

# Three new species of Vanguerieae (Rubiaceae) from Madagascar

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## ABSTRACT

### KEY WORDS

Rubiaceae,  
Vanguerieae,  
*Peponidium*,  
*Pyrostria*,  
Madagascar,  
new species.

Three new species of the tribe Vanguerieae (Rubiaceae) from Madagascar are described with illustrations. Two species are placed in *Pyrostria*, one in *Peponidium*. *Peponidium crassifolium* is recognized by its thick and slightly succulent leaves, *Pyrostria pendula* by the pendulous flowers and persistent pedicels, and *Pyrostria serpentina* by a serpentine habit and small leaves. The morphology and taxonomic history of the dioecious genera of the tribe are discussed.

## RÉSUMÉ

*Trois nouvelles espèces de Vanguerieae (Rubiaceae) de Madagascar.*

Trois nouvelles espèces de la tribu des Vanguerieae (Rubiaceae) de Madagascar sont décrites et illustrées. Deux espèces sont placées dans le genre *Pyrostria* et une troisième est attribuée à *Peponidium*. *Peponidium crassifolium* se distingue des autres espèces du genre par ses feuilles épaisses et légèrement succulentes, *Pyrostria pendula* se caractérise par ses fleurs pendantes et ses pédicelles persistants, et *Pyrostria serpentina* se différencie dans le genre par son port sinueux et ses petites feuilles. La morphologie et l'histoire taxinomique des genres dioïques de la tribu sont discutées.

## MOTS CLÉS

Rubiaceae,  
Vanguerieae,  
*Peponidium*,  
*Pyrostria*,  
Madagascar,  
espèces nouvelles.

## INTRODUCTION

Vanguerieae is a tribe of around 600 species notorious for its difficult generic circumscriptions (e.g., Bridson 1992). This situation was in part recently improved by the presentation of a new classification of the large genera *Canthium* Lam. and *Vangueria* Juss. based on combined molecular-morphological and combined molecular studies (Lantz & Bremer 2004, 2005, respectively). Nevertheless, several genera remain little studied and in particular some geographic regions need to be investigated further. Vanguerieae is distributed in sub-Saharan Africa, southern parts of Asia, Australia and Oceania, with the least amount of studies done in Central and West Africa, South East Asia (including Indonesia), and Madagascar. In this study we describe three species from Madagascar, a country in which the flora of Vanguerieae is especially rich, but where many species still have not been described. Around 90 species of Vanguerieae from Madagascar are currently accepted, but based on our own observations it is likely that at least 30 more need to be described. This rather extreme situation is probably a result of the earlier vague generic concepts that has made it difficult to determine specimens, and also the very real possibility that many of these species are quite rare. The tribe is represented in all areas of Madagascar, in dry or humid climates and from sea level to the highest altitudes.

Although the genera in Vanguerieae often are hard to recognize, the tribe is not. A combination

of axillary inflorescences paired at the nodes, valvate aestivation, and a unique type of pollen presenter (Igersheim 1993) on the apex of the style makes the tribe easy to recognize. The majority of the species found in Madagascar are members of the “dioecious group” (Lantz & Bremer 2004), an informal name for a monophyletic clade of species, in which most taxa are dioecious. The dioecious species are heteromorphic with a variation in the number of flowers per inflorescence and number of corolla lobes. The most common situation is that male individuals have fasciculate inflorescences with comparably more flowers (> 2) and in some cases fewer corolla lobes (4 or 5). Female individuals have flowers solitary or in pairs and sometimes more numerous corolla lobes (up to 8). However, we see some disagreement with this in the species described here, and it must be concluded that the sex dependent variation in Vanguerieae is still insufficiently studied.

A total of eight generic names have been suggested for the species in the dioecious group: *Canthium* (represented by the African *Canthium* subgenus *Bullockia* Bridson, 1987), the African *Dinocanthis* Bremek. (Bremekamp 1933), the Malagasy *Leroya* Cavaco (1970), *Neoleroya* Cavaco (1971), and *Pseudopeponidium* Arènes (1960), the Malagasy and Comorian *Peponidium* Arènes (1960), the African and Malagasy *Pyrostria* Comm. ex Juss. (*sensu* Bridson 1987), and *Scyphochlamys* Balf.f. from the Mascarene island Rodriguez (Verdcourt 1983). In a study focusing on the African species (Bridson

1987), *Dinocanthium* and *Pseudopeponidium* were included in *Pyrostria* due to an almost complete overlap of diagnostic characters. Schatz (2001) accepted only two of the genera, *Canthium* and *Pyrostria*, and listed *Leroya*, *Neoleroya*, *Peponidium*, and *Pseudopeponidium* as synonyms of *Pyrostria*. He, however, made no mention of *Dinocanthium* or *Scyphochlamys* and probably based his suggestions solely on the Malagasy material. The most recent classification (Razafimandimbison *et al.* unpubl. data) places all dioecious species of Vanguerieae from Madagascar in *Peponidium*, *Pyrostria*, or in a third new genus which in part corresponds to the African *Canthium* subgenus *Bullockia* (Bridson 1987). This is the classification we follow here.

In our own collections and in some kindly provided by fellow researchers, a large number of the Malagasy Vanguerieae specimens not identifiable to species have been found. Based on the completeness of the material available to us and/or morphological distinctiveness we have chosen three of these to be described. One is collected in the arid regions of Toliara in the south west and two are so far only known from localities of high elevation in the Marojejy and Manongarivo mountain ranges in northeastern Madagascar.

## SYSTEMATICS

Genus *Peponidium* Arènes

*Peponidium crassifolium*

Lantz, Klack. & Razafim., sp. nov.

(Fig. 1)

*Species haec a congeneribus ceteris foliis succulentis differt; ramis validis, foliis obovatis et crassis cum nervis obscure visibilibus etiam dignoscenda.*

**TYPUS.** — Madagascar. Antsiranana Province, Andapa District, Marojejy Massif, 3.II.2006, fl., *Razafimandimbison & Ravelonarivo* 628 (holo-, S; iso-, MO, TAN).

**PARATYPES.** — Madagascar. Antsiranana Province, Ambanja District, Réserve spéciale de Manongarivo: Bekolosy, cours supérieur de la Bekolosy, crête rive gauche, entre CR11 et CR12, 14°02'S, 48°18'E, 1240 m, 28.III.1996, fr., *Gautier & Be* 2913 (G, P). — Andranomalaza, source, 200 m au N du point coté 1728, 14°02'S, 48°25'E,

1720 m, 26.V.2000, fr., *Gautier & Rakotomamonjy* 3677 (G, P). — Antsatrotro, à l'Est d'Ankaramibe, 14°05'S, 48°24'E, 679-1876 m, 15.I.1994, fl., *Rakotomalala & Narison* 187 (MO, P). — Crête bordant la cuvette d'Antsahakolona, 14°03.266'S, 48°24.488'E, 1731 m, 25.XI.2000, fr., *Wohlauser et al.* 389 (G, P). — Andapa District, Réserve naturelle intégrale de Marojejy, 10.5 km NW of Manantenina, along tributary at head of Andranomifototra River, Campement 4, 14°26'24"S, 49°44'30"E, 1625 m, 4-13.XI.1996, fl., fr., *Rakotomalaza et al.* 892 (MO, P).

## DESCRIPTION

Shrub, 1.5-4 m tall, rarely tree. Branches stout, compressed when young becoming terete, with thick nodes giving older branches a knobby appearance, glabrous. Leaves opposite, persistent up to six nodes, glabrous; petiole 5-12 mm long; blade obovate, 30-70 × 15-40 mm, cuneate at base and decurrent, blunt at apex, thick and slightly succulent; venation pinnate, arched, best visible on upper surface; mid-rib distinct, ± even with leaf surface on lower side, distinctly raised on upper surface when dry; lateral nerves not visible or with 3 or 4 faintly visible pairs; tertiary nerves not visible; domatia absent; stipules broadly obovate to triangular, 6 × 5 mm, blunt at apex, glabrous on both sides, early caducous. Inflorescences axillary, sessile, fasciculate, 5-10-flowered; peduncular bracts fused to form a cupular structure; pedicels 2-3 mm long. Male flowers: calyx: tube 1-1.5 mm long; limb tube 0.5 mm long, truncate to minutely toothed; lobes absent or in form of ciliate haired shallow teeth. Corolla 5-merous, white to yellowish, glabrous outside, at mouth densely provided with usually retrorse verrucose hairs; tube ± cylindrical, 2 mm long; lobes triangular, 3-4 × 1.6-1.9 mm, acute and thickened at apex; apex bent inwards. Stamens attached to corolla tube near mouth; anthers oblong, partly exerted. Style including stigmatic head 4 mm long, shortly exerted; stigmatic head 1.1 mm long, vaguely ridged, apically bilobed; style slightly recessed into the stigmatic head; disk reduced, ovary absent. Female flowers: calyx: tube 2-3 mm long; limb tube 0.5 mm long, truncate to minutely toothed, often ciliate at margin; lobes absent or in form of ciliate haired shallow teeth. Corolla 5-6-merous, white, glabrous outside, at mouth densely provided with usually

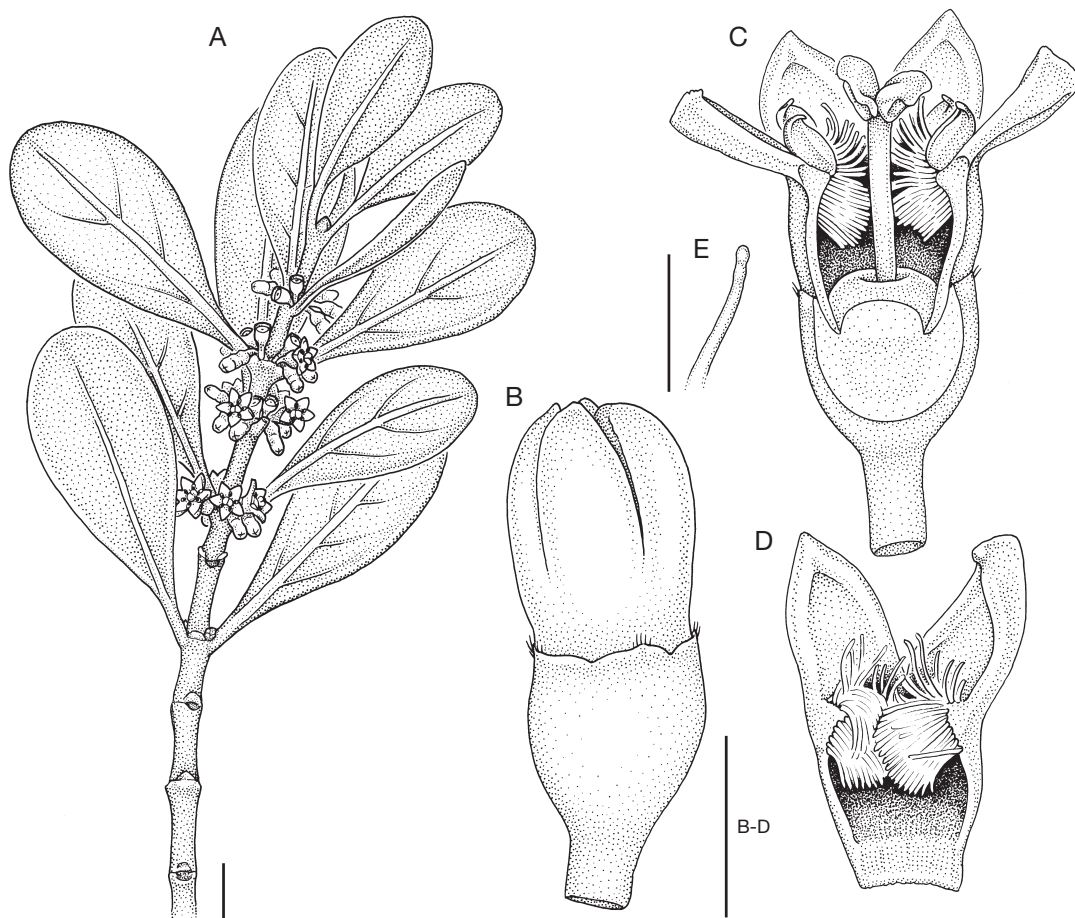


FIG. 1. — *Peponidium crassifolium* Lantz, Klack. & Razafim.: **A**, flowering branch; **B**, flower bud; **C**, female flower, one corolla lobe and corresponding part of tube removed, tangential longitudinal section; **D**, part of female corolla; **E**, close-up of hair from inside of corolla. Scale bars: A, 1 cm; B-D, 3 mm; E, 0.5 mm.

retrose verrucose hairs; tube  $\pm$  cylindric, 1-2 mm long; lobes triangular, 2-3  $\times$  1.3-1.8 mm, acute and thickened at apex; apex bent inwards. Stamens attached to corolla tube near mouth; anthers oblong, partly exerted. Style including stigmatic head 4 mm long, shortly exerted; stigmatic head 1 mm long, vaguely ridged, deeply bilobed; style slightly recessed into the stigmatic head; disk glabrous. Fruit green-brownish turning orange-reddish, slightly bilobed, 7-11 mm long, 7-11 mm wide, cuneate at base, somewhat laterally compressed, flesh deep, pedicel 3-4 mm long. Pyrene straight, slightly flattened abaxially, 6-9  $\times$  3-4 mm, cartilaginous (very

thin and smooth), with an apical prominent line of dehiscence. Seed albuminate, entire, a straight embryo with very short cotyledons.

#### HABITAT

Wet and cloudy evergreen forests or summit ericoid bushes and sclerophyll thickets at *c.* 1200-1900 m altitudes.

#### REMARKS

*Peponidium crassifolium* leaves are quite thick, slightly succulent and snap when broken. Leaves of this type are unknown in the tribe, and fresh material

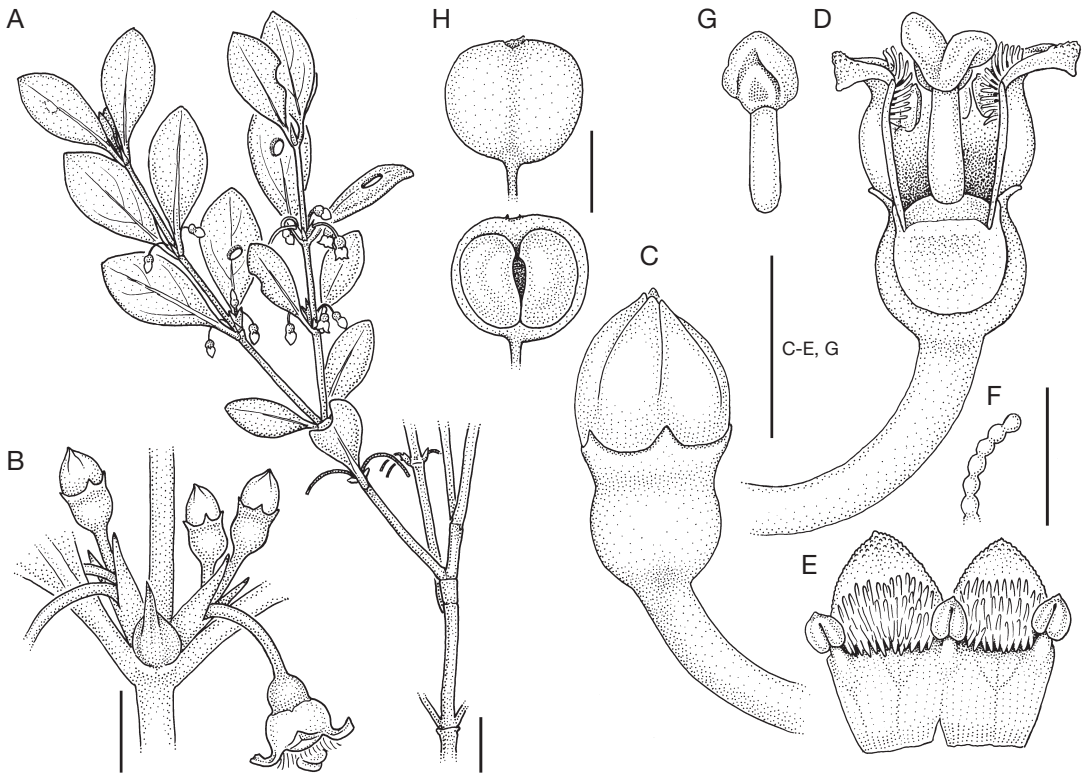


FIG. 2. — *Pyrostria pendula* Lantz, Klack. & Razafim.: **A**, flowering branch; **B**, close-up of female inflorescences; **C**, flower bud; **D**, female flower, one corolla lobe and corresponding part of tube removed, tangential longisection; **E**, part of female corolla; **F**, close-up of hair from inside of corolla; **G**, style; **H**, fruit. Scale bars: A, 1 cm; B, H, 5 mm; C-E, G, 3 mm; F, 0.5 mm.

is unlikely to be confused with other species. The fused bracts are often hidden by the stipules or the flowers and are hard to observe. The species appears functionally dioecious as classically observed in this genus. However, the female inflorescences have five to ten flowers per inflorescence in contrast to other dioecious species, where the female individuals have solitary flowers or flowers in pairs. The generic placement of this species is based on the presence of the fused but not long acuminate bracts, a distinguishing character of *Peponidium*, as well as on molecular data (Razafimandimbison *et al.* unpubl. data). The species was previously recorded by Gautier (2002: 209) in the checklist of Manongarivo plants as *Canthium* sp. 2. The author included several collections cited above, plus one (*Rakotomalaza* 97) not seen by us.

Genus *Pyrostria* Comm. ex Juss.

*Pyrostria pendula*

Lantz, Klack. & Razafim., sp. nov.  
(Fig. 2)

*Species haec a congeneribus ceteris floribus pendulis et pedicellis persistentibus differt. Apices bractearum longe subulati.*

TYPUS. — Madagascar. Antsiranana Province, Andapa District, Marojejy Massif, 3.II.2006, fl., *Razafimandimbison & Ravelonarivo* 626 (holo-, S; iso-, MO, TAN).

DESCRIPTION

Much branched shrub, 2-3 m tall. Branches slender, terete, glabrous, with a few lenticels. Leaves opposite, present on recent growth and to a smaller extent on older branches but soon caducous, glabrous; petiole



3-6 mm long; blade elliptic to (rarely) obovate, 16-28 × 8-16 mm, cuneate at base and decurrent, acute to slightly acuminate at apex, coriaceous, with revolute margins when dry; venation pinnate, arched; mid-rib prominent, slightly raised on lower surface, raised at basal part on upper surface when dry but disappearing towards apex; lateral nerves not visible when dry or with 1 or 2 faintly visible pairs; tertiary nerves not visible; domatia present as hair-filled pits in axils of main nerves; young stipules ± subulate, older ones with broadly ovate basal part with thin margins and brown hairs within, 2 × 2 mm, and with thicker central part, abruptly and subulately protruding long above basal part. Female inflorescences axillary on 2-3 mm long peduncles, 1-3-flowered; peduncular bracts large, 4-5 mm long, long acuminate, glabrous, enclosing the young inflorescence; pedicels pendulous, 5-6 mm long at anthesis, up to 12 mm long in fruit, persistent in dry state even after fruit dehiscence. Female flowers: calyx glabrous; tube 1-1.5 mm long; limb tube 0.3 mm long; lobes very broadly triangular, 0.3 × 0.8 mm. Corolla 4-5-merous, white, glabrous outside; tube bell-shaped, 2 mm long, at mouth filled with moniliform and verrucose hairs; lobes rounded triangular, 2 × 2 mm, recurved, acute to slightly acuminate at apex and thickened into a very short apiculum. Stamens attached to corolla tube near mouth; anthers subrotund, 0.5 mm long, included to partly exerted. Style including stigmatic head 3-3.5 mm long, shortly exerted; stigmatic head 1 mm long, deeply bilobed, style not recessed into the stigmatic head; disk glabrous. Ovary 2-locular. Male flower unknown. Fruits glabrous, slightly wider than long, 7 × 8 mm, not or very slightly indented at apex, truncate at base; pyrenes 2.

#### HABITAT

Wet and cloudy evergreen forests at *c.* 1900 m altitude.

#### REMARKS

*Pyrostria pendula* is only known from the type collection. This species was collected at the same locality as the type of *Peponidium crassifolium* in the Marojejy Massif. *P. pendula* is easily recognized by its pendulous flowers and persistent pedicels. This combination of characters is unique in the tribe and the species is

unlikely to be confused with other species. The only known specimen is female, evidenced by the absence of pollen and the presence of fruits, but atypically the flowers are sometimes 4-merous, a character usually attributed to male individuals of dioecious Vanguerieae. The presence of long acuminate bracts enclosing the young inflorescence clearly suggests a position in *Pyrostria*, which is also supported by molecular data (Razafimandimbison *et al.* unpubl. data).

### *Pyrostria serpentina*

Lantz, Klack. & Razafim., sp. nov.

(Fig. 3)

*Species haec a congeneribus ceteris habitu serpentino differt; foliis parvis ad brachyblastos dispositis etiam dignoscenda.*

**TYPUS.** — **Madagascar.** Toliara Province, Sud, Cap Sainte-Marie et environs Nord du Cap, 17.XII.1968, fr., SF-28538 (holo-, P).

**PARATYPES.** — **Madagascar.** Toliara Province, Fort-Dauphin District, Andohahela Réserve naturelle intégrale, Parcelle 2, *c.* 51 km WNW (BRG 295°) of Taolanaro (Fort Dauphin), forest 3.9 km E of Ihazofotsy, 24°48'58.8"S, 46°35'38.1"E, 150 m, 29.XI.1997, fl., fr., Davis *et al.* 1162 (BR, K, P, TAN). — Réserve spéciale du Cap Sainte, Tanjona I Vohimena (Cap Sainte Marie), 196.9 km WSW (BRG 251°) of Taolanaro, 25°35'41.16"S, 45°8'27.18"E, 110 m, 6.XII.1997, fl., Davis *et al.* 1200 (K, P, TAN).

#### DESCRIPTION

Much branched shrub, 1-2 m high. Branches tortuously twisting, terete, slightly pilose when young, later glabrous, dark grey; side shoots usually as short brachyblasts (up to 2 mm long). Leaves opposite, usually on brachyblasts, rarely on extended internodes, glabrous; petiole 0-1 mm long; blade elliptic to obovate, 5-10 × 2-4 mm, cuneate at base, blunt at apex, coriaceous, with tip or margins incurved when dry but straight at the very margin; venation of mid-rib only, faintly visible when dry, ± even with the leaf surface on both sides; domatia not seen; stipules and bracts small, narrowly triangular, acute, *c.* 0.5 mm long, early caducous, with hairs present within seen as small tufts on brachyblasts, also slightly pilose outside on developed internodes. Inflorescences axillary, sessile, two small triangular bracts present, early caducous. Male flowers paired,

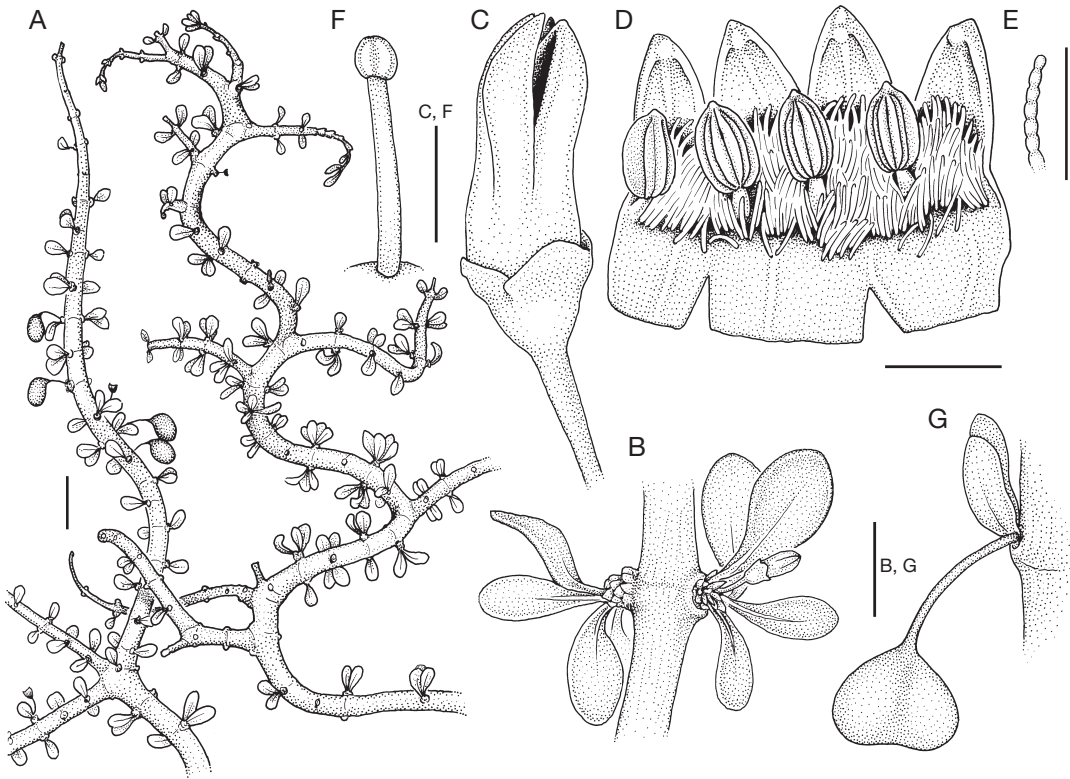


FIG. 3. — *Pyrostria serpentina* Lantz, Klack. & Razafim.: **A**, flowering branch, note that the depicted fruits all have one pyrene aborted; **B**, close-up of female inflorescences; **C**, flower bud; **D**, dissected corolla from within; **E**, close-up of hair from inside of corolla; **F**, style; **G**, fruit. Scale bars: A, 1 cm; B, G, 5 mm; C, D, F, 1 mm; E, 0.25 mm.

pedicels erect, 1–3 mm long. Calyx glabrous, tube 0.3–0.4 mm long, with an uneven  $\pm$  truncate margin. Corolla 4-merous, white, glabrous outside, tube cylindrical to slightly urceolate, 2–2.5 mm long, at mouth filled with moniliform hairs, lobes triangular,  $2 \times 0.8$  mm, acute and bent inwards at the very apex. Stamens attached to corolla tube near mouth; anthers ellipsoidal, 0.8 mm long, exserted. Style including stigmatic head 3 mm long; stigmatic head 0.3 mm long; style not recessed into the stigmatic head; disk glabrous; ovary absent. Female flowers (only flowers in bud seen) solitary; pedicels erect, 1–2 mm long (up to 10 mm in fruit). Calyx glabrous; tube 0.3 mm long; limb 0.5 mm long, with low and rounded lobes,  $0.3 \times 0.6$  mm, or with an uneven  $\pm$  truncate margin. Corolla 4-merous, greenish white, glabrous outside; tube  $\pm$  cylindric, 1.1 mm long, at mouth filled with moniliform hairs; lobes triangular,

$1.5 \times 0.8$  mm, acute and bent inwards at the very apex. Stamens attached to corolla tube near mouth; anthers ellipsoidal, 0.8 mm long, partly exserted. Style including stigmatic head 2 mm long; stigmatic head 0.3 mm long; style not recessed into the stigmatic head; disk glabrous; ovary 2-locular. Fruit bilobed but often with one locule aborted and gibbous (similar to a golf club), 5 mm long, 7 mm wide, only slightly indented at apex, cuneate at base.

#### HABITAT

Deciduous, dry southern forest and scrubland. Specimen in bud seen from late November, in fruit from December.

#### REMARKS

*Pyrostria serpentina* is known from three collections, one with female flowers in bud, one with fruits, and

one (Davis *et al.* 1200) with both male and female branches which thus must be a composite collection of two individuals. The position in *Pyrostria* is supported by molecular data (Razafimandimbison *et al.* unpubl. data). We can see no paired bracts although the very condensed nodes of the brachyblasts make it quite impossible to differ between any possibly present bracts and the morphologically very similar stipules.

Material of this species was known to Leroy who annotated the Paris (P) specimen with the unpublished name "*Canthium torsivum*". However, he used the name also for a specimen without the characteristically twisting branches (Seyrig 269 [P]) and he therefore seemed to have a broader concept of the species than we do. We restrict this species to specimens with serpentine branches. There are also in Paris some specimens (SF-20188; SF-22464; Labat *et al.* 2066) that lack the serpentine branches and have elongated brachyblasts, up to 30 mm in length, compared to the ones of *P. serpentina* that are up to 2 mm long. Leroy annotated the two SF-specimens as "*Canthium extraordinaire*" and they are in other characters similar to *P. serpentina*. These specimens might represent a new species, or an older stage of *P. serpentina*, in which the brachyblasts have had time to grow by the addition of new nodes. Field studies are needed to analyse this accurately, and at the moment we exclude them from *P. serpentina*. There are also similarities between *P. serpentina* and *Canthium decaryi* Homolle ex Cavaco (Cavaco 1972), a small-leaved species only known from the region of Ankazobe (holotype *Decary* 7562 [P], from Ankazobe, 90 km northwest from the city of Antananarivo). However, the side shoots of *C. decaryi* are much more developed with longer internodes, the branches are not twisting, and the young branches are covered with a brown, short, indumentum, and there can be no doubt that this is a different species.

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