Reassessment of the *Psychotria speciosa* G. Forst. (Rubiaceae) complex in Tahiti, Society Islands, with a new combination and description of new species, *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov.

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ABSTRACT
The genus *Psychotria* L. (Rubiaceae) is one of the most diverse in the Pacific, including the islands of French Polynesia with 28 described endemic species. The *Psychotria speciosa* G. Forst. complex is evaluated, and *P. speciosa* is lectotypified and an epitype designated. The new combination *Psychotria trichocalyx* (Drake) Fosberg ex J.-Y. Meyer, Lorence & J. Florence, comb. nov., is made based on *Calycosia* (*Uragoga*) *trichocalyx*. The new species *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov., endemic to Tahiti (Society Islands), is described and illustrated. It differs from the closely related *Psychotria speciosa* by having leaves with longer petioles (up to 5 cm long), flowers fewer per inflorescence (1-3) and with longer pedicels up to 15 mm long, calyx with longer tube and short lobes, a 5-7-lobed corolla, longer fruit pedicels up to 4 cm long, and cylindrical to ovoid fruits 2-3 cm long. The conservation of this extremely rare species, known from only one locality on Tahiti and directly threatened by invasive alien plants (proposed IUCN status: CR), is a priority.

KEY WORDS
Rubiaceae,
Psychotria,
French Polynesia,
endemism,
conservation,
invasive plants,
lectotypification,
new combination,
new species.

RÉSUMÉ

Réévaluation du complexe Psychotria speciosa *G. Forst. (Rubiaceae) de Tahiti (archipel de la Société), avec une nouvelle combinaison et une nouvelle espèce,* Psychotria paulae *J.-Y. Meyer, Lorence & J. Florence, sp. nov.*

Le genre *Psychotria* L. (Rubiaceae) est l'un des plus diversifiés du Pacifique, et en particulier dans les îles de la Polynésie française avec 28 espèces endémiques décrites. Le complexe *Psychotria speciosa* G. Forst. est réévalué, *P. speciosa* est lectotypifiée, et un épitype désigné. Une nouvelle combinaison, *Psychotria trichocalyx* (Drake) Fosberg ex J.-Y. Meyer, Lorence & J. Florence, comb. nov., est proposée. Une nouvelle espèce endémique de Tahiti (archipel de la Société), *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov., est décrite et illustrée. Elle diffère de *Psychotria speciosa*, qui est l'espèce la plus proche, par ses feuilles à pétiole plus long (jusqu'à 5 cm), son faible nombre de fleurs par inflorescence (1-3), ses fleurs longuement pédicellées (pédicelles jusqu'à 15 mm), son calice à tube plus long et lobes plus courts, une corolle à 5-7 lobes, ses fruits longuement pédicellés (pédicelles jusqu'à 4 cm) et une drupe ovoïde à pyriforme de 2-3 cm de longueur. La conservation de cette espèce extrêmement rare, connue d'une seule localité sur l'île de Tahiti, et directement menacée par l'invasion de plantes introduites (statut UICN proposé : CR), constitue alors une priorité.

MOTS CLÉS
Rubiaceae,
Psychotria,
Polynésie française,
endémisme,
conservation,
plantes envahissantes,
lectotypification,
combinaison nouvelle,
espèce nouvelle.

INTRODUCTION

Psychotria L. (Psychotrieae) as traditionally circumscribed is the largest genus of Rubiaceae, with estimates ranging from 1500 to as high as 2000 species in the tropics and subtropics of both hemispheres (Nepokroeff *et al.* 1999; Andersson 2002; Frodin 2004; Davis *et al.* 2009). Most species are shrubs, small trees, or climbers with white, pink-white, or cream-colored, entomophilous, often distylous flowers, valvate corolla lobe aestivation, an inferior usually bilocular ovary, each locule with a single, basally attached ovule, and drupaceous fruits with usually two plano-convex pyrenes with or without preformed germination slits [PGS] (Piesschaert 2001; Andersson 2002). The application of modern molecular analyses to the genus, however, has shown it to be highly paraphyletic and has resulted in separation of *Psychotria* and its relatives into two tribes: Psychotrieae and Palicoureeae (see Barrabé *et al.* 2012, 2014 and Razafimandimbison *et al.* 2014 for more details). Both these groups occur in the Pacific-Malesian-Asian area and are currently undergoing further study, with corresponding nomenclatural changes forthcoming.

This group has undergone extensive speciation and radiation, particularly in tropical lowland and lower montane areas where its members are conspicuous and important components of the understory and middle stratum vegetation. Most *Psychotria* species have fruits with fleshy pericarps containing two pyrenes that are readily dispersed by birds, and consequently the genus has reached most of the high oceanic islands in the Pacific and elsewhere, often displaying high levels of insular endemism (Lorence & Wagner 2005). Current estimates of *Psychotria sensu lato* in Oceania include 59 species in New Caledonia (Barrabé *et al.* 2013), 76 species in Fiji (Smith & Darwin 1988), 23 in Samoa (Whistler 1986; WCSP 2014), 18 in Micronesia (Fosberg & Sachet 1991; Lorence & Wood 2012), and 11 in the Hawaiian Islands (Wagner *et al.* 1999). In French Polynesia, 13 species are recognized in the Marquesas Islands (Lorence & Wagner 2005), 12 in the Society Islands, and three species in the Austral Islands (Meyer *et al.* 2003; Florence *et al.* 2007; WCSP 2014).

Among the 12 species of *Psychotria* recorded from the Society Islands, seven species are recognized for Tahiti by Welsh (1998) in his *Flora Societensis* (six endemic to the island), two of which were described after Drake del Castillo's treatment (1893). They are: *P. cernua* Nadeaud, *P. forsteriana* A. Gray, *P. franchetiana* (Drake) Drake, *P. grantii* Fosberg, *P. marauensis* Fosberg & J. Florence, *P. speciosa* G. Forst., and *P. tahitensis* (Drake) Drake. Since *Psychotria cernua* Nadeaud is an illegitimate homonym of *P. cernua* Steudel (1840), the next available name for this species is *P. lepiniana* (Baill. ex Drake) Drake based on *Uragoga lepiniana* Baill. ex Drake (Florence *et al.* 2007).

Among these seven species, *Psychotria speciosa* was the first to be described by G. Forster in 1786 during the second voyage of Capt. James Cook in the Pacific Ocean. In his treatment of *Psychotria* for the "*Énumération des plantes indigènes de l'île de Tahiti*", J. Nadeaud (1873: 51) proposed four variants of *P. speciosa,* the first three having sessile, glabrous inflorescences with white corollas and the fourth short-pedunculate, reddish pubescent inflorescences with pink-white corollas: "Var. A. *Calyx foliaceus*" is characterized by inflorescences with 3-7 sessile white flowers and a 3-partite campanulate calyx with broad obtuse lobes; "Var. B. *Calyx integer*" with a truncate calyx essentially lacking lobes; "Var. C. *ovata,"* with calyx subentire, shortly 5-toothed, and pinkish- white corollas; and "Var. D. *cymosa*" with several small, shortly pedunculate 3-4-flowered cymes clustered distally, the inflorescence covered by erect reddish hairs, and a campanulate calyx with membranaceous lobes. However, not all these varietal names have the same nomenclatural status, and if specimens could be traced, those names could

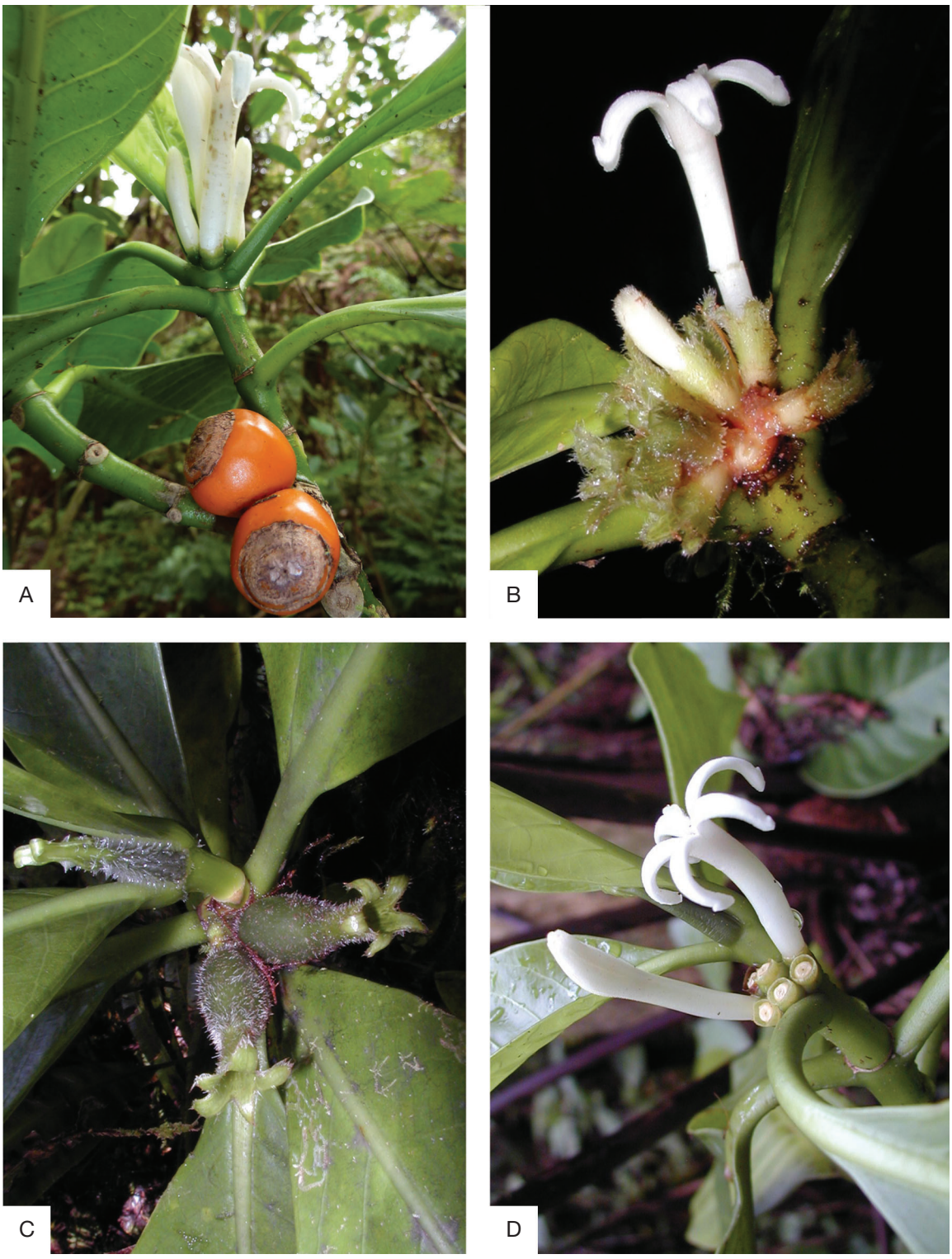

Fig. 1. — Tahitian *Psychotria* L. species: **A**, **D**, *P.* aff. *speciosa*, with truncate shortly-toothed calyx; **B**, **C**, *P. trichocalyx* (Drake) Fosberg ex J.-Y. Meyer, Lorence & J. Florence, comb. nov.; **B**, inflorescence with bud and corolla at anthesis; **C**, young fruits and stipule (upper left); **D**, corolla in bud and expanded. **A**, **D**, Tahiti, Marau, J.-Y. Meyer photos; **B**, **C**, Tahiti, Atara, J.-Y. Meyer photos.

be accounted for and synonymized. In "Flore de la Polynésie française" Drake Del Castillo (1892: 97) recognized no infraspecific taxa for *P. speciosa* (as *Uragoga speciosa* (G. Forst.) Drake), which he described as being a shrub about 2 m in height, the inflorescences with 3-7 nearly sessile white flowers with glabrous campanulate calyces with the

limb entire or divided into five short teeth or unequal lobes, corolla tubes 6-7 cm long, and ovoid drupes. Unfortunately, in this complex the calyx usually is deciduous in fruit, thus complicating identification of fruiting specimens.

In view of the taxonomic confusion surrounding this species, and since no recent critical revision of Tahitian *Psychotria* species exists, we provide here a starting point for revising this group by elucidating the species concept and lectotypifying the oldest described taxon, *P. speciosa*. It seems that *P. speciosa* as originally construed by Nadeaud represents a variable species or species complex characterized by inflorescences with sessile or subsessile flowers and essentially lacking a peduncle. Nadeaud's variety A "*Calyx foliaceus*" corresponds to forms characterized by a deeply 5-lobed, foliaceous or shallowly 3-5-lobed campanulate-cylindrical calyx (Fig. 2A-D), and this variety, published as an invalid name, probably corresponds most closely to Forster's concept of *P. speciosa;* unfortunately, no specimen was located at P. His variety B "*Calyx integer,*" with no nomenclatural status, has a truncate calyx; one specimen was found at Paris and is considered to be *P. marauensis* Fosberg & J. Florence. His variety C "*ovata"* is described as having a subentire, shortly 5-toothed calyx (Fig. 1A, D), but no specimen has been located at Paris, and so its status is pending. The fourth variety D with pubescent calyx and hypanthium (*P. speciosa* var. *cymosa*) is herein recognized at species level as *P. trichocalyx* (Drake) Fosberg ex J.-Y. Meyer, Lorence & J. Florence, comb. nov. (Fig. 1B, C).

METHODS

All specimens have been seen by the authors, except where noted by "n.v." Measurements are taken from dried specimens. Specimens from the following herbaria were examined and annotated during this study: BISH, GOET, K, NY, P, PAP, PTBG, and US.

TAXONOMIC TREATMENT

Lectotypification of *Psychotria speciosa* and selection of an epitype

Georg Forster described *Psychotria speciosa* in his "Florulae Insularum Australium Prodromus" published in 1786 based on material collected in Tahiti by him and his father Johann Reinhold (J. R.) Forster during Capt. James Cook's second circumnavigation of the globe (1772-1775). The Forsters collected many hundreds of specimens on the voyage and proposed many new names or sometimes applied old names if they thought the plants were already known. Since the Forsters did not cite individual specimens, all specimens that formed the basis of one of their new species should be regarded as syntypes. The difficulties associated with typification of the Forsters' names are discussed in detail by Fosberg (1993) and by Nicolson & Fosberg (2004) who made a systematic attempt to provide lectotypifications for many of the names. Further complicating the situation, because of financial difficulties the Forsters' herbarium was sold piecemeal and the specimens dispersed to at least 25 herbaria in European including BM, GOET, K, P, UPS, and two in North America. Labels for many of the specimens were lost, copied incorrectly, or thrown away by the new owners, and consequently the locality of origin for many specimens is uncertain.

In their discussion of *Psychotria speciosa* Nicolson & Fosberg (2004) noted that this species had never been typified, primarily because the existing herbarium material was poor, sterile, and presumably unsuitable. They cited two scrappy Forster collections from Tahiti deposited at BM. One is a "*small twig with 8 detached leaves and detached terminal bud enclosed in a calyptrate stipule 2.5 cm long incl. 2 rounded 'ears', lvs elliptic to 10 × 4 cm, cuneate-decurrent at base, blunt to pointed apex, 6-7 veins on a side*", and a second collection mounted on the same sheet is a "*scrappy branch with 1 fruit*".

Since calyx morphology is crucial for separating taxa in this species complex, and furthermore the calyces are often deciduous in fruit, we were granted permission by the respective collection managers to carefully dissect the terminal buds of the Forster specimens at BM and GOET. Dissection of the first BM specimen revealed the calyptra encloses a vegetative bud. The second BM collection is scrappy with one fruit, and therefore neither of these collections constitutes a suitable lectotype. In the GOET specimen, however, the calyptra encloses an inflorescence in young bud in which the calyx lobes are distinctly oblong (Fig. 2B) thus resolving the identity of *Psychotria speciosa.* We hereby designate the GOET specimen as lectotype and also select a representative collection as epitype to fix application of this name.

At first we considered selecting G. Forster's pencil drawing of "*Psychotria speciosa*, Fl. Ins. Austr. p. 16, n. 89" housed at the BM for lectotypification. The drawing is presumably life-sized although no scale is shown, and it shows a branchlet with eight leaves and a terminal 2-flowered inflorescence. The sketch shows details of several diagnostic features: a calyptrate-sheathing stipular sheath with wrinkled surface and two ear-like, apically bifid lobes enclosing an inflorescence with two expanded flowers protruding from a sheath which conceals their basal parts. A close-up sketch shows a view of one flower emerging from the sheathing stipule, and another view shows a subsessile flower with a very unusual cup-like structure bearing a series of tiny, broadly triangular teeth subtending a calyx with longer subulate teeth. This drawing seems artificial and may represent a misinterpretation or an "artistic synthesis" of two taxa by Forster and is therefore unsuitable for lectotype. A color pencil drawing housed at the Gotha Library in Thuringia, Germany (see Nicolson 1998) is obviously based on the same branchlet but does not show many details, only 8 green leaves and 2 white corollas emerging from a green, stipule-like calyptrate bract or involucre at the branch tip concealing the base of

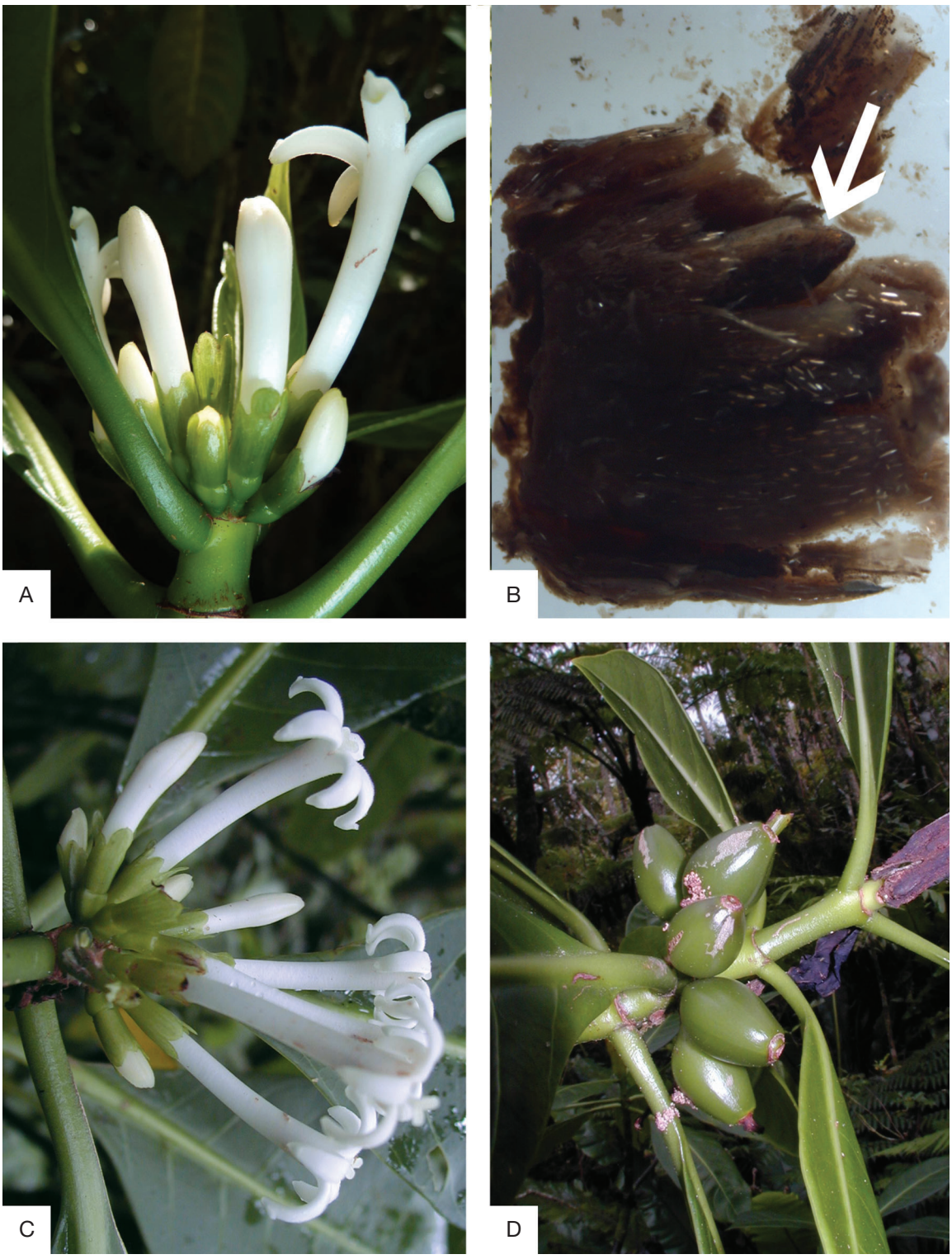

FIG. 2. — *Psychotria speciosa* G. Forst., various calyx forms: **A**, **C**, **D**, form with campanulate calyx and triangular-ovate to spathulate lobes; **B**, basal part of dissected flower bud from lectotype specimen showing triangular-ovate calyx lobe (**arrow**); orientation is horizontal, base of bud is to left. **A**, **C**, **D**, Tahiti, Marau, J.-Y. Meyer photos; **B**, *Forster 57* (lectotype, GOET), E. Carnero-Diaz photo.

the flowers. No fruits are present nor are critical details of the calyx visible. Forster's original description reads thus:

"89. *P. speciosa*, arborea, foliis oblongo-lanceolatus, involucro terminale subtrifloro. F. Taheiti."

Since Forster's description is general and scarcely diagnostic, in the following section we include a new detailed description of *Psychotria speciosa* along with lectotypifications and designation of an epitype.

Psychotria speciosa G. Forst.
(Fig. 2)

Florulae Insularum Australium Prodromus: 16, taxon 89 (1786). — *Cephaelis speciosa* (G. Forst.), Spreng., *Systema vegetabilium* 1: 749 (1824). — *Uragoga speciosa* (G. Forst.) Drake, *Illustrationes Florae Insularum Maris Pacifici* 15: 38 (1890). — Lectotype, here designated: Society Islands, Tahiti, without locality or date (fl. buds), *G. Forster 57* (GOET[GOET012552]!). The sheet is annotated "57. Psychotria speciosa Prodr. 89" perhaps in handwriting of G. Forster; on a second blue label is written "Original Forster" with a det. slip by F. R. Fosberg "57. Psychotria speciosa Forst. f. in 1986". Due to the poor condition of the lectotype, we also designate the following specimen as epitype.

Epitype. — Here designated: **Society Islands**. Tahiti, plateau de Taravao, captage de l'Hamoa, 17°47'S, 149°15'W, 950 m, 9.II.1983, (fl.), *J. Florence 4492* (epi-, P[P02286909]!; isoepi-, BISH, P[P02286910]!, PAP).

Distribution, habitat and ecology. — *Psychotria speciosa* occurs as isolated plants in mid-elevation forests at 700-1500 m. Its ecology is poorly known, but collectors' notes indicate it is rare in high valleys along streams associated with species of *Cyathea* Sm. and *Cyrtandra* J. R. Forst. & G. Forst. Many of these areas are invaded by *Miconia calvescens* DC.

Representative specimens. — Society Islands. Tahiti, Plateau de Taravao, captage de l'Hamoa, 930 m, 17°47'S, 149°15'W, 9.II.1983, *J. Florence 4487* (P[P02286904]!). Without precise locality: bel arbrisseau dans les hautes vallées, fl. & fr., s.d., *Vieillard s.n.* (P[P00701046]!); b. fl., *Vieillard s.n., s.d.* (P[P02286905]!).

Description

Shrubs or treelets 2-4 m tall, sparsely branched, vegetative parts glabrous; twiglets cylindrical, fistulose. Leaves of a pair equal or subequal; stipules caducous, united into a calyptra 2-2.5 cm long, terminated by a narrowly elliptic appendage 0.4-0.8 cm long, ± bifid at the tip; petiole stout, 1.2-5.2 cm long; blade when fresh light green to bright green above, paler below, subcoriaceous, obovate, elliptic or oblong-elliptic, 5.3-19.2 cm long, 6.2-9.3 cm wide, base cuneate to very narrowly decurrent, apex obtuse or rounded to acute or short acuminate, abaxially with whitish or reddish brown domatia sometimes present in secondary vein axils, costa flattened adaxially, prominulous abaxially, secondary veins 8-13 on each side, prominulous abaxially, tertiary vein network inconspicuous. Inflorescence terminal, in bud enclosed in a stipule-like calyptra 3.3-4.5 cm long, bifid at apex, enclosing 3-9 densely clustered sessile or subsessile flowers, inflorescence becoming pseudo-axillary by development of sympodial vegetative branch. Flowers fragrant when fresh, monomorphic. Hypanthium glabrous, turbinate, 2.5-4.2 mm long, 2-3.3 mm wide, calyx pale green, tube 2.5-4.2 mm long, 2.8-4 mm wide, flared; calyx lobes linear to triangular-ovate, narrowly oblong, or spathulate, 2.8-5.2 mm long, 1-1.8 mm wide (Fig. 2A-D). Corollas white, fleshy, hypocrateriform, tube 2.8-3.5 cm long, 2.0-2.5 mm in diam., straight or slightly curved, glabrous without or the lobes sparsely puberulent, lobes narrowly oblong-triangular, 1.3-1.5 cm long, 2.1-2.5 mm wide, recurved at maturity, papillose to tomentellose within, more densely so at the throat, apex acute, uncinulate at tip. Stamens inserted below top of tube; anthers sessile, linear, 2.8-3 mm long. Style 2.8-3.3 cm long, reaching throat, pubescent in distal third, stigmatic branches *c.* 2 mm long, scarcely exserted or exserted for 2-3 mm, spreading at maturity, ventrally with white hairs 0.3 mm long, apex disciform-lobed; nectary disc glabrous. Infructescence terminal or lateral by displacement. Fruits sessile or scarcely pedicellate, clustered, ellipsoid-ovoid to subglobose, 1.5-2.2 cm long, 0.8-1.1 cm wide, red at maturity, apex umbonate. Pyrenes ellipsoid, 1.4-1.7 cm long, 0.7-1.0 cm wide, 0.2-0.4 cm thick, ventral surface plane, dorsal surface with two marginal and one central crests; preformed germination slit ventral, extending ¼-⅓ distance from apex (Fig. 5B). Endosperm not ruminate, lacking reddish alcohol-soluble pigment.

Identity of *Psychotria trichocalyx*, comb. nov.

Drake Del Castillo (1886) considered Nadeaud's "Var. D *cymosa*" of *P. speciosa* to represent a distinctive species with inflorescences having villous peduncles and calyces and described it as *Uragoga trichocalyx* Drake, citing two specimens *(Lépine 184* and *Nadeaud 343*). He later (Drake Del Castillo 1892) transferred it to *Calycosia* A. Gray as *Calycosia trichocalyx* (Drake) Drake. *Calycosia* is a genus of six to eight species distributed in Fiji, Samoa, the Solomon Islands, and New Guinea. It is closely related to *Psychotria* (Smith & Darwin 1988; Andersson 2002) and is distinguished morphologically by the capitular or capitular-cymose inflorescences with conspicuous, often numerous, pale green to white, free or united, involucrate stipule-like deciduous bracts, and flowers with a large, infundibular calyx limb, deciduous in fruit (Smith & Darwin 1988). However, Smith & Darwin (1988) stated these characters are not reliable in separating the genus from all groups of *Psychotria*. Our observations reveal that young inflorescences of many Pacific *Psychotria* species are enveloped by stipules or stipule-like bracts. Capitular-cymose inflorescences occur in several Marquesan and Micronesian *Psychotria* species (Fosberg & Sachet 1991; Lorence & Wagner 2005; Lorence & Wood 2012). Furthermore, calyx limb size and lobing varies considerably between *Psychotria* species. For these reasons we believe *C. trichocalyx* is best placed in *Psychotria* and make the following new combination.

Psychotria trichocalyx (Drake) Fosberg ex J.-Y. Meyer, Lorence & J. Florence, comb. nov.
(Fig. 1B, C)

Basionym: *Uragoga trichocalyx* Drake, *Illustrationes florae insularum Maris Pacifici* 16: 40 (1886). — Type: Tahiti, *Lépine 184* (lecto-, P[P007010414, P00701042]!, 2 sheets, here designated). — Syntype: Tahiti, Mt. Marau, 1200 m, *Nadeaud 343 p.p.* (P[P00701043]!).

Calycosia trichocalyx (Drake) Drake, *Illustrationes florae insularum Maris Pacifici*: 196 (1886).

Psychotria speciosa var. D *cymosa* Nadeaud, *Énumération des plantes indigènes de l'île de Tahiti*: 51 (1873).

Remark

Drake Del Castillo (1886) cited two syntype collections, *Lépine 184* and *Nadeaud 343* (a mixed collection), both at Paris. F. R. Fosberg proposed but never published this combination in his herbarium annotations of the syntypes. We hereby

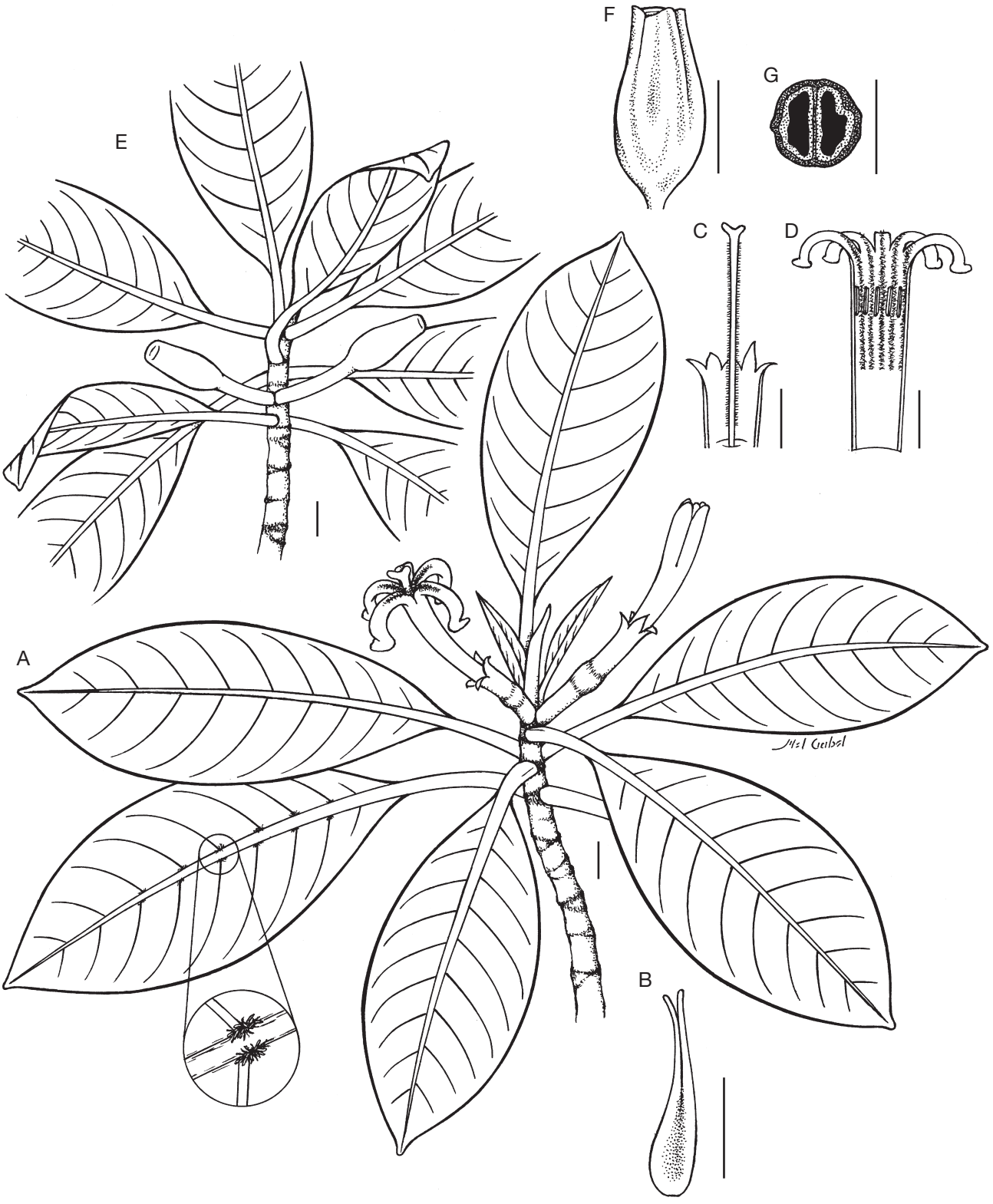

FIG. 3. — *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov.: **A**, habit, flowering branch; inset shows barbate secondary vein axils on lower leaf surface, **B**, stipule-like sheath enclosing inflorescence bud, margins of apical lobes revolute and appearing linear; **C**, calyx, longitudinal section showing style; **D**, corolla, longitudinal section; **E**, habit, fruiting branch; **F**, ripe fruit, side view; **G**, fruit, cross section showing pyrenes. **A**-**D**, from *Meyer 950*; **E**-**G** from *Meyer 2468*. Scale bars: A, C-G, 1 cm; B, 2 cm.

designate *Lépine 184* (2 sheets) as lectotype. This species is distinguished from other Tahiti congeners by a shortly pedunculate, 3-4-flowered inflorescence covered by spreading reddish-brown hairs, externally pilose campanulate calyx with short triangular to oblong lobes, pilose hypanthium and fruit, and white corollas with lobes puberulent distally (Fig. 1B, C).

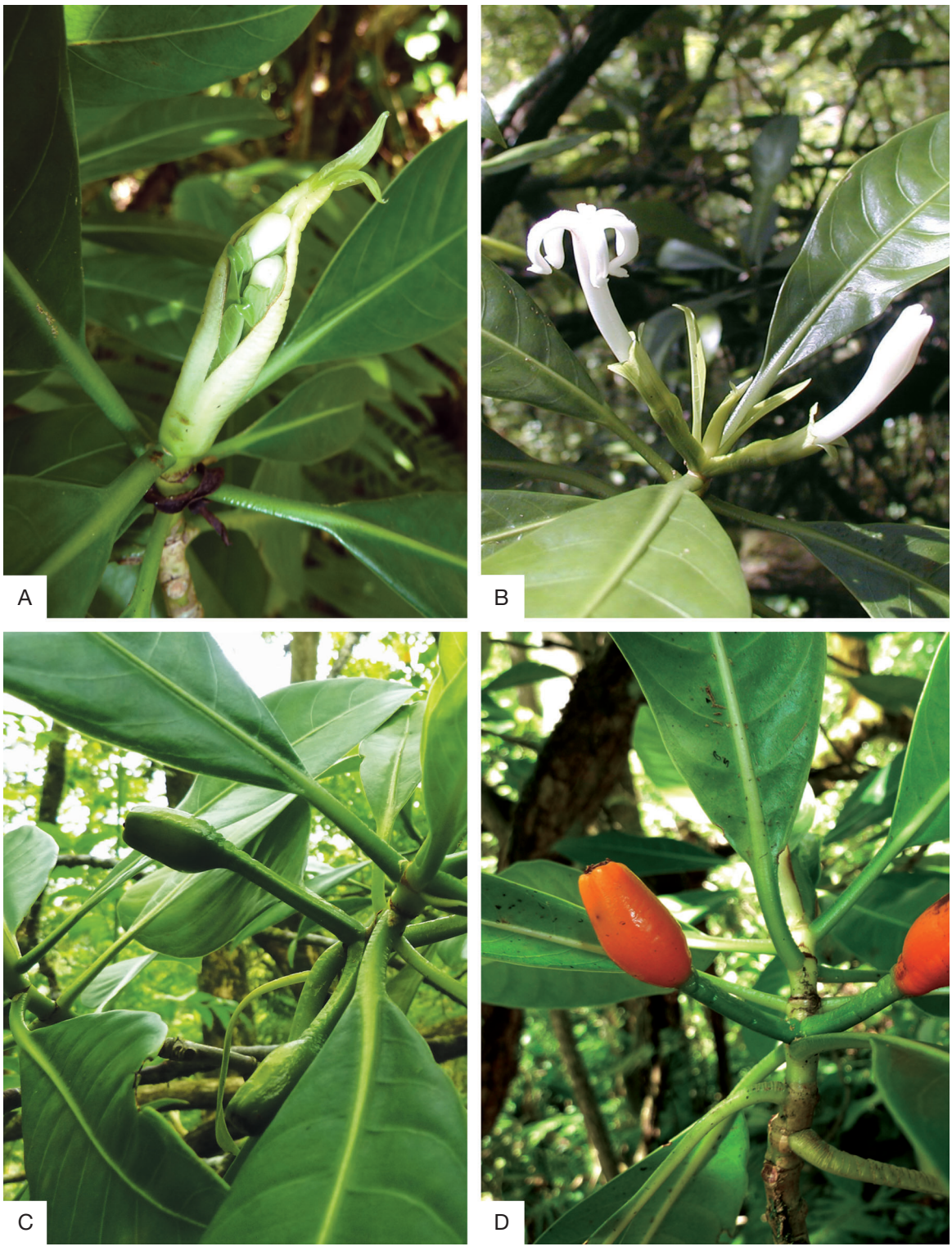

Fig. 4. — *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov.: **A**, inflorescence enclosed by stipule-like bract; **B**, inflorescence with two flowers (*Meyer 950*); **C**, two green submature fruits; **D**, two ripe fruits. **A**, **B**, *Meyer 950*; **C**, **D**, all Tahiti, Col Hamuta, J.-Y. Meyer photos.

Description of a new species, *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov.

Intensive botanical surveys on the island of Tahiti have produced numerous new collections and new locations for *Psychotria*, including a distinctive new species discovered by J.-Y. Meyer at one locality on the western slopes of Tahiti. This new species does not match any of the recognized Pacific Island taxa but is most similar to *P. speciosa.* Tahiti currently has nine *Psychotria* species, including *P. trichocalyx*, comb. nov., and the new species *P. paulae*, sp. nov., described below.

Fig. 5. — Pyrenes of two Tahitian *Psychotria* L. species, adaxial (left) views showing preformed germination slits, and abaxial (right) views: **A**, *P. paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov., *Meyer 2468*; **B**, *P. speciosa* G. Forst., *Quayle 270* (BISH).

Psychotria paulae
J.-Y. Meyer, Lorence & J. Florence, sp. nov.
(Figs 3; 4A-D; 5A; 6)

Psychotriae speciosae G. Forst. *affinis, sed petiolis longioribus 2-5 cm longis, inflorescentia 1-3-floribus, calyce distincte tubuloso, corolla 5-6 (7)-lobata, pedunculo longiore 10-15 mm longo, differt.*

Typus. — **Society Islands**. Tahiti: Sortie Aorai, 920 m, 17°34'50"S, 149°30'59"W, 31.I.2001, fl., fr., *J.-Y. Meyer 950* (holo-, PTBG[PTBG1000050583]!; iso-, P!, PAP!, US!).

Paratypi. — **Society Islands**. Tahiti : trail from Belvédère to Aorai, 950 m, 23.V.2000 , fl., *J.-Y. Meyer 845* (PAP); 940 m, 28.II.2003, fl., fr., *J.-Y. Meyer 2468* (P, PAP, PTBG); gulch below the trail from Belvédère to Aorai, 900 m, 31.IX.2003, fl., *J.-Y. Meyer & J. Florence 2693* (PAP); 930 m, 11.III.2004, fl., *J.-Y. Meyer 2870* (P, PAP).

Relationships. — Morphologically this new species is most similar to *Psychotria speciosa*, but differs by its inflorescence with fewer flowers (1-3 vs 3-5(-12) in *P. speciosa*) and longer pedicels 10-15 mm long in flower and up to 40 mm long in fruit (vs sessile or subsessile in *P. speciosa*), calyx with a distinct tube, 5-6(-7) lobed corolla, and cylindrical to ovoid fruits 20-30 mm long vs 15-22 mm long in *P. speciosa*. The pyrenes of *P. paulae*, sp. nov. are relatively smaller and with the preformed germination slit extending halfway or more from apex to base (Fig. 5A), compared with those of *P. speciosa* which are somewhat larger and with the PGS extending ¼-⅓ from apex to base (Fig. 5B).

Etymology. — This very rare species, with beautiful large, white fragrant flowers, is dedicated to J.-Y. Meyer's wife Paula for her patience and understanding, and all the sacrifices made during his numerous field trips in Tahiti and in the other islands of French Polynesia and the Indo-Pacific Oceans over the past 23 years.

Distribution, habitat and ecology. — *Psychotria paulae*, sp. nov. is only known from Tahiti where first seen in fruit in June 1999 and first collected in flower by JYM in May 2000. The only known population is located on the western (leeward) side of Tahiti between 900 and 950 m elevation near the trail from Belvédère ("Fare Rau Ape" in Tahitian) to mount Aorai, the third highest summit of Tahiti culminating at 2066 m elevation. Only four mature (or reproductive) individuals and between 10 and 20 seedlings and young non-reproductive plants (< 2 m tall) were observed. They occur on steep slopes, in the understory of mesic to wet forest severely invaded by the alien trees *Spathodea campanulata* P. Beauv. (Bignoniaceae), *Miconia calvescens* DC. (Melastomataceae), and *Tecoma stans* (L.) Juss. ex Kunth. (Bignoniaceae), and by the alien thorny shrubs *Lantana camara* L. (Verbenaceae) and *Rubus rosifolius* Sm. (Rosaceae).
The remnant indigenous and endemic trees include *Neonauclea forsteri* (Seem. ex Havil.) Merr. (Rubiaceae), *Pisonia tahitensis* (Heimerl) F. Friedman ex J. Florence (Nyctaginaceae), *Myrsine* sp. (Primulaceae), *Allophylus rhomboidalis* (Nadeaud) Radlk. (Sapindaceae), with the endemic shrubs *Phyllanthus manono* (Baill. ex. Müll. Arg.) Müll. Arg. (Phyllanthaceae), *Cyrtandra apiculata* C.B. Clarke and *C. taitensis* W. Rich ex A. Gray (Gesneriaceae), *Ophiorriza subumbellata* G. Forst. (Rubiaceae), the native liana *Freycinetia impavida* (Hombr. & Jacquinot) B.C. Stone (Pandanaceae), the endemic herb *Elatostema sessile* J.R. Forst. & G. Forst. (Urticaceae), and the native ferns *Diplazium harpeodes* T. Moore (Woodsiaceae), *Bolbitis lonchophora* (Kunze) C. Chr. (Dryopteridaceae), and *Davallia* spp. (Davalliaceae) in the understory.
Psychotria paulae, sp. nov. is sympatric with two other *Psychotria* species with smaller corollas 11-15 mm long, i.e., *P. tahitensis* and *P. marauensis*. The latter species was formerly known only from the upper Tipaerui valley (above 800 m elevation) near the road to mont Marau (Fosberg 1983), and collected also by JYM in 1999. The large-flowered *P. speciosa* is found at much higher elevations near the trail to mont Aorai, above 1100 m (Meyer pers. obs.). *Psychotria paulae*, sp. nov., was observed in flower between January and May, i.e. mainly during the end of the rainy warm season in Tahiti which is between November and March, with green and ripe fruits mainly produced between February and December during the last ten years of episodic phenological surveys conducted in 2000 and between 2002 and 2014 (Meyer pers. obs.).

Description

Shrubs 2.5-4 m tall with multiple erect stems to 15-20 cm diam., glabrous throughout, bark blackish. Leaves opposite, those of a pair equal to subequal, limb 5-13 cm long, 10-22 cm wide, elliptic to obovate or broadly oblanceolate, chartaceous to subcoriaceous, when fresh glossy green above, paler green and dull beneath, base cuneate, attenuate, apex shortly acuminate, secondary veins 6-9 on each side, eucamptodromous to weakly brochidodromous, adaxially glabrous, abaxially glabrous or sparsely pilose with brown septate hairs to 1 mm, secondary veins axils barbate with tufts of brown hairs; petioles 2-5 cm long, glabrous or sparsely pilose abaxially with white or brown hairs 1-2 mm long; stipules intrapetiolar, caducous, glabrous, calyptrate, cylindrical-sheathing, 1-2 cm long, 4-10 mm wide, transversely wrinkled, apex usually with 2 lobes 3-10 mm long, 1.5-2.5 mm wide, ovate-elliptic to linear with revolute margins. Inflorescences terminal becoming pseudoaxillary by displacement, when young enclosed by a caducous stipule-like bract 3-4 cm long, cymose-fasciculate, 1-2(-3)-flowered. Flowers apparently hermaphroditic, the pedicels 10-15 mm long, glabrous or villous with white hairs 1-2 mm long. Hypanthium narrowly obconical, 6-7 mm long, 4-5 mm wide; calyx tubular, externally glabrous or rarely sparsely villous with white hairs 1-2 mm long, the tube 15-20 mm long, with 5-6 (-7) unequal to subequal triangular-ovate to oblong lobes 3-7 mm long, the apex acute to obtuse. Corolla white and fragrant when fresh, at anthesis hypocrateriform, tube 30-35 mm long, 2.5-3 mm diam. medially, lobes 5-6(-7), 10-12 mm long, 2-2.5 mm wide, apex adaxially thickened with curved appendage, externally glabrous, internally pilosulous in lines extending medially from base of lobes, to middle of tube, lobes densely papillose-puberulent adaxially. Stamens 5-6(-7), inserted *c.* 8 mm below top of tube, anthers sessile, 4.5-5 mm long. Style 40-45 mm long, spreading puberulent except toward base, stigma with two papillose ovoid lobes 2-3 mm long. Fruit drupaceous, 20-30 mm long, 10-13 mm wide, cylindrical to narrowly ovoid, bright orange when ripe, initially crowned by the deciduous calyx; pedicel to 40 mm long; pyrenes obovoid-ellipsoid, 1.2-1.5 cm long, 0.6-0.7 cm wide, 0.3 cm thick, ventral surface plane, dorsal surface with one central and two marginal crests; pre-formed germination slits present, ventral, in distal half; endosperm non-ruminate; alcohol-soluble red-pink pigment absent.

CONSERVATION STATUS OF TAHITIAN *PSYCHOTRIA*

Six Tahitian endemic *Psychotria* species are recorded by IUCN's Red List of Threatened Species (IUCN 2014). Four of them are classified as Critically Endangered (CR) (*P. grantii*, *P. tahitensis*, *P. speciosa* and *P. trichocalyx*, comb. nov.), one as Vulnerable (VU) (*P. lepiniana*), and one as Data Deficient (DD; *P. franchetiana*). Following the recommendations of Meyer *et al.* (2003), based on recent botanical surveys, six species considered among the rarest and the most threatened in Tahiti (namely *P. franchetiana, P. grantii, P. lepiniana, P. marauensis, P. speciosa,* and *P. trichocalyx*, comb. nov.) were legally protected in French Polynesia since 2008 (arrêté n°306/CM du 20 février 2008). All of them are directly threatened by *Miconia calvescens*, a small invasive alien tree forming dense closed-canopy forests,

FIG. 6. — Holotype of *Psychotria paulae* J.-Y. Meyer, Lorence & J. Florence, sp. nov., *J.-Y. Meyer 950* (PTBG-10000050583).

causing a dramatic decrease of the light availability in the understory which prevents the reproduction of *Psychotria* species (Meyer *et al.* 2003). Their conservation status was recently re-assessed based on extensive field-work by local botanists and naturalists: *P. franchetiana* and *P. lepiniana* as CR, *P. marauensis*, *P. speciosa* and *P. trichocalyx*, comb. nov., as EN, *P. tahitensis* as LC, and *P. grantii* as DD (UICN France *et al.* 2015).

We propose classifying *Psychotria paulae*, sp. nov., as Critically Endangered (CR, B2abiii) following IUCN criteria (IUCN 2014) based on its extreme rarity (only a single small population of less than five mature individuals is known, with and extent of occurrence of less than 10 km² and area of occupancy of less than 1 km²) and the direct threat caused by invasive alien trees (*Miconia calvescens*, *Spathodea campanulata*, *Tecoma stans*) and shrubs (*Lantana camara*, *Rubus rosifolius*).

A revision of the *Psychotria* species in the Society Islands, especially on the large islands of Moorea and Raiatea, is urgently needed both for scientific reasons and conservation purposes.

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