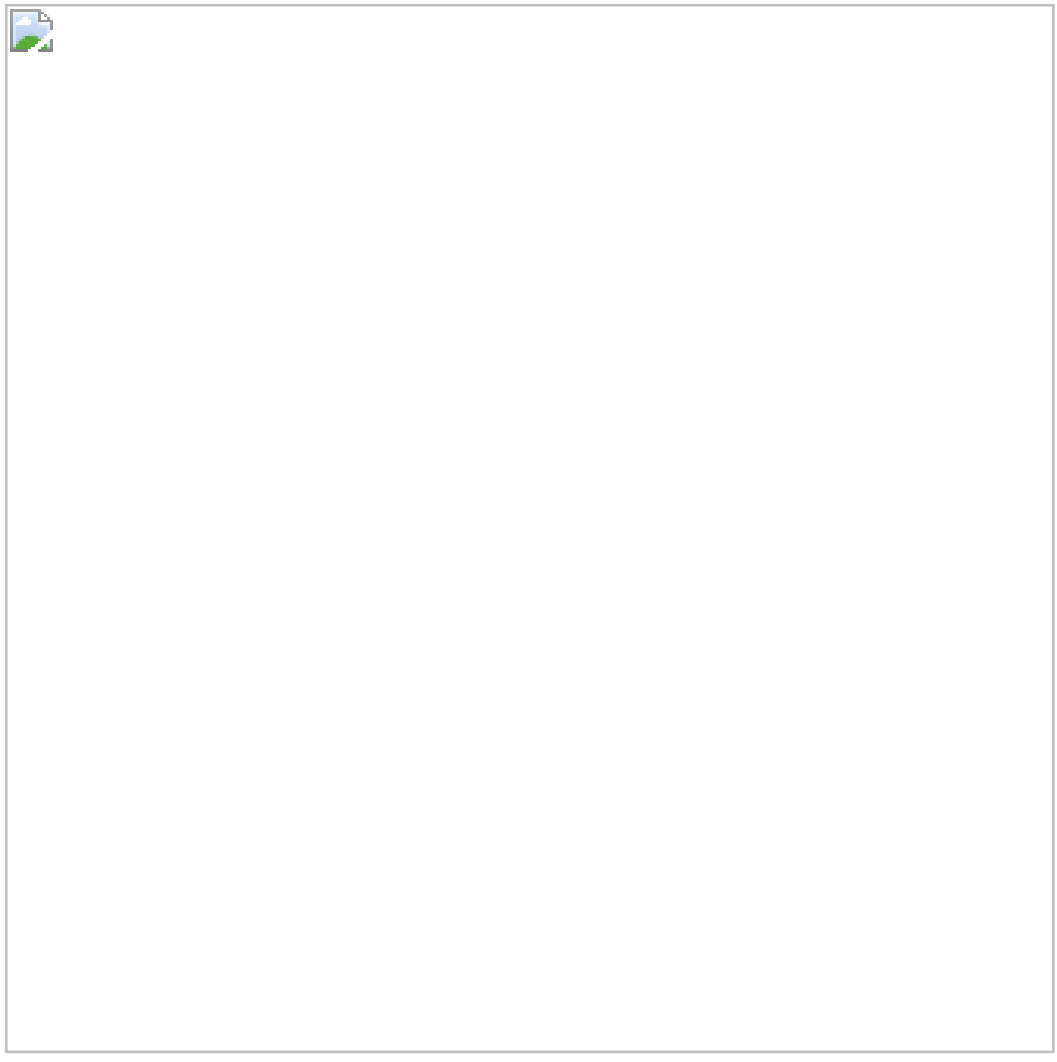

A Synoptic Revision of the Malagasy Endemic Genus Socratina Balle (Loranthaceae)

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A synoptic revision of the Malagasy endemic genus Socratina Balle (Loranthaceae)

Martin W. Callmander, Iacopo Luino, Simona Da-Giau, Charles Rakotovao & Laurent Gautier

Abstract

CALLMANDER, M. W., I. LUINO, S. DA-GIAU, C. RAKOTOVAO & L. GAUTIER (2014). A synoptic revision of the Malagasy endemic genus Socratina Balle (Loranthaceae). *Candollea* 69: 65-73. In English, English and French abstracts.

The hemiparasitic endemic genus *Socratina* Balle *(Loranthaceae)* is revised for Madagascar. Three species are recognized, including a new one, *Socratina phillipsoniana* Callm. & Luino. The vegetative and floral morphology of the new species is distinctive; in particular the conspicuous longitudinal villous fringe of long dendritic trichomes on the outer surface of its corolla along each suture of the lobes that contrasts with the shorter floccose indument that covers the rest of the outer corolla surface. All three known species are provided with preliminary risk assessments based on the IUCN Red List Categories and Criteria. A key to the genus is presented and a discussion of the morphological affinities of each species is also provided.

Key-words

LORANTHACEAE – *Socratina* – Beanka – Madagascar – Taxonomy – Conservation

Résumé

CALLMANDER, M. W., I. LUINO, S. DA-GIAU, C. RAKOTOVAO & L. GAUTIER (2014). Une révision synoptique du genre endémique malgache Socratina Balle (Loranthaceae). *Candollea* 69: 65-73. En anglais, résumés anglais et français.

Le genre hémiparasite endémique *Socratina* Balle *(Loranthaceae)* est révisé pour Madagascar. Trois espèces sont reconnues, y compris une nouvelle, *Socratina phillipsoniana* Callm. & Luino. Les caractères végétatifs et floraux de la nouvelle espèce permettent de la distinguer clairement, en particulier la frange longitudinale villeuse sur la surface extérieure de la corolle le long de chaque suture des lobes formés de longs trichomes dendritiques qui contraste avec l'indument floconneux plus court qui couvre le reste de la surface extérieure de la corolle. Une évaluation préliminaire des risques d'extinction des trois espèces connues est proposée; elle est basée sur les Catégories et Critères de la Liste Rouge de l'UICN. Une clé du genre est présentée et une discussion des affinités morphologiques de chaque espèce est également fournie.

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Introduction

The endemic Malagasy genus *Socratina* Balle *(Loranthaceae)* is distinguished from *Bakerella* Tiegh., the only other genus of *Loranthaceae* occurring in Madagascar, based on the presence of an indument at least on young parts (vs. glabrous in *Bakerella*) and its long recurved filaments at anthesis (vs. short, straight) (Balle, 1964a). *Socratina* was placed in the subtribe *Tapinanthinae* Nickrent & Vidal-Russell along with 14 African and Arabian genera (Nickrent & al., 2010). Among these genera, *Socratina* is unique in the presence of an indument of straight appressed trichomes on the inner surface of the corolla-lobes (Balle, 1964b; Polhill & Wiens, 1998). It nevertheless has strong morphological affinities with both *Taxillus* Tiegh. and *Vanwykia* Wiens, and with the latter, an eastern and south-eastern African genus, it shares styles with peculiar pluricellular ramified trichomes (Polhill & Wiens, 1998). This character is absent in *Taxillus*, a predominantly south-east Asian genus of c. 35 species with a single species in East Africa, *T. wiensii* Pohl. (Polhill & Wiens, 1999). *Vanwykia* was revealed to be sister to *Socratina* in a recent molecular phylogenetic study and consequently a "dispersal event to Madagascar from a common ancestor with *Socratina* could be implied" (Vidall-Russel & Nickrent, 2008: 1026; see also Buerki & al., 2013).

Previous treatments of *Socratina* recognised two well-defined species: *Socratina bemarivensis* (Lecomte) Balle and *S. keraudreniana* Balle. They are localized respectively in the south-western dry bush and in the dry deciduous forests of the northern part of Madagascar (Fig. 1). A recent review of material of the genus *Socratina* for the "Catalogue of the Vascular plants of Madagascar" (Madagascar Catalogue, 2014) revealed a collection from the limestone region of Bemaraha *(Jongkind & al. 3548)* that did not match either of the currently known species. Subsequently, further collections of this undescribed species have been made at sites on a similar substrate in the Beanka area, about 100 km to the north of Bemaraha. The Beanka forests have recently been the subject of intensive biodiversity inventories and a recently published monograph on the biodiversity of this interesting area (Goodman & al., 2013), including a checklist of vascular plant species (Gautier & al., 2013). These inventories lead to the discovery of new species in different groups including one bird, several invertebrates [see Goodman & Gautier (2013) for a review] and plants (Letsara & al., 2012; Callmander & al., 2013; Gautier & Deroin, 2013).

In the present article, we provide a synoptic revision of *Socratina* and describe a new species endemic to western Madagascar, *S. phillipsoniana* Callm. & Luino. All three known species are provided with preliminary risk assessments based on the IUCN Red List Categories and Criteria (IUCN, 2012). Calculations of the Area of Occupancy (AOO), Extent of Occurrence (EOO) and number of subpopulations were based on the methods presented in Callmander & al. (2007). A key to discriminate the three currently known species in the genus is presented and a discussion of the morphological affinities of each species is also provided.

Key to the endemic Malagasy genus *Socratina*

1. Flowers buds c. 1-2 mm in diam. just prior to anthesis; corolla tube covered by a sparse indument; splitting distally between each of the five lobes at anthesis ..... ***S. keraudreniana***

1a. Flowers buds c. 4-6 mm in diam. just prior to anthesis; corolla tube covered by a dense indument, splitting mostly unilaterally at anthesis 2

2. Mature leaves and petiole covered by a russet indument; corolla with a dense uniform external indument ..... ***S. bemarivensis***

2a. Mature leaves and petiole glabrescent; corolla with two different external indument types: a uniform, relatively sparse indument over the entire surface, and with conspicuous villous fringe of long trichomes on the outer surface of its corolla longitudinal along each suture ..... ***S. phillipsoniana***

Systematics

Socratina Balle in Adansonia ser. 2, 4: 135. 1964.

Typus: *Socratina bemarivensis* (Lecomte) Balle

Socratina bemarivensis (Lecomte) Balle in Adansonia ser. 2, 4: 135. 1964.

≡ *Loranthus bemarivensis* Lecomte in Not. Syst. (Paris) 4: 37. 1923.

≡ *Tapinanthus bemarivensis* (Lecomte) Danser in Verh. Kon. Akad. Wetensch., Afd.Natuurk., sect. 2. 29: 108. 1933.

Lectotypus (designed by Balle, 1964b: 135): **Madagascar. Prov. Mahajanga:** Bois de la Haute Bemarivo, [16°06'S 47°44'E], XI.1918, fl., *Perrier de la Bâthie 10646* (P [P00573453]!; isolecto-: P [P0573454, P0573455]!).

Conservation status. – With an EOO of 2,336 km², and an AOO of 27 km² and three subpopulations, none situated within the protected area network, *S. bemarivensis* is assigned a preliminary status of "Vulnerable" [VU B1ab(i)+2ab(i)] following IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – *Socratina bemarivensis* was originally described in *Loranthus* Jacq. by Lecomte (1923) following the very broad generic concept of Engler & Krause (1935), a genus that is now circumscribed as mostly restricted to temperate or mountain forest from Europe to south-est Asia (Barlow, 1997). Henri Perrier de la Bâthie, who collected both syntypes

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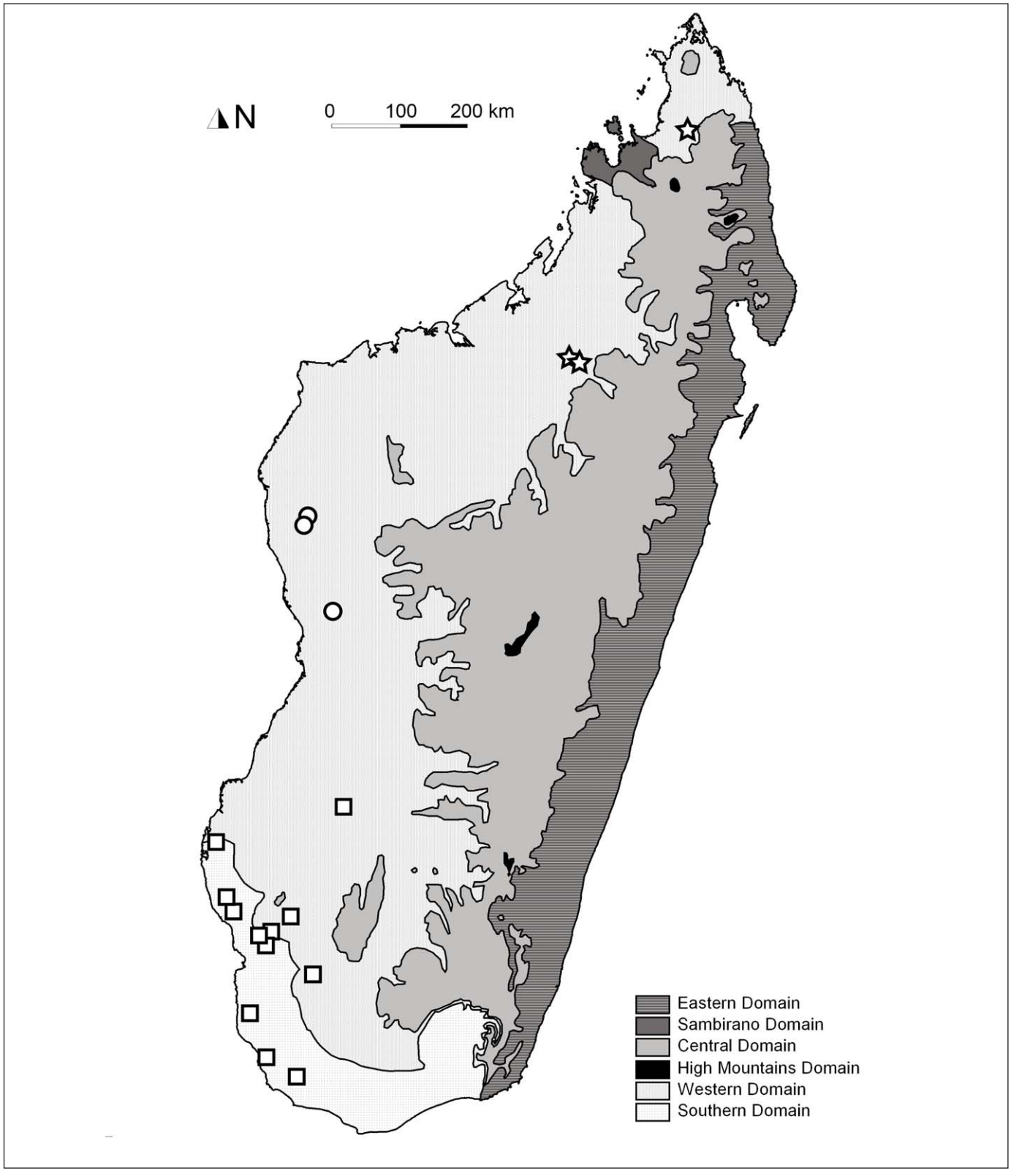

Fig. 1. – Map showing the distribution of *Socratina bemarivensis* (Lecomte) Balle (stars), *S. keraudreniana* Balle (squares) and *S. phillipsoniana* Callm. & Luino (circles) in Madagascar, plotted on the map of phytogeographical domains sensu HUMBERT (1955).

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wrote on the label of one of them *(Perrier de la Bâthie 10652),* that the flowers open at maturity with only one longitudinal split along the entire length of the corolla lobes (see Balle, 1964b: 137). Anthesis of *S. bemarivensis* is very different to that of *Socratina keraudreniana* where the corolla divides into five lobes in the distal part (Fig. 2). Several other characters of the morphology of its leaves and flowers allow to differentiate those two species: limb sub-orbicular to largely ovate, 0.8-4.8 cm in width in *S. bemarivensis* (vs. oblanceolate to obovate, 0.3-0.8 cm in *S. keraudreniana*); corolla broad, covered with long (2-2.5 mm) trichomes forming dense indument (vs. corolla slender covered by short (1-1.5 mm) trichomes forming a sparse indument) (Fig. 2).

Perrier de la Bâthie noted several hosts for *Socratina bemarivensis: Acacia sp.* and *Dalbergia sp. (Leguminosae), Eugenia sp. (Myrtaceae)* and *Vernonia sp. (Asteraceae)* (Balle, 1964b). Most *Loranthaceae* species seem to have a wide range of hosts (Polhill & Wiens, 1998) but some species have also very restricted hosts such as *Taxillus wiensii* known only to grow on *Cynometra webberi* Baker f. *(Leguminosae)* (Polhill & Wiens, 1998). Further studies are needed in Madagascar to determine if the genus *Socratina* has host specificity as this information is recorded on very few collections (see also comments under *S. keraudreniana*).

Additional material examined. – **Madagascar. Prov. Antsiranana:** Ambilobe, Ambakirano, Behefaka, Anjahana, forêt d'Ampivanana, 9 km au S de Behefaka, 13°21'12"S 49°09'11"E, 276 m, 6.V.2005, fl. & fr., *Ratovoson 105* (CNARP, MO, P [P06714072], TAN). **Prov. Mahajanga:** Bord de l'Anovilava, affluent du Bemarivo (Boïna), [16°09'S 47°51'E], VI.1906, fl., *Perrier de la Bâthie 10642* (P [P05447659, P05447668, P05447669] [syntypes]!)

Socratina keraudreniana Balle in Adansonia ser. 2, 4: 135. 1964.

Typus: Madagascar. Prov. Toliara: Gorges du Fiherenana, entre Beanty et Anjamala, [22°57'S 44°19'E], 30-300 m, I.1947, fl., *Humbert 19902* (holo-: P [P05447658]!; iso-: [P05447656, P05447657, P05447660, P05447661]!).

Conservation status. – With an EOO of 34,514 Km², and an AOO of 108 km² and nine subpopulations, two of which are within the protected area network (Beza Mahafaly and Tsimanampetsotsa) and one occurs in a proposed protected area which currently benefits from only temporary protection (Mikea Forest), *S. keraudreniana* is assigned a preliminary status of Least Concern (LC) following IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – *Socratina keraudreniana* is unique in the genus in having the corolla tube not splitting unilaterally at anthesis but rather divided into five lobes in the distal part only, thus the tube is much longer than the corolla lobes (Balle, 1964a; Fig. 2A). The species is known from the south-western part of Madagascar in dry deciduous forests and xerophyte scrub, sometimes on limestone. Despite being a rather widely collected species, only two different hosts have been documented: *Grewia sp. (Malvaceae) (Du Puy & al. 699)* and *Mimosa delicatula* Baill. *(Leguminosae) (Phillipson 2595).*

Additional material examined. – **Madagascar. Prov. Toliara:** Ampanihy vers la Linta, 24°53'S 44°23'E, I.1999, fl., *Allorge 2304* (P [P00156506]); 30 km de Tuléar, [23°16'S 44°00'E], II.1962, fr., *Bosser 15660* (MO, P [P05447665, P05447666], TAN); ca. 2 km N of Itampolo on route to Lavavolo, 10 m, 24°39'S 43°58'E, 8.II.1990, fl., *Du Puy & al. 630* (K, P [P00075257], TAN); Forest of Mikea c. 3 km N of Beroroha, 60 m, 22°52'54"S 43°33'25"E, 8.II.1990, fl., *Du Puy, Labat & Comtet 699* (K, P [P016795], TAN); Env. Lac Tsimanampetsotsa (SO), 30 m, [24°07'30"S 43°47'00"E], 24.XI.1960, fl., *Leandri & Saboureau 4023* (P [P05447651, P05447654]); Env. Lac Tsimanampetsotsa (SO), 30 m, [24°07'30"S 43°47'00"E], 24.XI.1960, fl., *Leandri & Saboureau 4034* (P [P05447652]); 40 km au env. de Tuléar, 300 m, [23°10'S 44°04'E], II.1962, fl., *Keraudren 1368* (P [P05447662]); Fiherena, [22°57'30"S 44°19'00"E], 8.XII.1967, fl., *Koechlin 10* (P [P05447663]); Beza Mahafaly RS, 160 m, 23°40'S 44°36'E, 19.XI.1987, fl., *Phillipson 2595* (MO, P [P05447653], TAN); Betaimboraky, 120 m, 22°44'12"S 43°31'17"E, 11.XI.1998, fl., *Rakotomalaza & Messmer 1816* (G, MO, P [P05447655]); Forêt de Mikea, axe Belo-Ankilimihavotse, 0-50 m, 22°05'S 43°22'E, 30.I.2000, fl., *Ranaivojaona & al. 280* (MO, P [P05447543], TAN); Makay, forêt Akolitsika, 238 m, 21°40'04"S 44°59'45"E, 22.I.2011, buds, *Razakamalala 6136* (MO, P, TAN).

Socratina phillipsoniana Callm. & Luino, **spec. nova** (Fig. 2, 3, 4).

Typus: Madagascar. Prov. Mahajanga: Beanka, partie N, 18°07'05"S 44°27'04"E, 174 m, 23.VII.2013, fl. & fr., *Luino & Ranaivoarisoa 63* (holo-: G [G00341307]!; iso-: K [K000865017]!, MO!, P [P00853035]!, TEF!).

Haec species a congeneris foliis glabrescentibus, alabastro apice fusiformi atque corolla extus secus quamque suturam loborum conspicue longitudinaliter fimbriata trichomatibus villosis dendriticis longis praeut indumento floccoso breviore corollam extus ceterum obtegente distinguitur.

Hemi-parasitic *shrub*, 0.5-1 m in diam., young fertile and sterile parts covered by a white floccose indument; twigs c. 0-7-1 mm long. *Leaves* alternate on young shoots, becoming clustered on twigs; petiole 1-6 mm, sometimes sub-sessile; lamina papery-coriaceous, obovate to oblanceolate, rounded at apex, cuneate or attenuate at base; (10-)15-25(-45) × 10-15(-20) mm, tomentose at first, soon becoming glabrescent, triplinerved, attenuate at the base. *Inflorescence* an umbel, developing at nodes, sessile, 2-5-flowered. *Bracts* c. 2.5 mm long, boat-shaped, apex rounded, soon glabrescent except for margins and apex that remain covered with longer reddish brown persistent trichomes. *Receptacle* c. 3 × 2 mm, covered with a dense white indument. *Calyx* short, c. 1 mm long, green,

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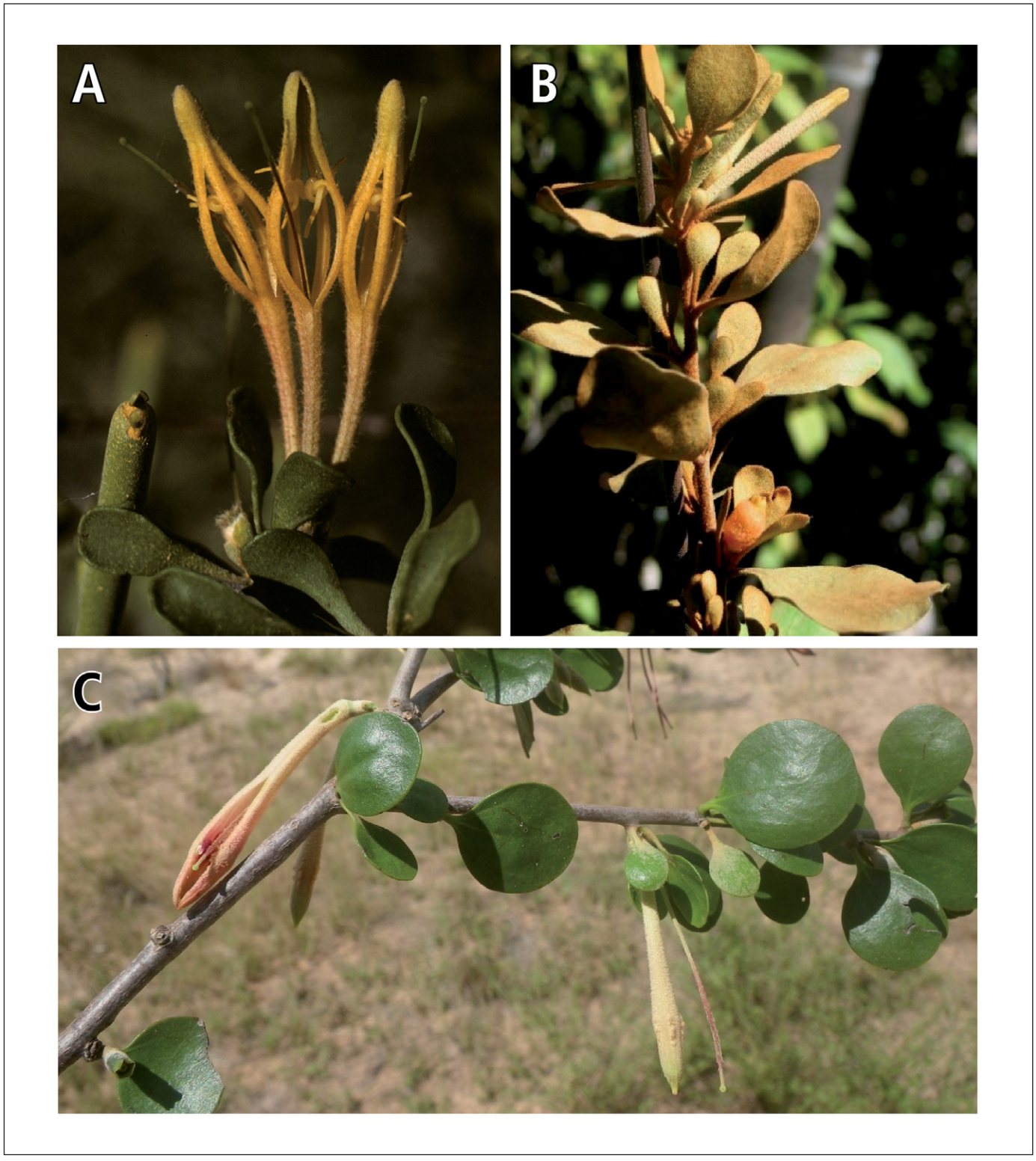

Fig. 2. – Living plants. **A.** *Socratina keraudreniana* Balle ; **B.** *S. bemarivensis* (Lecomte) Balle ; **C.** *S. phillipsoniana* Callm. & Luino.
[Photos : **A:** J. Bosser ; **B:** F. Ratovoson ; **C:** I. Luino]

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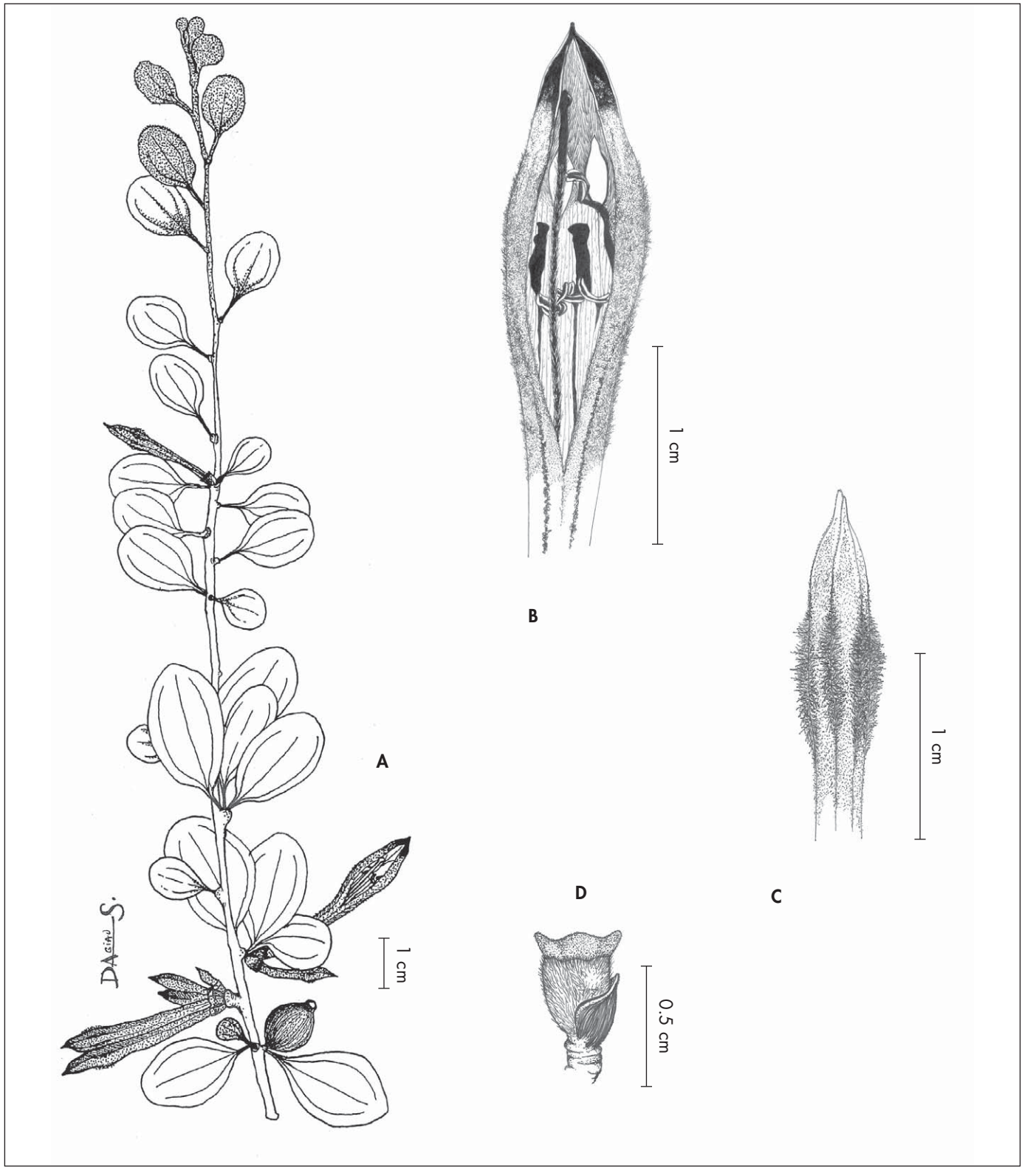

Fig. 3. – *Socratina phillipsoniana* Callm. & Luino. **A.** Fertile branch with flowers and fruit; **B.** Apex of open flower; **C.** Bud apex showing the fringe of trichomes along the sutures; **D.** Calyx and bract.

[*Luino & Ranaivoarisoa 63*, G] [Drawings: S. Da-Giau]

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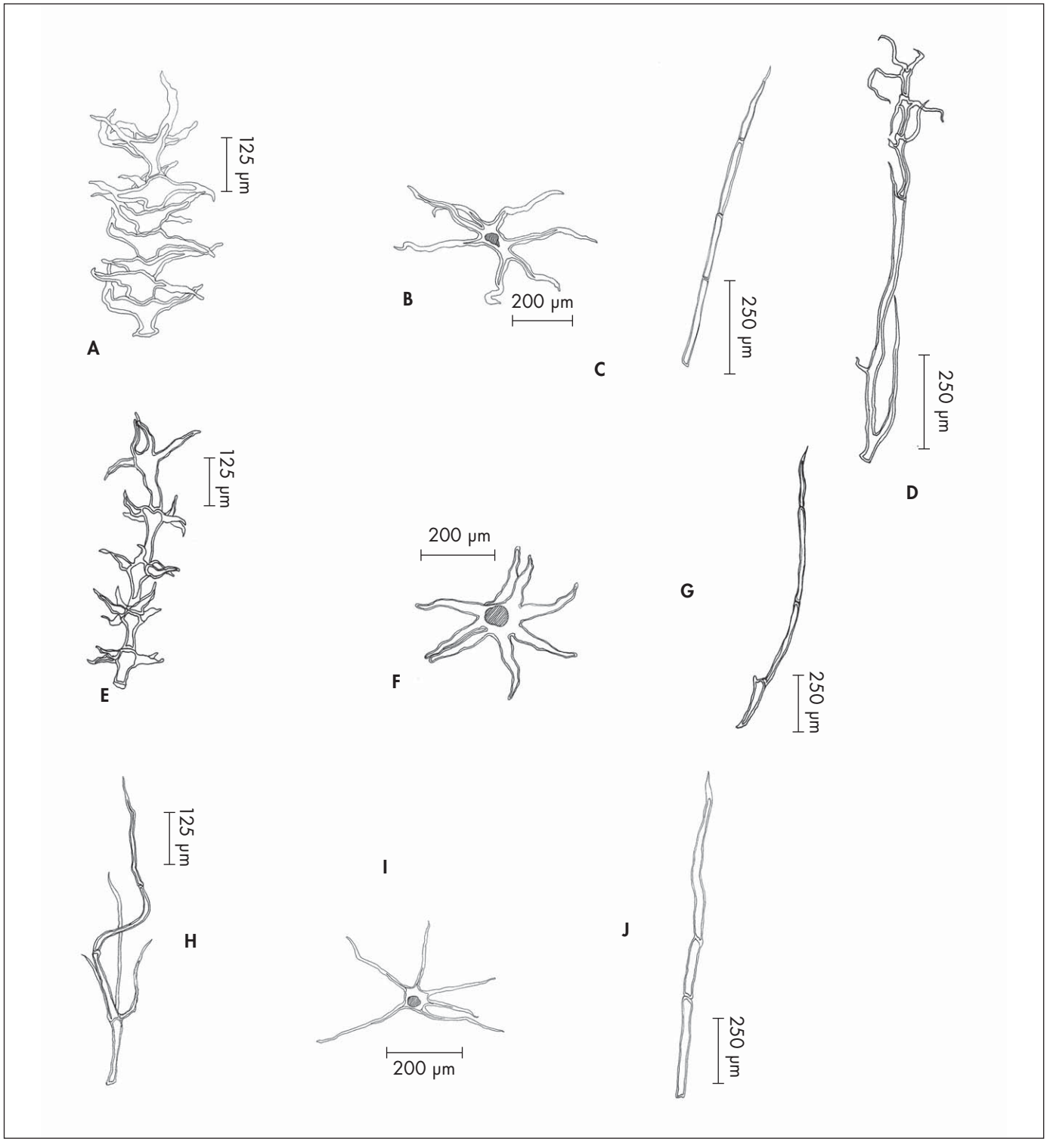

Fig. 4. – Trichomes. **A-D:** *Socratina phillipsoniana* Callm. & Luino; **E-G:** *S. bemarivensis* (Lecomte) Balle; **H-J:** *S. keraudreniana* Balle.

A, E, H. Trichomes from the outer surface of the corolla tube: side view; **B, F, I.** Trichomes from the outer surface of the corolla tube: cross section; **C, G, J.** Trichome from the inner surface of the corolla tube: side view; **D:** Trichome from villous fringe of the corolla tube: side view.

[**A-D:** *Luino & Ranaivoarisoa 63*, G; **E-G:** *Ratovoson 105*, P; **H-K:** *Rakotomalaza & Messmer 1816*, G]

[Drawings: S. Da-Giau]

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soon glabrescent, with 5 scarcely differentiated teeth. *Corolla* 5-merous, 35-50 mm long; the outer surface covered with a dense white shorter floccose indument, composed of dendritic trichomes up to 0.8 mm long, the ramifications forming a series of closely whorled layers; and with a conspicuous longitudinal villous fringe along each suture, composed of slender elongated dendritic trichomes up to 1.5 mm long with a few irregular proximal ramifications and only a few distal whorled ones. *Buds* sub-conic, with a fusiform apex in the upper 1/3 distal part; tube splitting unilaterally between 2 lobes at anthesis, sometimes slightly splitting between the other lobes distally; lobes c. 20 × 1.5 mm, broadly linear-spatulate in the proximal part, apiculate in the last 7-10 mm distal part. Stamens coiled, arising at or just above the base of the corolla lobes; anthers 2.5 mm long, rolled; filaments 4 mm long, puberulent, dark purple. *Style* 40 mm in length, pale green, covered with long white trichomes except in the distal 4 mm, filiform. *Stigma* obovoid to globular, c. 0.5 mm in diam. *Fruit* a red berry "in vivo", pale orange when dried, covered with a sparse indument, obovoid, c. 12-14 × 7-9 mm.

Etymology. – The species is named in honour of our colleague Peter Phillipson who obtained funds and arranged the first field mission to Beanka in 2009 and contributed to the floristic checklist recently published on the region (Gautier & al., 2013). Peter has collected over 3000 plants in Madagascar, especially in the dry south-western region where he first collected in 1987. He has a wide knowledge on many plant groups on the Island and participates actively in the milestone "Catalogue of the Vascular plants of Madagascar" project (Madagascar Catalogue, 2014).

Distribution and ecology. – *Socratina phillipsoniana* is only known from the limestone region of Bemaraha and Beanka in western Madagascar (Fig. 1).

Conservation status. – With an EOO of 557 km², and an AOO of 27 km² and three subpopulations, one of which occurring in the protected area network (Bemaraha) and the other two in a projected protected area and already holding a temporary status (Beanka), *S. phillipsoniana* is assigned a preliminary status of Vulnerable (VU D2) following IUCN Red List Categories and Criteria (IUCN, 2012).

Notes. – *Socratina phillipsoniana* is similar to *S. bemarivensis* in having a corolla tube splitting unilaterally at anthesis. It can however easily be recognized when flowering by the conspicuous longitudinal villous fringe of long dendritic trichomes on the outer surface of its corolla along each suture in addition to a uniform floccose indument over the entire surface (vs. uniform indument in *S. bemarivensis*) and the fusiform shape of the bud apex (vs. rounded in *S. bemarivensis*) (Fig. 3, 4). When sterile *S. phillipsoniana* differs from *S. bemarivensis* by its glabrescent leaves whereas the latter species has leaves covered by a russet indumentum (Fig. 2).

Paratypi. – **Madagascar. Prov. Mahajanga:** Beanka, partie S, Andoloposa, 18°00'27"S 44°30'10"E, 287 m, 20.III.2012, fr., *Hanitrarivo, Bolliger & Rakotozafy 343* (BR, G [G00376797], K, MO, P, TEF); Tsingy de Bemaraha, S of the river Manambolo, 19°09'S 44°49'E, 50 m, 15.XII.1996, *Jongkind, Andriantiana & Razanatsoa 3548* (G [G00404128], P [P05096712], MO, WAG); Beanka, partie N, 18°07'09"S 44°27'02"E, 165 m, 23.VII.2013, fl. & fr., *Luino & Ranaivoarisoa 60* (BR, G [G00341313], K, MO, P, TEF).

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