturnum*, *P. vokoanensis*, *P. sahamalazensis*, *Rhodocolea multiflora*, *R. lemuriophila*). A key to Bignoniaceae of Masoala is provided.

Key words: Bignoniaceae, *Colea*, Coleeae, new species, *Ophiocolea*, *Phyllarthron*, *Rhodocolea*, taxonomy

Introduction

Bignoniaceae have not been treated comprehensively for Madagascar since the early coverage by Perrier de la Bâthie (1938a, 1938b). During collections and pollination fieldwork at Vokoanina watershed, southeastern Masoala Peninsula in Madagascar, the following species were collected and vouchered, their pollination biology studied, and DNA sequenced in preparation of a treatment for the *Flore de Madagascar et des Comores*.

Bignoniaceae are a predominately tropical family of trees and lianas with ca. 107 genera and ca. 900 species. Madagascar is center to the second greatest diversity of species of Bignoniaceae in the world. Two tribes of Bignoniaceae are represented on Madagascar, pantropical Tecomeae (4 genera/15 species, occurring on Madagascar) and Malagasy near endemic Coleeae (4 genera/47 species). Species of Coleeae are predominately in wet forest from sea level to the highest mountains, with fewer spe-

cies (three) in the dry deciduous and spiny forests. Most species are rare, narrow endemics and suffer from insufficient collecting. Conservation assessment of the tribe suggests that the majority of the species are threatened with extinction and several species are already presumed extinct.

Tribe Coleeae was resurrected as distinct from neotropical Crescentieae by Gentry (1976) based on geographic distance, and Gentry's separation of neotropical Crescentieae from Malagasy Coleeae was confirmed by molecular sequencing results (Spangler & Olmstead 1999, Zjhra *et al.* 2004). Perrier de la Bâthie (1938a, 1938b) delineated five genera of Coleeae: *Phylloctenium*, *Colea*, *Ophiocolea*, *Phyllarthron*, and *Rhodocolea*. New species of the latter four genera, recently collected on the Masoala Peninsula and distinct from previously described species (Perrier de la Bâthie 1938a, 1938b), are described herein. Based on my extensive collecting throughout Madagascar and GIS mapping of previous collections, these are all Masoala Peninsula endemics.

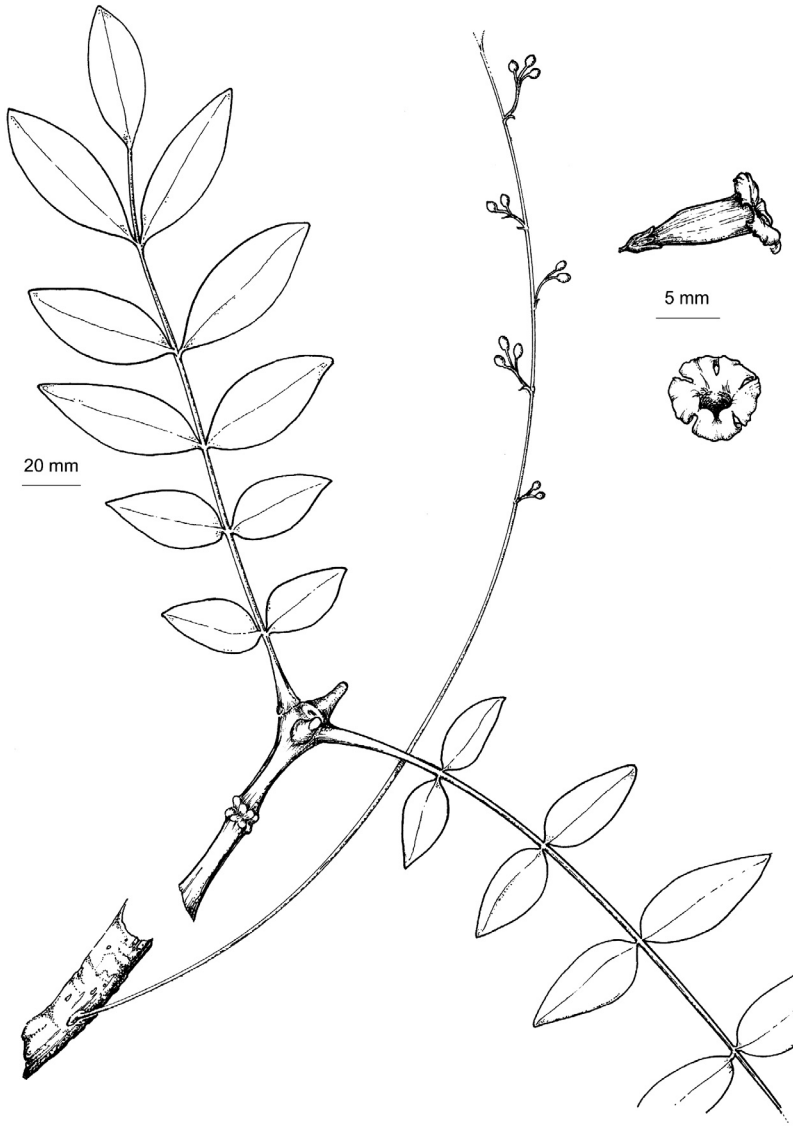


Fig. 1. *Colea gentryi* (from holotype). Leaves, cauliflorous inflorescence and side and front view of flower.

Colea is a wet forest genus of treelets and small trees, characterized by pinnately compound, whorled leaves, unilocular stamens, and ovoid smooth, warty or furrowed fruit. *Ophio-colea* is a genus of treelets and small trees found in wet and dry deciduous forests, characterized by whorled pinnately compound leaves, unilocular stamens, and long smooth fruit. *Phyllar-thron* is a genus of shrubs, treelets and canopy trees represented in every forest type, characterized by bilocular stamens and articulated phyllodes. *Rhodocolea* is a genus of trees, treelets, and shrubs with pinnately compound usually

opposite leaves, bilocular stamens, and smooth oblong fruit.

***Colea gentryi* M.L. Zjhra, sp. nova (Fig. 1)**

Arbuscula cum apicali verticillo 4-pinnatorum foliorum; inflorescentiae ad basin trunci affixae et erectis pedunculis munitae. Flores resupinati, propter pedicellos proxime sub calycem ad angulum 180° tortos. Corolla parva pallidaque, cum antherarum paribus ad palatum locates.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, 950 meters from camp on trail A, 15°47'S, 50°13'E, 70 m, 15.I.1997 Zjhra 876 (holotype GAS; isotype TAN).

Small (6 m height, 3 cm dbh) branched treelet with apical whorl of four pinnately compound leaves per node, 11–13 small (35–65 mm length, 15–30 mm width) oblong leaflets, margin entire, petiole 25–33 mm long, petiolules sessile. Cauliflorous (from 0–0.5 m from ground) with panicles on 150–500 mm long peduncles. Flowers zygomorphic. Calyx (5 mm length, 3 mm width), 3-lipped and pinkish-white with red dots. Corolla tubular, small (7–13 mm length, 3–4 mm width), and pale pink with fine red dots on outer corolla tube, corolla lobes white, throat pale orange (dorsal) with golden floral guides (ventral). Flowers with no odor, and no nectar. Stamen pairs (6–8 mm and 4–6 mm) along upper throat, white, anthers unilocular. Style 8–10 mm length, ovary 1 mm and light green. Fruit unknown.

POLLINATION BIOLOGY. Pollinated exclusively by small, pollen-gathering bees (e.g., *Patellapis castaneus*).

PHENOLOGY. Individual flower longevity one day, with 2–15 flowers per tree per day, and flowering duration about three weeks.

HABITAT. Lowland primary forest, 100 m.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named in honor of the late Bignoniaceae specialist, Alwyn Gentry.

***Colea resupinata* M.L. Zjhra, sp. nova (Fig. 2)**

Arbuscula non ramosa, cum apicali verticillo 4-pinnatorum foliorum; inflorescentiae ex trunco, longirectis pedunculis munitae. Flores parvi, laetos roseos corollae lobos praebentes. Stamina paria ex oppositis corollae lateribus orta, in medio decussata. Fructus valde atque irregulariter porcatus.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, trail III, 15°47'S, 50°13'E, 90 m, 22.XII.1996 Zjhra 785 (holotype GAS; isotype TAN).

Small (5 m height, 4 cm dbh) unbranched treelet with apical whorl of 4 pinnately compound leaves per node, 19–21 large (150–260 mm length, 58–70 mm width) oblong acuminate leaflets, petiole 145 mm. Cauliflorous (flowers from 0.5–2 m height on trunk) with racemes on 45–200 mm long peduncles that twist 180 degrees resulting in resupinate flower presentation. Flowers zygomorphic. Calyx (6 mm length, 3 mm width) with 5 minute lobes, whitish-purple with sparse hairs. Corolla tubular, small (12–14 mm length, 3–5 mm width), and light pinkish-yellow outer corolla tube with sparse hairs, corolla lobes bright pink, throat pink with pair of golden and translucent ridges (dorsal). Flowers with faint sweet odor, and no nectar. Stamen pairs (7–10 mm, 7–9 mm) originate at opposite sides of the corolla, crossing midway. Stamens white, anthers unilocular. Style 8–10 mm length, ovary 2 mm and light green. Fruit a berry (130 mm length, 40 mm width) strongly and irregularly ridged, light green with a faint sweet odor. Seeds unwinged, 5 mm diameter, round, flattened.

POLLINATION BIOLOGY AND DISPERSAL. Pollinated by small pollen-gathering bees (*Patellapis suareaensis*, *P. castaneus*). Fruit eaten by mouse lemurs.

PHENOLOGY. Individual flower longevity one day, with 3–180 flowers per treelet per day and flowering duration about four weeks.

HABITAT. Lowland primary forest, 90 m.

DISTRIBUTION. Known only from Vokoanina and Andranobe watersheds, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named for the unusual resupinate presentation of the flower.

***Colea ramiflora* M.L. Zjhra, sp. nova (Fig. 3)**

Arbor parva sciaphila, ut videtur semper uliginosa; erectos racemos ex ramulis praebens. Flores fere actinomorphi. Corolla atrobrunnea, acute longis albisque pilis secus semitas ad nectarem munita. Unum staminum par tantum fungens, alterum reductum. Fructus rotundus, glutinosus atque verrucosis umbonibus parvis praeditus, id est pusticulatus.

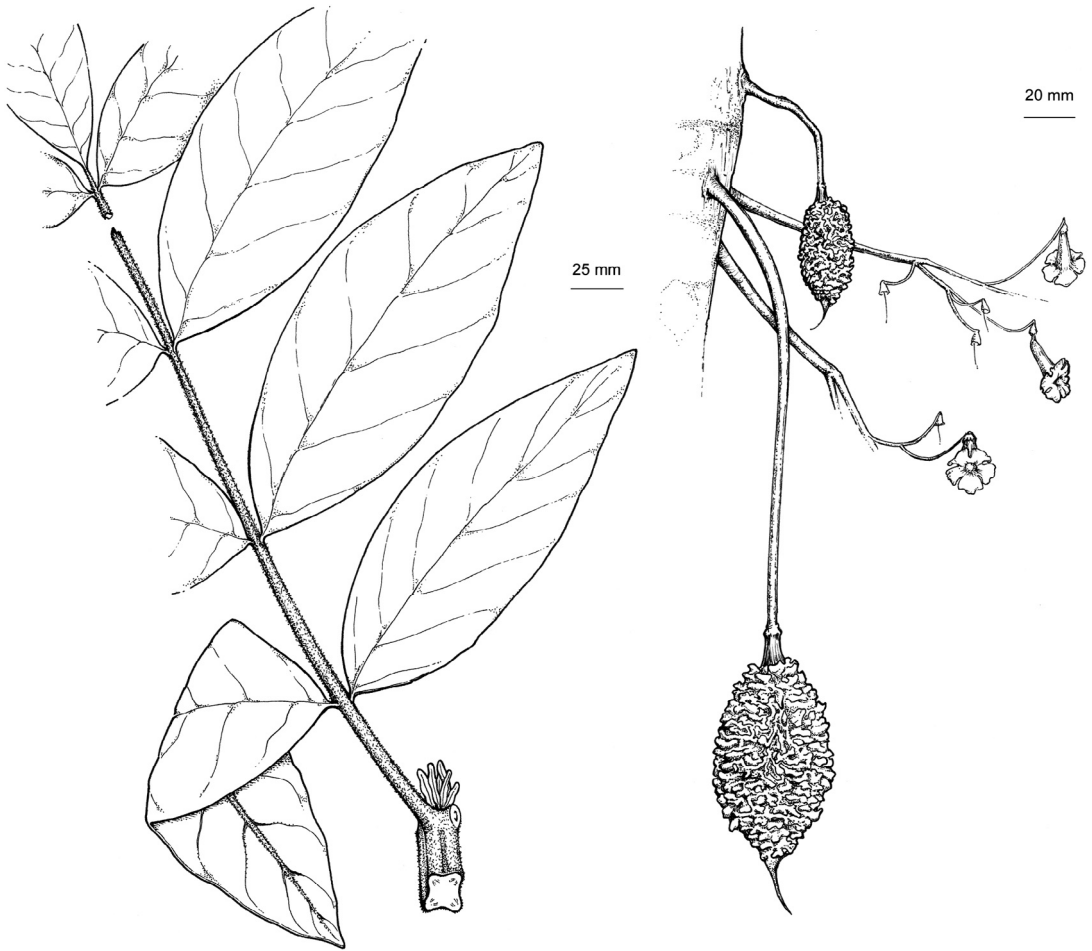


Fig. 2. *Colea resupinata* (from holotype). Leaf, fruit, and side and front view of flower.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, trail W, 15°46'41''S, 50°13'16''E, 60 m, 22.I.1997 *Zjhra* 913 (holotype GAS; isotype TAN).

Small (6–10 m height, 10 cm dbh) tree with 4–6 leaves per whorl of imparipinnate leaves, 19–23 small (130–160 mm length, 30–40 mm width) lanceolate leaflets, petiole 70–140 mm, petiolule sessile. Ramiflorous with erect racemes on 15–20 mm peduncles. Flowers zygomorphic. Calyx (2 mm length, 2 mm width) with 5 minute teeth, light green. Corolla campanulate, small (6–9 mm length, 4–6 mm width), and deep-maroon, throat maroon with long white hairs on two white nectar guides. Floral odor subtle, sweet and musky. Nectar 5–7 μ l. Stamen with one functional pair (5–7 mm) and second pair reduced (2–3 mm), filaments originating at lower

throat and crossing along upper throat, white, and anthers unilocular. Style 6–9 mm, ovary 1 mm, light green. Fruit a berry (30 mm length, 20 mm width) with warty protrusions, sticky, and light green. Seeds 3–6, unwinged, 25 mm length, 15 mm width, round, flat.

POLLINATION BIOLOGY. Pollinated predominately by beetles (*Hoplini*), medium-sized bees (*Apis mellifera unicolor*), and small-sized bees (*Lasioglossum emirnense*).

PHENOLOGY. Individual flower longevity about two days with 120–800 flowers per tree per day, and flowering duration about four weeks.

HABITAT. Lowland primary forest, 100 m, growing only in low areas with standing water.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

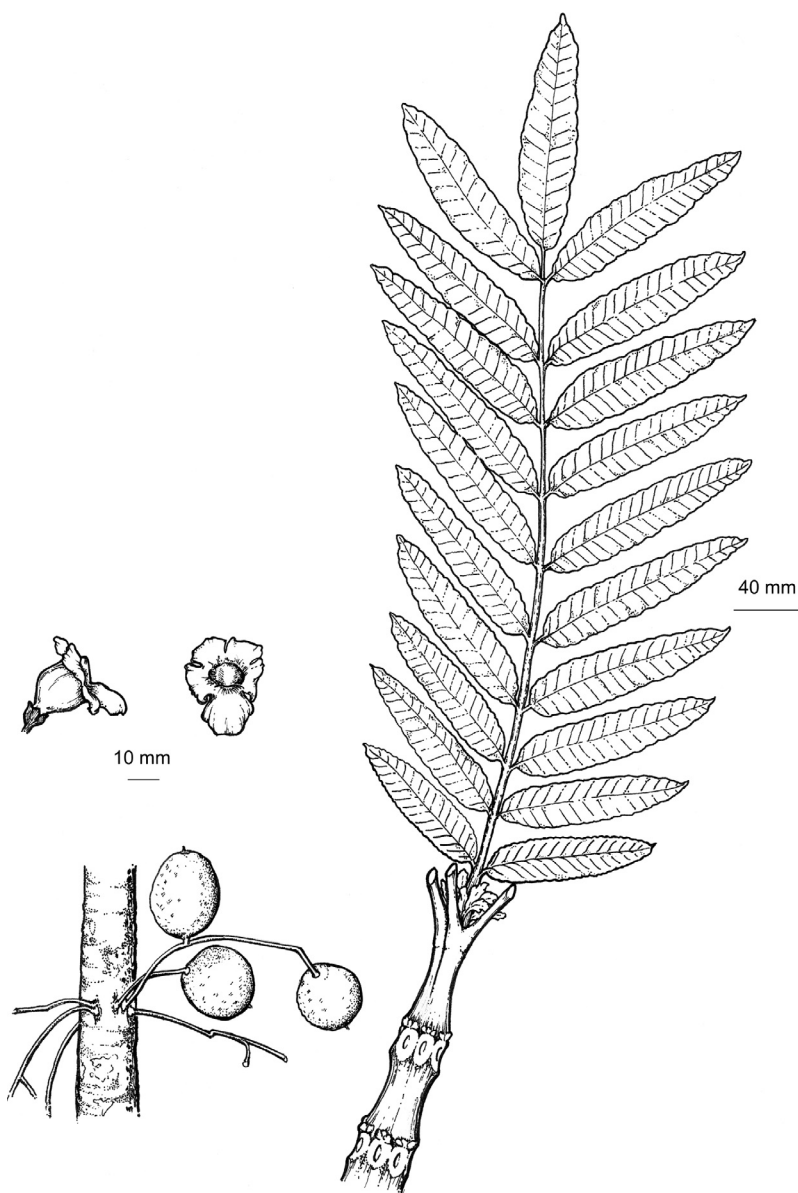


Fig. 3. *Colea ramiflora* (from holotype). Leaf with cauliflorous fruit, and side and front view of flower.

ETYMOLOGY. Name describes the placement of flowers along the branches.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, trail 4, 15°46'12"S, 50°13'44"E, 60 m, 27.I.1997 Zjhra 928 (holotype GAS).

***Colea rosea* M.L. Zjhra, sp. nova (Fig. 4)**

Arbuscula non ramosa, foliolis glabris; inflorescentiae usque ad medium trunci affixae et erectis pedunculis munitae. Flores fere actinomorphi. Corolla rosea laeta, cum aureis semitis ad nectarem. Unum staminum par tantum fungens, alterum reductum. Fructus ignotus.

Small (2.5 m height, 3 cm dbh) unbranched treelet with apical whorl of 5 pinnately compound leaves per node, 15–17 small (123–160 mm length, 32–40 mm width) lanceolate leaflets, with 110 mm petiole and 3 mm petiolule. Cauliflorous (flowers at 1.5 m on trunk) with cymose panicles on 50 mm peduncles. Flowers zygomorphic. Calyx (5 mm

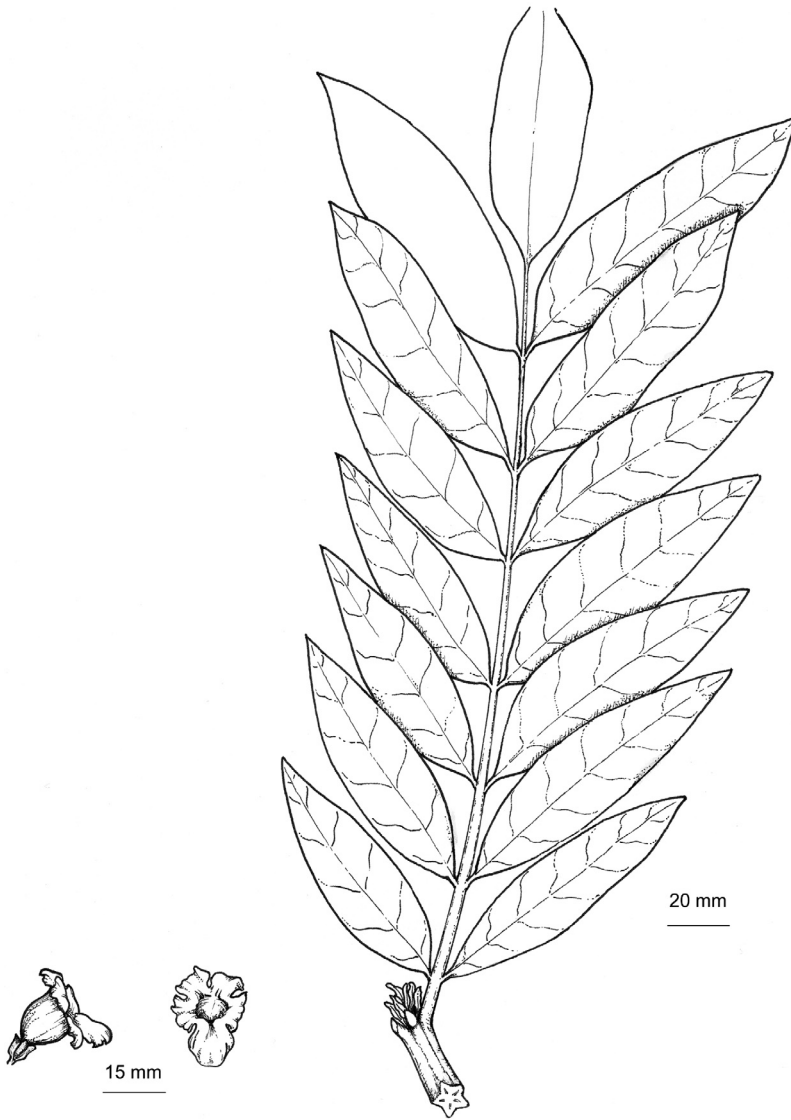


Fig. 4. *Colea rosea* (from holotype). Leaf and flower (side and front view).

length) cup-shaped with 5 minute teeth, light greenish-white. Corolla campanulate, small (13 mm length, 9 mm width), ventral lobes inwardly pinched forming landing platform, and throat pink with pair of golden nectar guides with long white hairs (ventral). Floral odor sweet. Nectar 1 μ l. Stamens white with one functional pair (9 mm) along upper corolla and one reduced pair (4 mm), anthers unilocular. Style 11 mm length and nearly exerted, ovary 0.5 mm and white. Fruit unknown.

POLLINATION BIOLOGY. Pollination by medium-sized bees.

PHENOLOGY. Individual flower longevity one day. Seven flowers/tree/day, with two-week flowering duration.

HABITAT. Lowland primary forest, 100 m, growing only in low areas with standing water.

DISTRIBUTION. Known only from single individual in 100 ha surveyed, Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named for the pink flowers, easily distinguishing this unusually shaped flower from *C. systmae* and *C. ramiflora*.

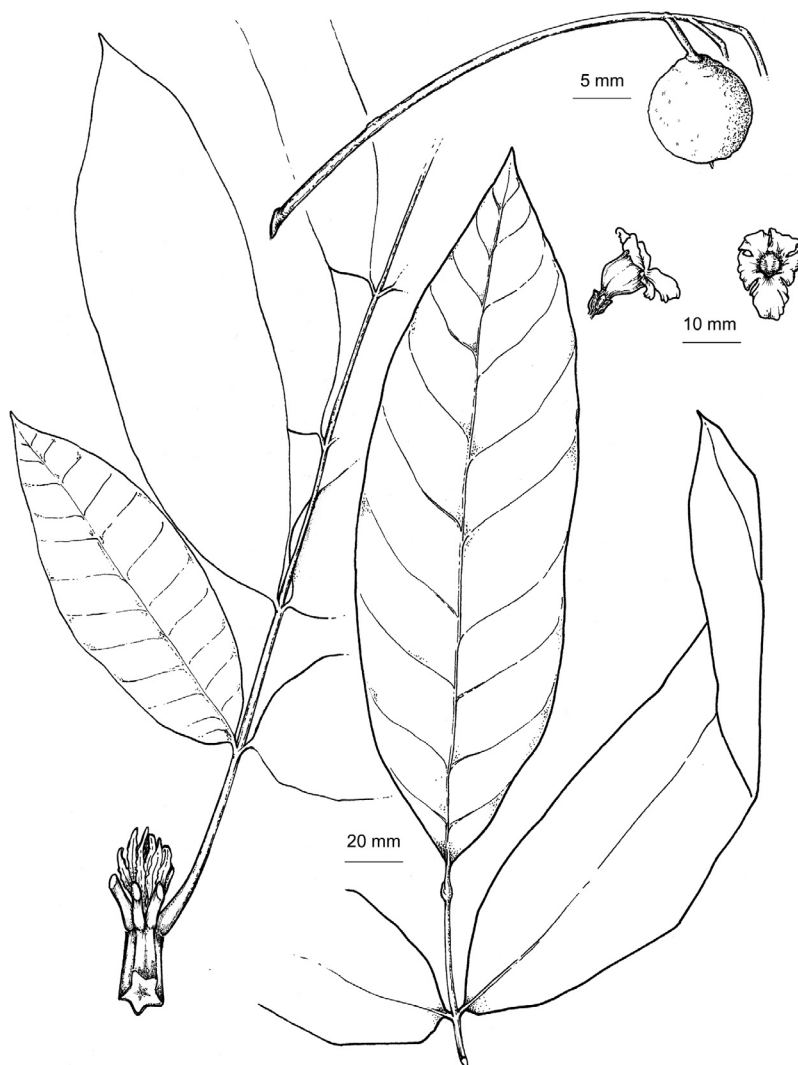


Fig. 5. *Colea sytsmae* (from holotype). Leaf with cauliflorous fruit and flower (side and front view).

***Colea sytsmae* M.L. Zjhra, sp. nova (Fig. 5)**

Arbuscula non ramosa; inflorescentiae ex trunco proxime sub apicali verticillo foliorum affixae. Flores fere actinomorphi. Corolla alba cum aureis semitis ad nectarem. Unum staminum par tantum fungens, alterum reductum. Fructus rotundus atque pusticulatus.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, 1260 m along trail A, 15°46'25"S, 50°13'52"E, 60 m, 25.I.1997 Zjhra 917 (holotype GAS; isotype TAN).

Small (3–4 m height, 3 cm dbh) unbranched treelet with apical whorl of 5 pinnately compound leaves per node, 13 large (150–240 mm length, 45–65 mm width) lanceolate leaflets, petiole 35–40 mm and petiolule sessile. Cauliflorous (flowers at 2–4 m height on trunk, just below leaves) on cymose panicle with 25–110 mm long peduncles. Flowers zygomorphic. Calyx (6 mm length, 4 mm width) with 5 minute teeth, greenish white. Corolla campanulate, medium-sized (6–11 mm length, 4–8 mm width), white, with lower corolla lobe pinched at base to form a

landing platform, and throat white with golden nectar guides covered in long white hairs (ventral). Floral odor sweet. Nectar 1–5 μ l. Stamens one pair functional (5–7 mm) and second pair reduced (2–4 mm), white with unilocular anthers. Style 9–11 mm length, ovary 1 mm and white. Fruit a berry (40 mm length, 30 mm width), maroon with green warty protrusions, and covered in thick white film during early development.

POLLINATION BIOLOGY. Pollination by medium-sized bees.

PHENOLOGY. Individual flower longevity one day, with 40–110 flowers per tree per day and flowering duration approximately five weeks.

HABITAT. Lowland primary forest, 100 m, growing only in low areas with standing water.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named in honor of the esteemed tropical systematist, Kenneth Sytsma.

***Ophiocolea vokoaninensis* M.L. Zjhra, sp. nova** (Fig. 6)

Arbuscula cum apicali verticillo 4–7 pinnatorum foliorum; brevipedunculatis floribus paucis vel numerosis ex trunco. Corolla flava, aureas longe albopilosas semitas ad nectarem praebens. Fructus longe cylindricus atque laevis, brunneus.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, 250 meters from camp along Trail B, 15°49'04''S, 50°26'09''E, 100 m altitude, 24.I.1997 *Zjhra* 907 (holotype GAS; isotype TAN).

Small (5–7 m height, 10 cm dbh) treelet with apical whorl of 4 to 7 pinnately compound leaves per node, 19 large (basal: 63 mm length, 52 mm width; mid: 136 mm length, 68 mm width; apical: 128 mm length, 43 mm width) oblong leaflets with 22 mm petiole and 9 mm petiolule. Petiolule and mid-veins maroon, rachis brown. Cauliflorous (flowers present 1–6 m on trunk) on reduced panicle with 6–18 mm long peduncles with presentation following phyllotaxy. Flowers zygomorphic. Calyx (4 mm length, 4 mm width) 2 lobed, and light green. Corolla tubu-

lar, medium-sized (12–20 mm length, 5–10 mm width), and yellow. Corolla lobes light yellow, throat yellow with three ventral golden nectar guides covered in long white hairs. Faint sweet odor, and no nectar. Stamen pairs (6–8 mm and 8–11 mm length) along upper corolla, white, anthers unilocular. Style 9–12 mm length, ovary 1 mm length and purple-brown. Fruit long, cylindrical berry (250–260 mm length, 5–13 mm width), smooth, green turning maroon when mature.

POLLINATION BIOLOGY. Flowers pollinated by medium-sized bees (*Patellapis* sp., *Patellapis castaneus*).

PHENOLOGY. Individual flower longevity one day, with 8–250 flowers per tree per day, with flowering duration three to four weeks.

HABITAT. Lowland primary forest, 100 m.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named after the collecting locality to distinguish this regional endemic from other regional endemics of this group.

***Phyllarthron nocturnum* M.L. Zjhra, sp. nova** (Fig. 7)

Arbor parva sylvicola atra striata cortice praedita. Folia opposita, nervatione inconspicua, duobus amplis articulatis phyllodiis composita. Flores valde zygomorphi. Calyx longe 5-dentatus. Corolla alba lata cum latis fimbriatis lobis. Fructus ignotus.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, 790 m from camp along trail B, 15°47'02''S, 50°39'06''E, 90 m, 15.I.1997 *Zjhra* 711 (holotype GAS).

Small (8–10 m height, 10 cm dbh) tree with dark striated bark. Leaves opposite with 2 large articles (apical orbicular 70 mm length, 60 mm width; basal deltoid 70 mm length, 57 mm width) on 26 mm petiole. Secondary venation visible above but not below. Inflorescence terminal racemes on 7 mm peduncles. Flowers strongly zygomorphic. Calyx (12–20 mm length, 7 mm width) with five teeth as long as the calyx cup

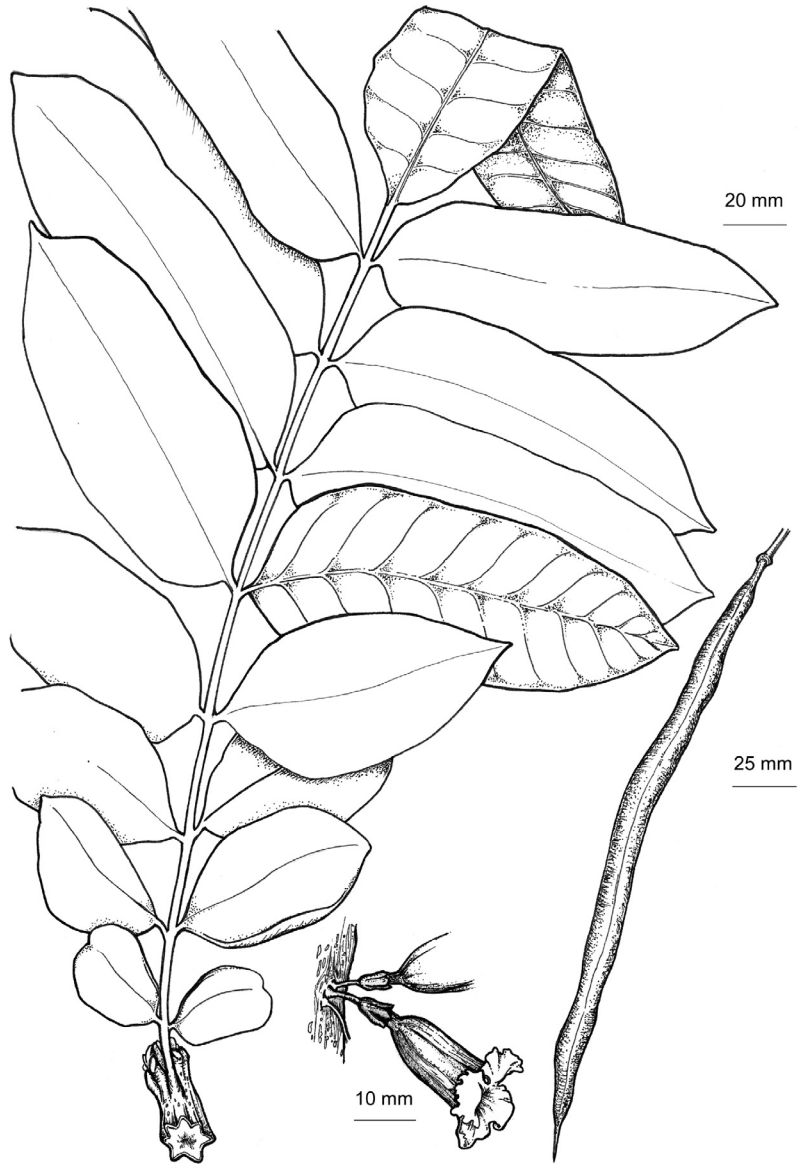


Fig. 6. *Ophiocolea vokoaninensis* (from holotype). Leaf, cauliflorous flowers and fruit.

and connected by thin membrane, light green. Corolla large (32–45 mm length) and white, lobes large, fringed, white, and throat pink (dorsal) and white with yellow ridges (ventral). Floral odor light and sweet. Nectar unknown. Stamen pairs (22 mm and 18 mm) white, anthers bilocular. Style 22 mm, ovary 2 mm. Fruit unknown.

POLLINATION BIOLOGY. No visitors observed during four months (three flowering events), but likely pollinated by nocturnal lemurs (e.g., *Avahi* or *Lepilemur*) or bats (e.g., *Pteropus* or *Eidolon*).

PHENOLOGY. Individual flower longevity one day and one night with anthesis around 3 a.m. and senescence the following day around noon. Two to 24 flowers per tree with flowering duration a single day-night event (with 3 events in an 11-week period).

HABITAT. Lowland primary forest, 100 m.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Name describes the night opening flowers.

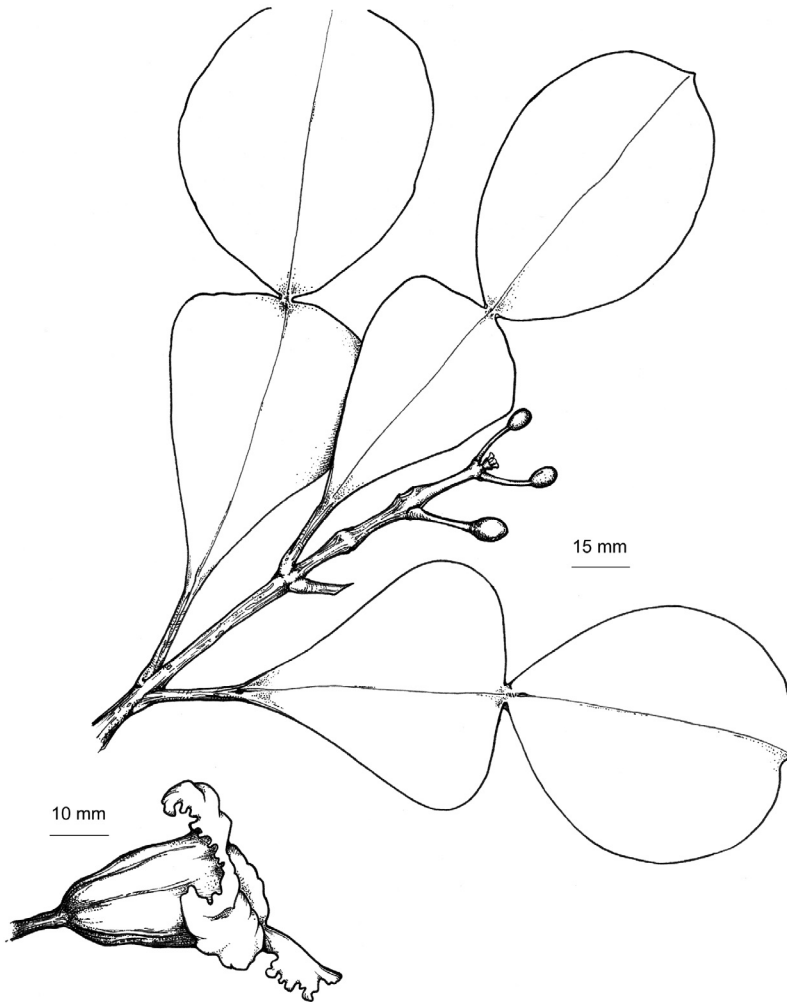


Fig. 7. *Phyllarthron nocturnum* (from holotype). Leaves, buds, and flower.

***Phyllarthron sahamalazensis* M.L. Zjhra, sp. nova (Fig. 8)**

Arbor excelsa, cum foliis oppositis, duobus mediocribus articulatis phyllodiis compositis. Calyx bilobatus. Corolla alba flavis rubrostrictis faucibus praebens. Fructus oblongus, laevis viridisque.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Sahamalaza village on coast, 15 minutes by foot south of village on main path, 15°48'00"S, 50°17'00"E, 70 m, 29.I.1998 *Zjhra* 990 (holotype GAS).

Large (6 m) canopy tree with opposite leaves comprised of two medium oblong articles (apical oblong 77 mm length, 30 mm width; basal deltoid 76 mm length, 26 mm width) with petiole indistinguishable from basal article. Inflores-

cence a terminal raceme with 20 mm peduncles. Flowers zygomorphic. Calyx zygomorphic (9 mm length, 3 mm width) with 2 lobes and green. Corolla funnelform, large (18 mm length, 8 mm width), white with throat yellow (dorsal) and yellow guides with red dots (ventral). Floral odor musky-sweet. Nectar unknown. Stamen pairs 8 mm and 5 mm, anthers bilocular. Style 14 mm length, ovary about 2 mm. Fruit a small, green oblong berry.

POLLINATION BIOLOGY. Unknown.

PHENOLOGY. Flowers and fruits in January. Phenology otherwise unknown.

HABITAT. Coastal primary forest, 10 m.

DISTRIBUTION. Known only from Sahamalaza region, southeastern Masoala Peninsula, Madagascar.



Fig. 8. *Phyllarthron sahamalazensis* (from holotype). Leaves, flower, bud, and fruit.

ETYMOLOGY. Named after the collecting locality to distinguish this regional endemic from other regional endemics of this group.

***Phyllarthron vokoaninensis* M.L. Zjhra, sp. nova** (Fig. 9)

Arbor excelsa rubella cortice praedita. Folia opposita, tribus articulatis phyllodiis composita. Corolla alba flavis semitis ad nectarem praebens. Fructus oblongus, laevis viridisque.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, trail 3 off trail A, 15°49'02"S, 50°27'04"E, 100 m, 18.XII.1996 Zjhra 742 (holotype GAS).

Large (15 m) canopy tree with reddish bark. Leaves opposite, with three medium articles (apical oblong-orbicular 46 mm length, 32 mm width; mid oblong-orbicular 86 mm length, 45 mm width; basal deltoid 85 mm length, 30 mm width) with petiole indistinguishable from basal article. Secondary venation not visible. Inflorescence axillary. Flowers zygomorphic. Calyx unknown. Corolla funnellform, medium-sized (22–31 mm length, 15–22 mm width) and white, with white lobes, and white throat with yellow nectar guides.

Stamen pairs (15 mm length), white, anthers bilocular. Style 16 mm length. Fruit an ovoid berry (60 mm length, 20 mm width), smooth and green.

POLLINATION BIOLOGY. Pollinated by large bees, with nectar-robbing by both the Long-billed Green Sunbird (*Nectarinia notata*) and the Souimanga Sunbird (*Nectarinia souimanga*).

PHENOLOGY. Two-week flowering duration with 8–80 flowers per tree per day. Phenology otherwise unknown.

HABITAT. Lowland primary forest, 100 m.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named after the collecting locality to distinguish this regional endemic from other regional endemics of this group.

***Rhodocolea multiflora* M.L. Zjhra, sp. nova** (Fig. 10)

Arbuscula non ramosa, cum apicali verticillo 5-pinnatorum foliorum, foliolis latis, trunco floribus praedito. Corolla perangusta, pallida aurea, rosea ad basin, lobis albis atque aureis semita ad nectarem in palato munita, odorem dulcem

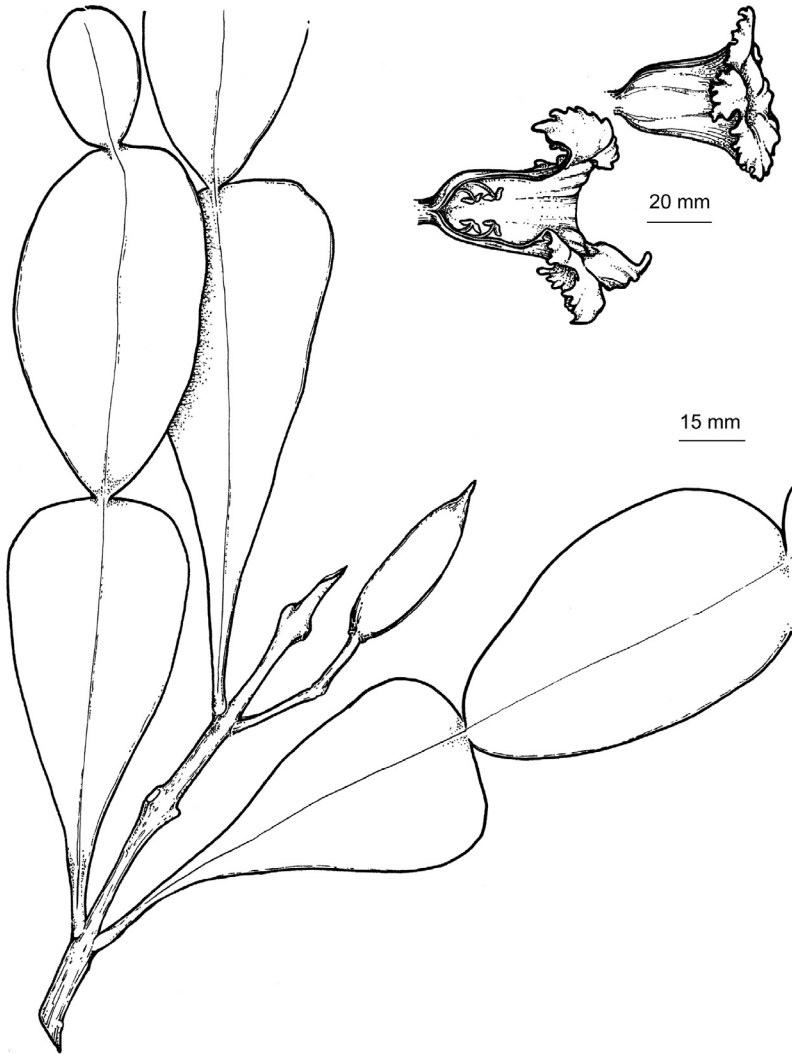


Fig. 9. *Phyllarthron vokoaninensis* (from holotype). Leaves with fruit, flower, and stamens.

valde exhalens. Fructus ovoideus, laevis, glutinosus viridisque.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, 1010 m from base camp along trail A, 15°46'32"S, 50°13'34"E, 80 m, 15.I.1997 Zjhra 882 (holotype GAS).

Small (5 m height, 60 mm dbh) unbranched treelet with apical whorl of 5 pinnately compound leaves per node, 15 large leaflets (apical and mid oblong 225 mm length, 64 mm width; basal deltoid 107 length, 56 mm width), rachis brown, petiole 100 mm, and petiolule 3 mm. Cauliflorous (at 1.5–6 m from ground) on sessile cymes. Flowers zygomorphic. Calyx (4 mm

length, 4 mm width), 5 lobed with 5 minute teeth, maroon. Corolla tubular, medium-sized (12–31 mm length, 4–5 mm width), light gold with pink markings at the base, corolla lobes white, and inner corolla pink and white with golden guides covered in white hairs. Strong, sweet odor, and no nectar. Stamen pairs (6–11 mm and 4–8 mm) along upper corolla, pink at base, anthers white and bilocular. Style 7–9 mm length, stigma white, ovary 2 mm and yellow. Fruit an ovoid berry (40 mm length, 6 mm width) sticky and green.

POLLINATION BIOLOGY. Flowers visited by medium-sized bees, butterflies, and moths, with pollination apparently by small bees (*Patellapis punctifrons*, *Lasioglossum emirnense*).

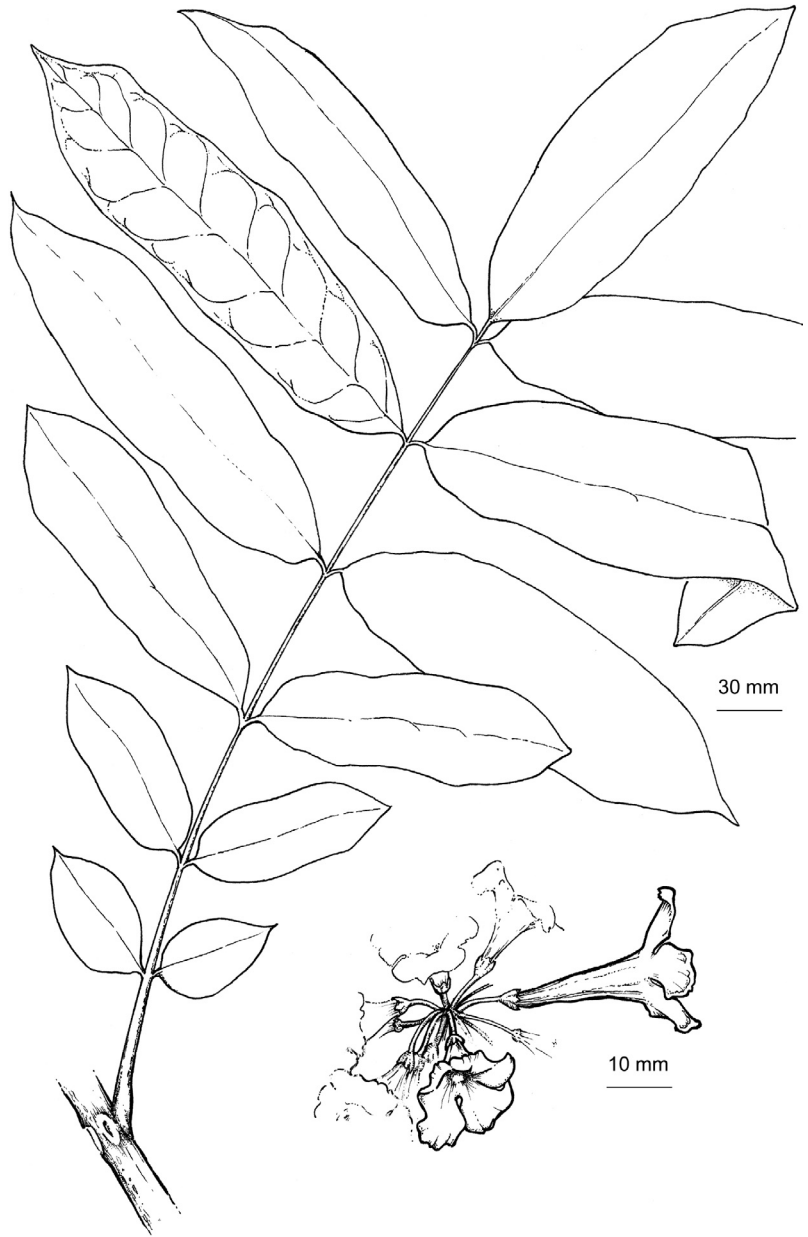


Fig. 10. *Rhodocolea multiflora* (from holotype). Leaf and flower.

PHENOLOGY. Individual flower longevity one day, with 250–300 flowers per tree per day, and flowering duration about five weeks.

HABITAT. Lowland primary forest, 100 m.

DISTRIBUTION. Known only from Vokoanina watershed, southeastern Masoala Peninsula, Madagascar.

ETYMOLOGY. Named for the striking carpet of flowers that covers the trunk.

***Rhodocolea lemuriophila* M.L. Zjhra, sp. nova** (Fig. 11)

Arbuscula ramosa sciaphila, cum apicali verticillo 3-pinnatorum foliorum, trunco ad inferiorem dimidiam partem floribus praedito. Flores actinomorphi campanulati latissimi. Corolla externe atrobrunnea, interne conspicue pallida flava. Stamina paria divergentia, unum secus

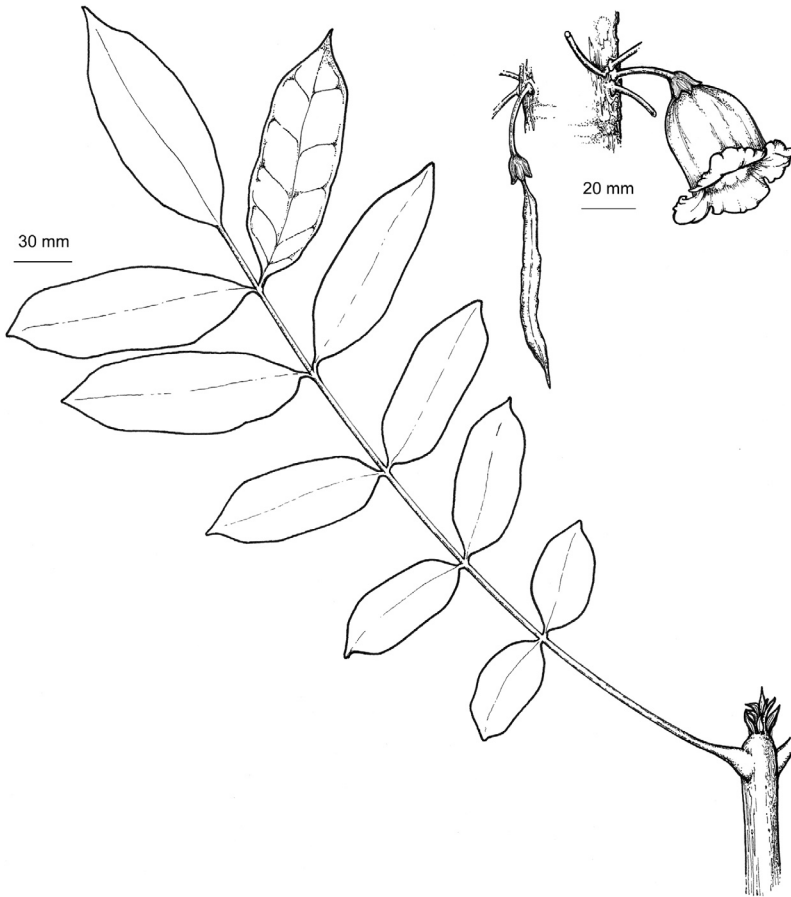


Fig. 11. *Rhodocolea lemuriophila* (from holotype). Leaf, cauliflorous flower and fruit.

palatum, alterum secus corollae latera. Fructus ovoideus, laevis, glutinosus viridisque.

TYPE: Madagascar. Antsiranana, Masoala Peninsula, Vokoanina watershed 2 km W of Sahamalaza, 250 meters from camp along trail B, 15°49'04''S, 50°26'09''E, 100 m altitude, 24.I.1997 *Zjhra* 902 (holotype GAS).

Medium (6 m height, 80 mm dbh) branched treelet with apical whorl of three pinnately compound leaves per node, 13–15 medium (153–170 mm length, 46–51 mm width) oblanceolate leaflets, petiole 123 mm, and petiolule 8 mm. Cauliflorous (flowering from the ground to 3 m along the trunk) on cymes 16 mm long. Flowers nearly actinomorphic. Calyx large (13–20 mm length, 10–13 mm width), 5 lobed, and light green. Corolla campanulate, large (33–37 mm length, 29–36 mm width) with deep maroon outer corolla and lobes, and inner corolla pale yellow.

Flowers with strong, sweet musky odor, and copious nectar (75 μ l). Stamen pairs (28–37 mm and 28–34 mm) along upper corolla and along side of corolla with long white hairs at point of insertion, yellow. Anthers large (5 mm) and bilocular. Style 36–49 mm length, ovary 6 mm and light green. Fruit an ovoid berry (35+ mm length, 10 mm width), sticky and green.

POLLINATION BIOLOGY. Flowers open at night and last 18 hours. Mammal pollinated.

PHENOLOGY. Individual flower longevity 18 hours, night opening, 5–56 flowers per tree per night, with flowering duration two to three weeks.

HABITAT. Lowland primary forest, 100 m.

DISTRIBUTION. Known only from Masoala Peninsula, including Vokoanina watershed, Point Tompolo, and Cap Est watershed, Madagascar.

ETYMOLOGY. Named after the presumed pollinator.

Key to Bignoniaceae of Masoala

1. Cauliflorous shrubs, treelets or trees with opposite or whorled pinnately compound leaves 2
1. Trees with axillary or terminal flowers, leaves pinnately compound or articulated phyllodes 10
2. Anthers bilocular, leaves opposite or whorled 3
2. Anthers unilocular, leaves whorled 5
3. Shrub, flowers axillary, terminal or cauliflorous on raceme with large bracts *Rhodocolea racemosa*
3. Treelet, unbranched or little branched 4
4. Trunk covered with flowers white or pale golden, narrow and elongate *Rhodocolea multiflora*
4. Large (33–37 mm long, 29–36 mm wide) flowers, maroon, strong sweet, musky odor
..... *Rhodocolea lemuriophila*
5. Flowers campanulate, standing water habitat 6
5. Flowers tubular 8
6. Understory branched tree, ramiflorous, flowers deep maroon *Colea ramiflora*
6. Treelet monopodial 7.
7. Flowers white, cauliflorous just below leaves, 13 leaflets *Colea sytsmae*
7. Flowers pink, cauliflorous well below leaves, 15–17 leaflets *Colea rosea*
8. Flowers medium-sized (12–20 mm), yellow, sessile on trunk, fruit long and narrow *Ophiocolea vokoanensis*
8. Flowers small (7–14 mm), fruit not long and narrow .. 9
9. Flowers resupinate, with 180 degree twist of peduncle ..
..... *Colea resupinata*
9. Flowers not resupinate, with red dots *C. gentryi*
10. Leaves pinnately compound, flowers large and orange ..
..... *Rhodocolea nobilis*
10. Leaves articulated phyllodes 11
11. Three or more phyllodes 12
11. Two phyllodes 13
12. Three phyllodes, flowers white
..... *Phyllarthron vokoanensis*
12. Three to five phyllodes on same tree
..... *Phyllarthron articulatum*
13. Flowers large (32–45 mm), white, large fingers, nocturnal opening, bark dark and striated, leaves coriaceous ...
..... *Phyllarthron nocturnum*
13. Flowers smaller (18–31 mm), leaves thin 14

14. Flowers white with pink throat
..... *Phyllarthron sahamalazensis*
14. Flowers magenta *Phyllarthron madagascariense*

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References

- Gentry, A. H. 1976: Relationships of the Madagascar Bignoniaceae: a striking case of convergent evolution. — *Plant Syst. Evol.* 126: 255–266.
- Perrier de la Bâthie, H. 1938a: Les Bignoniacées de la région Malgache. — *Ann. Mus. Col. Marseille* 46: 1–101.
- Perrier de la Bâthie, H. 1938b: Bignoniacées. — In: *Flore de Madagascar*, vol. 178: 1–91. Mus. Nat. d'Hist. Nat., Paris.
- Spangler, R. E. & Olmstead, R. G. 1999: Phylogenetic analysis of Bignoniaceae based on the cpDNA gene sequences *rbcL* and *ndhF*. — *Ann. Missouri Bot. Garden* 86: 33–46.
- Zjhra, M. L., Sytsma, K. J. & Olmstead, R. G. 2004: Delimitation of Malagasy tribe Coleeae and implications for fruit evolution in Bignoniaceae inferred from a chloroplast DNA phylogeny. — *Pl. Syst. Evol.* 245: 55–67.