New species of Apocynaceae from Madagascar

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New species of *Apocynaceae* from Madagascar

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Abstract: Preparation of a treatment of the family *Apocynaceae* for the *Flore de Madagascar et des Comores* necessitates the description of 11 new species and one new variety in subfamilies *Periplocoideae* (*Baroniella effusa*, *Pentopetia suarezensis*) and *Secamonoideae* (*Calyptranthera punctulata*, *C. rosea*, *Pervillaea lanata*, *Secamone chouxii*, *S. dictyoneura*, *S. furcata*, *S. glabra*, *S. laevis*, *S. parviflora* and *S. toxocarpoides* var. *incana*). Furthermore, an amended description of *Pervillaea tomentosa* is provided necessitated by an earlier confusion of this taxon with *P. brevirostris* (here synonymized) and with the new species *P. lanata*.

Key words: *Apocynaceae*, *Baroniella*, *Calyptranthera*, Madagascar, new species, *Pentopetia*, *Periplocoideae*, *Pervillaea*, *Secamone*, *Secamonoideae*, taxonomy

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Introduction

During continuous studies of *Apocynaceae* for the *Flore de Madagascar et des Comores*, I have come across several specimens that do not fit into any known taxon and are here described as twelve new taxa in *Baroniella* Costantin & Gallaud (one species) and *Pentopetia* Decne. (one species) in subfamily *Periplocoideae* and in *Calyptranthera* Klack. (two species), *Pervillaea* Decne. (one species) and *Secamone* R. Br. (six species and one variety) in subfamily *Secamonoideae*. These genera are all endemic to the Madagascar-Mascarene area, except *Secamone*, which has a wide palaeotropical distribution.

Baroniella is a small, periplocoid genus of suffrutescent twiners endemic to the East Malagasy Phytogeographic Region (for the division into Phytogeographic Regions and Domains, see Humbert 1955), found from the littoral forest up to 1700 m altitude. In a revision of the genus (Klackenberg 1997b), seven species were recognized. More recently, two species have been added, *B. collaris* Klack. and *B. linearifolia* Klack., both from the littoral forest. Along with *B. camptocarpoides* Costantin & Gallaud, a rather common and widespread species in the littoral forest, *B. effusa* described below adds a fourth taxon from this habitat.

Pentopetia androsaemifolia Decne., found in Madagascar as well as in the Comoro and Assumption Islands, is the only species of *Pentopetia* known also from outside Madagascar. Representatives of the genus are known from all Phytogeographic Domains of Madagascar. Since the latest revision of the genus (Klackenberg 1999), *P. viridis* Klack. & Meve from Ampasindava and *P. astephana* Klack. from the Antsiranana area have been described. Together with *P. suarezensis* described below, 23 species are currently included in the genus.

Pervillaea was revised by Klackenberg (1996a). Four species were accepted, all endemic to Madagascar and distributed in the drier northwestern, western and south-

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ern parts of the island (West Malagasy Phytogeographic Region). Some years later, a fifth taxon, *P. brevirostris* Klack., was described as an endemic from Mauritius (Klackenberg 2007), but in the present article it is synonymized with *P. tomentosa* Decne. from northernmost Madagascar. With *P. lanata* described in the current article, the genus now comprises five species.

Calyptranthera was recognized by Klackenberg (1996b) based on a specimen previously placed in *Toxocarpus* Wight & Arn. In a revision one year later, four new species were added, all from the eastern, wetter part of Madagascar (Klackenberg 1997a). More recently, new species of *Calyptranthera* have also been found in northern and northwestern parts of the island in predominantly drier areas. However, these species are also confined to pockets with humid climate, viz. *C. viridiflava* Amman, L. Gaut. & Klack. from Sambirano Domain and *C. gautieri* Klack. from wetter parts of the Manongarivo massif in Central Domain as well as from Montagne d'Ambre, an isolated mountain forest surrounded by the drier Western Domain. Two species, *C. sulphurea* Klack. and *C. villosa* Klack., were described from the same humid forest in the Daraina area in Vohémar District, a phytogeographically complex border area between Eastern, Western and Central Phytogeographic Domains. This distribution conforms with the pattern discussed by Nusbaumer & al. (2010), i.e. a phytogeographic connection between the evergreen lowland rainforest of Eastern Domain and those of Sambirano and of the isolated Ambre mountain, with Daraina as a link in between. With *C. punctulata* and *C. rosea* described below, 13 species are now recognized in this genus.

Secamone is a palaeotropical genus distributed in Africa from the Western and Eastern Cape Provinces of South Africa in the south to Senegal, the Republic of Central Africa and Socotra in the north. The genus is widely distributed in Madagascar and is also present on several smaller islands in the Indian Ocean. In Asia it is found from southern India and Sri Lanka and further eastward from Yunnan through SE Asia to New Caledonia and Australia. The genus was revised by Goyder (1992) and Klackenberg (2001) for continental Africa and by Klackenberg (1992a, 1992b) for Madagascar and Asia. Together with the six new taxa described below, 72 species are now known from Madagascar. The genus is represented in all Phytogeographic Domains of the island. All species found in Madagascar and the Comoro Islands are endemic to this area, except *S. pachystigma* Jum. & H. Perrier, which is also present in the Seychelles archipelago.

Material and methods

This study is mostly based on specimens from the herbaria BR, MO and P, collected during the last 20 years, in order to update an ongoing study for the *Flore de Madagascar et des Comores*. However, also material from G, GH, K, L, NY, S and US has been studied and cited (herbarium codes according to Thiers 2019+). The measurements and terminology of floral parts are in accordance with Klackenberg (1997a: fig. 2) for *Calyptranthera* and *Pervillaea*, with Klackenberg (1999) for *Pentopetia*, with Klackenberg (1997b) for *Baroniella*, and with Klackenberg (1992a: fig. 2, 3, 4; 2001: 318) for *Secamone*.

Taxonomy

Baroniella effusa Klack., **sp. nov.** – Fig. 1.
Holotype: Madagascar, Fianarantsoa, Atsimo-Atsinanana reg., Farafangana, Mahabo Mananivo, Forêt d'Analazaha à l'est du fokontany Nosiala, 23°11'S, 47°41'E, 21 m alt., 29 Oct 2004, *Ludovic, Jeannot & Emilson 933* (MO!; isotypes: P, TAN).

Diagnosis — Species haec *Baroniellae camptocarpoidi* in habitu similis sed differt lobis corollae brevioribus (< 5 mm) et stigmate cum lobis distinctis inter antheras protrudentibus.

Description — Suffrutescent, glabrous twiner. *Leaves* opposite; blade 2.5–5 × 1.5–3.5 cm, elliptic to obovate, cuneate at base, acute to apiculate at apex; venation pinnate; midrib and primary veins finely raised on upper surface, ± flush with lower surface when dry; petiole 3–4 mm long. *Inflorescences* longer than adjacent leaves, pendent, 4–20 cm long; cyme composed of several ± regular dichasia, with lower internodes 2–10 cm long, many-flowered; pedicels 3–10 mm long; bracts to 1 mm long. *Calyx* lobes 1–1.1 × 0.8–1 mm, about as long as corolla tube, very broadly ovate, broadly acute to rounded at apex; margin entire. *Corolla* narrowly ovoid in bud, fused for c. ¼ of its length into a tube, dull purple outside and white with pink centre inside; tube c. 1 mm long; lobes 3.3–3.5 × 1.7–2.1 mm, ovate, obliquely acute at apex. *Corona* forming an undulating ring at base; interstaminal lobes c. 0.3 mm high, rounded to truncate, reaching c. ½ way or more to style head. *Anthers* ± rectangular; filaments 0.4–0.5 mm long; elongation of connectives c. ½ as long as thecae. *Translators* with elliptic, 0.2–0.3 mm long spathe; stipe missing. *Style* including style head 0.8–0.9 mm high; style head discoid, with distinctly protruding apical portion, with 5 indistinct lobes opposite anthers and 5 longer interstaminal lobes protruding between stamens. *Follicles* c. 15 × 0.2 cm, curved and linear, slightly moniliform, recurved 45°–90° at base. *Seeds* not seen.

Phenology — Flowering specimens seen from October and November, in fruit from November.

Distribution and ecology — *Baroniella effusa* is known from two collections from Farafangana at c. 20 m altitude, one from littoral forest on sand and one from degraded forest.

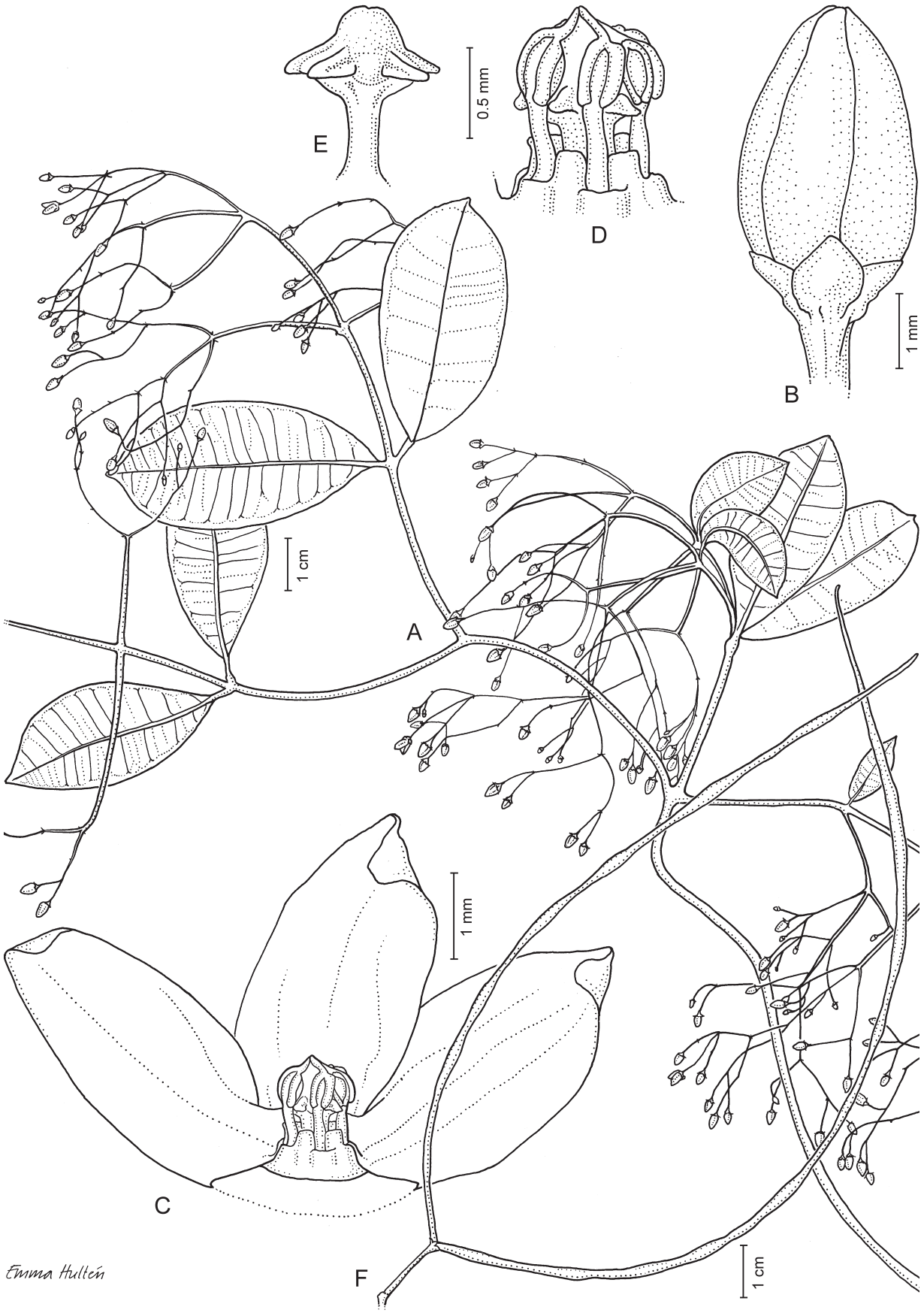

Fig. 1. *Baroniella effusa* – A: habit; B: flower in bud; C: gynostegium and portion of corolla; D: corona and anthers surrounding style head; E: style and style head; F: follicles. – From *Ludovic & al. 933* (MO). – Drawn by Emma Hultén, Stockholm.

Remarks — Baroniella effusa is in habit similar to *B. camptocarpoides* by its somewhat thick leaves with inconspicuous venation. Both species are found in the littoral forest. However, *B. effusa* is easily separated by the smaller flowers (< 5 mm long) gathered in profuse inflorescences and by the long style with discoid style head furnished with long lobes protruding between the anther filaments. The flowers in *B. camptocarpoides* are more than 5 mm long and the style head is obconical without protruding lobes.

Additional specimen studied — Madagascar: Fianarantsoa: Atsimo-Atsinanana, S of Farafangana, near village of Mahabo, 20 m alt., 2001, *McPherson & Rabenantoandro 18363* (MO).

Pentopetia suarezensis Klack., **sp. nov.** – Fig. 2.
Holotype: Madagascar, Prov. Antsiranana, Montagne de Français, 12°22'05"S, 49°21'E, 23 Jan 2002, *De Block, Rakotonasolo & Randriamboavonjy 1365* (BR!; isotypes: G, K, MO!, P!, TAN).

Diagnosis — Species haec *Pentopetiae boivinii* foliis variegatibus similis sed differt bracteis valde longioribus, lobis coronae brevioribus et foliis pubescentibus.

Description — Suffrutescent, scrambling liana with younger branches hairy. *Leaves* opposite; blade elliptic, 20–35 × 10–20 mm, abruptly tapering to truncate at base, acuminate or apiculate at apex, hairy, when dry pale on lower surface and darker on upper surface but with contrasting paler midrib and primary nerves as well as leaf margin; venation looped, with veinlets reticulate when dry; midrib ± impressed on upper surface when dry, raised on lower surface; primary nerves ± flush with both surfaces when dry, diverging at c. 45° from midrib; petiole 5–10 mm long, hairy. *Inflorescences* axillary or terminal on short lateral branches, about as long as to shorter than adjacent leaves, to 3 cm long; cyme irregularly branched with both longer internodes to a few mm long and very short ones, umbel-like, 5–7-flowered; pedicels 10–15 mm long, hairy; bracts several, narrow, 4–6 mm long. *Calyx* lobes narrowly ovate, c. 4 × 1.3 mm, gradually narrowing and acute to acuminate at apex, much longer than corolla tube, often recurved, hairy at least along central part, ciliate along margin. *Corolla* with lobes fused for 1/5–1/6 of their length into a tube, white; tube 0.7–1.2 mm long, ± densely hairy inside and particularly below anther filaments; lobes oblong, 5–7 × 3–4 mm, bluntly acute and laterally notched at apex, lengthwise incurved, with a ± triangular boss at base, rotate to recurved, glabrous except for a patch of long hairs at each side of basal boss. *Corona* lobes 0.7–1 mm high, subulate to filiform, straight, as long as or shorter than filaments, glabrous. *Staminal cone* 2.4–2.7 mm high, distinctly exserted; filaments c. 1 mm long, filiform, slightly curved, inserted at mouth of corolla tube just below corona lobes, with long hairs near base inside; anthers c. 1.5 mm long, glabrous, with slightly protruding flat connective. *Translators* c. 1 mm long; spathe roundish, c. 0.5 mm long; stipe distinct, ± cylindric. *Ovary* and proximal part of style without longitudinal ridges. *Style* c. 1.5 mm long, glabrous; style head ovate in outline. *Follicles* not seen.

Phenology — Flowering specimens seen from January.

Distribution and ecology — Pentopetia suarezensis has hitherto been collected twice, both near Antsiranana (Diego Suarez), in deciduous forest on littoral sand or on limestone (tsingy).

Remarks — Pentopetia suarezensis is similar to *P. boivinii* Prain, a fairly common species from the littoral forests of the Malagasy E coast, by flower morphology but also by its variegated leaves when dry, i.e. the leaves have a darker upper leaf surface with contrasting pale areas along the midrib, larger veins and margin. It differs, however, by having shorter corona lobes but linear and much longer bracts. *Pentopetia suarezensis* and *P. boivinii* have similar, somewhat triangular bosses at the corolla lobes just outside the tube. In *P. suarezensis*, a patch of hairs on each side of these bosses is present, i.e. the petals are hairy also outside the tube. *Pentopetia boivinii* is hairy only inside the tube. In addition *P. suarezensis* differs by its smaller and hairy leaves with primary nerves that diverge at a narrower (c. 45°) angle from the midrib. In *P. boivinii* also young leaves are glabrous.

Another similar species to *Pentopetia suarezensis* is *P. astephana*. Both species have hairy and variegated leaves, and also a distinctly hairy corolla mouth. *Pentopetia suarezensis* differs by its short and widely funnel-shaped corolla tube topped by arched filaments of the anther cone and by its calyx lobes being almost twice as long as in *P. astephana*. It is furthermore characterized by its laterally notched corolla lobes. Although short, corona lobes are present in *P. suarezensis* (vs totally lacking in *P. astephana*).

Additional specimens studied — Madagascar: Antsiranana: forêt d'Orangea, side closest to Ramena, *De Block, Rakotonasolo & Randriamboavonjy 1375* (BR, MO).

Calyptranthera punctulata Klack., **sp. nov.** – Fig. 3, 4A.
Holotype: Madagascar, Toamasina, Alaotra Mangoro, Antampon'i Bevendra, 18°49'29"S, 48°57'09"E, 241 m alt., 26 Feb 2006, *Andriambololonera 147* (P!; isotypes: MO!, P!, TAN).

Diagnosis — Species haec *Calyptrantherae caudiclavae* lobis coronae spathulatis et connectivi lobis filiforme prolongatis et corollis punctatis similis autem differt corollis majoribus et parte connectivii basali omnino pubescenti.

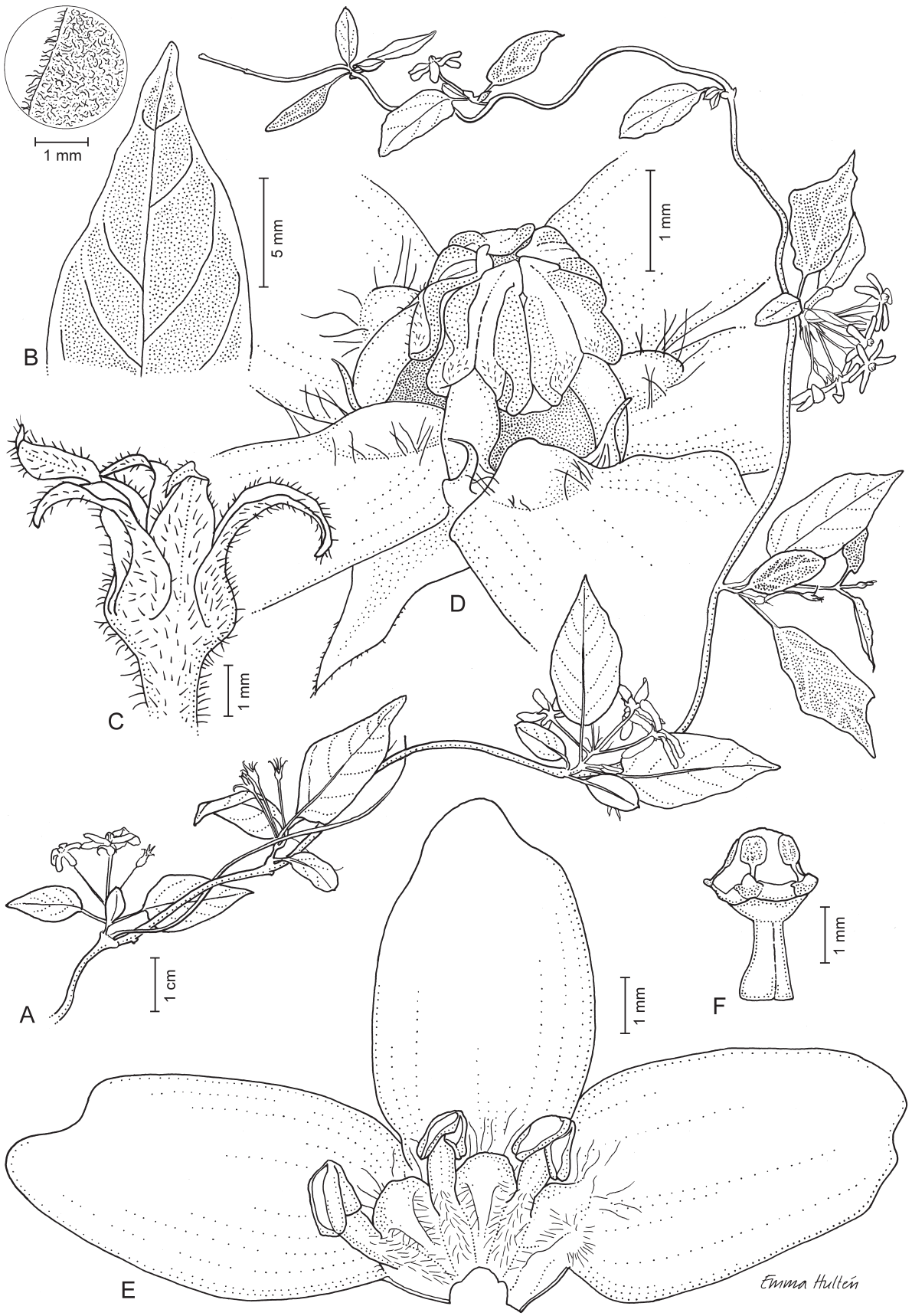

Fig. 2. *Pentopetia suarezensis* – A: habit; B**:** leaf distal portion showing variegated upper surface and magnification of hairy lower surface; C: calyx; D: central part of flower showing corona and anther cone; E: portion of flower with gynoecium removed; F: style and style head with translators. – From *De Block & al. 1365* (BR). – Drawn by Emma Hultén, Stockholm.

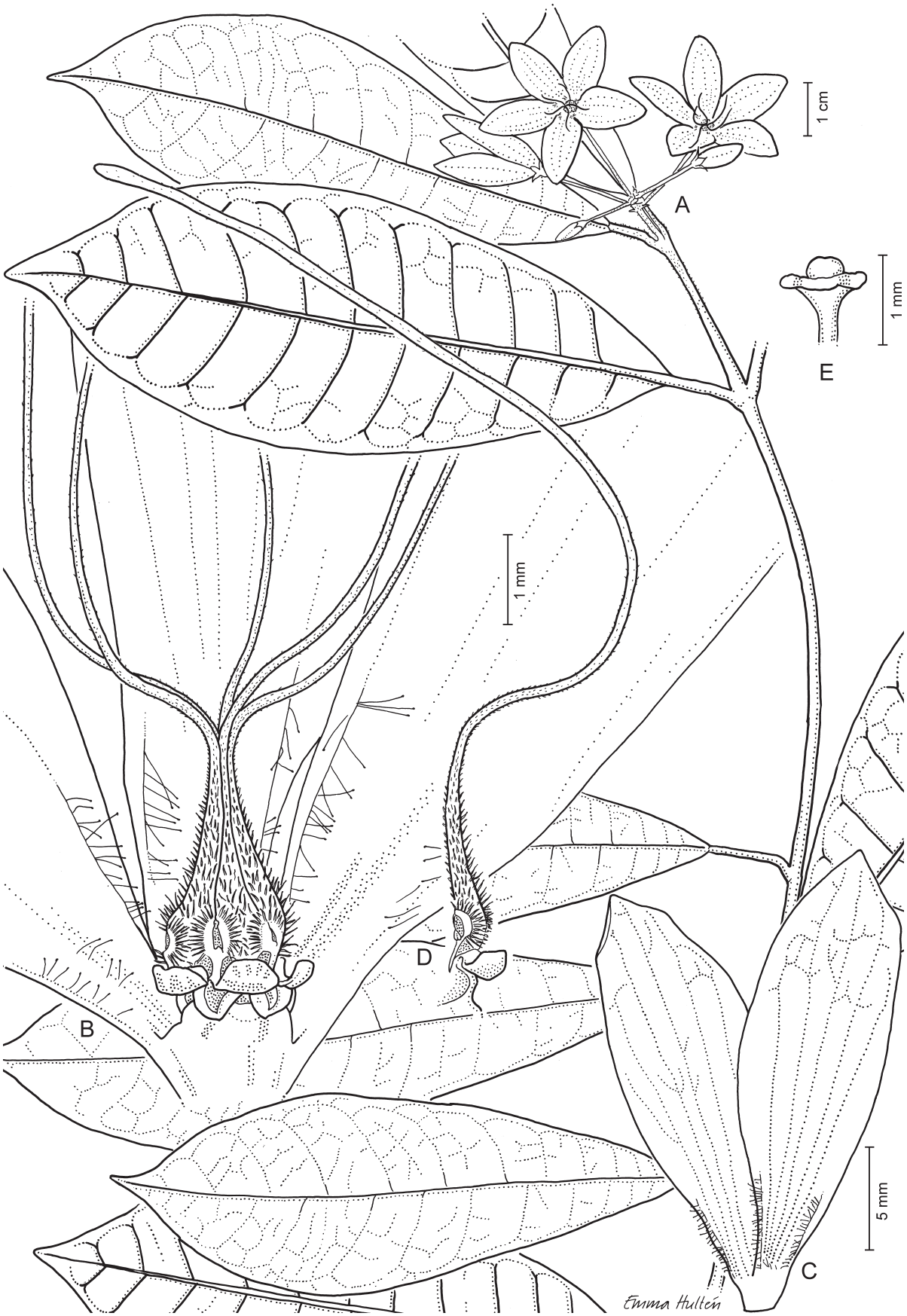

Fig. 3. *Calyptranthera punctulata* – A: habit; B: gynostegium and portion of corolla; C: portion of corolla from within; D: anther in lateral view; E: style head. – From *Andriambololonera 147* (MO, P). – Drawn by Emma Hultén, Stockholm.

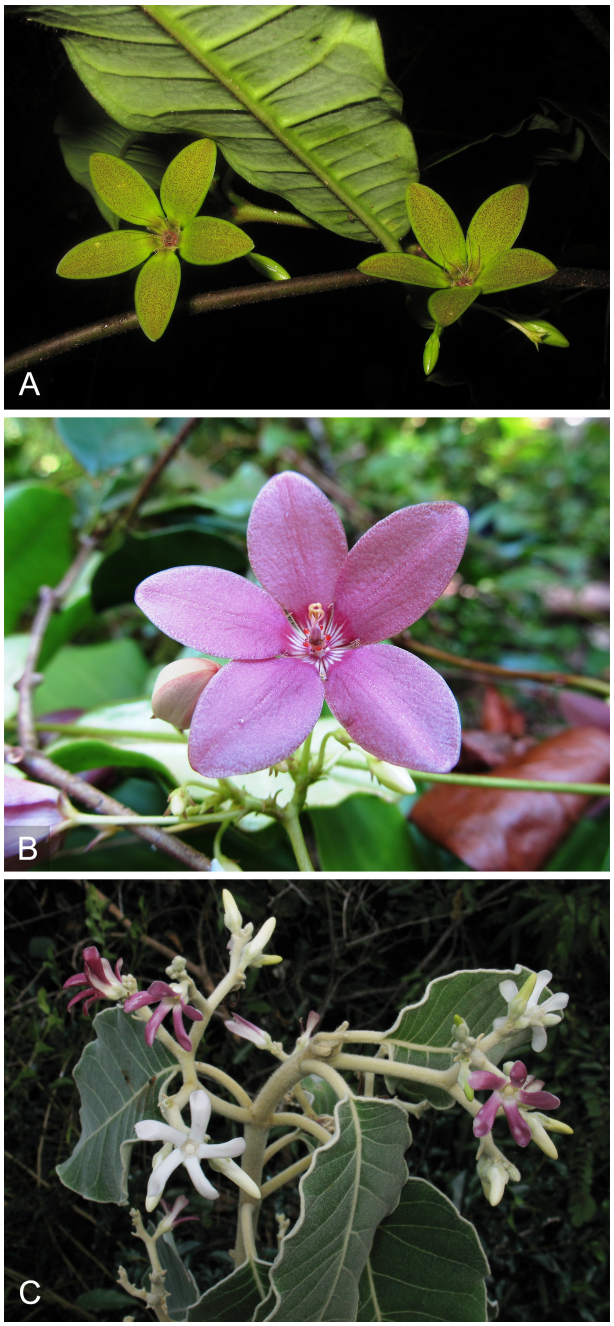

Fig. 4. A: *Calyptranthera punctulata*, NAP Sahifina, Antsinanana, Feb 2006, *Andriambololonera 147*, photograph by and © David Rabehevitra. – B: *Calyptranthera rosea*, Fort Dauphin, Nov 2011, *Ratovoson 1784*, photograph by and © Fidy Ratovoson. – C: *Pervillaea lanata*, Boeny, Mahajanga, Apr 2007, *Callmander & Phillipson 676*, photograph by and © Peter Phillipson. – With the courtesy of Tropicos, Missouri Botanical Garden.

Description — Suffrutescent twiner with younger branches densely covered by erect, reddish hairs, glabrescent. *Leaves* opposite; blade 8–13 × 3–5 cm, elliptic to usually obovate, cuneate at base, acuminate to apiculate at apex, glabrous but with reddish hairs along midrib on lower surface and along margin; secondary nerves slightly raised on both surfaces when dry; veinlets reticulate; petiole distinct, 1–1.5 cm long, with reddish hairs. *Inflorescences* much shorter than adjacent leaves; cyme with few flowers, sparsely hairy to almost glabrous; pedicels 1–2 cm long; bracts and bracteoles triangular, c. 1.2 mm long. *Calyx* lobes c. 2.2 × 1.2 mm, much longer than corolla tube, triangular to slightly ovate, acute at apex. *Corolla* greenish with violet-brownish dots; tube c. 0.5 mm long; lobes 18–20 × 6–7 mm, elliptic, bluntly acute at apex, rotate, with 5 parallel veins, glabrous outside, finely hairy near base inside but also with two c. 2 mm long, submarginal rows of longer, distinct, somewhat bulbous hairs at each side. *Staminal column* in total c. 12 mm high (c. 1.5 mm with elongated portion of connectives excluded); filament cylinder below pollinaria entrances short; thecae and broader basal part of connectives distinctly hairy; connectives much elongated, at base dorsiventrally flattened and narrowly triangular, standing together in form of a cone, apically narrowing into 5 free, very thin, c. 1 cm long, filiform appendages. *Corona* lobes dorsiventrally flattened, c. 0.6 mm long, horizontal but folded, much shorter than connectives, glabrous, smooth, reddish brown. *Pollinia* not seen. *Style* narrow and cylindric but conical just below style head; style head c. 0.5 mm high. *Follicles* not seen.

Phenology — Flowering specimen seen from February.

Distribution and ecology — *Calyptranthera punctulata* is known only from the type locality in the New Protected Area (NAP) Sahifina near Brickaville (on label Antampon'i Bevendra) in the southern part of Antsinanana (on label Alaotra Mangory by mistake [Sylvie Andriambololonera, pers. comm.]) in disturbed forest at 241 m altitude.

Remarks — *Calyptranthera punctulata* is similar to *C. caudiclava* (Choux) Klack. and *C. filifera* Klack. These three species are all characterized by short and rotate corona lobes, and by their elongated connectives that basally are dorsiventrally flattened forming a usually cone-shaped calyptra above the thecae but apically transform to long and filiform appendages. *Calyptranthera punctulata* differs, however, by having the thecae and connectives densely covered by somewhat scale-like hairs. The apical parts of the connectives are evenly filiform, not club-shaped. It also differs by its corona lobes being dorsiventrally flattened and bent, almost folded, in contrast to the club-shaped lobes of *C. filifera*. *Calyptranthera punctulata* has flowers twice as large as *C. caudiclava*. In addition, it differs from *C. caudiclava* and particularly from *C. filifera* by its short (< 0.5 mm) basal tubular portion of the staminal column (the part below the entrances for the pollinia at pollination). In *C. caudiclava* and *C. filifera* this basal tubular portion of the filaments is distinctly longer, 1 mm long or more.

Calyptranthera rosea Klack., **sp. nov.** – Fig. 4B.
Holotype: Madagascar, Tôlanaro, Forêt de Mandena, 17 Mar 1985, *Dorr 4018* (MO!; isotypes: P!, TAN).

– *Calyptranthera caudiclava* sensu Klackenberg in Adansonia, ser 3, 19: 29. 1997, pro parte quoad fig. 5A, B, E–G, non *Toxocarpus caudiclavus* Choux.

Diagnosis — Species haec *Calyptrantherae caudiclavae* lobis coronae spathulatis et connectivi lobis filiforme prolongatis similis autem differt corollis roseis.

Description — Suffrutescent twiner to c. 3 m high. *Leaves* opposite; blade 5–10 × 3–6 cm, oblong or obovate to very broadly elliptic, cuneate to truncate but sometimes minutely cordate at very base, acuminate to apiculate or rounded at apex, hairy on lower surface, more sparsely so on upper surface and glabrescent; veinlets reticulate and raised on lower surface but indistinct on upper surface when dry; petiole 1–1.5 cm long, when young densely hairy, glabrescent. *Inflorescences* shorter than adjacent leaves; cyme with short internodes on a 1–1.5 cm long peduncle; pedicels 1–1.5 cm long; bracts 2–3 mm long. *Calyx* lobes 2.3–3.5 × 0.8–1.5 mm, longer than corolla tube, ovate-triangular, acute at apex. *Corolla* purple-lavender to rose; tube 0.4–0.8 mm long; lobes 12–20 × 6–10 mm, elliptic, rounded at apex, glabrous outside or with a few scattered longer reddish hairs, glabrous inside except for a patch of straight, erect, white hairs near base including long, distinct, somewhat bulbous hairs in a submarginal row c. 1.3–2 mm long at each side; margin glabrous. *Staminal column* in total 8–10 mm high (1.7–2 mm with elongated portion of connectives excluded); filament cylinder below pollinaria entrances distinct; anthers glabrous; connectives much elongated, fused and broadened proximally forming a cone above thecae and crowned with 5 free, filiform to ± club-like appendages, glabrous. *Corona* lobes somewhat spathulate or club-shaped, 0.5–0.8 mm long, truncate at apex, rotate, much shorter than connectives, glabrous. *Pollinia* 0.1–0.15 mm long. *Style* narrow and cylindric proximally but slightly conical below style head, 1.2–1.5 mm high; style head 0.35–0.5 mm high. *Follicles* not seen.

Phenology — Flowering specimens seen from November, January and March.

Distribution and ecology — *Calyptranthera rosea* is distributed in the southeasternmost part of Madagascar. It grows in littoral forest on sand.

Remarks — In Klackenberg (1996a), this taxon was confused with *Calyptranthera caudiclava* (Choux) Klack. However, with more material of this genus accumulated from southern Madagascar accompanied with a re-evaluation of the type of *C. caudiclava*, it has become clear that the population from the littoral forest, here described as *C. rosea*, differs from *C. caudiclava* found in forests of some hundred metres altitude. In addition to *C. caudiclava* and *C. rosea*, a third species, *C. filifera*, is also known from the southern part of Madagascar. *Calyptranthera rosea* conspicuously differs by its bright rose-violet flowers in contrast to the dull greenish to brownish petals with reddish spots seen in the other two species, a colour pattern also characteristic for the new *C. punctulata* described in this article (Fig. 4A). Furthermore, the elongated connectives (see Remarks to *C. punctulata*) stand tightly together forming a long and almost cylindric calyptra in *C. rosea* and the filiform appendages are more or less upright. In contrast, *C. caudiclava*, *C. filifera* and *C. punctulata* are furnished with more triangular connectives forming a conical calyptra that is topped by diverging appendages.

Additional specimens studied — MADAGASCAR: TÔLANARO: Manafiafy (Ste Luce), 1990, *Dumetz 1188* (MO, P); N of Tôlanaro, Manafiafy (Ste Luce), c. 4.5 air km W and slightly S of Manafiafy, 5 m alt., 1998, *Lowry & al. 5005* (MO, P, S); Anosy Region. Fort Dauphin, Mahatalaky, Belavenoko S6 – 3.45–4 km E of Belavenoko, 17 m alt., 2011, *Ratovoson 1784* (MO).

Pervillaea lanata Klack., **sp. nov.** – Fig. 4C.
Holotype: Madagascar, Antsalova, 2 Apr 1993, *Villiers, Klackenberg & Badré 5007* (S [specimen mounted on 2 sheets: S07-6993! & S07-6996!]; isotypes: K, MO!, P!).
– *Toxocarpus tomentosus* sensu auct. div. incl. Jumelle & Perrier de la Bâthie in Ann. Mus. Colon. Marseille, ser. 2, 5: 391. 1907 and in Ann. Mus. Colon. Marseille, ser. 2, 6: 214. 1908 (extended descr.), non *Pervillaea tomentosa* Decne.
– *Pervillaea tomentosa* sensu Klackenberg in Nordic J. Bot. 16: 174. 1996, pro parte quoad fig. 4, 5A, E, non Decne.

Diagnosis — Species haec habitu *Pervillaeae tomentosae* primo adspectu maxime similis sed differt inflorescentiae ramis magis crassis et longis, connectivis multo longioribus et corollis majoribus atque roseis albescentibus.

Description — Suffrutescent, woolly twiner to 8 m high. *Leaves* opposite; blade narrowly ovate to usually elliptic or broadly ovate, 8–17 × 6–12 cm, cuneate to truncate or cordate at base, acuminate to apiculate at apex, with entire margin, with dense curled whitish hairs on lower surface and sparser ± straight hairs on upper surface; venation pinnate and somewhat arched, reticulate; midrib and primary nerves distinctly raised on lower surface; petiole distinct, thick, 1.5–4 cm long, woolly. *Inflorescences* c. ½ as long as adjacent leaves or rarely longer; cyme lax, rather many-flowered, woolly; pedicels often in pairs, 2–4 mm long; bracts usually very short to 3 mm long. *Calyx* lobes narrowly triangular to ovate, 2.7–4.3 × 1.3–1.6 mm, longer than corolla tube, acute at apex, with long, wavy, dense hairs on both surfaces. *Corolla* contorted with left lobe margin overlying, not twisted, with lobes fused for $^1/_5$–$^1/_7$ of their length into a tube, glabrous inside but rarely with a few scattered longer hairs outside, first

pale reddish outside and darker red inside but becoming white; tube c. 2 mm long; lobes narrowly oblong to narrowly obovate, 9.5–11.5 × 2.3–3.9 mm, rounded at apex. *Staminal column* 1–1.2 mm high (connectives excluded); thecae glabrous; connectives projecting long above thecae forming a cone, 1.2–2 mm long, glabrous. *Corona* lobes narrowly triangular, 2–3 mm long, gradually tapering toward apex, straight, slightly longer to almost 2 × as long as connectives, glabrous; margin usually entire but sometimes with irregular teeth. *Pollinia* elliptic to ovate, 0.18–0.27 mm long. *Style head* with short, broader than high, 0.3–0.5 mm high apical portion. *Follicles* narrowly ovate to narrowly oblong in outline, 7–14 × 2–3 cm, not recurved or recurved c. 90°, gradually tapering toward acute apex but seeming rounded to truncate because of indumentum, covered with very dense, long, wavy, intertwining hairs. *Seeds* c. 10 mm long; hairs c. 2 cm long.

Phenology — Flowering specimens seen from January, March and April, in fruit from January, March, July and August.

Distribution and ecology — *Pervillaea lanata* is distributed in the northwestern half of Madagascar in Western Domain. It has been found in usually dry, sometimes degraded forest on sandy soil up to 120 m altitude.

Remarks — Decaisne (1844) described *Pervillaea tomentosa* from northeasternmost Madagascar. Some 60 years later, Perrier de la Bâthie collected extensively in the northwestern part of the island and came across what he believed to be the same species as Decaisne's *P. tomentosa*, although he considered this taxon better placed in *Toxocarpus* Wight & Arn. (Jumelle & Perrier de la Bâthie 1907). Klackenberg (2007) described *P. brevirostris* as an endemic from Mauritius. However, an analysis of recently collected material, together with a re-examination of the type of *P. tomentosa* (Vohémar, *Richard 91*), shows the Mauritian *P. brevirostris* and the Malagasy *P. tomentosa* to be conspecific, and *P. brevirostris* is here placed in synonymy of *P. tomentosa*. In contrast, the Malagasy northwestern population of what has been conceived as *P. tomentosa* (*Toxocarpus tomentosus* sensu Jum. & H. Perrier) differs in several characters from the northeastern population and is here described as *P. lanata*. A new description of the more narrowly circumscribed *P. tomentosa* including *P. brevirostris* and a list of material referred to this species are presented below.

Pervillaea lanata and *P. tomentosa* are easily distinguished by their large and broad leaves, much larger than the leaves of the other taxa of this genus. Flowering branches in *P. lanata* bear broadly ovate, usually cordate leaves. On vegetative branches, the lamina is usually narrower, narrowly ovate to elliptic and with a truncate to tapering base. The petals are reddish but turn white in late anthesis. This is in contrast to the greenish yellow ones covered with purple dots that are characteristic for *P. tomentosa*. Furthermore, the corolla lobes are longer (c. 1 cm long in *P. lanata* vs usually 5–6 mm long in *P. tomentosa*) and the inflorescences are larger in all parts (5–10 cm long in *P. lanata* vs less than 5 cm long in *P. tomentosa*). The connectives are distinctly elongated above the thecae in *P. lanata*, about as long as the corona lobes and directed upward forming a cone above the style head. In *P. tomentosa* these elongated connectives are small, broadly triangular and directed horizontally forming a lid directly above the style head.

For additional illustrations of *Pervillaea lanata*, see Klackenberg (1996a: fig. 4A–G, 5A, E).

Additional specimens studied — Madagascar: Mahajanga: the dunes, 30 Mar 1912, *Afzelius s.n.* (MO, NY, P, S); Besalampy, Jun 1906, *Alleizette s.n.* (L); Madagascar s. loc., *Baron 4789* (P); baie de Bombetoka, au bord de la mer, 1839, *Bojer s.n.* (mixed collection, also one piece of *Pervillaea tomentosa*) (P); Boeny, à 15 km au nord-ouest de la ville Mahajanga, au sud-ouest de la rivière Morira, entre les villages Mangatsa et Antsianitia, 5 m alt., 2007, *Callmander & Phillipson 676* (MO, P); entre Boriziny (Port Bergé) et la Sofia, 1973, *Cremers 2429* (MO, P); sud de Besalampy, *Decary 8064* (K, P); Maintirano, 1930, *Decary 8242* (P); plateau d'Ankara, 1900, *Perrier de la Bathie 1098* (P); Manongarivo, 1903, *Perrier de la Bathie 1098* (same no.!) (P); plateau d'Antanimena entre la Mahavavy et la Betsiboka, 1905, *Perrier de la Bathie 1098* (same no.!) (P); Boiny et Ambongo, *Perrier de la Bathie 1098* (same no.!) (P); env. de Marovoay, Ankarafantsika, 1910, *Perrier de la Bathie 9011* (MO, P); entre la Manambolo et la Tsiribihina, 1911, *Perrier de la Bathie 11771* (P); env. de Marovoay, 1908, *Perrier de la Bathie 11780* (P); route vers la forêt de Mangabe, 90 m alt., 1995, *Rakotomalaza & al. 388* (BR, MO); Ambato Boeni, Tsaramandroso, Bevazaha, *Réserves Naturelles: RN 1880 Ramamonjisoa* (P); Ankarafantsika, Bevasaka, 120 m, *s. coll. 66* (P, US).

Pervillaea tomentosa Decne. in Candolle, Prodr. 8: 613. 1844; K. Schum. in Engler & Prantl, Nat. Pflanzenfam. 4(2): 291, fig. 85W–Y. 1895. – Lectotype (designated by Klackenberg 1996a: 174): trouvé à Vohémar, à la Baie de Ringy ou Lingwaton, *Richard 91* (P!).

= *Pervillaea brevirostris* Klack. in Bot. Jahrb. Syst. 126: 204, fig. 1. 2005, **syn. nov.** – Holotype: Mauritius, *Duncan 12* (K!).

Description — Suffrutescent, densely hairy twiner to 8 m high. *Leaves* opposite; blade ovate to usually elliptic to broadly elliptic, 5–11 × 3.5–7 cm, cuneate to truncate at base, obtuse but usually finely apiculate at apex, on lower surface with dense, curled, reddish hairs when dry, on upper surface with sparser, ± straight, whitish hairs; margin flat, entire; venation pinnate and arched near margin, indistinctly reticulate when dry; midrib and primary veins raised on lower surface, impressed or ± flush with upper surface;

petiole distinct, 1–3 cm long, densely hairy with curled, reddish hairs. *Inflorescences* usually slightly longer than adjacent petiole but distinctly shorter than leaf, covered by dense, reddish hairs; cyme rather lax with 5–10 flowers, irregularly branched; pedicels 3–5 mm long; bracts 2–6 mm long, narrow. *Calyx* lobes narrowly triangular to lanceolate, 2.7–3.4 × 1.2–1.7 mm, much longer than corolla tube, acute at apex, with long, wavy, dense hairs on both surfaces. *Corolla* contorted with left lobe margin overlying, not or only slightly twisted, with lobes fused for 1/5–1/6 of their length into a tube, glabrous on both surfaces, greenish yellow with purple spots; tube 1.2–1.7 mm long; lobes oblong to elliptic or obovate, 5.4–6.4(–8.7) × 2.7–4 mm, usually rounded at apex. *Staminal column* 0.6–0.8 mm high (corona lobes excluded); connectives elongated, bent above thecae at 90° inward covering style head, glabrous. *Corona* lobes narrowly triangular to linear, directed outward but bent upward apically, 0.7–1 mm long, distinctly longer than elongated connectives, glabrous; margin entire. *Pollinia* elliptic to ovate, c. 0.15 mm long. *Style head* with broad and short apical portion, slightly depressed at centre, c. 0.1 mm high. *Follicles* narrowly ovate to narrowly oblong in outline, 7–14 × 2–3 cm, recurved c. 90°–135°, gradually tapering toward acute apex but seeming rounded to truncate because of indumentum, covered with very dense, long, wavy, intertwining hairs. *Seeds* 13–15 mm long; hairs 3–4 cm long.

Phenology — Flowering specimens seen from January to March and October, in fruit from April to May and November to January.

Distribution and ecology — *Pervillaea tomentosa* is known from the northeasternmost tip of Madagascar, but also from a 150-year-old collection from Mauritius. It has been found in dry deciduous, dense to degraded forest on sand up to 290 m altitude.

Remarks — For an illustration of *Pervillaea tomentosa*, see Klackenberg (2007: fig. 1). Diagnostic characters are discussed under Remarks to *P. lanata*.

Additional specimens studied — MADAGASCAR: SINE LOCO: *Blackburn s.n.* (GH, K); 1961, *Bosser 14854* (MO, P). — ANTSIRANANA: Sava, bord de la route entre Antalaha et Sambava à 13 km au sud de Sambava, 12 m alt., 2010, *Aubriot 177* (P); Ramena, Ambodivahibe, Ampio 2.5 km au nord-ouest du village d'Ambodivahibe, 2005, *Jullet Be & al. 105* (MO, P); Andrafiabe, Ambolobozokely, Anjialava, 3 km au nord du village d'Amolobozokely, 2005, *Jullet Be & al. 133* (MO, P); Antsiranana-Ambilobe, Mahamasina, Massif de l'Ankarana, Betsimipohaka, 150 m alt., 2003, *Bardot-Vaucoulon 1350* (MO, P); Antsiranana (Diego Suarez), Mafaly, *Bernier 130* (P); Vohémar, *Boivin 2472* (P); Jard. Bot. Tsimbazaza d'origine de la region d'Antalaha, 1962, *Bosser 19800* (P); Massif d'Antsahabe, Vohémar, Daraina, 2004, *Callmander & al. 247* (MO, P); Sava, Vohémar, Nosibe, Anjiabe, Anaborano, forêt littorale d'Analabe, Antovonjianivo, 34 m alt., 2004, *Manjakahery & Sola 89* (MO); Ramena, Baie des Sakalava, à 3.5 km à l'est du fokontany Ankorokihely, 10 m alt., 2004, *Leopold & al. 12* (MO, P); Forêt d'Orangea, along dirt track near remains of French fort on hill above Ramena, 50 m alt., 2003, *Miller & al. 10722* (MO, S); Vohémar, Daraina, forêt de Bekaraoka, 180 m alt., 2004, *Nusbaumer & Ranirison LN 1190* (G, P, S); Vohémar, Nosy be, Anjiabe, forêt d'Analabe, 2004, *Rabehevitra & al. 927, 972* (MO); Vohémar, Tsarabaria, Manakana, forêt sublittorale d'Ambondrobe, 2003, *Rabevohitra & al. 4578* (MO); Vohémar, Nosy be, Anjabe, forêt littorale d'Analabe (Anaborano) près du lac Sahaka, 5 m alt., 2003, *Rabenantoandro & al. 1346* (MO); Diana Region, Andrafiabe, à 2 km ouest du village d'Ambolozobe, forêt d'Ankonahona, 20 m alt., 2007, *Rakotonandrasana 1092* (MO); Diana, Andrafiabe, Ambolobozokely, Anosy, 3 m alt., *Rakotonandrasana & al. 1147* (MO); Vohémar, Daraina, Ambatoharanana, Ankijabe, forêt de Bembosa, à 2 km à l'ouest d'Ankijabe, 200 m alt., 2005, *Randrianaivo & al. 1283* (MO); Sava, Vohémar, Vohimarina, Fanambana, Antsatoby, 109 m alt., 2007, *Rasoafaranaivo 210* (MO, P); Vohémar, *Richard 69* (P); Diana region, forêt d'Ambararata, Orangea Peninsula, 50 m alt., 2005, *Schatz & al. 4255* (MO). — MADAGASCAR?, MAURITIUS?, SEYCHELLES?: [presented by Admiral Bowles 17 July 1863] (MO).

Secamone chouxii Klack., **sp. nov.** – Fig. 5, 6A.
Holotype: Madagascar, Toamasina, Moramanga, Andasibe. Menalamba, Analamay, 18°48'43"S, 48°20'20"E, 1060 m alt., 10 Nov 2005, *Razanatsoa, Antilahimena & Edmond 144* (MO!; isotypes: P, TAN).

Diagnosis — Species haec *Secamonae obovatae* affinis sed differt foliis minoribus et capite stigmatis breviore columna staminali solum duplo longiore vel corollis viridi-rubiscentibus.

Description — Suffrutescent twiner to small, scrambling shrub to 4 m high; branches ± divaricate with youngest parts covered with reddish hairs. *Leaves* opposite, somewhat coriaceous and revolute at very margin; blade 1.5–2.5 × 0.5–1.5 cm, narrowly elliptic to usually obovate, tapering at base, acute to truncate but usually obtuse at apex and sometimes apiculate, glabrous; venation faintly or not visible except for distinct midrib; midrib impressed on upper surface, raised on lower surface for larger part; epidermis ± smooth on both surfaces; petiole 3–6 mm long, glabrous or with few hairs. *Inflorescences* extra-axillary (sometimes seeming terminal), shorter than adjacent leaves; cymes rather dense, irregularly reduced and with a few umbels on short axes, few- to 5-flowered, densely pubescent; axes few, usually very short but sometimes to 2 mm long, thick; pedicels 4–6 mm long; bracts minute to 1 mm long, often early deciduous. *Calyx* lobes 1–1.3 × 0.6–0.7 mm, oblong to ovate, rounded to obtuse at apex, with few red-

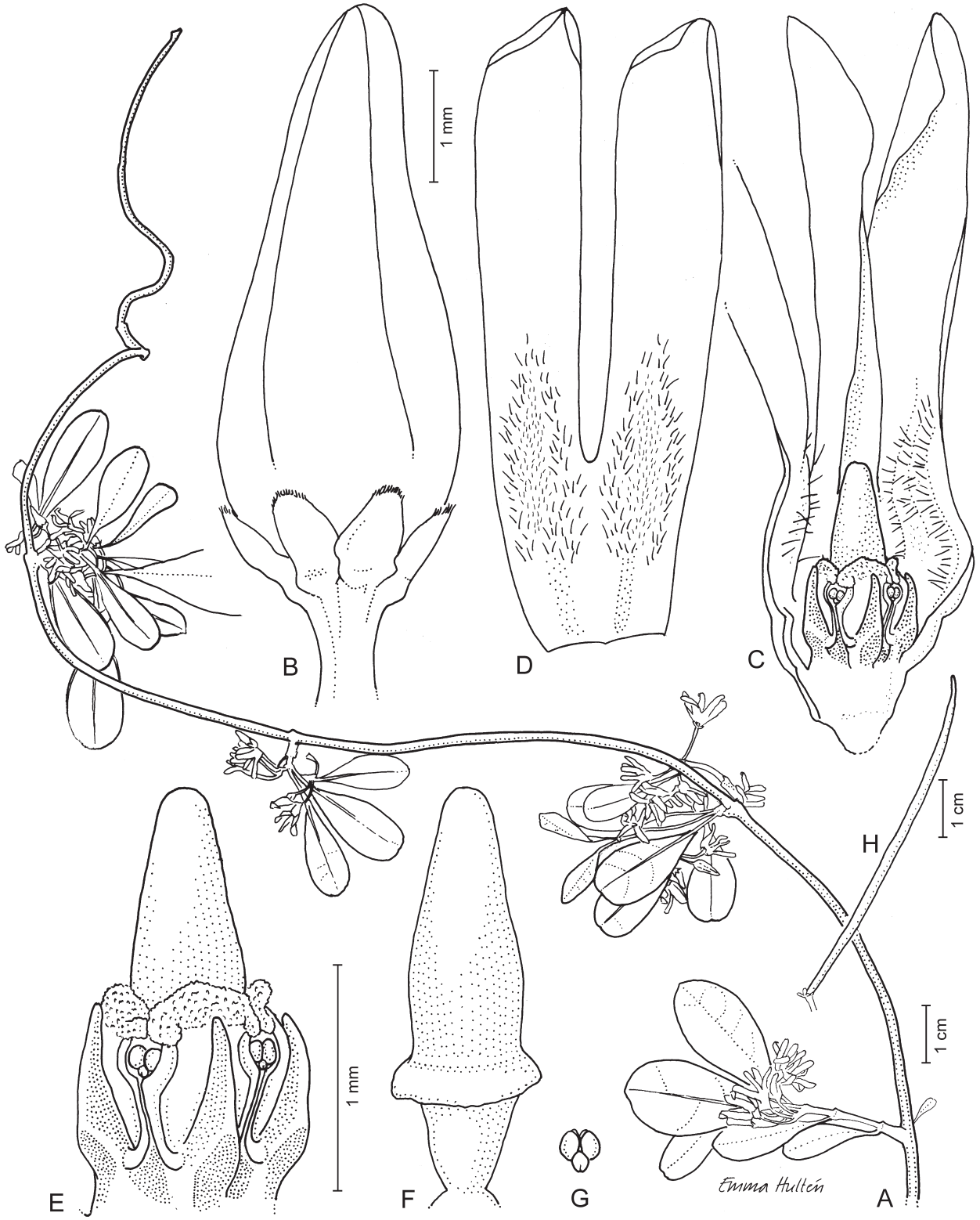

Fig. 5. *Secamone chouxii* – A: habit; B: flower in bud; C: flower with calyx and two corolla lobes removed; D: portion of corolla from within; E: gynostegium; F: style head; G: pollinarium; H: follicle. – A–G from *Razanatsoa & al. 144* (MO); H from *Rakotonandrasana 633* (MO). – Drawn by Emma Hultén, Stockholm.

dish hairs mostly along margin and at apex. *Corolla* ± conical in bud and rounded to usually subacute at apex, fused for ¼–⅕ of its length into a tube, contorted with left lobe margins overlying, not twisted, with hairs directed inward or bent upward in filled triangles at mouth inside (esp. along lateral ridges), yellowish to usually greenish, reddish toward base of lobes inside, dark when dry; tube 1.3–1.7 mm long; lobes spreading, 4.1–6 × 1–1.4 mm,

narrowly oblong with ± asymmetric, rounded to obtuse apex to narrowly triangular with subacute apex and often revolute margin, thin. *Staminal column* 0.8–1 mm high. *Corona* lobes 0.6–0.8 mm long (free part), basally with flat back but laterally compressed toward apex, falcate, ± equalling staminal column. *Pollinia* c. 0.1 mm long. *Style head* projecting c. 2 × longer than staminal column; apical portion c. 2 × as long as basal portion, 1–1.2 mm long, slightly fusiform, entire. *Follicles* c. 5.5 × 0.2 cm, linear, thin-walled, sparsely hairy (only 1 follicle seen). *Seeds* not seen.

Phenology — Flowering specimens seen from October, November and January, in fruit from November.

Distribution and ecology — *Secamone chouxii* is found in humid, sometimes degraded forest at altitudes of 1000–1200 m in eastern Madagascar.

Remarks — This species is similar to *Secamone obovata* Decne. from the littoral forest, but it differs by its smaller leaves, longer pedicels (4–5 mm long) and larger corolla (c. 7 mm long), albeit with a shorter style head protruding only about twice as long as the staminal column. *Secamone chouxii* differs also by having greenish flowers that are tinged with red in two indistinct lines toward the base (Fig. 6A) (vs entirely white-yellowish in *S. obovata*).

This species is named after Pierre Choux, a French specialist in Malagasy *Asclepiadaceae*, who significantly contributed to the study of *Secamone*.

Additional specimens studied — Madagascar: Toamasina: Moramanga, Andasibe, Menalamba, Ambatovy, Analamay forest, 1073 m alt., 2005, *Antilahimena & Edmond 4171* (MO); ibid., *Antilahimena & al. 5991* (MO photo!); Alaotra-Mangoro reg., along road to Lakato, c. 18 km S of Rt 2, just S of small village, 1050 m alt., 2004, *Lowry & al. 6542* (S); fiv. Ambatondrazaka, commune Antanandava, Parc National de Zahamena, Campement Bemoara, 2 km au sud-est d'Ankosy à côté de la rivière Manambato, 1200 m alt., 2002, *Rakotonandrasana 633* (MO); 17 km S of Route Nationale 2 (Antananarivo to Toamasina), along road to Lakato, 1080 m alt., 2003, *Schatz & al. 4177* (S); near Andasibe. Forest of Mantadia, beyond the graphite mine, 1000–1200 m alt., 1994, *Van der Werff & al. 13785* (BR, S).

Secamone dictyoneura Klack., **sp. nov.** – Fig. 6B, 7.
Holotype: Madagascar, Toamasina, Alaotra-Mangoro, Fivondronana Moramanga, Commun Andasibe, Fokontany Menalamba. Andranovery forest / Ambatovy forest, 18°51'32"S, 48°18'34"E, 1031 m alt., 24 Jan 2008, *Antilahimena & Ralaisabotsy 5977* (MO!; isotypes: P, TAN).

Diagnosis — Species haec *Secamonae marsupiatae* floribus paucis parvis urceolatis et caulibus indumento ferrugineis similis sed differt nervatura in sicco manifeste prominenti in superficiebus ambabus folii et foliis ellipticis cuneatis.

Fig. 6. Flowers of *Secamone.* – A: *S. chouxii*, Andasibe, *Antilahimena 5991*, photograph by and © Peter B. Phillipson. – B: *S. dictyoneura*, Andasibe, *Antilahimena 5977*, photograph by and © Patrice Antilahimena. – With the courtesy of Tropicos, Missouri Botanical Garden.

Description — Suffrutescent twiner or scrambling shrub to 8 m high; younger branches covered with ± erect, reddish hairs. *Leaves* opposite, somewhat coriaceous, flat but revolute at very margin; blade 2–3.5 × 0.8–2 cm, elliptic, cuneate at base, acute at apex, glabrous but hairy along basal part of midrib on both surfaces and sometimes also along margin; venation pinnate, spreading, looped near margin, ± reticulate and very distinct on both surfaces when dry; midrib and primary nerves on both surfaces distinctly raised when dry; epidermis smooth on both surfaces, shining on upper surface; petiole 1–2 mm long, hairy. *Inflorescences* extra-axillary along branches, shorter than adjacent leaves; cymes dense with shortened axes, few-flowered, ± hairy; pedicels 1.3–1.9 mm long, glabrous; bracts c. 0.5 mm long, hairy. *Calyx* lobes c. 0.6 × 0.6 mm, broadly triangular, acute to rounded at very apex, sparsely hairy outside, glabrous inside, finely ciliate along margin. *Corolla* ovoid in bud and rounded at apex, fused for ⅔–¾ of its length into a tube, lobes val-

Fig. 7. *Secamone dictyoneura* – A: habit; B: leaf, lower surface; C: inflorescence; D: flower; E: gynostegium and portion of corolla; F: style head with ovary, surrounded by three anthers and corona lobes; G: follicles. – A–F from *Antilahimena & Ralaisabotsy 5977* (MO); G from *Bernard & al. 1445* (MO). – Drawn by Emma Hultén, Stockholm.

vate, not twisted, with a small patch of hairs below each lobe in proximal ½ of tube inside, yellow; tube c. 1.6 mm long, slightly pitcher-shaped; lobes slightly bent outward, c. 0.7 × 0.8 mm, broadly triangular, rather thick, subacute to rounded at apex. *Staminal column* c. 0.8 mm high. *Corona* lobes c. 0.6 mm long (free part), dorsiventrally compressed, erect, longer than staminal column; basal part ± as broad as lobe, attached along c. ½ of stamen, with 2 distinct, pouch-like structures at bases of sclerified margins (anther wings). *Pollinia* less than 0.1 mm long. *Style head* projecting above staminal column, about as long as corona lobes; apical portion c. 0.5 mm long, about as long as basal portion, broadened at apex, faintly bilobed. *Follicles* 3–5 × 0.3–0.5 cm, narrowly ovoid to almost linear, thin-walled, glabrous or with sparse, short hairs, recurved ± 45°. *Seeds* not seen.

Phenology — Flowering specimens seen from January, March to May and October, in fruit from January to June, September and October.

Distribution and ecology — *Secamone dictyoneura* is known from montane forests of eastern Madagascar, mostly collected in the Moramanga-Andasibe area at altitudes of 850–1250 m.

Remarks — *Secamone dictyoneura* is similar to *S. marsupiata* Klack. from the same habitat in northern Madagascar. Both species have small, slightly pitcher-shaped flowers in short, few-flowered cymes, and stems covered with ferruginous, erect hairs. *Secamone dictyoneura* differs by having slightly larger corona lobes that reach about as high as the style head, by its larger and more elliptic leaves with cuneate bases (vs ovate and more or less truncate bases in *S. marsupiata*) and particularly by the leaves having more prominent venation, distinctly reticulate by fibrous veinlets also on the lower surface (vs much less prominent veinlets on the lower than on the upper surface when dry in *S. marsupiata*).

Additional specimens studied — Madagascar: Toamasina: Antsinanana reg., Distr. Brickaville, Commune Maroseranana, Fkt. Ambodilendemy, Ankerana, 873 m alt., 2011, *Antilahimena & al. 7736* (MO). — Toamasina: Alaotra Mangoro, Moramanga: Andasibe, Menalamba, Berano, Avondrona forest, 1015 m alt., *Antilahimena & al. 6822* (MO); Andranovery, forêt d'Andranovery, 1031 m alt., 2009, *Bernard 1434* (MO, S); commune rurale Morarano Gara, Fkt. Ambohibolakely, Forêt d'Anambofampana, corridor Forestier Analamay Mantadia, 960 m alt., 2012, *Rakotovao 5882* (MO); Analamay, forêt de Mahatakatra, Analamay côté nord-nord-ouest, 1007 m alt., 2008, *Randrianasolo 1051* (MO); Morarano, Marovoay, forêt de Mahatakatra, 997 m alt., 2008, *Ravelonarivo 3150* (MO). — Moramanga: Ambohibary, Ampitambe: lambeau forestier d'Ankoditrazo, 973 m alt., 2009, *Andriamiarinoro & al. 156* (MO); Ambatovy, forêt d'Analamay, 1092 m alt., 2008, *Andriantiana & al. 475* (MO); ibid., 1102 m alt., 2008, *Andriantiana & al. 492* (MO); Ambatovy, forêt d'Ampanadiofanantsy, route vers Befotsy, 1021 m alt., *Andriantiana & al. 548* (MO); ibid., 996 m alt., 2008, *Andriantiana & al. 572* (MO); Ambatovy. Ambatotsiandrorana forest, 1035 m alt., 2008, *Antilahimena 6572* (MO); Ambatovy / Andranovery forest, 1068 m alt., 2007, *Antilahimena & Marcelin 5930* (MO); Vavanaomby forest, 1024 m alt., 2007, *Antilahimena & al. 5261* (MO); ibid., 1032 m alt., 2008, *Antilahimena & al. 6089* (MO); Amboasarikely forest, 1062 m alt., 2008, *Antilahimena & al. 6469* (MO); Ambatovy, Ampangadiatrandraka, 1014 m alt., 2009, *Bernard & al. 1445* (MO); NE of Moramanga, at nickel-mining exploration site, Ambatovy, 1000 m alt., 1998, *McPherson 17532* (S); Ambatovy, 965 m alt., 2005, *Phillipson & al. 5761* (MO); Forêt d'Analamay, 1067 m alt., 2008, *Rakotandrajaona 630* (MO); ibid., 1033 m alt., 2008, *Rakotandrajaona 677* (MO); Andasibe, Menalamba, 11 km E d'Ampitambe, Ambatovy, 1004 m alt., 2005, *Rakotovao & Edmond 1856* (MO); Ambatovy, environ 22 km NE de Moramanga, 1027 m alt., 2005, *Rakotovao & al. 1541* (MO); Ambatovy, Andranovery, 1002 m alt., 2008, *Randrianasolo 659* (MO); Forêt d'Ambatovy, 1029 m alt., 2008, *Ratolojanahary 52* (MO); Ambatovy, forêt de Vodibasy, 1145 m alt., 2010, *Ravelonarivo & Radona 3397* (MO); Ambatovy, forêt d'Antranolambo, 989 m alt., 2008, *Ravelonarivo & al. 3172* (MO); Ambatovy, 1111 m alt., 2011, *Rasoazanany & al. 23* (MO); Ambatovy, entre Tapimbato et Berano, 1215 m alt., 2005, *Razanatsoa 106* (MO); Antsangimaso, Ambatovy, 1044 m alt., 2005, *Razanatsoa 342* (MO).

Secamone furcata Klack., **sp. nov.** – Fig. 8.
Holotype: Madagascar, Antsiranana, Faritra Sava, Vohémar, Daraina, Ankarafa, Antsahabe, 5 km à l'ouest du village de Daraina, 13°12'41"S, 49°33'35"E, 644 m alt., 5 Nov 2005, *Jullet Be & al. 216* (MO!; isotypes: CNARP, P!, TAN)

Diagnosis — Species haec *Secamonae tsingycolae* similis sed lobis coronae uncinatis et capite stigmatis distincte bilobato differt.

Description — Suffrutescent twiner; branches ± divaricate, with white to somewhat reddish hairs. *Leaves* opposite, herbaceous, flat at very margin; blade 5–6 × 2–2.5 cm, elliptic, cuneate to truncate at base, usually shortly caudate at apex, pubescent; indumentum of white, erect, straight to slightly curved hairs on both surfaces, denser along midrib, not intertwined; venation pinnate, looped, ± reticulate on both surfaces; midrib impressed to flush with upper surface, distinctly raised on lower surface; epidermis smooth; petiole c. 5 mm long, densely pubescent as midrib. *Inflorescences* extra-axillary, much shorter than adjacent leaves; cymes 1- to probably usually few-flowered, densely hairy; axes reduced; pedicels 1.8–2 mm long; bracts to 2 mm long, narrow. *Calyx* lobes 1.6–2 × 0.5–0.8 mm, longer than corolla tube, triangular to ovate, acute at apex, with dense, probably reddish hairs outside, glabrous inside. *Corolla* cylindric in bud and gradually narrowing from base, obtuse to subacute at apex, fused for c. ¼ of its length into a tube, contorted with right lobe margins overlying, very slightly twisted to right, with short hairs at base of lobes and distal part of tube, yellow, dark when dry; tube c. 0.8 mm long; lobes probably ± spreading, c. 3.5 × 1.2 mm, narrowly oblong, rounded to subacute at apex, thin. *Staminal column* c. 1 mm high. *Corona* lobes c. 0.7 mm long (free part), dorsiventrally compressed, curled to hooked at apex, projecting above staminal column; basal part with rounded back, narrower than lobe, attached along c. ⅔ of stamen. *Style head* projecting c. ½ longer than staminal column, longer than revolute corona lobes; apical portion slightly longer than basal portion, c. 0.8 mm long, broadened and distinctly bilobed at apex. *Follicles* c. 5.5 × 2 cm, ovoid, very thick-walled, with dense, short hairs, recurved c. 90°. *Seeds* 7–8 mm long; hairs 1.5–2 cm long.

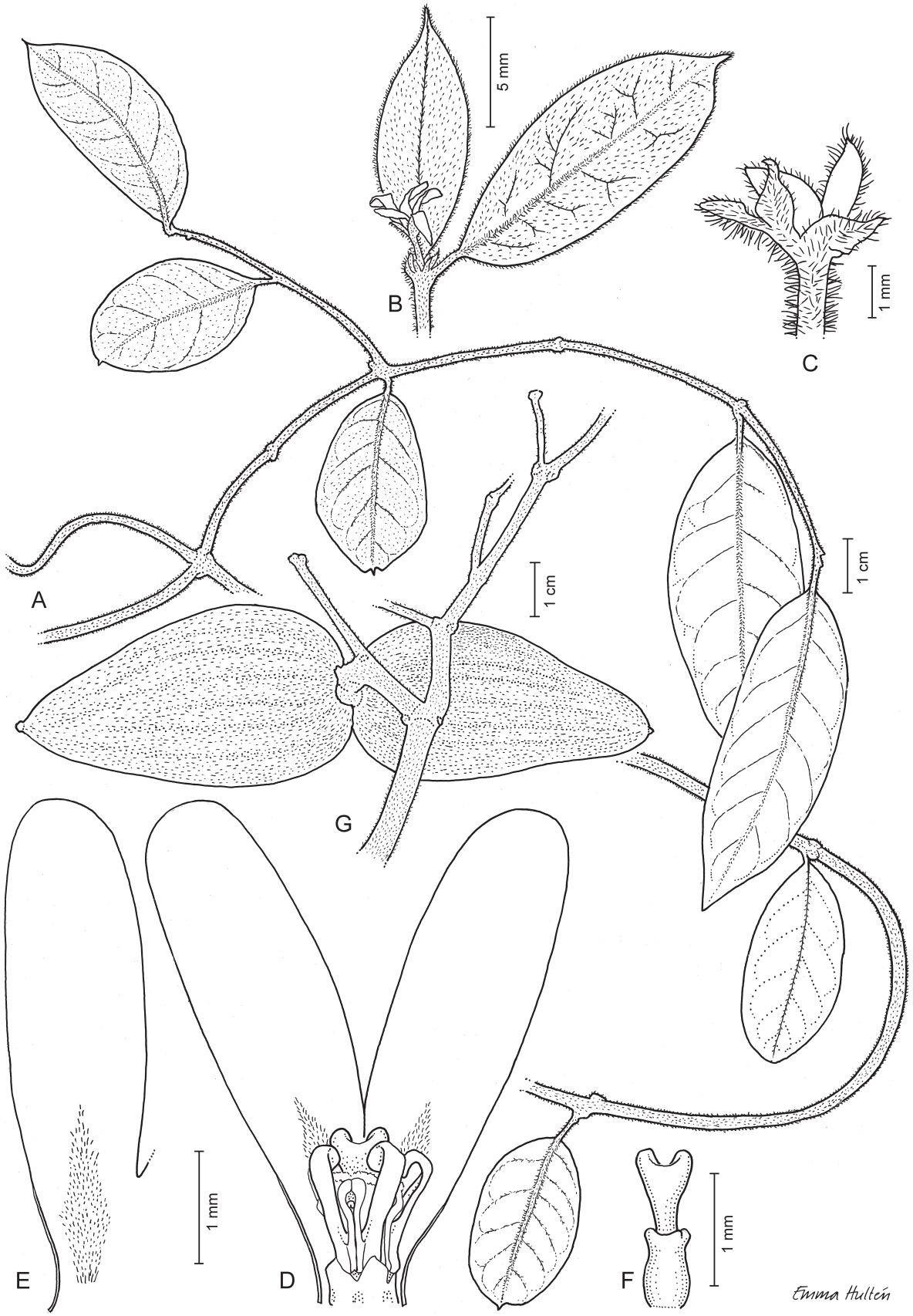

Fig. 8. *Secamone furcata* – A: habit; B: single flower in inflorescence; C: calyx; D: flower with calyx and 3 corolla lobes removed; E: corolla lobe from within; F: style head; G: follicles. – A–F from *Jullet Be & al. 216* (MO); G from *Guittou & al. 54* (MO). – Drawn by Emma Hultén, Stockholm.

Phenology — Flowering specimen seen from July and November, in fruit from July.

Distribution and ecology — *Secamone furcata* is known up to 650 m altitude by two collections from the very north of Madagascar, one collected in dry forest on sand and the other in transitional forest on rocky ground.

Remarks — *Secamone furcata* is similar to *S. tsingycola* Klack., a taxon known only by the type specimen described from the tsingy of Bemaraha. Both species have floral parts of about the same size in very short inflorescences and the leaves are covered by erect hairs. *Secamone furcata*, however, is distinguished by the apical portion of the style head being obconical with two short but distinct lobes (vs basally cylindric but toward the apex spherically broadened and only finely cleft at the very apex in *S. tsingycola*). The corona lobes are hooked to curled and not overtopping the style head (vs broadened toward the apex, upright and overtopping the style head in *S. tsingycola*). On the other hand, the large and thick-walled fruits are similar to those seen in *S. ankarensis* (Jum. & H. Perrier) Klack. and *S. uniflora* Decne. The fruits of these three species, however, can be distinguished by their indumentum, which is the same as for the leaves, i.e. thick with bent and curled hairs in *S. ankarensis*, lacking or with very sparse, short and appressed hairs in *S. uniflora* and rather thick but with more or less straight hairs in *S. furcata*. Also, in *S. ankarensis* and *S. uniflora*, furcate style heads are present. In contrast to the short lobes in *S. furcata*, however, these style heads are furnished with conspicuously long lobes that protrude high above the staminal column. Fruiting material of *S. tsingycola* is not known.

Additional specimen studied — Madagascar: Antsiranana: Andrafiabe, Sahafary, 191 m alt., *Guittou & al. 54* (MO).

Secamone glabra Klack., **sp. nov.** – Fig. 9.
Holotype: Madagascar, Antsiranana, Fivondronana Vohémar, Firaisana Nosy be, Fokontany Anjiabe. Analabe (Anaborano) près du lac Sahaka, 13°04'53"S, 49°54'03"E, 5 m alt., 25 Feb 2003, *Rabenantoandro & al. 1337* (MO!).

Diagnosis — Species haec *Secamonae obovatae* et praesertim *S. toxocarpoidi* similis sed differt corolla glabra et corollae tubo angustiore.

Description — Suffrutescent twiner to small, scrambling shrub; branches ± divaricate with younger parts covered with reddish hairs, glabrescent. *Leaves* opposite, somewhat coriaceous, revolute at very margin; blade 2–4 × 1–2.5 cm, elliptic to broadly obovate, cuneate to tapering at base, broadly acute to retuse at apex and sometimes apiculate, glabrous but sometimes with short, reddish hairs along midrib when young; venation not visible except for distinct midrib or faintly pinnate; midrib impressed on upper surface, raised on lower surface; epidermis ± smooth on both surfaces; petiole 3–5 mm long, usually pubescent as blade. *Inflorescences* extra-axillary, shorter than adjacent leaves; cymes dense, much and irregularly condensed, few- to rather many-flowered, densely pubescent; axis usually very short to 2 mm long, thick; pedicels very short to 2 mm long; bracts minute. *Calyx* lobes 1.1–1.7 × 0.4–0.6 mm, narrowly triangular to narrowly ovate, acute but rounded at very apex, with reddish hairs outside and also at very apex inside. *Corolla* cylindric in bud and gradually narrowing from base, subacute at apex, fused for c. 1/5 of its length into a tube, contorted with right lobe margins overlying, slightly twisted to left, glabrous except for some reddish hairs at very tip in bud, yellowish to greenish cream; tube 1.2–1.4 mm long; lobes probably ± erect, 5–5.4 × 1.2–1.5 mm, narrowly oblong, acute, but obtuse at very apex, thin. *Staminal column* 0.6–0.7 mm high. *Corona* lobes c. 0.5 mm long (free part), dorsiventrally compressed, straight, slightly projecting above staminal column; basal part flat, broader than lobe, attached along c. ½ of stamen. *Pollinia* c. 0.1 mm long. *Style head* projecting 3–3½ × longer than staminal column; apical portion 3–4 × longer than basal portion, 2–2.5 mm long, not broadened at apex, entire. *Follicles* not seen.

Phenology — Flowering specimens seen from February and November.

Distribution and ecology — *Secamone glabra* is known from the Vohémar region. It has been found in littoral forest on sand at altitudes up to 20 m.

Remarks — This species is similar to *Secamone toxocarpoides* Choux. *Secamone toxocarpoides* together with *S. bemaharensis* Klack., *S. sulfurea* (Jum. & H. Perrier) Klack. and *S. valvata* Klack. form a group of species characterized by dense and short inflorescences, long and narrow corolla lobes and a long and protruding style head, as well as by a dark olive green upper surface of the leaves when dry. The flowers are greenish yellow, sometimes tinged red at the base. *Secamone glabra* from the littoral forest adds a fifth species to this group. It is distinguished by having glabrous corolla tubes. It is most similar to *S. toxocarpoides*, a fairly often collected species from the far north of the island, including from the Vohémar region. However, *S. toxocarpoides* is in contrast to *S. glabra* found at some hundred metres altitude and is not known from the littoral forest. In addition to the glabrous corolla, *S. glabra* differs from *S. toxocarpoides* by a narrower corolla tube that in bud gradually narrows into the lobes. In *S. toxocarpoides*, the buds are subglobose at base and more abruptly narrow above the tube into the contorted lobes. The broader corolla tube of *S. toxocarpoides* also manifests as small pouches protruding between the calyx, and the corolla lobes are distinctly widened at the very base. In *S. glabra*, the tube does not

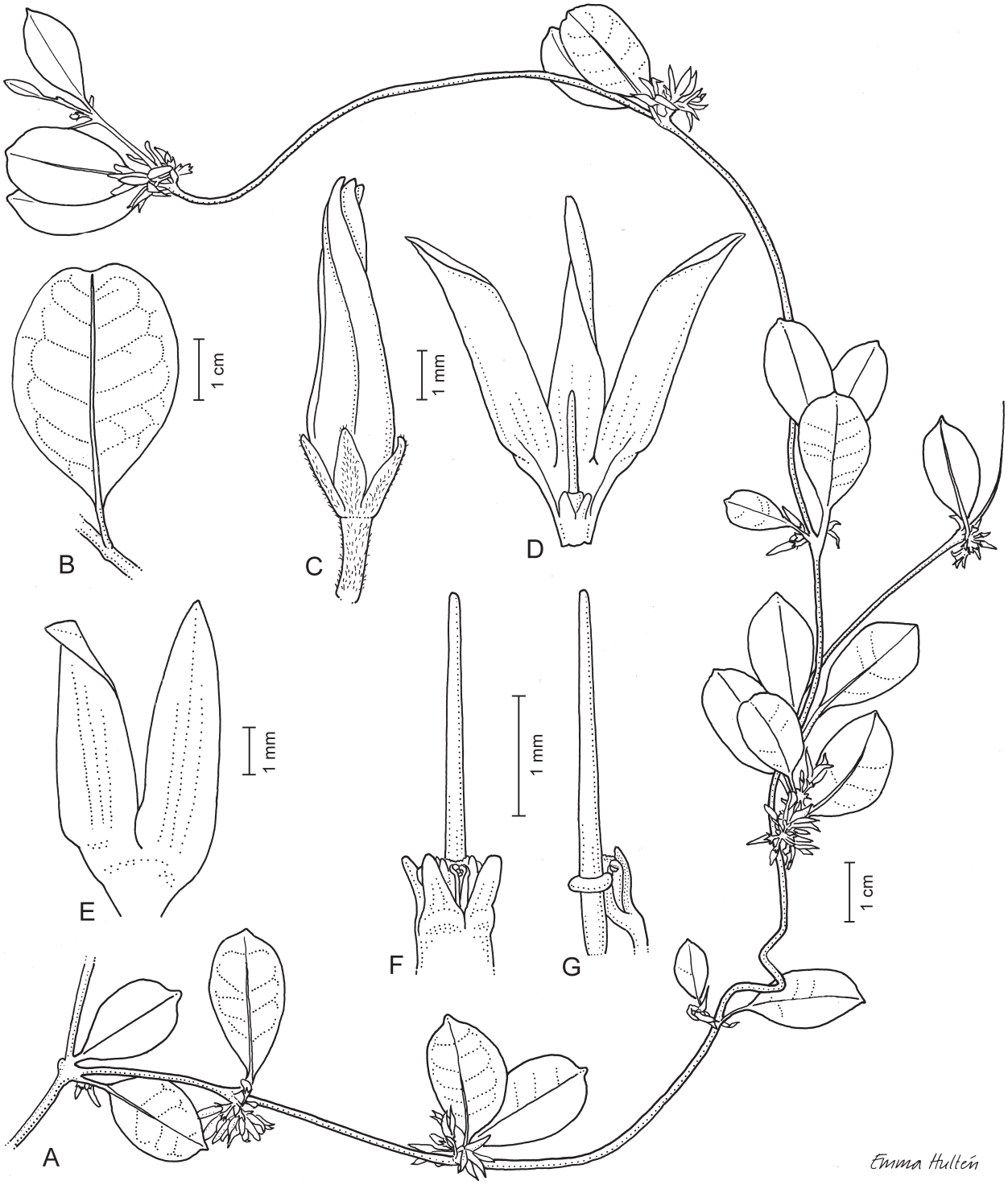

Fig. 9. *Secamone glabra* – A: habit; B: leaf, lower surface; C: flower in bud; D: flower with calyx and 2 corolla lobes removed; E: portion of corolla from within; F: gynostegium; G: style head with anther and corona lobe. – From *Rabenantoandro & al. 1337* (MO). – Drawn by Emma Hultén, Stockholm.

protrude or only insignificantly protrudes between the calyx lobes and the corolla lobes gradually narrow from the base.

Secamone glabra might also be confused and furthermore shares habitat with *S. obovata* Decne., a common species found along all of the eastern littoral forest on sand. *Secamone glabra* differs by dorsiventrally flattened corona lobes (vs falcate lobes in *S. obovata*) and by its glabrous corolla.

Additional specimen studied — Madagascar: Antsiranana: 40 km N of Vohémar, near N end of Lac Sahaka. Fir. Nosibe, Fkt. Anjiabe, 2002, *McPherson 18843* (MO).

Secamone laevis Klack., **sp. nov.** – Fig. 10.
Holotype: Madagascar, Tulear, Fort Dauphin. Forêt de Sainte Luce nord de Fort Dauphin, 10 m alt., 4 Dec 1994, *Civeyrel 1299* (S!).

Diagnosis — Species haec *Secamonae glaberrimae* foliis ovatis aliquantum coriaceis vel lobis corollae valvatis similis sed differt lobis coronae minutis gynostegium brevioribus et ad nodos colleteris minutis modo, non late vel distincte triangularis.

Description — Suffrutescent twiner with terete, glabrous stems. *Leaves* opposite, herbaceous but somewhat coriaceous when dry, flat but at least when dry slightly revolute at very margin, glabrous; blade 3–4 × 1–1.5 cm, narrowly ovate, cuneate at base, acute at apex; venation not visible except for midrib when dry; midrib ± flush with upper surface, flush to slightly protruding on lower surface; epidermis smooth on both surfaces; petiole 3–6 mm long. *Inflorescences* axillary or terminal, shorter than adjacent leaves; cymes mostly dichasial, rather lax and with few flowers; axes 1–5 mm long, glabrous; pedicels 3–7 mm long; bracts c. 0.5 mm long, hairy along margin. *Calyx* lobes 0.7–1 × 0.7–1 mm, very broadly ovate to orbicular, rounded at apex, glabrous but finely ciliate along margin. *Corolla* ovoid to broadly ovoid in bud and subacute to rounded at apex, fused for ½–⅔ of its length into a tube, valvate, not twisted, hairy from mouth with hairs becoming longer and retrorse toward base of tube, white to yellow; tube c. 1.3–1.7 mm long; lobes erect to curved outward, 1–1.4 × 1–1.4 mm, triangular, subacute at apex, somewhat papillate at central part toward base inside. *Staminal column* 1.2–1.4 mm high. *Corona* lobes small, c. 0.3 mm long (free part), dorsiventrally compressed, slightly shorter than staminal column, truncate at apex; basal part flat, attached along $^{3}/_{5}$ of length of stamen. *Pollinia* ellipsoid, c. 0.15 mm long. *Style head* protruding above staminal column; apical portion about as long as basal portion, 0.7–0.8 mm long, broadened at apex, entire. *Follicles* c. 5 × 0.4 cm, almost linear and slightly bent, thin-walled, glabrous, recurved ± 90°. *Seeds* not seen.

Phenology — Flowering specimens seen from October, December and February, in fruit from August.

Distribution and ecology — *Secamone laevis* is known from littoral forest at the Malagasy eastern coast. It has been collected on sand at altitudes of 5–8 m.

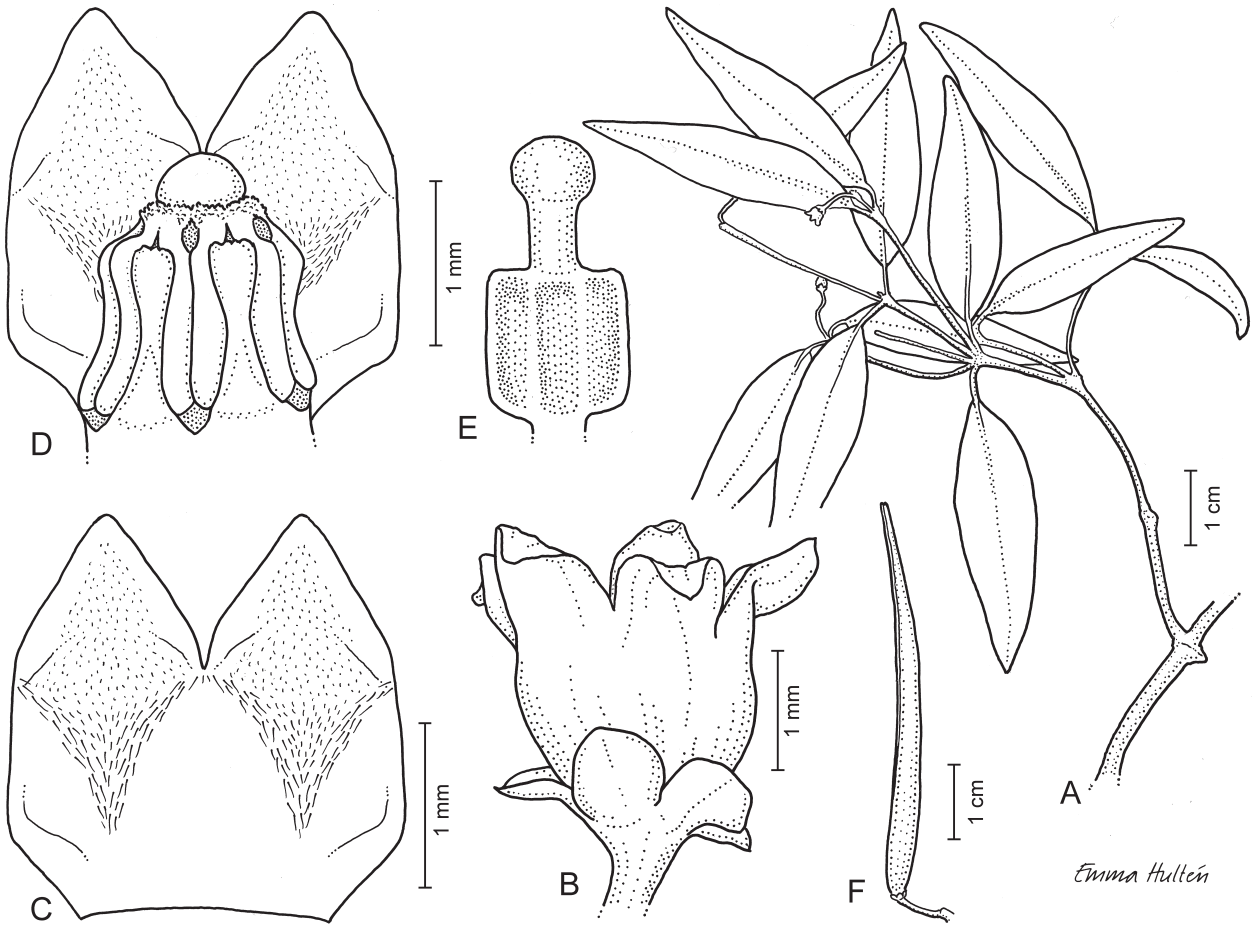

Fig. 10. *Secamone laevis* – A: habit; B: flower; C: portion of corolla from within; D: flower with calyx and 3 corolla lobes removed; E: style head; F: follicle. – From *Civeyrel 1299* (S). – Drawn by Emma Hultén, Stockholm.

Remarks — *Secamone laevis* from the Malagasy eastern coast is in habit similar to *S. glaberrima* Schum. from the central plateau and *S. schatzii* Klack. from the Masoala peninsula by the ovate, somewhat coriaceous and glabrous, elliptic leaves with only the midrib visible when dry. Furthermore, all three species have small, white-yellow flowers in inflorescences that adhere to the stem in an axillary position, in contrast to the usual extra-axillary position. *Secamone laevis* also shares with *S. glaberrima* corolla lobes with a papillate upper surface. In *S. laevis*, however, the lobes are thinner and the papillae less prominent (seen only when dry). In *S. glaberrima*, persistent, broadly triangular stipular colleters with dark apices are present around the stems at the nodes. In *S. laevis*, these are absent or only small, mostly linear colleters are present. *Secamone laevis* has minute corona lobes, narrow and distinctly shorter than the gynostegium. In both *S. glaberrima* and *S. schatzii*, the corona lobes are broadened toward the apex and as long as to overtopping the gynostegium. *Secamone laevis* and *S. glaberrima* have valvate corolla lobes in bud; in *S. schatzii* the lobes are overlapping. Although the prevailing aestivation is contorted in *Secamone* in line with *Apocynaceae* in general, species with valvate or imbricate aestivation are present in different groups of the genus.

Additional specimens studied — Madagascar: Toamasina: Vohibola, forest N to NNW of Andranokoditra village, N of Lac Ampitabe, 5 m alt., 2003, *Lowry & al. 6084* (MO, P); Brickaville, Andranonkoditra, Ankanin'ny nofy. Forêt de Vohibola, 8 m alt., 2003, *Rabehevitra & al. 407* (MO). — Toliara: Fort-Dauphin, Sainte Luce, 5 m alt., 2012, *Razakamalala & al. 7319* (MO).

Secamone parviflora Klack., **sp. nov.** – Fig. 11.
Holotype: Madagascar, Antsiranana, Sava reg., Vohémar, Antsirabe-Nord, Antanambaon'Isokitra, forêt de Tsihomanaomby, au sud-est du village Antanambaon'Isokitra, 14°06'S, 50°02"E, 18 Nov 2013, *Martial, Rakotonirina & Georges Be 256* (MO!; isotype: TAN).

Diagnosis — Species haec *Secamonae humbertii* et *S. supranervi* affinis structura gynostegii umbinibus parvis elongatisque supra basim antherarum instructis autem differt inflorescentiis confertis.

Description — Suffrutescent twiner to scrambling shrub to 3 m high; branches ± spreading to divaricate, glabrous. *Leaves* opposite, somewhat coriaceous, with flat margin; blade 4–7 × 2–3.5 cm, elliptic to obovate, tapering at base, acuminate at apex, glabrous; venation rather densely pinnate, spreading or divaricate, undivided but looped near

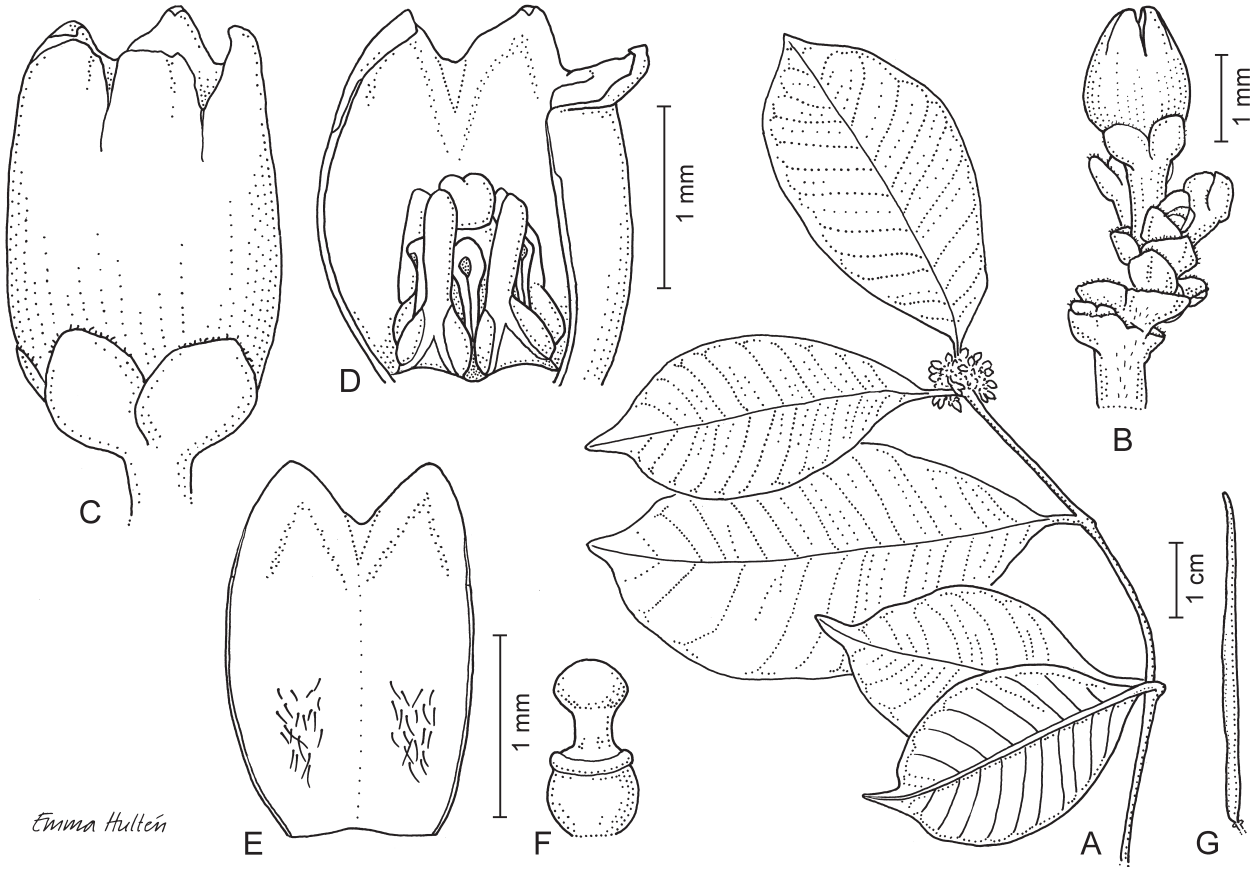

Fig. 11. *Secamone parviflora* – A: habit; B: portion of inflorescence; C: flower; D: flower with calyx and 2 corolla lobes removed; E: portion of corolla from within; F: style head; G: follicle. – From *Martial & al. 256* (MO). – Drawn by Emma Hultén, Stockholm.

margin; midrib impressed in proximal part on upper surface, somewhat raised on lower surface; primary nerves and veinlets somewhat raised on both surfaces; epidermis smooth on both surfaces; petiole 4–5 mm long, glabrous. *Inflorescences* extra-axillary to terminal on branches, much shorter than adjacent leaves; cymes dense, di- to monochasial, many-flowered, with axes and pedicels spreading to divaricate from each other, glabrous or with some small hairs; axes several, 0.5–1 mm long, ± of same length from base to apex, thick; pedicels 1–1.5 mm long; bracts to 0.5 mm long, broad. *Calyx* lobes 0.5–0.7 × 0.5–0.7 mm, ± orbicular to very broadly ovate, rounded at apex, glabrous but ciliate along margin. *Corolla* ovate in outline in bud and rounded at apex, fused into a tube for c. ¾ of its length outside and ⅚ of its length inside, valvate, not twisted, white; tube c. 1.5 mm long, with hairs inside in a triangle below each lobe in middle of tube; lobes ± erect to barely opening, c. 0.5 × 0.5 mm, triangular, rounded to broadly acute at apex, thin, glabrous. *Staminal column* c. 0.8 mm high. *Corona* lobes 0.5–0.6 mm long (free part), dorsiventrally compressed with flat back, erect, equalling to slightly longer than staminal column; basal part with 2 distinct pouch-like structures at bases of sclerified margins (anther wings), attached along c. ½ of stamen. *Pollinia* not seen. *Style head* projecting above staminal column and corona lobes; apical portion about as long as basal portion, c. 0.5 mm long, broadened at apex, slightly bilobed. *Follicles* c. 4.5 × 0.2 cm, linear, thin-walled, glabrous, not recurved. *Seeds* not seen.

Phenology — Flowering specimens seen from November and February, in fruit from November.

Distribution and ecology — *Secamone parviflora* is known from the northeastern part of Madagascar near Sambava. It has been collected in humid forest on sand at 85 m altitude.

Remarks — This species is similar to *Secamone nervosa* Klack. from Loko Be in leaf morphology and by its condensed inflorescences, but differs by its much smaller corona lobes, by having only faintly reticulate leaf venation and by the presence of minute pouch-like structures along the anther wings on the filaments, a character present also in other small-flowered species from the Malagasy eastern coast (e.g. in *S. humbertii* Choux and *S. supranervis* Klack.; Klackenberg 1992a). *Secamone parviflora* differs from all small-flowered species with pouch-like structures along the anther wings by its condensed inflorescences.

Additional specimen studied — Madagascar: Antsiranana: Sava reg., Sambava, Anjangoveratra, Ambavala, forêt de Tsihomanaomby, Antsahakasaka, 85 m alt., 2014, *Martial, Rakotonirina & Georges Be 496* (MO).

Secamone toxocarpoides var. ***incana*** Klack., **var. nov.** – Fig. 12.

Holotype: Madagascar, Antsiranana II, Saharenana, Sadjoavato, Forêt de Sahafary, 12°36'18"S, 49°26'35"E, 270 m alt., 26 May 2005, *Hong-Wa 200* (MO!; isotypes: CNARP, P!)

Fig. 12. *Secamone toxocarpoides* var. *incana*, Antsiranana, Sahafary, May 2005, *Hong-Wa 200*, photograph by and © Fidy Ratovoson. – With the courtesy of Tropicos, Missouri Botanical Garden.

Diagnosis — Varietas haec a typo divergens foliis subter valde pubescentibus.

Description — *Leaf* blade 2.5–3 × c. 1 cm, elliptic to obovate, attenuate at base, obtuse and usually bluntly apiculate at apex, hairy on both surfaces, densely so on lower surface; petiole 3–5 mm long, covered with mostly reddish hairs. *Corolla* fused for c. ⅙ of its length into a tube, yellow with reddish base, pale when dry; tube c. 1.3 mm long; lobes c. 7.1 × 1.3 mm. *Staminal column* c. 0.6 mm high. *Corona* lobes c. 0.6 mm long (free part), dorsally flat, straight, projecting above staminal column. *Style head* projecting c. 2½ × longer than staminal column; apical portion c. 2½ × longer than basal portion, c. 1.3 mm long. *Follicles* not seen.

Phenology — Flowering specimen seen from May.

Distribution and ecology — *Secamone toxocarpoides* var. *incana* is known only from the type locality in Sahafary, Antsiranana, a dry deciduous forest area. It was found at an altitude of 270 m.

Remarks — In addition to *Secamone glabra*, described above from the littoral forest north of Vohémar, a specimen representing a sixth taxon in the group of species morphologically close to *S. toxocarpoides* (see Remarks to *S. glabra*) has been found that merits recognition as a new variety. This plant was collected near Sadjoavato in Sahafary forest in the very north of Madagascar and is characterized by its lower leaf surfaces being completely covered by a conspicuous, whitish indumentum of appressed hairs. This is in contrast to the smooth leaves of both *S. glabra* and *S. toxocarpoides*. Sahafary forest is

located within the distribution range of *S. toxocarpoides*. The area is covered by dry deciduous forest. The new variety, here described as *S. toxocarpoides* var. *incana*, has flowers with short and open corolla tubes with five distinct pouches that protrude between the calyx lobes. The buds are obpyriform, almost globose at the base and with a much narrower, cylindric, apical part of contorted corolla lobes. The flowers are yellowish and basally tinged with red (Fig. 12). These are all floral characters shared with *S. toxocarpoides*. In fact, no morphological character that distinguishes this taxon from *S. toxocarpoides* other than the dense indumentum has been observed, and var. *incana* may be considered an ecotype of this species adapted to a locally dry climate.

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