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New and little-known species of *Strobilanthes* (Acanthaceae) from India and South East Asia

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Summary. Descriptions and information about 26 species of *Strobilanthes* Blume are provided. Sixteen species are described as new: *Strobilanthes bilabiata* J. R. I. Wood, *S. fragrans* J. R. I. Wood and *S. trichantha* J. R. I. Wood from Thailand, *S. borii* J. R. I. Wood and *S. parvifolia* J. R. I. Wood from India, *S. chrysodelta*, J. R. I. Wood, *S. muratae* J. R. I. Wood, *S. ramulosa* J. R. I. Wood, *S. tanakae* J. R. I. Wood and *S. wardiana* J. R. I. Wood from Burma, *S. disparifolia* J. R. I. Wood from Laos, *S. fusca* J. R. I. Wood from the Philippines, *S. longipedunculata* Terao ex J. R. I. Wood from Vietnam, *S. longistaminea* J. R. I. Wood and *S. pusilla* J. R. I. Wood from Indonesia and *S. orientalis* J. R. I. Wood from East Timor. Species placed in *Aechmanthera* Nees and *Sericocalyx* Bremek. are transferred to *Strobilanthes*, resulting in the new name *Strobilanthes sulewesiana* J. R. I. Wood for *Sericocalyx collina* Bremek. and the new combinations *Strobilanthes tomentosa* (Nees) J. R. I. Wood, *Strobilanthes celebica* (Bremek.) J. R. I. Wood and *Strobilanthes schomburgkii* (Craib) J. R. I. Wood for the species hitherto known respectively as *Aechmanthera gossypina* (Wall.) Nees, *Sericocalyx celebicus* Bremek. and *S. schomburgkii* (Craib) Bremek. The new combinations *Strobilanthes barisanensis* (Bremek.) J. R. I. Wood and *S. persicifolia* (Lindl.) J. R. I. Wood are made, the latter based on an earlier name for the relatively well-known *S. anisiphylla* (G. Lodd.) T. Anderson. *Kjellbergia celebica* Bremek. is renamed *Strobilanthes kjellbergii* J. R. I. Wood. Some 22 species are illustrated with line drawings for the first time. Pollen of 16 species is illustrated with scanning electron micrographs. The more widespread species are mapped.

Key Words. Burma, India, Malesia, pollen, species delimitation, *Strobilanthes*, taxonomy, Thailand.

Strobilanthes Blume is the most species-rich genus of Acanthaceae in Asia with some 400 species making it probably the second largest genus in the family after *Justicia* L. Despite this level of diversity and the ecological importance of the genus — some species are locally abundant, even subdominant in the shrub layer of hill forest — species delimitation remains problematic, essentially because many species are poorly known and rarely collected, mainly because of their plietesial flowering pattern. On-going monographic studies of *Strobilanthes* at Oxford are gradually resolving many issues in relation to species delimitation (Bennett & Scotland 2003; Carine & Scotland 2000; Carine *et al.* 2000, 2004; Deng *et al.* 2006; Scotland 1998; Wood & Scotland 2003a, 2003b, 2006; Wood *et al.* 2003) and generic limits (Carine & Scotland 2002, Moylan *et al.* 2004). This paper continues this process through the description of new species and the transfer of species previously described in segregate genera to *Strobilanthes*.

Neither the traditional classification adopted by Anderson (1867) and followed by Clarke (1884) based on gross morphology, nor that of Bremekamp (1944) based mainly on pollen and seed structure are satisfactory. Although many species groups are readily discernible such as the "*Stenosiphonium* group" (Carine & Scotland 2000), the *Strobilanthes kunthiana* group (Carine *et al.* 2004), the *S. pentstemonoides* group (Wood & Scotland 2006) or the "*Sympagis* group" (Wood *et al.* 2003), these groups are mostly small and relatively few in number. Even apparently well-defined small species clusters with shared gross morphological characters, treated as genera by Bremekamp such as *Pseudostenisiphonium* Lindau (five species), *Championella* Bremek. (six species), *Gutzlaffia* Hance (seven species) or *Leptacanthus* Nees (five species) break down as at least one species in each cluster has a totally different pollen type (Wood 1995: 1 – 2; Carine & Scotland 1998; Deng *et al.* 2006: 370 – 375). Specific characters such as the 2-lipped calyx, the 2-seeded capsule, the extended anther connective or the presence of only two fertile stamens, many of which have been used to define species clusters that have been recognised as

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genera, do in fact occur apparently randomly in species which show no clear relationship either using traditional morphological methods or molecular analysis (Wood & Scotland 2003a; 2003b and discussion below under *Strobilanthes tomentosa* (Nees) J. R. I. Wood). Additionally *Strobilanthes* also contains a large number of species that have no obvious morphological affinity to indicate their close relatives and many of these were placed in monospecific genera by Bremekamp (1944). The list of species in this category is lengthy and includes *Strobilanthes cusia* Nees (*Baphiacanthus* Bremek.), *S. henryi* Hemsl. (*Paragutzlaffia* H. P. Tsui), *S. assimulata* S. Moore (*Psacadopaepale* Bremek.), *S. affinis* (Griff.) J. R. I. Wood & J. R. Benn. (*Tarphochlamys* Bremek.), *S. apoënsis* (Elmer) Merr. (*Echinopaepale* Bremek.), *S. multangula* Benoist as well as many others.

We have demonstrated (Carine & Scotland 2002; Moylan *et al.* 2004) that even if a complete, accurate and robust phylogeny of *Strobilanthes* were available, the level of homoplasy displayed by morphological characters would preclude a diagnostic, mutually exclusive classification of species of *Strobilanthes*. It is possible to delimit and diagnose *Strobilanthes* the genus, and also possible to identify unique combinations of characters to delimit species. The problem lies in delimiting groups of species within the genus because virtually all characters evolve multiple times independently within *Strobilanthes* and this precludes accurate diagnoses. For example, Carine & Scotland (2002) coded 32 morphological characters within *Strobilanthes* and demonstrated that 22 of these 32 characters changed four times or more on a phylogeny of *Strobilanthes*. Therefore because of these high levels of homoplasy which preclude diagnosability and the many isolated species with autapomorphic character combinations, the broad concept of *Strobilanthes* proposed by Terao (1983) has to be accepted and the segregate genera described by Bremekamp and his followers cannot be upheld.

This paper presents a number of new species and provides notes on others. All new species are illustrated and care has been taken to compare species with others that are morphologically similar. Many of the species described here are only known from one or two specimens and this merits some comment as species delimitation appears very difficult in this situation and the description of new taxa a risky enterprise. However we believe there is both scientific and pragmatic justification for this.

In the first place the apparently random occurrence of a wide range of characters which makes a scientific infrageneric classification so difficult is a feature that makes species delimitation relatively easy. Variation takes place in a wide range of characters including life form, indumentum, anisophylly, leaf shape, inflorescence structure, bract and bracteole presence or absence as well as their shape and persistence, calyx and corolla form, number of stamens and form of the gynoecium, number of seeds and seed indumentum. Nothing illustrates this better than pollen. *Strobilanthes* has a greater diversity of pollen form than any other Acanthaceae genus, and perhaps than any other genus of flowering plants and numerous examples are given by Bremekamp (1944), Carine & Scotland (1998), Bennett & Scotland (2003), Wood *et al.* (2003), Wood & Scotland (2003a, 2006), Wang & Blackmore (2003), Hu *et al.* (2005) and Deng *et al.* (2006).

The apparent rarity of many species and the paucity of collections are in no way surprising. Exactly the same phenomenom can be observed with the two large *Acanthaceae* genera of neotropical hill forest, *Aphelandra* (Wasshausen 1975) and *Stenostephanus* (Daniel 1999, Wood 1988, 2009). Many species of both these genera are frequently encountered in isolated populations and are rarely recollected or found away from their original collection site. In the case of *Strobilanthes* the paucity of collections is further explained by the plietesial habit of most species. Even species that are locally abundant are rarely collected. The history of *Strobilanthes accrescens* J. R. I. Wood illustrates this well. It is locally abundant for some 20 to 30 kilometres along the main road from India to the capital of Bhutan, Thimphu, a route travelled by a good many botanists over the years. It was first collected in 1914 but apart from a single collection in a neighbouring valley in 1967, it was not recollected until 1991. The explanation lies in its plietesial habit. It flowers every 12 years or so and will pass unnoticed in any year when it is not flowering.

Strobilanthes is widely distributed over tropical south and south east Asia and individual species are restricted to isolated islands or continental inselbergs. It is, therefore, not at all surprising to find isolated species on islands such as Timor or Sulawesi or in poorly explored mountain ranges of mainland Asia such as the Chin Hills of Burma (Myanmar) or the limestone scarps along the Vietnam-China border from where many species were described recently by Fang & Lo (1997). Many of these areas such as north east India or the Golden Triangle, or the mountains of Sulawesi or northern Sumatra are physically or politically difficult of access and few or no modern collections have emerged from these regions. Consequently there has seemed little possibility of obtaining additional collections of many species and our decision has been to describe well-marked species on less material than is normally desirable, thus putting these plants clearly on record and drawing attention to the rich biodiversity of the regions from where they come.

Malesian Species

The following species are all from island South East Asia, occurring within the *Flora Malesia* region.

Strobilanthes longistaminea *J. R. I. Wood* **sp. nov.** propter granum pollinis globosum echinulatum, stamina exserta, flores infundibulariformes, capsulam 2 seminibus instructam manifeste *S. autapomorpha* J. R. Benn. proxima sed corolla parviore usque 16 mm, non 25 mm longa, lobulis calycis comosis, foliis basin attenuatis recedit. Typus: Indonesia, Sulawesi, *P. J. Eyma* 3976 (holotypus L).

Perennial undershrub of unknown height, not or only weakly anisophyllous. Stems sulcate, glabrous. Leaves petiolate, petioles scabrid, 0.5 – 4.5 cm long; lamina 3.5 – 9 × 1 – 3.5 cm, narrowly elliptic, attenuate at both ends, margins undulate to crenate, scabrid-pubescent above, scabrid on the veins below. Inflorescence of small, leafy, few-flowered heads, borne on axillary branchlets, shorter than the subtending leaves; peduncles mostly 5 – 15 mm long; outer (inflorescence) bracts resembling reduced leaves, 10 – 18 × 4 – 5 mm, ovate-elliptic, acute, thinly pilose; floral bracts 8 × 4 mm, oblanceolate, obtuse, coarsely pilose with large-celled white hairs especially on the margins and on the upper half; bracteoles 5 × 1 mm, oblong, obtuse, ± ciliate with large-celled white hairs; calyx 6 mm long, subequally 5-lobed to 1 mm above the base, lobes 5 × 2 mm, narrowly oblong-elliptic, acute, comose; corolla white with fine dull red dots, glabrous on the exterior, 15 – 16 mm long, funnel-shaped, the tube 6 – 7 mm long, the lobes suborbicular, rounded, 3 – 4 × 3 mm; stamens 4, the 2 longer exserted, filaments glabrous, the two shorter c. 2 mm long, the two longer 5 – 6 mm long, anthers ellipsoid, c. 1.5 mm long, glabrous; pollen spheroidal, c. 70 μm diameter, 3-aperturate, apertures situated equatorially, tectum uneven and almost solid with regularly spaced but somewhat unequal sized short spines 2 – 3 μm long, arranged in longitudinal rows (Plate 1E); style exserted, glabrous; ovary comose. Capsule c. 3.5 × 1.25 mm, comose, 2-seeded. Fig. 1.

DISTRIBUTION. Only known from type locality in northern Sulawesi (Indonesia).

INDONESIA. Sulawesi: Menado, Kolonedale, between the saddle and east slope of the Tomongkoboe group, altitude not noted, 9 Oct. 1938, *P. J. Eyma* 3976 (holotype and isotype L, duplicates left at BO were probably lost or destroyed in 1945 (Van Steenis 1950: 161)).

HABITAT. No habitat details are known.

CONSERVATION STATUS. Data insufficient but only known from the type.

NOTES. *Strobilanthes longistaminea* clearly belongs to the "*Sympagis* group" discussed by Wood *et al.* (2003) and to a subset which includes *S. autapomorpha* J. R. Benn, *S. calcicola* J. R. I. Wood & J. R. Benn. and *S. renschiae* (Bremek.) J. R. I. Wood & J. R. Benn.), all of which have echinulate pollen (Plate 1E), the spines arranged in longitudinal rows. All these species have a 2-seeded capsule and a small, funnel-shaped corolla with exserted stamens. *S. longistaminea* differs from all in its foliose inflorescence in which the capitula are difficult to discern. The filaments are also strikingly unequal in length. The calyx is subequally 5-lobed to the base with the distinct oblong-elliptic lobes found also in *S. koordersii* C. B. Clarke ex Koord. but differs from that and other species in having comose calyx lobes. The only other species from the group known from Sulawesi is *S. calcicola*, which differs in its naked spikes and different calyx shape and indumentum.

Strobilanthes orientalis *J. R. I. Wood* **sp. nov.** floribus infundibuliformibus in capitulis brevepedunculatis dispositis, lobis calycis superioribus connatis sed duobos inferioribus ad basin libris ad *S. renschiae* tangit sed lobis calycis fere glabris in acumine longo tenue productis et granis pollinis sine echinulis recedit. Typus: East Timor, Bobanaro, *C. Friedberg* 1175 (holotypus L).

Undershrub. Stems angled, slightly winged, thinly pilose with scattered long, white hairs especially near the nodes. Leaves petiolate; petioles 1.2 – 1.4 cm long, thinly pubescent; lamina 5 – 6 × 1.5 – 2 cm, narrowly ovate, shortly acuminate, attenuate at the base, margins serrate, sparsely pilose on both surfaces with stiff white hairs, bullate above, paler and reticulate beneath. Inflorescence of short axillary subracemose panicles with 1 – 8 small, shortly-pedunculate, often opposite, head-like spikes 1.5 – 3 cm long arranged along a rachis 1 – 5 cm long; peduncles 4 – 8 mm long; inflorescence bracts 4 – 5 × 1 – 2 mm, oblong-elliptic, shortly pilose on the veins, green; floral bracts 7 – 8 × 2.5 mm, oblong-lanceolate, obtuse, persistent, shortly pilose on dorsal surface and with sessile glands (probably elongating in fruit) and longer white, hairs on the upper half; bracteoles 8 × 1 mm, lanceolate, comose with whitish hairs; calyx c. 11 mm long, glabrous except for the tips of the lobes, scarious and contrasting strongly with the green bracts and bracteoles, the three upper lobes connate and forming a trifid upper lip, the two lower lobes free to the base, 10 × 2 mm, lanceolate, acuminate, the midribs extended into a long, fine glandular point; corolla 2 – 2.2 cm long, glabrous except for the hairs retaining the style, white, infundibuliform, the basal tube c. 9 × 0.75 mm, cylindrical, then abruptly and symmetrically widened to 7 – 10 mm, lobes 2.5 – 3 × 3 – 3.5 mm, ovate, obtuse; stamens 4, didynamous, all fertile, filaments pilose below, glabrous above, the longer pair c. 4 mm long, the shorter pair c. 3 mm long; anthers oblong, muticous, 2 × 0.5 mm, the two longer held at mouth of corolla; pollen spheroidal, c. 55 μm diameter, 3-aperturate, apertures situated equatorially, tectum solid with pairs of adjacent

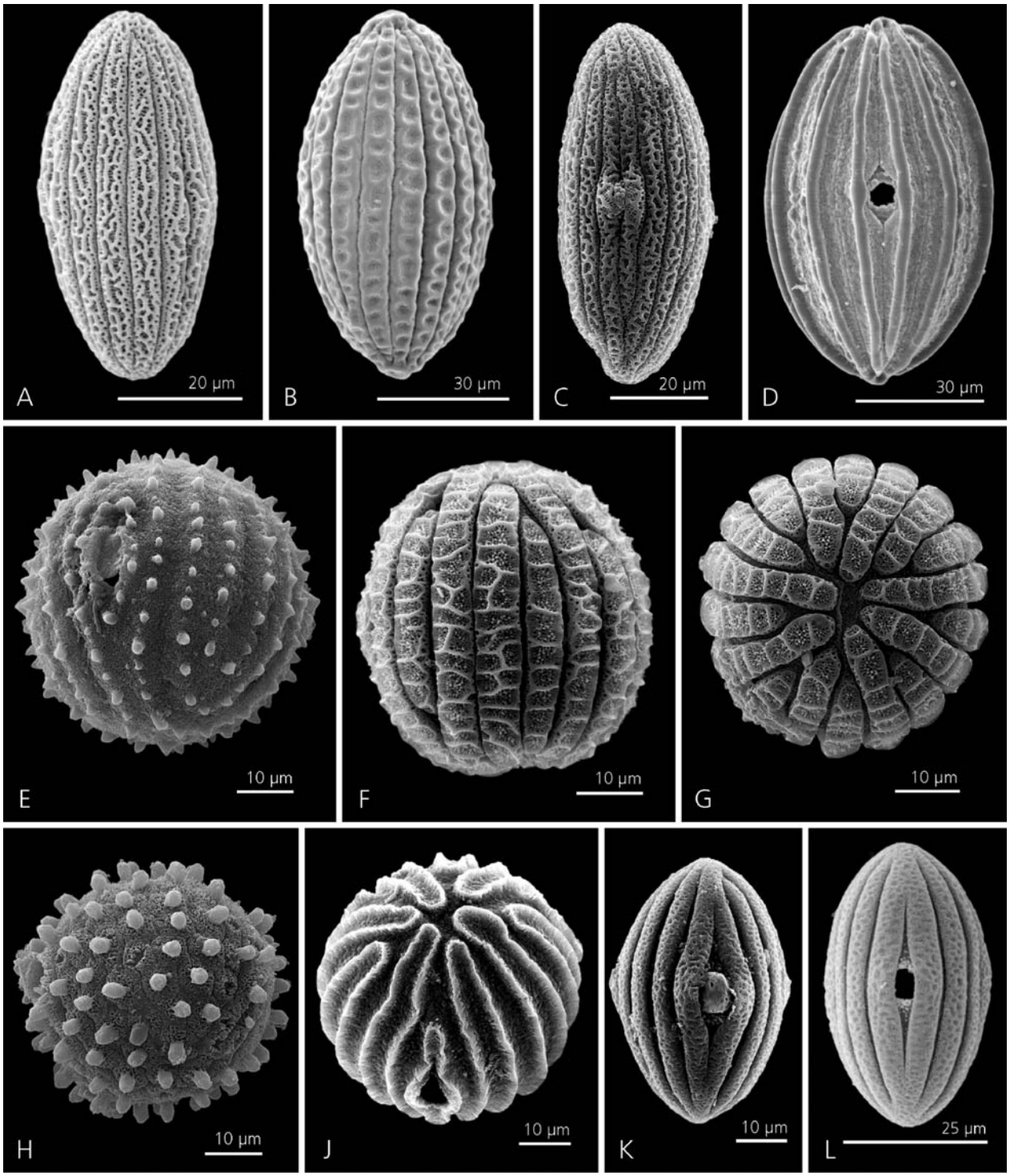


Plate 1. S.E.M. pollen images. **A** *Strobilanthes tomentosa* from *Wraber* 36835. **B** *S. ramulosa* from *Kingdon Ward* 9031. **C** *S. muratae* from *Murata et al*. 229051. **D** *S. cruciata* from *Kingdon Ward* 12873. **E** *S. longistaminea* from *Eyma* 3976. **F** *S. parvifolia* from *Kingdon Ward* 8718. **G** *S. parvifolia* from *Kingdon Ward* 8718. **H** *S. apöensis* from *Kostermans & Wirawan* 819. **J** *S. orientalis* from *Friedberg* 1179. **K** *S. fusca* from *Reynosa* 4164. **L** *S. schomburgkii* from *Kerr* 18097.

longitudinal ridges that coalesce more or less at the poles (Plate 1J); style c. 20 mm long, glabrous; ovary 1.75 mm long, 2-ovulate, comose; capsule not seen but presumably 2-seeded, comose. Fig. 2.

DISTRIBUTION. Known only from East Timor (Timor Leste).

EAST TIMOR. Bobonaro, Ue Peg, 1200 m, 18 June 1970, *C. Friedberg* 1179 (holotype L).

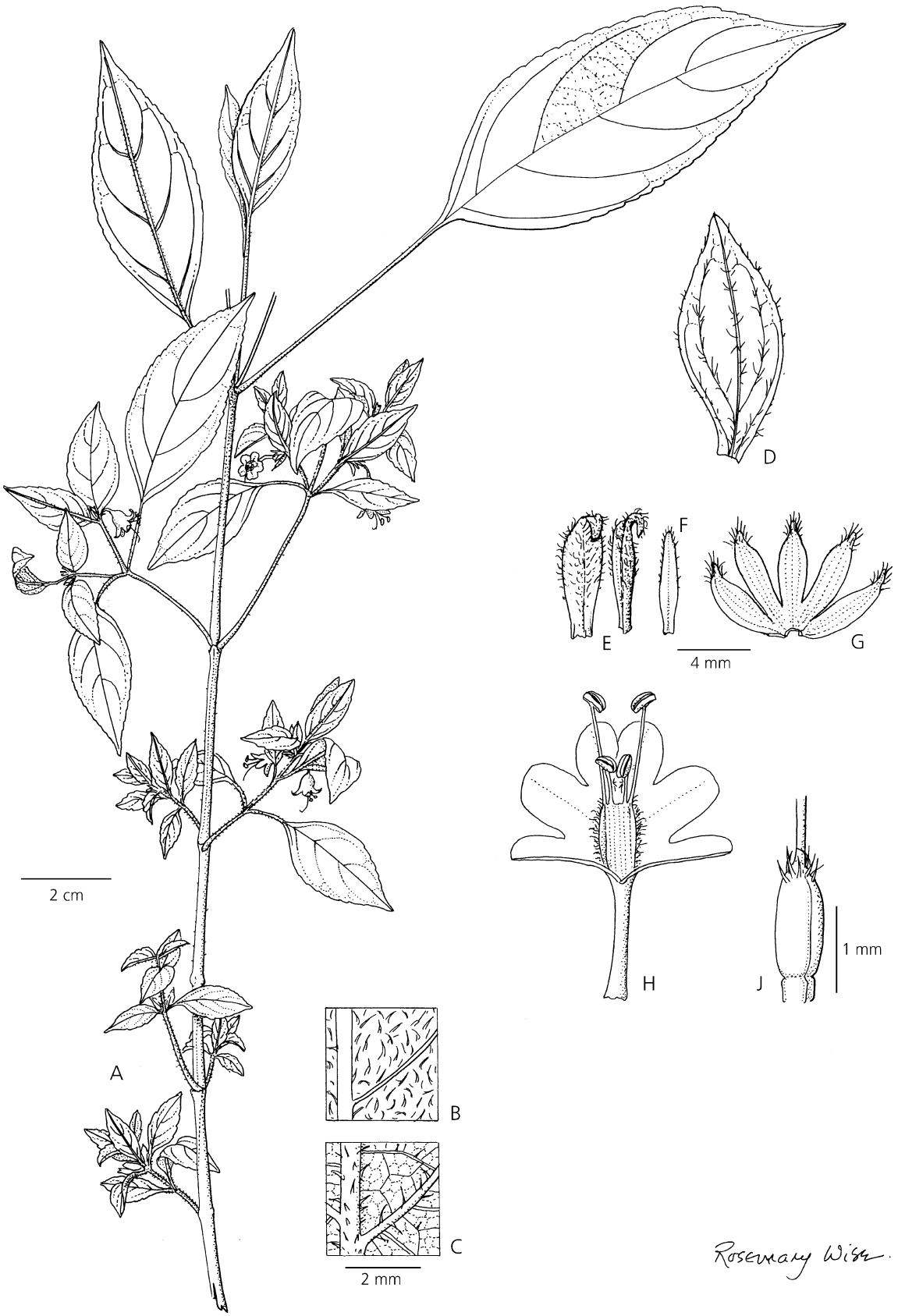


Fig. 1. *Strobilanthes longistaminea* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** inflorescence bract; **E** bracts, upper and lower surfaces; **F** bracteole; **G** calyx; **H** corolla opened out to show stamens; **J** ovary. From *Eyma* 3976. DRAWN BY ROSEMARY WISE.

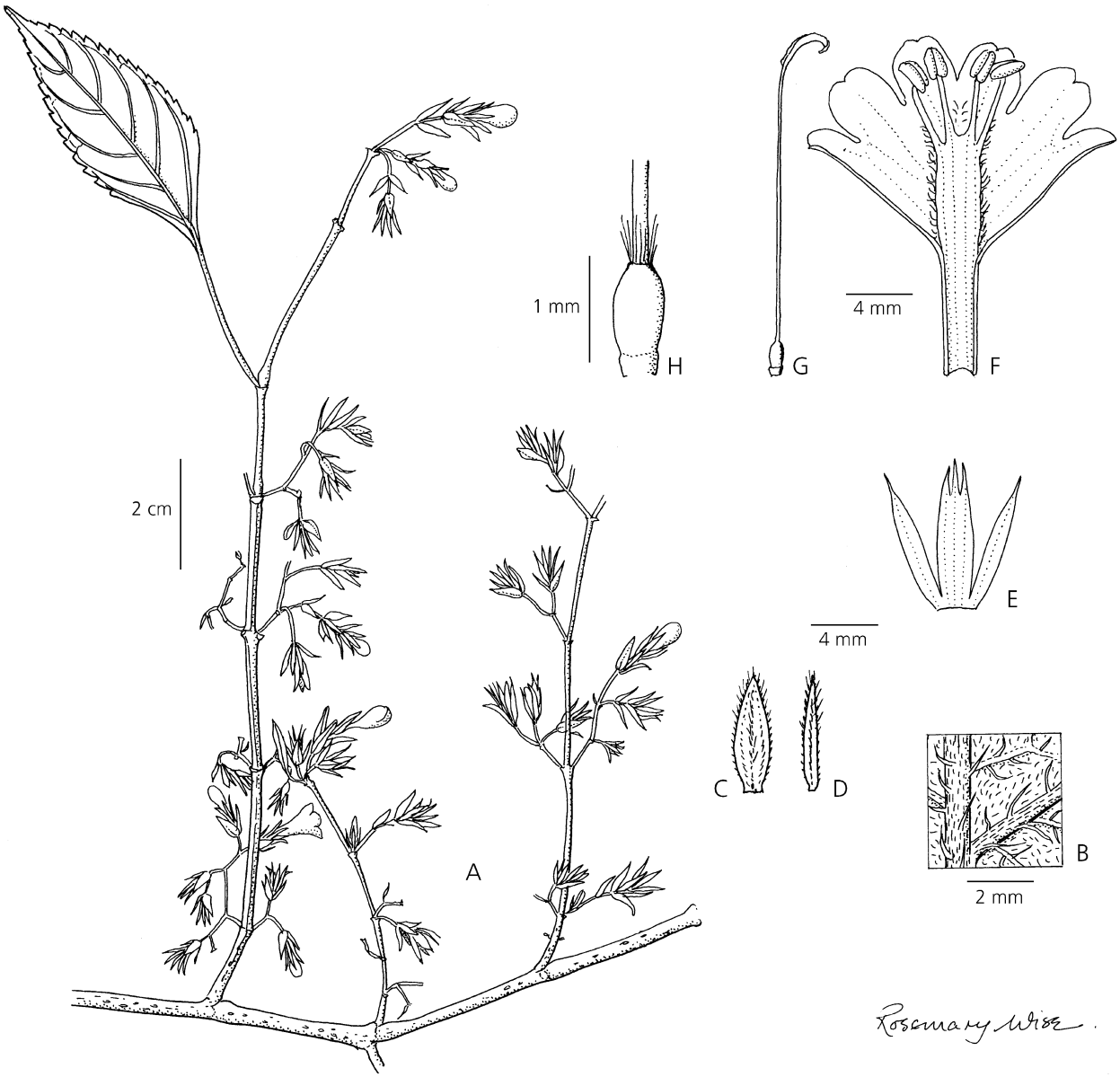


Fig. 2. *Strobilanthes orientalis*. **A** habit; **B** abaxial leaf surface; **C** bract; **D** bracteole; **E** calyx; **F** corolla opened out; **G** style; **H** ovary. From *Friedberg* 1179. DRAWN BY ROSEMARY WISE.

HABITAT. Moist forest; 1200 m.

CONSERVATION STATUS. Insufficient data but there has been much deforestation on East Timor so probably Endangered (EN).

EPONYMY. This species is named *Strobilanthes orientalis* in allusion to both component words of the name of the country where it grows both of which mean "east", although in different languages. It is in any case one of the most eastern of all *Strobilanthes* in its distribution.

NOTES. *Strobilanthes orientalis* has the characteristic pollen and inflorescence of the "*Sympagis* group" (Wood *et al.* 2003) but belongs to a small cluster within this group in which the three upper calyx lobes are connate, the calyx thus somewhat bilabiate (Wood & Scotland 2003a). The shape of the calyx suggests an affinity with *S. renschiae* and *S. teraoi* J. R. I. Wood & J. R. Benn. but the pollen of the former is echinulate and the inflorescence of the latter is dense and undifferentiated in form. The bullate, scabrid leaves, however are very similar to those of *S. teraoi*. The calyx is perhaps unique in *Strobilanthes* because of the shortly trifid upper lip and the very distinctive, long-acuminate glandular tips to the calyx lobes formed from an extension of the midrib. The only specimen available lacks fruit but it seems possible that the tips may elongate in fruit as in *S. accrescens* (Wood 1994: 225 – 227).

Strobilanthes apoënsis (*Elmer*) *Merr.* (1923: 475).
Hypoestes apoënsis Elmer (1915: 2544). Type: Philippines, Mindanao, *A. D. E. Elmer* 10722 (syntypes A, K).
Goldfussia apoënsis (Elmer) Bremek. (1944: 231).
Hypoestes sibulanensis Elmer (1915: 2546) **synon. nov.** Type: Philippines, Mindanao, *A. D. E. Elmer* 11152 (syntype NY).
Strobilanthes sibulanensis (Elmer) Merr. (1926: 488).
Strobilanthes boholensis Merr. (1926: 487) **synon. nov.** Type: Philippines, Bohol, *Ramos* 43256 (syntypes BM, G, K).
Echinopaepale javanica Bremek. (1944: 298). Type: Indonesia, Java, *Kühl & Hasselt* s.n. (holotype L).

A full description of *Strobilanthes apoënsis* is given by Bennett & Scotland (2003: 29) under the name *S. boholensis*. It is a very strongly anisophyllous species with a zigzag stem, the smaller leaf in each pair caducous so the leaves sometimes appear alternate. Important elements missing in Bennett & Scotland's description relate to the corolla colour, ovary and fruit. The corolla is usually white but sometimes pale blue. The base of the ovary is unusually constricted above the apex of the pedicel which is strongly ribbed (Fig 3F). The capsule is 18 – 20 × 4 – 4.5 mm, 4-seeded, glabrous and relatively large and woody. The seeds are 2.5 × 2 mm, superficially glabrous, but in fact covered in extremely short spreading hairs, some of these capitate and others multicellular. The presence of dimorphic hairs on the testa is another character marking out this species from others in the genus. It is also the only species of *Strobilanthes* in the Malesian region with spheroidal pollen with obtuse echinulae which are regularly scattered throughout (Plate 1H) rather than in distinct longitudinal rows as in *S. longistaminea* (Plate 1E). Fig. 3.

We have not selected a lectotype for this species as both syntypes we have seen are rather poor fruiting specimens. A more suitable specimen for selection as lectotype may be extant in Manila or elsewhere.

DISTRIBUTION. Widely distributed in scattered localities throughout the Malesian region. It is the most widespread species in the Malesian region. Map 1.
INDONESIA. Flores: Nusa Tenggara Timur, Rana Mesé, 11 June 1938, *Jaag* 1576 (BM). Wae Mas, West Flores, 1000 m, 7 May 1965, *Kostermans & Wirawan* 819 (L); Dalur-Loit, Mebengan. SE West Flores, 600 m, 11 May 1965, *Kostermans* 22139 (L); Nunang, Todong Kopé, 1000 m, 24 May 1974, *E. Schmutz* 3659 (L). Java: Sagasanten, 24 June 1875, *O. Kuntze* 5190 (NY); Mt Burangrang, Karawang Distr., 26 July 1920, *Bakhuizen van der Brink* 4667 (L). Kalimantan: West Kutei, Mt Maranga, Tundjung, 200 m, 29 July 1956, *Kostermans* 12591 (K). Sumbaya: Mt Batulanteh, West Sumbaya, 800 m, 13 April, 1961, *Kostermans* 18417 (L). **MALAYSIA**. Sabah: Ulu Sangai, Kalabakan, 22 May 1984, *M. Pikko* 103693 (K, SAN). Sarawak: Gunong Selabor, Ulu Kedap, Serian Dist., 29 Sept. 1962, *J. A. R. Anderson* 20831 (K); Gunong Gading, Lundu, 700 m, 19 Sept. 1974, *James et al.* 35056 (K). **PHILIPPINES**. Bohol: Aug. 1923, Ramos 43256 (BM, G, K). Luzon: Quezon, Mt. Cristobal [14°047'N, 121°30'E], 650 m, 14 Dec. 1996, *Reynoso & Majaducan* 27254 (K). Mindanao: Todaya (Mt Apo), Davao Distr., 1,250 m, May 1909, *A. D. E. Elmer* 10722 (A, K, type); ibid., 600 m, July 1909, *A. D. E. Elmer* 11152 (NY).
HABITAT. Growing on forested hills; below 1250 m.
CONSERVATION STATUS. Insufficient data but very widespread so probably Least Concern (LC) although habitat destruction must pose some threat.
NOTE. This is one of very few species of *Strobilanthes*, in which the flowers are in reduced, lax axillary spikes which are much shorter than the leaves. It can be distinguished from the other Malesian species with this character, *S. axilliflora* C. B. Clarke ex S. Moore and *S. winckelii* (Bremek.) J. R. Benn. by the echinulate pollen (Plate 1H) and the caducous bracts.

Strobilanthes sulawesiana *J. R. I. Wood* **nom. nov.**
Sericocalyx collina Bremek., *Svensk. Bot. Tidskr.* 42: 385 (1948), non *Strobilanthes collina* Nees (1832). Type: Indonesia, Sulawesi, *Kjellberg* 1682 (holotype S).

DISTRIBUTION AND HABITAT. Only known from the type found on limestone cliffs at 1200 m near Makale in central Sulawesi.
CONSERVATION STATUS. Data Deficient (DD); only once collected.
NOTE. This species clearly belongs to the species cluster treated by Bremekamp under the name *Sericocalyx* Bremek. and appears to be close to *Strobilanthes crispa* (L.) Blume from Java as it has glabrous seeds (Fig. 4Q). However, we believe Bremekamp was correct to treat it as a distinct species as the inflorescence is densely covered in glandular hairs and the bracts are much smaller. Superficially it resembles *S. timorensis* Nees but differs by the smooth leaves, stouter inflorescence and glabrous seeds.

Strobilanthes celebica (*Bremek.*) *J. R. I. Wood* **comb. nov.**
Sericocalyx celebicus Bremek., *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect.* 2, 41 (1): 162 (1944). Type: Indonesia, Sulawesi, *Bünnemeyer* 12429 (holotype L).
Sericocalyx celebicus var. *caudatus* Bremek (1944: 162), *nom. superfl.* Type as for *Sericocalyx celebicus*.
Sericocalyx celebicus var. *calcitrapa* Bremek. (1944: 163). Type: Indonesia, Sulawesi, *Bünnemeyer* 11753 (holotype L).

A weedy undershrub about a metre high clearly belonging to the cluster of species placed by Breme-

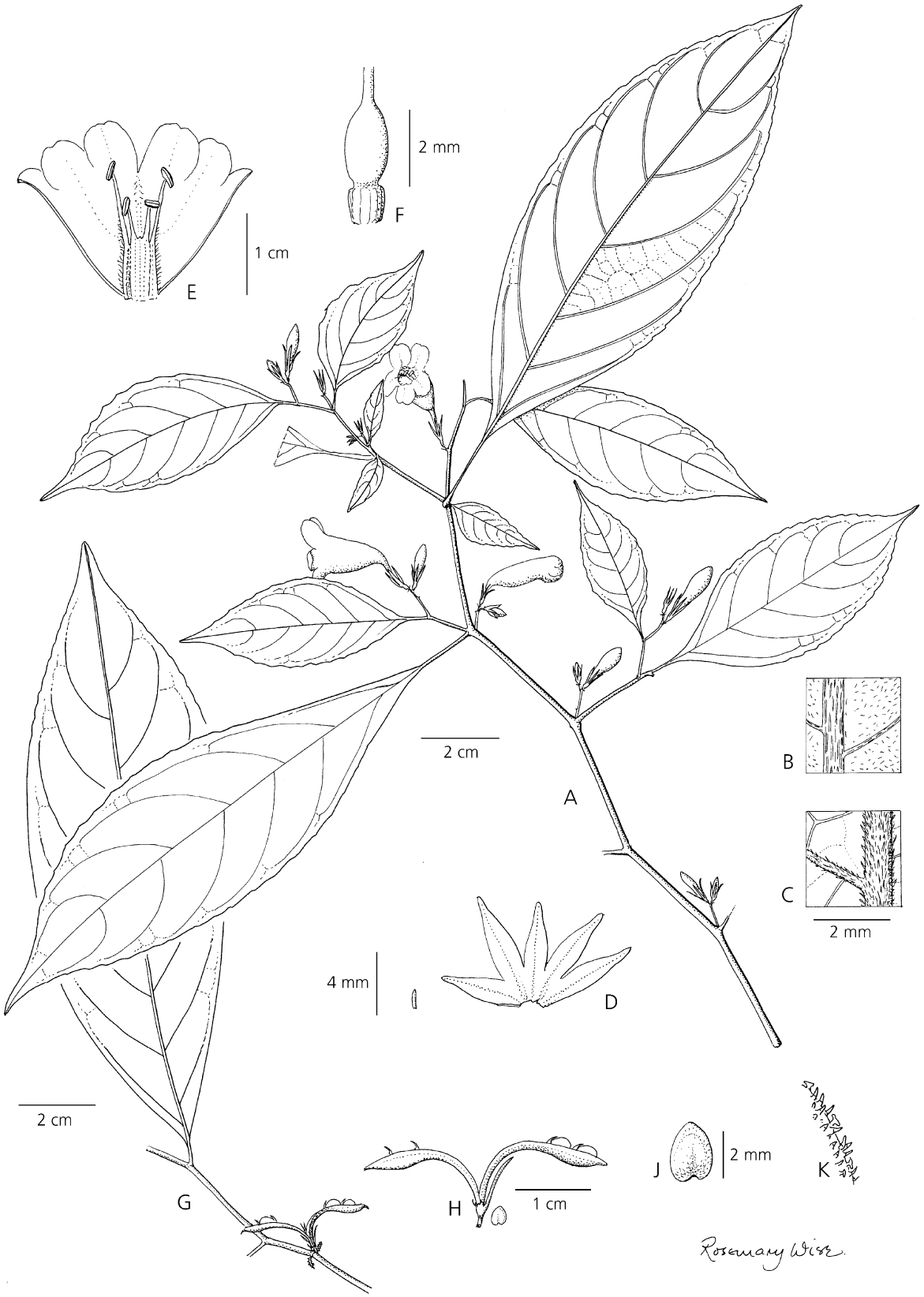
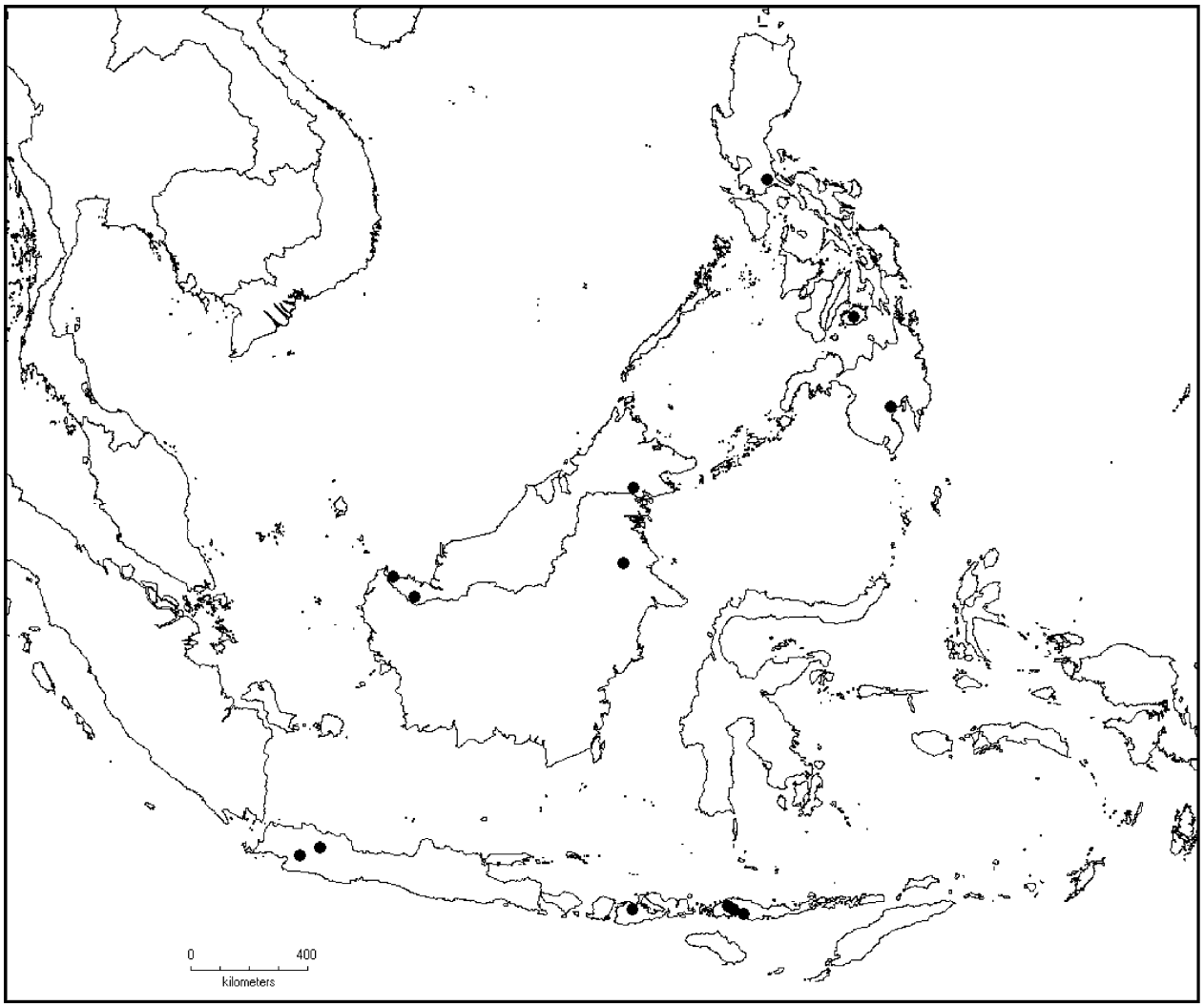


Fig. 3. *Strobilanthes apoënsis* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** calyx; **E** corolla opened out to show stamens; **F** ovary; **G** habit with fruit; **H** capsule; **J** seed; **K** seed indumentum magnified. **A** – **C**, **E** – **F** from *Ramos* 43256, **D**, **G** – **J** from *Kostermans* 22139, **K** from *Elmer* 10722. DRAWN BY ROSEMARY WISE.



Map 1. Distribution of *Strobilanthes apoënsis* (●).

kamp in *Sericocalyx* because of its yellow flowers, rigid, rather bristly leaves and the silky hairs on the inside of the calyx. This species is distinguished from other similar Indonesian species by the absence of bracteoles. The seeds have a prominent areole with a broad prominent, marginal hairy zone. The bracts are relatively small but have a long caudate apex which gives the inflorescence a characteristic eared appearance. Fig. 4A – J.

DISTRIBUTION. Endemic to the south-western arm of Sulawesi (Indonesia),

INDONESIA. Sulawesi: Macassar, 1840, *G. Barclay* s.n. (BM); Tanette, 450 m, 26 June 1921, *Bünnemeyer* 12429 (holotype L); Pasoei, 15 – 18 May 1929, *G. Kjellberg* 4015 (S); new campus grounds of Hasanuddin University, Makassar, 26 June 1976, *W. Meijer* 10656 (L, MO, US); Maros, by entrance to Bantimurung Park, 11 June 1986, *S. C. Chin* 3448 (K, L).

HABITAT. On limestone outcrops; 450 – 600 m.

CONSERVATION STATUS. Data insufficient but may be adaptable to disturbance although limited to one area of Sulawesi.

NOTES. Both this and the previous species seem to choose limestone outcrops as their favoured habitat. This is the case for a number of very local species of *Strobilanthes* occurring in the equatorial region including *S. calcicola*, also from Sulawesi, *S. insularis* Terao from Langkawi Island and *S. fragrans* described later in this paper. Limestone outcrops are clearly of importance for conservation, and field workers searching for *Strobilanthes* should examine these sites with special attention.

Teysmann 14108 (L) from Bonthain (Sulawesi) also belongs to this species, *fide* Bremekamp (1944: 162).

Strobilanthes fusca *J. R. I. Wood* **sp. nov.** ex affinatate *S. schomburgkii* (Craib) J. R. I. Wood sed inflorescentia paniculiforme, bracteis anguste ellipticis, glandulis

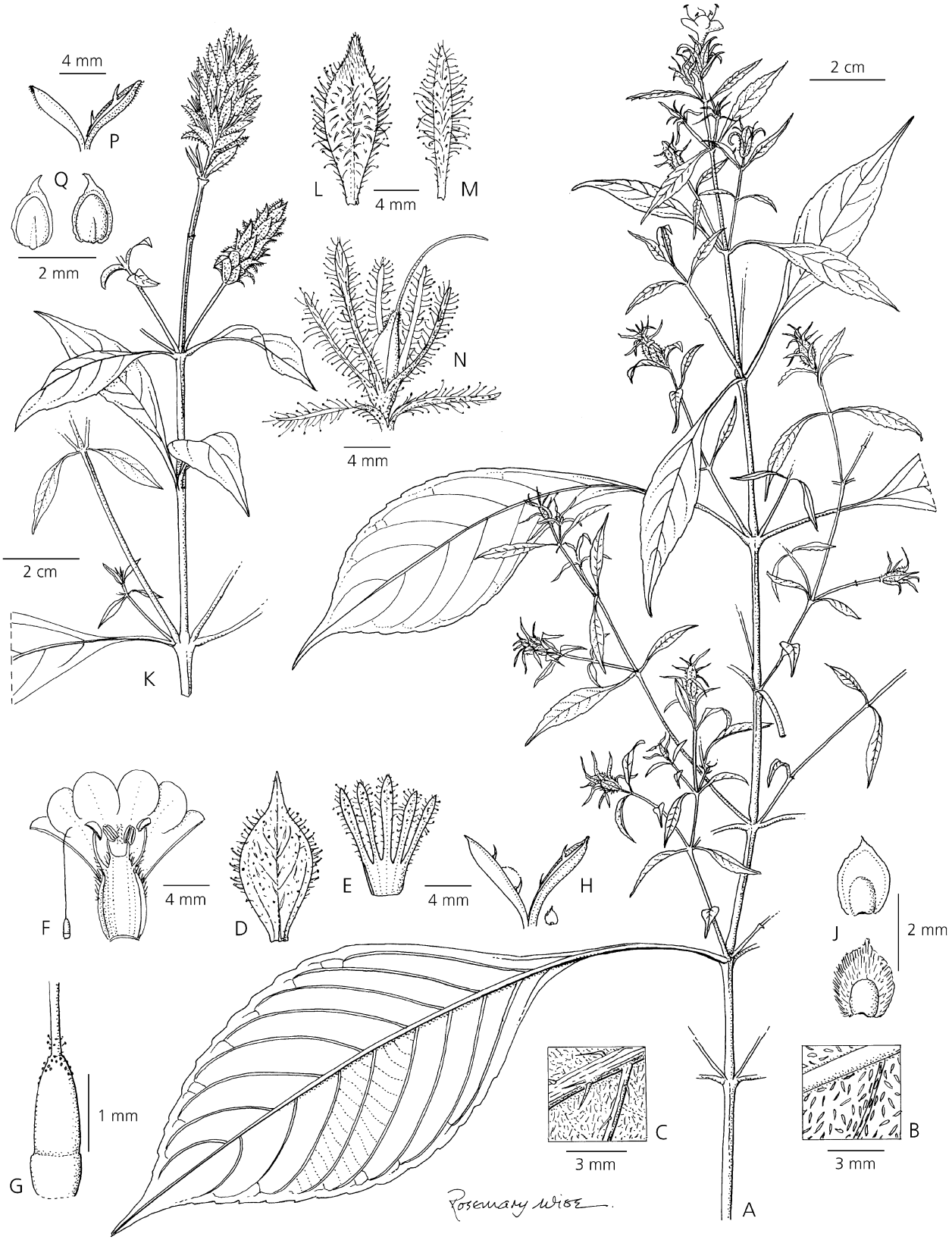


Fig. 4. *Strobilanthes celebica* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract; **E** calyx; **F** corolla opened out to show stamens and style; **G** ovary; **H** capsule; **J** seeds. *Strobilanthes sulawesiana* **K** habit; **L** bract; **M** bracteole; **N** calyx with bracteoles, young fruit and style; **P** capsule; **Q** seed. **A** – **C** from *Chin* 3448, **D** – **J** from *Meijer* 10656, **K** – **Q** from *Kjellberg* 1682. DRAWN BY ROSEMARY WISE.

fuscis brevibus dense indutis (fere sin pilis albis longis), calyce intra fere glabro. Typus: Philippines, Luzon, *Reynoso, Alvarez & Fernando* 4164 (holotypus K).

Isophyllous shrub to 0.5 m high. Stems glabrous, young branchlets reddish. Leaves shortly petiolate; petioles 0 – 5 mm long, glabrous; lamina 5 – 12 × 1.5 – 3.3 cm, oblong-elliptic, acuminate to an obtuse apex, tapered to the base, the margins undulate, paler and slightly scabrid beneath, glabrous and with prominent cystoliths on both surfaces. Inflorescence a small terminal panicle up to 7 cm long; rachis and branches densely pilose with short, glandular hairs; branches trifurcate with 2 – 3 imbricate flower pairs; bracts at inflorescence branching points 15 – 20 × 3 – 4 mm, oblong, tapered at both ends, fuscous, densely pilose with short glandular hairs; floral bracts 10 – 13 × 4 – 5 mm, elliptic to oblong-elliptic, acute and narrowed at both ends, fuscous, densely pilose with short, gland-tipped hairs, ciliate on the margins with a few scattered long, white multicellular setae; bracteoles absent; calyx 8 – 10 mm long, divided into 5 lobes to c. 3 mm above the base, lobes narrowly lanceolate, finely attenuate, shortly glandular-pilose, one lobe c. 2 mm longer than the others, interior surface glabrous or with a few short hairs; corolla c. 2 cm long, white, glabrous outside, straight, the tube 5 – 6 × 2 mm, then expanded to c. 8 mm, 5-lobed, the lobes ovate, obtuse, c. 2.5 mm long; fertile stamens 4, all included, filaments glabrous, the longer pair c. 4 mm long, the shorter pair c. 2 mm long; anthers 2 mm long; pollen prolate, 55 × 35 µm, 3-colporate, pseudocolpate, c. 12-ribbed, the tectum between the pseudocolpi consisting of a coarse irregular reticulum with a punctate tectum between the course reticulum (Plate 1K); style c. 12 mm long, sparsely pilose; ovary pilose. Capsule 11 × 1.75 mm, elliptic in outline, glandular-pilose, 4-seeded; seeds 1.5 × 1 mm, pilose with a small but distinct glabrous areole. Fig. 5.

DISTRIBUTION. On Luzon Island in the Philippines.
PHILIPPINES. Luzon: Zambales Province, Masinloc, Coto Mines, 300 m, 1 Feb. 1992, *Reynoso, Alvarez & Fernando* 4128 (K); ibid., 2 Feb. 1992, 400 m, *Reynoso, Alvarez & Fernando* 4164 (holotype K).
HABITAT. In forest on basic soil; 300 – 400 m.
CONSERVATION STATUS. Data insufficient but clearly very rare and probably Endangered (EN).
NOTE. This species appears to be most closely related to *Strobilanthes schomburgkii* (Craib) J. R. I. Wood from Thailand. It is similar in facies and both species lack bracteoles. However, the inflorescence is clearly terminal and branched although rather small and compact. The bracts are narrowly elliptic rather than ovate, fuscous in colour and covered in an indumentum of short, dense glandular hairs. The long white, multicellular setae which cover the bracts of *S. schomburgkii* are restricted to scattered cilia along the margins in *S. fusca*. The calyx is glabrous inside and the central posterior lobe is noticeably longer than the others. It is the only species, which Bremekamp would have placed in *Sericocalyx* known from the Philippines.

Strobilanthes pusilla *J. R. I. Wood* **sp. nov.** habitu facieque *S. labordei* H. Lév. sed granis pollinis ellipsoideis virgatis, lobis calycis brevioribus (5 – 6 mm longis), pilosis dignoscenda. Typus: Indonesia, Sulawesi, *P. J. Eyma* 3859 (holotypus L).

Prostrate herb rooting at the nodes. Stem weakly quadrangular, sulcate, pubescent. Leaves slightly unequal in each pair, petiolate; petioles 2 – 4 mm long, villous; lamina 7 – 15 × 3 – 9 mm, broadly ovate, acute, at the base broadly cuneate, margins serrate, densely pubescent with long bulbous-based, white hairs on both surfaces. Flowers in few-flowered, terminal leafy head-like spikes, occasionally with a single flower in the axils of the leaves below; outer inflorescence bracts resembling reduced leaves, persistent; floral bracts 4 – 5 × 1 mm long, narrowly oblanceolate, white-pilose; bracteoles linear c. 2.5 mm long, white-pilose; calyx c. 6 mm long, subequally divided to the base, the lobes 5 × 0.5 mm, linear-subspathulate, pilose on both surfaces and margins with bulbous-based white hairs; corolla 2.6 cm long, white with pale lilac lines (*fide* Eyma), pubescent on the exterior; funnel-shaped, the cylindrical basal tube c. 11 mm long, then gradually and symmetrically widened to c. 10 mm at the mouth, lobes c. 3 × 4 mm, ovate, rounded; fertile stamens 4, didynamous, included; filaments straight, thinly pilose, the longer pair c. 4 mm long, the shorter pair c. 1 mm long; anthers oblong, muticous, c. 1 mm long; pollen prolate, c. 65 × 45 µm, pseudocolpate, scalariform (*fide* Terao 1983: 102); ovary pilose, 2-ovulate; style 2 cm long, thinly pilose; capsule not seen. Fig. 6.

DISTRIBUTION. Only known from the type collection from NE Sulawesi.
INDONESIA. Sulawesi: Loewoek between Pinapoeang, Gunong Loloa and Gunong Beabis, Menado, 27 Sept. 1938, *P. J. Eyma* 3859 (L, holotype, duplicates left at BO were probably lost or destroyed in 1945 (Van Steenis 1950: 161)).
HABITAT. No altitude or habitat details are noted.
CONSERVATION STATUS. Insufficient data but only known from the type collection made in 1938 so presumably very rare and probably Endangered (EN).
NOTE. This species recalls *Strobilanthes labordei* H. Lév. from China in facies, creeping habit, leaf shape and indumentum, the form of the inflorescence, the prominent large-celled white inflorescence hairs and the shape and size of the corolla. Indeed it is only clearly distinguished from *S. labordei by* the non-echinulate, prolate pollen and its geographical distribution.

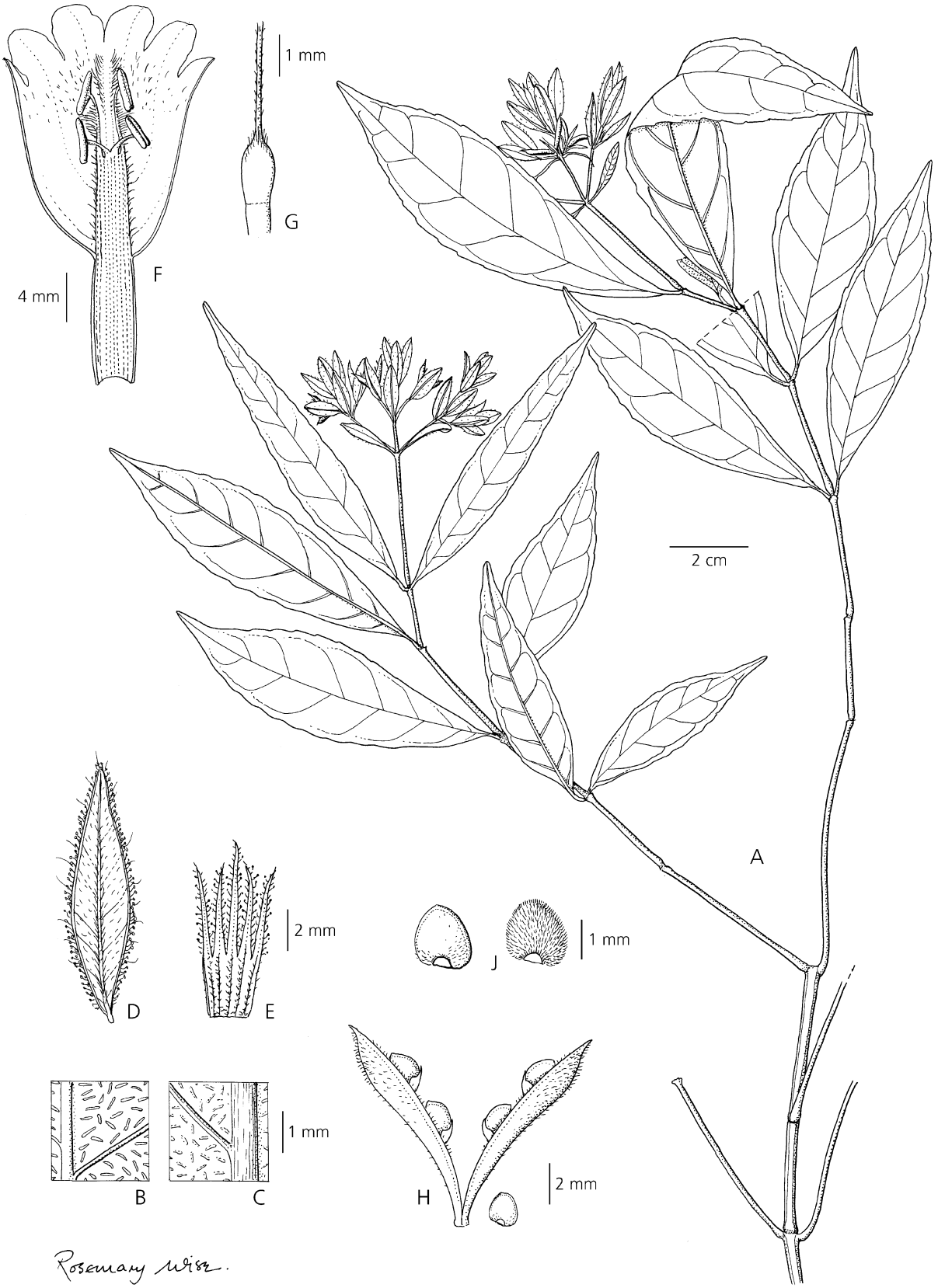


Fig. 5. *Strobilanthes fusca.* **A** habit; **B** adaxial leaf surface; **C** adaxial leaf surface; **D** bract; **E** calyx; **F** corolla opened out; **G** ovary; **H** capsule; **J** seeds. From *Reynoso, Alvarez & Fernando* 4164. DRAWN BY ROSEMARY WISE.

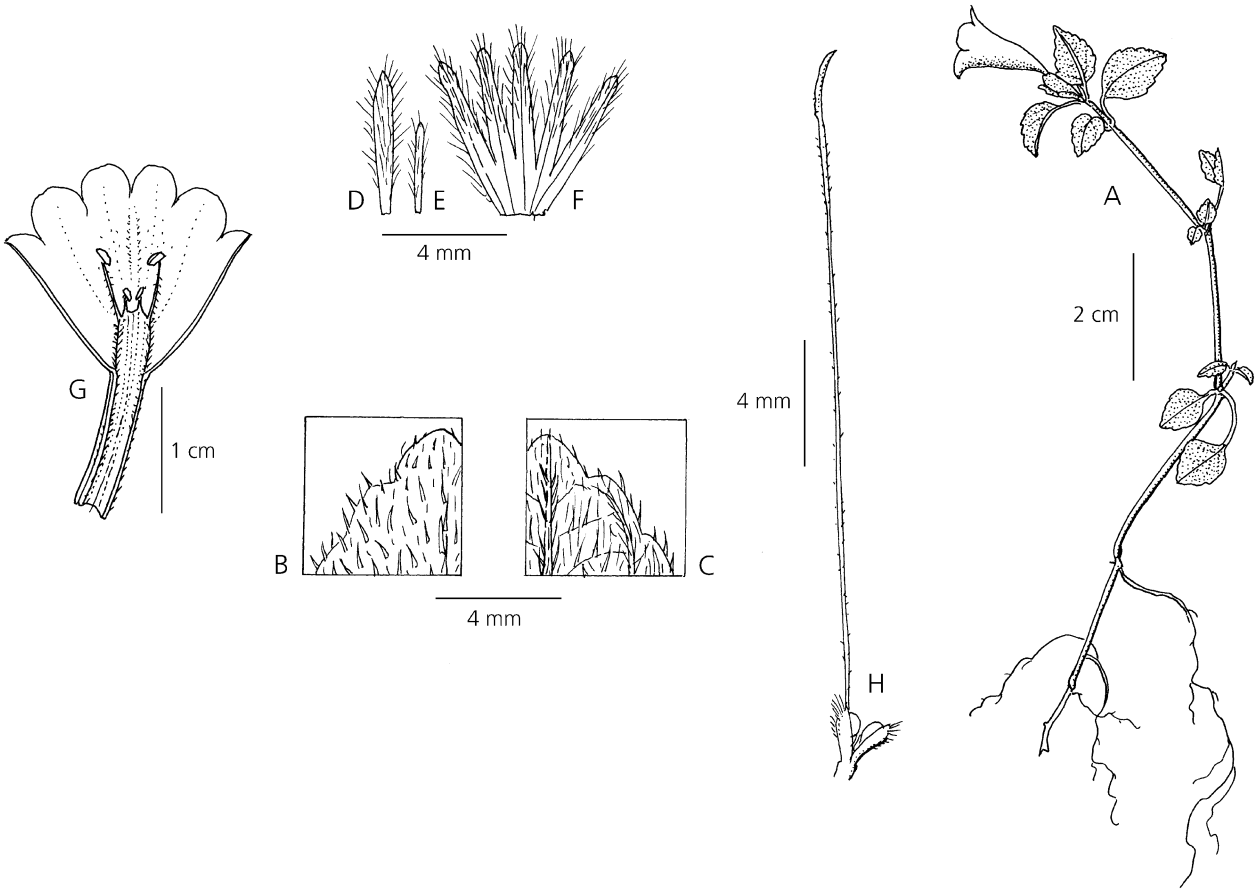


Fig. 6. *Strobilanthes pusilla*. A habit; B adaxial leaf surface; C abaxial leaf surface; D bract; E bracteole; F calyx; G corolla opened out; H ovary and style. From *Eyma* 3859. DRAWN BY ROSEMARY WISE.

Strobilanthes kjellbergii *J. R. I. Wood* **nom. nov.**
Kjellbergia celebica Bremek., *Svensk. Bot. Tidskr.* 42: 387 (1948), non *Strobilanthes celebica* (Bremek.) J. R. I. Wood. Type: Indonesia, Sulawesi, *G. Kjellberg* 4134 (holotype S).

If *Strobilanthes pusilla* recalls *S. labordei* then the resemblance of *S. kjellbergii* to the Chinese *S. tetracantha* (Champ.) Druce is even more striking. It has similar narrowly ovate leaves with abundant cystoliths on the dark upper surface and an undulate to crenate margin. The inflorescence is similar as is the infundibuliform corolla, which likewise reaches 2 cm in length. Even the seeds have similar annulate hairs. However, *S. kjellbergii* is anisophyllous and has prolate, ribbed (pseudocolpate) pollen (*fide* Bremekamp 1948: 387).

DISTRIBUTION. Only known from central Sulawesi.
INDONESIA. Sulawesi: Lake Towuti, Timanpu, 300 m, Aug. 1929, *Kjellberg* 4134 (holotype S).
HABITAT. Growing in forest; 400 m.
CONSERVATION STATUS. Data insufficient but reported as "rare" by Kjellberg in 1929 and not collected since so presumably Endangered (EN).

NOTE. Both *Strobilanthes kjellbergii* and *S. pusilla* have many features in common but appear to be quite distinct. *S. kjellbergii* has nearly glabrous, narrowly ovate leaves up to 6.5 cm long and a calyx with linear lobes 9 – 11 mm long. *S. pusilla*, in contrast, has densely pubescent, broadly ovate leaves up to 1.5 cm with short, subspathulate calyx lobes only 5 mm in length. Both are slender herbs superficially similar to species placed in *Hemigraphis* Nees and *Championella* Hance, but differ from the former in having only two ovules in each ovary cell, so the capsule is 4-seeded, and from the latter in having prolate pollen without spines. Both species come from Sulawesi in Indonesia and are only known from the type collections, on which there is a single corolla and no obvious buds. Our comments on pollen are therefore based on the observations of Bremekamp (1948: 387) and Terao (1983: 102).

Strobilanthes pusilla and *S. kjellbergii* are not the only two species of *Strobilanthes*, which are difficult to distinguish from morphologically near identical species except by their pollen. Other examples are *S. involucrata* Blume and *S. warburgii* Terao ex J. R. Benn. from Java (Bennett & Scotland 2003), *S. tashiroi*

Hayata and *S. flexicaulis* Hayata from Taiwan and the Ryukyu Islands, and *S. mogokensis* Lace and *S. decipiens* J. R. I. Wood from India and Burma (Wood & Scotland 2003a). Careful examination of pollen may reveal other overlooked species in the future.

Strobilanthes barisanensis (*Bremek.*) *J. R. I. Wood* **comb. nov.**

Paragoldfussia barisanensis Bremek., *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect.* 2, 41 (1): 212 (1944). Type: Indonesia, Sumatra, *Bünnemeyer* 3860 (holotype L).

Paragoldfussia caroënsis Bremek. (1944: 212) **synon. nov.** Type: Indonesia, Sumatra, *Loerzing* 5961 (holotype L).

Superficially similar to the widespread and variable *Strobilanthes echinata* Nees, which also occurs in Sumatra, *S. barisanensis* can be distinguished by the muticous anthers, in which the anther connective is not extended into a point. Additionally the bracts are entire and glabrous to very sparsely pubescent whereas in *S. echinata* they are usually crenate and roughly hirsute. Fig. 7A – H.

DISTRIBUTION. Indonesia: northern Sumatra. Map 2.

INDONESIA. Sumatra: Toba, 1916 – 17, *Hagerup* s.n. (C); without precise locality, *H. S. Yates* 1406 (BM); "East Coast", *H. S. Yates* 1921 (US); Gunong Malintang, 1250 m, 22 July 1918, *Bünnemeyer* 3860 (holotype L); Berastagi, 1450 m, 28 Aug. 1918, *Lörzing* 5961 (L); 10 Feb. 1921, *Ridley* s.n. (K); ibid, 1600 m, 15 June 1923, *H. S. Yates* 688 (K, MICH); ibid., 1450 m, 3 April, 1925, *H. S. Yates* 1406 (UC); ibid., Dec. 1930, *Symington* 23986 (KEP); Karo, Deleng Singkoet, 8 June 1928, *C. Hamel & Rahmat Si Toroes* 519 (MICH); Vulkan Pintau, 11 Nov. 1929, *E. S. Nielsen* 1235 (C); Aceh, Boer ni Limtang, 1800 m, Feb 1935, *Van Steenis* 6329 (K, ?L, n.v.); Aceh, Gunung Leuser Nature Reserve, c. 15 km W of Kutacane, Upper Mamas R. Valley, 1500 m, 22 June 1979, *de Wilde & de Wilde-Duyfjes* 18577 (KLU); ibid., 1400 m, 27 June 1979, *de Wilde & de Wilde-Duyfjes* 18577 (KLU).

HABITAT. Locally frequent in mountains.

CONSERVATION STATUS. Insufficient data but probably Least Concern (LC).

NOTE. *Strobilanthes barisanensis* is closest to the little-known Khasi endemic, *S. glabrata* Nees from Eastern India (Fig. 7J – P). The differences between the two species are shown in Fig. 7. All specimens we have seen of *S. glabrata* except *G. Mann* 845 (K) lack corollas but this specimen shows that the anthers are apiculate. The bracts, bracteoles and calyx lobes are all glabrous and more acuminate than in *S. barisanensis* and the heads are distinctly narrower, rarely exceeding 1 cm in width.

Widespread Continental Species

The two following species are widely distributed in continental Asia, *Strobilanthes cruciata* extending also to Sumatra.

Strobilanthes tomentosa (*Nees*) *J. R. I. Wood* **comb. nov.**

Aechmanthera tomentosa Nees in Wallich, *Plantae Asiaticae Rariores* 3: 87 (1832). Type: India, Kumaon, *Blinkworth* in *Wallich* 2333b (lectotype K-W, **chosen here**).

Aechmanthera wallichii Nees (1847: 170), *nom. illeg. superfl.* var. α *tomentosa*. Type as for *Aechmanthera tomentosa*.

Ruellia gossypina Wall. (1830: 38). Type: Nepal, Rio Rapti, *Wallich* 2332a (lectotype K-W, **selected here**), non *Strobilanthes gossypina* T. Anderson (1867).

Aechmanthera gossypina (Wall.) Nees (1832: 87).

Aechmanthera wallichii Nees, *nom. illeg. superfl.* var. β *gossypina* (Wall.) Nees subvar. β ** *fomentaria* Nees (1847: 170). Type as for *Ruellia gossypina* Wall.

Aechmanthera wallichii Nees var. β *gossypina* (Wall.) Nees subvar. β * *leuconeura* Nees (1847: 170). Type: Specimen probably from India annotated *Ruellia leuconeuron, Royle* s.n. (LIV, n.v.).

Aechmanthera tomentosa var. *wallichii* C. B. Clarke (1884: 428). Type: as for *Ruellia gossypina* Wall.

Aechmanthera leiosperma C. B. Clarke (1884: 429). Type: India, Meghalaya (Mungot, Jaintea), *C. B. Clarke* 14825 (lectotype K, **chosen here**).

Strobilanthes bodinieri H. Lév. (1913: 19). Type: China, Guizhou, *Martin* in *Bodinier* 1931 (holotype E).

Strobilanthes blinii H. Lév. (1913: 19). Types: China, Guizhou, *Cavalerie* 2685 and *Esquirol* 767 (syntypes E).

Strobilanthes cavaleriei H. Lév. (1913: 18), *pro parte. quoad Cavalarie* 3621 (E).

Aechmanthera claudiae Bernardi (1963: 243). Type: Nepal, *Zimmermann* 2064 (holotype G, n.v., isotype K).

Aechmanthera was created by Nees (1832: 87) to accommodate a small group of species related to *Strobilanthes* but distinguished by having apiculate anthers and an 8-seeded capsule. Both these characters are somewhat variable. The mucro of the apiculate anthers is formed by an extension of the anther connective (Fig. 8G) but, as in another common species of *Strobilanthes* with this character, *S. echinata* (Bennett *et al.* 2008), the degree of extension is very variable so that the anthers sometimes appear muticous (Clark 1884: 428 – 9), although we have not noticed this in any of the specimens we have examined. The number of seeds is commonly 6 – 8 (Fig. 8J) and we have not seen specimens with only four seeds. All species placed by Nees, Clarke and Bernardi in *Aechmanthera* are here considered to belong to a single species, *Strobilanthes tomentosa*. Fig. 8.

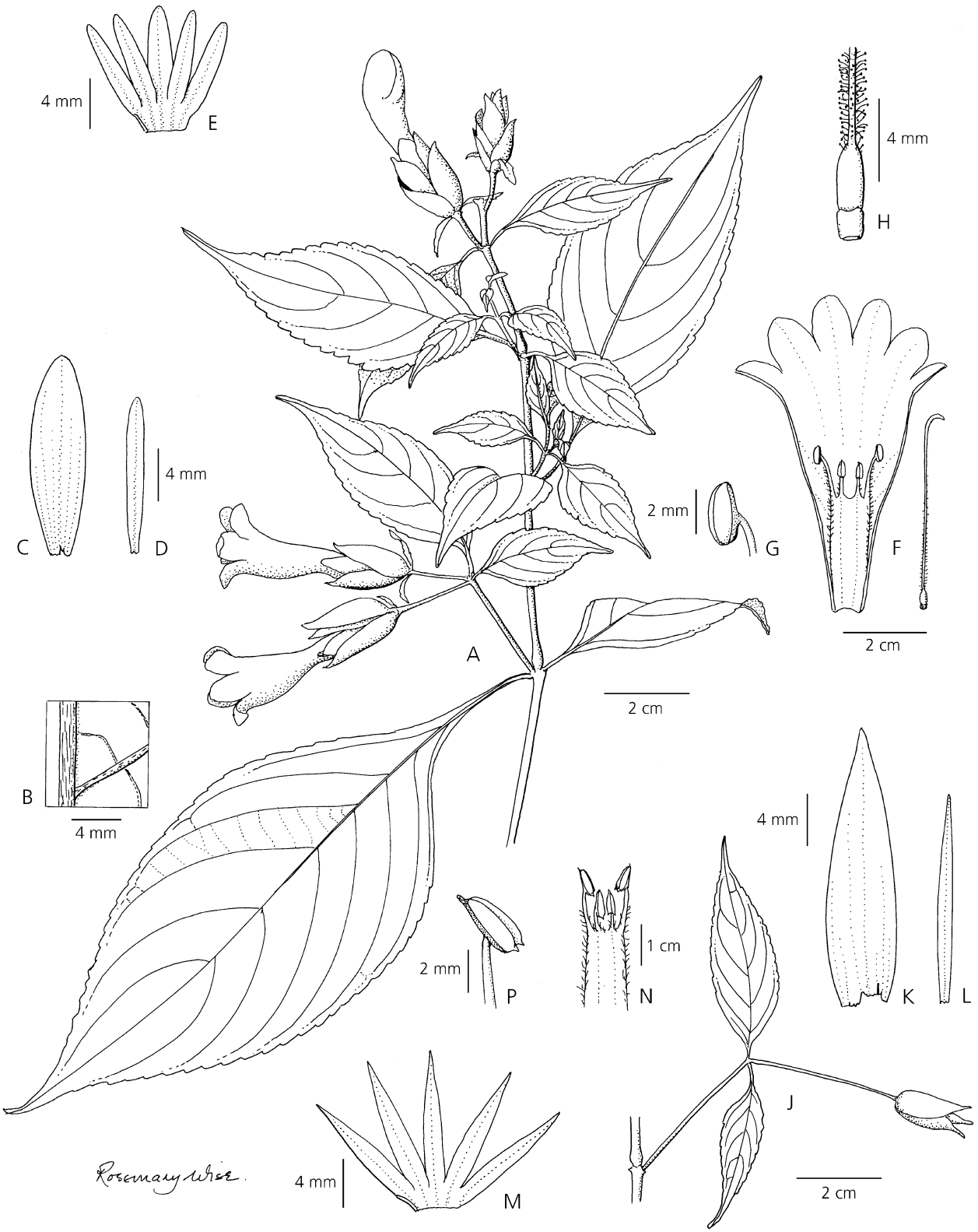
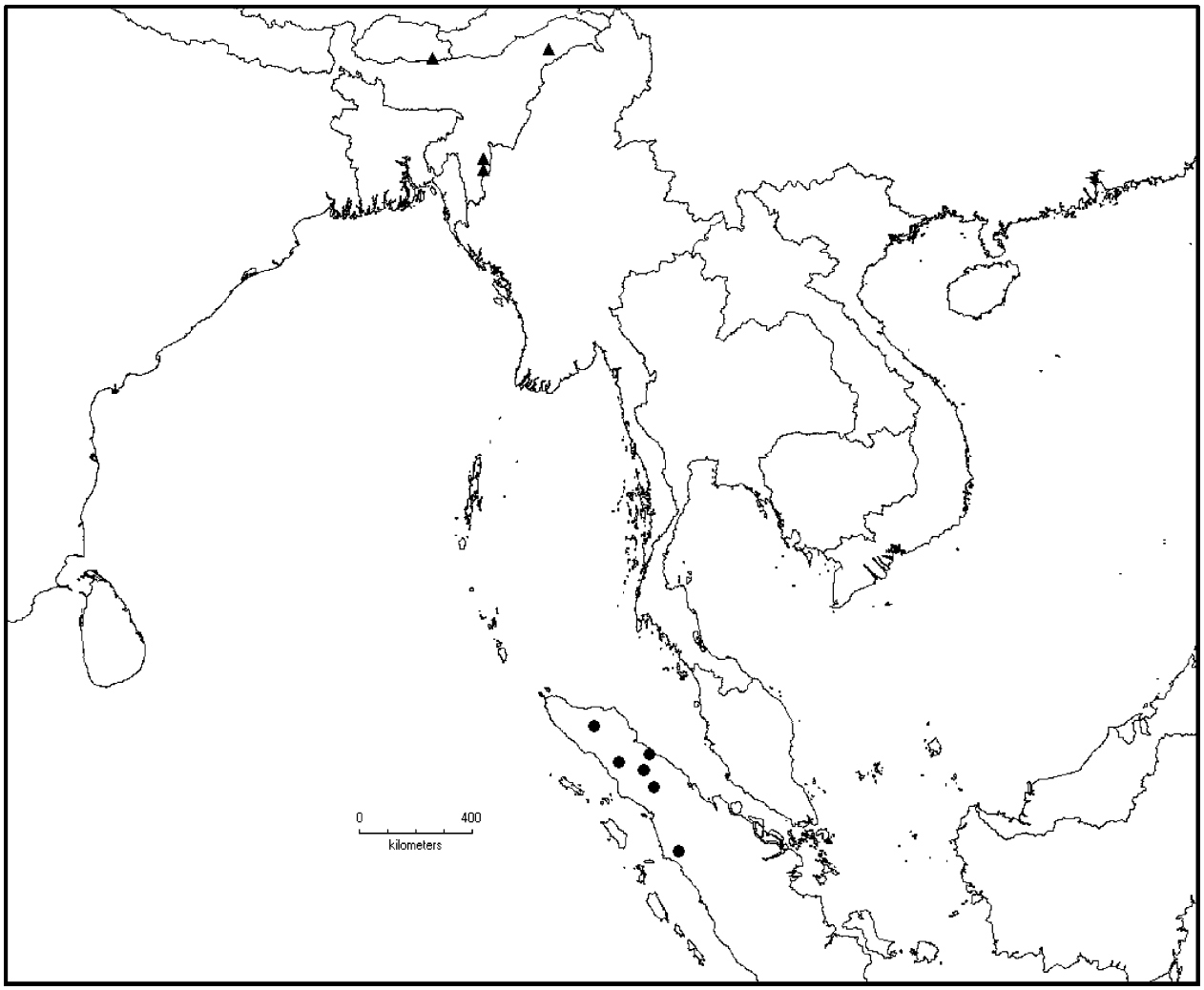


Fig. 7. *Strobilanthes barisanensis* **A** habit; **B** abaxial leaf surface; **C** bract; **D** bracteole; **E** calyx; **F** corolla opened out to show stamens; **G** anther; **H** ovary. *Strobilanthes glabrata* **J** habit; **K** bract; **L** bracteole; **M** calyx; **N** androecium; **P** anther. **A** – **B** from *Nielsen* 1235, **C** – **H** from *Yates* 1406, **J**, **N** – **P** from *Mann* 845, **K** – **M** from *Griffiths* 6097. DRAWN BY ROSEMARY WISE.



Map 2. Distribution of *Strobilanthes barisanensis* (●) and *S. simonsii* (▲).

The oldest name for this species is *Ruellia gossypina* Wall. (1830) but this cannot be transferred to *Strobilanthes* because of the existence of *S. gossypina* T. Anderson (1867). The combination *S. tomentosa* is thus based on the second oldest name *Aechmanthera tomentosa* Nees (1832).

Nees (1847) and Clarke (1884) created great nomenclatural confusion with this species. In order to treat the plants he had regarded as two separate species (*Aechmanthera tomentosa* and *A. gossypina*) in 1832, Nees (1847: 170 – 171) redescribed them as a single species under the name *A. wallichii* Nees. This name is superfluous and so illegitimate as it is based on the type of *Ruellia gossypina* Wall. The type variety is in fact var. β *gossypina,* which was divided into two subvarieties: β* *leuconeura* and β** *fomentaria,* the latter corresponding to the type subvariety as the original syntypes of *R. gossypina* were all cited under it. Subsequently Clarke (1884: 428) added to the confusion by incorrectly treating this species as *A. tomentosa* (the epithet *gossypina* is valid within *Aechmanthera*), treating the form with the white-woolly stems originally described as *R. gossypina* as var. *wallichii.*

DISTRIBUTION. A widespread species extending from northern India along the Himalayas through Nepal, Bhutan and Burma (principally Shan area) to China and Laos. Map 3.

SELECTED SPECIMENS EXAMINED. PAKISTAN. Punjab: Masrund, Chamba, 21 June 1916, *R. R. Stewart* 2318 (K); Karnal, 1885, *Drummond* 23614 (K). **INDIA.** Kashmir: Sradabad, Oct. 1880, *Young* s.n. (BM); Mila, Lahul, 1900 m, 1941, *Bor* 15841 (K). Himachal Pradesh, Sabathu, 11 Oct. 1831, *Lady Dalhousie* s.n. (K). Uttaranchal: Kumaon, *Blinkworth* in *Wallich* 2333b (lectotype K-W); ibid., 1200 m, *Strachey & Winterbottom* s.n. (K); Sahanidara, Dehra Dun, 950 m, Oct. 1890, *J. S. Gamble* 22304 (K). Bihar: 2 – 3 km E of Neterhat, 10 Nov. 1983, *van der Maesen* 5021 (K). West Bengal (Darjeeling Distr.): Rangit, 650 m, 13 Oct. 1869, *Clarke* 9449 (BM). Arunachal Pradesh: Dirang Dzong, 6 Sept.

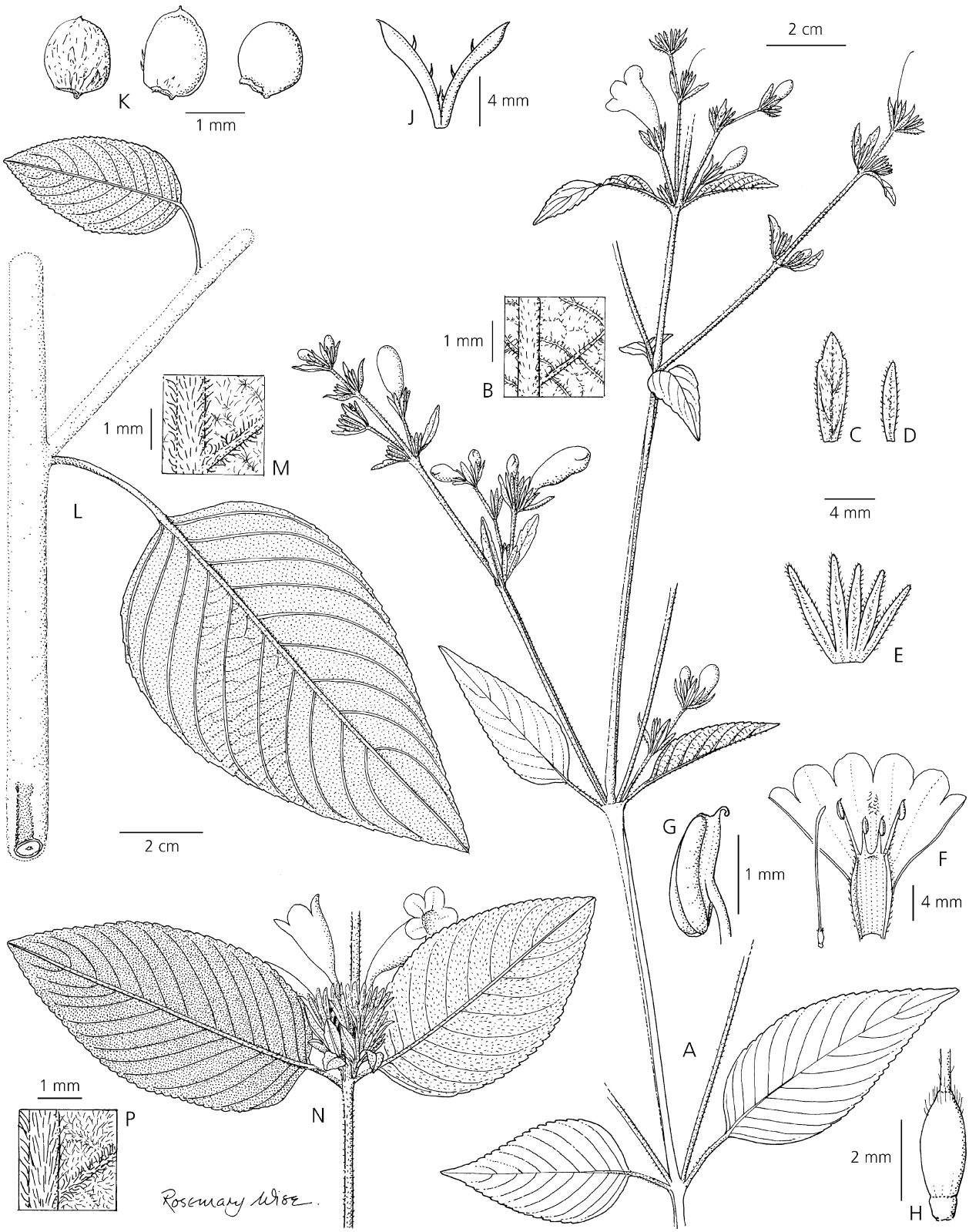
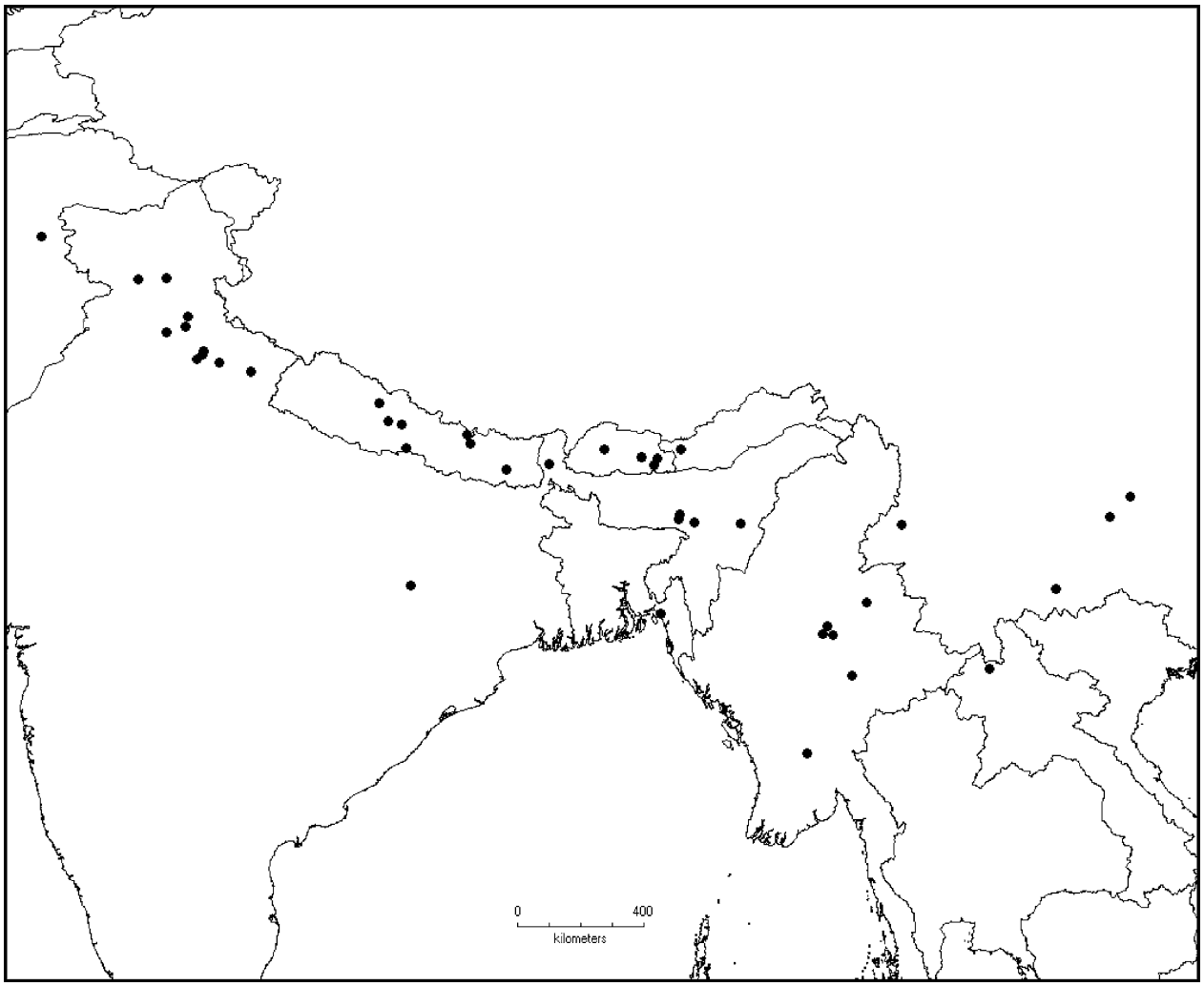


Fig. 8. *Strobilanthes tomentosa* **A** habit; **B** abaxial leaf surface; **C** bract; **D** bracteole; **E** calyx; **F** corolla opened out to show stamens and style; **G** anther; **H** ovary; **J** capsule; **K** seeds showing caducous hairs; **L** portion of stem showing floccose indumentum of "*Aechmanthera gossypina*"; **M** abaxial leaf surface; **N** compact axillary inflorescence of "*Aechmanthera claudiae*"; **P** abaxial leaf surface. **A** – **H** from *Parkinson* 11217, **J** from *Lace* 5294, **K** from *Clarke* 41983, **L** – **M** from Gamble 22304; **N** – **P** from Schilling 2117. DRAWN BY ROSEMARY WISE.



Map 3. Distribution of *Strobilanthes tomentosa* (●).

1938, *Kingdon Ward* 14204 (BM); near Beting, Nyam Jang Chu, 2300 m, 5 Nov. 1938, *Ludlow, Sherriff & Taylor* 7080. Meghalaya: Jowye, Jaintea Hills, 1250 m, 16 Oct. 1867, *Clarke* 6004 (K); Nurtiring, Jaintea Hills, 1250 m, 1 Dec. 1871, *C. B. Clarke* 14576 (K); Mungot, Jaintea Hills, 900 m, 29 Nov. 1871, *C. B. Clarke* 14825 (K). Manipur: Karong, 1250 m, 14 Nov. 1885, *C. B. Clarke* 41983 (K, BM). **NEPAL**. Pokhara, 1200 m, 15 Aug. 1954, *Stainton, Sykes & Williams* 6895 (BM, E); Dudh Kosi [27°30'N, 86°48'E], 2000 m, 25 Oct. 1969, *Stainton* 6605 (BM); Marsyandi Valley, Jogat-Bahundara, 1 Nov. 1969, *Wraber* 36835 (BM); Boti, Kosi Valley, 1250 m, 15 Oct. 1975, *Schilling* 2117 (K); Manebhangjyang to Sun Kosi, 1580 m, 5 Nov. 1954, *Zimmermann* 2064 (G, K); Khebang- Bharomdin, 24 Nov. 1963, *Hara et al.* 6304739 (BM). **BHUTAN**. Kuru Chu Valley, 25 Aug. 1915, *Cooper* 4572 (BM); Punakha, between Chuzomsa and Samtengang, 1300 m, 2 Oct. 1987, *J. R. I. Wood* 5900 (E); Lhuntse Dzong, 1300 m, *Ludlow & Sherriff* 18729 (BM); Mongar, 1300 m, 24 Oct. 1990, *J. R. I. Wood* 7362 (E); Tashigang, 1300 m, 15 Oct. 1934, *Ludlow & Sherriff* 1061 (BM). **BANGLADESH**. Sitikund, Chittagong region, 13 July 1857, *Hooker & Thomson* s.n. (K). **BURMA**. Maymyo, 1150 m, 25 June 1911, *Lace* 5294 (K); ibid., Hsun Hsai, 1100 m, 11 Sept. 1931, *Parkinson* 11217 (K). **CHINA**. Yunnan: E of Gaoligong Shan, Longyang Qu, Mangkuan Xiang, Baihualing Cun, Dajie Shan, 1525 m, 10 Sept. 2003, *Gaoligong Shan Biodiversity Survey* 19080 (CAS). Guizhou: Near Man Cuo Cho, Oct. 1915, *O. Schoch* 402 (K); also Guangxi *fide* Hu (2002: 88 – 89).

HABITAT. An annually flowering undershrub of relatively dry Himalayan valleys with a similar distribution to that of *Strobilanthes lamiifolia* (Nees) T. Anderson, with which it sometimes grows (Deng *et al.* 2006: 376). Its distribution is also similar to that of *S. auriculata* Nees and, like it, *S. tomentosa* occurs south of the Ganges in Bihar (Wood & Scotland 2003a: 93); 650 – 2300 m.

CONSERVATION STATUS. Widespread and often abundant. Least Concern (LC).

PHENOLOGY. Flowers from June to December throughout its range.

NOTES. *Strobilanthes tomentosa* is very variable. The stems of sterile shoots of plants from widely scattered localities in India, Nepal, China and Burma are sometimes covered in a soft, thick, white felt (Fig. 8L), which is the character on which *Aechmanthera gossypina* was based. This appears to be a development stage as it is mostly absent from flowering shoots, at least from the inflorescence itself. It is only matched elsewhere in *Strobilanthes* in the reddish felted indumentum found in *S. rufescens* (Roth) T. Anderson, a species which has a very similar pollen to that of *S. tomentosa* (Plate 1A) (Wood & Scotland 2003a: 84, 124) but which otherwise appears to be unrelated. This is a further example of the homoplasy discussed at the beginning of this paper.

The inflorescence is also very variable. Although it is essentially spicate, the flowers are characteristically clustered towards the apex and the spicate structure is not obvious. In all specimens seen from Burma, China, Laos and south of the Himalayas in Bihar and Meghalaya in India, the spikes are aggregated to form an open lax panicle (Fig. 8A). However in some Himalayan specimens, most notably in *Zimmermann* 2064, the type of *Aechmanthera claudiae,* the inflorescence appears axillary with the spikes reduced to dense axillary thyrses (Fig. 8N). Locally there is some geographical patterning to inflorescence variation. Wood (2001: 1254) commented on how plants from western Bhutan tended to have narrowly ovate leaves combined with a lax, open, paniculate inflorescence whereas those from Eastern Bhutan tended to have broadly ovate leaves with axillary inflorescences formed of dense thyrses of flowers, similar to those of *Zimmermann* 2064.

Another variable element is in the seed coating. Essentially the seed is covered in adpressed mucilagineous hairs and appears glabrous unless wetted. In the specimens Clarke assigned to *Aechmanthera leiosperma*, the seeds appear to be glabrous. However careful examination of the seeds (Fig. 8K) shows that hairs are present on some seeds but are partially to completely caducous leaving extensive "bald patches" which may extend to cover the whole surface of the seed. Caducous hairs on the seeds have also been noted in *Strobilanthes affinis* and formed the basis for Bremekamp's genus *Tarphochlamys*. In any case, as both Clarke (1884: 429) and Bremekamp (1944: 149) noted, if the seeds were truly glabrous these plants would have to be accommodated in a separate genus. *A. leiosperma* is otherwise indistinguishable from typical *S. tomentosa*.

Strobilanthes cruciata (*Bremek.*) *Terao* (1980: 59).

Tetragoga cruciata Bremek. (1944: 300). Type: Indonesia, Sumatra, *Lörzing* 5668 (holotype L; isotypes A, SING).

Tetragoga nagaënsis Bremek. (1944: 299). Type: India, Nagaland, *Meebold* 4891 (holotype B) **synon. nov.**

Tetragoga esquirolii sensu Hu (2002: 191), non E. Hossain (1973: 410).

Strobilanthes cruciata has the apiculate anthers of the majority of species apparently related to the widespread *S. echinata*, but is very distinct because of its inflorescence. The petioles of the bracts are widened and form a tight involucre around the flower heads, the lamina spreading at right angles from the capitula forming a "cross" from which the epithet *cruciata* is derived. The pollen is also rather different as there is no scalariform patterning (Plate 1D). Scalariform patterning is absent in other species including *S. filiformis* Blume (Bennett & Scotland: 2003: 11), but the ridges of sexine are particularly prominent and widely spaced in *S. cruciata*. The presence of silky hairs on the inside of the calyx is another unusual character of this species, elsewhere found mainly in the yellow-flowered species placed by Bremekamp in *Sericocalyx*. The inflorescence of most specimens is covered in rough brown hairs, which extend onto the leaves, but one collection (*Liang* 61705) from Hainan Island is rather different in facies as the whole plant is nearly glabrous. Careful examination shows that there are a few brown hairs on the bract petioles and it remains uncertain whether this rather distinct variant deserves formal recognition. Fig. 9.

DISTRIBUTION. Sumatra, NE India, south China, north Burma, Thailand and south Vietnam. Map 4.

INDIA. state unknown, Hinje No. 1 Camp, 550 m, 30 March 1921, *Russell* 1909 (K, CAL). Nagaland: Narum Naga Hills, 1500 m, *Meebold* 4891 (B). **BURMA**. Kachin: Fort Hertz (Putau), Hkamti Plain, 375 m, 19 Dec. 1930, *Kingdon Ward* 9052 (BM); Tisang Valley, E of Mali Hka [27°30'N], 450 – 800 m, 2 July 1937, *Kingdon Ward* 12873 (BM). **THAILAND**. Chumphon: Ban Racha Krude [9°48'N, 98°42'E], 150 – 200 m, 6 July 1992, *Larsen et al.* 43165 (C). Nan: Doi Phu Kha, c. 70 km NE of Nan [19°25'N, 101°10'E], 1700 m, 28 July 1992, *Larsen et al.* 43704 (C).**VIETNAM**. Upper Douaï Province, near Sapoum, S of Blau Agricultural Station, 1000 – 1200 m, 23 Feb. 1933, *Poilane* 22109 (P). **INDONESIA**. Sumatra: Sibolangit, between Bandar Baroe and Dolok Boros Estate, 900 m, 1 May 1918, *Lörzing* 5668 (holotype L; isotypes A, SING). **CHINA**. Hainan: Seven Finger Mountain, 30 April 1932, *H. Y. Liang* 61705 (E, K, NY). Yunnan: 52 km from Xiao Meng Yung towards Menglun, *Sino-American Exped. to Yunnan* 0213 (KUN); Lafu, Menglian, *Expedition to Menglian* 9722 (KUN).

HABITAT. Widespread but apparently very scattered, occurring in moist hill forest; 150 – 1700 m.

CONSERVATION STATUS. Data Deficient (DD). Very widespread but rarely collected.

NOTES. The distribution of *Strobilanthes cruciata* is remarkable (Map 4). It is known from six countries

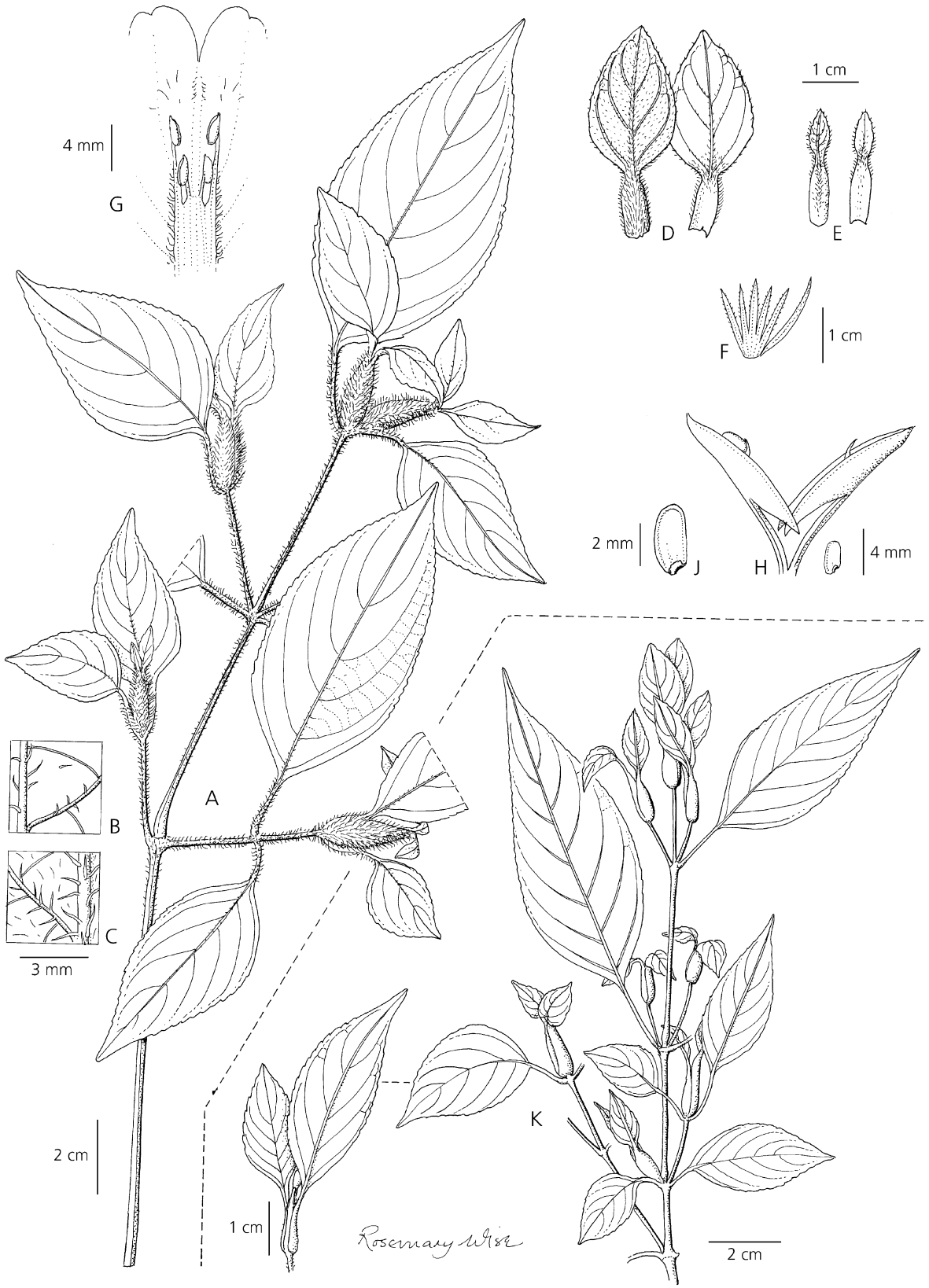
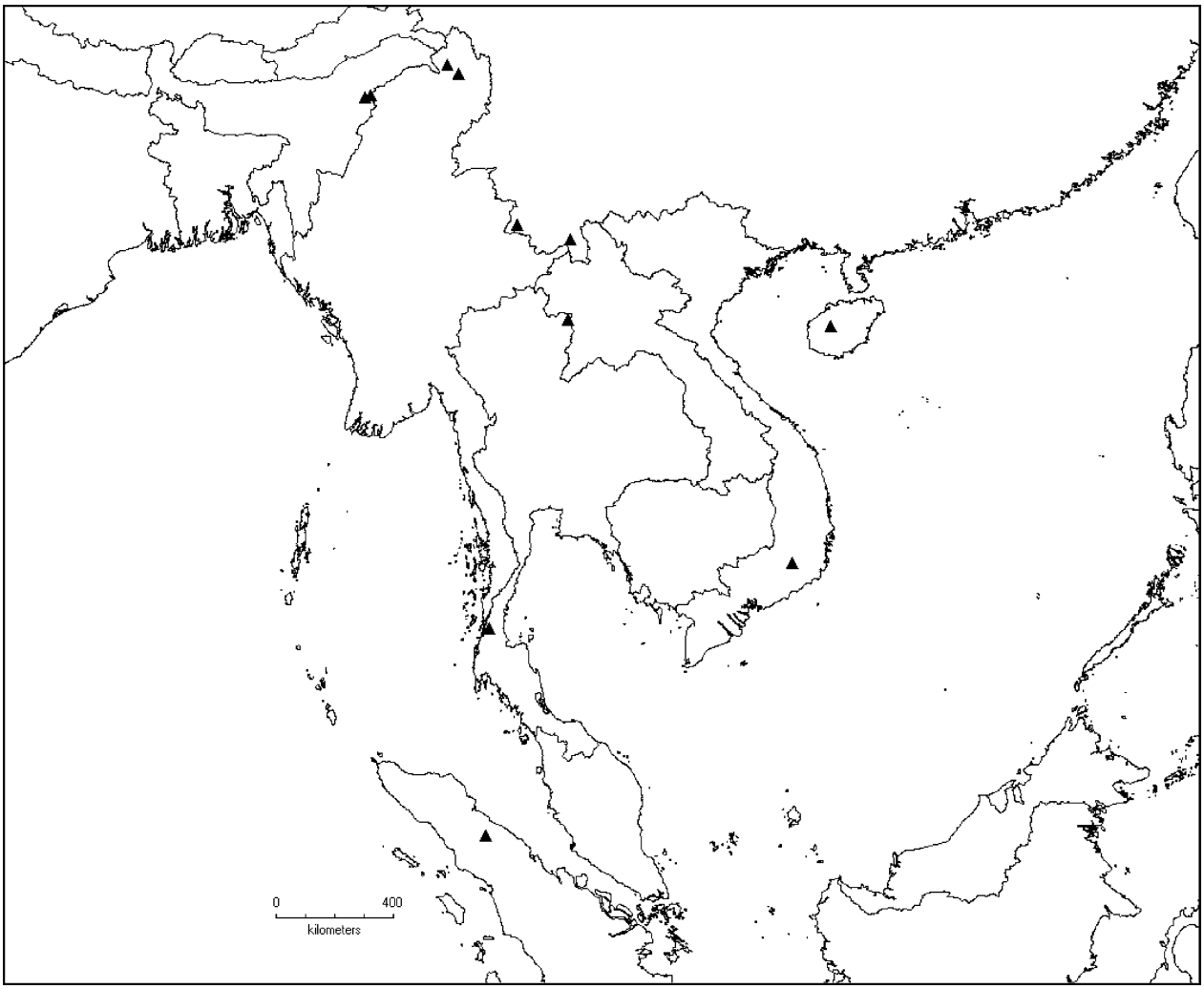


Fig. 9. *Strobilanthes cruciata* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** outer bracts; **E** inner bracts; **F** calyx and bracteole; **G** corolla opened out to show stamens; **H** capsule; **J** seed; **K** habit of near glabrous form. **A** – **C** from *Larsen et al.* 43704, **D** – **F** from *Lörzing* 5668, **G** – **J** from *Kingdon Ward* 12873; **K** from *Liang* 61705. DRAWN BY ROSEMARY WISE.



Map 4. Distribution of *Strobilanthes cruciata* (▲).

but only 11 collections. The localities where it has been found are widely scattered but extend over a large part of tropical east Asia. There is no hint in the collector's notes that it is plietesial but its wide distribution and apparent rarity suggest that it probably is. However, this general distribution pattern is similar to that of two widespread species, *S. atropurpurea* and *S. echinata* Nees (Bennett *et al.* 2008) both of which also occur in Sumatra and over an extensive area of continental Asia from India to eastern China.

Indian Species

Strobilanthes simonsii *T. Anderson* (1867: 474). Type: Bhutan, Deothang ("Dewangari"), *Simons* s.n. (lectotype K, **chosen here**).

This little-known species is probably the closest to *Strobilanthes cruciata*. It is the only other species with widened petiole bases although these do not form a tight involucre around the flower heads in the same way. The white, glabrous corolla, the distinctly falcate leaves and the outer bracts with a clearly demarcated, petiolate, basal portion and long-caudate, falcate upper portion serve to identify this species. Fig. 10.

DISTRIBUTION AND HABITAT. Known from a few, widely scattered localities in Bhutan, NE India and SW China (Tibet/Xixang), it is said to be gregarious in evergreen hill forest. It is probably plietesial and may well be a good deal more common than the few records suggest (Map 2). The record from Tibet indicates that it is one of several species from relatively low altitudes on the southern Himalayan slopes which penetrate along deep Himalayan valleys into Tibet. Other species showing a similar pattern include *Strobilanthes cuneata* (Shakya) J. R. I. Wood and *S. pentstemonoides* (Nees) T. Anderson from Nepal and *S. urophylla* (Nees) Nees and *S. paniculiformis* J. R. I. Wood from

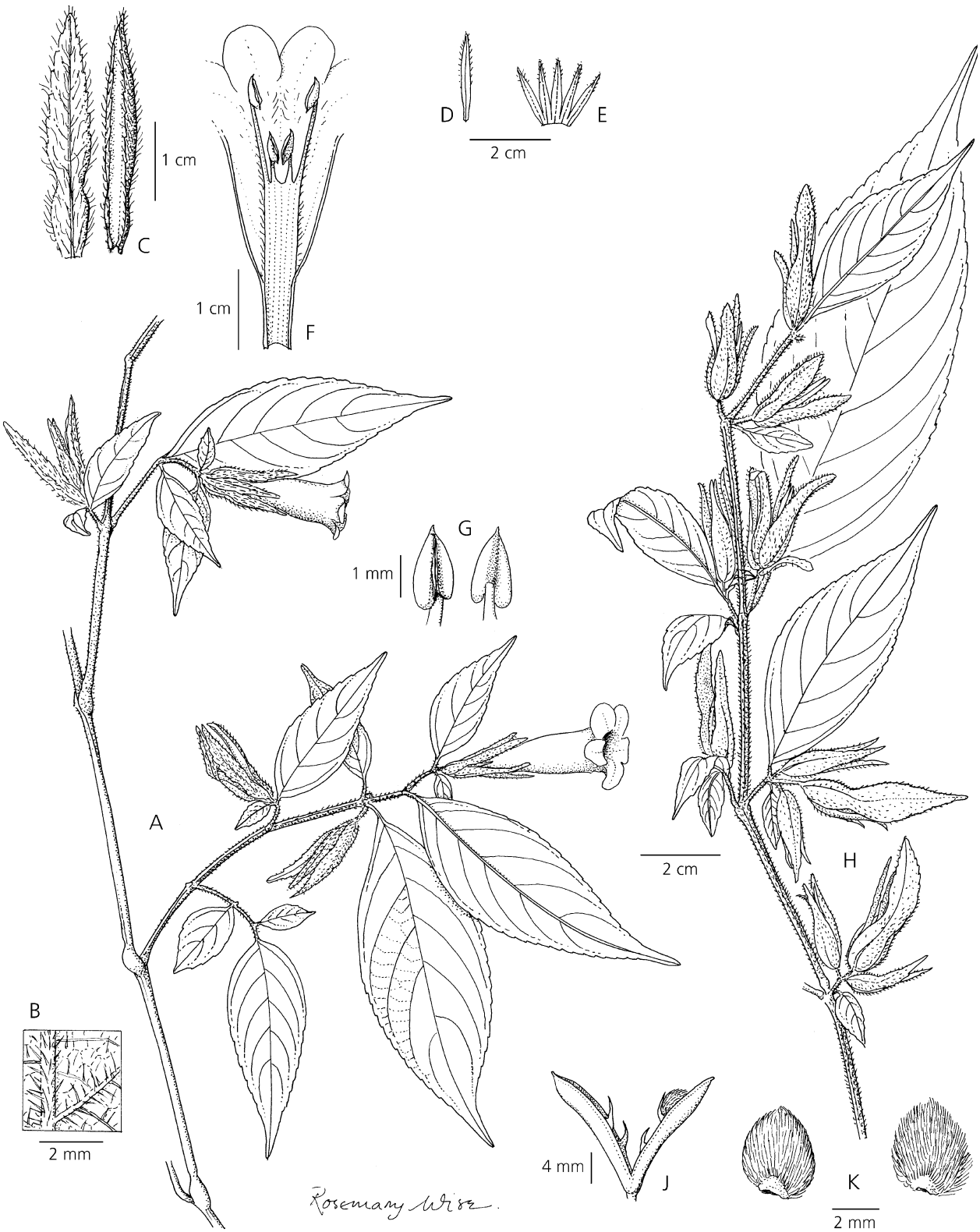


Fig. 10. *Strobilanthes simonsii* **A** habit in flower; **B** abaxial leaf surface; **C** bracts, outer and inner surfaces; **D** bracteole; **E** calyx; **F** corolla opened out to show stamens; **G** anthers; **H** habit in fruit; **J** capsule; **K** seeds. From *A. W. Parry* 203. DRAWN BY ROSEMARY WISE.

further east. Records from Burma (Kurz 1877: 244, repeated in Kres *et al.* 2002: 134) are almost certainly errors for *S. capitata* (Nees) T. Anderson, which is common in Martaban. Kurz's description states that his plant has blue flowers and this character serves to separate these records from true *S. simonsii*.

BHUTAN. Deothang ("Dewangari"), *Simons* (holotype K). **CHINA**. Xixang (Tibet): Medog, Beibeng Qu, Geilin, Ni Legu, Shang Yuan, 1700 m, 24 May 1983, *Li Bosheng, Cheng Shuzhi & Ni Zhicheng* 03773 (PE). **INDIA**. Arunachal Pradesh: Namrup, Patkai Hills, *W. Griffith* 249 (BM, CAL). Mizoram: Tuisen, 1300 m, April 1927, *A. D. Parry* 203 (K); South Lushai, 1450 m, Aug. 1930, *M. L. Wenger* 311 (K).

CONSERVATION STATUS. Data Deficient (DD) but clearly threatened by habitat destruction.

Strobilanthes parvifolia *J. R. I. Wood* **sp. nov.** inflorescentia paniculata, glandulosa, floribus paribus oppositis dispositis, corolla glabra, bracteolis parvis, caducis primo adspectu *S. mastersii* T. Anderson simulans sed inflorescentia foliosa, foliis subintegris granis pollinis globosis ab ea recedens et ad *S. candidam* J. R. I. Wood tangens, a qua inflorescentia paniculata, glandulosa statim dignoscenda. Typus: India, Arunachal Pradesh, *F. Kingdon Ward* 8718 (2 sheets) (holotypus K).

Anisophyllous perennial herb of unknown height. Stems geniculate below, somewhat sulcate and with distinct, small parallel ridges, glabrous. Leaves shortly petiolate, unequal in each pair, the larger mostly c. 3 times the size of the smaller; petioles 0 – 4 mm long, glabrous; lamina 1 – 3.5 × 1 – 1.75 cm, lanceolate, ovate or ovate-elliptic, acute, broadly to narrowly cuneate at the base and somewhat decurrent on the petiole, margin undulate to weakly crenate, glabrous on both surfaces or, rarely, with a few glandular hairs on the veins beneath, paler beneath, cystoliths somewhat obscure. Inflorescence foliose with long, few-flowered branches; branches densely covered in short stalked glands, strict, sparingly 3-forked with the subsessile flowers in opposite pairs (rarely solitary) in the axils of the foliose inflorescence bracts at the tips of the ultimate branches; bracts at panicle branching points and at base of flower pairs foliose, sessile or nearly so, variable in size and shape and often very unequal in each pair, 0.5 – 3.5 × 0.3 – 1.5 cm, usually oblong-lanceolate but sometimes ovate, elliptic or oblong, acute, base attenuate, margin undulate, sparsely covered with stalked glands along the margin and densely so on the attenuate base but otherwise glabrous; floral bracts 5 × 1 mm, oblong, glandular-pilose, caducous; bracteoles similar but c. 2 × 1 mm; calyx c. 11 mm long at anthesis, accrescent to c. 20 mm in fruit, subequally 5-lobed to just above the base, the lobes 1 – 1.5 mm wide, narrowly oblong-lanceolate, obtuse, densely covered in relatively short gland-tipped hairs; corolla 2.5 – 3 cm long, white, flushed violet, glabrous outside, pubescent inside, the tube gradually widened from a broad base, c. 3 mm wide for c. 12 mm, then curved 90° and widened to c. 12 – 15 mm at the mouth, lobes c. 6 mm broad and long, broadly ovate, obtuse; stamens 4, didynamous, all fertile, included; filaments glabrous, the shorter pair 1.5 – 2 mm long, the longer pair 5 – 6 mm long; anthers 2 × 0.5 mm, oblong; pollen spheroidal, c. 50 µm diameter, 3-aperturate, situated equatorially, pseudocolpate with pseudocolpi coalescing at poles, the tectum between the pseudocolpi consisting of a coarse irregular reticulum — often ladder-like — with a punctate tectum between the course ridges (Plate 1F – G); style c. 15 mm long, glabrous; ovary glabrous. Capsule 22 × 4 mm, narrowly clavate, 4-seeded, glabrous; seeds not seen. Fig. 11.

DISTRIBUTION. India, Arunachal Pradesh.

INDIA. Arunachal Pradesh: Lohit Valley [28°0'N, 96° 25'E], 1600 m, 31 Oct. 1928, *Kingdon Ward* 8718 (holotype K).

HABITAT. Restricted to the margins of hill forest.

CONSERVATION STATUS. Data Deficient (DD) but clearly rare.

NOTES. The relationship of this species is uncertain. Its pollen (Plate 1F – G)) is an unusual pollen-type in *Strobilanthes* being found only in *S. sabiniana* (Wood 1994: 204), *S. candida* (Wood 1994: 211), *S. hypomalla* Benoist and two Javanese species, *S. axilliflora* and *S. winckelii*, both only known from the type collections and possibly conspecific. All these five species have subentire leaves (except *S. axilliflora*) and a tendency towards small axillary inflorescences, which may be panicled as in *S. parvifolia*, but differ in many other features. *S. parvifolia* is outstanding because of its flowers, which are solitary in the axils of leaf-like bracts forming an open leafy, paniculate, glandular inflorescence. Another unusual feature is the presence of hairs on the inside of the corolla, a character it shares with *S. candida*.

Strobilanthes parvifolia is only certainly known from the type but two collections seen on a visit to CAL in January 2004, *R. S. Rao* 1486 and *G. Panigrahi* 19679, both from Arunachal Pradesh may well belong here but unfortunately we have not had the opportunity to compare them in detail with *Kingdon Ward* 8718 and, in particular, we have not been able to examine their pollen.

Strobilanthes borii *J. R. I. Wood* **sp. nov.** ex affinitate *S. tibeticae* J. R. I. Wood sed foliis pubescentibus, bracteis obovatis vel ellipiticis et inflorescencia glandulosa distincta. Typus: India, Naga Hills, *N. L. Bor* s.n. (holotypus K).

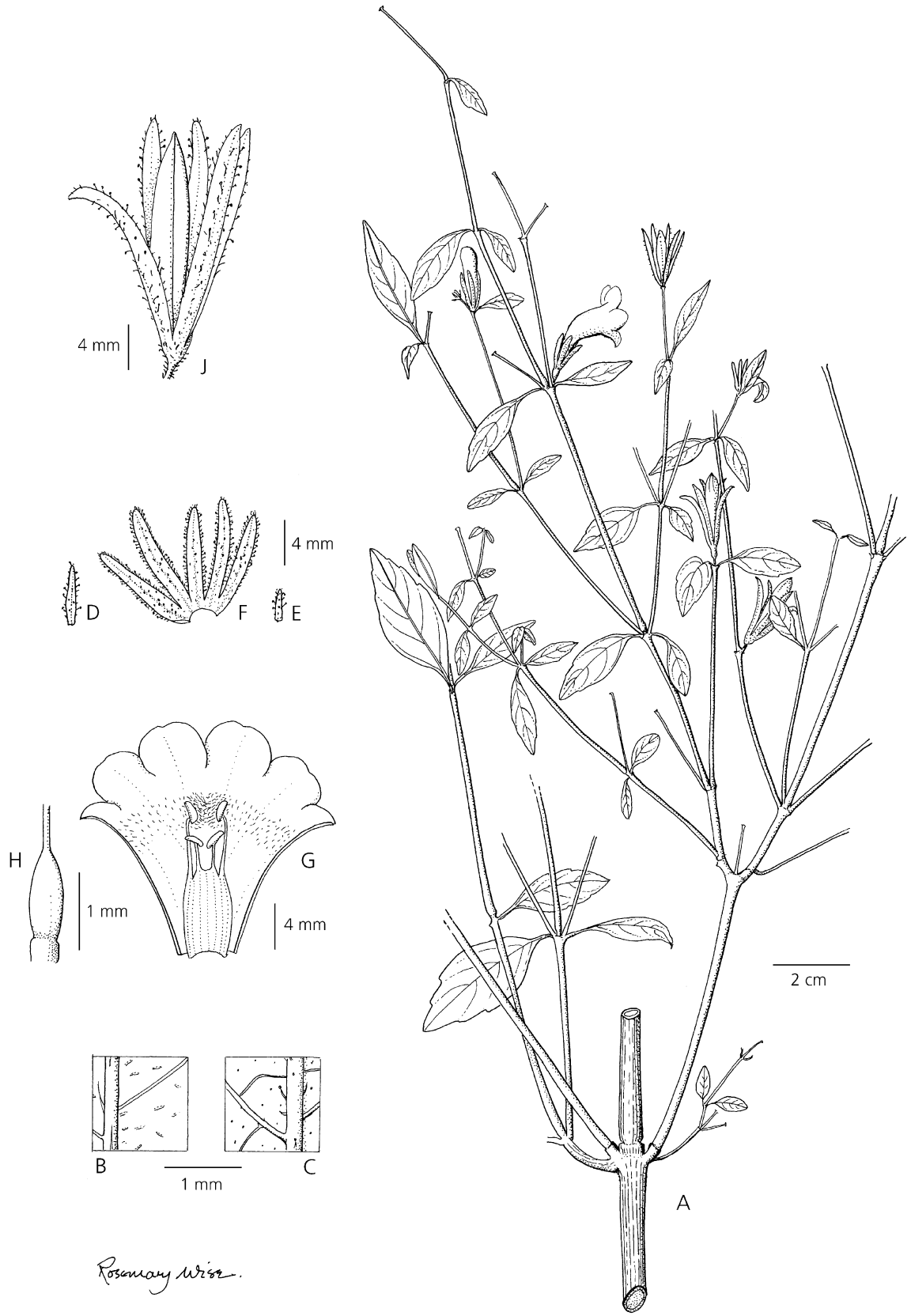


Fig. 11. *Strobilanthes parvifolia*. **A** habit; **B** adaxial leaf surface; **C** adaxial leaf surface; **D** bract; **E** bracteole; **F** calyx; **G** corolla opened out; **H** ovary; **J** accrescent fruiting calyx and capsule. From *Kingdon Ward* 8718. DRAWN BY ROSEMARY WISE.

Presumably perennial, nearly isophyllous herb at least 20 cm high. Stems dark green, bifariously pilose with brownish, glandular hairs, eventually glabrescent, sulcate. Leaves petiolate; petioles 0.5 – 1.5 cm long, densely glandular-pilose with large celled hairs; lamina 1.5 – 5 × 0.7 – 3.5 cm, ovate, acute, rounded at the base and commonly decurrent onto the petiole, margin serrulate, dark green and with scattered large hairs on the upper surface, paler and pubescent on the veins beneath, cystoliths obscure. Inflorescence of few-flowered, one-sided axillary spikes up to 8 cm long; rachis winged, densely glandular-pilose with brownish hairs; flowers in opposite pairs, up to 3 pairs per spike; bracts at base of spike resembling small leaves, petiolate; suborbicular or broadly elliptic, rounded to acute; upper bracts 5 – 10 × 1 – 5 mm, narrowly elliptic or linear, acute, shortly petiolate, glandular-pilose; bracteoles 3 – 6 mm long, oblong, pilose; calyx 1.4 – 1.6 cm long, subequally 5-lobed to 1 mm above the base, lobes oblong, obtuse, glandular-pubescent; corolla c. 2.4 – 3.2 cm long, presumably blue, finely pubescent outside, basal cylindrical part of tube c. 1 mm wide for 5 mm, then sharply bent 90° and abruptly widened to the mouth, strongly ventricose, lobes 3 × 5 mm, broadly ovate, rounded; outer filaments pubescent, 2 mm longer than the inner glabrous pair; ovary glabrous; style glabrous below, stigma glandular. Capsule not seen, presumably glabrous. Fig. 12.

DISTRIBUTION. Known only from the Naga Hills of NE India.

INDIA. Nagaland: Naga Hills, 1935, *N. L. Bor* s.n. (K).

HABITAT. Not known

CONSERVATION STATUS. Data Deficient (DD).

EPONYMY. Named after N. L. Bor who is most famous for his monumental work on Indian grasses but also made valuable collections of *Strobilanthes* during a brief but productive period of work in Assam. He was the last of a series of eminent botanists associated with the British Raj over more than 150 years.

NOTES. Although only known from a single inadequate specimen, *Strobilanthes borii* can be immediately placed next to *S. tibetica* and *S. pterygorrhachis* C. B. Clarke by the winged rachis of the axillary, one-sided spikes and the strongly saccate corolla. It can be distinguished by its glandular-pilose indumentum, smaller dimensions and rounded, lowermost bracts. As there appear to be no other collections it is presumably a very local, plietesial species.

Strobilanthes persicifolia (*Lindl.*) *J. R. I. Wood* **comb. nov.**

Ruellia persicifolia Lindl., *Bot. Reg.* 11, pl. 955 (1 Feb. 1826). Type: Plant grown by Mr Colvill's nursery from seed introduced by Mrs Fairlie, presumably

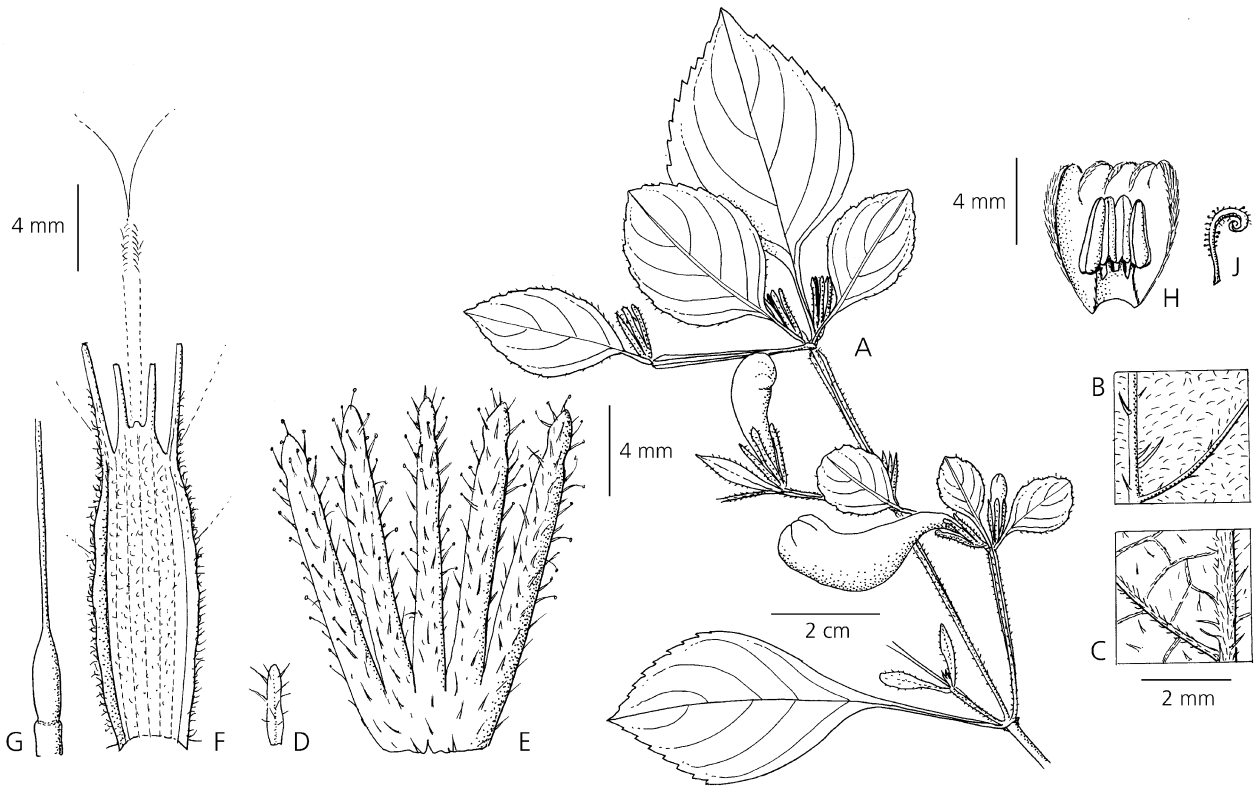


Fig. 12. *Strobilanthes borii* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bracteole; **E** calyx; **F** base of androecium; **G** ovary; **H** anthers in unopened bud; **J** stigma. From *Coloni* 7303. DRAWN BY ROSEMARY WISE.

from Calcutta (lectotype CGE ex Herb. Lindley, **chosen here**, unlabelled portion on top left of sheet labelled *Ruellia anisophylla*, annotated "1" and cross-referenced below to H. H. S. (Herbarium Horticultural Society)).

Ruellia anisophylla G. Lodd. (March 1826: pl. 1070). Type: Ic. 1070 in *Bot. Cab.*, drawn from a cultivated plant grown from seeds from France.

Goldfussia anisophylla (G. Lodd.) Nees (1832: 88).

Strobilanthes anisophylla (G. Lodd.) T. Anderson (1865: 43).

This species has long been known under the name *Strobilanthes anisophylla*, which is based on *Ruellia anisophylla*. This was published and illustrated by Loddiges in the *Botanical Cabinet* in March 1826 (not 1825 as erroneously stated by Bremekamp (1944: 232) but is antedated by the publication of *R. persicifolia* Lindl. published in the *Botanical Register* on 1 February of the same year. The combination *S. persicifolia* has, therefore, to be made for this species.

The epithet *persicifolia* is appropriate as it captures the shape of the leaves quite well. In some ways it is more appropriate than *anisophylla* as isophyllous forms are frequently cultivated and forms intermediate between the two extremes can sometimes be found (Wood 1994: 229). Isophyllous forms should be named:

Strobilanthes persicifolia f. **isophylla** (*Nees*) *J. R. I. Wood*

Goldfussia isophylla Nees (1832: 88). Type: India, plant cultivated at Calcutta originating from the Khasi Hills, *Wallich* 7162 (syntype K-W).

Strobilanthes isophylla (Nees) T. Anderson (1865: 43).

Strobilanthes anisophylla forma *isophylla* (Nees) J. R. I. Wood (1994: 229).

DISTRIBUTION AND HABITAT (of *Strobilanthes persicifolia sensu lato*). Although widely cultivated in the tropics and occasionally in conservatories in cooler countries, *S. persicifolia* is not a common plant in the wild. It is known in India from the West Bengal Duars and a number of mostly old collections from the Khasi and Garo Hills of Meghalaya, and in Bhutan from only three collections (Wood 2001: 1273). All plants of wild provenance seem to be strongly anisophyllous with a markedly zigzag stem. Forma *isophylla* seems always to be cultivated.

Species from Burma, Laos, Thailand and Vietnam

Strobilanthes wardiana *J. R. I. Wood* **sp. nov.** ex affinitate *S. gigantoides* Benoist et *S. echinatae* sed corolla hirsuta arcuata, bracteis ciliatis bene distincta. Typus: Burma, *Kingdon Ward* 6632 (holotypus K, two sheets).

Isophyllous perennial undershrub. Stems 1.5 – 2 m long, at first erect but soon decumbent over other vegetation, deeply sulcate, minutely scurfy-puberulent. Leaves ± equal in each pair, petiolate; petioles 4 – 7 cm long, densely puberulent and with a few longer, stiff, bent bristles; lamina 9 – 25 cm long, 4.5 – 12 cm wide, elliptic, narrowed to a caudate apex, attenuate at the base, margin undulate, dark green and with prominent cystoliths above, paler and very shortly puberulent beneath, the veins prominent, yellow-green. Inflorescence of short, very dense axillary spikes from the upper leaf axils; bracts 1.9 – 2.8 cm long, 1.1 – 1.3 cm wide, ovate or ovate-elliptic, obtuse, scurfy-pubescent, the margins ciliate with brown hairs; bracteoles 11 × 3 mm, narrowly elliptic, obtuse, ciliate-margined; calyx c. 9 mm long, subequally 5-lobed to just above the base, lobes 7 mm long, lanceolate, acuminate, scurfy on the dorsal surface, brown-ciliate on the margins, sericeous on the inside; corolla 4 – 4.2 cm long, curved, white with purplish veins, hirsute on the exterior becoming subglabrous towards base of tube, inside glabrous except hairs retaining style, basal subcylindrical portion of tube c. 10 mm long, gradually widened from c. 3 mm at base to 5 mm at top of cylindrical part, then gently curved 90° and widened to c. 15 mm at mouth, 5-lobed, the lobes broadly ovate, rounded, c. 7 × 3 mm; fertile stamens 4, didynamous, included; filaments glabrous flattened, straight, the two longest 5.5 mm long, the two shortest 2 mm long, anthers oblong, erect, 4 × 1 mm, equalling or slightly shorter than the connective which is sometimes extended to a blunt point; pollen prolate, 70 × 45 µm, 3-aperturate, pseudocolpate, the sexine divided into c. 18 ribs some of which pass over the poles, ribs irregularly punctate (Plate 2A); style glabrous; ovary with a comose tip. Capsule not seen. Fig. 13.

DISTRIBUTION. Known only from the type in Upper Burma.

BURMA. Tibetan border region, Nam Ti, 650 m, 18 April 1926, *Kingdon Ward* 6632 (holotype K).

HABITAT. Growing socially as part of the rain forest undergrowth; 650 m.

CONSERVATION STATUS. Data Deficient (DD), but clearly very rare.

EPONOMY. This plant is named after Frank Kingdon Ward who has good claims to being the most important collector of *Strobilanthes* in the 20th century, perhaps ever. He contributed the holotypes of no less than 16 species which W. W. Smith, Terao and we have described as new as well as numerous paratypes.

NOTE. A distinct species on account of its scrambling habit, pubescent corolla (apparently unique in species with *Strobilanthes echinata*-type of inflorescence) and unusual pollen in which the ribs pass over the poles.

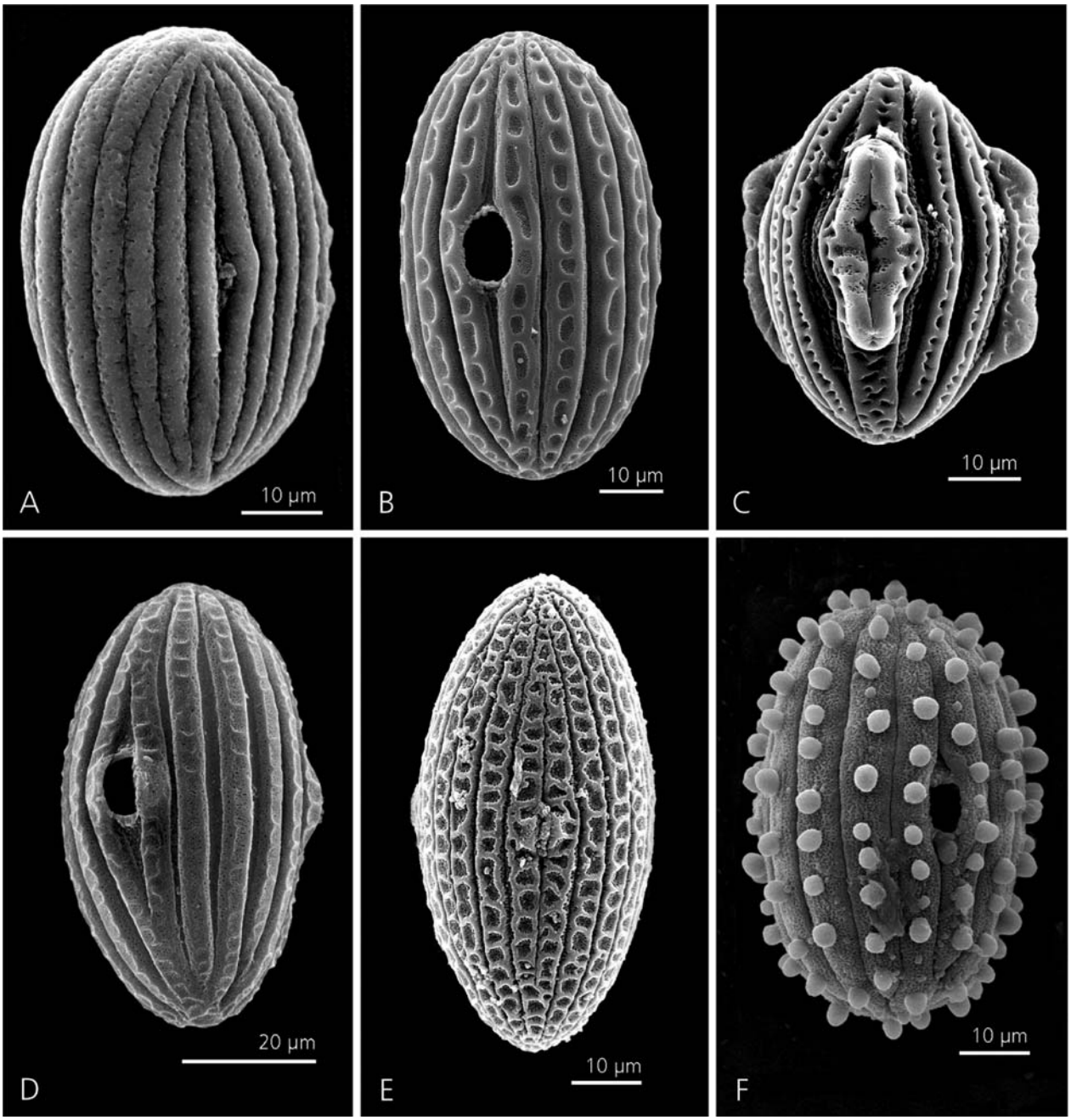


Plate 2. S.E.M. pollen images. A *Strobilanthes wardiana* from *Kingdon Ward* 6632. B *S. tanakae* from *Murata et al.* 025237. C *S. bilabiata* from *Maxwell* 05-201. D *S. fragrans* from *Van der Bult* 817. E *S. disparifolia* from *Coloni* 70731. F *S. trichantha* from *Hara* A175.

This is a rare feature found in only a few species such as *S. panichanga* (Nees) T. Anderson, which also occurs in the Kachin area, and some species from southern India and Sri Lanka such as *S. zeylanica* T. Anderson (Carine & Scotland 1998: 148 – 149).

Strobilanthes longipedunculata *[Terao ex] J. R. I. Wood* **sp. nov.** foliis infra albidis, capitulis pilis rubescentibus indutis, bracteis obovatis-spatulatis ad *S. hossei* C. B. Clarke accedens sed capitulis paucifloris, longipedunculatis ab ea recedens. Typus: Vietnam (S), Quang Nam, *M. Poilane* 31657 (holotypus P, isotypus KYO).

Perennial herb up to 1 m high. Stems much-branched, deeply sulcate, subglabrous to weakly bifariously pubescent with reddish hairs. Leaves slightly unequal in each pair, petiolate; petioles 3 – 1 7 mm long, with scattered, stiff reddish hairs; lamina 2.5 – 22 × 1 – 8.5 cm, obtuse, acute or very shortly acuminate at the

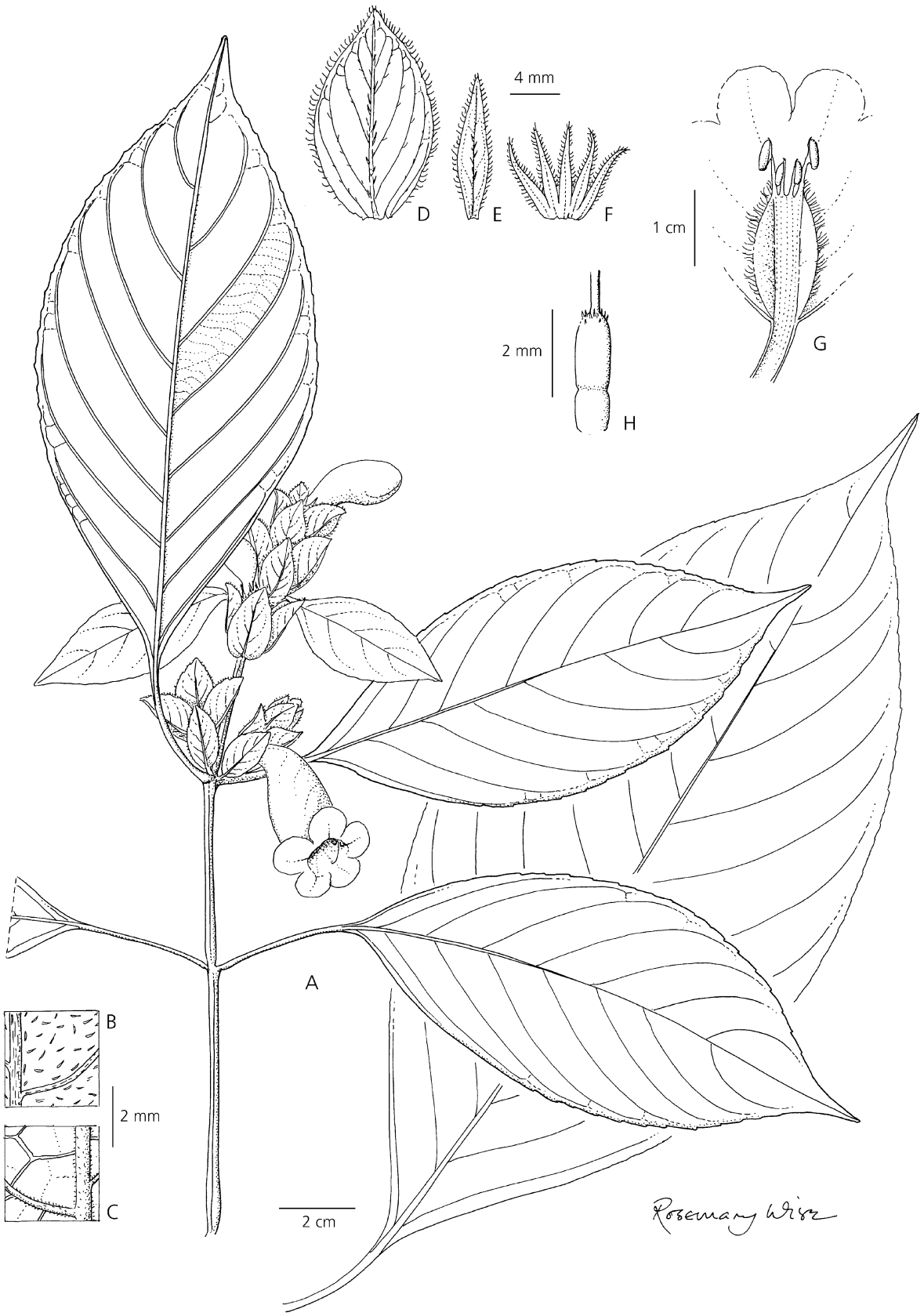


Fig. 13. *Strobilanthes wardiana* **A** habit and lower leaf; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract; **E** bracteole; **F** calyx; **G** corolla opened out to show stamens; **H** ovary. From *Kingdon Ward* 6632. DRAWN BY ROSEMARY WISE.

apex, tapering at the base, the margin undulate to obscurely dentate, above sparsely hispid with stiff reddish hairs, these denser on the veins and margins, below whitish, with sparse but prominent cystoliths, glabrous except for a few hairs on the midrib. Inflorescence of few-flowered axillary and terminal heads borne on long peduncles, often with a single flower in the axils of a pair of leaf-like bracts at about the midpoint of the peduncle; peduncles 3 – 18 cm long, usually simple but occasionally forked, glabrous except for a few stiff red hairs below the heads; bracts 6 – 8 × 3 – 4 mm, obovate, the base pale, petiole-like, glabrous, the upper part expanded, undulate-margined, foliaceous, bearded with red hairs on the upper part of the inner surface, the margins and all the exterior except the upper part with prominent cystoliths; bracteoles 5 – 6 × 1.5 mm, oblanceolate-obovate, obtuse, pilose on the margins and both surfaces with red hairs, foliaceous; calyx 4 – 5 mm long in flower, elongating to 6 – 8 mm in fruit, scarious, subequally 5-lobed to base the lobes linear, one lobe slightly longer than the others, the tips green, foliose, comose with reddish hairs; corolla c. 2.5 cm long, blue, pubescent outside, the tube cylindrical for c. 7 mm, then abruptly ventricose and widened to 8 mm at the mouth, lobes 5 × 4 mm, ovate; stamens 4, all fertile, didynamous, the longer filaments 7 mm long, the shorter pair 2 mm long; anthers included, 2 mm long; pollen not examined; style not found, ovary comose. Capsule 9 × 3 mm, clavate, glabrous except for a few hairs at the apex, 4-seeded; seeds lenticular, 2.5 × 2 mm, pubescent with appressed mucilagineous hairs, areole very small. Fig. 14.

DISTRIBUTION. Vietnam, Quang Nam Province.
VIETNAM. Quang Nam: SW of Eramy, 19 Feb. 1941, *Poilane* 31366 (P); Near Moi De Go in SW Quang Nam, 500 m, 22 Feb. 1941, *Poilane* 31476 (P); between Moi de Go'o and Mo'o, 500 – 1000 m, 25 Feb. 1941, *Poilane* 31657 (holotypus P; isotypus KYO).
HABITAT. In moist rain forest on granite; 500 – 1000 m.
CONSERVATION STATUS. Data Deficient (DD), but clearly rare.
NOTES. *Strobilanthes longipedunculata* was named by Hiroshi Terao in The Museum of Natural History in Paris in 1981 but it was never published. It is a rare endemic of Vietnam, possibly plietesial since all the collections were made in a single year. It appears to be related both to *S. hossei* and *S. rufopaupera* C. B. Clarke. With both these species it shares the distinctive leaves with white undersides and the prominent red inflorescence hairs. From both it can be immediately distinguished by its long peduncles. It is one of many interesting plants collected by M. Poilane in Indo-China. Although we have not been able to examine pollen on this collection, it is likely to be prolate with scalariform patterning.

Strobilanthes disparifolia *J. R. I. Wood* **sp. nov.** ex affinitate *S. urophyllae* (Nees) Nees sed corolla recta, glabra, foliis inaequalibus et calyce pilis longis glandulosis indutis valde distincta. Typus: Laos, Cammon, *Coloni* 7303 (holotypus, sheet with handwritten label P; probaliter isotypus P).

Strongly anisophyllous, decumbent perennial herb to 1.5 m high. Stems sulcate, strongly zigzag, brownish-puberulent, glabrescent below. Leaves very unequal in each pair, the smaller about one fifth the size of the larger, petiolate; petioles 1 – 4 cm long, minutely puberulent; blades 1.5 – 15 × 0.8 – 8 cm, ovate or ovate-elliptic, shortly acuminate and weakly falcate, broadly cuneate at the base, margin coarsely dentate, glabrous except for scattered large-celled trichomes along the margins. Inflorescence of terminal and axillary spikes 4 – 8 cm long; rachis zigzag, finely glandular-pubescent and rather scurfy; inflorescence bracts resembling reduced leaves but pubescent and with long, stiff trichomes on the petioles, margins and main veins; floral bracts 7 – 9 × 2 mm, obovate-spathulate (suborbicular with expanded petiole), densely pilose with gland-tipped hairs and with scattered longer, eglandular large-celled trichomes, bracteoles 5 – 9 × 1 mm, linear-oblong, shortly and densely glandular-pubescent with scattered eglandular trichomes; calyx c. 5 mm long in flower, accrescent to 9 mm in fruit, densely glandular-pubescent with a few longer, eglandular, large-celled trichomes, cystoliths prominent on the exterior, subequally 5-lobed to the base, the lobes linear-oblong, obtuse, pale with greenish tips; corolla 2.5 – 2.8 cm long, straight, glabrous outside, mauve, basal cylindrical portion of tube c. 8 mm long, then gradually widened to c. 10 mm at mouth, lobes 4 × 3 mm, ovate, acute; fertile stamens 4, didynamous, included; the two longer filaments c. 5 mm long, sparsely pubescent, the two shorter c. 1 mm long, glabrous; anthers broadly oblong, 1.5 × 1 mm; pollen prolate, 55 × 35 μm, 3-aperturate, pseudocolpate, c. 18-ribbed, bireticulate with scalariform patterning; style c.1.5 cm long, glabrous apart from a few scurfy hairs; ovary with sessile glands. Capsule c. 9 mm long, sparsely covered in subsessile glands, 4-seeded; seeds lenticular, c. 2 × 1.5 mm, densely pilose with ferrugineous hairs. Fig. 15.

DISTRIBUTION. Laos, known only from the type collection.
LAOS. Cammon: Mahaxay [17°25'N 105°12'E], 150 m, Jan. 1931, *Coloni* 7303 (holotype P) & 7308 (P).
HABITAT. Growing on chalky ground in a cave; 150 m.
CONSERVATION STATUS. Data Deficient (DD), but presumably rare.
NOTES. A very distinctive plant growing at an unusually low altitude and apparently related to *Strobilanthes urophylla* but easily distinguished by its very unequal leaves, zigzag rachis, straight, glabrous corolla and distinctive inflorescence indumentum, in which gland

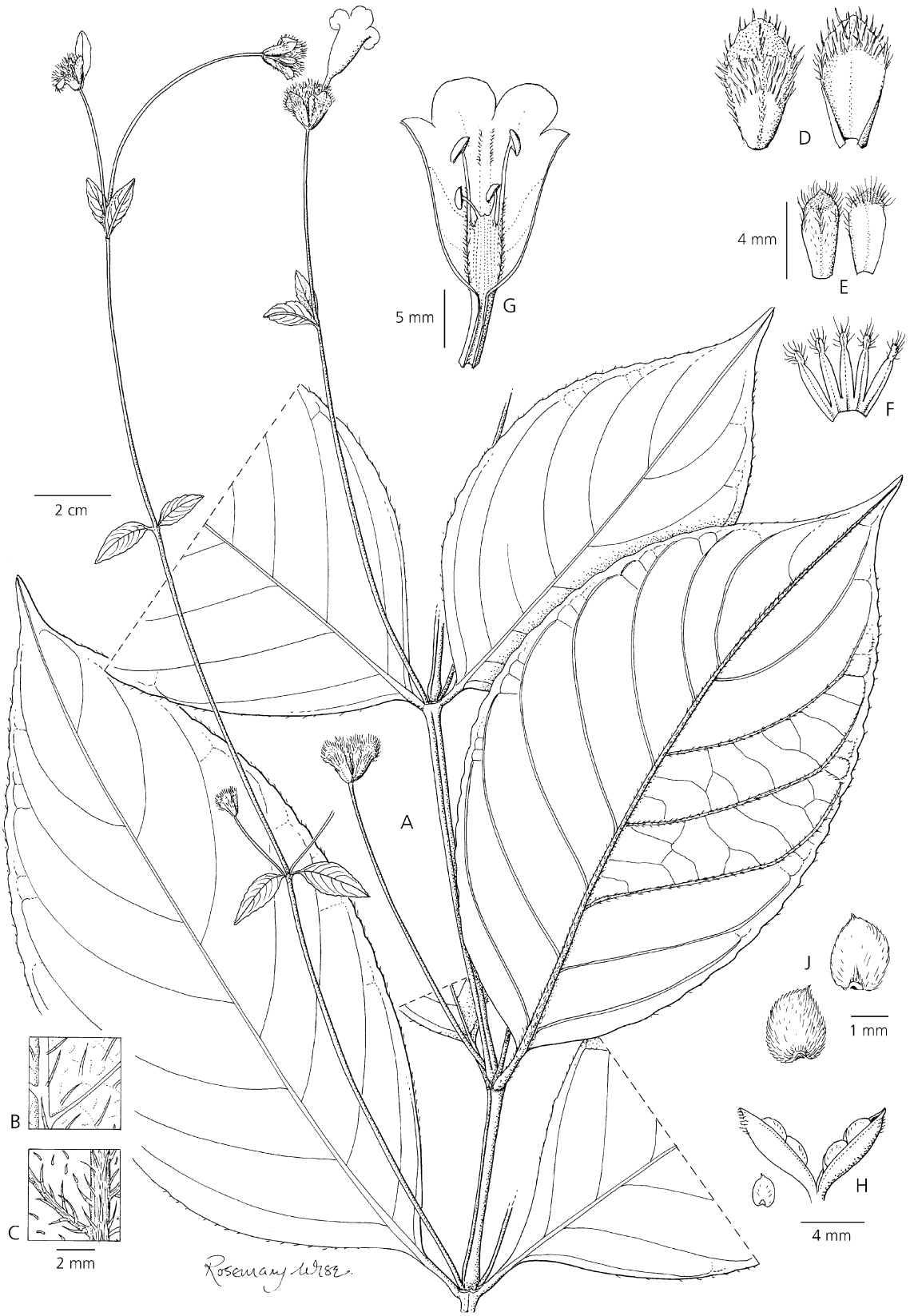


Fig. 14. *Strobilanthes longipedunculata* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bracts, upper and lower surfaces; **E** bracteoles, upper and lower surfaces; **F** calyx; **G** corolla opened out to show stamens; **H** capsule; **J** seeds. From *Poilane* 31657. DRAWN BY ROSEMARY WISE.

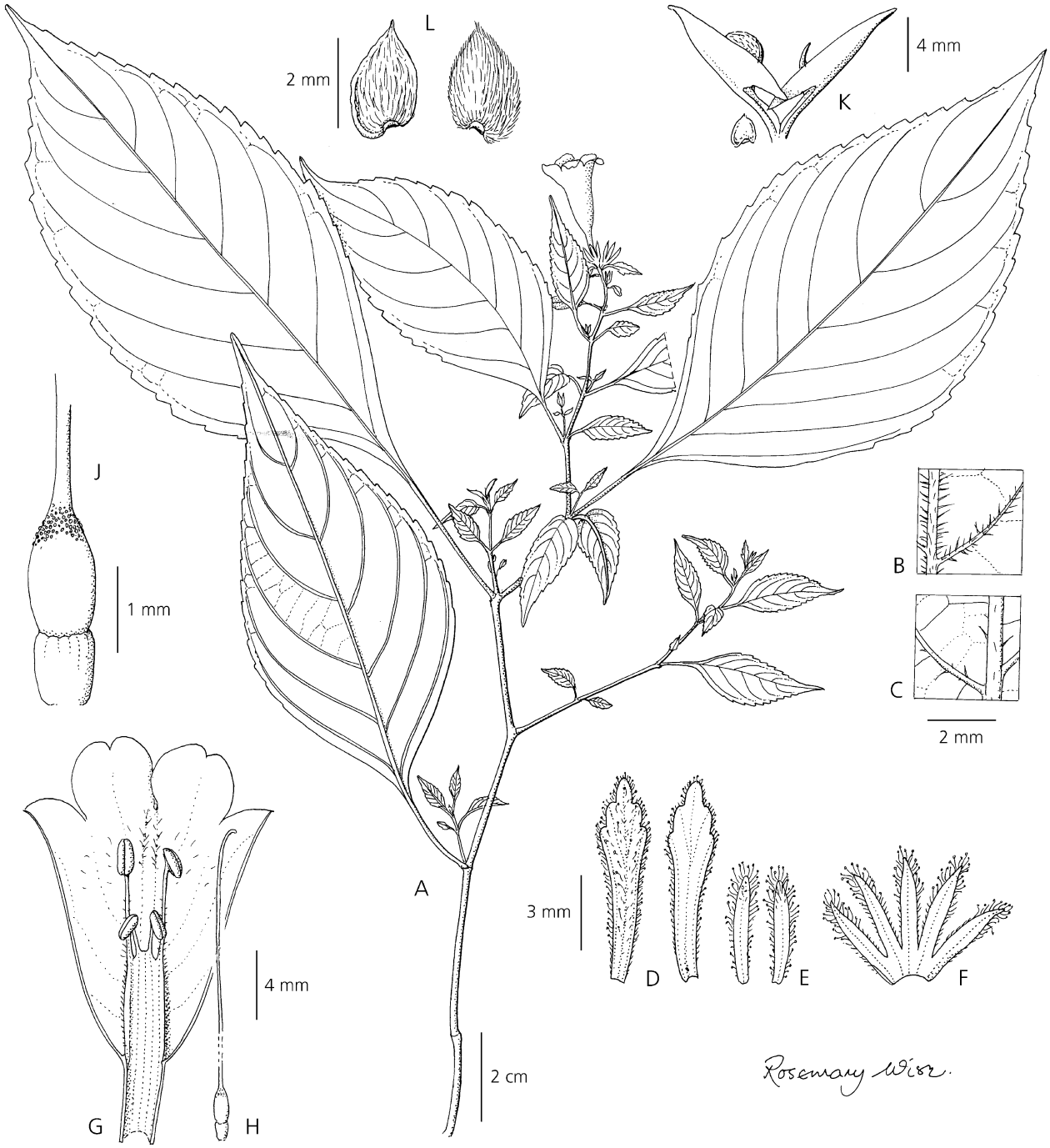


Fig. 15. *Strobilanthes disparifolia* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bracts, upper and lower surfaces; **E** bracteoles, upper and lower surfaces; **F** calyx; **G** corolla opened out to show stamens; **H** style; **J** ovary; **K** capsule; **L** seeds. From *Coloni* 7303. DRAWN BY ROSEMARY WISE.

tipped hairs are mixed with longer, large-celled trichomes.

There are two sheets at P. One has the original label on it and the number 7303 written on it in another hand. This is the sheet here chosen as holotype. The other sheet has a typed label, obviously copied from the original label with the number 7308. This is chosen as a probable isotype as it seems to be the same collection even though the number is different. Since there is no number in the collector's hand, we are not certain what the original number was.

Strobilanthes bilabiata *J. R. I. Wood* **sp. nov.** floribus in spicis unilateralibus dispositis *S. inflatam* T. Anderson, *S. urophyllum* et species affines simulans sed calyce

bilabiato labiis integris ab omnibus speciebus *Strobilanthis* distincta. Typus: Thailand, Chiang Mai, *M. Hara* A271 (holotypus CMU).

Anisophyllous treelet 2 – 5 m high with a dense, spreading crown. Trunk 12 cm thick at base, the nodes swollen; bark thin, light brown, finely and sparsely pustular-lenticellate; branches light green, weakly quadrangular with the angles rounded, sulcate, bifariously glandular-pilose, somewhat glabrescent. Leaves unequal in each pair, the smaller about a third to a quarter the size of the larger, petiolate; petioles 1 – 5 cm. thinly pilose with gland-tipped hairs; laminas 6 – 22 × 3 – 10 cm, elliptic, acuminate and caudate, the base attenuate and decurrent onto the petiole, margins dentate with prominent teeth, glandular-pilose, upper surface sparsely pilose with stiff hairs glabrescent, cystoliths conspicuous; lower surface paler, pilose and more densely pubescent along the veins. Inflorescence of axillary, 1-sided spikes 5 – 12 cm long, the rachis somewhat zigzag, often with a pair of reduced leaves arising in the leaf axil at the base of the peduncle; peduncle up to 4.5 cm long, green-winged, glandular-pilose; rachis winged, glandular pilose; flowers solitary, up to 2.5 cm apart below, closer above; floral bracts 14 – 17 × 6 mm, obovate, foliose, dentate, glandular pilose; bracteoles 12 × 2 mm, linear-spathulate, glandular-pilose; calyx 16 – 18 mm long, 2-lipped to 3 mm above the base, lips pale 13 – 15 × 4 – 5.5 mm, green with darker veins, oblong, apex obtuse, entire, exterior sparsely glandular-pilose, inside glabrous; corolla 3.6 – 4.2 cm long; white, curved, minutely hirsute, the basal cylindrical tube 8 – 10 mm long, then relatively gradually widened to 11 mm at the mouth, slightly asymmetrically saccate, lobes 7 × 5 mm ovate-elliptic, obtuse; stamens 4, didynamous, all fertile, included, longer filaments c. 9 mm long, glabrous apart from a few hairs near the base, shorter filaments c. 4 mm long, glabrous; anthers 2 – 3 × 0.5 – 0.75 mm, oblong, muticous, erect; pollen prolate, 90 × 70 µm, 3-aperturate, pseudocolpate, c. 9-ribbed with scalariform patterning, tectum in area bordering apertures much raised (Plate 2C); style sparsely pilose; ovary glandular. Capsule 12 – 15 × 4 mm, narrowly oblong-elliptic in outline, covered in short subsessile glands but otherwise glabrous, 4-seeded; seeds 4 × 3 mm, ovate, pilose with mucilagineous hairs. Fig. 16.

DISTRIBUTION. Known from two collections from Chiang Mai in Thailand.

THAILAND. Chiang Mai: Mae Chaem Distr., Doi Inthanon National Park by beginning of road to Mae Chaem village, 1700 m, 26 Dec. 1996, *M. Hara* A271 (holotype CMU); Mae Wang Distr., Mae Win subdistr., above Jet Lahng village, below Pah Ngaem cliffs, 1750 m, 10 March 2005, *J. F. Maxwell* 05-201 (CMU).

HABITAT. Growing in evergreen oak forest on granite bedrock; 1700 – 1750 m.

CONSERVATION STATUS. Although very rare and presumably vulnerable to forest clearance, at least one of the localities of this species lies within a national park. It should be treated as Endangered (EN).

NOTES. *Strobilanthes bilabiata* is a one of the most distinctive species in the whole genus. The one-sided axillary spikes with a winged rachis immediately recall the kind of inflorescence found in *S. inflata*, *S. urophylla*, *S. pterygorrhachis* and *S. tibetica* but it is readily distinguished from these and all other species of *Strobilanthes* by the form of the calyx. This is strictly 2-lipped with three lobes united into an entire upper lip and the other two lobes united into an entire lower lip. There are no indications of either lip fracturing into separate lobes even on fruiting specimens. Another unique feature is the pollen (Plate 2C). While it is similar to the common prolate, scalariform, pseudocolpate type of many species of *Strobilanthes*, it has raised areas of sexine surrounding each aperture which give it a very characteristic diagnostic morphology within *Strobilanthes*. We have seen nothing quite like this elsewhere in the genus, although raised areas of sexine surrounding apertures is relatively common in other genera of Ruellieae (Scotland 1993; Scotland & Vollesen 2000).

Strobilanthes trichantha *J. R. I. Wood* **sp. nov.** alabastris albo-pubescentibus, corolla dense pubescenti et floribus in paniculis axillaribus parvis dispositis ad *S. panichangam* tangit sed caulibis foliisque glabris, ramis inflorescenciae rectos, rigidis, calyce glanduloso recedit. Typus: Thailand, Chiang Mai, *M. Hara* A175 (holotypus CMU).

Small anisophyllous treelet 1.5 – 2.5 m high. Basal trunk c. 2.5 cm thick, bark thin, smooth, brown; young stems and branches glabrous. Leaves very unequal in each pair, the smaller about a quarter the size of the larger, petiolate; petioles 0.5 – 5.5 cm, glabrous; laminas 4.5 – 17 × 2 – 6.5 cm, narrowly elliptic, acuminate and caudate, slightly asymmetric, attenuate and shortly decurrent at the base, margin serrate, glabrous, above with scattered cystoliths, beneath paler. Inflorescence glabrous when young but becoming glandular-pilose when mature, axillary and terminal formed of bi(tri-)furcately branched small panicles 3 – 16 cm long, the ultimate branches sometimes zigzag in form; flowers sessile, mostly solitary at the branch tips, sometimes with a second flower below, rarely in opposite pairs; bracts at branching points leaf-like, very small, somewhat caducous; bracts 3 × 1.5 mm, oblong to obovate, acute to shortly mucronate, caducous; bracteoles 4 – 6 × 1 mm, linear, obtuse, becoming glandular-pilose, more tardily cadu-

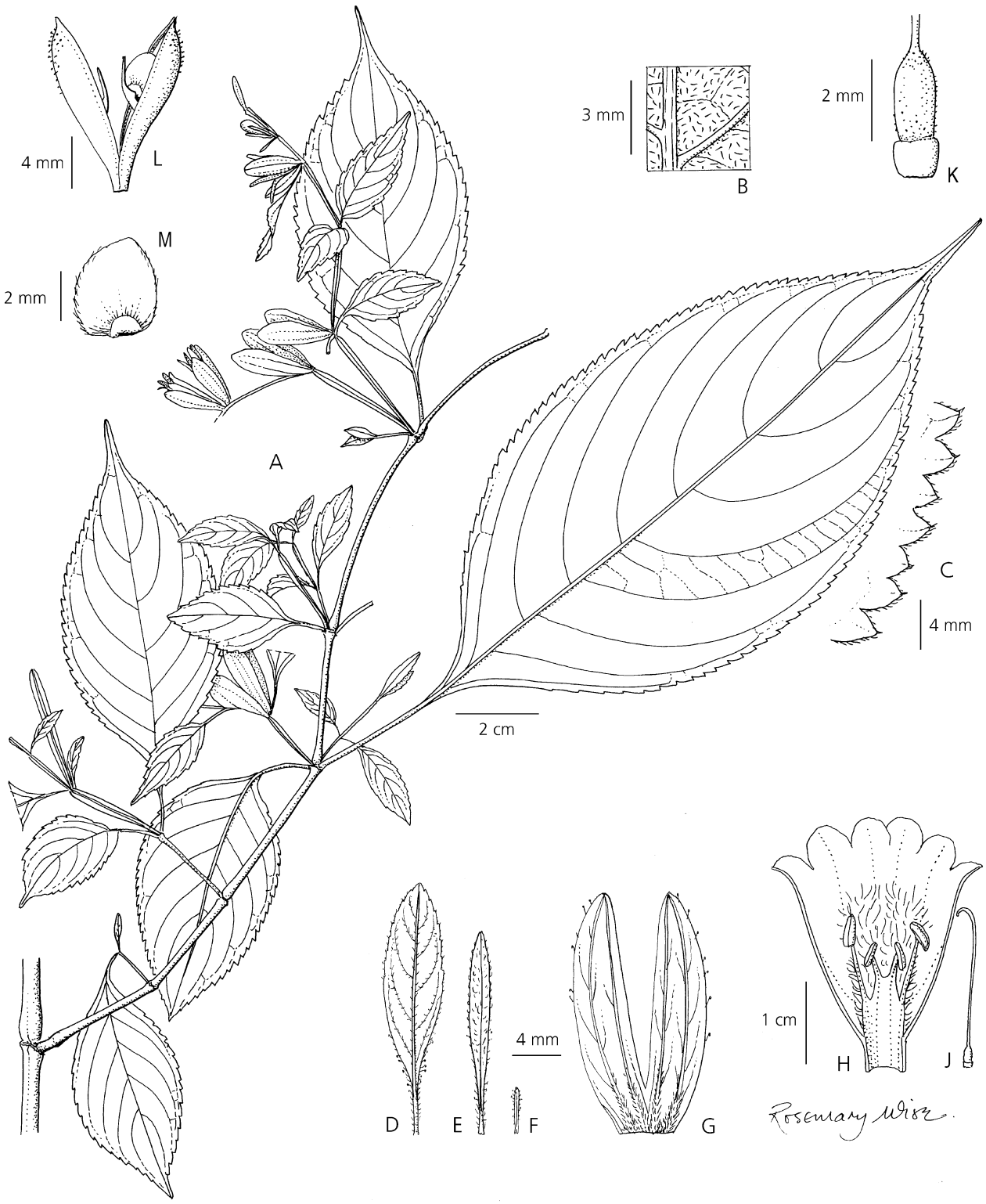


Fig. 16. *Strobilanthes bilabiata* **A** habit; **B** abaxial leaf surface; **C** leaf margin; **D** bract from base of spike; **E** bract from apex of spike; **F** bracteole; **G** calyx; **H** corolla opened out to show androecium; **J** style; **K** ovary; **L** capsule; **M** seed. From *M. Hara* A271. DRAWN BY ROSEMARY WISE.

cous than the bracts; calyx 9 – 11 mm long at anthesis, accrescent to 13 mm, subequally 5-lobed to c. 2 mm above the base, the lobes linear, acute, 1 – 1.5 mm wide, glabrous when young, the glands becoming increasingly stipitate with maturity, remaining glabrous inside; corolla 3.6 – 4 cm long, colour unknown, densely pubescent and appearing white in bud, basal cylindrical tube c. 5 mm long, then sharply bent and widened to c. 10 mm with a conspicuous ventral, saccate bulge, lobes c. 5 × 6 mm, suborbicular, rounded; stamens 4, didynamous, included; longer filaments 5 mm long, sparsely pubescent below, shorter filaments 2 mm long, glabrous; anthers 3 × 1 mm, oblong, muticous, pollen prolate, 65 × 40 µm, 3-aperturate, pseudocolpate, 18-ribbed, the ribs with a line of unevenly developed blunt spines (Plate 2F); style c. 3 cm long, glabrous; ovary glandular, comose. Capsule 16 – 22 × 4 – 5 mm, oblong, thinly glandular-pilose especially above; seeds 4 × 3 mm, lenticular, pilose with mucilagineous hairs. Fig. 17.

DISTRIBUTION. Known from three collections from Chiang Mai in Thailand.

THAILAND. Chiang Mai: Chom Tong Distr., Doi Inthanon, near beginning of road to Mae Ban Falls off main road, 1700 m, 24 Feb. 1989, *J. F. Maxwell* 89-252 (CMU); Mae Chaem Distr., Doi Inthanon National Park by beginning of road to Mae Chaem village, 1700 m, 24 Dec. 1996, *M. Hara* A175 (CMU); Mae Wang Distr., Mae Win subdistr., above Jet Lahng village, below Pah Ngaem cliffs, 1700 m, 10 March 2005, *J. F. Maxwell* 05-205 (CMU).

HABITAT. Growing in evergreen forest on granite bedrock; 1700 m

CONSERVATION STATUS. Although very rare and presumably vulnerable to forest clearance, at least two of the localities of this species lie within a national park. It should be treated as Endangered (EN).

NOTES. A distinctive species with no obvious close relative but sharing with *Strobilanthes panichanga* an axillary, paniculate inflorescence and a densely hairy corolla after which it is named. It differs in the rigid, straight branches of the inflorescence and the glabrous stem and leaves. The pollen is also distinct and only a small number of species share this type of prolate pseudocolpate pollen with blunt spines along the ridges. This type of pollen is homoplastic within *Strobilanthes* as the species that have it have no obvious phylogenetic relationship. These species are *S. stenodon* C. B. Clarke from Sri Lanka, *S. zenkeriana* (Nees) T. Anderson and *S. urceolaris* Gamble from India (Carine & Scotland 1998: 152 – 153), *S. mogokensis* from Burma (Wood & Scotland 2003a: 124), *S. wilsonii* J. R. I. Wood & Y. F. Deng and *S. vallicola* Y. F. Deng & J. R. I. Wood from China (Deng *et al.* 2006: 372 – 3) and *S. assimulata* from Indonesia.

Strobilanthes fragrans *J. R. I. Wood*, **sp. nov.** capsula 2-seminale, caule lignoso ad *S. microcarpam* T. Anderson tangens sed lobis calycis subaequalibus et piliis brevibus densis albis capsulam tegentibus. Typus: Thailand, Nakorn Sawan, *M. van der Bult* 817 (holotypus CMU).

Weakly anisophyllous shrub to 2 m leafless when flowering, all parts reported to be strongly fragrant; root system shallow, spreading, densely velvety-tomentose with reddish hairs; stem woody below, up to 1.4 cm in diameter, hollow, bark greyish-white with white pustules, wood soft, yellow; young stems obscurely sulcate, dull green with light brown lenticels, puberulent. Leaves very slightly unequal, long-petiolate; petioles 2 – 10 cm long, pubescent; lamina 4 – 18 × 2.5 – 11 cm, elliptic to broadly oblong-elliptic, shortly acuminate, attenuate and slightly asymmetric at the base, margin undulate to obscurely crenate, somewhat ciliate with regularly spaced tufts of hair, both surfaces pubescent, the upper surface with prominent cystoliths, the lower surface paler with denser pubescence. Inflorescence of short axillary spikes 1 – 4 cm long, occasionally reduced to a single pedunculate flower; flowers sessile; rachis glandular-pilose, the orange-green glands with sticky orange-green exudant; bracts 3 – 4 × 1 mm, oblong-lanceolate, obtuse, persistent, glandular-pilose; bracteoles 4 × 0.5 mm, linear, persistent, glandular-pilose; calyx c. 4 mm long at anthesis, accrescent to 8 mm, subequally 5-lobed to c. 1 mm above the base, lobes narrowly lanceolate, obtuse, c. 1 mm wide at base, glandular-pilose with some white eglandular hairs; corolla 2.3 cm long, straight, infundibuliform, purple with orange and white honey guides on lowest lobe, inside white, very glandular in bud becoming thinly glandular-pilose as flowers develop, basal cylindrical part c. 6 mm long, then abruptly symmetrically widened to 9 mm, lobes 3 × 4 mm, suborbicular; stamens 4, didynamous, filaments, anthers white; pollen prolate, 65 × 37 µm, 3-aperturate, pseudocolpate, 15-ribbed, the ribs with distinct scalariform patterning (Plate 2D). Capsule 10 × 2.5 mm, oblong, finely-white pubescent, 2-seeded. Fig. 18K – S.

DISTRIBUTION. Known from four populations in the Tam Pet Tam Tong Forest Park, Nakhon Sawan Province in central Thailand.

THAILAND. Nakhon Sawan: Takli Distr., 1.7 km N of Doi Khun Ming in the Tam Pet Tam Tong Forest Park, 220 m, fl., fr. 12 Feb. 2005, *M. van der Bult* 817 (holotype CMU); 2 km N of headquarters along trail from Doi Kun Ming to Chon Duea in Tham Pet Tahm Tong Forest Park, 220 m, leaves 15 Oct. 2006, *M. van der Bult* 919 (FHO).

HABITAT. Growing in dry limestone areas, both in degraded deciduous hardwood forest with evergreen understorey and in open rocky areas; 220 m. Forest fires occur infrequently in the park.

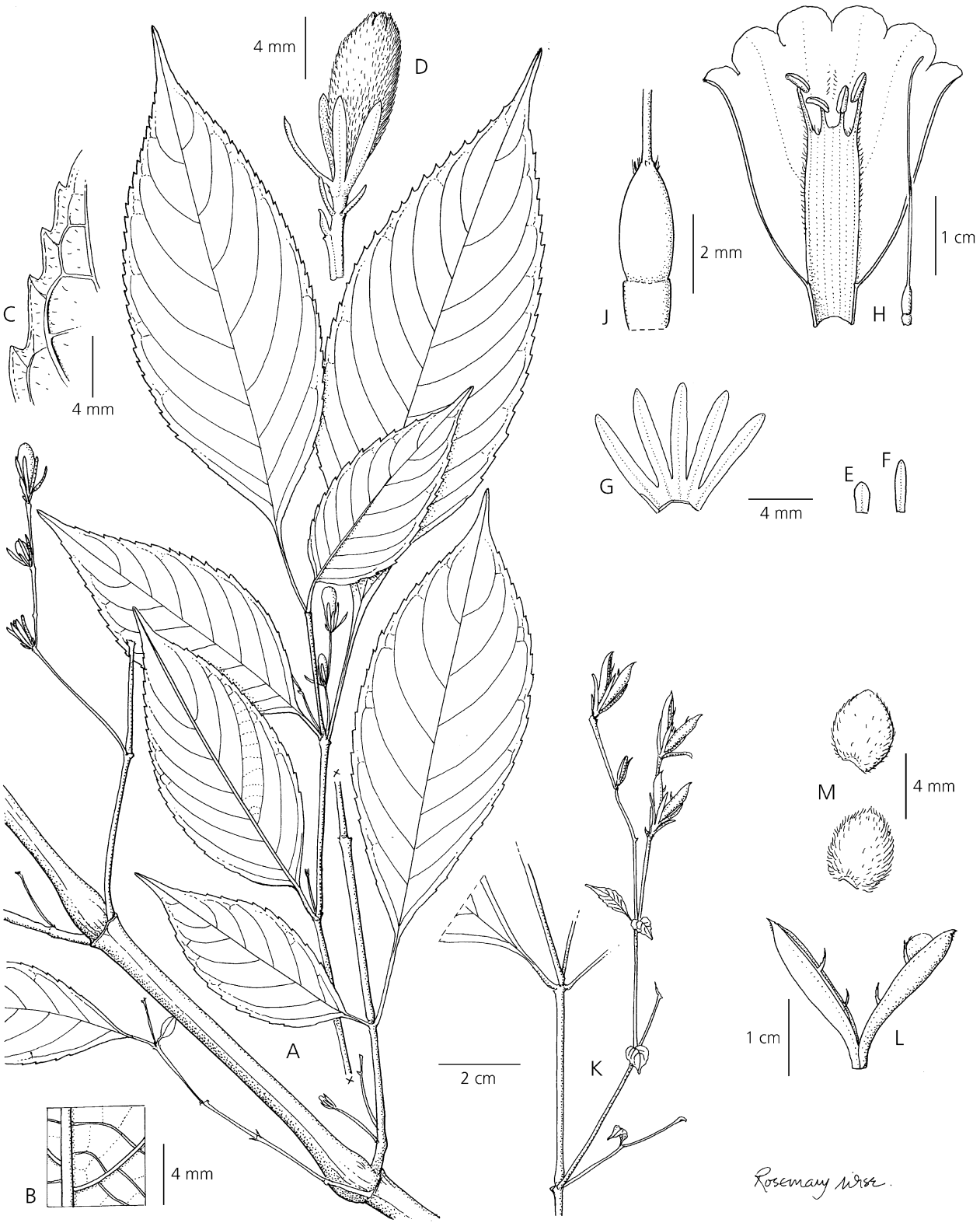


Fig. 17. *Strobilanthes trichantha* **A** habit; **B** abaxial leaf surface; **C** leaf margin; **D** bud; **E** bract; **F** bracteole; **G** calyx; **H** corolla opened out to show androecium and style; **J** ovary; **K** fruiting branch; **L** capsule; **M** seeds. **A** – **J** from *M. Hara* A175, **K** – **L** from *Maxwell* 89-252, **M** from *Maxwell* 05-205. DRAWN BY ROSEMARY WISE.

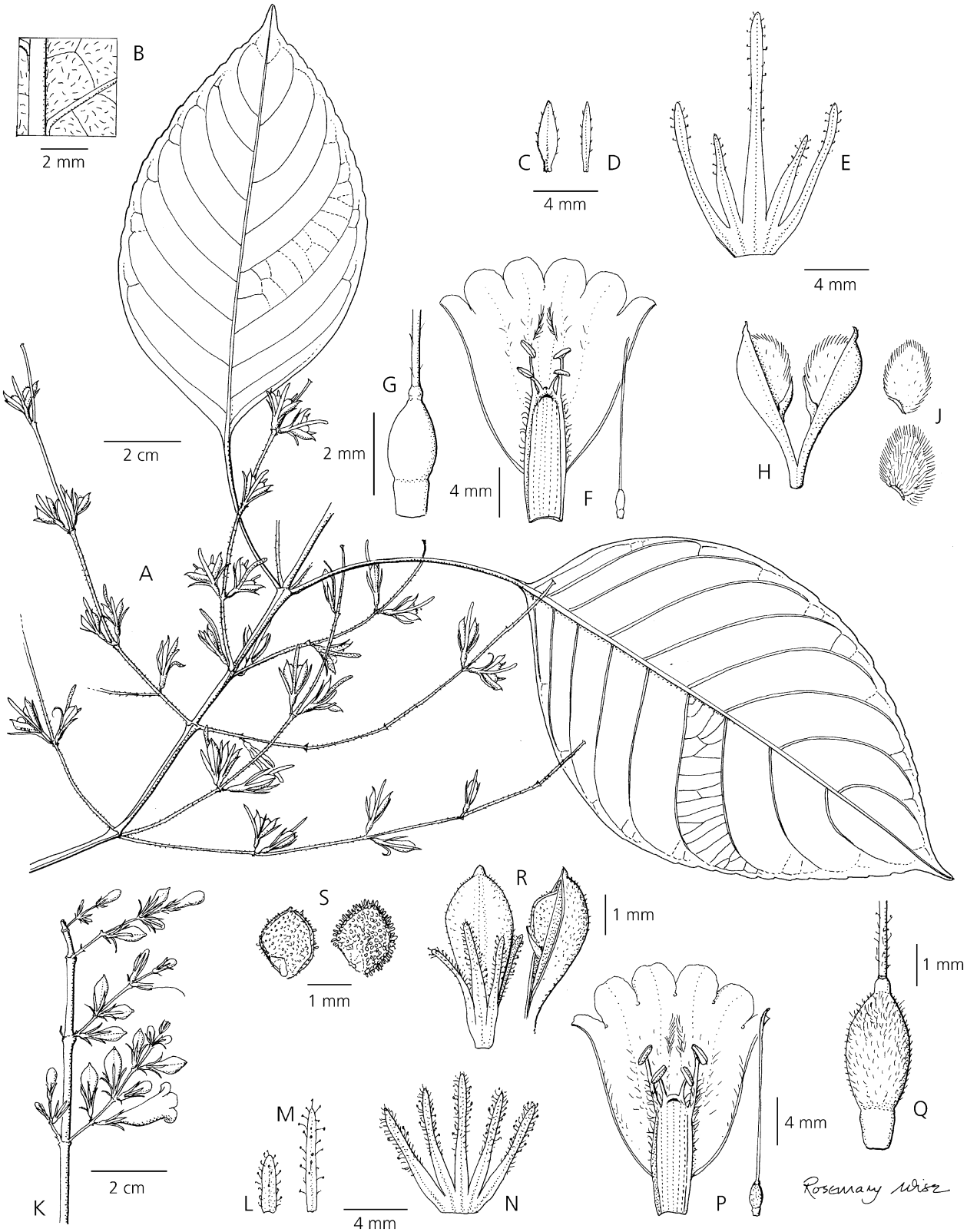


Fig. 18. A – J *Strobilanthes microcarpa* **A** habit; **B** abaxial leaf surface; **C** bract; **D** bracteole; **E** calyx; **F** corolla opened out to show stamens and style; **G** ovary; **H** capsule; **J** seeds. **K** – **S** *Strobilanthes fragrans* **K** portion of inflorescence; **L** bract; **M** bracteole; **N** calyx; **P** corolla opened out to show stamens and style; **Q** ovary; **R** capsule; **S** seeds. **A** – **G** from *Maxwell* 94-52, **H** – **J** from *Larsen* 8489, **K** – **S** from *Van der Bult* 919. DRAWN BY ROSEMARY WISE.

CONSERVATION STATUS. Known from four populations of around 5 to 25 individuals within the approximately 560 hectare Tam Pet Tam Tong Forest Park (Martin van der Bult, pers. comm.). Although the park is somewhat degraded, it offers a degree of protection although the small number of individuals and colonies suggest that the plant should be classified as Endangered (EN).

NOTES. We owe a special debt to Martin van der Bult, the discoverer of this species who went back to the type locality in October 2006 to reassess and recollect the plant. On his return visit he found only non-flowering plants with distinctly herbaceous stems, which contrast strongly with the woody stems of the leafless flowering and fruiting specimen he collected 20 months earlier. This suggests strongly that this species follows the pattern of other plietesial species and that the sterile, herbaceous plants collected in October 2006 are young plants which will eventually develop woody stems and flower after an unknown number of years before eventually dying. This species is quite obviously related to *Strobilanthes microcarpa* by its 2-seeded capsule, woody stem, axillary spicate inflorescence with flowers in opposite pairs and the infundibuliform corolla which is found in only a few species of *Strobilanthes* from Thailand. It differs markedly by the much shorter, subequally divided calyx and the indumentum of the capsule, which is densely covered in short spreading eglandular white hairs. The sticky exudant on the inflorescence and the scattered tufts of hairs on the leaf margins are unusual, if not unique within *Strobilanthes*. *S. microcarpa* is illustrated (Fig. 18A – J) in contrast to *S. fragrans* and is further discussed in Wood & Scotland (2003b: 699 – 700).

Strobilanthes muratae *J. R. I. Wood* **sp. nov.** floribus in capitulis axillaribus, breve-pedunculatis dispositis, bracteis foliaceis et indumento glandulo *S. glomeratam* (Nees) T. Anderson tangit sed bracteis caducis, forma foliorum gaudentibus, antheris oblongis erectis, capsula ad basin glandulosa recedit. Typus: Burma, Chin, *J. Murata, H. Nagamasu, N. Kawakubu, H. Akiyama, N. Kuroiwa, A. Maeda & Khin Myo Htwe* 022905 (holotypus FHO; isotypus MBK).

Weakly anisophyllous undershrub to at least 75 cm. Stem rounded, dark purple, thinly to densely hirsute with slightly brown, gland-tipped hairs mixed with shorter crisped white hairs, glabrescent. Leaves slightly unequal in each pair, petiolate; petioles 0.5 – 2.5 cm long, hirsute with a mixture of sessile glands, short gland-tipped hairs and scattered longer multicellular hairs; lamina 3.5 – 15 × 2 – 9 cm, ovate, acuminate, at base abruptly contracted to a narrowly cuneate and briefly decurrent, indistinctly asymmetric base, margin serrate, upper surface with indistinct cystoliths, lower surface whitish, both surfaces with few or very few large hispid hairs, the midrib beneath glandular-puberulent. Inflorescence of subsessile flowers arranged in short spicate heads composed of 1 – 2 bracteate flower pairs borne on peduncles 0.5 – 4 cm long from the leaf axils, sometimes also with a sterile bract pair below the head, the inflorescence sometimes much reduced with single flowers arising in the leaf axils; bracts petiolate, resembling the true leaves in texture, shape and indumentum but caducous at anthesis, petioles 1 – 4 mm long, lamina very variable in size, 5 – 20 × 2 – 16 mm; bracteoles 4 × 1 mm, oblong, pubescent, caducous before the bracts; calyx 9 – 10 mm long at anthesis, accrescent to 12 – 15 mm in fruit, pale green apart from the darker base and central area along the midrib of the lobes, subequally 5-lobed to 2 – 4 mm above the base, lobes narrowly oblong-elliptic, acuminate, glandular-pilose on the exterior and margins, glabrous on the interior; corolla 4.6 – 5.5 cm long, "pink" or "pale purple", glabrous apart from a few glandular hairs visible in bud, very slightly curved, the expanded part distinctly veined, the basal cylindrical part 14 – 14 × 2 – 3 mm, then abruptly widened and slightly asymmetrically ventricose reaching 1.5 cm in width at the mouth, lobes 7 – 9 × 10 – 11 mm, ovate, rounded; stamens 4, didynamous, included; longer pair of filaments 7 – 8 mm long, shorter pair 3 – 4 mm long; anthers 3 – 3.5 × 0.75 mm, ellipsoid, muticous, erect; pollen prolate, 64 × 34 μm, 3-aperturate, pseudocolpate, 18-ribbed, the tectum between the pseudocolpi consisting of a coarse irregular reticulum with a punctate tectum between the coarse ridges (Plate 1C); style 3 cm long, glabrous; ovary glandular. Capsule 18 – 20 × 5 mm, oblong, glandular-pilose to the base, 4-seeded; seeds 2.5 × 2 mm, ovoid, flattened, apparently glabrous but somewhat immature. Fig. 19.

DISTRIBUTION. Burma: Chin State.

BURMA. Chin: Mindat, Southern Chin Hills [21°30'N, 94°00'E], 1300 m, *F. Kingdon Ward* 21749 (BM); Mt Victoria, Natmataung National Park [21°12'N, 94° 02'E], 1750 – 1820 m, 10 March 2002, *J. Murata et al.* 022905 (holotype FHO; isotype MBK); near the Guest House, Natma Taung National Park, 1750 m, 1 April 2003, *Ling Shing Maung & Chocho Win* 025794 (MBK).

HABITAT. Gregarious in small colonies; 1300 –1820 m.

CONSERVATION STATUS. Data Deficient (DD). Although only known from three records and obviously very local, this species grows in a protected area and because of the plietesial nature of many species of *Strobilanthes* is likely to be more common than appears to be the case.

EPONYMY. This species is named after the collector, Jin Murata, who has contributed to our knowledge of *Strobilanthes* by his collections, participation in the

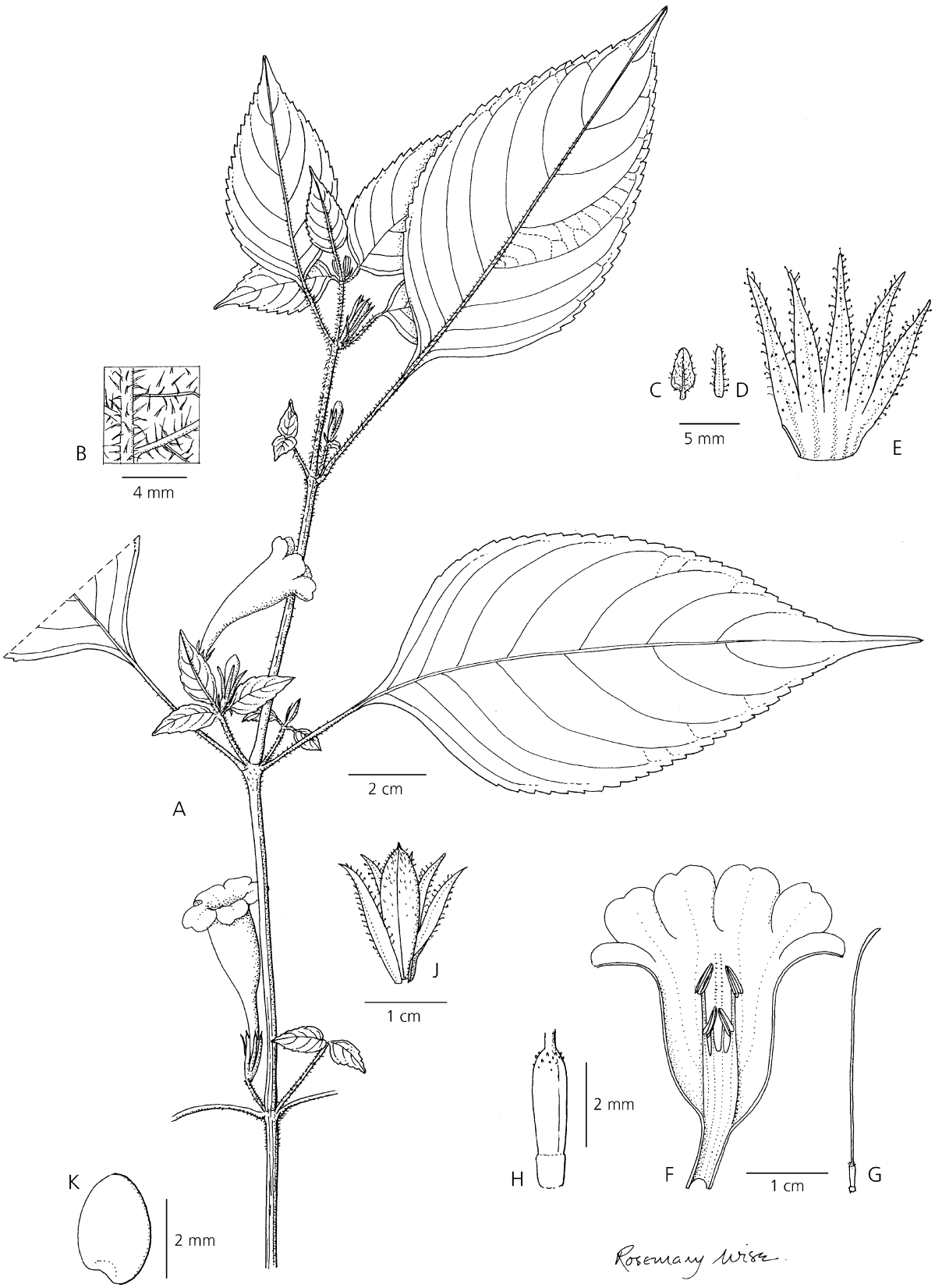


Fig. 19. *Strobilanthes muratae* **A** habit; **B** abaxial leaf surface; **C** bract; **D** bracteole; **E** calyx; **F** corolla opened out to show androecium; **G** style; **H** ovary; **J** capsule and fruiting calyx; **K** seed. **A** – **B**, **J** – **K** from *Murata et al.* 22905, **C** – **H** from *Kingdon Ward* 21749. DRAWN BY ROSEMARY WISE.

descriptions of *Strobilanthes refracta* D. Fang, Y. G. Wei & J. Murata and *S. lanyuensis* Seok, C. F. Hsieh & J. Murata, and supervision of PhD theses related to *Strobilanthes* by Hiroshi Terao and Dong-Im Seok.

NOTES. This species would seem to be most closely related to *Strobilanthes glomerata* because of the shortly pedunculate, foliose, capitulate, axillary inflorescence and glandular indumentum but is distinguished by many characters. The leaves are nearly symmetric at the base and the bracts are caducous and similar to the leaves whereas in *S. glomerata* the leaves are strongly asymmetric at the base and the bracts are persistent, lanceolate and dissimilar in shape to the leaves. The corolla is soon glabrescent (in *S. glomerata* it is glandular on the tube) and the capsule is glandular-pilose to the very bottom. The very large corolla and, if not an aberration, the glabrous seeds are distinct features of this species.

Strobilanthes chrysodelta *J. R. I. Wood* **sp. nov.** affine *S. erectae* C. B. Clarke (= *S. orbicularis* Imlay) et *S. simplicis* J. R. I. Wood sed anisophylla et floribus in spicis terminalibus dispositis, bracteis ovatis-ellipticis, lobis calycis obtusis, antheris oblongis divergens. Typus: Burma, Shan, *F. Kingdon Ward* 8859 (holotypus F, isotypi GH, NY).

Anisophyllous perennial 30 – 60 cm high. Stem weakly quadrangular, sulcate, glabrous. Leaves unequal, the smaller about two thirds the size of the larger but similar in shape; petiolate; petioles 0.5 – 2.5 cm long, glabrous; lamina 3 – 9 × 1.7 – 4 cm, elliptic, acute, attenuate and slightly decurrent at the base, glabrous, margin weakly serrate, upper surface with prominent cystoliths, lower surface much paler. Inflorescence of terminal spikes 2 – 10 cm long, the flowers in 1 – 5 distant opposite pairs, 1 – 2 cm apart; rachis glandular pilose; inflorescence bracts at base of spike leaf-like but sessile or almost so, ovate, rounded at the base; floral bracts 5 – 6.5 × 2 mm, ovate-elliptic, obtuse, glandular-pilose, ± persistent; bracteoles 8 × 1 mm, oblong-oblanceolate, obtuse, glandular-pilose, persistent until after anthesis; calyx 10 – 11 mm long at anthesis, accrescent to 15 mm in fruit, lobes linear, obtuse, glandular-pilose, the posterior three lobes united for 3 mm above the base at anthesis, becoming free in fruit, the central lobe slightly longer than the others and becoming subspathulate, the two anterior lobes free to the base; corolla 3.7 – 4 cm long, pale violet with a white tube, glabrous, straight, the basal cylindrical tube c. 11 × 2.5 mm. then gradually widened, reaching 12 mm at the mouth, lobes 9 – 10 × 7 mm, ovate, rounded; stamens 4, didynamous, all fertile, included; filaments very sparsely pilose, erect, the 2 shorter c. 2 mm long, the 2 longer c. 4 mm long; anthers 2 × 0.5 mm, oblong, erect, muticous; pollen not examined; style pilose. Capsule 1.5 cm long, glabrous except for a few glandular hairs at the apex; seeds 4, 3 × 2.5 mm, lenticulate, pilose with mucilagineous hairs, almost lacking an areole. Fig. 20A – J.

DISTRIBUTION. East of Mong Kai in the Golden Triangle area of Shan State in Burma. Also known without data from the south of Yunnan, China.

BURMA. Shan: Hills E of Mong Kai [21°16'N, 100°06'E], 2150 – 2400 m, 20 April 1929, *F. Kingdon Ward* 8859 (F, GH, NY). **CHINA**. Yunnan: without data, *Biological Resource Expedition to tropical Yunnan* 2185 (KUN).

HABITAT. Growing gregariously under bamboo in shaded, forested gullies; 2150 – 2400 m.

CONSERVATION STATUS. Data Deficient (DD). Only known from two collections.

EPONYMY. The species is named after the near legendary Golden Triangle area where Burma, Laos, Thailand and China meet.

NOTES. This species is apparently related to both *Strobilanthes erecta* (= *S. orbicularis*) (Fig. 20K – S) and *S. simplex*. Although *S. erecta* also occurs in Shan State and in neighbouring north Thailand, *S. chrysodelta* is readily distinguished by its elliptic, petiolate leaves and obtuse calyx lobes as well as the distinctive spicate inflorescence. It is, in fact, much closer to *S. simplex* from NE India, which has similar leaves but differs in its obovate bracts and subacute calyx lobes which are commonly bent at the tips. Unlike both these species, *S. chrysodelta* is distinctly anisophyllous and has oblong anthers borne on erect filaments in contrast to the suborbicular nodding anthers of the other two species.

Strobilanthes tanakae *J. R. I. Wood* **sp. nov.** antheris filamentorum breviorum suborbicularis incurvis et bracteis bracteolisque caducis ad species quas Nees ab Esenbeck ad *Goldfussiam* ascripsit pertinens sed floribus in spicis terminalibus, laxis facile dignoscenda. Typus: Burma, Chin State, *J. Murata, N. Tanaka, T. Sugawara, T. Nemoto, Y. Iokawa, F. Shimozono, Hung Maung, Ling Shing Maung & ChoCho Win* 025237 (holotypus FHO; isotypi K, TI).

Anisophyllous perennial of unknown habit to at least 60 cm. Stem weakly quadrangular, slightly sulcate, glabrous. Leaves unequal in each pair, the smaller about half the size of the larger, long-petiolate; petioles 0.8 – 5 cm long, commonly equalling the lamina, glabrescent; laminas 3 – 6 × 1.2 – 3.1 cm, ovate-elliptic, shortly acuminate, base cuneate and very asymmetric with one side shorter than the other, margin undulate to crenate, glabrous or with a few long hairs on the midrib beneath and on the margins, cystoliths present on both surfaces but more promi-

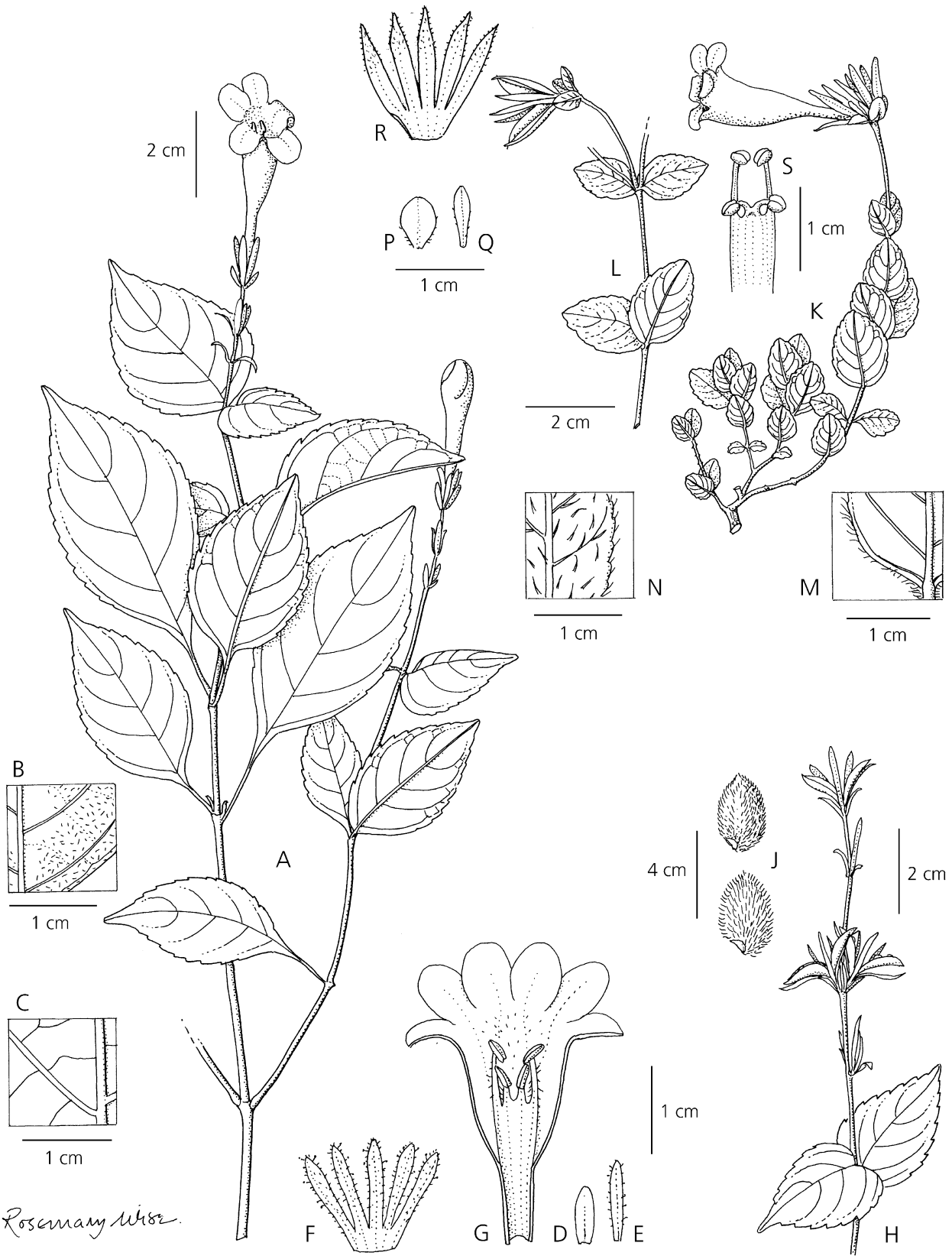


Fig. 20. A – J *Strobilanthes chrysodelta* **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract; **E** bracteole; **F** calyx; **G** corolla opened out to show stamens; **H** fruiting spike; **J** seeds. **K** – **S** *Strobilanthes erecta* **K** habit; **L** fruiting branch; **M** adaxial leaf surface; **N** abaxial leaf surface; **P** bract; **Q** bracteole; **R** calyx; **S** androecium. **A** – **J** from *Kingdon Ward* 8859, **K** – **S** from *Garrett* 1108. DRAWN BY ROSEMARY WISE.

nent above, the lower surface paler. Inflorescence of 1 – 3 terminal spikes up to 16 cm long, the central one usually more developed than the laterals; flowers sessile in opposite pairs up to 2.5 cm apart below but becoming confluent above; rachis glandular-pilose; bracts at base of inflorescence leaf-like but shortly petiolate to subsessile, the petiole and lower leaf margin sparsely ciliate; floral bracts and bracteoles caducous, not seen; calyx c. 9 mm long at anthesis, accrescent to 19 mm in fruit, hirsute with longer gland-tipped hairs mixed with shorter, stiff, white, eglandular hairs, 5-lobed to 3 – 4 mm above the base, the lobes linear with a slight widening in the centre, obtuse, 1 – 1.25 mm wide, one lobe in fruit up to 2 mm longer than the others; corolla 2.8 – 4.5 cm long, very variable in size on the same plant, dark bluish-purple with a pallid tube, nearly glabrous apart from a few glandular trichomes, slightly curved, basal cylindrical tube relatively stout, 2 – 4 mm wide, gradually widening to 12 mm, the asymmetrically saccate part reaching 10 – 12 mm wide at the mouth, lobes c. 7 × 8 mm, ovate, emarginate and obtuse; stamens 4, didynamous, all fertile, included; longer outer filament pair glabrous, 6 mm long, erect; the inner pair 1.5 mm long, partially recurved; anthers small, c. 1 mm, suborbicular, nodding; pollen prolate, 70 × 35 μm, 3-aperturate, pseudocolpate, 15-ribbed, the tectum between the pseudocolpi consisting of a coarse irregular scalariform reticulum, with a punctate tectum between the course ridges (Plate 2B); style 3.5 cm long, glabrous; ovary glabrous. Capsule c. 18 × 3.5 mm, oblong-oblanceolate in outline, with scattered glands near apex, 4-seeded; seeds 4 × 3.5 mm, lenticular, pilose with mucilaginous hairs, almost lacking an areole. Fig. 21.

HABITAT & DISTRIBUTION. Natma Taung National Park in Chin State, Burma.

BURMA. Chin: Hilawng, Mindat distr. [21°23'N, 93° 48'E], 2650 m, 11 Nov. 1962, *U. Mg Gale* 9193 (E); N of Natma Taung National Park [21°25'40"N, 93°47'35"E], 2300 –2550 m, 7 Dec. 2002, *J. Murata et al.* 025237 (holotype FHO; isotypes K, TI).

HABITAT. Collected in moist gullies on roadsides

CONSERVATION STATUS. Data Deficient (DD); only known from two collections but field notes on one collection describe it as "common".

EPONYMY. This species is named after Nobuyuki Tanaka, director of Makino Botanical Garden in Japan and important collector of the Myanmar-Japanese Co-operative Inventory Programme of Plants of Myanmar. He has greatly assisted our studies of *Strobilanthes* by his collections.

NOTE. This is a very distinct species having the distinctive small, suborbicular, nodding stamens, calyx with one lobe elongated and caducous bracts of many species assigned by Nees to *Goldfussia* but combined with a lax, terminal, spicate inflorescence. The undulate to weakly crenate leaves and the laxly spicate inflorescence set it apart from all other species previously assigned to *Goldfussia*.

Strobilanthes ramulosa *J. R. I. Wood* **sp. nov.** floribus in capitulis dispositis et bracteis bracteolis caducis manifeste ex affinitate *S. stramineae* W. W. Sm. et *S. rhombifoliae* C. B. Clarke ab illa staminibus omnibus fertilibus et inflorescencia bene ramificada ab hac foliis ovatis, basin rotundis et corolla parviore usque 3.5 cm, ab ambobis labiis corollae glabris distincta. Typus: Burma (Myanmar), Kachin, *F. Kingdon Ward* 9031 (holotypus BM).

Anisophyllous bushy undershrub to c. 1 m. Stem rounded, sometimes sulcate, glabrous or with a few scattered stalked glands, cystoliths prominent. Leaves somewhat unequal, the smaller leaf three-quarters or four-fifths the size of the larger; shortly petiolate below, sessile above, diminishing in size upwards; petioles 0 – 7 mm long, glabrous; laminas 2.5 – 14 × 2 – 6 cm, ovate-elliptic or (above) ovate, acuminate, rounded, slightly asymmetric and briefly decurrent at the base, margin serrate, glabrous and green on both surfaces, cystoliths prominent, especially above. Inflorescence axillary and terminal, the flowers sessile in 1 – 4-flowered heads borne at the tips of trifurcately branched peduncles arising in the leaf axils, the central branch often longer and trifurcately branched 2 – 3 times, the heads sometimes with single flowers on the peduncle below; peduncles glabrous; bracts at inflorescence branching points mostly 10 – 20 × 3 – 6 mm, lanceolate, foliose, diminishing in size upwards; floral bracts 4 × 2 mm, elliptic-obovate, obtuse to truncate, glabrous, caducous; bracteoles 5 × 1 mm, oblong-spathulate, rounded, caducous; calyx c. 10 mm long at anthesis, weakly accrescent to 13.5 mm, 5-lobed to c. 1.5 mm above the base, the lobes very narrowly oblong-elliptic, obtuse, one c. 1 mm longer than the others, glabrous with sessile glands when young, becoming hirsute with stalked glands and short, stiff, multicellular, eglandular hairs later; corolla 3.2 – 3.8 cm, pale violet or white or thin purple lines, glabrous apart from a few scattered glandular hairs mainly on the tube, weakly curved, basal cylindrical tube 10 – 15 × 2.5 mm, then somewhat asymmetrically ventricose and reaching 11 mm in width at the mouth, lobes 4 × 6 mm, ovate, obtuse; stamens 4, didynamous, all fertile, included; filaments glabrous, the shorter pair c. 2.5 mm long, the longer pair c. 6 mm long; anthers c. 1 × 1.25 mm, suborbicular, nodding, muticous; pollen prolate, 58 × 30 μm, 3-aperturate, pseudocolpate, the tectum between the pseudocolpi consisting of a coarse irregular scalariform reticulum, with a punctate tectum between the coarse reticulum (Plate 1B); style 2.5 cm long, glabrous; ovary glabrous. Capsule and seeds not seen. Fig. 22A – F.

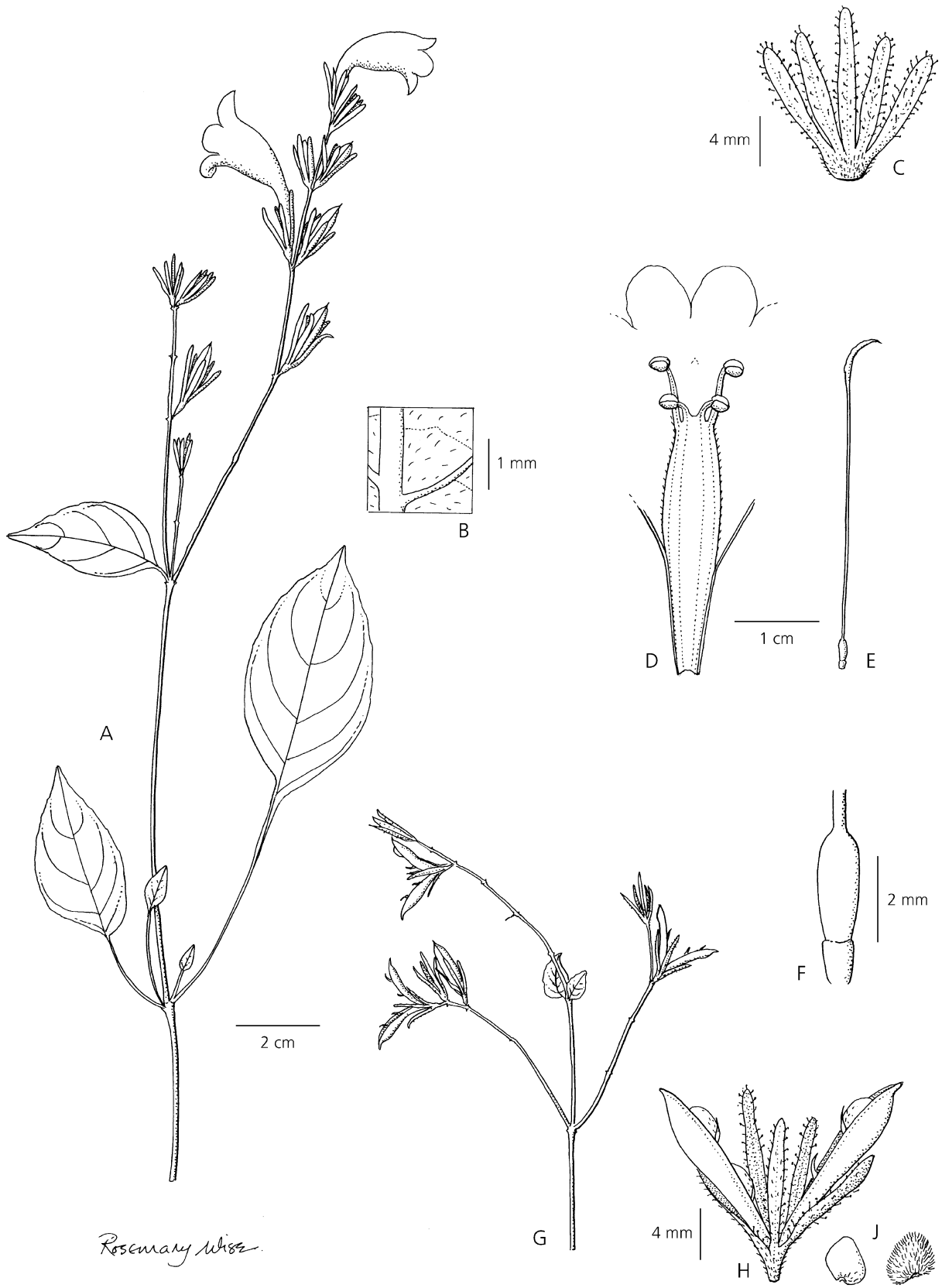


Fig. 21. *Strobilanthes tanakae* **A** habit; **B** abaxial leaf surface; **C** calyx; **D** corolla opened out to show androecium; **E** style; **F** ovary; **G** portion of inflorescence with fruit; **H** capsule; **J** seeds. From *Murata et al.* 025237. DRAWN BY ROSEMARY WISE.

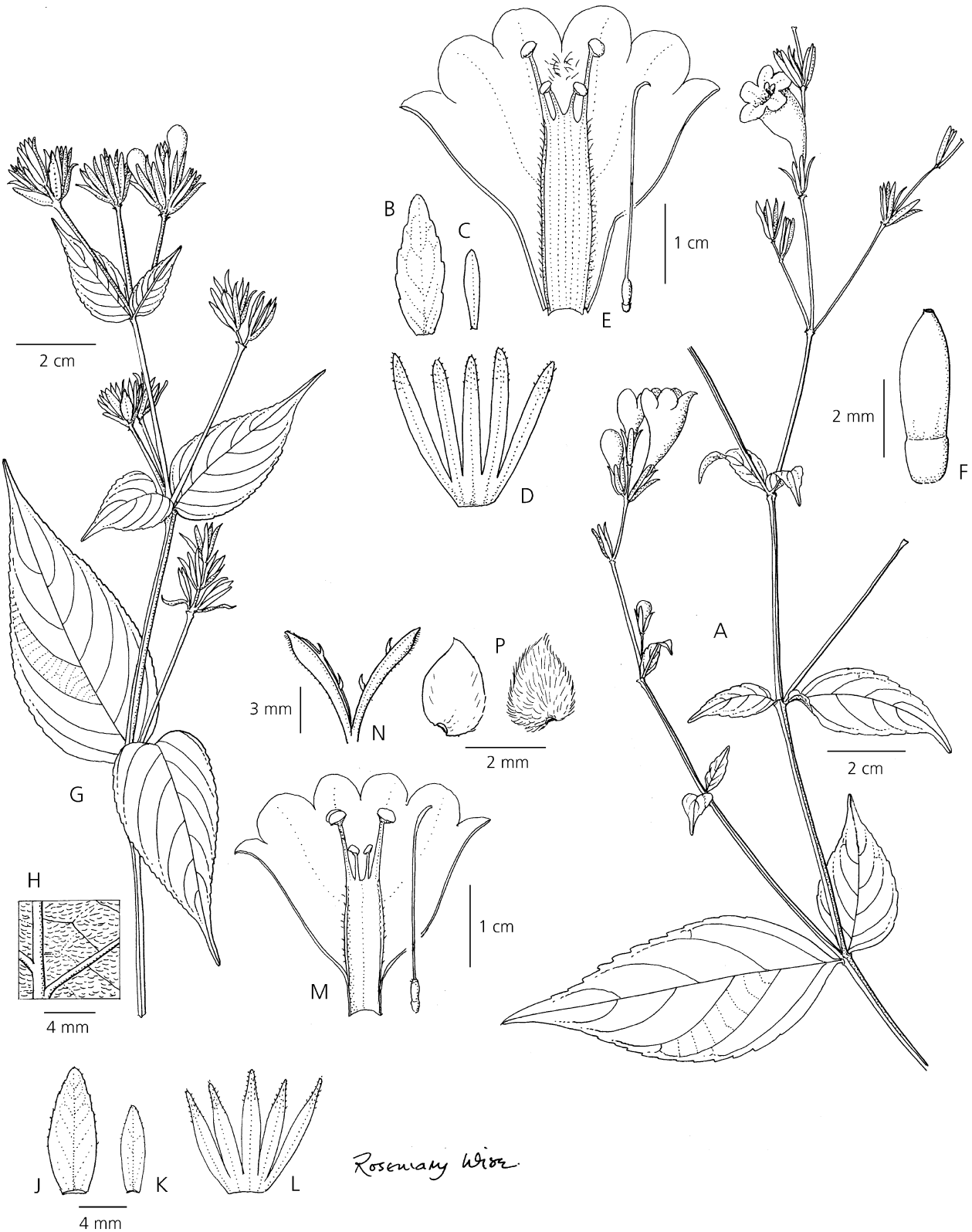


Fig. 22. **A** – **F** *Strobilanthes ramulosa* **A** habit; **B** bract; **C** bracteole; **D** calyx; **E** corolla opened out to show stamens and style; **F** ovary. **G** – **P** *Strobilanthes straminea* **G** habit; **H** abaxial leaf surface; **J** bract; **K** bracteole; **L** calyx; **M** corolla opened out to show stamens and style; **N** capsule; **P** seeds. **A** – **F** from *Kingdon Ward* 20335, **G** – **L** from *Kingdon Ward* 42239, **M** – **P** from *Kingdon Ward* 3726. DRAWN BY ROSEMARY WISE.

DISTRIBUTION. Endemic to the Kachin Hills region of Burma.

BURMA. Kachin: without details *S. M. Toppin* 4118 (K); ibid., *S. M. Toppin* 4307 (K); without precise locality, 500 m, 9 Dec. 1930, *F. Kingdon Ward* 9031 (holotype BM); between Fort Hertz (Putao) and Sumprabum, 22 Dec. 1931, *F. Kingdon Ward* 10223 (BM); Mali Hka Valley, Myitkyina, 150 – 320 m, 2 Jan. 1953, *F. Kingdon Ward* 20335 (BM).

HABITAT. Growing on banks near streams in shaded thickets; c. 200 – 950 m.

CONSERVATION STATUS. Data Deficient (DD), but clearly very local in distribution.

NOTES. *Strobilanthes ramulosa* is similar to both *S. straminea* and *S. rhombifolia* in general appearance, but is distinguished from both by the inflorescence in which the flowers are in very depauperate terminal capitula with scattered flower pairs on the axis below. The corolla is completely glabrous and much smaller than that of *S. rhombifolia*.

Strobilanthes straminea (Fig. 22G – P) gives the appearance of being a hybrid between *S. ramulosa* and another species, most probably *S. rhombifolia*, which is known from Arunachal Pradesh, not very far to the west. It is intermediate between the two in almost all characters, occurs in the same area as *S. ramulosa*, and is distinguished by the poorly developed and apparently sterile anthers borne on the inner filaments. This is the first mention of a possible hybrid in *Strobilanthes*. In contradiction, and to add to the complexity, all specimens of *S. ramulosa* that we have seen fail to develop capsules despite having four fertile stamens whereas *S. straminea* freely produces ripe capsules.

Strobilanthes schomburgkii (*Craib*) *J. R. I. Wood* **comb. nov.**

Hemigraphis schomburgkii Craib, *Bull. Misc. Inform., Kew* 1911: 435 (1911). Type: Thailand, *Schomburgk* 145 (holotype K).

Sericocalyx schomburgkii (Craib) Bremek. (1944: 163).

Possibly native in Thailand but certainly used as a hedge plant there and introduced to Cambodia, Malaysia (Sabah), Trinidad (West Indies) and doubtless elsewhere. This species seems always to be sterile and is spread by cuttings. It has pollen typical of species assigned by Bremekamp to *Sericocalyx* and *Aechmanthera* (Plate 1L), although this pollen type is found elsewhere in *Strobilanthes*.

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