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New species in Orchidaceae from Madagascar

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Summary. Five new species from Madagascar, *Aerangis bovicornu* (Vandeae: Angraecinae), *Angraecopsis lemurelloides* (Vandeae: Angraecinae), *Didymoplexis stella-silvae* (Gastrodieae), *Habenaria crocodilium* (Orchideae: Orchidinae) and *Polystachya siederi* (Vandeae: Polystachinae) are described and illustrated. A short summary of endemism and the history of description of orchids of Madagascar are given.

Key Words. Distribution, endemism, history, IUCN Red List assessments, new species, taxonomy.

Introduction

The flora and fauna of Madagascar are well known for their exceptionally high levels of diversity and endemism (85% of its species), the island having also been identified as one of the most important biodiversity hotspots (Myers *et al.* 2000: 855). The Orchidaceae are the largest plant family on Madagascar (Callmander *et al.* 2011: 122) and novelties are still discovered frequently. A new tabulation by one of the authors (JH) of all orchids currently recognised (April 2019) from Madagascar and surrounding W Indian Ocean Islands shows that there are now a total of 1002 species, subspecies (17) and varieties (51) known from Madagascar. Eighty-five percent of these are endemic to Madagascar and this endemism increases to c. 95% when the surrounding archipelagos of the Mascarenes, Comoros and the Seychelles are included.

Many botanists and collectors have been involved in the discovery of this remarkable orchid flora but only a few are responsible for their formal description. Until the 1820's, only a handful of orchid species were recognised from Madagascar and most were then only known from the Mascarene Islands. In 1822, Louis Marie Aubert du Petit Thouars described and illustrated 31 species from the island (Thouars 1822). Between 1824 and 1850, John Lindley added another 15 species. Heinrich G. Reichenbach *f.* described a further 51 between 1850 and 1885, mostly based on collections by Johann Hildebrandt (Reichenbach 1881a & b) and Léon Humblot (Reichenbach 1885a & b). Between 1883 and 1886, Henry Ridley described 57 new species based on collections by various missionaries, mainly of the London Missionary Society, including William Deans Cowan (Ridley 1883), Richard Baron and Joseph Tregelles Fox (Ridley 1885, 1886). Robert A. Rolfe added 23 species in the 1890's from a variety of sources but principally from commercial collectors. Rudolf Schlechter contributed no fewer than 282 new names to the list between 1911 and 1925 with most of them based on collections by the French explorer Henri Perrier de la Bâthie (Schlechter 1913, 1915, 1916, 1918a & b, 1922, 1924, 1925 and 1932 posthumously). Following Schlechter's death in 1925, Perrier de la Bâthie described many novelties (Perrier 1930, 1934, 1936a, b, c, 1937, 1938a, b, c, d, 1939a, 1951, 1955) and revised a number of genera. Perrier's work culminated in the orchid volumes of the *Flore de Madagascar* (Perrier in Humbert 1939b & 1941). He described 195 novelties mainly based on his own collections but also those of Raymond Decary, Henri Humbert and others working on the island during the French colonial era between 1929 and 1955. From the early 1960s until 2013, Jean Bosser, in collaboration with others, described 102 new taxa (Bosser 1965, 1969a, b, c, d, 1970a, b, 1971, 1980, 1989, 2000) and published an illustrated orchid flora of the Island with Marcel Lecoufle in 2011 (Bosser & Lecoufle 2011). Recent work by Johan Hermans, Phillip Cribb and collaborators has added 57 new orchids to the flora (most notably Hermans *et al.* 2007, 2017; Hermans & Cribb 2014 & others in press) together with a new checklist, bibliography (Hermans *et al.* 2007) and Field Guide (Cribb & Hermans 2009). The most recent illustrated guide is by Hervouet (2018).

As part of ongoing research and fieldwork on the orchid flora of Madagascar at the Royal Botanic Gardens Kew, the University of Vienna and PBZT Antananarivo, specimens of putative new taxa were compared with descriptions, herbarium material and drawings of all the type specimens of the genus to ascertain their novelty. This has resulted in the recognition of a number of new species.

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IUCN Red List assessments

The conservation status of the new species given in this paper are summaries of the full IUCN Red List assessments which will be completed and submitted for review and publication by IUCN once the species names are validly published and therefore available for assessment. All the assessments have been compiled based on current knowledge of these taxa, by one of the authors (Landy Rajaovelona), who is an IUCN Red List assessor, using the IUCN Red List Categories and Criteria (2012).

New Species

Aerangis bovicornu *Hermans* **sp. nov.** Type: Madagascar, Fianarantsoa prov., near Ankazomivady, in lee side of large inselberg, 1797 m, Dec. 1997, *Hermans* 8179 (holotype K!).

http://www.ipni.org/urn:lsid:ipni.org:names:77214543-1

Short monopodial epiphytic *herb* up to 5 × 6.5 cm, with a short woody stem c. 8 mm in diam., covered in brown corrugate sheaths, bearing numerous somewhat hirsute orange-brown roots becoming grey with age, c. 1.5 mm in diam. *Leaves* 3 – 5, leathery, on a short 3 – 5 mm conduplicate petiole, ovate to elliptic, 20 – 33 × 16 – 22 mm, somewhat convex, emarginate at the tip, laevigate, more or less brownish-orange on the upper surface, greyish-green, punctate underneath with the central vein darker. *Inflorescence* very short, up to 2.5 cm long, bearing 2 – 3 flowers and an aborted bud. *Rachis* 3 – 5 mm in diam., orange-brown, almost entirely covered with 2 – 3 conduplicate to almost tubular bracts, 3.4 – 4.8 × 1.8 – 2.1 mm. *Floral bracts* thin, amplexicaul, 1.8 – 2.3 × 1.8 × 2 mm. *Flowers* c. 10 × 10 mm without the spur, about 10 mm apart, stellate, not opening fully; petals, sepals and lip white with the tips sometimes tinged with orange, the ovary and spur orange-brown, the buds green. *Pedicel* and *ovary* straight, rounded, slightly ridged, 8 – 12 × 1.9 – 2.3 mm. *Dorsal sepal* ovate-elliptic, acuminate, 7.8 – 8.6 × 3.6 – 3.9 mm, narrowed, reflexed towards the base. *Lateral sepals* obliquely lanceolate, acuminate, 8.7 – 8.9 × 3.5 – 3.7 mm. *Petals* ovate elliptic, obtuse, 8.3 – 8.6 × 3.8 – 4.1 mm. *Lip* ovate-lanceolate, attenuate, 7.6 – 8.2 × 3.9 – 4.1 mm; *spur* slender, horn-shaped, terete at the tip, a little broadened towards the base, 20 – 23 × 0.9 – 1.3 mm. *Column* short, stout, slightly winged, broadly mucronate at the apex, rostellum ligulate-ensiform, up to 5 mm long; *anther* broadly obovoid with a small rounded swelling at the apex, up to 1.4 × 1.6 mm; *pollinia* globose c. 0.8 × 0.6 mm, stipes short and slender, viscidium elongate, narrow. *Seed capsule* fusiform, glabrous, brown, 16 × 5 mm. Figs 1A, B; 2.

RECOGNITION. *Aerangis bovicornu* is a few-flowered compact plant with small flowers that do not open fully, ovate to elliptic leaves which are brownish-orange on top and greyish-green underneath; the stellate flowers have a short horn-shaped spur and white perianth with an orange-brown ovary and spur and long rostellum and anther with a small rounded swelling at the apex. It is undoubtedly most closely related to *Aerangis fastuosa* (Rchb.f.) Schltr. (Schlechter 1914: 598) (Fig. 1C) but differs substantially in its flowers which are consistently a third of the size, the straight slender, up to 23 mm long, spur which is consistently much shorter (vs a minimum of 76 mm in *A. fastuosa*), the perianth tips and spur coloured brownish-orange (vs generally white), the narrower column apex and the obovoid anther with a small rounded swelling at the apex (vs conical with a long beak). The new species flowers from December to January whilst *Aerangis fastuosa* flowers earlier from June to November. Table 1 shows a comparison of characteristics and measurements based on 28 herbarium specimens [*Lawrence* (BM00540114); *Baron* s.n. (K); *Hillerman* 12, 13, s.n. (K); *Kotozafy* 334 (K); *Pettersson & Nilsson* 380 (K); *Hermans* 3240, 3766, 4139, 4277, 5169, 5449, 5485, 6664, 6666 (all K); *Humblot* s.n. (W-R46259); Hort. (W-R30844); *Hildebrandt* 4207 (W); cult. Lendy (W-R29591); cult. Low (W-R28278); *G. Fischer et al.* FS1586-2004 (WU); *Humbert & Cours* 17779 (P); *Bosser* 14643, 16423 (P); *Decary* 18402 (P); *Rakotoson* 12418RN (P); *Bernardi* 11128 (P)].

DISTRIBUTION. Endemic to south-central Madagascar, Fianarantsoa province, only known from the type collection.

HABITAT. Epiphyte on small moss- and lichen-covered trees in remnants of forest on granite inselberg. Elevation c. 1800 m.

CONSERVATION STATUS. Recent observations by one of the authors (JH) found only six plants remaining in the type locality, one bearing an immature seed capsule. The area has now been cleared for cultivation of *Pelargonium*, grown increasingly in the region for the production of essential oils. *Aerangis bovicornu* has an EOO less than 100 km^2 and an AOO less than 10 km^2 and only one threat location is identified. In addition, the number of mature individuals is estimated to be less than 50. The species is therefore assessed as Critically Endangered CR with Criterion D.

FLOWERING TIME. December to January.

ETYMOLOGY. The epithet refers to the typical shape of the spur, resembling a bull's horn, especially that of the local Madagascan zebu cattle.

NOTES. The genus *Aerangis* Rchb.f. (Reichenbach 1865: 190) now comprises 59 species; they are largely epiphytes confined to Africa and the Madagascar region, apart from one species which occurs both in eastern Africa and Sri Lanka. There are 28 species in Madagascar, Réunion and the Comoros with 20 of them endemic to Madagascar.

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Fig. 1. A, B *Aerangis bovicornu*. A plant in habitat; B plant and flowers; C *Aerangis fastuosa* for comparison. PHOTOS: JOHAN HERMANS.

Aerangis fastuosa (Fig. 1C) was first described by H. G. Reichenbach as *Angraecum fastuosum* Rchb.f. (Reichenbach: 1881c: 748) based on a plant collected by Léon Humblot in Madagascar and imported into England by the nurseryman Frederick Sander. The type specimen consists of two flowers and a drawing in the Reichenbach herbarium in W (number 46259). Reichenbach described it as having rugose leaves on the upper surface, a narrow lip and a long caudicula immersed in the spur. Two weeks later (Reichenbach 1881d: 844) added notes on a specimen from the same source and grown by Sir Trevor Lawrence, as equal to his type in all details, but having an obovate rounded lip, instead of a narrow acute one, and suggested either that M. Humblot's plant was a peloric form, or that there were two closely allied species. Joseph Hooker (1891: t.7202) later commented on Reichenbach's confusing descriptions. He added that the rugosity of the leaf occurs only after flowering and is hardly perceptible. He referred to the 1885 illustration of a Lawrence plant in *Gardener's Chronicle* (Masters 1885: 533) as a good likeness. Subsequently a great number of plants found their way into European collections and the variability of the species became evident as recognised by Perrier de la Bâthie in 1941 (pp. 93 – 95) when he described six varieties of the species, none being validly published because they lacked Latin descriptions. He also mentioned that they may well be separate species, all coming from different localities, a long way from each other. All are only

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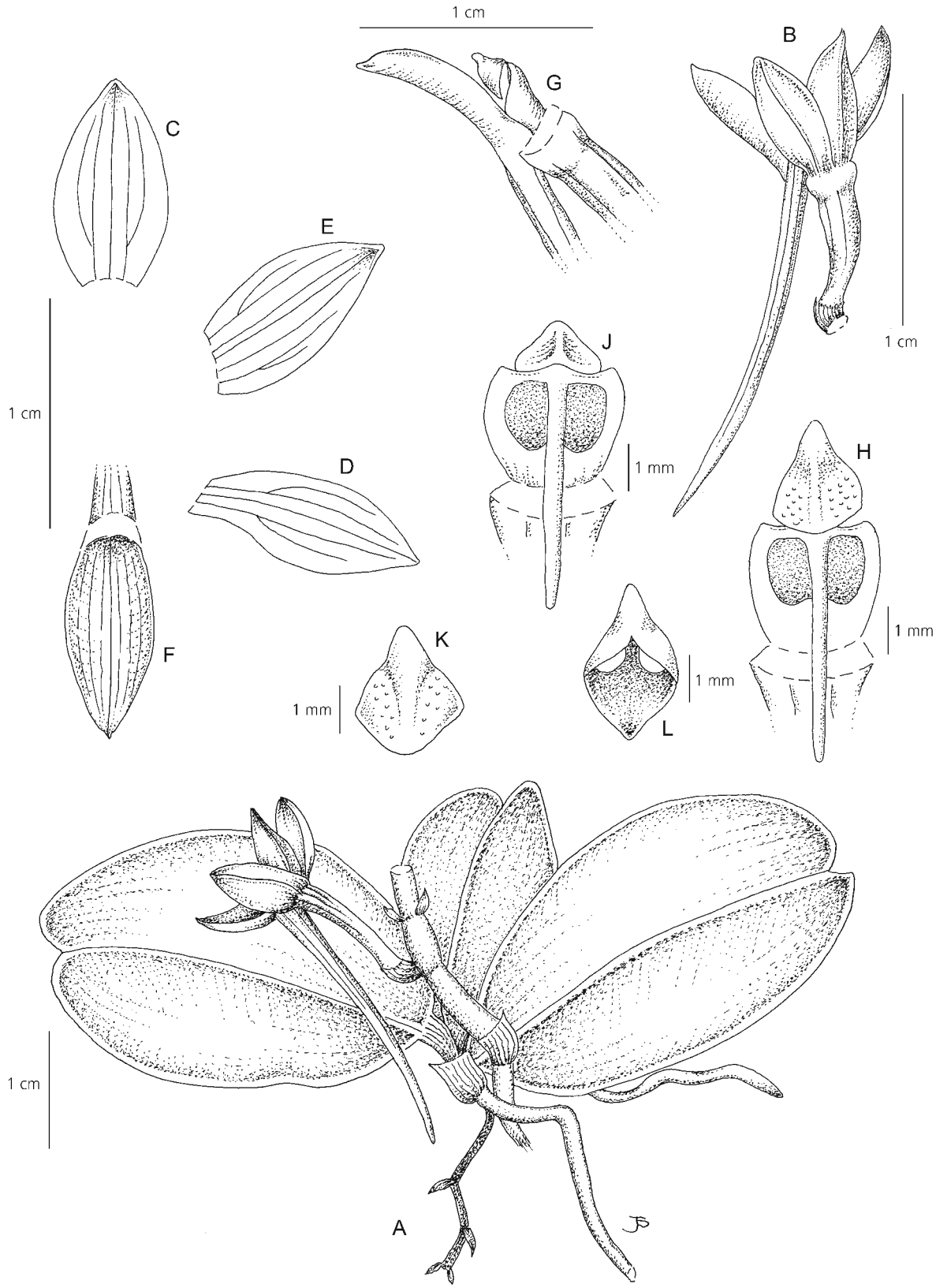

Fig. 2. *Aerangis bovicornu*. **A** habit; **B** flower; **C** dorsal sepal; **D** lateral sepal; **E** petal; **F** lip; **G** column and lip side view; **H** column, front view; **J** column, front view, anther cap removed; **K** anther cap, dorsal view; **L** anther cap, ventral view. From spirit material *Hermans* 8179. DRAWN BY JUDI STONE.

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Table 1. Comparison of differences and measurements of *Aerangis bovicornu* and *A. fastuosa*, based on 28 herbarium specimens and the types of the varieties of the latter.

	Aerangis fastuosa	Aerangis bovicornu
Dorsal sepal (mm)	17 – 36 × 5.5 – 9	7.8 – 8.6 × 3.6 – 3.9
Lateral sepals (mm)	19 – 36 × 5.5 – 8.5	8.7 – 8.9 × 3.5 – 3.7
Petals (mm)	19 – 34 × 6 – 10	8.3 – 8.6 × 3.8 – 4.1
Lip (mm)	20 – 34 × 5 – 13	7.6 – 8.2 × 3.9 – 4.1
Spur	70 – 102 × 1 – 1.8 mm, generally coiled	20 – 23 × 0.9 –1.3 mm, straight
Column	3 – 4 × 2 – 3 mm, apex broadened	3 – 5 mm × 1 – 3 mm, apex narrow
Anther	2.2 – 4 × 1.8 – 2 mm, conical with long beak	up to 1.4 × 1.6 mm, broadly obovoid with a small rounded swelling at the apex
Flowering time	June to November	December to January

represented by very few herbarium specimens and it is difficult to define constant characteristics. Five of the varieties, notably var. *francoisii*, var. *grandidieriana*, var. *maculata*, var. *rotundifolia* and var. *vondrozensis* (Perrier 1941: 93 – 95) are generally accepted as local forms of one variable species (Stewart 1986a: 905; Hermans *et al.* 2007: 12; La Croix 2014: 149), the stated variation was mainly in the leaf shape and texture. The sixth, var. *maculata* (Perrier 1941: 95) was considered by Bosser (2006: 50) to be *Aerangis punctata* J.Stewart (1986b: 1120). A seventh, *Aerangis fastuosa* var. *angustifolia* H.Perrier (1941: 95), was considered an immature form of *Aerangis modesta* (Hook.f.) Schltr., (Schlechter 1914: 600). At first sight Aerangis bovicornu could be considered another local variant of *Aerangis fastuosa*, especially as it comes from a relatively accessible region but closer examination proves otherwise. They share the leaf shape, short rachis, shape of the perianth and the long rostellum but size of all the floral parts, spur length, column and anther shape and colour are all very different. Table 2 outlines the main characteristics of the different variants, none corresponding with *Aerangis bovicornu*. The characteristics of the new species were found to be consistent within the local colony of about 20 plants which consisted of plants with flowers that were just opening and others that had almost wilted.

Angraecopsis lemurelloides *P.J.Cribb & Hermans* **sp. nov.** Type: Madagascar, Antsiranana Prov., Andapa, Doany, Anjialavahely, Ankarongameloka forest, 1546 m, epiphyte on tree, March 2006, *Antilahimena & Tianina* 4742 (holotype K!, isotypes P!, TAN!).

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Arching to pendent epiphytic *herb* 15 – 21 cm long; roots basal, glabrous, greenish-white, 1 – 2 mm in diam. *Stem* woody, up to 15 cm × 3 – 4 mm, zigzag, flattened, the margins winged, carrying 12 – 17 leaves, pale green with the lower part somewhat corrugate and brown. *Leaves* alternate, coriaceous, flat with an indistinct central vein, lanceolate-linear, 6.5 – 8.1 × 0.5 – 0.8 cm, narrowing towards the apex, attenuate, the base subcordate, surface somewhat glossy, pale green. *Inflorescences* emerging from the leaf-axils along the entire length of the stem, sometimes several produced from the same axil, 5 – 8 cm long, with 3 – 7 flowers. *Peduncle* wiry, 3 – 5 cm, c. 0.5 mm in diam., with a short thin, brownish bract at the base peduncle, 1 – 2 peduncle sheaths c. 3 × 1 mm. *Rachis* loosely racemose, wiry, 3 – 5 cm, somewhat zigzag. *Floral bracts* amplexicaul, 3.1 – 3.8 × 1.1 – 1.4 mm, green becoming brown with age. *Flowers* small, c. 7 × 5 mm, yellowish-green. *Pedicel* and *ovary* turbinate, 9 – 12 × 1.3 – 1.6 mm. *Dorsal sepal* convex, ovate, acute, 2.1 – 2.5 × 1.9 – 2.2 mm. *Lateral sepals* partly fused to the petals at the base, broadly lanceolate, acuminate with the tip reflexed, 3.1 – 3.4 × 1.2 – 1.4 mm, margins recurved, the apex of the dorsal mid-vein mucronate before the apex of the leaf. *Petals* reflexed, ovate-triangular, acute, 1.4 – 1.7 × 1.5 – 1.7 mm, convex with a thickened mid-vein. *Lip* 3-lobed, 2.3 – 2.9 × 2 – 2.2 mm, the hypochile orbicular beneath with the obtuse lateral lobes partly enveloping the column, the epichile broadly ovate, concave, somewhat bullate with a few fine hairs at the base; *spur* incurved below the flower, 4.9 – 5.4 × 0.6 – 0.8 mm, narrow at the opening, slightly thickened in the apical half. *Column*, fleshy, short, c. 1.6 × 1.5 mm; rostellum 3-lobed, wings sub-orthogonal, with an acicular median tooth; pollinia on separate viscidia, oblong, c. 1 mm long; anther cap elliptic, c. 0.6 × 1.1 mm. *Seed capsule* turbinate, c. 20 × 5 mm, green. Figs 3, 4.

RECOGNITION. *Angraecopsis lemurelloides* is recognised by the long zigzag flattened stem with lanceolate-linear leaves alternate along its length, small flowers on the upper third of the serial wiry inflorescences, and flowers with petals and sepals that are fused at the base and with a mucronate tip to the mid-vein, the roundly 3-lobed lip with a concave epichile with wiry hairs at the base and the lateral lobes enveloping the column and a short inflated spur.

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Table 2. Main characteristics of the different variants of *Aerangis fastuosa*.

	var. **francoisii** *François* 12 (P)	var. **grandidieriana** *Grandidier* s.n. (P)	var. **maculata** *Humbert* 11845 (P)	var. **rotundifolia** *Decary* 5700 (P)	var. **vondrozensis** *Decary* 5188 (P)
Leaves (cm)	1.8 – 3 × 1.2 – 1.6	4.5 – 6 × 2 – 2.7	1.5 – 2.7 × 1 – 1.5	2.5 – 3 × 2.5	up to 6 × 3
Dorsal sepal (mm)	18 × 6	22 × 8	19 × 5.5	27 × 9	17 × 7
Lateral sepals (mm)	20 × 6	21 × 7	19 × 5.5	30 × 9	19 × 7
Petals (mm)	19 × 6	22 × 7	19 × 6	19 × 6	19 × 6
Lip (mm)	20 × 8	25 × 5	20 × 9	22 × 8	20 × 5.5
Spur (cm)	7	8	7	Over 6 (damaged)	Over 6 (damaged)
Distribution	Central	SW coast	S Central	SE	SE
Main differences from typical form	leaves more rounded and more obovate, single flower	leaves small, bracts obtuse, spur long	leaves small, obovate-oblong spotted with red	leaves orbicular, flowers larger	bracts wide, lip obovate, anther obtuse

It is very different in plant habit and flower morphology from *Angraecopsis parviflora* (Thouars) Schltr. (Schlechter 1914: 601), the only other *Angraecopsis* Kraenzl. (Kraenzlin 1900: 171) recorded from Madagascar. That species has a stem that is always much shorter than the leaf, a lip with three distinct attenuate lobes and a slightly longer spur. In habit and inflorescence it somewhat resembles *A. trifurca* (Rchb.f.) Schltr. (Schlechter 1915: 428) from the Comoros but it has a much longer stem, carrying leaves along its length, the flowers being about half the size, the spur much shorter and the lip very different (three distinct attenuate lobes in *A. trifurca*). It is closest to *Angraecopsis pobeguinii* (Finet) H.Perrier (1941: 81) from the Comoros in flower size and in having a lip with small rounded lateral lobes but the plant of *A. pobeguinii* is much smaller (3.5 cm long), the stem shorter (1 cm long), the leaves much smaller (c. 2 cm long), the spur is also much more clavate towards the apex.

DISTRIBUTION. Endemic to NE Madagascar.

SPECIMENS EXAMINED. MADAGASCAR. Anjialavahely, Ankarongameloka forest, 1546 m, March 2006, *Antilahimena & Tianina* 4756 (paratypes MO, P!, TAN!).

HABITAT. Humid forest, epiphyte. Elevation c. 1550 m.

CONSERVATION STATUS. *Angraecopsis lemurelloides* is distributed in N Madagascar, in Doany, Sava region, Antsiranana. With the AOO estimated to be 4 km^2, one threat location identified and the number of mature plants, the species is assessed as Critically Endangered CR with criterion D.

FLOWERING TIME. March.

ETYMOLOGY. Refers to the similarity of the flowers to those of the genus *Lemurella* Schltr. (Schlechter 1925: 366).

NOTES. Morphologically the new species is somewhat ambiguous in its generic position. With a long stem, many wiry inflorescences and flowers with a three-lobed lip with hairs at its base it resembles some species in the genus *Lemurella* and especially *Lemurella culicifera* (Rchb.f.) H.Perrier (1941: 334) but it lacks the non-resupinate flowers, has more flowers and the opening of the spur is narrow (vs funnel-shaped). It illustrates that the generic circumscription of both these genera is somewhat uncertain and needs further research. As determined by Bosser (2007), it fits more easily in the genus *Angraecopsis*. This genus, somewhat diverse and containing a confusing variety of species, was established by Kraenzlin (1900), based on *Angraecopsis tenerrima* Kraenzl. from Tanzania. Schlechter (1914 & 1918a) extended the genus to seven species based on a spur with a narrow opening, entire side lobes of the lip and lip flat at the base, five being from mainland Africa and two from Madagascar, the Mascarenes and the Comoros. Perrier de la Bâthie (1941: 81) recognised five species in the *Flore de Madagascar*. Summerhayes (1951) in his revision of the genus recognised three sections: *Angraecopsis*, *Cardiochilos* and *Coenadenium*, mainly based on differences in the shape of the lip and column, with 14 species from the Afro-Madagascan region. Rasmussen (1978: 137) added further observations on the genus but doubted the generic and sectional

Fig. 3. *Angraecopsis lemurelloides*. Photograph of the syntype: *Antilahimena & Tianina* 4756. PHOTO: © PATRICE ANTILAHIMENA. TROPICOS - MBG.

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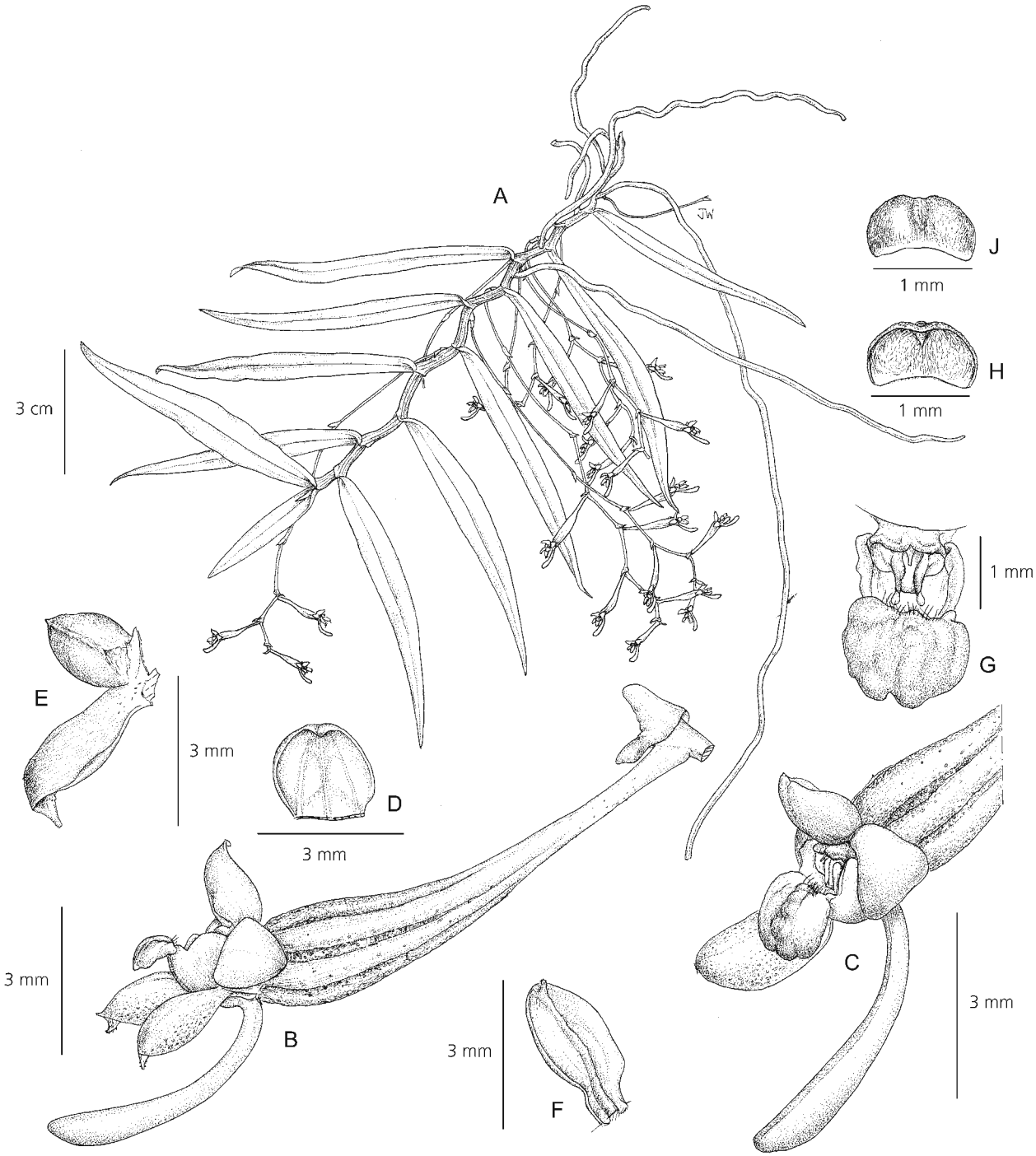

Fig. 4. *Angraecopsis lemurelloides*. **A** habit; **B** flower side view; **C** flower detail ¾ view, lateral sepal removed, showing lip; **D** dorsal sepal, inside; **E** lateral sepal & petal, above; **F** lateral sepal, underside; **G** front view lip, rostellum; **H** anther front view; **J** anther back view. Based on *Antilahimena & Tianina* 4742. DRAWN BY JULIET BEENTJE.

circumscription. Recent molecular analyses by Martos *et al.* (2017) confirmed this view and proposed to restrict the concept of *Angraecopsis* to the species in section *Angraecopsis*, which includes all the species from the Madagascar region. The characteristics for the genus were summarised by Martos *et al.* (2017: 8) as: small to medium-sized plants with lateral sepals longer than the dorsal, a deeply three-lobed lip, a three-lobed glabrous rostellum with prominent lateral lobes and two pollinia each attached to a separate viscidium. *Angraecopsis lemurelloides* which is a relatively large plant with a long stem and roundly-lobed lip with hairs at the base only partly fits this definition but it does match it in the other aspects and also has the

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petals adnate to the lateral sepals as defined for the genus by Kraenzlin and Summerhayes. It is therefore placed in *Angraecopsis* but will remain a somewhat aberrant species.

Didymoplexis stella-silvae *Hermans* **sp. nov.** Type: Madagascar, Fianarantsoa prov., Mahakajy area, near Ifanadiana. c. 800 m, Dec. 1996, *Hermans* 8137 (holotype K!).

http://www.ipni.org/urn:lsid:ipni.org:names:77214547-1

Erect holomycotrophic *herb* up to 9 cm tall, on a subterranean, stem-like rhizome, roots wiry, glabrous, c. 1.5 mm in diam. *Rhizome* terete, pale brown, elongate, a little verrucose, puberulent, ave. 12 × 0.3 cm. *Leaves* scale-like, at the base of the inflorescence, c. 5 × 3 mm. *Inflorescence* erect as an uninterrupted continuation of the rhizomatous stem, with 1 – 2 brown scarious scales towards the base. *Peduncle* slender, c. 1.5 mm in diam., with 2 – 3 short nodes, otherwise smooth, brown, bearing a short 3 mm scale below the rachis. *Rachis* apical, racemose with 1 – 4 flowers opening one at a time in succession. *Floral bracts* ovate, acute, 2 – 2.3 × 1.4 – 1.6 mm, verrucose abaxially. *Flowers* resupinate, spreading, reclining, overall 18 – 19 × 14 × 16 mm, crystalline white except for the yellow-orange lip callus and base, the lip with a greenish-yellow triangle abaxially. *Pedicel* and *ovary* fusiform, 8 – 11 × 0.8 – 1.1 mm, with longitudinal ridges during flowering, minutely verrucose, pale brown. *Dorsal sepal* connate to the petals for 2 – 3 mm at the base, erect, broadly lanceolate, 8.1 – 8.5 × 4 – 4.3 mm, subacute, verrucose-warty on the exterior. *Lateral sepals* connate to each other at the base for c. 3 mm, spreading, ovate, 9.8 – 10.2 × 5 – 5.5 mm, obtuse to subacute. *Petals* oblanceolate, 6.9 – 7.2 × 3.8 – 4 mm, acute, partly adnate to the dorsal sepal. *Lip* with a strap-like 3 – 5 mm foot at the base, blade then reniform, truncate, margins curved, undulate, becoming serrate towards the anterior part, overall 5.1 – 5.3 × 9.1 – 9.3 mm, base claw-like, extended into a bilobed callus irregularly laciniate at the anterior margin, the blade with two irregular longitudinal rows of long thorn-like hairs, the entire lip mobile and seems to retract back against the column, during or after fertilisation. *Column* slender at the base, with short, triangular stelidia and with obovate, rounded arms just below the stelidia, 3.8 – 4 × 3.4 – 3.5 mm; *anther* elliptic, disk-like, c. 1.2 × 1.9 mm. Figs 5, 6.

RECOGNITION. *Didymoplexis stella-silvae* is a holomycotrophic plant with a thin erect inflorescence carrying few flowers opening successively and one at a time. The petals are adnate to the dorsal sepal and the lateral sepals adnate to one another. The mobile truncate reniform lip, undulate to laciniate at the margin, has two rows of thorn-like hairs, a bilobed callus becoming laciniate at the front, and a column with obovate, rounded arms just below the stelidia. The new species has some characteristics in common with a number of other *Didymoplexis* species but there are also several distinct differences. In the Africa – Madagascar region it has flowers about half the size of *D. avaratraensis* P.J.Cribb, Nusb. & L.Gaut. (Cribb *et al.* 2013: 43) and *D. africana* Summerh. (Summerhayes 1952: 465): the petals and sepals are also less fused, while the lip adornments and shape and callus are also very different. It has a similar habit and flower colour to *D. verrucosa* J.Stewart & Hennessy (1980: 841), but *D. stella-silvae* has 1 – 4 flowers (vs 8 – 12), the sepals and petals are connate (vs fused to the middle), the lip reniform (vs transversely triangular) and two rows of long hairs on the lip (vs lines of warts from base to tip). It is closest to *Didymoplexis recurvata* P.J.Cribb, Nusb. & L.Gaut. (Cribb *et al.* 2013: 44), recently described from northern Madagascar which is comparable in size and colour, the petals and sepals adnate toward their base, its lip shape and column wings being similar but *D. stella-silvae* has narrower petals, and the lip larger and broader (3.5 – 4 × 5 – 6 mm vs 5.1 – 5.3 × 9.1 – 9.3 mm). *Didymoplexis recurvata* also lacks the rows of long hairs on the disk and has a 3-lobed callus at the base (vs 2-lobed).

DISTRIBUTION. Endemic to eastern Madagascar, Fianarantsoa province, around Ifanadiana and Ranomafana National Park.

SPECIMENS EXAMINED. MADAGASCAR. Without specimen: observed by one of the authors (JH) and other researchers in Ranomafana National Park, at c. 1000 m.

HABITAT. Humid evergreen forest, in deep shade, in leaf litter and humus. Elevation 800 – 1070 m.

CONSERVATION STATUS. Recent observations of several colonies by one of the authors (JH) found an increasing threat by two different species of bamboo in the area; one tall *Bambusa* with its fallen leaves covering the forest floor and a smaller species forming an equally impenetrable mass. Some Asian *Didymoplexis* species are associated with bamboo but this may not be the case for this species as it was only found some distance away from invasive bamboos. *Didymoplexis stella-silvae* is distributed in SE Madagascar in the Vatovavy-Fitovinany region, Fianarantsoa. With two threat locations, found within the Ranomafana Protected Area, the extent of occurrence is estimated to be less than 5000 km^2 and the area of occupancy less than 500 km^2, in continuing decline due to habitat destruction caused by fire, the species is therefore assessed as Endangered EN under criteria B1ab(i,ii,iii) + 2ab(i,ii,iii).

FLOWERING TIME. December to January.

ETYMOLOGY. The name refers to the bright white flowers, resembling stars appearing on the forest floor.

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Fig. 5. *Didymoplexis stella-silvae*. A plant in habitat; B detail of flower. PHOTOS: JOHAN HERMANS.

NOTES. *Didymoplexis* Griff. (Griffith 1844: 383) is a genus of 21 terrestrial, holomycotrophic, achlorophyllous species found in tropical and southern African, tropical Asia from India and the Ryukyu Islands eastwards through Malesia to Australia and the Pacific archipelagos to Fiji and Samoa (Govaerts 2019). Until 2011 no true *Didymoplexis* had been recorded from Madagascar (*D. madagascariensis* (Schltr. ex H.Perrier) Summerh. (Summerhayes 1953: 131) is now considered *Gastrodia madagascariensis* Schltr. ex Martos & Bytebier (Martos *et al.* 2015: 048). Cribb *et al.* recorded *D. verrucosa* from northern Madagascar in 2011 (Cribb *et al.* 2011) and two years later (Cribb *et al.* 2013) described *D. avaratraensis* and *D. recurvata*, also from northern Madagascar and wondered how many species of *Didymoplexis* there were on the island. *Didymoplexis stella-silvae* is another surprising discovery and brings the total to four, it is the first to be found in the central eastern forest of the island. The bright star-white flowers stand out in the deep shade of the forest; recently small colonies were observed and photographed in the Ranomafana National Park in a very well researched area near one of the main paths. It is likely that the species has rarely been seen because it has no leaves and the flowers only seem to open immediately after a significant rain shower and only remain open for less than a day, new flowers then open after the next rain shower. The pollination and lip mechanism deserves further research: the lip is hinged on a thin strap-like foot and was observed to retract against the column in a number of flowers, it is possible that the lip and its hairs act as a simple balance and flip back when visited by pollinators, it also possible that it just retracts after pollination has been effected or it may even be a trapping mechanism as has been observed in the South American orchid genus *Porroglossum* Schltr. (Schlechter 1920: 82).

Habenaria crocodilium *Hermans* **sp. nov.** Type: Madagascar, Toamasina Prov., Andasibe, forest around Vakona Lodge, 950 m, Sept. 1996, *Hermans* 4880 (holotype K!).

http://www.ipni.org/urn:lsid:ipni.org:names:77214548-1

Erect terrestrial *herb* 20 – 40 cm tall without the inflorescence, with two ellipsoid tubers, c. 2.5 – 3 cm long, hirsute, roots wiry, clustered around the base of the stem c. 3 mm in diam. *Stem* not branched, 10 – 30 × 0.5 – 0.8 cm with 3 – 4 leaf-like sheaths along its length dividing it into short segments, becoming progressively

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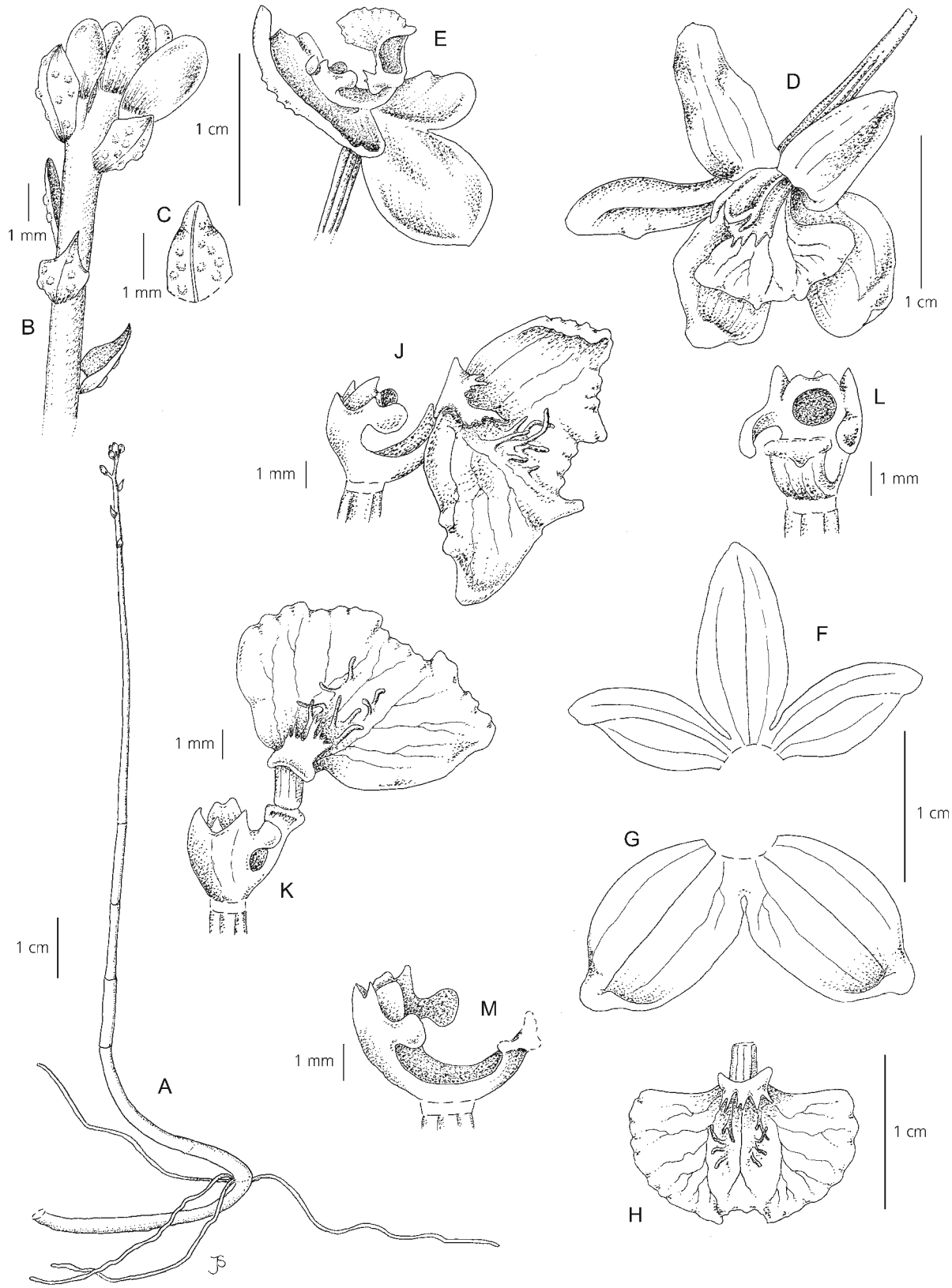

Fig. 6. *Didymoplexis stella-silvae*. **A** habit; **B** inflorescence; **C** bract; **D** flower, front view; **E** flower, side view; **F** dorsal sepal & petals; **G** lateral sepals; **H** lip; **J** column & lip, side view; **K** column & lip from above; **L** column, front view; **M** column, side view. Based on *Hermans* 8173. DRAWN BY JUDI STONE.

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larger toward the top, 3 – 8 × 1 – 3.5 cm. *Leaves* spreading, 3 – 5, arranged spirally along the stem forming an apical crown, lanceolate, 7 – 18 × 1.2 – 2.8 cm flat, somewhat fleshy, attenuate, subcordate at the base, shortly petiolate, somewhat serrate at the margins, pale green, darker along the veins. *Inflorescence* terminal, c. 15 cm, laxly racemose with c. 15 flowers. *Peduncle* c. 10 cm, 2 – 4 mm in diam., with 1 – 2 ovate sheaths, attenuate, subcordate at the base, hirsute, c. 20 × 8 mm. *Floral bracts* lanceolate, conduplicate, attenuate, dentate to hirsute at the dorsal ridge and basal margins, 11 – 16 × 2.1 – 3.2 mm. *Flowers* evenly distributed along the rachis, spreading, overall c. 25 × 25 mm, all segments pale green becoming paler towards the centre, the veins a little darker, column white, pollinia yellow. *Pedicel* and *ovary* fusiform, sharply ridged, densely denticulate, pale green, 15 – 21 × 1.2 – 2.5 mm. *Dorsal sepal* cucullate, arching over the column, lanceolate, 10 – 12 × 4.5 – 5 mm, the exterior echinate along the mid-vein. *Lateral sepals* spreading, obliquely ovate, 11.2 – 11.6 × 6 – 6.2 mm, almost flat, the apex a little mucronate, the veins thickened. *Petals* bifid to the base, posterior lobe (11 – 12.1 × 1.1 – 1.4 mm) adnate to dorsal sepal, ligulate-linear, attenuate, anterior lobe (9.3 – 12 × 1.2 – 1.3 mm) spreading to curved. *Lip* 3-lobed, all lobes pendent — recurved, the mid-lobe more strongly recurved especially at the tip, linear falcate, attenuate, mid-lobe (11 – 14.2 × 0.7 – 0.9 mm), lateral lobes (15.7 – 14.3 × 1.1 – 1.4 mm); *spur* clavate, tubular in the basal half, thickened and laterally compressed in the apical half, 12.3 – 13.1 × 1.2 – 1.9 mm. *Column* c. 5 mm high, 9 mm long, anther loculi narrowly ovoid, anther channels distinctly up-curved, c. 6.7 × 0.3 mm, stigmatic lobes linear incurved, staminodes bilobed, verrucose, pollinarium c. 8 mm long. Figs 7, 8.

RECOGNITION. *Habenaria crocodilium* is distinct in being a tall plant with spirally arranged leaves forming an apical crown, having an inflorescence borne on a short peduncle, denticulate floral bracts and flowers that are large for the genus in Madagascar, with denticulate ovary ridges, bifid petals with equal lobes, a lip with three equal descending lobes, a slightly flattened clavate spur shorter than the pedicellate ovary, and long and strongly up-curved anther channels. Amongst the large and medium-sized-flowered species of Madagascar and mainland Africa it is somewhat similar in flower shape to *H. beharensis* Bosser (1969a: 293), *H. cirrhata* (Lindl.) Rchb.f. (Reichenbach 1865: 180) and *H. clavata* (Lindl.) Rchb.f. (Reichenbach 1865: 180) but it is very distinct in its habit with its leaves borne along the stem (vs apical), and much smaller flowers (half the size) with a much shorter and differently shaped spur. It has a similar spur and anther-channel shape to *H. cornuta* Lindl. (Lindley 1837: 208) but again differs by its distinct habit, smaller flowers and differently proportioned lip and petals. The short clavate spur is also found in *H. cochleicalcar* Bosser (1969a: 294), and its flowers are also similar in size but the habit of *H. crocodilium* is different and the lobes of the petals and lip are of different proportions (unequal vs equal). It is similar in plant habit to *H. tianae* P.J.Cribb & D.L.Roberts (2008: 199) but its flowers are smaller by at least $^{1}/_{3}$, the spur much shorter (12 mm vs 12 cm) and the anther channels a different shape. None of the other species listed above have the pronounced echinate-denticulate ovary, floral bract and exterior of the dorsal sepal.

DISTRIBUTION. Known from two localities in Toamasina province, the type location in the eastern forest and another in NE Madagascar.

SPECIMENS EXAMINED. MADAGASCAR. Toamasina, Analanjirofo, Lohan'i Ambitsy forest, Makira, 808 m, July 2007, *Antilahimena et al.* 5672 (TAN!).

HABITAT. Humid evergreen forest, on riverbanks and wet areas. Elevation 800 – 950 m.

CONSERVATION STATUS. *Habenaria crocodilium* is distributed in E Madagascar, in the Alaotra-Mangoro and Analanjirofo regions, Toamasina province. Two threat locations were identified, although the two subpopulations are protected in Makira and Vakona lodge, the species habitat quality is continuing in decline due to shifting agriculture and forest logging. Recently, colonies in the type locality were destroyed by landslides. The species is therefore assessed as Endangered EN B1ab(iii) +2ab(iii).

FLOWERING TIME. July to September.

ETYMOLOGY. Referring to the type locality near a crocodile enclosure and the resemblance of the column and dorsal sepal to the head of a crocodile, plus the numerous teeth on the flowers and ovary.

NOTES. *Habenaria* Willd. (Willdenow 1805: 44) is a genus of about 600 terrestrial orchids, widely distributed in tropical and subtropical regions of the Old and New World (Cribb in Pridgeon *et al.* 2001: 300). There are now a total of 48 *Habenaria* species recognised from the Madagascar, Mascarene and Comoro region, 33 of which are found on Madagascar. Twenty-eight *Habenaria* species are endemic to Madagascar.

Polystachya siederi *Hermans* **sp. nov.** Type: Madagascar, Mahajanga prov., Bealanana area, 924 m, Jan. 2017, *Sieder, Pertl, Prehsler & Andriantiana* 7112 (leg. *Hermans* 8151), (holotype WU!).

http://www.ipni.org/urn:lsid:ipni.org:names:77214549-1

A large erect creeping lithophytic *herb* up to 18 cm high, on a very short rhizome with the new growth emerging from the base or node of the old pseudobulbs, with a dense mass of thick glabrous greyish roots 2 – 3 mm in diam. *Pseudobulbs* conical to

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Fig. 7. *Habenaria crocodilium*. A plant habit; B inflorescence and detail of flower. PHOTOS: MAG IZOUARD.

subcylindrical, 35 – 60 × 4 – 7 mm, longitudinally ridged, the older ones distinctly annulate at the old leaf joints, partly covered by several overlapping greyish-brown sheaths, 3 – 4 leaves towards the apex. *Leaves* linear-ligulate, attenuate at the tip, 8 – 15 × 1.2 – 1.5 cm, narrowed into a conduplicate petiole at the base, the basal one much smaller and almost bract-like, pale green. *Inflorescence* erect, surpassing the leaves, up to 18 cm, 1.2 – 2.1 mm in diam., densely racemose in the apical third with up to 9 flowers. *Peduncle* flattened – laterally compressed, almost glabrous towards the base but becoming echinate-hirsute towards the rachis, generally with a prominent conduplicate leaf-like scale towards the middle (35 – 65 × 4 – 6 mm) and 2 – 4 thinner and much shorter amplectant sheaths. *Rachis* terete, not branched, 3 – 6 cm, flowering in succession, hirsute. *Floral bracts* lanceolate acuminate, persistent and thickened at the base, hirsute on the exterior especially towards the base, 3 – 3.2 × 1.5 – 2.1 mm. *Flowers* c. 10 × 9 mm, pure white except for the orange callus in the middle of the lip and farinose orange-yellow patch on the mid-lobe of the lip, the white ovary becoming green on fertilisation. *Pedicel* and *ovary* glabrous, fusiform, longitudinally ridged, 4.8 – 5.2 × 1.1 – 1.3 mm. *Dorsal sepal* ovate, acute, 5.1 – 5.5 × 3.4 – 3.7 mm, arching over the column. *Lateral sepals* spreading, forming an indistinct rounded mentum with the column foot, ovate, shortly acuminate, 5.4 – 5.6 × 5.4 – 5.9 mm. *Petals* oblanceolate, 4.2 – 4.3 × 1.9 – 2 mm, acute, incurved. *Lip* 5.1 – 5.3 × 4.9 – 4.8 mm, 3-lobed in the apical half, the lateral lobes porrect elliptic obtuse, the mid-lobe sub-triangular, ending in a short incurved apicule, margins rounded, the disc and mid-lobe minutely pubescent-farinose, disk with a distinct ovoid to almost globular callus in the centre, densely covered in farina. *Column* stout, 3-lobed, stigma rounded, transversally oblong, 2.5 – 3 × 1.5 – 1.6 mm; *anther* hemispherical with a rounded apical lobe, c. 1.1 × 1.2 mm; *pollinia* (2) ovoid, c. 0.8 × 0.6 mm. *Seed capsule* fusiform, c. 15 × 5 mm. Figs 9, 10.

RECOGNITION. *Polystachya siederi* is distinct in having ascending pseudobulbs on a very short rhizome, large leaf-like scales towards the middle of the inflorescence, an unbranched inflorescence densely racemose towards the apex, hirsute rachis and floral bracts, medium-sized flowers with ovate lateral sepals forming a short rounded mentum at the base, a lip three-lobed in the apical half, and a farinose disk with an ovoid to globular callus in the centre. Amongst the *Polystachya* Hook. (Hooker 1824: t.103) species occurring in Madagascar, *P. siederi* has some vegetative and floral similarities to *P. anceps* Ridl. (Ridley 1885: 473), *P. heckeliana* Schltr. (Schlechter 1913: 167) and *P. rhodochila* Schltr. (Schlechter 1916: 323) but it differs in having an unbranched inflorescence, slightly smaller flowers, and more oval lateral sepals and lip shape; it also has much shorter floral bracts than *P. rhodochila*. In flower shape it is most similar to *P. heckeliana* but the lip is lobed in the apical half (vs the basal half), the callus is more distinct and the flower colour is also different. It shares a number of characteristics with several *Polystachya* from mainland Africa: the inflorescence, lip shape and callus are most similar to *P. transvaalensis* Schltr. (Schlechter 1895: 28) and *P. albescens* Ridl. (Ridley 1887: 199) and its variants but it is distinct from both by its shorter and broader pseudobulbs, unbranched inflorescence, and slightly smaller flowers with shorter and more rounded ovate lateral sepals.

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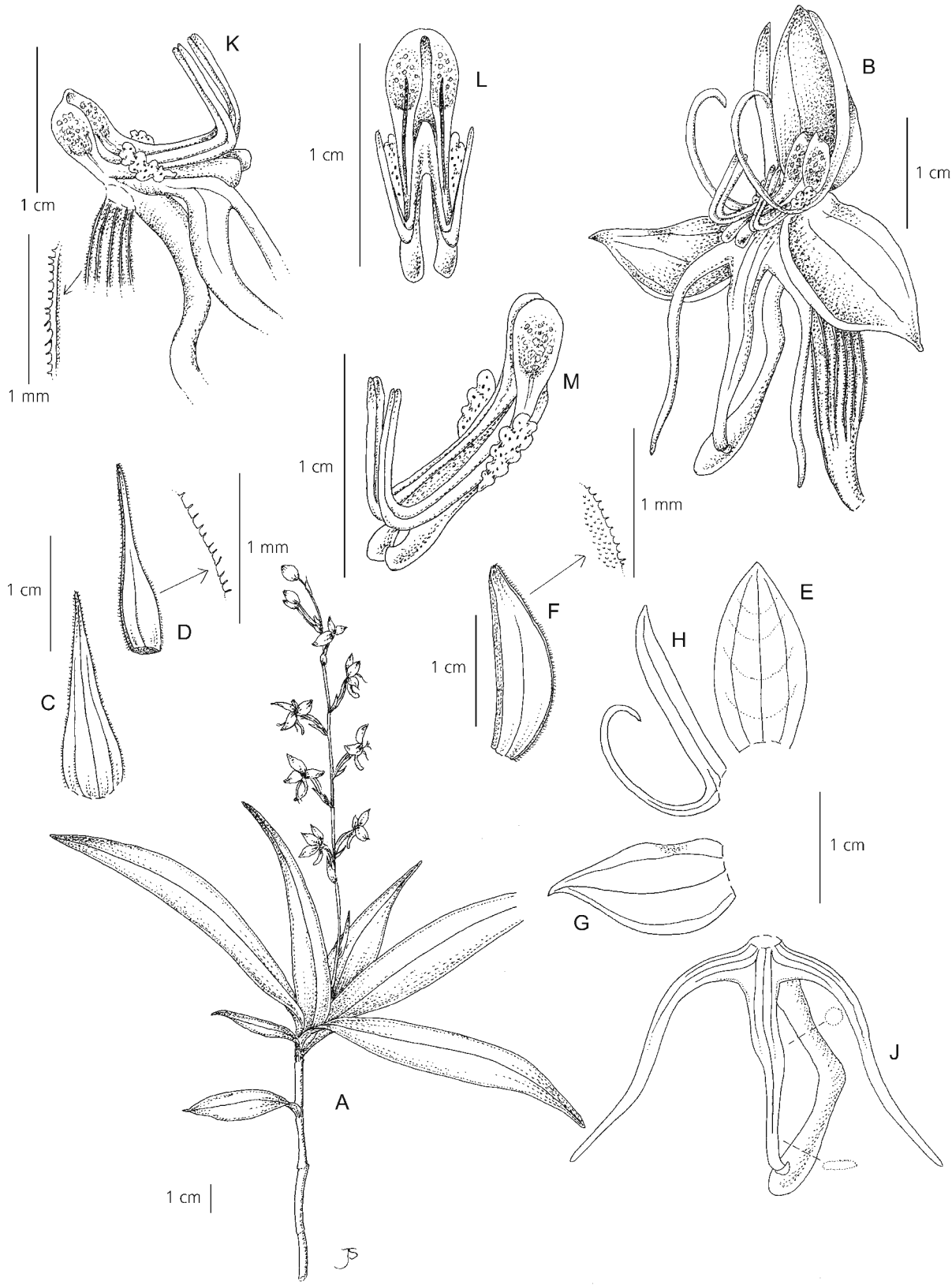

Fig. 8. *Habenaria crocodilium*. **A** habit; **B** flower; **C** bract, dorsal view; **D** bract, side view; **E** dorsal sepal, front view; **F** dorsal sepal, side view; **G** lateral sepal; **H** petal; **J** lip; **K** column and lip, side view; **L** column, from above; **M** column, side view. Based on *Hermans* 4880. DRAWN BY JUDI STONE.

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Fig. 9. *Polystachya siederi*. **A** plant in habitat; **B** part of the rachis **C** detail of flower. PHOTOS: ANTON SIEDER.

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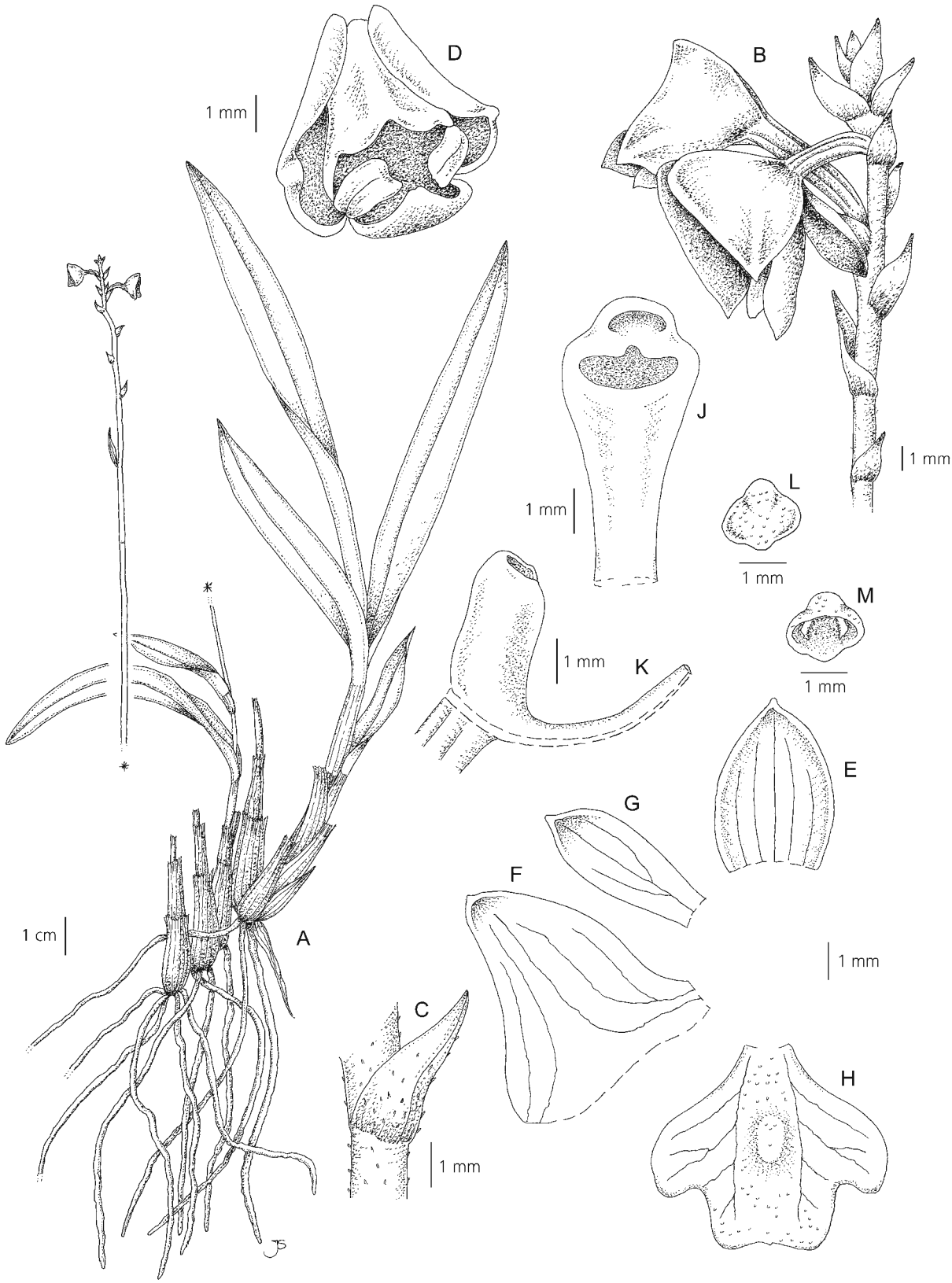

Fig. 10. *Polystachya siederi*. **A** plant habit; **B** inflorescence; **C** floral bract, enlarged; **D** flower front view; **E** dorsal sepal; **F** lateral sepal; **G** petal; **H** lip; **J** column, front view; **K** column, side view; **L** anther cap, dorsal view; **M** anther cap, ventral view. Based on spirit material *Sieder* 7112. DRAWN BY JUDI STONE.

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DISTRIBUTION. Endemic to Mahajanga province in northern Madagascar, only known from the type collection.

HABITAT. In semi-shade in riverine forest on rock. Elevation 900 m.

CONSERVATION STATUS. *Polystachya siederi* is known from one location, outside a protected area in Sofia region, Mahajanga province. The habitat, the extent of occurrence and the area of occupancy face continuing decline due to fire and agricultural practices. *Polystachya siederi* is therefore assessed as Critically Endangered CR B1ab(i,ii,iii) + 2ab(i,ii,iii).

FLOWERING TIME. January.

ETYMOLOGY. Named for Anton Sieder of the Botanical Garden, University of Vienna, Austria; an intrepid explorer, grower and connoisseur of the orchids of Madagascar.

NOTES. *Polystachya* is a pantropical genus of about 250 epiphytic, lithophytic or terrestrial plants, with the greatest diversity in sub-Saharan tropical Africa (Cribb in Pridgeon *et al.* 2014: 455). There are currently 23 *Polystachya* species recognised from the Madagascar, Mascarene and Comoro region, 16 of which are only found on Madagascar and three have a wider distribution outside the region.

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