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Begonia ambodiforahensis Scherber. & Duruiss., sp. nov., habit and female flower.

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Three new species of *Begonia* sect. *Erminea* (Begoniaceae) from north-east Madagascar

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ABSTRACT
Three new species of *Begonia* section *Erminea* A.DC. from north-east Madagascar are described and illustrated. They share a tuberous habit, four tepaled male flowers and six tepaled female flowers, which are typical of that section. *Begonia ambanizanensis* Scherber. & Duruiss., sp. nov. differs from the other species in that section by the symmetric, sub-orbicular, succulent leaf blades. *Begonia ambodiforahensis* Scherber. & Duruiss., sp. nov. is compared to *B. antongilensis* Humbert and *B. erminea* L'Hér. but it differs from both by the combination of an acaulescent habit and the numerous lanceolate leaves with red margins and spiculiform red hairs on the blade. *Begonia harimalalae* Scherber. & Duruiss., sp. nov. is also compared to *B. erminea* from which it differs by the thicker, larger leaves, which are glabrous, with the margins shallowly and sparsely serrate vs densely biserrate.

KEY WORDS
Begoniaceae,
Begonia,
Madagascar,
Masoala,
Makira,
new species.

RÉSUMÉ
Trois nouvelles espèces de Begonia *sect.* Erminea *(Begoniaceae) du nord-est de Madagascar.*
Trois nouvelles espèces de *Begonia* de la section *Erminea* A.DC. du nord-est de Madagascar sont décrites et illustrées. Elles partagent le port tubéreux, les fleurs mâles à quatre tépales et femelles à six tépales qui sont typiques de cette section. *Begonia ambanizanensis* Scherber. & Duruiss., sp. nov. diffère des autres espèces de cette section par les limbes des feuilles sub-orbiculaires, symétriques et succulents. *Begonia ambodiforahensis* Scherber. & Duruiss., sp. nov. est comparé à *B. antongilensis* Humbert et *B. erminea* L'Hér. mais diffère des deux par la combinaison de son port acaulescent et les nombreuses feuilles lancéolées à bordures rouges et poils rouges spiculiformes sur le limbe. *Begonia harimalalae* Scherber. & Duruiss., sp. nov. est également comparé à *B. erminea* dont il diffère par les feuilles plus grandes et plus épaisses, qui sont glabres avec les bords légèrement et éparsement serrés vs densément bi-serrés.

MOTS CLÉS
Begoniaceae,
Begonia,
Madagascar,
Masoala,
Makira,
espèces nouvelles.

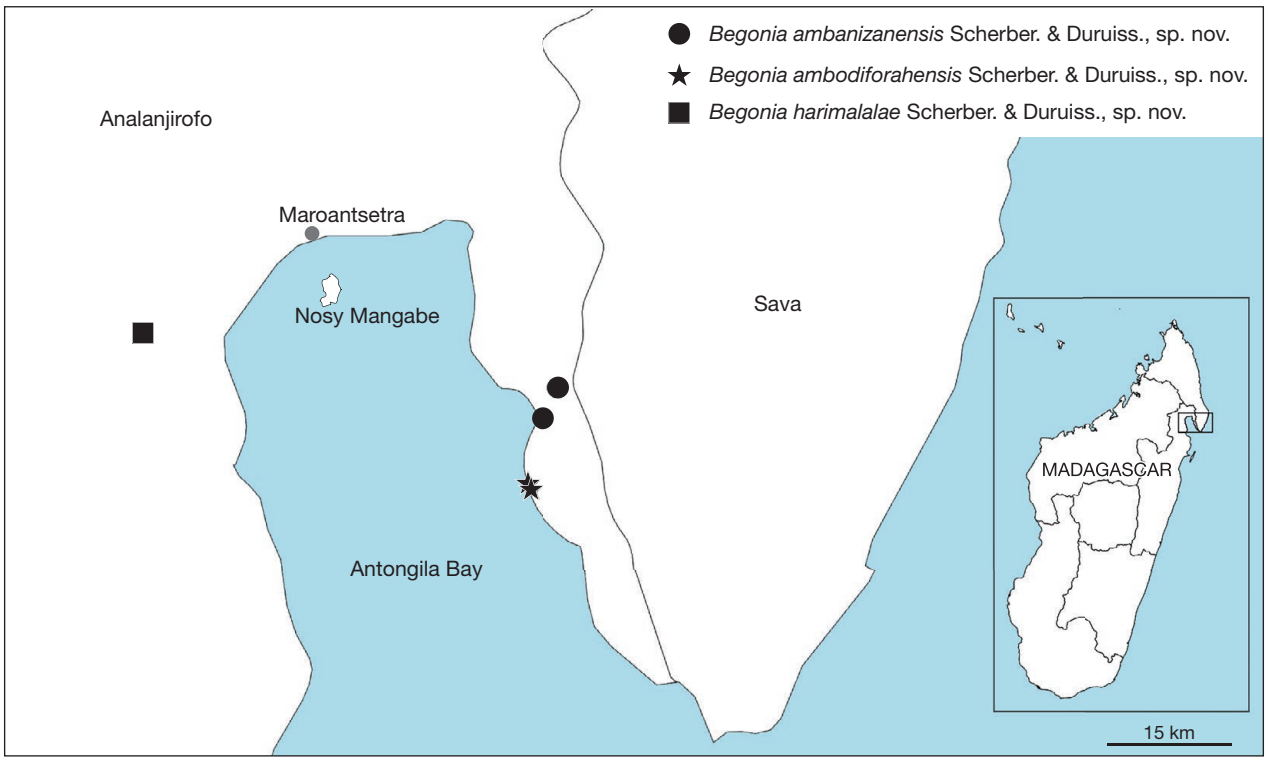

FIG. 1. — Geographic distribution of *Begonia ambanizanensis* Scherber. & Duruiss., sp. nov., *Begonia ambodiforahensis* Scherber. & Duruiss., sp. nov. and *Begonia harimalalae* Scherber. & Duruiss., sp. nov. in north-east Madagascar.

INTRODUCTION

Begonia L. is one of the largest genera of angiosperms, comprising as of today 1899 recognized species (Hughes *et al.* 2015), distributed in the tropics and subtropics. Recent studies on *Begonia* from Madagascar have led to the recognition and description of several new species (Hughes 2011; Scherberich & Duruisseau 2016, 2017), all from the northeastern tropical humid forests of the Masoala Peninsula. The area has however still been little explored. Collections have mostly been made only in the relative periphery of the Masoala National Park, and further exploration in the heart of the park will certainly reveal more novelties. Two of these are described here as *B. ambanizanensis* Scherber. & Duruiss., sp. nov. and *B. ambodiforahensis* Scherber. & Duruiss., sp. nov.

Another major area of exceptional biodiversity lies west of the Masoala peninsula. Created in 2012, the Makira Natural Park covers 372,470 hectares of low and mid-altitude rainforest. Preliminary estimations suggest that the Makira forest would have the highest level of species diversity and could contain around 50% of Madagascar's floral biodiversity (Meyers 2001). *Begonia harimalalae* Scherber. & Duruiss., sp. nov. from the southern part of the Makira forest is here described as a new species (Fig. 1).

The three here newly described species belong to *Begonia* section *Erminea* which is defined by the following characteristics (De Candolle 1859): tuberous habit; male flowers with four tepals, usually with monadelphous stamens; female flowers with 6 tepals with 3 bifid styles and lunulate stigma; fruit a capsule unequally 3-winged dehiscent from the valve opposite to the main wing.

The recognition of these new species brings to 55 the number of *Begonia* species for the flora of Madagascar and to 13 the number of species for the flora of Masoala (Keraudren-Aymonin 1983). These include *B. ambanizanensis* Scherber. & Duruiss., sp. nov., *B. ambodiforahensis* Scherber. & Duruiss., sp. nov., *B. antongilensis* Humbert, *B. bogneri* Ziesenh., *B. erminea* L'Hér., *B. henrilaportei* Scherber. & Duruiss., *Begonia keraudreniae* Bosser, *B. lyallii* A. DC., *B. masoalaensis* M.Hughes, *B. nana* L'Hér., *B. nosymangabensis* Scherber. & Duruiss., *B. pteridoides* Scherber. & Duruiss. and *B. tsimihety* Humbert. Among these, *B. henrilaportei* and *B. lyallii* are members of section *Nerviplacentaria* A.DC., *B. masoalaensis* is unplaced yet, while the remaining species all belong to section *Erminea*. With 10 out of the 17 recognized species belonging to that section (Moonlight *et al.* 2018), the Masoala Peninsula obviously appears as the center of distribution of *Begonia* sect. *Erminea*. Most of them have relatively restricted geographical ranges, many being endemic from the peninsula, and several are only known from the type locality.

SYSTEMATICS

Begonia ambanizanensis Scherber. & Duruiss., sp. nov. (Fig. 2)

Begonia ambanizanensis Scherber. & Duruiss., sp. nov. shares with *B. antongilensis* var. *antongilensis* the tuberous habit, with sub-caulescent stems, the symmetric, basally rounded to scarcely cordate blades, the number of perianth segments in male and

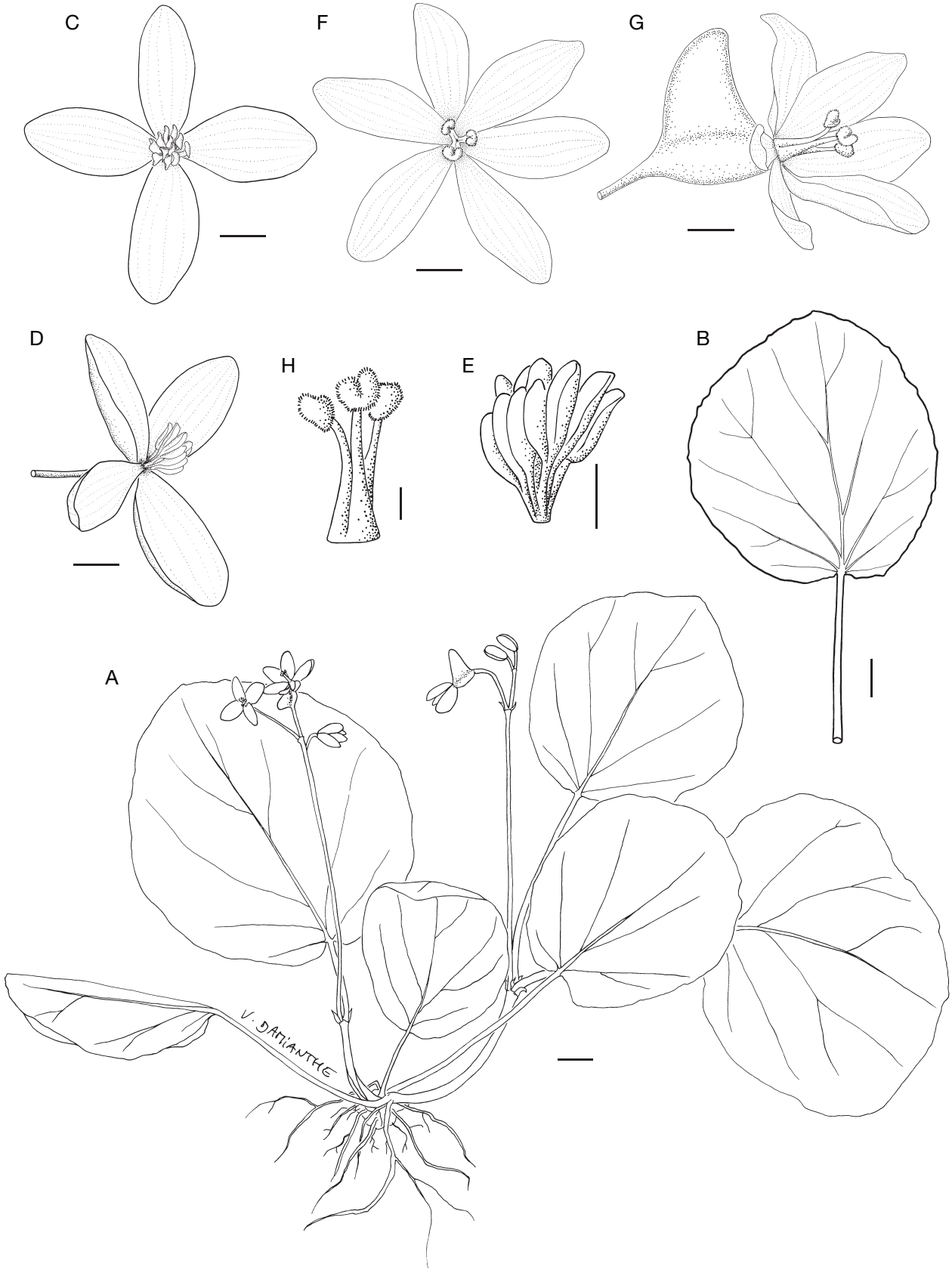

Fig. 2. — *Begonia ambanizanensis* Scherber. & Duruiss., sp. nov. : **A**, habit; **B**, leaf, adaxial side; **C**, male flower, front view; **D**, male flower, side view; **E**, androecium; **F**, female flower, face view; **G**, female flower, side view; **H**, styles and stigmas; **A**-**H**, *Schatz et al. 3381* (Drawing: Vanessa Damianthe).

female flowers and dry material have the same typical yellow brown color. It differs however substantially by the sub-orbicular shape of the leaf blade vs ovate-lanceolate in *B. antongilensis* and the absence of a staminal column.

TYPUS. — **Madagascar**. Analanjirofo region: Masoala Peninsula, Ambanizana, "S Trail" (S of Androka River) climbing into hills SE of Ambanizana, 15°38'S, 49°59'E, 150-700 m, 1.XI.1992, *Schatz et al. 3381* (holo-, MO[MO-5567669]!; iso-, P[P06803304]!, TAN!, WAG [WAG.1572957]!).

PARATYPES. — **Madagascar**. Analanjirofo region, Maroantsetra: Mountains NE of village of Ambanizana, along trail across Masoala Peninsula toward Antalaha, 560 m, 20.X.1986, *Lowry et al. 4197* (MO[MO-3437123]!, WAG[WAG.1572932]!); Cap Masoala Grand Parc, sources d'Anaovanandrano (confins), 15°36'S, 50°00'E, 630 m, 27.IX.2003, *Wohlhauser et al. 658* (G[G00418726]!, WAG[WAG.1572931]!).

DISTRIBUTION AND ECOLOGY. — *Begonia ambanizanensis* Scherber. & Duruiss., sp. nov. is only known from the mountains East of the Ambanizana village (Fig. 1), in dense forest, on moss covered rocks or as an occasional epiphyte on fallen logs, at an altitude of around 150-630 m. It has been found flowering from September to November.

CONSERVATION STATUS. — Although the new species is only known from three collections within the periphery of the Masoala National Park, the two collections with GPS data are separated by a direct line of about 3.6 km. It is obvious that little has been explored of that area within the park, so that we do not know the actual extent of distribution of *B. ambanizanensis* Scherber. & Duruiss., sp. nov. and if it is common or established as fractioned populations. Furthermore, satellite observations with Google Earth images from July 2014, although a few years old now, do not seem to show deforestation in that part of the park. It is estimated that there is not enough evidence to indicate that the new species might be under threat, therefore a preliminary status "LC" is proposed for now, following the IUCN Red List Categories and Criteria (IUCN 2012).

DESCRIPTION

Tuberous perennial lithophytic herb with short clumping stems and spreading leaves.

Tuber

Small, 10-25 mm, irregular, strongly adherent.

Stem

Herbaceous, to 7.5 cm. Internodes short, to 2 cm.

Stipules

Persistent, the margins entire.

Leaves

2-8, somewhat succulent; petiole to 10 cm long, 1-3 mm diam., canaliculate, glabrous, red; blade sub-orbicular 3-11.5 cm long, 3.3-12 cm wide., sub-symmetric, base rounded to cordate, glabrous, medium green on adaxial side, conspicuously paler on abaxial side, drying brown to yellow-brown, with minute darker glands on both sides; venation basally 7-9 palmate, major veins then pinnate with 1-4 secondary veins on each side; midrib and primary lateral veins slightly raised on abaxial side.

Inflorescence

Monochasial, occasionally dichasial cyme, solitary or sometimes two, axillary, pauciflowered, bisexual, seemingly protandrous but female flower appearing early, longer than leaves, axis 6-13 cm long, 1-2 mm diam.; bracts conspicuous, enclosing buds, 6-14 mm, early deciduous; bracteole absent; perianth segments pink, sometimes paler at apex.

Male flower. Perianth segments 4, free, pedicel 10-20 mm; outer perianth segments elliptic-obovate, rounded at apex 7-9.5 × 4-5.5 mm; inner perianth segments elliptic *c.* 6-7 × 3.3-3.5 mm; stamens 10-12; androecium zygomorphic; filaments free 0.8-1.4 mm; anthers as long or longer than filament, oblong, 1.4-1.7 mm, dehiscent through lateral longitudinal slits; connective not extended, yellow.

Female flower. Perianth segments 6, free; pedicel 7.5-12 mm; outer perianth segments elliptic-ovate, apex obtuse, *c.* 6.5-10 × 4-5 mm; inner perianth segments elliptic-lanceolate *c.* 6.5-10 × 3.5-4 mm; ovary 3-winged, unequal, with one wing conspicuously larger than the two others, *c.* 4-5 mm long vs *c.* 2 mm long, placentae unknown; styles 3, free, persistent in fruit; stigma reniform, in a band, yellow.

Fruit

3-winged dry capsule, nodding, the wings unequal.

Seeds

Unknown.

REMARKS

Begonia ambanizanensis Scherber. & Duruiss., sp. nov. is atypical in section *Erminea* by the absence of a staminal column, a feature it shares only with *B. bosseri*.

Begonia ambodiforahensis Scherber. & Duruiss., sp. nov. (Fig. 3)

Begonia ambodiforahensis Scherber. & Duruiss., sp. nov. can be compared to *B. erminea* with which it shares the distinct red margin and spiculiform hairs on the adaxial side of the leaf blade. It differs however by the narrowly lanceolate shape of the blade, less than 2 cm wide with an acute base, vs an elliptic-ovate blade to 8 cm wide with a broadly cordate base. The new species is also similar to *B. nana* but it has more leaves (10-20 vs 2-6 in *B. nana*), which are proportionally longer and narrower, and the latest misses the spiculiform hairs and red margin of the lamina. It could also be compared to the narrow leaf variety of *B. antongilensis* (*B. antongilensis* var. *cuneata*), but that species has conspicuous stems to 10 cm (vs acaulous), glabrous and entire to weakly dentate leaves that typically dries dark brown while *B. ambodiforahensis* Scherber. & Duruiss., sp. nov. dries yellow-green to green-brown.

TYPUS. — **Madagascar**. Analanjirofo region: Maroantsetra District, Tampolo, Péninsule de Masoala, Ambodiforaha, au Nord de Tampolo, 15°42'35"S, 49°58'13"E, 200 m, forêt dense humide, bas-fond, Mission Radeau des Cimes 2001, 20.X.2001, *Labat et al. 3360* (holo-, P[P00340594]!; iso-, G[G00405571]!, K!, MO, TAN, TEF).

PARATYPES. — **Madagascar**. Analanjirofo region: Maroantsetra District, Ambanizana, pente au-dessus de Tampolo, près de la

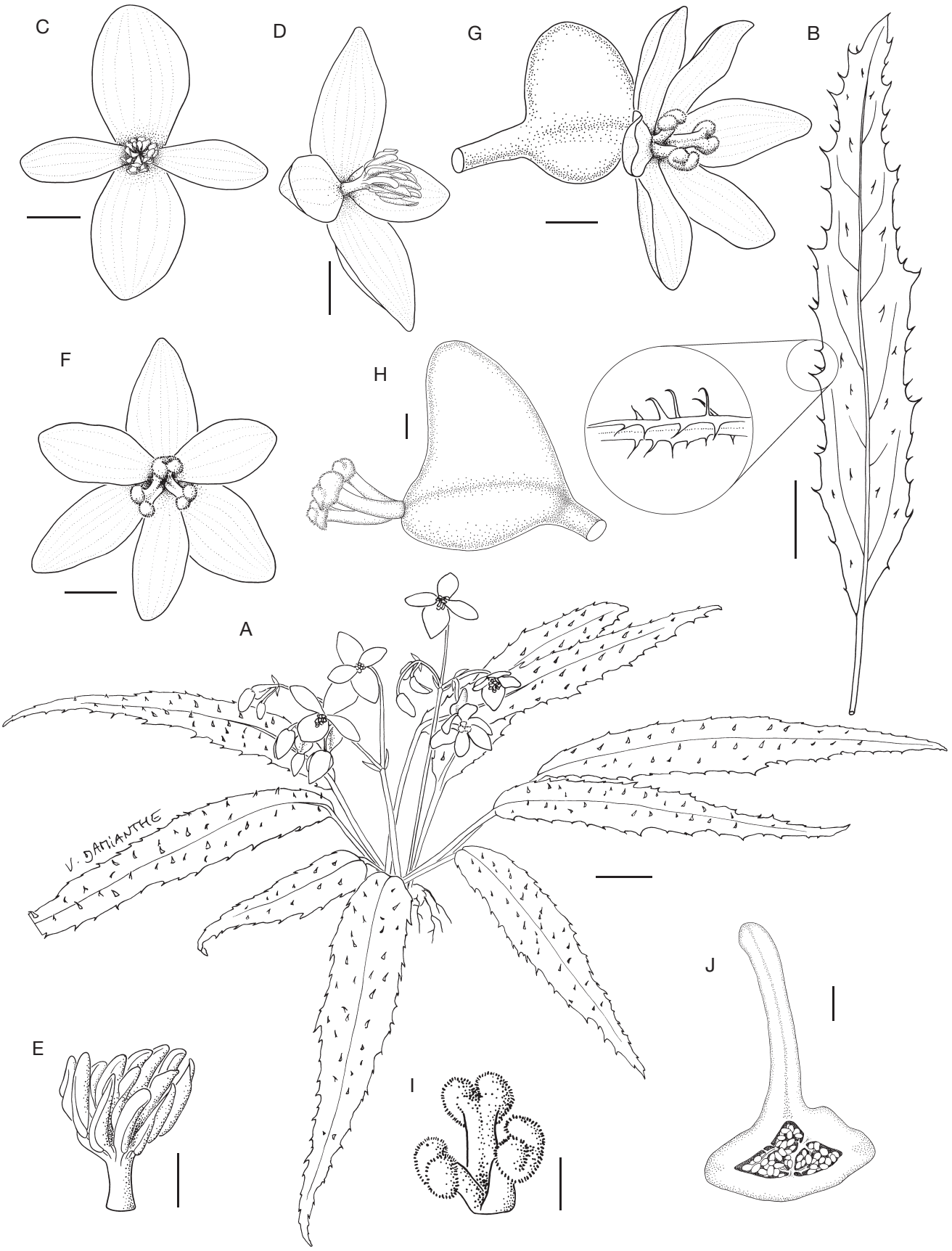

Fig. 3. — *Begonia ambodiforahensis* Scherber. & Duruiss., sp. nov.: **A**, habit; **B**, leaf, adaxial side; **C**, male flower, front view; **D**, male flower, side view; **E**, androecium; **F**, female flower, face view; **G**, female flower, side view; **H**, gynoecium; **I**, styles and stigmas; **J**, Ovary cross-section. **A**, from a picture in the type locality, not collected ; **B**-**J**, from a cultivated plant (no. 150333), Lyon Botanical Garden (Drawing: Vanessa Damianthe). Scale bars: A, 1cm; B, 5 mm; C, D, F, G, 2 mm; E, H-J, 1 mm.

limite du Parc national Masoala, "S: 15.42.180 E: 49.57.713", 8.XI.2004, *Aridy 455* (P[P05619949]!, ZT[ZT-00162682, ZT-00162685, ZT-00162686]!); Ambodiforaha, sur rochers moussus le long de la rivière, 15°42'12"S, 49°58'02"E, 157 m, plant in cultivation in Lyon Botanical Garden under n°150333, originally collected by E. Bouquet and J. Duruisseau, *Scherberich 1157* (LYJB!).

Distribution and ecology. — *Begonia ambodiforahensis* Scherber. & Duruiss., sp. nov. is only known from a small area north of Tampolo, where it can form small colonies on mossy rocks (gneiss), in proximity to rivers, in dense humid forest, at low elevation (45-200 m). Flowering has been observed from October to March but probably extends further.

Conservation status. — The new species has a very restricted distribution within the Masoala Peninsula, right on the margin of the Masoala National Park (Fig. 1). Furthermore, satellite images observation with Google Earth indicate anthropomorphic disturbance in the area. Thus, having an area of occupancy which is less than 20 km², the conservation status as "Vulnerable" [VUD2] is proposed following the IUCN Red List Categories and Criteria (IUCN 2012).

Description

Tuberous perennial lithophytic herb, acaulescent.

Tuber

Small, 10-20 mm, irregular, strongly adherent.

Stem

Absent or very short, to 5 mm.

Stipules

Persistent, the margins entire.

Leaves

Numerous, usually 10 to 20, alternate, straight, spreading to pendent; lamina and petiole sparsely minutely orange brown glandular dotted; petiole 1.1-5.5 cm long, 1-2 mm diam., 1.7-4.8 times shorter than lamina, canaliculate, glabrous, red; lamina 2-14 cm long, 3-17 mm wide, narrowly lanceolate, symmetric, 6.5-17.8 times longer than wide, with many spiculiform red hairs to 2.5 mm long between veins on adaxial side, base cuneate to obtuse, apex narrowly acute, margin conspicuously dentate, each tooth ending with a short soft spine, adaxially bright green to yellow-green with a distinct red-brown margin, semi-glossy, abaxially paler; midrib and primary veins barely raised adaxially, conspicuously so on abaxial side; primary lateral veins 3 to 6 pairs, evenly spaced along midrib, remotely branching along margin, the first 1-3 pairs sub-opposite; secondary venation reticulate.

Inflorescence

Axillary, dichasial at base, monochasial at apex, bisexual, protandrous, with basal male flowers and distal female flower; inflorescence axis 3-8 cm long, 1-2 mm diam.; bracts present at anthesis, eventually caducous, triangular-lanceolate, 4-5.5 mm long, 1.5-1.8 mm wide at base; bracteole absent; perianth segments pink.

Male flower. Perianth segments 4, free, pedicel 9-16 mm; outer perianth segments ovate, apex obtuse 6-7 × 4.5-5.5 mm; inner perianth segments elliptic-lanceolate 5-6 × 2.5-2.9 mm, paler than outers; stamens 12-16, yellow; androecium zygomorphic; filaments fused at the base into a column *c.* 0.8-1 mm long, free part *c.* 0.5 mm; anthers unilateral, longer than filament, oblong, *c.* 1.3-1.7 mm, dehiscent through lateral longitudinal slits; connective not extended.

Female flower. Perianth segments 6, free; pedicel 10-12 mm; outer perianth segments elliptic-lanceolate, apex obtuse, 7-8 × 3-4.5 mm; inner perianth segments obovate-oblanceolate, 6.5-7 × 2.5-3.5 mm, paler than outers; ovary 3-winged, unequal, with one wing conspicuously larger than the two others, 5-6 mm long vs 2-2.5 mm long, green to red-brown, composed of 3 locules; placentae septal, bi-lamellate; ovules numerous, white; styles 3, free or fused only at the base, pale yellow, persistent in fruit; stigma reniform, in a band, yellow.

Fruit

3-winged, nodding, the wings unequal; main wing *c.* 6-8 × 5-8 mm.

Seeds

Unknown.

Remarks

Begonia ambodiforahensis Scherber. & Duruiss., sp. nov. is present in cultivation in several Botanical Gardens e.g. Royal Botanic Garden Edinburgh, Botanicka Zahrada Praha and the Jardin botanique de Lyon as well as in the Collection nationale de *Begonia* d'Afrique et de Madagascar held by the second author. It is a very attractive species, but has proved difficult to keep on long term, requiring constant, high humidity, combined with good air movement and a very well drained mix.

Begonia harimalalae Scherber. & Duruiss., sp. nov. (Fig. 4)

Begonia harimalalae Scherber. & Duruiss., sp. nov. can be compared to *B. erminea* but it differs by the much thicker, more numerous (3-8 vs 2-5) and larger (10-15 vs 4-8 cm) leaves, which are glabrous, without spiculiform hairs adaxially and with the margins shallowly and sparsely serrate vs densely biserrate.

Typus. — Cultivated plant in J. Duruisseau's (Fig. 5) greenhouse, [originally collected by H. Laporte in the nineties in Madagascar, Analanjirofo region: Makira forest, in the lower basin of the Voloina river, near Vodriana (or Ambodiriana) village (Fig. 1), 15°32'44.5"S, 49°33'02"E, 175 m], 28.XI.2016, *Scherberich 1153* (holo-, LYJB!; iso-, P!; TAN!).

Distribution and ecology. — Known only from a single collection at the eastern border of the Makira Natural Park in north-east Madagascar, in the lower basin of the Voloina river, near Vodiriana (or Ambodiriana) village, where it grows in scattered primary forest remains or old secondary forest, on rocky (gneiss) slopes, in a population with few individuals, at low elevation, around 100-200 m.

Fig. 4. — *Begonia harimalalae* Scherber. & Duruiss., sp. nov.: **A**, habit; **B**, leaf, adaxial side; **C**, male flower, front view; **D**, male flower, side view; **E**, androecium; **F**, female flower, face view; **G**, female flower, side view; **H**, gynoecium; **I**, styles and stigmas; **J**, gynoecium, early fruiting stage; **K**, ovary cross-section. Drawn from living plant, *Scherberich 1153* (Drawing: Vanessa Damianthe). Scale bars: A, B, 1 cm; C, D, F-H, J, K, 2 mm; E, I, 1 mm.

Conservation status. — The Makira Natural Park is one of the largest protected areas of Madagascar, with a surface of 3850 km². This park was entirely covered with rainforest vegetation before significant deforestation occurred along the east border, an inhabited area with many villages. Considering that the new species has an area of occupancy estimated to be less than 10 km², that is known to exist at only a single location, with a continuous decline of habitat due to deforestation, the conservation status as "Vulnerable" [VUD2] is proposed following the IUCN Red List Categories and Criteria (IUCN 2012).

Etymology. — The newly described species honors Paul Clément Harimalala, our guide from Maroantsetra and the Northeast area of Madagascar. Paul Clément was also the guide of Henri Laporte, who discovered and introduced into cultivation many species from Madagascar including *Begonia harimalalae* Scherber. & Duruiss., sp. nov. in the nineties.

Description

Tuberous perennial lithophytic herb with short upright stems, 10-25 cm high.

Tuber

20-30 mm, irregular, rather flat, gnarled, strongly adherent on rock.

Stem

Fleshy herbaceous, glabrous, red with white tiny lenticels, 10-20 mm long, 5 mm diam. Stipules persistent, membranous, green, translucent, nearly triangular, acuminate, the margin entire, 4 × 1 mm.

Leaves

3-8(-15), alternate, spreading, straight; petiole nearly as long as the blade, slightly canaliculate, 5-8 cm long, 2-4 mm diam., green tainted red, glabrous; blade sub-symmetrical, entire, thickly fleshy to succulent, ovate-lanceolate to sub-trullate, 10-15 cm long, 3-10 cm wide, base obtuse to rounded, apex long acuminate, glabrous; margin markedly dentate in upper two-third, teeth acuminate sometimes ending with a short mucro, adaxially bright green with a distinct dark red margin and sparse 1-2 mm small dark red spots between veins, semi-glossy, adaxially paler; venation pinnate, midrib and primary veins very prominent adaxially, concolorous, tainted red-brown; primary lateral veins 3-4 pairs, evenly spaced along midrib, remotely branching near margin, the first pair sub-opposite, the following ones usually alternate but sometimes sub-opposite; secondary venation indistinct.

Inflorescence

Axillary, dichasial, pauciflowered, bisexual, protandrous with basal male flowers and 1-2 distal female flowers; inflorescence axis 10-15 cm long, 3 mm diam., green, tainted red at base, glabrous; bracts present at anthesis, eventually caducous, elliptic, 3 × 5 mm, membranous, very light yellow green to red brown; bracteole absent; perianth segments white to pink.

Male flower. Perianth segments 4, free, pedicel 10-18 mm; outer perianth segments obovate, apex obtuse, 15 × 5-8 mm, markedly bicolorous, basally white, upper part and margins contrasting deep pink; inner perianth segments elliptic-lanceolate to oblanceolate, 6 × 12 mm, white; stamens 12-18, yellow; androecium zygomorphic; filaments fused at the base into a column *c.* 1 mm long, free part *c.* 1 mm; anthers unilateral, longer than filaments, oblong, *c.* 2-3 mm, dehiscent through lateral longitudinal slits; connective not extended.

Female flower. Perianth segments 6, free; pedicel 12-15 mm; outer perianth segments obovate, apex obtuse, *c.* 6 × 12 mm, deep pink at apex, paler towards base; inner perianth segments obovate-oblanceolate, *c.* 5 × 11 mm, paler than outers, pale pink to white; ovary 3-winged, unequal, with one wing conspicuously larger than the two others, *c.* 8 mm long, green to red-brown, composed of 3 locules; placentae septal, bi-lamellate; ovules numerous; styles 3, fused at the base to about half length, bifid, pale yellow, persistent in fruit; stigma reniform, in a band, yellow.

Fruit

3-winged, dry capsule, nodding, the wings unequal.

Seeds

Unknown.

Acknowledgements

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Fig. 5. — Cet article est dédié à la mémoire de Jacky Duruisseau, qui nous a quittés peu de temps avant sa publication. Jacky était un passionné et spécialiste de Bégonia. Il possédait une collection exceptionnelle de spécimens originaires du monde entier, surtout d'Afrique et de Madagascar. Il a vécu plusieurs années au Gabon ainsi qu'à Madagascar, où il avait été professeur de mathématiques. Il y retournait régulièrement afin de retrouver les espèces peu connues de la Flore malgache mais aussi d'explorer la péninsule de Masoala ou la forêt de la Makira, conscient de la rapide détérioration de la nature dans cette région. Il écrivait régulièrement des récits de ses voyages dans le *Bégofil* ou dans *The Begonian*.