Some distinctive new species of Psychotria (Rubiaceae, Psychotrieae) from Madagascar

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Abstract

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Psychotria L. (Rubiaceae, Psychotrieae) is an unusually species-rich genus in Madagascar. Recent botanical explorations here have found a number of undescribed species, and some unusual morphological structures for this genus. Here ten new Psychotria species from Madagascar are formally described: Psychotria ambatovensis C.M. Taylor, Psychotria antilahimenae C.M. Taylor, Psychotria birkinshawiana C.M. Taylor, Psychotria davisiana C.M. Taylor, Psychotria eumachioides C.M. Taylor, Psychotria hamifera C.M. Taylor, Psychotria mutabilis C.M. Taylor, Psychotria notopleuroides C.M. Taylor, Psychotria palifera C.M. Taylor, and Psychotria razafimandimbisonii C.M. Taylor. Unusual morphological features of some of these species include a prostrate habit, deeply retuse leaves, and enlarged, persistent, funnelform stipules. Assessment of the conservation status of these using IUCN Red List categories finds four of them “Vulnerable” and six “Endangered”.

Résumé

TAYLOR, C.M., R.E. GEREAU & H.H. SCHMIDT (2020). Quelques nouvelles espèces remarquables du genre Psychotria (Rubiaceae, Psychotrieae) à Madagascar. Candollea 75: 159–182. En anglais, résumés anglais et français. DOI: http://dx.doi.org/10.15553/c2020v752a1

Psychotria L. (Rubiaceae, Psychotrieae) est un genre exceptionnellement riche en espèces à Madagascar. Des explorations botaniques récentes y ont trouvé un certain nombre d’espèces non décrites et des structures morphologiques inhabituelles pour ce genre. Dix nouvelles espèces de Psychotria de Madagascar sont formellement décrites: Psychotria ambatovensis C.M. Taylor, Psychotria antilahimenae C.M. Taylor, Psychotria birkinshawiana C.M. Taylor, Psychotria davisiana C.M. Taylor, Psychotria eumachioides C.M. Taylor, Psychotria hamifera C.M. Taylor, Psychotria mutabilis C.M. Taylor, Psychotria notopleuroides C.M. Taylor, Psychotria palifera C.M. Taylor et Psychotria razafimandimbisonii C.M. Taylor. Les caractéristiques morphologiques inhabituelles de certaines de ces espèces comprennent un port prostré, des feuilles profondément rétuses et des stipules en forme d’entonnoir agrandies et persistantes. L’évaluation du statut de conservation de ces espèces en utilisant les catégories de la Liste Rouge de l’UICN montre que quatre espèces sont «Vulnérables» et six «En danger».

Keywords

RUBIACEAE – Psychotrieae – Psychotria – Madagascar – New species
Introduction

Psychotria L. is one of the most species-rich genera in Madagascar (G. Schatz, pers. comm.). The genus was recently reviewed taxonomically and morphologically there by Taylor (2020), who gave an overview of pertinent taxonomic and molecular study of this genus and its tribe. She also noted that recent botanical exploration has found additional species that are new to science. Several of these have morphological features that are uncommon in Psychotria and/or Madagascar, as discussed in more detail there. Several of these new species are described here, and additional new species will be described later (Taylor, in prep.).

Psychotria (Rubiaceae, Psychotrieae; i.e., Psychotria s.s.; Andersson, 2002) is a pantropical genus that comprises 1500+ species of shrubs and small trees found in seasonal to wet tropical vegetation of the Americas, Africa, Madagascar, Asia, Australia, and Pacific Islands (Razafimandimbison et al., 2014). Study of Psychotria in recent years shows that this unusually large genus is systematically complicated with the duplicates that have been studied.

Psychotria is characterized by its perennial, nearly always woody habit; tissues with raphides; usually deciduous, often bilobed stipules; basically terminal, cymose inflorescences; four-merous or usually five-merous distylos flowers; corollas with valvate aestivation; usually bilocular ovaries with a single basal ovule in each locule; and drupaceous fruits with usually two pyrenes that have an alcohol-soluble pigment in their wall and lack preformed germination slits (PGS’s). Additionally, the stem nodes usually have a ring of persistent colleters that are visible after the stipules have fallen, and dried specimens of Psychotria usually have a distinctive reddish-brown or gray tinge (though they also often dry green; Taylor, 2020).

Ten distinctive new Psychotria species from Madagascar are described here, to document the morphological variation found in this group on this single island. The content provided here for these each species presents formal nomenclatural and morphological descriptions, diagnostic line drawings, data corresponding to the specimens studied of these species, conservation assessments using the IUCN Red List format based on the specimens studied, an overview of habitat and phenology, an explanation of the basis for first author’s personal choice for the epithet, notes on distinctive and peculiar morphological characters and ecology, the putative placement of the species in Bremekamp’s (1963) classification of this group, an outline of similar species that can easily be confused, and selected photographs of some species.

Methods

This work is based on standard herbarium techniques. Additional information is available online in the Rubiaceae Project (2020), including specimen data and maps, high-resolution specimen scans, and notes on ecology and identification. The new species are presented in alphabetical order because the species groups that Bremekamp (1963) distinguished in Western Indian Ocean Psychotria are not clearly distinct (Taylor, 2019), but the putative group assignment in his classification is indicated because his treatment is often useful for identification. Some of these new species are most similar to other Psychotria species that do not, however, fall in the same group of Bremekamp; these similar species are noted and contrasted in the discussion because of their similarity, and because Bremekamp’s groups are probably not natural and those similar species may actually be closely related. Duplicate specimens that are reportedly deposited at institutions other than MO are cited here based on collection management records, but those have not seen in this study and are not confirmed to be conspecific with the duplicates that have been studied.

Morphological terminology follows Lawrence (1951) for general features, Taylor (2006, 2012) for characteristic features of Psychotria, and Robbrecht (1988) with regard to the contracted inflorescence form of Psychotria being subcapitate rather than genuinely capitate. As with most Rubiaceae, the flowers here have bilocular ovaries and the “merosity” noted applies to the calyx, corolla, and anthers. Measurements describe length unless otherwise specified, and those of particular structures are given in the same units consistently to facilitate comparison. Some terminology that has varied among authors is defined here. Some of his treatments of the flowers, the hypanthium as a separate structure from the calyx, corolla, and anthers. Measurements describe length unless otherwise specified, and those of particular structures are given in the same units consistently to facilitate comparison. Some terminology that has varied among authors is defined here. Some of his treatments of the flowers, the hypanthium as a separate structure from the calyx, corolla, and anthers. Measurements describe length unless otherwise specified, and those of particular structures are given in the same units consistently to facilitate comparison. Some terminology that has varied among authors is defined here. Some of his treatments of the flowers, the hypanthium as a separate structure from the calyx, corolla, and anthers. Measurements describe length.
Taxonomy

_Psychotria ambatovensis_ C.M. Taylor, _sp. nov._ (Fig. 1A–F).

**Holotypus:** MADAGASCAR. **Reg. Alaotra-Mangoro [Prov. Toamasina]:** Moramanga, Ambohibary, Ampitambe, 18°50'17"S 48°15'44"E, 975 m, 24.II.2009, Andriamianiroro et al. 164 (MO-6416482; iso-: P, TAN).

_Psychotria ambatovensis_ C.M. Taylor is distinguished from _P. macrochlamys_ (Bremek.) A.P. Davis & Govaerts by its smaller leaves, subsessile subcapitate inflorescences, and calyx limbs that are pubescent externally (i.e., abaxially).

_Shrubs_ and _small trees_, collected in flower at 2–6 m tall, branched; stems flattened, smooth or with shallow medial channel, densely hirtellous with trichomes 0.3–1.2 mm. _Leaves_ opposite; _petiole_ 0.3–1.8 cm, densely hirtellous with trichomes 0.3–1.2 mm; _blade_ obovate to elliptic, 1.5–6.5 × 0.8–5 cm, at base acute to obtuse or rounded, at apex obtuse to rounded, truncate, or shallowly retuse, drying chartaceous to subcoriaceous, adaxially weakly bullulate to plane, shiny, and glabrous, abaxially densely hirtellous with trichomes 0.3–1.2 mm; secondary veins 4 to 10 pairs, looping to interconnect near margins, apparently without domatia, without intersecondary veins or sometimes with 1 short vein arising from costa between a pair of secondary veins, adaxially costa and secondary veins impressed, tertiary venation plane to impressed or thinly prominulous, and remaining venation not visible, abaxially costa and secondary veins prominent and loosely reticulated tertiary and quaternary venation prominulous. _Stipules_ calyptrae, caducous, in bud fully fused into a conical or ovoid cap, 6–18 mm, acute at top, splitting along 1 or 2 sides then separating from stem at base, abaxially (i.e., externally) densely hirtellous with trichomes 0.3–1.2 mm, adaxially (i.e., internally) densely to sparsely hirtellous with trichomes 0.5–1.5 mm. _Inflorescences_ terminal, subcapitate, subsessile, subglobose, 3– to 7-flowered, initially enclosed by a calyptrae, caducous stipule 10–18 mm; bracts 2 or 4, stipulariform, 4–6 mm. _Flowers_ all subsessile, at base surrounded by dense ring of pilose or stigmatic trichomes 1–2 mm, 4-, 5-, or 6-merous; _hypanthium_ cylindrical to ellipsoid, 1–1.5 mm, densely stigioso to hirtellous with trichomes 0.5–1.5 mm; _calyx_ limb c. 2 mm, externally hirtellous to stigioso with trichomes 1–1.5 mm, internally glabrous, lobed for ¼–½ of its length, lobes narrowly triangular to linear; _corolla_ funnelform, yellow, externally glabrous or moderately to densely stigioso on top part of tube and base of lobes with trichomes 0.5–1 mm, tube 4.5–5 mm, c. 1.5 mm diam. near middle, internally glabrous except densely tomentulose with trichomes 0.3–0.5 mm at top of tube (i.e., in throat), lobes narrowly triangular, 2–2.5 mm, acute, adaxially shortly galeate, abaxially with rounded thickening near apex; _stamens_ with filaments c. 1 mm, inserted in uppermost part of tube, anthers oblong, c. 0.8 mm, exserted, _style_ and _stigma_ not seen. _Infructescences_ similar to inflorescences. Young _fruits_ ellipsoid, c. 6 × 5 mm, densely stigioso to hirtellous with trichomes 1–1.5 mm, with calyx often enlarging, to 4 mm, when mature not seen but reportedly orange to red; _pyrenes_ hemispherical, adaxially plane, abaxially apparently smooth; _endosperm_ deeply and densely ruminate on all sides.

_Habitat, distribution, and phenology._ _Psychotria ambatovensis_ has been collected in humid evergreen forest at 974–1180 m in east-central Madagascar (Toamasina), with flowers in February and March, and with fruits in July.

_Conservation status._ _Psychotria ambatovensis_ is known from five specimen collections representing five unique occurrences in humid evergreen forest. Two occurrences are within the mine footprint of the Ambatovy nickel-mining project, and have been removed from the dataset for the calculation of assessment parameters. The Extent of Occurrence (EOO) of the species is 18 km², within the limits for “Critically Endangered” under IUCN Red List Criterion B1; and the Area of Occupancy (AOO) is 12 km², within the limits for “Endangered” under Criterion B2 (IUCN, 2012). One occurrence is within the well-protected Mantadia Protected Area (PA), and the other four occurrences are in areas to the west of the Park: three in Analamay Forest (with one label indicating “conservation zone”), and one in a “degraded forest patch” at Ankoritrazo. Forested areas without formal protection in the vicinity of Mantadia PA are subject to degradation by small-scale slash and burn agriculture (Goodman et al., 2018). Two of the sites within Analamay Forest are within the mine footprint of the Ambatovy nickel-mining project, while the third is within the adjacent conservation zone. After removal of the two collection
sites on the mine footprint, which have already been destroyed, three locations (sensu IUCN, 2012; see also IUCN, 2019) can be defined relative to the known threats: the degraded site at Ankoditrazo; the one protected site within the Ambatovy conservation zone; and the one protected site within Mantadia PA. With three locations, given general habitat degradation in unprotected sites with the westernmost location at Ankoditrazo likely to disappear in the near future, causing a decline in EOO, AOO, number of locations, and number of mature individuals, the Red List status of *P. ambatovensis* is assessed as “Endangered” [EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)].

**Notes.** — *Psychotria ambatovensis* is characterized by the combination of its dense hirtellous to hirsute pubescence on both vegetative and reproductive structures; relatively small obovate leaf blades that are obtuse to truncate at the tip; caducous calytrate stipules; subsessile, subcapitate, few-flowered inflorescences; lobed, rather well developed calyx limbs; rather small yellow corollas; rather small fruits; and endosperm that is ruminate on both surfaces. The plants dry with a dark brown or reddish brown color, with the dried trichomes deeply reddish brown to brown. The leaves are often weakly bullulate. This species apparently lacks acarodomatia on the leaves, although the dense pubescence of the abaxial vein axes may have this function. The flowers seen have variously four to six lobes and anthers, with the number apparently consistent on an individual plant. The few flowers seen agree with the short-styled form of distylyous *Psychotria* species, but whether this species is distylyous is not yet known. The fruits seen appear to be young, and they mature (Taylor, 2020) and this is a possibility here. The smooth young pyrenes of some species develop ridges as the anthers, with the number apparently consistent on an individual flower. The flowers seen have variously four to six lobes and stamens with filaments c. 1 mm, inserted near top of corolla tube, anthers narrowly oblong, 1–1.2 mm, exserted; style c. 2 mm, stigma c. 0.8 mm, included. Infructescences similar to congested-cymose, pedunculate, glabrous; pedicel 1–5 cm; flower-bearing portion hemispherical to irregularly subglobose, 1–3 × 1.5–3 cm, unbranched or shortly branched to 1 order, 20– to 140-flowered; bracts reduced or few, ovate, 0.5–1 mm; pedicels 1–2 mm. *Flowers* all pedicellate in cymes of 3– to 7-, 5-merous; hypanthium narrowly ellipsoid, c. 1 mm, glabrous; calyx limb 1–1.2 mm, glabrous, denticulate or lobed for up to 1/3 of its length, lobes narrowly triangular, acute; corolla tubular, white, externally glabrous, tube c. 3 mm, c. 1.2 mm diam. near middle, internally glabrous except pilose in throat with white trichomes 1–1.5 mm, lobes narrowly triangular, c. 2.5 mm, acute, adaxially smooth; stamens with filaments c. 1 mm, inserted near top of corolla tube, anthers narrowly oblong, 1–1.2 mm, exerted; style c. 2 mm, stigmas c. 0.8 mm, included. Infructescences similar to congested-cymose or becoming laxer, to 4 × 4 cm. *Fruits* ellipsoid to subglobose, 8–9 × 7–8 mm, glabrous, red, with calyx often enlarging, to 2 mm; pyrenes hemispherical, adaxially plane, abaxially with c. 6 well developed, rounded, longitudinal ridges; endosperm sparsely ruminate to a moderate depth on all sides.

**Psychotria antilahimenae** C.M. Taylor, sp. nov. (Fig. 2A–E).

**Holotypus:** MADAGASCAR. Reg. Analanjirofo [Prov. Toamasina]: Nosy Mangabe, 15°50’S 49°46’E, 0–330 m, 10.X.1987, Schatz 1619 (MO–3586737; iso–: K, P, TAN).

*Psychotria antilahimenae* C.M. Taylor is distinguished from *P. simianensis* A.P. Davis & Govaerts by its 5-merous flowers, longer calyx, and white corollas.

Shrubs, collected in flower and fruit variously at 0.3–1.5 m tall, unbranched (i.e., monopodial), sometimes accumulating detritus along stem inside leaf bases; stems flattened to subterete, smooth, glabrous. *Leaves* opposite; petiole 0.2–1 cm, glabrous or puberulous with trichomes 0.1–0.2 mm; blade obovate to oblanceolate, 18–35 × 4–14.5 cm, at base tapered then acute to obtuse, at apex obtuse to rounded then shortly abruptly acuminate with tip 3–10 mm, drying papyraceous to chartaceous, adaxially glabrous, abaxially glabrous or occasionally densely puberulous on costa with trichomes up to 0.1 mm; secondary veins 14 to 20 pairs, looping to interconnect near margins, without domatia, on both surfaces costa prominent, secondary veins prominent, and remaining venation plane and not evident or sometimes one intersecondary vein evident between pairs of secondary veins and infrequently some tertiary venation evident and prominent. *Stipules* interpetiolar, caducous, triangular, c. 25 mm, acute, abaxially glabrous and costate, adaxially glabrous. *Inflorescences* terminal, subcapitate to congested-cymose, pedunculate, glabrous; peduncle 1–5 cm; flower-bearing portion hemispherical to irregularly subglobose, 1–3 × 1.5–3 cm, unbranched or shortly branched to 1 order, 20– to 140-flowered; bracts reduced or few, ovate, 0.5–1 mm; pedicels 1–2 mm. *Flowers* all pedicellate in cymes of 3– to 7, 5-merous; hypanthium narrowly ellipsoid, c. 1 mm, glabrous; calyx limb 1–1.2 mm, glabrous, denticulate or lobed for up to 1/3 of its length, lobes narrowly triangular, acute; corolla tubular, white, externally glabrous, tube c. 3 mm, c. 1.2 mm diam. near middle, internally glabrous except pilose in throat with white trichomes 1–1.5 mm, lobes narrowly triangular, c. 2.5 mm, acute, adaxially smooth; stamens with filaments c. 1 mm, inserted near top of corolla tube, anthers narrowly oblong, 1–1.2 mm, exerted; style c. 2 mm, stigmas c. 0.8 mm, included. Infructescences similar to congested-cymose or becoming laxer, to 4 × 4 cm. *Fruits* ellipsoid to subglobose, 8–9 × 7–8 mm, glabrous, red, with calyx often enlarging, to 2 mm; pyrenes hemispherical, adaxially plane, abaxially with c. 6 well developed, rounded, longitudinal ridges; endosperm sparsely ruminate to a moderate depth on all sides.

*Psychotria ambatovensis* is similar to *P. macrochlamys* (Bremek.) A.P. Davis & Govaerts (Taylor, 2020), which differs in its glabrous to sparsely hirtellous stems and leaves, leaf blades with regularly developed acarodomatia, interpetiolar, bilobed, shorter stipules 3–5 mm long, and pedunculate branched inflorescences.

**Paratypes.** — MADAGASCAR. Reg. Alaotra-Mangoro [Prov. Toamasina]: Moramanga, Andasibe, Ambatovy, forêt d’Analamy, 18°49°13’S 48°20°06’E, 3–5.II.2005, Andriatsiferana et al. 2531 (MO, P, TAN); ibid. loco, 18°48°38’S 48°20°41’E, 1151 m, 27.VI.2008, Antilahimena et al. 6408 (MO, P, TAN); ibid. loco, 18°49°35’S 48°20°06’E, 1180 m, 2.II.2005, Razafindishe & Antilahimena 7 (MO, P, TAN); Mantadia National Park, 18°49°03’S 48°26°03’E, 1080 m, 1.III.2011, Razafimandimbison et al. 1095 (MO, S).

**Etymology.** — This distinguished, handsome species has been documented by Mr. Patrice Antilahimena, an exceptionally productive explorer of Madagascar’s flora who has collected more than 11,000 high-quality specimens, and the species epithet honors him.
New species of Psychotria (Rubiaceae) from Madagascar

Fig. 1. – *Psychotria ambatovensis* C.M. Taylor: A. Flowering branch; B. Stem apex with bases of two petioles and stipules in process of dehiscence; C. Hypanthium and calyx limb of flower; D. Corolla at anthesis; E. Fruit; F. Cross-section of pyrene and seed. *Psychotria eumachioides* C.M. Taylor: G. Fruiting branch; H. Stem apex with stipule and basal part of two petioles; I. Portion of stem below leaves with two nodes, stipules (upper node), and stipule scar (lower node); J. Portion of inflorescence with three flowers from which corollas have fallen and one flower at anthesis; K. Cross-section of pyrene and seed. *Psychotria notopleuroides* C.M. Taylor: L. Flowering stem and part of basal prostrate stem; M. Portion of inflorescence with two flower buds and one flower at anthesis; N. Cross-section of pyrene and seed.

[A–D: Andriamiarinoro 164; E–F: Antilahimena 6408; G, K: Rabehevitra 1059; H–J: De Block 1172; L: Schatz et al. 3666; M: Labat & Andrianjafy 3377; N: Zijra & Hutcheon 378]
Habitat, distribution and phenology. – Psychotria antilahimenae has been collected in perhumid evergreen forest at 0–600 m on the Masoala Peninsula in northeastern Madagascar (Antsiranana, Toamasina), with flowers in February, October, and November and with fruits in April through July.

Conservation status. – Psychotria antilahimenae is known from 11 specimen collections representing nine unique occurrences in perhumid evergreen forest. The EOO of the species is 2,407 km², within the limits for “Endangered” under IUCN Red List Criterion B1; and the AOO is 32 km², also within the limits for “Endangered” under Criterion B2 (IUCN, 2012). One occurrence is within the well-protected Masoala PA, two occurrences are within Nosy Mangabe PA, and the other six occurrences are in unprotected areas adjoining but distinctly outside Masoala PA and Makira PA. Forested areas without formal protection in the vicinity of Masoala PA and Makira PA are subject to degradation by small-scale slash and burn agriculture and mineral exploitation (Goodman et al., 2018).

Six locations (sensu IUCN, 2012) can be defined relative to the known threats: the one collection site within Masoala PA; the two collection sites within Nosy Mangabe PA; the three collection sites near Ambanizana just west of Masoala PA; and one location for each of the collection sites to the northeast and northwest of Masoala PA and near the east edge of Makira PA. With six locations, given general habitat degradation in unprotected sites and with no reason to assume that any of the unprotected sites is more likely to disappear than the others, the Red List status of P. antilahimenae is assessed as “Vulnerable” [VU B1ab(iii)+2ab(iii)].

Notes. – Psychotria antilahimenae is characterized by its unbranched or little-branched habit with well developed, subesissile to shortly petiolate, obovate leaves; pedunculate, subcapitate to shortly cymose inflorescences; five-merous flowers; somewhat short, subtruncate to dentate calyx limbs; short white corollas; red fruits; abaxially ridged pyrenes; and endosperm that is ruminate on all surfaces. The habit of this species is found in only a small percentage of Psychotria species worldwide, and has sometimes been called a “trash bucket” habit due to the detritus that is accumulated along the stems by the closely set leaves. No adventitious roots were seen along the stems in the specimens studied here, but these are sometimes found growing into the accumulated detritus in other “trash bucket” species. The inflorescences and infructescences are terminal on all the specimens studied, but one well developed axillary bud subtends the infructescence of one collection (Zjbra & Hutcheon 318): the unbranched stem may at least sometimes continue its growth from this position, so the plants may be able to flower and fruit more than once. In contrast, another specimen (Zjbra & Hutcheon 174) bears two peduncles from the stem apex, so some plants may have determinate stems, or be able to branch. The flowers are described on one collection (Lowry et al. 4243) as having an “unpleasant odor suggesting fly pollination”; however, the flowers have showy (though small), bright white corollas with barbate throats and exerted anthers that are not usually suggested to be correlated with fly-pollination. The few flowers seen agree with the short-styled form of distylos Psychotria species, but whether this species is distylos is not yet known. The flowers are pedicellate at anthesis but usually borne in short congested groups, then later the inflorescence axes develop and the fruits become separated from each other as they mature. Psychotria antilahimenae agrees with Bremekamp (1963)'s Mapouria Group VI.

Psychotria antilahimenae is similar to P. simianensis, the only other Psychotria species known so far from Madagascar with a monopodial, “trash-bucket” habit. Psychotria simianensis can be separated by its dried leaves with regularly reticulated tertiary venation that is prominent on both leaf surfaces, 6- or 7-merous flowers, shorter calyx limbs c. 0.5 mm long, and yellow corollas. In the classification used here, P. simianensis includes only plants that agree with these particular characteristics, and is now only documented from the area of Mananara on Madagascar’s mainland. This circumscription of P. simianensis includes plants that match the type of that species, but excludes additional specimens that have been subsequently identified as this species but do not match it (Taylor, in prep.).

Paratypi. – Madagascar. Reg. Analamizana [Prov. Antsiranana]: Maroantsetra, Anjahana, Ambaniza, 15°38’03”S 49°57’30”E, 600 m, V.1993, Zjbra & Hutcheon 318 (K, MO); Antsirabe Sahatany, Anjahely, 15°34’16”S 49°24’16”E, 393 m, 27.V.2004, Antilahimena 2583 (MO, P, TAN); hills E of village of Sahavary; up Andranofotsy riv. from Maroantsetra, [15°19’S 49°52’E], 300 m, 24.X.1986, Lowery et al. 4243 (K, MO); Masoala Peninsula, W of Ambihotralana forest near Sahafary, 15°16’50”22’’E, 75 m, 19.IV.1997, McPherson 17105 (MO); ibid. loco, Antalaviso, following coastal path leading toward headwaters of Sahafotra River (Ravim Bé swamp), S, 15°16’50”01’’E, 25 m, 17.IV.1997, Nicoll et al. 563 (K, MO); RS Nosy Mangabe, 15°30’49”47’’E, 215 m, 22.IV.1997, Nicoll & Schwarz 597 (K, MO); ibid. loco, 15°30’49”46’’E, 0–330 m, 6–8.V.1998, Schatz et al. 2374 (K, MO). Reg. SavA [Prov. Antsiranana]: Masoala Peninsula, forest surrounding research station at Andondrabe on W coast, 15°39’30”S 49°57’30”E, 0–600 m, 19.II.1992, Zjbra & Hutcheon 174 (MO).

Psychotria birkinshawiana C.M. Taylor, sp. nov. (Fig. 3A–E).

Holotypus: MADAGASCAR. Reg. Analamizana [Prov. Toamasina]: Maroantsetra, hills E of village of Sahavary, up Andranofotsy River from Maroantsetra, along trail toward headwaters of Sahafotra River (Ravin Bé swamp), [15°19’S 49°52’E], 300 m, 24.X.1986, Lowery et al. 4248 (MO-3436895!; iso-: K, MO; TAN).

Psychotria birkinshawiana differs from P. nossibensis A.P. Davis & Govaerts and P. humblotii (Bremek.) A.P. Davis & Govaerts by its shorter calyx limbs, smaller corollas, and smaller fruits.
Fig. 2. – *Psychotria antilahimenae* C.M. Taylor: **A.** Flowering branch; **B.** Flower bud; **C.** Corolla at anthesis; **D.** Fruit; **E.** Cross-section of pyrene and seed.

*Psychotria davisiana* C.M. Taylor: **F.** Flowering branch; **G.** Stem apex with bases of two leaves and a stipule;

**H.** Stem apex with bases of two petioles, one stipule, and one flower at anthesis; **I.** Fruit; **J.** Cross-section of pyrene and seed.

[A–C: Schatz 1619; D–E: Schatz et al. 2374; F–G: Randrianasolo et al. 511 (isotype); H: Randrianaivo et al. 511 (holotype); I–J: Miandramana 398]
Small trees, collected in flower and fruit variably at 4–9 m tall, branched; stems flattened when young quickly becoming suberete, smooth, glabrous, at apex sometimes with shiny exudate on stipules and young leaves. Leaves opposite; petiole 0.5–2.5 cm, glabrous; blade obovate to oblanceolate or narrowly elliptic, 4.5–15 × 1.8–7.5 cm, at base acute to cuneate, at apex obtuse to rounded or truncate, drying chartaceous, on both surfaces glabrous; secondary veins 8 to 28 pairs, looping to obtuse to rounded or truncate, drying chartaceous, on both surfaces glabrous; adaxially densely sericeous to strigose with silky trichomes 1–2 mm. Inflorescences terminal, cymose, subsericeous (i.e., apparently fasciculate), glabrous or with patches of sericeous trichomes 1–2 mm at nodes; peduncle reduced, represented by a leafless node with reduced stipule borne immediately above distalmost leaf-bearing node of stem; flower-bearing portion corymbose, 2–3 × 2–4 cm, branched to 1- or 2 orders, c. 25– to 70-flowered; bracts triangular, 0.2–0.5 mm, adaxially sericeous with trichomes 1–2 mm. Flowers all subsericeous in clusters of 5 to 7, subtended by sericeous trichomes 1–2.5 mm, 5-merous; hypotrichous obconic, 1.2–1.5 mm, glabrous; calyx limb 1.5–2.2 mm, glabrous, truncate to irregularly subtruncate; corolla salverform, yellow, externally glabrous, tube cylindrical to weakly funnel-form, 2.5–3 mm, 1–1.2 mm diam. near middle, internally densely tomentulose-pilosulous with white trichomes 0.5–1 mm in a zone just above middle of tube but not extending into throat, lobes narrowly triangular, c. 2 mm, acute, fleshy, adaxially shortly galeate, abaxially with rounded to conical low thickening near tip; stamens with filaments c. 1 mm, inserted below top of corolla tube, anthers narrowly oblong, c. 1 mm, positioned with tips in corolla throat; style c. 3.5 mm, stigmas c. 1 mm, included. Inflorescences similar to inflorescences or becoming laxer, to 4 × 8 cm. Fruits subglobose, 10–15 mm diam., glabrous, yellowish orange; pyrene hemispherical, adaxially plane, abaxially smooth; endosperm densely and deeply ruminate on all sides.

**Etymology.** – The epithet of this very tall, apparently mammal-dispersed new species honors Dr. Christopher R. Birkinshaw, a lemur biologist who has contributed extensively to conservation in Madagascar.

**Habitat, distribution and phenology.** – Psychotria birkinshawiana has been collected in perhumid evergreen forest at 0–400 m, sometimes on sandy soils, on the Masoala Peninsula (Antsiranana, Toamasina), with flowers in October and with well-developed fruits in February, April-August, October, and November.

**Conservation status.** – Psychotria birkinshawiana is known from 23 specimen collections representing 19 unique occurrences in perhumid evergreen forest at 0–400 m elevation. The EOO of the species is 7,290 km², within the limits for “Vulnerable” under IUCN Red List Criterion B1; and the AOO is 68 km², within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Four of the 19 occurrences are within the well-protected Masoala PA. The remaining fifteen occurrences are in unprotected areas. Two of the collection sites have degraded or disturbed forest habitats. Forested areas without formal protection in the vicinity of Masoala PA are subject to degradation by small-scale slash and burn agriculture and resource exploitation, including logging, hunting and mining (Goodman et al., 2018). Five collection sites indicate watershed/headwaters/river basin drainages as habitat; two sites have coastal habitat. The four occurrences within Masoala PA can be counted as one protected location (sensu IUCN, 2012, 2019), and the remaining, unprotected occurrences can be grouped into nine additional locations based on geographic clustering relative to the scale of threats, some of them at high risk for further disturbance and exploitation due to their water resources. With ten locations and given general habitat degradation in unprotected sites, the sensitive nature of watershed areas, and no reason to assume that any of the unprotected sites is more likely to disappear than the others, the Red List status of P. birkinshawiana is assessed as “Vulnerable” [VU Blab(iii)+2ab(iii)].

**Notes.** – Psychotria birkinshawiana can be recognized by the combination of its robust habit; medium-sized, glabrous, obovate leaf blades that are obtuse to rounded at the apex; triangular, broadly angled stipules; rather short, cymose, terminal inflorescences with patches or tufts of dense sericeous pubescence along the axes and adaxially on the bracts; subsericeous flowers with truncate calyx limbs; short yellow corollas; relatively well developed, yellow to orange fruits; and seeds with the endosperm densely ruminate on all sides. This species is notable in Malagasy Psychotria for its robust size. The leaves appear to be fleshy or rather succulent in life. The few flowers seen agree with the short-styled form of distylous Psychotria species, but whether this species is distylous is not yet known. The fruits are relatively large for Psychotria and appear on dried material to be fleshy rather than juicy, and their form suggests they may be eaten by lemurs (C. Birkinshaw, pers. comm.); whether these could be bird-dispersed has not been investigated. No ecological documentation is available for P. birkinshawiana, so its dispersers are only postulated here. Psychotria birkinshawiana agrees with Breneck (1963)’s Mapouria Group III, which comprises species with a similar general aspect and relatively large fleshy fruits. The fruits of P. birkinshawiana range to a smaller size than Breneck gave for that group, which he diagnosed as having fruits 15–20 mm in diameter, but its largest fruits and other features agree with that group.
Fig. 3. – Psychotria birkinshawiana C.M. Taylor: A. Flowering branch; B. Infructescences with bases of two lateral stems; C. Portion of inflorescence with four flower buds; D. Corolla at anthesis; E. Cross-section of pyrene and seed. Psychotria razafimandimbisonii C.M. Taylor: F. Flowering branch; G. Stem node with bases of two petioles and one stipule; H. Portion of inflorescence with one flower from which corolla has fallen, one flower bud, and one flower at anthesis; I. Cross-section of pyrene and seed. [A: Lowry et al. 4248; B, E: Ralimanana 1209; C–D: Bernard 1675; F: Rakotovao & Randriantatofika 1011; G: Rakotovao 957; H: Daniel 9098; I: Overdorff 39]
Psychotria birkinshawiana is similar to *P. megalocarpa* (Bremek.) A.P. Davis & Govaerts, and *P. hibrida* both of which are also found in eastern Madagascar. These others are only known from south of the range of *P. birkinshawiana*, however, and differ in their larger calyx limbs, 3–5 mm long; larger corollas, with the tube c. 8 mm long and lobes 4–5 mm long; and generally larger fruits, 15–20 mm in diameter, that may be green at maturity. *Psychotria birkinshawiana* is also similar to *P. nosisibensis* A.P. Davis & Govaerts, which is found in northwestern Madagascar and has flowers and fruits that are similar in size and color to those of *P. megalocarpa*. *Psychotria birkinshawiana* is also similar to *P. mangorensis* (Bremek.) A.P. Davis & Govaerts, and *P. birkinshawiana* are only known from south of the range of *P. birkinshawiana*, and possibly only on white sand soils. *Psychotria mangorensis* can be separated from all of these other species by its generally smaller fruits, 6–9 mm in diameter, that turn white as they mature then blue at maturity and its endosperm that is only radially adaxial. 

Paratypes. – MADAGASCAR. Reg. Analanjirofo [Prov. Toamasina]: Maroantsetra, Anjahana, Ambanizana, 15°38’12”S 49°58’15”E, 120 m, 10.VI.2002, Antilahimena & Arida 1073 (MO, TAN); Andranofotsy, 15°25’10”S 49°57’30”E, 600 m, VI.1993, McPherson et al. 17567 (K, MO, TAN); Tampolo, 15°43’57”S 49°57’05”E, 0–5 m, 31.X.1992, Schatz & Zijhuis 3376 (MO); Andranobe, vicinity of Peregrine forest, 15°41’39”S 49°57’00”E, 250 m, 14.VII.1999, Vasey & Behnke 46 (MO, P, TEF); ibid. loco, Vasey & Velo 346 (MO, P, TAN); ibid. loco, Vasey & Velo 347 (MO); Ambanizana, 15°39’30”S 49°57’30”E, 600 m, VI.1993, Zijhuis & Hutcheson 322 (K, MO); Andranobe, Camp Be-dinta, 15°39’30”S 49°57’30”E, 550–600 m, VII.1993, Zijhuis & Hutcheson 509 (K, MO). Reg. SAVA [Prov. Antsiranana]: Masoala PN, à 22 km de la ville de Mananara, sur la route d’Ifasina, 15°41’50”S 49°57’30”E, 0–200 m, 1.II.1996, Aridy & Rabajosa 102 (MO, P, TEF); Antalaha, à 21 km du village de Sahamalaza, sur la route de Vakonina, Vinanvao, 15°48’50”S 49°57’10”E, 10–15 m, 15–16.II.1996, Aridy & Meias 138 (MO, P, TEF); c. 10 km au S de Sahafy, à 3 km W du nez de Sahalampona, 15°23’S 50°22’E, 100–200 m, 5.V.1995, Bernard 108 (MO, P, TAN); Ampanoanena, Antalaha, Sananijika, 15°43’33”S 50°13’30”E, 12–100 m, 2.II.1996, Bernard et al. 150 (MO, P, TAN); Ankavà, Mantazanina, Ambalavà, 15°20’10”S 50°14’07”E, 76 m, 20.X.2010, Bernard & Ndrano 1673 (K, MO, P, TAN).

**Psychotria davisonii** C.M. Taylor, sp. nov. (Fig. 2F–J, 4).

**Holotypos.** MADAGASCAR. Reg. Analamanga [Prov. Antananarivo]: Anjorozobera, Betatao, forêt de Vohitralongo, rte Antozorobe-Ambondrazaka, à 30 km au NE de Betatao, 18’04’07”S 47°58’41”E, 950–1093 m, 8.III.2000, Randrianaivo et al. 511 (MO-6071774!; iso-: BR, G [G00341940], K, MO-6146891!, P, TAN).

*Psychotria davisonii* C.M. Taylor is distinguished from *P. hoplanta* Bremek. by its larger leaf blades with acarodiumata, often shortly pedicellate flowers, longer calyx limbs, longer corollas, and endosperm that is at least shallowerly ruminate on both abaxial and adaxial surfaces.

Shrubs and small trees, collected in flower and fruit variously at 1–4 m tall, much-branched, with well developed main stems bearing numerous branched lateral stems; stems weakly flattened when young becoming subterete, densely hirtellous to hirsute with trichomes 0.2–0.5 mm, pubescent deciduous with age. Leaves opposite; petiole 0.1–0.5 cm, glabrous; blade oblanceolate to elliptic, 0.6–4.5 × 0.5–2 cm, at base cuneate to acute, at apex obtuse to acute or weakly acuminate with tip to 2 mm, drying papyraceous to chartaceous, on both surfaces glabrous; secondary veins 4 to 10 pairs, looping to interconnect near margins, usually with regularly developed small domatia comprising a pit and/or a tuft of strigose trichomes 0.1–0.3 mm, usually with 1 intersecondary vein present between pairs of secondary veins, adaxially costa thickened to prominent, secondary veins plane to thickened, remaining venation plane, abaxially costa prominent, secondary and tertiary veins plane to prominent, and remaining venation not visible. Stipules interpetiolar, caducous, abaxially and marginally densely hirsute to hirtellous with trichomes 0.2–0.5 mm, adaxially glabrous in upper part and densely strigillose in lower part with trichomes 0.1–0.2 mm, oblong to pandurate in outline, 1.2–7 mm, lobed for ¼–½ their length, basal portion (i.e., below lobes) lunate to triangular or ovate, lobes lanceolate to narrowly triangular or linear, acute, erect when young then spreading laterally with age. Infructescences terminal, reduced from a cyme to 1-flowered or shortly cymose and 2–3-flowered, enclosed by 1 pair of persistent stipules; bracts apparently reduced; pedicels 0.1–1 mm. Flowers variously sub sessile to pedicellate, 5-merous, distylous; hyp santum obconical to cylindrical, c. 1 mm, glabrous to densely hirtellous with trichomes 0.3–0.5 mm; calyx limb abaxially and adaxially glabrous, tubular portion 1–2 mm, lobes narrowly lanceolate to narrowly triangular or linear, acute, erect when young then spreading laterally with age. Inflorescences terminal, reduced from a cyme to 1-flowered or shortly cymose and 2–3-flowered, enclosed by 1 pair of persistent stipules; bracts apparently reduced; pedicels 0.1–1 mm. Flowers variously sub sessile to pedicellate, 5-merous, distylous; hyp santum obconical to cylindrical, c. 1 mm, glabrous to densely hirtellous with trichomes 0.3–0.5 mm; calyx limb abaxially and adaxially glabrous, tubular portion 1–2 mm, lobes narrowly lanceolate to narrowly triangular, 1–2.5 mm, acute to obtuse or rounded, marginally ciliate; corolla salverform, yellow, externally glabrous, tube cylindrical, 5–8 mm, 1.2–1.5 mm diam. near middle, internally glabrous except densely pilosulous at stamen insertion in upper part of tube, lobes triangular, 2–2.5 mm, acute, adaxially plane (i.e., not galeate), abaxially with conical thickening 0.5–1 mm near tip; stamens in short-styled form with filaments 2–2.5 mm, inserted in upper part of corolla tube, anthers c. 1.2 mm, exerted, in long-styled form not seen; style in short-styled form c. 3 mm with stigmas c. 1 mm, included, in long-styled form c. 7.5 mm with stigmas c. 1 mm, exerted. Infructescences similar to inflorescences. Fruits subglobose, c. 5 mm diam., sparsely hirtellous to glabrous, red, apparently...
juicy; pyrenes 2, hemispherical, adaxially plane, abaxially smooth to weakly irregularly ridged or wrinkled; endosperm adaxially sparsely but deeply ruminate, abaxially sparsely shallowly ruminate.

**Etymology.** – The epithet of this species honors Dr. Aaron Davis, a Rubiaceae specialist who has documented and studied Malagasy *Psychotria* (Davis et al., 2007).

**Habitat, distribution and phenology.** – *Psychotria davisiana* has been collected in humid, usually dense evergreen forest at 950–1342 m in central eastern Madagascar, and reportedly is often locally common. It has been collected with flowers in February, March, May, and June, and with ripe fruits in July and October.

**Conservation status.** – *Psychotria davisiana* is known from 19 specimen collections representing 19 unique occurrences in humid, usually dense evergreen forest at 950–1342 m elevation. The EOO of the species is 2,705 km², within the limits for “Endangered” under IUCN Red List Criterion B1; and the AOO is 44 km², also within the limits for “Endangered” under Criterion B2 (IUCN, 2012). One occurrence is within the protected Anjozorobe Angavo forest corridor, one of the last vestiges of natural forests in Madagascar central highlands. The other 18 occurrences are in unprotected areas, one to the north and 17 to the south of the protected area. Forested areas without formal protection in the vicinity of Anjozorobe Angavo are subject to degradation by small-scale slash and burn agriculture and fire to create habitat for cattle farming (Goodman et al., 2018). The one occurrence to the north of Anjozorobe Angavo (at Vohitralongo Forest) constitutes one location (sensu IUCN, 2012) with respect to the known threats; the one within the protected area is a second location; the two isolated occurrences to the south constitute one location each; and the 15 collection sites from the Moramanga area, the site of a long-standing nickel mining operation, are a fifth location. Given the nature of three of the locations with general habitat degradation in unprotected sites and the remaining location in close proximity to on-going mining operations, causing a decline in AOO and number of mature individuals, the Red List status of *P. davisiana* is assessed as “Endangered” [EN B1ab(ii,iii,v)+2ab(ii,iii,v)].

**Notes.** – *Psychotria davisiana* is characterized by its stems with smooth internodes and hirtellous pubescence; relatively small, obovate, abaxially glabrous leaves with small crypt-type domatia; hirtellous, rather small, caducous stipules that are bilobed for ¼–¼ of their length; terminal, subsessile to shortly pedunculate, solitary to three flowers subtended by a pair of persistent stipules; rather well developed, deeply lobed calyx limbs; medium-sized yellow corollas with the lobes abaxially bearing a conical projection; medium-sized red fruits; pyrenes that are smooth abaxially; and endosperm that is ruminate both abaxially and adaxially. The specimens seen dried brownish green or dark brown, with the dried trichomes dark reddish brown. *Psychotria davisiana* has a distinctive branching arrangement, with leafless principal stems bearing smaller, ascending, branched stems that do bear leaves. The acarodoma-tia are relatively small, and only one or two are developed on some leaves so these can be overlooked. On flowering branches, most of the stems bear inflorescences but few flowers are open at any time. Few long-styled flowers have been seen, and these were not dissected in order to preserve them. The style length is presented here following Bremekamp (1963)’s format and based on one flower, but it probably varies with corolla size to position the stigmas just above the top of the corolla tube. This is one of several *Psychotria* species with relatively small leaves and the flowers borne singly or in small groups at the stem apices; only five such species were treated by Bremekamp, but this habit and flower presentation are now known from more species of *Psychotria* as well as some very similar species of *Gaertnera* Lam. (Malcomber & Taylor, 2009). *Psychotria davisiana* agrees with Bremekamp's *Mapouria*.
Psychotria eumachioides differs from $P.$ rubropedicellata (Bremek.) Razafim. & B. Bremer by its stems that become yellowed and indurated with age, narrower ob lanceolate leaves that lack domatia, and shorter inflorescences.

Shrubs, at least sometimes apparently deciduous, collected in flower and fruit variously at 1.5–2 m tall, branched with lateral stems usually comprising 5 to 10 nodes separated by reduced internodes; stems glabrous, weakly flattened becoming subterete, with bark often becoming yellowed or brown and thickened with age. Leaves opposite; pediole 4–28 mm, glabrous or moderately to densely puberulous or pilosulous with trichomes 0.1–0.3 mm; blade ob lanceolate, 2.8–9 × 0.5–3.2 cm, at base tapered and acute, at apex broadly obtuse to rounded, drying papyraceous, on both surfaces glabrous or moderately puberulous to pilosulous with trichomes 0.1–0.3 mm; secondary veins 7 to 12 pairs, weakly looping to interconnect or reticulating near margins, without domatia, without intersecondary veins, adaxially venation plane or costa thinly impressed, secondary veins thickened, and remaining venation not evident. Stipules interpetiolar or shortly fused around stem, deciduous leaving thickened scar, ovate to triangular, 3–5 mm, abaxially glabrous or moderately pilosulous with trichomes 0.1–0.3 mm, adaxially sparingly pilosulous with trichomes 0.1–0.3 mm, acute to acuminate, at tip sometimes glandular or bifid with lobes 0.2–0.5 mm.

Infl orescences terminal, cymose, pedunculate, sparingly to moderately pilosulous with trichomes 0.1–0.3 mm; peduncle 0.5–1 cm; flower-bearing portion rounded-corymbiform, 1.5 × 1–2 cm, branched to 1 or 2 orders, c. 10–25 flowered; bracts reduced or usually triangular, 0.1–0.5 mm, acute; pedicels 1–1.5 mm. Flowers all pedicellate in umbelliform groups of 5 to 7, 5-merous; hypanthium cylindrical to ellipsoid, c. 0.8 mm, moderately pilosulous with trichomes 0.1–0.3 mm, calyx limb c. 0.8 mm, externally moderately to sparsely pilosulous with trichomes 0.1–0.3 mm, lobed for $\frac{1}{2}–\frac{1}{2}$ of its length, lobes ovate, acute to shortly acuminate; corolla funnel-form, yellow, externally sparingly pilosulous with trichomes 0.1–0.3 mm, tube c. 3 mm, c. 1.2 mm diam. near middle, internally glabrous except densely hirtellous in upper part of tube, lobes narrowly triangular, c. 2 mm, adaxially galeate, abaxially with rounded thickening near tip; stamens with filaments c. 1.5 mm, inserted in upper part of corolla tube, anthers c. 1.2 mm, exerted; style c. 2 mm, stigmas c. 0.8 mm, included and positioned above pubescent internal ring of corolla tube. Inflorescences similar to inflorescences except sometimes displaced to pseudoaxillary by subsequent stem growth from an axillary bud, and with axes elongating and deciduous as fruits fail to develop or fall off; pedicels elongating, to 6 mm.
becoming fleshy. Fruits didymous, c. 5 × 8 mm, glabrous, juicy, orange to red; pyrenes subglobose, abaxially smooth, adaxially plane; endosperm abaxially entire (i.e., not ruminate), adaxially with a few deep ruminations.

Etymology. – The species epithet refers to the similarity of this new species to some species of Eumachia, as discussed below. Eumachia has been commonly confused with Psychotria but these are not closely related (TAYLOR et al., 2017). Eumachia differs from Psychotria in its stipules that are generally persistent and have one or two gland-tipped lobes, a lack of persistent collaters at the stipule insertion, and molecular sequences that indicate its relationships are in another tribe, Palicoureeae.

Habitat, distribution and phenology. – Psychotria eumachioides has been collected in gallery forest in subhumid or dry bioclimatic zones (CORNET, 1974), from near sea level to c. 40 m in northwestern Madagascar (Antsiranana), variously in littoral has been collected in gallery forest in subhumid or dry bioclimatic zones. It has been collected with flowers in January, and with fruits in February and May.

Conservation status. – Psychotria eumachioides is known from four specimen collections representing four unique occurrences in gallery forest in subhumid or dry bioclimatic zones at 0–40 m elevation. The EOO of the species is 896 km², within the limits for “Endangered” under IUCN Red List Criterion B1; and the AOO is 12 km², also within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Two occurrences are within the generally well-protected Loky-Manambato PA, though there are reports of some artisanal gold mining within the protected area (C. Birkinshaw, pers. comm.). A third occurrence is near the northern boundary of, but distinctly outside, Analamerana PA, and the remaining occurrence is not in a formally recognized protected area, although the label indicates “forêt d’Ambondrabe”. Forested areas without formal protection in the vicinity of Loky-Manambato PA are subject to degradation by small-scale slash and burn agriculture and resource exploitation including logging, hunting and mining (GOODMAN et al., 2018). The northernmost collection site outside Analamerana PA is stated to be in dry, semi-deciduous, very degraded forest, and it constitutes one “location” (sensu IUCN, 2012) with respect to the known threats. This is the northernmost location and its disappearance would significantly reduce both EOO and AOO.

Notes. – Psychotria eumachioides is characterized by its stems with shortened internodes and an epidermis that often becomes yellowed and indurated with age; medium-sized oblanceolate leaves that are obtruse to rounded at the apex and lack domatia; triangular to ovate, acute, medium-sized stipules that are deciduous and leave a thickened scar; corymbiform several-flowered inflorescences that are overtopped by the leaves; flowers that are pedicellate in umbelliform cymes; developed calyx limbs; somewhat small yellow corollas; orange to red fruits borne on thickened pedicels; smooth subglobose pyrenes; and endosperm with several adaxial ruminations. The plants dry with a generally green color. The dried trichomes are mostly white, though some trichomes on old stipules turned brown. The stems do have developed internodes but these are quite short, so the growth pattern can almost be considered a brachyblast and its arrangement is accentuated by thickened petiole and stipule scars. This growth pattern may be related to the habitat of this species, which lives in relatively dry areas and is apparently deciduous. Psychotria eumachioides appears to produce flowers and new leaves together, then the fruit and stem development proceed concurrently. The few flowers seen resemble the short-styled form of distylos Psychotria species, but whether this species is distylos is not yet known. A fruiting specimen is chosen as the type because most of characters that diagnose this new species are in the fruits and seeds. Psychotria eumachioides agrees with BREMEKAMP (1963)’s Mapouria, and keys there to either Group VI or Group V but does not fully agree with either. It agrees with Group IV in its lack of domatia, but differs in its fruits that are not blue or white at maturity; it agrees with Group V in its yellow to red fruits, but differs in its lack of domatia and entire stipules.

Psychotria eumachioides is similar to P. rubropedicellata, which has stems with regularly developed, elongated internodes, larger leaf blades 6.5–16 × 2–10 cm with pilosulous domatia and tips that are sharply obtuse to acute, stipules with two linear lobes, often larger inflorescences 2–7 cm long, and usually longer fruiting pedicels, 5–12 mm long, that become fleshy and red.

Paratypes. – MADAGASCAR. Reg. Sava [Prov. Antsiranana]: Analamera, bank of Irodo riv., side of Irodo village, 12°40’25”S 49°32’40”E, 41 m, 10.I.2002, De Block et al. 1172 (BR, MO, P, TAN); Nosy Be, au bord du lac Sahaka, forêt d’Analabe, 13°04’43”S 49°54’04”E, 2.II.2003, Rabevohitra et al. 4463 (MO, TEF); ibid. loco, 13°04’43”S 49°54’04”E, 13.V.2003, Rasazamalala et al. 1272 (MO, P, TEF).

Psychotria bamifera C.M. Taylor, sp. nov. (Fig. 5A–E).

Holotypus: MADAGASCAR. Reg. Analanjififo [Prov. Toamasina]: Maroantsetra, Ambinanitero, Marovovonana, nearest village Ambatofotsy, Mangabe forest, 15°17’54”S 49°29’15”E, 690 m, 30.VIII.2004, Antilahimena 2657 (MO-6877030!; iso-: G [G00341935], P, TAN).

Psychotria eumachioides C.M. Taylor, sp. nov. (Fig. 5A–E).

Holotypus: MADAGASCAR. Reg. Analanjififo [Prov. Toamasina]: Maroantsetra, Ambinanitero, Marovovonana, nearest village Ambatofotsy, Mangabe forest, 15°17’54”S 49°29’15”E, 690 m, 30.VIII.2004, Antilahimena 2657 (MO-6877030!; iso-: G [G00341935], P, TAN).
Psychotria hamifera C.M. Taylor is distinguished from other Psychotria species in Madagascar by its the combination of the cupuliform shape and length, 20–25 mm long, of the stipules.

shrubs and small trees, collected in flower and fruit variously at 2.5–6 m tall, branched; stems stout, weakly flattened becoming subterete, glabrous. leaves opposite; petiole 2.5–5 cm, glabrous; blade obovate, 12.5–30 × 5–15 cm, at base tapered and acute, at apex obtuse to rounded or truncate and shortly acuminate with delate tip 2–5 mm, drying papyraceous, on both surfaces glabrous; secondary veins; pedicel to 0.5 cm; bracts triangular and 0.1–0.5 mm or reduced and represented by a tuft of hirtellous trichomes on basal smooth portion with trichomes 1–3 mm, with upper portions of tube densely longitudinally venose or fibrous and this visible on one or both sides depending on age and preservation of the stipule. Inflorescences terminal, branched, glabrous, subsessile to shortly pedunculate; peduncle to 0.5 cm; branched portion rounded-corymbiform, c. 6 × 6 cm, branched to 2 or 3 orders, c. 35–50-flowered; bracts triangular and 0.1–0.5 mm or reduced and represented by a tuft of hirtellous trichomes 0.2–0.5 mm; pedicels 2–5 mm. Flowers all pedicellate in umbel-like cymes of 5 to 7, 5–6-merous; hypanthium obconic, c. 2 mm, glabrous; calyx limb 5–7 mm, glabrous, fleshy, lobed for c. ⅜ of its length, lobes narrowly triangular, acute; corolla salverform, orange, fleshy, externally glabrous, tube 5–6 mm, cylindrical, c. 3 mm diam. near middle, internally glabrous except densely pilose in throat with tichomes 2–3 mm, lobes narrowly ligulate to triangular, 3–4 mm, obtuse, adaxially shortly galeate, abaxially with conical thickening c. 1 mm; stamens with filaments c. 1 mm, inserted in upper part of corolla tube, anthers c. 1.5 mm, exserted; style c. 2 mm, stigmas c. 1.5 mm, included and positioned below ring of corolla pubescence. Inflorescences similar to inflorescences or becoming laxer, with pedicels to 8 mm. Fruits ellipsoid, 12–15 × 7–10 mm, glabrous, orange, texture unknown; pyrenes hemispherical, abaxially with 5 or 6 low, rounded to angled ridges, adaxially glabrous; endosperm densely ruminate on all surfaces.

etymology. – The stipules of this new species resemble buckets or pails, and its species epithet refers to this feature.

habitat, distribution and phenology. – Psychotria hamifera has been collected in perhumid evergreen forest at 383–861 m on the Masoala Peninsula and nearby eastern escarpment of Madagascar (Antsiranana, Toamasina), with flowers in December and with well-developed fruits in January, February, May, July, and August.

conservation status. – Psychotria hamifera is known from six specimen collections representing six unique occurrences in perhumid evergreen forest at 383–861 m elevation. The EOO of the species is 889 km², within the limits for “Endangered” under IUCN Red List Criterion B1; and the AOO is 24 km², also within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Three occurrences are within the generally well-protected Makira PA, and one occurrence is within Mosaola PA. The coordinates of its remaining two collection sites map outside Makira PA, but one of them (Davis et al. 4534) has label data indicating that it is inside Makira PA in an area where “minimal disturbance”. The interiors of the reserves are well protected but parts close to villages are seriously impacted by exploitation of timber and, to a lesser extent, shifting cultivation (C. Birkinshaw, pers. comm.). Forested areas without formal protection in the vicinity of Mosaola PA and Makira PA are subject to degradation by small-scale slash and burn agriculture and mineral exploitation (GOODMAN et al., 2018). The one occurrence definitely outside Makira PA constitutes one location (sensu IUCN, 2012) with respect to the known threats; and the occurrences within each protected area constitute a location each for a total of three locations. With one location subject to general habitat degradation and the remaining two locations in protected areas, the Red List status of P. hamifera is assessed as “Endangered” [EN B1ab(iii)+2ab(iii)].

notes. – Psychotria hamifera is characterized by its robust leaves with obovate blades that are obtuse to rounded or truncate and shortly acuminate at the tip; unusual, large, persistent, tubular stipules; cyme, subsessile to shortly pedunculate inflorescences with pedicellate flowers; well-developed truncate calyx limbs; orange, somewhat large corollas; well-developed fruits that become orange; and endosperm that is densely ruminate on all sides. The dried specimens seen have a strong reddish brown color. The stipules are distinctive in Psychotria in the combination of their tubular, funnel- or skirt-shaped form, persistence, and relatively large size; among the previously known species of Psychotria, they are similar only to those of P. retusa (Bremek.) A.P. Davis & Govaerts, another endemic Malagasy species. These stipules are also similar to those of P. palifera, which is newly described below. The inflorescences have relatively short axes and flowers that are rather closely grouped at anthesis, but the axes and pedicels elongate as the fruits develop so the inflorescences are quite lax. The calyx limbs are apparently fleshy, and enclose the corollas
Fig. 5. – Psychotria hamifera C.M. Taylor: A. Fruiting branch; B. Stipule at stem apex; C. Hypanthium and calyx limb of flower; D. Corolla at anthesis; E. Cross-section of pyrene and seed. Psychotria palifera C.M. Taylor: F. Fruiting branch; G. Stem apex with bases of two petioles and young stipules; H. Stem apex with bases of two petioles and older stipules; I. Portion of inflorescence with two flowers from which corollas have fallen and one flower bud; J. Corolla at anthesis; K. Cross-section of pyrene and seed. [A: Antilahimena 1778; B–D: Antilahimena 1594; E: Antilahimena 2657; F, K: Andrianjafy 368; G: Rasoandriana 169; H: Andrianjafy 371; I–J: Croat 32639]
near margins or sometimes looping weakly to interconnect near margins, without intermediate veins or more often with 1 weak intermediate vein present between pairs of secondary veins, sometimes with a distinct dense tuft of pubescence in abaxial axils of secondary veins, adaxially venation plane or costa thickened, abaxially costa and secondary veins prominent, intermediate and loosely reticulated tertiary and quaternary venation plane to prominent, and remaining venation plane.

*Stipules* interpetiolar, caducous, on both surfaces moderately to densely pilosulous or hirtellous with trichomes c. 1 mm, ovate, 12–21 mm, abaxially with triangular central portion bounded by low rounded ridges, 2-lobed, lobes linear to ligulate, 2–4 mm, acute, adaxially with dense row of persistent pilose trichomes 1–1.5 mm borne on stem at base of stipule. *Inflorescences* terminal, subcapitate, subsessile; flowering head subglobose, 2–3 cm diam., c. 45– to 60-flowered; bracts narrowly triangular, 1–3 mm, acute. *Flowers* all subsessile in glomerules of 3 to 7, surrounded at base by sericeous to pilose trichomes 1–2 mm, 5- or 6-merous; hynpanthium obconic, c. 2 mm, densely pilose to hirtellous with trichomes 1–2 mm; calyx limb 2–3 mm, glabrous or sparsely hirtellous with trichomes c. 0.5 mm, truncate to shallowly broadly lobed, lobes up to 0.5 mm, marginally densely pilosulous with trichomes 0.5–0.8 mm; corolla tubular-funnelform, yellow, externally sparsely striigillose with trichomes 0.1–0.3 mm, tube cylindrical to funnelform, 2.5–3.5 mm, 2–2.5 mm diam. near middle, internally glabrous except with densely pilosulous ring c. 1 mm wide in upper part, lobes ligulate, 2.5–3 mm, fleshy, adaxially shortly galeate, abaxially with rounded thickening 0.5–1 mm; stamens inserted in upper part of corolla tube, filaments c. 0.3 mm, anthers c. 0.8 mm, included; *style* 5–6 mm, stigmas 0.5–0.8 mm, exserted. *Inflorescences* becoming lax, cymose, pedunculate; peduncle 1–4.5 cm; branched portion broadly pyramidal to corymbiform, 1.5–2 × 4.5–7 cm, branched to 1 to 3 orders. *Fruits* sessile or with stipule up to 2 mm, subglobose to ellipsoid, 10–11 mm diam., sparsely to moderately pubescent with pilose to hirtellous trichomes c. 1 mm, dark green becoming orange or red, fleshy; *pyrenes* 2, hemispherical, adaxially plane, abaxially smooth; *endosperm* densely and deeply ruminate on both surfaces.

**Etymology.** – The specific epithet refers to the extensive morphological change from the inflorescence to the infructescence.

**Habitat, distribution and phenology.** – *Psychotria mutabilis* has been collected in perhumid evergreen forest at 640–1100 m in east-central Madagascar (Fianarantsoa, Toamasina), with flowers in November and with well-developed fruits in April, May, and November.

**Conservation status.** – *Psychotria mutabilis* is known from 12 specimen collections representing 12 unique occurrences in...
Fig. 6. – Psychotria mutabilis C.M. Taylor. A. Flowering stem; B. Corolla, external view; C. Basal portion of flower: hypanthium, calyx, subtending bract, style, stigma; D. Corolla dissected, interior view; E. Fruiting branch; F. Cross-section of pyrene and seed. [A–D: Randrianasolo et al. 1506; E–F: McPherson & van der Werff 16468]
perhumid evergreen forest at 640–1100 m elevation. The EOO of the species is 19,610 km², within the limits for “Vulnerable” under IUCN Red List Criterion B1; and the AOO is 40 km², within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Six of the collection sites are within five protected areas: Analamazoatra PA and Mantadia PA, both with a good level of protection; Makira PA and Ankeniheny-Zahamena Corridor PA (two occurrences), both with the interior of reserve well protected but parts close to villages seriously impacted by exploitation of timber and, to a lesser extent, shifting cultivation; and Ranomafana PA, with a good level of protection. The other six collection sites are in unprotected areas adjacent to but outside Analamazoatra, Ankeniheny-Zahamena, and Ranomafana. Forested areas without formal protection in the vicinity of these protected areas are subject to degradation by small-scale slash and burn agriculture and fire to create habitat for cattle farming as well as resource exploitation including logging, hunting and mining (GOODMAN et al., 2018). The five protected areas with one or more collection sites constitute one “location” (sensu IUCN, 2012) each. The remaining six collection sites can be considered as four distinct locations, based on geographic clustering with respect to the scale of the known threats, giving a total of nine locations. Four collection sites in or near Mantadia PA are in close proximity to an active graphite mine and a reduction in habitat, locations, and mature individuals can be inferred. The four unprotected locations are subject to general habitat degradation and at least one of the protected areas is in close proximity to on-going mining operation, causing a decline in AOO, extent and/or quality of habitat, and number of mature individuals. Thus, the Red List status of \( P. \) mutabilis is assessed as “Vulnerable” [VU B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v)].

Notes. – \( P. \) mutabilis is characterized by its dense hirtellous pubescence on both vegetative and reproductive structures; medium-sized leaf blades that are mostly obtuse at the tip; well developed interpetiolar stipules with two acute lobes; inflorescences that are initially subsessile, subcapitate, and globose then expand markedly in fruit; subsessile six-merous flowers; rather well developed tubular calyx limbs with rounded, short, densely pubescent lobes; medium-sized yellow corollas; lax, branched inflorescences with well developed peduncles and axes; somewhat large red fruits; and endosperm that is ruminate on both surfaces. The plants dry with a brown or reddish brown color, and the dried trichomes are dark reddish brown or reddened. The upper surfaces of the leaf blades seen are unusual in being completely glabrous, rather than having sparse pubescence at least on the principal veins as in other \( P. \) mutabilis species with dense pubescence. This species apparently lacks crypt-type domatia, but the dense pubescence of the abaxial vein axils may function as acarodomatia. The few flowers seen agree with the long-styled form of distylos \( P. \) mutabilis, but whether this species is distylous cannot be confirmed. The change in form between the subcapitate, subsessile inflorescence and the lax inflorescences is notable, but both of these structures are borne on the same stem of \( P. \) mutabilis so they clearly belong to the same species. This species agrees with BREMENKAMP (1963)'s Mapouria Group VI.

\( P. \) mutabilis is similar to \( P. \) rufovillosa, which differs in its elliptic to narrowly elliptic leaf blades 3.5–7 cm wide, inflorescences that are branched before flowering commences and borne on developed peduncles, five-merous flowers, corollas with shorter lobes c. 2 mm long, and smaller fruits 5–6 mm in diameter.

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intersecondary veins, without domatia, adaxially venation plane or costa prominulous, abaxially costa and secondary veins prominent and remaining venation not visible. **Stipules** interpetiolar or shortly united around stem, caducous, abaxially hirtellous with trichomes 0.2–0.5 mm, ovate, 3–6 mm, adaxially glabrous, bilobed, lobes linear, 1–2 mm, glandular at tip. **Inflorescence** terminal, shortly cymose, pedunculate, sparsely to densely hirtellous with trichomes 0.3–1 mm, green; peduncle terminal, shortly cymose, branched to 1 or 2 orders; bracts narrowly triangular, 0.5–2 mm, acute, at tip glandular; pedicels 0.1–1.5 mm. **Flowers** subsessile to pedicellate with both arrangements mixed in cymose to umbelliform groups of 3 to 9, 4-merous; hypanthium obconic to cylindrical, c. 1 mm, glabrous or puberulous with trichomes 0.2–0.3 mm; calyx limb 1–1.2 mm, externally glabrous, shallowly lobed, lobes broadly triangular, obtuse, marginally with 2 or 3 glands on each lobe; **corolla** tubular to funnelform, white, externally glabrous, tube c. 3 mm, 1.2–2 mm diam. near middle, internally in upper part and throat with dense ring c. 1 mm wide of pilosulous c. 3 mm, 1.2–2 mm diam. near middle, internally in upper part and throat with dense ring c. 1 mm wide of pilosulous trichomes 0.3–0.5 mm, lobes ligulate, 1.2–1.5 mm, obtuse to rounded, adaxially plane or with minute galeate projection, abaxially smooth; **stamens** inserted in upper part of corolla tube, filaments c. 0.5 mm, anthers c. 0.8 mm, included or partially exerted; **style** c. 3.5 mm, stigmas c. 0.3 mm, exerted. **Infructescences** similar to inflorescences, except becoming displaced to pseudaxillary by stem growth from one axillary bud. **Fruits** ellipsoid, c. 6 × 5 mm, glabrous, red, apparently fleshy; **pyrenes** 2, hemispherical, adaxially plane, abaxially with 4–5 rounded longitudinal ridges; **endosperm** entire abaxially, adaxially with 1 medial, longitudinal, T-shaped intrusion.

**Etymology.** – This new species resembles several species of the neotropical genus *Notopleura* (Benth.) Bremc., and the species epithet refers to this similarity. *Notopleura* has been commonly confused with Neotropical species of *Psychotria* but these genera are not closely related (RAZAFIMANDIMBISON et al., 2014). Terrestrial species of *Notopleura* differ from *Psychotria* in their consistently pseudaxillary inflorescences, stipules with well developed glands on the margins and/or a medial appendage, lack of persistent callaters at the stipule insertion, and molecular sequences that indicate their relationships are in another tribe, *Palicoureae*.

**Habitat, distribution and phenology.** – *Psychotria notopleuroides* has been collected in perhumid evergreen forest at 0–200 m on the Masoala Peninsula in eastern Madagascar (Antsiranana, Toamasina), with flowers in October and November and with fruits in June and September.

**Conservation status.** – *Psychotria notopleuroides* is known from four specimen collections representing four unique occurrences in perhumid evergreen forest at 0–200 m elevation. The EOO of the species is 69 km², within the limits for “Critically Endangered” under IUCN Red List Criterion B1; and the AOO is 16 km², within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Three occurrences are within the Masoala PA. Two of these occurrences are in the Anaovandrano river watershed and may be particularly sensitive to disturbances. The interior of Masoala PA is well protected but parts close to villages are impacted by exploitation of timber and, to a lesser extent, shifting cultivation (C. Birkinshaw, pers. comm.). A fourth occurrence is the westernmost point, at Ambanizana, and is approximately 800 m outside Masoala PA. Forested areas without formal protection in the vicinity of Masoala PA are subject to degradation by small-scale slash and burn agriculture and resource exploitation including logging, hunting and mining (GOODMAN et al., 2018). The westernmost collection site is along the Androka River and it constitutes one location (sensu IUCN, 2012) with respect to the known threats. This location’s disappearance would reduce EOO, AOO, the number of locations, and the number of mature individuals. The two most common occurrences, within the Anaovandrano River watershed, constitute a second location with regard to known threats, and the remaining occurrence, within Masoala PA, south of the unprotected occurrence, is a third location. With three locations, the sensitive nature of watershed habitats at two of the locations, and given general habitat degradation in unprotected sites, the Red List status of *P. notopleuroides* is assessed as “Endangered” [EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)].

**Notes.** – *Psychotria notopleuroides* is characterized by its unusual prostrate habit, triangular caducous stipules, medium-sized to rather small leaves that are obtuse to usually rounded or truncate at the apex, shortly cymose inflorescences that are initially terminal but quickly displaced to pseudoxillary by subsequent growth from one axillary bud, somewhat small four-merous corollas, medium-sized red fruits, pyrenes that are shallowly ridged abaxially, and endosperm that lacks ruminations except for a well developed, medial, T-shaped intrusion on the adaxial face. The specimens dry with a brown or reddish brown color, and the dried trichomes are dark reddish brown. The prostrate stems root along their length, and produce new stems sympodially. The leaves appear to be similar to those of some other *Rubiaceae* found in dark humid understory, with the epidermis composed of relatively large cells, the upper surface dark velvety green in life, and the lower surface light-colored and perhaps silvery. The collection data of one specimen (Zjhra & Hutcheon 378) note that the leaves are brittle. Most of the leaves on the dried specimens have revolute margins, but it is not clear if this is a character found in life or an artifact of drying. The corolla lobes of *P. notopleuroides* are distinctive in being rounded at the tips, similarly to the leaves, rather than acute as in most species of this genus. Two flowering collections
have been seen, and both agree with the long-styled form of distylos Psychotria species; whether this new species is distylos cannot yet be determined. This new species is not similar to any other Psychotria known from Madagascar.

The pyrenes of Psychotria notopleuroides have the form Bremekamp (1963) used to diagnose Apomuria. All the Malagasy species of that group, however, differ from this new species in their erect shrub habit and five- or six-merous flowers. At first glance Psychotria notopleuroides is similar in aspect to the Rubiaceae genera Geophila D. Don and Puffia Razafim. & B. Bremer, but both of those differ in their cordiform leaves, subcapitate inflorescences, and seeds with endosperm that lacks any rumination or intrusions. Psychotria notopleuroides is also similar to P. decumbens (Bremek.) A.P. Davis & Govaerts, which is not well known but can be separated by its hirtellous bilobed stipules and obovate leaves with acute to deltate tips that appear, based on herbarium specimens, to be similarly colored on both surfaces. The number of P. decumbens’ corolla lobes was not described and cannot be discerned from the on-line type images. Bremekamp classified P. decumbens in Mapouria, which was diagnosed by its seed with the endosperm ruminate to some degree, but he did not actually see its seeds so this character has also not been confirmed.

Paratypes. – MADAGASCAR. Reg. Sava [Prov. Antsiranana]: Antalaha-CR Vinaniaivo, CAP Massola Grand Parc, 15°44’S 50°10’E, 50 m, 15.IX.2003, Wohlkäser et al. 503 (G, MO, NEU). Reg. Analanjiforo [Prov. Toamasina]: Massola Peninsula, Tampolo, 15°41’52”S 49°57’56”E, 22.X.2001, Labat & Andrianjafy 3377 (BR, G, K, MO, TAN, TEF); Ambanizana, along Androka River south of MBG house, 15°39’30”S 49°57’30”E, 0 m, VI.1993, Zijla & Hutchinson 378 (MO).

Psychotria palifera C.M. Taylor, sp. nov. (Fig. 5F–K, 7).

Holotypus: MADAGASCAR. Reg. Sava [Prov. Antsiranana]: Antalaha-CR Vinaniaivo, CAP Massola Grand Parc, 15°44’S 50°10’E, 50 m, 15.IX.2003, Wohlkäser et al. 503 (G, MO, NEU). Reg. Analanjiforo [Prov. Toamasina]: Massola Peninsula, Tampolo, 15°41’52”S 49°57’56”E, 22.X.2001, Labat & Andrianjafy 3377 (BR, G, K, MO, TAN, TEF); Ambanizana, along Androka River south of MBG house, 15°39’30”S 49°57’30”E, 0 m, VI.1993, Zijla & Hutchinson 378 (MO).

Psychotria palifera C.M. Taylor is distinguished from its congeners by its relatively large stipules with a distinctive shape in bud, along with the combination of its obovate, domatiate leaf blades that are subtruncate to shallowly retuse at the apex, relatively short, fasciculate, rounded inflorescences that often become overtopped by stem growth from both axils, and well developed lobed calyx limbs; the stipules of this new species are fused around the stem in the basal part into a tubular sheath and in the upper portion free, obovate, acute to acuminate or bidenticulate, and with dense longitudinal veins or fibers.

Shrubs and small trees, collected in flower variously at 6–12 m tall, branched; stems weakly flattened becoming terete, glabrous. Leaves opposite; petiole 5–30 mm, glabrous; blade obovate, 5–18 × 2.8–11.5 cm, at base cuneate to obtuse, at apex subtruncate to shallowly retuse then abruptly acuminate with tip 1–3 mm, drying papyraceous to chartaceous, on both surfaces glabrous and weakly shiny; secondary veins 6 to 12 pairs, looping to interconnect near margins at least in apical part of blade, without intersecondary veins or usually with 1 intersecondary vein present between pairs of secondary veins, with regularly developed crypt domatia, adaxially venation plane or costa and sometimes secondary veins prominent, abaxially costa and secondary veins prominent and remaining venation plane. Stipules fused around stem, caducous, glabrous on both surfaces, sheath portion cylindrical, 3–12 mm, free upper portion ovate, 5–15 mm, with dense longitudinal fibers or veins, acute to acuminate or bidenticulate. Inflorescences terminal, cymose, with cymes borne on fasciculate axes, the group of axes sessile to subsessile, glabrous to densely pilosulous with trichomes 0.1–0.2 mm; flowering-bearing portion rounded-corymbiform, 3–6 × 4–8 cm, branched to 2 or 3 orders, c. 30- to 60-flowered; bracts reduced or broadly triangular, 0.1–0.5 mm, acute; pedicels 0.5–1 mm. Flowers all pedicellate in dichasial cymes of 5 to 9, 5-merous; hypanthium obconic, c. 0.8 mm, glabrous; calyx limb 1–1.2 mm, glabrous, denticulate or lobed to ½ of its length, lobes triangular, acute to obtuse; corolla funnelform, yellow, externally glabrous, tube c. 3.5 mm, c. 1.5 mm in diam. near middle, internally densely pilose in upper part with trichomes c. 1 mm, lobes ligulate to triangular, c. 2 mm, obtuse, adaxially slightly galeate, abaxially smooth; stamens inserted in upper part of corolla tube, filaments not seen, anthers c. 0.8 mm, included or partially exerted, positioned with tips at top of corolla tube; style c. 4 mm, stigmas c. 1 mm. Infructescences similar to inflorescences or often markedly overtopped by growth from subtending axis. Fruits subglobose, c. 5 mm diam., glabrous, red, with calyx limb 1.5–4 mm, lobed for ½–⅔ of its length; pyrenes 2, hemispherically, adaxially plane, abaxially smooth; endosperm densely deeply ruminate on both surfaces.

Etymology. – The profile shape of the stipules in bud resembles a spade, and the specific epithet refers to that implement.

Habitat, distribution and phenology. – Psychotria palifera has been collected in humid evergreen forest at 560–1100 m in central eastern Madagascar (Toamasina), with flowers in March and with fruits in May and June.

Conservation status. – Psychotria palifera is known from ten specimen collections representing nine unique occurrences in humid evergreen forest at 560–1100 m elevation. The EOO of the species is 2,716 km², within the limits for “Endangered” under IUCN Red List Criterion B1; and the AOO is 36 km², also within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Six of the collection sites are within two protected areas: Zahamena PA (two sites), with a good protection
level; and Ankeniheny-Zahamena Corridor PA (4 sites), with the interior of the reserve well protected but parts close to villages seriously impacted by exploitation of timber and, to a lesser extent, shifting cultivation (C. Birkinshaw, pers. comm.). The remaining three collection sites are in unprotected areas: one to the east of Ankeniheny-Zahamena Corridor PA and c. 4 km west of Betampona PA (forêt secondaire de Sondrimaro); one c. 200 m outside Ankeniheny-Zahamena Corridor in secondary forest (Ambodivioromborogra Forest); and the third c. 11 km east of the northernmost parcels of Ankeniheny-Zahamena Corridor PA. This distant collection is from 1975 in an area with no protection, near a major roadway; it very likely that the population no longer exists at this collection site. The loss of this site would significantly decrease the EOO for this species as well as the AOO. Forested areas without formal protection in the vicinity of these protected areas are subject to degradation by small-scale slash and burn agriculture and fire to create habitat for cattle farming as well as resource exploitation including logging, hunting and mining (Goodman et al., 2018). All three of the unprotected collecting sites would be subject to such threats. The northernmost two collections are within Zahamena PA, and constitute a single “location” (sensu IUCN, 2012, 2019). Three collections are from the northernmost parcel of Ankeniheny-Zahamena Corridor adjacent to Zahamena PA, and constitute a second location. One collection is from forêt d’Ambatoaragana, Ankeniheny-Zahamena Corridor PA and constitutes a third location. Each of the three widely separated unprotected sites constitutes a separate location, giving a total of six locations. Three locations are in generally well-protected areas, but the other three are in vulnerable areas, one of which may already be lost, causing a decline in EOO and AOO, extent and/or quality of habitat, number of locations and number of mature individuals. Thus, the Red List status of *P. palifera* is assessed as “Vulnerable” [VU B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)].

**Notes.** – *Psychotria palifera* is characterized by the combination of its relatively robust habit for its genus; glabrous vegetative structures; medium-sized obovate leaf blades with small domatia in the abaxial axils and the apices truncate to shallowly retuse; distinctive large stipules; relatively short, fasciculate, corymbiform inflorescences that often become overtopped by growth from both subtending axils; well-developed lobed calyx limbs; medium-sized fruits; pyrenes that are smooth abaxially; and endosperm that is reticulate on both surfaces. The specimens dry with a dark brown color, which is also seen in the sapwood of cut stems. The stipules of *P. palifera* are unusually well developed and distinctive in form: these are fused in their basal portions into a cylindrical sheath, then the upper parts are ovate, venose or fibrose, and initially pressed flat together with their margins rolling back. These stipules also vary markedly in size, from smaller ones on terminal buds of stems with young leaves to those that are mature and dehiscing. These stipules are similar in form to those of *P. hamifera*, newly described above. Only one fully developed flower has been seen, and was not dissected in order to preserve it; it agrees with the long-styled form of distylous *Psychotria* species, but whether *P. palifera* is distylous cannot be determined. The infructescences are relatively short and have a characteristic form that is commonly seen in *Psychotria*, with the flowers borne in groups on several axes, and these axes then arising from a node that either bears developed leaves, or bears an internode that is hardly developed (1–2 mm long) and then another node that bears bracts and the axes. This arrangement was analyzed in detail by Taylor (2020), who...
noted that it is part of continuous variation in inflorescence form in this genus, and its interpretation as pedunculate vs. subsessile or fasciculate depends on the degree of development of the leaf-like structures borne from the subtending node: if these are small they are considered bracts and the inflorescence pedunculate, while if they are enlarged and green they are considered leaves and the inflorescence sessile to sub-sessile and fasciculate. In *P. palifera* the inflorescences seen are subtended by developed leaves, and are also overtopped or enclosed by leafy stems that develop form one or usually both of the axes of the subtending leaves. The development of a reduced internode just above the leaves that sub tend the inflorescence is variable in *P. palifera*, so it is sometimes evident and sometimes apparently did not develop. The calyx limb appears to enlarge as the fruit develops, to almost twice its size at anthesis, but the flowers are not well enough documented to confirm this. This species agrees with Bremekamp (1963)'s *Mapouria* Group VII. A fruiting specimen is chosen as the type because most of the characters that contrast it with the similar species Bremekamp treated are in the fruits and seeds.

*Psychotria palifera* is similar to *P. imerimensis* (Bremek.) A.P. Davis & Govaerts and *P. manampambensis* (Bremek.) A.P. Davis & Govaerts, which both can be separated by their shorter ligulate to ovate stipules, 2 – 5 mm long, and their shorter, truncate to denticulate calyx limbs, 0.5 – 1 mm long, and they also often differ by their narrower leaf blades, 1.2 – 6 cm wide.

**Paratypes.** – MADAGASCAR. Reg. Analanjirofo [Toamasina]: Ambatondrazaka, RN Zahamena, 17°39'46"S 48°59'05"E, 560 – 360 m, 27.V.2003, Andrianjafy et al. 371 (CNARP, MO, P, TEF); Vavatenina, à 10 km au N d’Ambanorono, 17°42'04"S 49°00'48"E – 17°42'04"S 49°00'48"E, 620 m, 12.VI.2004, Andrianjafy et al. 436 (CNARP, MO, P, TEF); PN Zahamena, 17°33'30"S 48°53'35"E, 800 m, 5.V.2003, Rakotonandrasana 688 (CNARP, MO, TEF); sine loco, 17°41'27"S 48°59'52"E, 13.VI.2001, Randrianjanakai et al. 611 (CNARP, MO, P, TEF); Miariarivo-Ambanorono, Ambinanisavarahina, 17°41'15"S 49°00'02"E, 580 – 620 m, 14.VI.2001, Ratvoson et al. 492 (CNARP, MO, P, TEF); Atsinanana, along rte #2, 41 km E of Perinet, 18°01'31"S 49°04'59"E, 675 m, 21.V.2017, Rakotonandrasana 688 (CNARP, MO, P, TEF); Andrianjafy et al. 436 (CNARP, MO, P, TEF); Randrianjanakai et al. 611 (CNARP, MO, P, TEF); Miarinarivo-Ambanorono, Ambinanisavarahina, 17°41'15"S 49°00'02"E, 580 – 620 m, 14.VI.2001, Ratvoson et al. 492 (CNARP, MO, P, TEF); Asisianana, along rte #2, 41 km E of Perinet, 18°55'00"S 47°24'06"E, 1075 m, 13.X.2000, Rivière Tatamaly, à 2 km W de la gare Andrambovato, côté Fianarantsoa:

**Holotypus:** MADAGASCAR. Reg. Haute Matsiatra [Prov. Fianarantsoa]: 2 km W de la gare Andrambovato, côté riv. Tamatamy, 21°30'07"S 47°24'06"E, 1075 m, 13.X.2000, Rakotvao & Randianantaoka 1011 (MO-04804424; iso-: TAN).

*Psychotria razafimandibisonii* C.M. Taylor is distinguished from *P. retusa* (Bremek.) A.P. Davis & Govaerts by its markedly retuse leaf blades without acarodomatia, shorter stipules, abaxially weakly ridged pyrenes, and endosperm that is ruminate on both surfaces.

*Shrubs* and small trees, collected in flower and fruit vari ously at 3 – 7 m tall, branched; stems glabrous, weakly flattened becoming suberete. *Leaves* opposite; *petiole* 4 – 42 mm, glabrous; *blade* ovate, 4 – 7 × 3 – 11 cm, at base acute to obtuse, at apex retuse for ½ – ⅓ of its length with sinus broadly rounded and sometimes costa terminating in an apiculate tip to 1 mm, drying papyraceous to chartaceous, glabrous on both surfaces; secondary veins 8 to 11 pairs, weakly looping to interconnect, without interescondary veins or with reticulated tertiary veins extending between some pairs of secondary veins, without domatia, adaxially costa prominent and remaining venation plane or secondary veins sometimes thickened, abaxially costa and secondary veins prominent, loosely reticulated tertiary venation plane to prominent, and remaining venation plane and not visible. *Stipules* fused around the stem for their entire length, caducous, externally glabrous, 2 – 4.5 mm, interpetiolarly truncate or rounded to obtusely angled, adaxially pilosulous with trichomes 0.8 – 1 mm, entire to bidenticulate. *Inflorescences* terminal, cymose, pedunculate, glabrous to moderately pilosulous with trichomes 0.1 – 0.3 mm, subtended by 1 reduced internode to 1 cm, at top with truncate to rounded stipules 1.5 – 3 mm, without leaves or with foliaceous bracts up to 2 cm; peduncles 0.6 – 4.5 cm; branched portion rounded-corymbose, 2 – 5.5 × 4 – 9 cm, branched to 2 or 3 orders, c. 35 – 70-flowered; bracts triangular to rounded, 0.2 – 1 mm, aristate to bilobed or fimbriate; pedicels 0.5 – 2.5 mm. *Flowers* all pedicellate in dichasial cymes of 5 to 7, 5-merous, disty los, hypianthium ellipsoid to obconic, c. 1 mm, glabrous to puberulous; *calyx* limb 1 – 1.2 mm, glabrous, truncate to denticulate; *corolla* funnelliform, yellow, externally glabrous, tube 4.5 – 5 mm, 1.2 – 1.5 mm diam. near middle, internally in upper part with densely pilosulous ring c. 1 mm wide with trichomes c. 0.3 mm, lobes triangular to narrowly triangular, 1.5 – 2 mm, at tip acute, adaxially galeate, abaxially with rounded thickening; *stamens* in short-styled form inserted in upper part of corolla tube, filaments c. 1 mm, anthers c. 1.5 mm, partially to fully exerted, in long-styled form filaments c. 0.3 mm, anthers c. 1 mm, included with tips positioned at top of corolla tube; *style* in short-styled form 2 – 3 mm, *stigmas* 0.5 – 1 mm and included, in long-styled form style 5.5 – 6 mm, stigmas 0.8 – 1 mm and exerted. *Inflorescences* similar to inflorescences. *Fruits* ellipsoid to subglobose, 5 – 6 mm diam., glabrous, red; *pyrenes* 2, hemispherical, adaxially with 3 – 4 weak rounded longitudinal ribs; *endosperm* densely deeply ruminate on both surfaces.

**Etymology.** – This elegant, tall, distinctive new species named for one of its collectors, Dr. Sylvain Razafimandibison, a leading specialist in Malagasy *Rubiaceae* and a native of Madagascar.
Habitat, distribution and phenology. – Psychotria razafimandimbisonii has been collected in humid evergreen forest at 400–1100 m in central eastern Madagascar (Fianarantsoa), with flowers in August through November and with fruits in April and October. This species is unusual for Psychotria in being represented by more flowering than fruiting specimens.

Conservation status. – Psychotria razafimandimbisonii is known from 13 specimen collections representing 12 unique occurrences in humid evergreen forest at 400–1100 m elevation. The EOO of the species is 322 km², within the limits for “Endangered” under IUCN Red List Criterion B1; and the AOO is 32 km², also within the limits for “Endangered” under Criterion B2 (IUCN, 2012). Eleven of the collection sites are within two protected areas: Fandrina Vondrozo Forest Corridor Reserve, whose interior is well protected but parts close to villages seriously impacted by exploitation of timber and shifting cultivation (C. Birkinshaw, pers. comm.); and the well-protected Ranomafana PA. One collection is on the eastern boundary of Ranomafana PA and label information indicates the habitat is infested with invasive Psidium L.; this constitutes a single location (sensu IUCN, 2012) based on the unique threats known to occur. It is likely that the border edges of the protected area are subject to degradation by small-scale slash and burn agriculture and resource exploitation including logging, hunting and mining (GOODMAN et al., 2018) and this location may have lost of suitable habitat. The northernmost collection is within Fandrina Vondrozo Forest Corridor Reserve, and constitutes a second location. The southernmost collection is also within Fandrina Vondrozo, along the Tatamaly River, a possible sensitive habitat due to its generally smaller, obovate leaf blades, 5–12 × 3–6 cm, that have regularly developed domatia in the abaxial vein axils, by its leaves that are only shallowly retuse at the apex and its well-protected Ranomafana PA. Therefore, this constitutes a single location (sensu IUCN, 2012) based on the unique threats known to occur. It is likely that the border edges of the protected area are subject to degradation by small-scale slash and burn agriculture and resource exploitation including logging, hunting and mining (GOODMAN et al., 2018) and this location may have lost of suitable habitat.

Notes. – Psychotria razafimandimbisonii is characterized by the combination of its glabrous vegetative structures; medium-sized leaves that are markedly retuse at the top and lack domatia; relatively small, broadly rounded to truncate stipules; pedunculate corymbose inflorescences with the flowers pedicellate in dichasial groups and the peduncle borne on a reduced internode topped by a leafless node; truncate to denticulate, medium-sized calyx limbs; slender, yellow, medium-sized corollas; medium-sized ellipsoid fruits; pyrenes that are weakly ridged abaxially; and endosperm that is ruminate on both surfaces. The specimens characteristically dry brown or yellowish brown. The markedly retuse leaves are distinctive, and unusual in Rubiaceae. These are easily mistaken at first glance for leaves that are damaged by insect or physical tearing, but the complete leaves consistently have this form. The sinus is usually edged for part or all of its length by the distalmost pair of secondary veins, with no blade tissue extending out from them on the distal side. The secondary leaf veins are not markedly more closely set near the apex, so the retuse shape appears to be due to additional growth of the lamina and marginal tissue rather than to a foreshortened central portion and costa. The margins of most of the leaf blades are thinly revolute, but this may be an artifact of drying rather than a character of the living plants. The adaxial trichomes of the stipules are a little longer than the sheath, so these extend past it and can appear to be marginal cilia; whether these trichomes are covered by the stipule in life then the stipule shrinks in drying is not known. The inflorescences are distinctive in the reduced stem segment at the base of the peduncle, which is leafless but has two truncate stipules. The inflorescences are described on some labels as whitened. This new species agrees with BREMEKAMP (1963)’s Mapouria Group VI.

Psychotria razafimandimbisonii is similar to P. retusa (Bremek.) A.P. Davis & Govaerts, which can be separated by its leaves that are only shallowly retuse at the apex and have regularly developed domatia in the abaxial vein axils, larger stipules 9–25 mm long, abaxially smooth pyrenes, and endosperm that is ruminate only on the abaxial side. Psychotria razafimandimbisonii is also similar to P. manampamibehisina (Bremek.) A.P. Davis & Govaerts, which can be separated by its generally smaller, obovate blade blades, 5–12 × 3–6 cm, that have regularly developed domatia and are obtuse to truncate at the apex with acuminate tips 1–8 mm long, stipules that are slenderly acuminate at the top, and flowers that are subsessile or borne on shorter pedicels, up to 0.5 mm long.

Paratypi. – Madagascar. Reg. Vatovavy-Fitovinanay [Prov. Fianarantsoa]: dist. Ifadiena, Ranomafana PN, 21°15′25″S 47°25′30″E, 915 m, 24.IV.2005, Acevedo-Rodríguez & Razafindrabe 14457 (MO, US); 21°02′00″S 47°18′00″E–21°25′00″S 47°37′00″E, 400–1375 m, 14.VIII.1988, Kremen 88-1 (MO); 21°15′36″S 47°25′12″E, 854–915 m, 1.XI.1998, Almeda 7932 (CAS, MO, TAN); 21°16′S 47°25′E, 900–1100 m, 31.X.1998, Davis et al. 1045 (K, MO, TAN); 21°16′S 47°26′E, 1000–1100 m, 4.XI.1998, Daniel 9098 (CAS, MO, TAN); 21°15′S 47°25′E, 1100 m, 3.XI.1998, Davis et al. 1045 (K, MO, TAN); 21°15′S 47°27′E, 800–1000 m, 3–8.IX.1993, Kotsaafy et al. 212 (MO); ibid. loco, 900 m, 19–21.X.1993, Kotsaafy & Randrianianantenina 335 (MO); 21°15′S 47°28′E, 950 m, 3.X.1986, Nicoll 116 (MO); 7 km W of Ranomafana, Duke University Primate Center, 21°15′S 47°25′E, 1000 m, 27.X.1987, Overdorff 39 (MO); 21°15′S 47°25′E, 998 m, 14.IV.2016, Razafimandimbison et al. 1382 (MO, S, TAN); Vatoharanana, 40 km S Ranomafana (ville), 21°17′04″S 47°26′00″E, 1025 m, 2.X.2000, Rakotovao & Randrianahafa 957 (MO, P, TAN).
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