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The 2-lipped species of *Strobilanthes* (*Acanthaceae*)

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Summary. The occurrence of the two-lipped calyx, used by Nees and Bremekamp as a defining character for the seven segregate genera, *Adenacanthus, Buteraea, Larsenia, Parachampionella, Perilepta, Triaenacanthus* and *Tetragompha*, is traced through the genus *Strobilanthes*. It is shown to occur almost randomly, with little correlation with inflorescence or pollen characters and to intergrade with the common subequally five-lobed calyx. No justification can be found in this character for the creation of separate genera. Individual species with this character are reassessed. Broad concepts are proposed for *Strobilanthes rufescens* with the recognition of three subspecies, and for *S. auriculata* with the commonly cultivated Persian Shield accepted as var. *dyeriana*. The widely used but misapplied name for the Assam Indigo plant, *Strobilanthes flaccidifolia*, is shown to be based on a specimen that correctly belongs to *S. denticulata*. Pollen is shown to be of crucial importance in species delimitation, allowing separation of *Strobilanthes tashiroi* and *S. mogokensis* from morphologically similar species. Seven new species, *Strobilanthes adpressa, S. bipartita, S. decipiens, S. heliophila, S. maxwellii, S. perplexa* and *S. tripartita* are described and new combinations for *S. decumbens* and *S. korthalsii* are made.

INTRODUCTION

Recent papers by Carine & Scotland (1998, 2002) have drawn attention to the difficulties of classifying the *Strobilanthinae sensu* Bremekamp. In particular they have shown that variation in pollen morphology is much greater than was previously supposed and that the different pollen types are not necessarily as distinct as Bremekamp had claimed. Examination of another character, the "bipartite" calyx, used by Nees and Bremekamp for generic delimitation raises similar issues. Of the 60-odd genera, into which Bremekamp eventually divided the *Strobilanthinae*, *Buteraea* Nees, *Perilepta* Bremek., *Larsenia* Bremek., *Adenacanthus* Nees, *Triaenacanthus* Nees, *Tetragompha* Bremek. and *Parachampionella* Bremek. are defined at least partly by having a two-lipped or bifid calyx.

Examination of the species placed by Bremekamp in these genera and of others with this character that our own studies have revealed shows that the character is far from uniform across the range of species involved. In three species, *Strobilanthes rufescens, S. bidentata* and the species represented by *Bunnemeyer* 11852, both the two lower calyx lobes and the three upper lobes are fused for most of their length to form a distinctly two-lipped calyx. In many of the species discussed below the two lower lobes are entirely free, while the upper lobes remain partially fused until anthesis or even much later. In yet others the three upper lobes are only basally connate at an early stage of flower development. Examination of specimens of some species, notably *Strobilanthes alboviridis*, suggests that there is some variation even within species. Bremekamp (1944: 56 – 61) attempted to distinguish some of this

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variation by using the words *bipartitus* and *tripartitus* to distinguish between calyx types but it is clear that the variation is both greater and less well-defined than these two terms suggest.

The occurrence of a bipartite or tripartite calyx in *Strobilanthes* correlates poorly with other characters and appears to be of almost random occurrence within the genus and is of relatively little systematic importance except at the level of species. This is clearly shown in the appendix on pages 128 – 129, which shows that the character is associated with the most diverse types of pollen and inflorescence morphologies. Small clusters of species can be easily discerned but no close relationship between clusters is obvious and the plants that share this character are very disparate indeed.

In the following account we have looked at the various clusters of species which show a "bipartite" or "tripartite" calyx structure discussing the structure in each case. In several cases morphologically similar and presumably related species can be identified which have the common subequally 5-lobed calyx or one which is clearly transitional to this.

Buteraea

Buteraea was originally described by Nees to accommodate a single species, now known as *Strobilanthes rufescens*. This has a number of remarkable characteristics. In the first place the calyx is more obviously 2-lipped than in any other species of *Strobilanthes* except *S. bidentata*, described for the first time in this paper. The three lobes of the upper lip are fused but also, and, more exceptionally so are the two lobes of the lower lip. The plants are also strongly foetid and may contain an essential oil that inhibits fire (Anon. 1895). The same paper gives a graphic description of the mass flowering of this species on the west side of the Upper Chindwin Valley in Burma, although there are few other reports of the phenomenon in this species apart from an indirect reference by Roxburgh (1832: 43). He observed that the plant cultivated in the Calcutta Botanical Garden was grown for seven years before it flowered. The stems are sometimes covered in dense shaggy, red hairs but this character is not constant and seems to occur sporadically in much the same way as in *Aechmanthera gossypina* (Wall.) Nees. However, the red hairs are always present on the petioles and on the veins of the lower surface of the leaves and on the bracts suggesting a relationship with the plants placed by Bremekamp in his genus, *Pyrrothrix*, although none of these has the distinctive calyx or spicate inflorescence of *Strobilanthes rufescens*. The pollen is ellipsoid but the coarse reticulum is irregular, not scalariform (Fig. 12A) and similar to that of *Aechmanthera*. The flowers are imbricate in shortly pedunculate, axillary spikes and the inflorescence is densely hairy with long silky, hairs, both features found in the next species to be discussed, *Strobilanthes auriculata*.

Several species have been described in *Buteraea* but we regard them all as part of a single variable species, which can be divided into three geographical subspecies. The three subspecies can be distinguished by their bracts but other distinguishing characters are few and unsatisfactory. Some plants, intermediate in bract shape occur in central Burma and cannot easily be assigned to subspecies.

Strobilanthes rufescens (*Roth*) *T. Anderson*, J. Linn. Soc., Bot. 9: 472 (1867). Fig. 1A – M.

Ruellia rufescens Roth, Nov. Pl. Sp.: 304 (1821). Type: India, Bengal, ex Calcutta Bot. Gard., *Heyne* (B†, neotype *Wallich* 2360 (K-W), **chosen here**). *Buteraea rufescens* (Roth) D. Dietr., Syn. Pl. 3: 589 (1843).

Strobilanthes rufescens var. *rubiginosa* C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 430 (1884), *pro parte*. Type: Bangladesh, Chittagong Hills, *C. B. Clarke* 19529 (K, lectotype, **chosen here**).

Ruellia comosa Roxb., Fl. Ind. 3: 43 (1832), non Vell. (1827). Type: a plant said (erroneously) to be from the Moluccas cultivated in the Calcutta Botanical Garden (loc. cit. 43) and apparently not preserved.

Ruellia eucoma Steud., Nomencl. Bot., Ed. 2, 2: 480 (1841), non Vell. (1827). Type: based on *Ruellia comosa*.

Buteraea ulmifolia Nees in Wall., Pl. Asiat. Rar. 3:84 (1832). Type: India ex Calcutta Bot. Gard., *Wallich* 2360 (syntypes K-W, BM, K).

We have designated a neotype for *Strobilanthes rufescens* as the original type was destroyed in Berlin in 1943. We have chosen *Wallich* 2360, an original syntype of *Buteraea ulmifolia* Nees, as it may have originated from the same cultivated material as the Heyne collection on which Roth based his *Ruellia rufescens*. The selection of a lectotype for var. *rubiginosa* C. B. Clarke is also of some importance. Clarke cited two very different specimens and his concept of the variety is not very clear. The name suggests it is characterised by its redness but the only common element mentioned is the glabrous, lineolate upper surface of the leaves. The first specimen cited by Clarke (*Helfer* K.D. 6118) has Anderson's manuscript name, *Strobilanthes rubiginosa*, on the sheet but the oblong bracts on this specimen fit Clarke's *Strobilanthes parishii* better than *S. rufescens*. We have therefore selected as the lectotype the other specimen cited and annotated by Clarke (*Clarke* 19529).

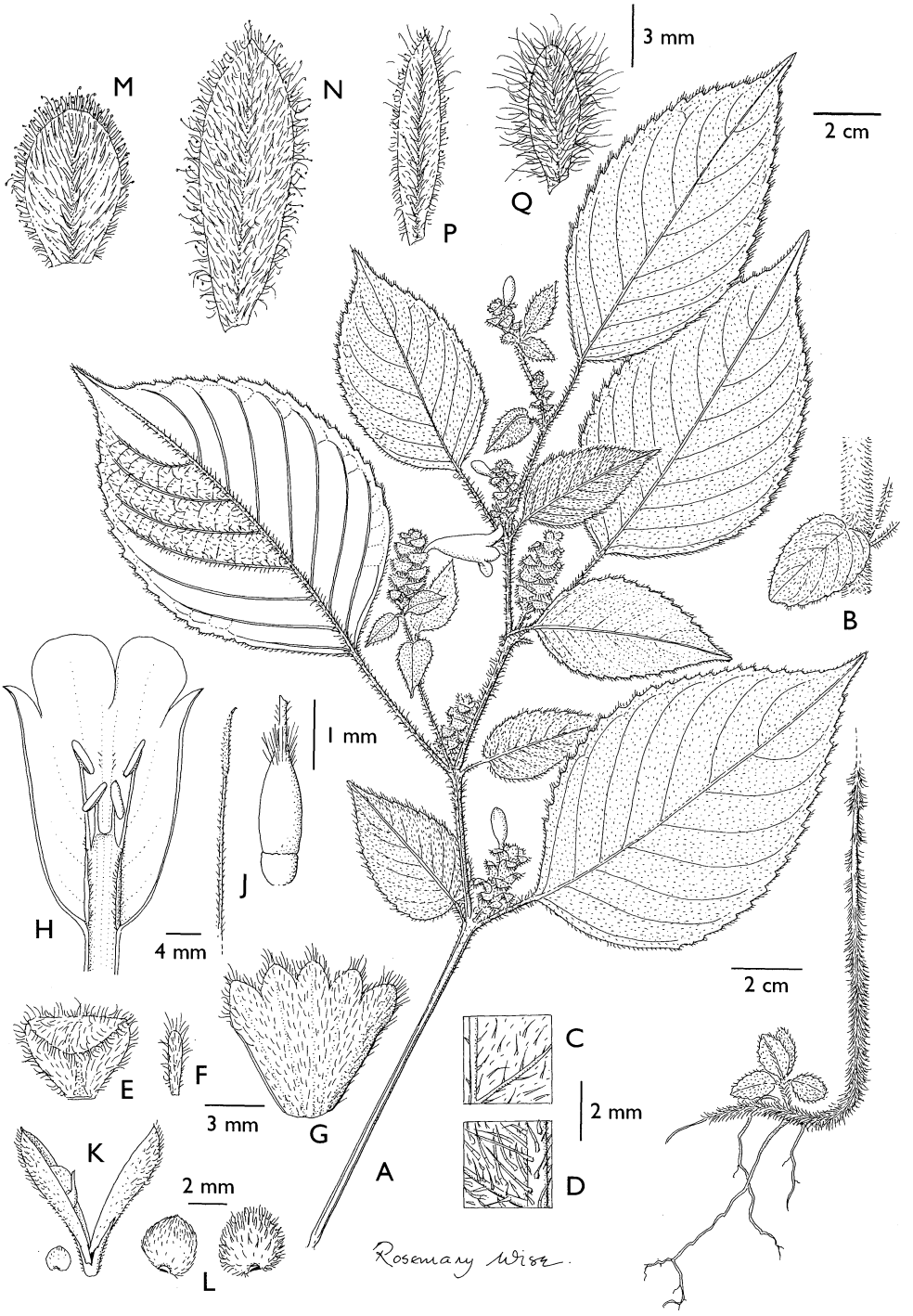
subsp. **rufescens**

This is distinguished by its broadly elliptic or obovate bracts, 5 – 8 mm long and 3 – 6 mm wide, so about one and a half times as long as wide. They are always conspicuously covered in spreading reddish hairs and the tips are usually reflexed. The spikes are relatively stout, commonly exceeding 1 cm in width. Some plants especially those from Pegu Yoma in Burma are to some extent intermediate with subsp. *parishii* and lack the recurved tips typical of subsp. *rufescens*.

HABITAT AND DISTRIBUTION. NE India (Nagaland/Manipur, Mizoram), Bangladesh (Chittagong), Upper Burma (Myanmar) north of about 20° and Pegu Yoma west of the Irrawaddy, where it is locally abundant in teak forest. Map 1.

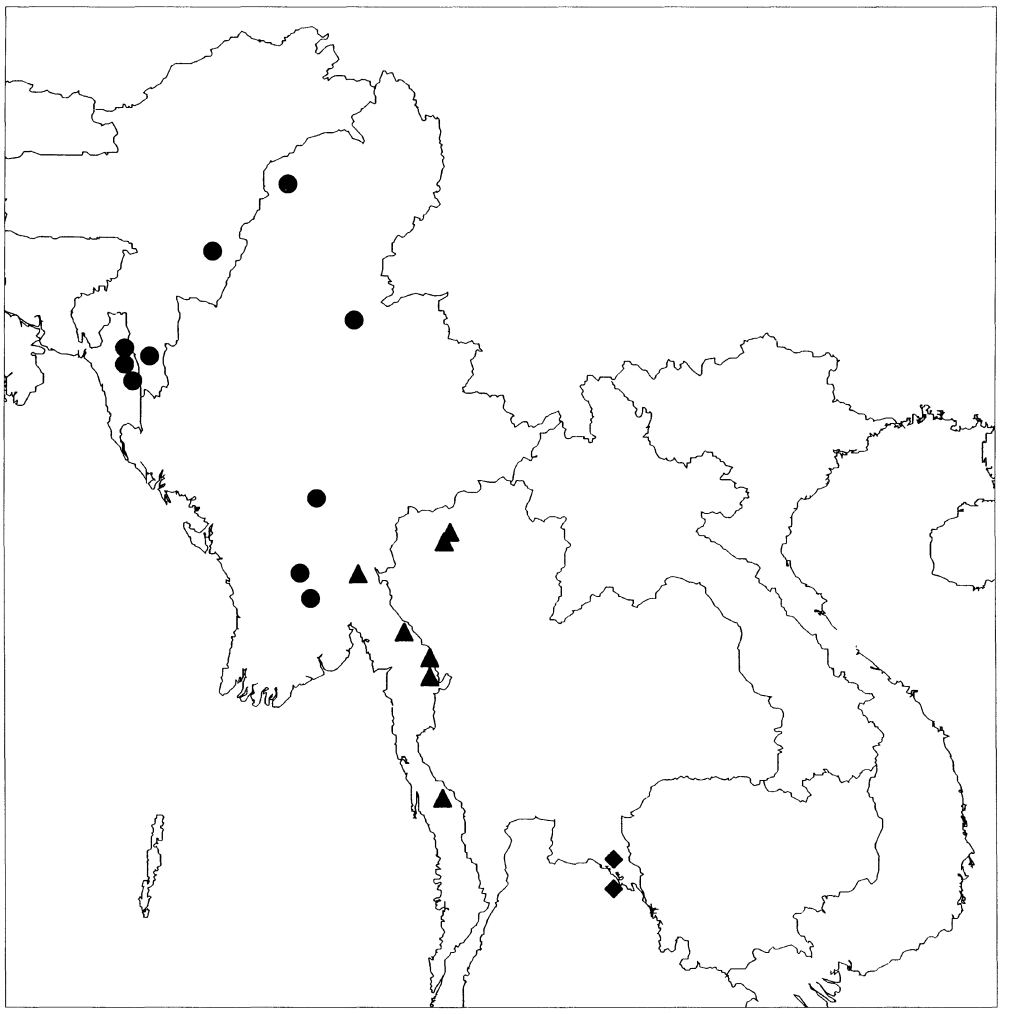
CONSERVATION STATUS. Low risk, least concern.

INDIA. Cult. ex Calcutta Botanical Gardens, *Wallich* 2360 (K-W, K, BM); Manipur/Nagaland: Kala, Naga Hills, 950 m, May 1882, *Watt* 7356 (K); Mizoram: Blue Mountain, 52 miles from Lungley, 1350 m, 3 Dec. 1931, *Wenger* 380 (K); ibid, 1200 m, 8 Dec. 1931, *Wenger* 381 (K).



BANGLADESH. Chittagong, *Clarke* 19970 (BM); Rangamati, Chittagong, 5 Feb. 1873, *Clarke* 19523 & 19529(K); Feelakudo, Chittagong, 26 Feb. 1873, *Clarke* 19970 (BM); Surty, Chittagong, 23 March 1876, *Lister* 294 (K); Sitakund, Chittagong, 21 Jan. 1968, *M. S. Khan* 1533 (E).

BURMA (MYANMAR). Layshi, Upper Chindwin, 950 – 1300 m, 19 March 1935, *Kingdon Ward* 11232 (BM); Kunchaung Reserve, Ruby Mines Distr., 130 m, 21 Jan.



MAP 1. Distribution of *Strobilanthes rufescens* subsp. *rufescens* (●); subsp. *parishii* (▲); subsp. *parvibracteata* (♦).

FIG. 1 (left). **A – L** *Strobilanthes rufescens*. **A** habit; **B** portion of stem; **C** adaxial leaf surface; **D** abaxial leaf surface; **E** bract with recurved tip; **F** bracteole; **G** calyx, outer surface; **H** corolla; **J** ovary and style; **K** capsule; **L** seeds; (**A**, **C – G** drawn from *Lace* 5062, **B**, **H – J** from *Po Chin* 6013, **K** from *Khan* 1533, **L** from *Brandis* 835). Inset of bracts: **M** subsp. *rufescens* from Pegu Yoma (*Brandis* 835); **N** subsp. *parishii* (*Po Chin* 6013); **P** subsp. *parishii* (*Parish* 412); **Q** subsp. *parvibracteata* (*Kerr* 17614). Drawn by Rosemary Wise.

1910, *Lace* 5062 (E, K); Pegu, *Brandis* 835 (K); Pegu Yoma, 500 m, 6 Jan. 1906, *Lace* 2874 (K); Ngalaik Reserve, 23 Jan. 1909, *Lace* 4550 (K); Myauklaing Reserve, Insein [16°54'N, 96°08'E], 350 m, 12 Jan. 1948, *Po Khant* 45 (A).

subsp. **parishii** (*C. B. Clarke*) *J. R. I. Wood,* **stat. nov.** Fig. 1N, P.

Strobilanthes parishii C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 431 (1884). Type: Burma (Myanmar), Moulmein, *Parish* 412 (lectotype K, **chosen here**). *Buteraea parishii* (C. B. Clarke) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 211 (1944).

Strobilanthes foetidissima Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43: 93 (1873). Type: Burma, Martaban, *Kurz* (?CAL, n.v.). *Buteraea foetidissima* (Kurz) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41(1): 211 (1944).

Clarke (1884: 431) cited two syntypes for *Strobilanthes parishii*, *Parish* 412 and *Beddome* 93. Both represent the same species, treated here as a subspecies, but we have selected *Parish* 412 as the lectotype as this collection was used by Clarke to create the epithet for his new species.

Subsp. *parishii* is distinguished by its longer, oblong-oblanceolate to narrowly elliptic bracts, 7 – 12 mm long and 2 – 4 mm wide. The tips of the bracts are never recurved. The spikes are characteristically narrower than in subsp. *rufescens* and are less than 8 mm wide. The reddish hairs are usually much less conspicuous as well.

HABITAT AND DISTRIBUTION. Evergreen forest in NW Thailand (Chiang Mai) and Burma/Myanmar (Northern Tenasserim around Moulmein). Map 1.

CONSERVATION STATUS. Low risk, least concern.

BURMA (MYANMAR). Tenasserim, 1838, *Helfer* K.D. 6118 (K); Moulmein, 1862, *Parish* 412 (K); Donat (?Dawna) Range, Tenasserim, 350 m, Feb. 1879, *Beddome* 108 (BM); Mulayit [16°11'N, 98°32'E), Donat (?Dawna) Range, Tenasserim, June 1879, *Beddome* 93 (K); Okkan Reserve [17°35'N, 96°04'E), Hantawaddy, 30 Jan. 1906, *Lace* 2897 (K)); Tavoy, 20 Nov. 1924, *Parker* 2236 (K); Salween, Palanlaung, 950 m, 24 Nov. 1928, *Po Chin* 6073 (CAS, E).

THAILAND. Chiang Mai: SE side of Doi Chiang Dao, 500 – 1510 m, 9 Feb. 1983, *Koyama, Terao & Wong-Prasert* 33252 (K, KYO); Pa Blawng cave area, E side of Doi Chiang Dao, 680 m, 29 Jan. 1989, *J. F. Maxwell* 89-105 (MO); Mawk Falls, Mae Dang, 675 m, 27 Jan 1990, *J. F. Maxwell* 90-129 (A, E, MO).

subsp. **parvibracteata** *(C. B. Clarke) J. R. I. Wood*, **stat. nov.** Fig. 1Q.

Strobilanthes parvibracteata C. B. Clarke, Bot. Tidskr. 24: 349 (1902). Type: Thailand, Trat, Ko Chang Island, *Schmidt* 609 (lectotype C, **chosen here**, isolectotypes BM, K).

Buteraea parvifolia Bremek., Dansk Bot. Ark. 20: 70 (1961). Type: Thailand, Chantaburi, *T. Sorensen, K. Larsen & B. Hansen* 529 (C, no holotype cited).

In selecting a lectotype for subsp. *parvibracteata* we have chosen the Copenhagen specimen as it is the only one annotated by Clarke. The BM and Kew sheets may never have been seen by Clarke and certainly the Kew sheet was only received in 1911, five years after Clarke's death.

This subspecies is distinguished by its relatively small, obovate or elliptic bracts, 4.5 – 5 mm long and 2 – 3 mm wide. The tips are never recurved. The hairs on the inflorescence are denser and redder than in the other species making it difficult to see the bracts and calyx.

HABITAT AND DISTRIBUTION. Restricted to lowland evergreen forest in Chantaburi and Trat Provinces in SE Thailand. It might be expected to occur in neighbouring Cambodia but we have seen no specimens from there. Map 1.

CONSERVATION STATUS. Insufficient data but possibly vulnerable.

THAILAND. Chantaburi: Pnui Falls, 150 m, 19 Jan. 1959, *Sorensen, Larsen & Hansen* 529 (C). Trat: Ko Chang Island, 1899 – 1900, *J. Schmidt* 609 (K); Ko Chang Island, 100 m, 2 April 1923, *Kerr* 6826 (BM, K): Lem Dan Kao, Ko Chang Island, 400 m, 3 Oct. 1924, *Kerr* 9305 (BM, K); Dar Chumpon, 50 m, 19 Dec. 1929, *Kerr* 17614 (BM, K).

Perilepta

The species placed in this genus by Bremekamp and those in the next, *Larsenia*, have many characters in common. The inflorescence consists of dense, terminal and axillary spikes with persistent, imbricate bracts, often covered in long, silky hairs as in *Strobilanthes rufescens*. Additionally the bracteoles are often suppressed although this is not always constant within two species, *Strobilanthes auriculata* and *S. helferi* and is not the case in *S. longipes*, which is peripheral to the other species under consideration here. The pollen of all five species is ellipsoid, ribbed and scalariform (Fig. 12B). Although Bremekamp (1944: 60, 194) described the calyx of both genera as bipartite, this is not the case. The two lower lobes seem always to be free to the base and slightly shorter than the upper three, which are sometimes connate just above the base. They are, therefore, transitional in terms of calyx structure to those species with a subequally 5-lobed calyx. The distinctive connate upper calyx lobes of most species discussed in this paper are not a feature of the species placed in *Larsenia* and *Perilepta*.

Perilepta itself consists of a single variable species, *Strobilanthes auriculata*, reduced from the eight names recognised by Bremekamp (1944: 194). It is characterised by the sessile leaves, spicate inflorescence usually covered in long, white, silky hairs, the absence of bracteoles, the broad, imbricate, persistent bracts and the calyx structure.

Strobilanthes auriculata *Nees* in Wall., Pl. Asiat. Rar. 3: 69 & 86 (1832). Type: Nepal, *Buchanan-Hamilton* in *Wallich* 2341 (syntypes K-W, BM). Fig. 2.

Perilepta auriculata (Nees) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41(1): 194 & 270 (1944).

Strobilanthes auriculata var. *bracteolata* C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 453 (1884). Type: India, Meghalaya, Khasi Hills, *Hooker & Thomson* (lectotype K, sheet with original collection label of 26 July 1850, **chosen here**).

S. auriculata var. *acuta* Benoist in Lecomte, Fl. Indo-Chine 4: 674 (1935). Types: Cambodia, Domrek, *Harmand* (syntype P) and Laos, between Bassac and Ubon, *Thorel* (syntype P).

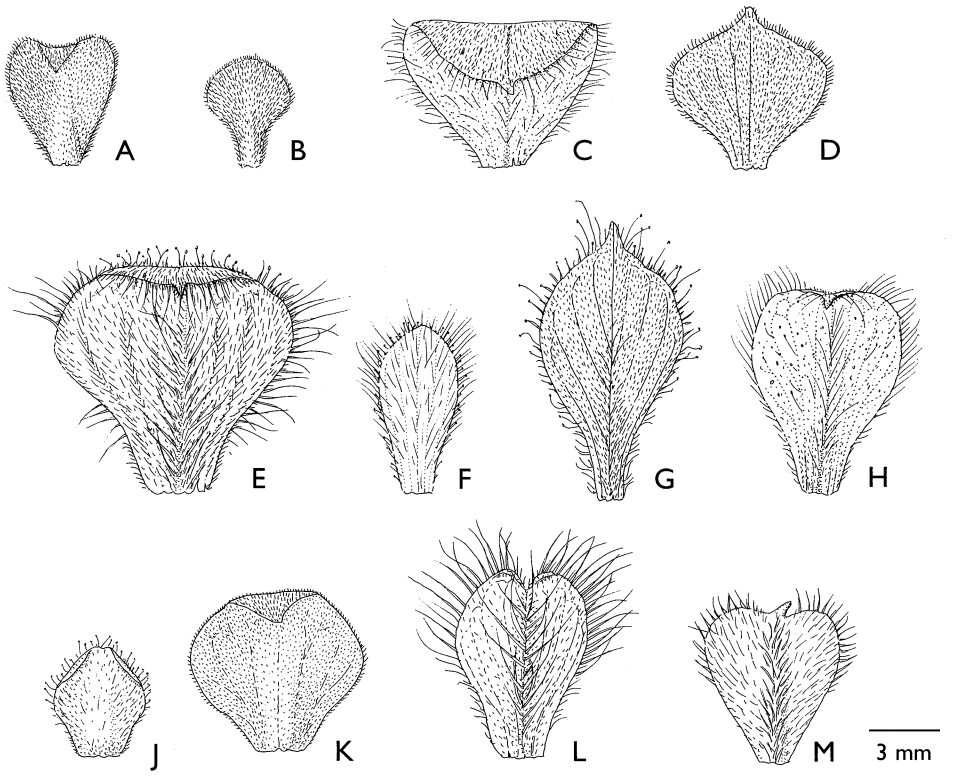


FIG. 2. **A – M** Variation in size, shape and indumentum of bracts in *Strobilanthes auriculata*. **A** *Henry* 12570 from Yunnan (China); **B** *Parry* 1076 (type of *S. trichophora*) from NE India; **C** *Kerr* 2296 (type of *S. venusta*) from N Thailand; **D** *Wallich* 2341 (type of *S. auriculata*) from Nepal; **E** *Gamble* 25318 from N India (zone of type of *S. edgeworthiana*); **F** *Robinson* 6196 (type of *S. leucopogon*) from Langkawi Island, Malaysia; **G** *Petrmitr* 248 from N Thailand, fitting *S. auriculata* var. *acuta*; **H** *Maxwell* 94-43 from Peninsular Thailand; **J** *Illmann* 15820, a cultivated plant of *S. auriculata* var. *dyeriana*; **K** *Kerr* 17768 from SE Thailand; **L** *Wallich* 7157 (type of *S. plumulosa*); **M** *Lace* 2857 from Pegu Yoma, Burma, fitting wild forms of *S. auriculata* var. *dyeriana*. Drawn by Rosemary Wise.

S. auriculata var. *rubrifolia* Benoist in Lecomte, Fl. Indo-Chine 4: 674 (1935). Type: Cambodia, Sral, *Pierre* 1180 (holotype P).

S. amplectens Nees in Wall., Pl. Asiat. Rar. 3: 86 (1832). Type: Burma (Myanmar), Taong Dong, *Wallich* 7158 (syntype K-W).

Perilepta amplectens (Nees) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 195 & 269 (1944).

Strobilanthes plumulosa Nees in Wall., Pl. Asiat. Rar. 3: 86 (1832). Type: Burma (Myanmar), Prome Mountains, *Wallich* 7157 (syntypes K-W, BM, K). *S. auriculata* var. *plumulosa* C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 453 (1884). *Perilepta plumulosa* (Nees) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 195 & 283 (1944).

Strobilanthes edgeworthiana Nees in DC., Prodr. 11: 190 (1847). Type: India, (Dehra) Dhun, *Edgeworth* s.n.(lectotype K, portion of sheet annotated "S. edgeworthii" in

Nees's hand, **chosen here**). *S. auriculata* var. *edgeworthiana* C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 453 (1884). *Perilepta edgeworthiana* (Nees) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 195 & 274 (1944).

Strobilanthes siamensis C. B. Clarke, Bull. Herb. Boissier, sér. 2, 7: 716 (1905). Type: Thailand, Long Isom to Nong Boa, *Lindhard* 55 (holotype K). *S. auriculata* var. *siamensis* (C. B. Clarke) Benoist in Lecomte, Fl. Indo-Chine 4: 674 (1935). *Perilepta siamensis* (C. B. Clarke) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41(1): 195 & 285 (1944).

Strobilanthes venusta Craib, Bull. Misc. Inform., Kew 1914: 131 (1914). Type: Thailand, a cultivated plant from Chaing Mai, *Kerr* 2296 (lectotype K, sheet with Kerr's collection data, **chosen here**). *Perilepta venusta* (Craib) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 195 & 287 (1944).

Strobilanthes leucopogon Ridl., J. Straits Branch Roy. Asiat. Soc. 86: 304 (1922). Type: Malaysia (West), Langkawi Island, *H. C. Robinson* 6196 (holotype K).

S. trichophora C. E. C. Fisch., Bull. Misc Inform., Kew 1932: 202 (1932). Type: India, Meghalaya, Garo Hills, *Parry* 1076 (holotype K).

S. incisa J. B. Imlay, Bull. Misc. Inform., Kew 1939: 120 (1939). Type: Thailand, Lampang, *Winit* 1818 (not found at K or BM).

Strobilanthes auriculata is one of the easiest species of the genus to recognise, even when sterile, because of the oblong, sessile and usually auriculate leaves, from which it derives its name, but like other widespread species such as *Strobilanthes echinata* and *S. wallichii* it is very variable. Most of the names listed in the synonymy are based on differences in the leaves and bracts, and variation in the size, shape and indumentum of the bracts is particularly striking. Fig. 2 gives some idea of the extent of this variation in selected specimens including the types of many of the names listed in the synonymy above. All drawings have been made from bracts taken from the middle of each spike because the bracts vary in size and shape on an individual spike. In the case of *Wallich* 7157, the type of *Strobilanthes plumulosa* (Fig. 2L), for example, the upper bracts are acute and only the middle and lower bracts are emarginate. The basic obovate shape of the bracts is readily apparent, as is the dramatic variation in bract size and indumentum. Much of the variation seems of almost random occurrence and correlates poorly with other morphological features or geographical distribution. However the following comments and generalisations may be useful:

- The development of long silky, white hairs may to some extent be a development stage as the hairs are absent or few on the bracts of obviously young plants. *Kerr* 17768 (Fig. 2K) and *Wallich* 2341 (Fig. 2D) appear to fit this pattern. *Maxwell* 87-1634 (CAS) is another interesting young specimen as, although the bracts have some long white hairs, these are much fewer than is usually the case in more mature specimens from Thailand.
- The absence of long, silky, white hairs on the bracts (Fig. 2A, B, D, K) is partially geographically linked. Specimens without these hairs are far more common in the northern part of the range of *Strobilanthes auriculata* but are very rare in Burma, Thailand and Indo-China, disappearing entirely in peninsular South East Asia. However specimens with the long, white, silky hairs are found throughout the range of *Strobilanthes auriculata.*

- Specimens from Lower Burma and from cultivation tend to have unusually large leaves, usually in excess of 15 cm in length. Some of these conform to var. *dyeriana*, discussed below, while others, including the type of *Strobilanthes plumulosa,* do not. In any case large leaves intergrade with smaller leaves over the range of *Strobilanthes auriculata.*
- Specimens from Langkawi Island (Malaysia) corresponding to *Strobilanthes leucopogon* (Fig. 2F) are distinctive because of their small, oblong-oblanceolate bracts with long, white hairs, which we cannot match elsewhere. They may merit some formal recognition because of their geographical isolation but we think it quite possible that other localities in peninsular South East Asia may yield specimens linking these to the larger-bracted forms found further north.

However, one form of *Strobilanthes auriculata* has long been cultivated under the name Persian Shield, *S. dyeriana.* The original description cited no type and no origin besides the words "East Indies" but commented on the rosy-lilac colouring of the leaves. In the text accompanying Tab. 7574 in the Botanical Magazine illustrating this plant, J. D. Hooker (1898) recounts how the original plants were collected by Boxall in Burma and sent to Singapore, thence to Kew and finally possibly by agency of Thistleton Dyer to F. Sander & Sons of St Albans. As *Strobilanthes dyeriana* is a well-known cultivated plant with more entries on the Internet than for all other *Strobilanthes* combined, it seems appropriate to give this plant recognition at varietal level and neotypify it to achieve nomenclatural stability:

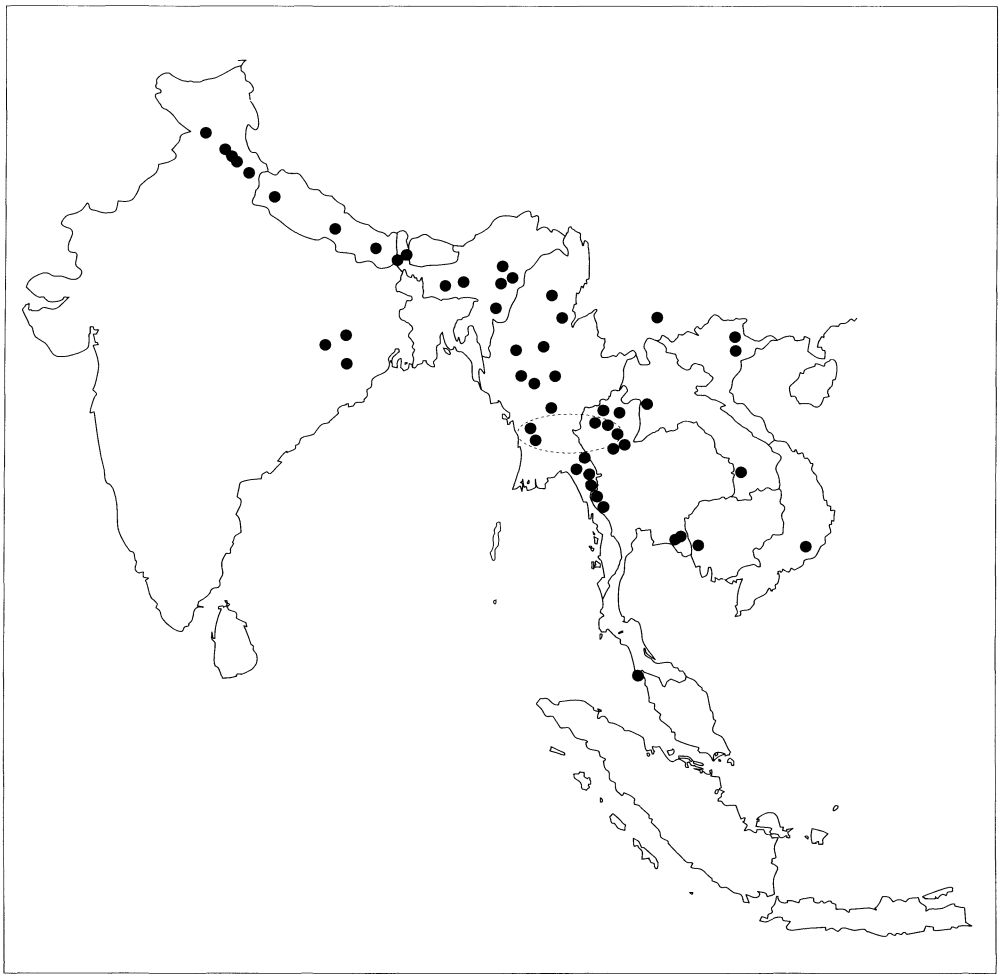
Strobilanthes auriculata var. **dyeriana** (*Mast.*) *J. R. I. Wood*, **comb. & stat. nov.**

Strobilanthes dyeriana Mast., Gard. Chron. 1: 442 (1893). Type: not specified; neotype K, a specimen cultivated at Kew in Feb 1916, **chosen here**. *Perilepta dyeriana* (Mast.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 195 & 274 (1944).

Strobilanthes maclellandii C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 453 (1884). Type: Burma (Myanmar), Rangoon, *McLelland* (holotype K). *Perilepta maclellandii* (C. B. Clarke) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 195 & 279 (1944).

Strobilanthes maclellandii var. *latipes* C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 454 (1884). Type: Burma Myanmar), probably Pegu Yoma but relabelled "Tenasserim" in another hand, *Beddome* (holotype K).

Although *Strobilanthes auriculata* var. *dyeriana* does flower in cultivation it is mainly cultivated for its foliage which is rosy-lilac to white-blotched above. Cultivated specimens also show nearly glabrous, distinctly large leaves, usually in excess of 15 × 7.5 cm combined with relatively small bracts (Fig. 2J). Wild plants corresponding to cultivated specimens of *Strobilanthes auriculata* var. *dyeriana* (Fig. 2M) are found in Burma and Thailand (Map 2) and it is very likely that cultivated specimens originate from Pegu Yoma, which is close to Rangoon and the only area then known botanically where this variety grows. The following are representative specimens of wild provenance that can safely be assigned to var. *dyeriana* but there may be others as the distinctive leaf colouring is not always apparent on dried specimens.



MAP 2. Distribution of *Strobilanthes auriculata* with area in which var. *dyeriana* occurs naturally, ringed.

BURMA (MYANMAR). Rangoon, boundary ranges between Hanise and Pourphy, 30 Jan. 1854, *Mclelland* s.n. (K); Pegu Yoma, *Beddome* 215 (BM); ibid, *Beddome* s.n. (K); Pegu, S Zamagi Forest, 19 Dec. 1905, *Lace* 2857 (K, E); ibid, 21 Dec. 1905, *Lace* 2858 (K).

THAILAND. Lampang, Wahng Nua, Jae Sawn National Park, 550 m, 6 Dec. 1995, *J. F. Maxwell* 95-1301 (A, CAS).

Additionally there is a specimen of a cultivated plant from Lampang in Thailand (*Winit* 1889 (K)) that shows the distinct large, variegated leaves of var. *dyeriana*. This suggests that var. *dyeriana* has long been cultivated in its native homelands and that it is possible that the plant exhibited in London and Paris for the first time in 1893 in fact originated from cultivated, rather than wild specimens in Burma. There are

also records of distinctly coloured leaves in *Strobilanthes auriculata* from other countries. Haines (1922: 678) refers to a form with "pretty white variegated leaves" from Chota Nagpore in the Indian state of Bihar and Benoist described a var. *rubrifolia* from Cambodia although this has sparsely pilose leaves which do not exceed 8 cm in length.

Strobilanthes auriculata is distributed along the foothills of the Himalayas from Ravi in Indian Punjab to Darjeeling but is apparently absent further east. It occurs further south in the Chota Nagpur area of Bihar (it is the only Himalayan species to grow south of the Ganges), in Meghalaya, Nagaland and Manipur in NE India, thence through Burma, Thailand, Cambodia, Laos and Vietnam, to Yunnan in China and south to Langkawi Island at the northern extremity of Peninsular Malaysia (Map 2). In some areas it is reported as plietesial[2] (Haines (1922): 678) but there is no report of this from Burma or Thailand or from those who cultivate var. *dyeriana*. It thus seems to behave in a rather similar way to *Strobilanthes wallichii* (Wood 1994: 265 – 266) in that it is plietesial in the western part of its range but not further east.

Larsenia

Larsenia was the last of over 40 genera described by Bremekamp in the *Strobilanthinae* and, in our opinion, conspecific with *Strobilanthes*. Bremekamp (1965: 205) placed his new genus next to *Perilepta* on the grounds of "the large, palmately nerved bracts and the bilabiate calyx" but distinguished it by its petiolate leaves and broader bracts and by the absence of gland-tipped hairs. While we agree with Bremekamp about the affinity of his *Larsenia* with *Perilepta* — the absence of bracteoles is another shared feature which he did not stress — the characters he mentions are of no significance at generic level and in any case the calyx of *Larsenia decumbens* is hardly bilabiate. All that can be observed is that the three upper lobes of the calyx are slightly shorter than the two lower ones.

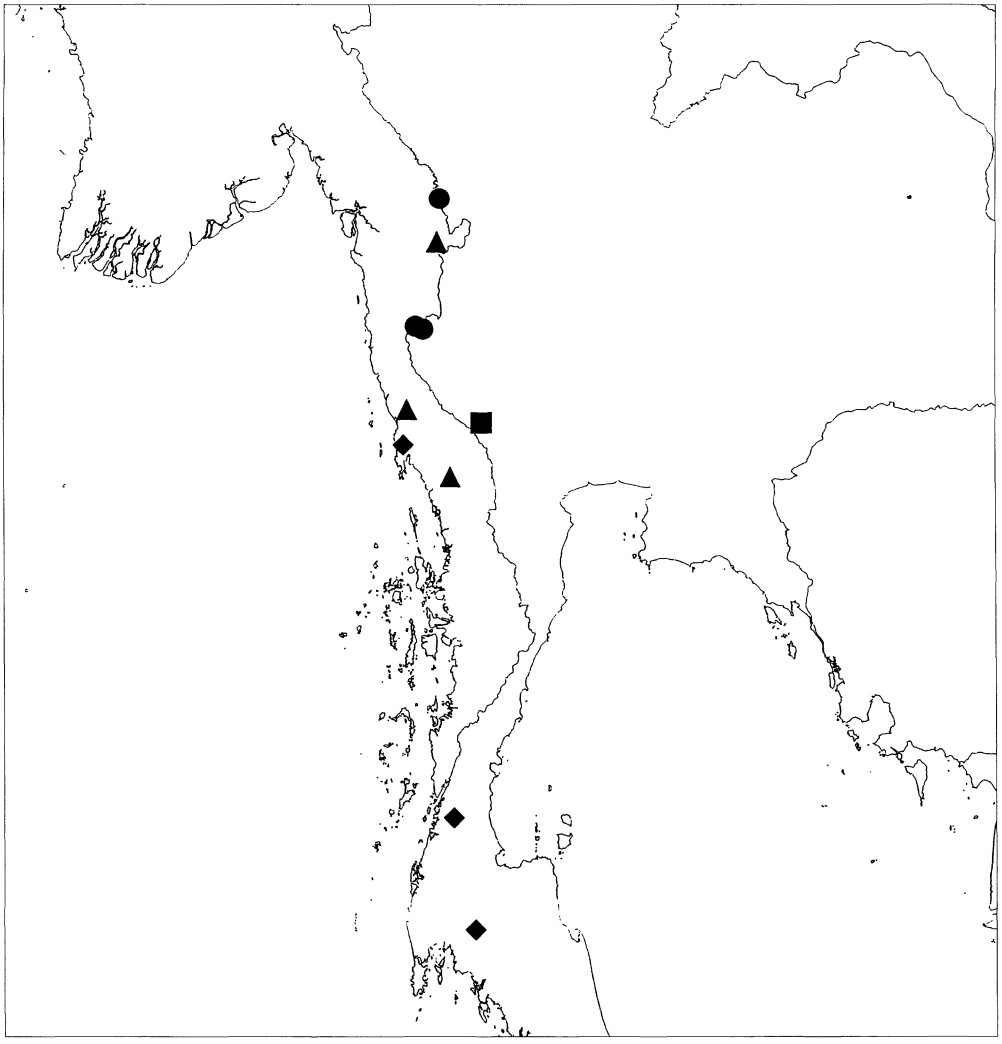
What Bremekamp did not observe was the similarity of his new genus to the little-known *Strobilantes helferi* T. Anderson. This also has broad bracts and is described as without bracteoles although we were able to find a rudimentary pair in *Kostermans* 377. In our opinion both species are part of a small, morphologically similar, cluster which includes *Strobilanthes auriculata* and two other species discussed below. All have simple, dense flower spikes with conspicuous, broad, persistent, imbricate, sessile bracts and ellipsoid, ribbed pollen typical of most *Strobilanthes* species. The bracteoles are often absent or much reduced and there is a tendency to develop long, silky, white hairs on the inflorescence although, like the bracteoles, these are not constant within a particular species. All four species below are very local plants of the South East Asian peninsular in Thailand and Burma Myanmar. Map 3.

[2] Plietesial is a term introduced by Bremekamp (1944: 20) to describe a perennial monocarpic species.

Strobilanthes helferi *T. Anderson*, J. Linn. Soc., Bot. 9: 472 (1867). Type: Burma (Myanmar), Tenasserim, *Helfer* 495/K.D. 6117 (syntype K). Fig. 3G – P.

Strobilanthes helferi is distinguished by its very long, flexuose flower spikes, which reach 30 cm and which have distant flower pairs subtended by small, rounded, sessile, densely but shortly pubescent bracts. Additionally the three upper calyx lobes are basally connate.

HABITAT & DISTRIBUTION. Known from only three collections, two probably from the same locality. Habitat details are not accurately known but one collection was made in forest on a limestone hill. Map 3.



MAP 3. Distribution of *Strobilanthes decumbens* (■), *S. heliophila* (♦), *S. helferi* (●)and *S. longipes* (▲).

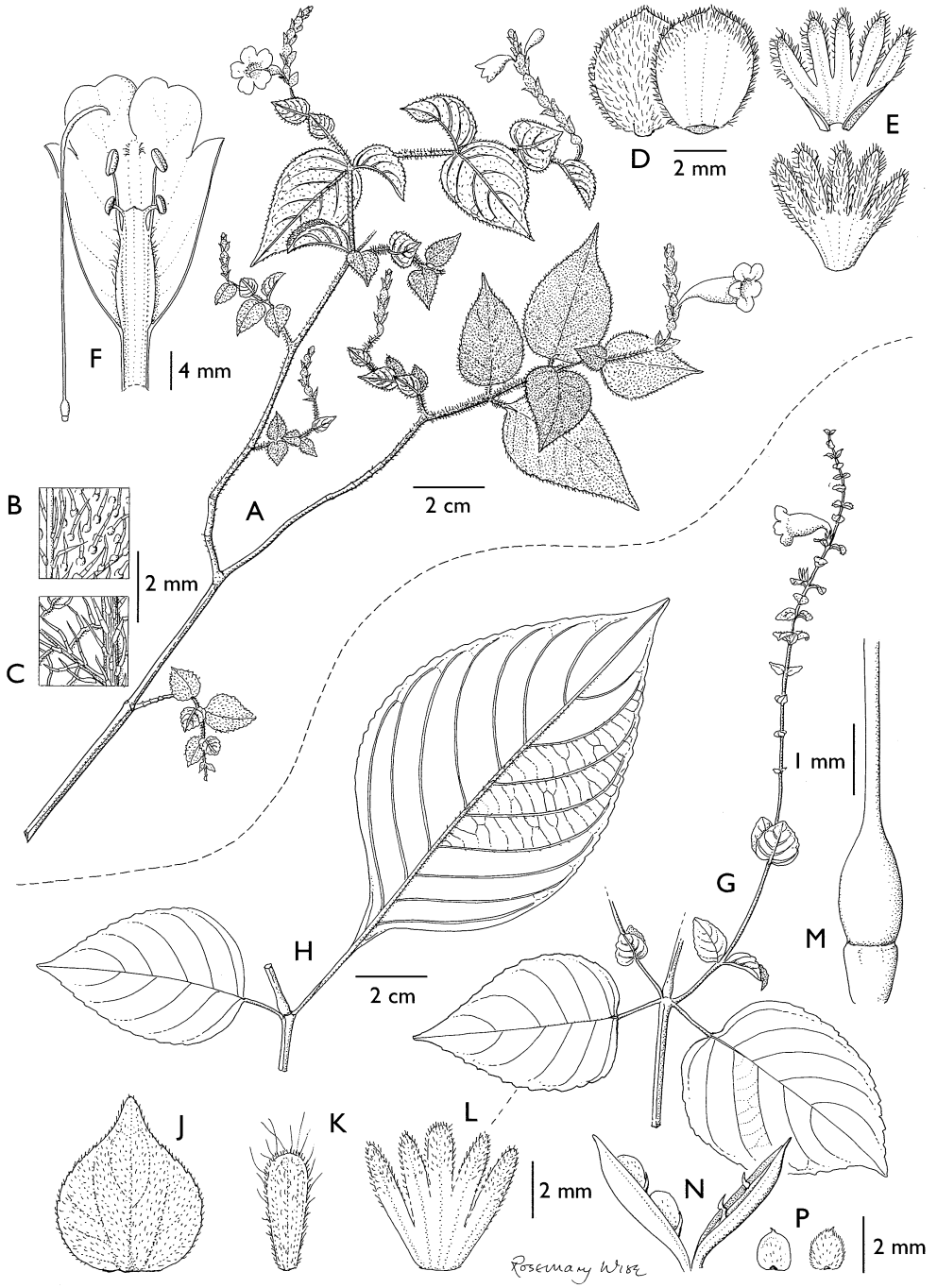


FIG. 3. **A – F** *Strobilanthes heliophila*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract, upper and lower surfaces; **E** calyx, inner and outer surfaces; **F** corolla and style. **G – P** *Strobilanthes helferi*. **G** habit with inflorescence; **H** leaf pair; **J** bract; **K** bracteole; **L** calyx; **M** ovary; **N** capsule; **P** seeds. **A – F** drawn from *Geesink et al.* 7626, **G, J – P** from *Kostermans* 377 and **H** from *Shimizu et al.* 18496 by Rosemary Wise.

CONSERVATION STATUS. Insufficient data but probably vulnerable.

BURMA (MYANMAR). Tenasserim, Tres Pagodas, *Helfer* 495/K.D.6117 (K, ?CAL).

THAILAND. Kanchanaburi, Tripagodas, Burmese Border, c. 40 km N of Wangka, 280 m, 8 – 11 May 1946, *Kostermans* 377; Kwae Noi Exped. 377(L, K, A); Tak, Mae Sot Distr., Khau Phra War, 700 – 850 m, 12 Oct. 1979, *Shimizu et al.* 18496 (C, K, BKF).

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

Larsenia decumbens Bremek., Dansk Bot. Ark. 23: 205 (1965). Type: Thailand, Rachaburi, *K. Larsen* 8371 (holotype U, isotypes C, P).

Strobilanthes decumbens is distinguished by its unusually large corolla (± 4 cm long), very large, imbricate suborbicular bracts, which are covered in long, silky, white hairs, and its relatively short spikes, up to about 8 cm in length. Bracteoles are absent.

HABITAT & DISTRIBUTION. Known from only two collections from close to the Thai-Burmese border. Map 3.

CONSERVATION STATUS. Insufficient data but almost certainly endangered.

THAILAND. Between Tavoy and Bangkok, 1898, *Candler* s.n. (K); Rachaburi: Sai Yok, 250 m, 7 Dec. 1961, *Larsen* 8371(U, P, ?C).

Strobilanthes longipes *C. B. Clarke* in Hook. f., Fl. Brit. India 4: 455 (1884). Type: Burma (Myanmar), Tenasserim, *Beddome* 218 (BM, lectotype **chosen here**).

Strobilanthes spathulata R. Parker, Repert. Spec. Nov. Regni Veg. 29: 105 (1931). Type: Burma (Myanmar), Mergui, *R. N. Parker* 3102 (holotype K).

When describing *Strobilanthes longipes,* Clarke cited two specimens representing two different species and his description is a compilation of the characters of both. One specimen, *Helfer* 304/K.D.6114 (K), had already been used by Kurz as the type of his *Strobilanthes subflaccida,* which Clarke considered to be conspecific with *S. acuminata* (Nees) T. Anderson and is now recognised as belonging to *S. repanda* Blume (Bennett & Scotland 2003: 57). As Clarke was clearly intending to describe another species, we have excluded this and selected the second cited specimen, *Beddome* 218 (BM) as the lectotype.

Strobilanthes longipes is a rare species whose spathulate bracts give it a superficial resemblance to *S. hossei* C. B. Clarke from which it differs in its obscurely crenulate or subentire leaves, terminal flower spikes and the complete absence of rufous hairs from the inflorescence and leaves. The spicate inflorescence with long, silky, white hairs places it with the other species considered under *Larsenia* although it is atypical in having well-developed bracteoles. This is confirmed by a close examination of the calyx which shows that the middle lobe of the upper lip is slightly longer than the two laterals to which it is fused at the base. The subentire leaves are an unusual feature in *Strobilanthes* shared with another species discussed later in this paper, *Strobilanthes alboviridis.*

HABITAT AND DISTRIBUTION. Endemic to the Tenasserim region of Burma (Myanmar) where it grows in hill forest undergrowth from 900 – 1350 m. Map 3.

CONSERVATION STATUS. Insufficient data but presumably vulnerable.

BURMA (MYANMAR). Tenasserim: Mulayit [16°11'N, 98°32'E), *Beddome* 218 (BM); Headwaters of Talaingya Chaung [14°19'N, 98°12'E), Tavoy, 900 m, 7 Feb. 1919, *Gage* 62 (K, ?CAL); Myinmolekat [13°34'N, 98°42'E), Mergui, 1350 m, 18 Jan. 1930, *Parker* 3102 (K).

Strobilanthes heliophila *J. R. I. Wood*, **sp. nov.** a *S. helferi* T. Anderson foliis hispidis, spicis brevioribus usque 8 cm longis, bracteis obovatis vel ellipticis diagnoscenda. Typus: Burma (Myanmar), Tenasserim, *J. Keenan, U. Tun Aung & R. H. Rule* 1681 (holotypus K, isotypus E). Fig. 3A – F.

Strongly anisophyllous herb to c. 45 cm; *stems* somewhat zigzag especially above, hispid with large-celled, white hairs, glabrescent below. *Leaves* unequal in each pair, the smaller a third to half the size of the larger, petiolate below, sessile above, petioles 0 – 5 mm long; blades 0.9 – 6 × 1 – 5.5 cm wide, apex shortly acuminate, base cordate to cuneate, margin serrulate, hispid-hirsute on both surfaces but especially above, paler beneath. *Inflorescence* of terminal spikes 3 – 8 cm long; flowers arranged in opposite pairs, 4 – 8 mm apart; rhachis pilose; *bracts* at base of spike 0.6 – 2 × 0.5 – 2 cm, very broadly-ovate, sessile, resembling the leaves; floral bracts 4 – 5 × 3 – 4 mm, ± elliptic below, strongly obovate above, obtuse or acute, pilose with conspicuous white hairs; bracteoles absent; *calyx* 3 – 4.4 mm long, obscurely 2-lipped, the upper three lobes united for c. 1 mm then free, lobes linear, white-pilose; *corolla* 2.3 – 2.8 cm long, light blue, apparently paler in the mouth, outside glabrous except on the exterior of the lobes, inside glabrous except for the filament curtain and the hairs retaining the style, tube c. 1 mm wide at base, cylindrical for c. 4 mm, then bent 90°, sharply widened for c. 12 mm to c. 8 mm at the mouth, ventricose, lobes 4 – 5 mm long and wide, ovate, rounded to weakly emarginate; *stamens* 4, all fertile, didynamous, filaments glabrous, the longer pair 5 – 6 mm long, the shorter pair c. 1 mm long; anthers included, the cells ellipsoid, glabrous, c. 1.5 mm long; *pollen* ellipsoid, ribbed, scalariform; ovary glabrous; style c. 2.5 cm long, glabrous. Capsule not seen.

HABITAT AND DISTRIBUTION. Known from three widely separated localities in peninsular SE Asia, in all of which it grows in open, rocky and/or grassy places on ridge tops between 650 and 1300 m. Map 3.

CONSERVATION STATUS. Insufficient data but probably vulnerable.

BURMA (MYANMAR). Tenasserim, Tavoy Distr.: Hills W of Paungdaw Power Station [app.14°N, 98°30'E], 650 – 800 m, Oct. 1961, *Keenan, Tun Aung & Rule* 1681 (E, K).

THAILAND. Ranong: Muang Distr., Ngao Waterfall, 20 km S of Ranong, 8 Dec. 1979, *Shimizu et al.* 26560 (C, BKF). Phang nga: Khao Pawta Luang Kaow [app. 8°30'N, 99°E], 1300 m, 17 Nov. 1974, *Geesink, Hiepko & Phengklai* 7626 (L, K, BKF).

Strobilanthes heliophila has a similar inflorescence to both *S. decumbens* and *S. helferi*, in that the flowers are in bracteate spikes terminal on leafy, axillary branchlets. The spikes are relatively short reaching only 8 cm in length, whereas in *Strobilanthes helferi* they reach 20 cm in length. The bracts are elliptic or obovate and never orbicular as in *Strobilanthes helferi* or *S. decumbens*.

Shimizu et al. 26560 is a little different from the other two collections in two respects. The base of the larger leaf in each pair is not cordate but cuneate and the bracts have an indumentum of long fine silky hairs mixed with the spreading pilose hairs found in the other two collections. Given the small number of collections available it is difficult to assess the significance of this variation but it is likely that it represents no more than a range of normal variation within the species, especially as very similar indumentum variation is found in the related *Strobilanthes auriculata.*

Adenacanthus

The two species in this group are similar to *Strobilanthes rufescens* in having the three upper calyx lobes connate below but the lobes of the lower lip of the calyx are not fused. The flowers are arranged in imbricate spikes but these are normally long-pedunculate and commonly branched giving the inflorescence a paniculate appearance very different from the inflorescences of the previous species discussed in this paper. The bracts often bear stalked glands but are otherwise glabrous and long, silky, white hairs are completely absent. The leaves of both species are crenate rather than dentate while in *Strobilanthes repanda* they are usually strongly repand. The pollen is the common type found in *Strobilanthes*, ellipsoid, ribbed and scalariform. Both species are figured, described and discussed by Bennett & Scotland (2003).

Strobilanthes repanda *(Blume) J. R. Benn.*, Kew Bull. 58: 56 (2003).

Lepidagathis repanda Blume, Bijdr. 13: 802 (1826). Type: Indonesia, Java, *Blume* C.L.1246 (lectotype L, chosen by Bennett & Scotland (2003)). *Apolepsis repanda* (Blume) Nees in DC., Prod. 11: 260 (1847). *Adenacanthus repandus* (Blume) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 196 (1944).

A. acuminatus Nees in Wall., Pl. Asiat. Rar. 3: 75 (1832). Type: Burma (Myanmar), *Wallich* 7153 (lectotype K-W, chosen by Bennett & Scotland (2003)). *Strobilanthes acuminata* (Nees) T. Anderson, J. Linn. Soc., Bot. 9: 473 (1867).

S. subflaccida Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42 (2): 94 (1873). Type: Burma, Tenasserim, *Helfer* 304 (syntype K).

S. rubroglandulosa Craib, Bull. Misc. Inform., Kew 1912: 268 (1912). Type: Thailand, *Kerr* 995 (holotype K, isotype BM). *Adenacanthus rubroglandulosus* (Craib) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 198 (1944).

Strobilanthes rubroglandulosa var. *longispicata* Benoist in Lecomte, Fl. Indo-Chine 4: 666 (1935). Type: Cambodia, *Pierre* (holotype P).

This species extends from Java to southern Burma, Thailand, Laos, Cambodia and Vietnam (south) but is unaccountably absent from Sumatra and, like many other species of *Strobilanthes*, from Malaya. It is a lowland plant occurring under 900 m.

Strobilanthes glandulosa *Blume*, Bijdr. 13: 800 (1826). Type Indonesia, Java, *Blume* s.n. (holotype L).

Adenacanthus glandulosus (Blume) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 197 (1944).

Strobilanthes cordiformis Lindau, Repert. Spec. Nov. Regni Veg. 13: 552 (1915). Types: Indonesia, Java, *Warburg* 3029 (syntype B, n.v.), *Nagler* 213 (syntype B, n.v.).

This is a local species of isolated mountains in Java and Sumatra and appears to be a mountain derivative of *Strobilanthes repanda* differing in its very narrow, minutely mucronate bracts and calyx lobes. It grows between 1000 and 2400 m.

The Strobilanthes alboviridis complex

The two species discussed under this heading have similarities with the two previous ones, placed by Bremekamp in *Adenacanthus*. They share a similar, but less marked calyx structure, the same small, oblong, persistent bracts and the same pedunculate inflorescence with stalked glands. The leaves also have the same tendency towards undulate leaf margins and pale undersides although in *Strobilanthes alboviridis* the margins are entire. The pollen is the common ellipsoid, ribbed and scalariform type.

The fused upper calyx lobes are not very obvious in this complex and seem to become free to the base around anthesis, which may explain why Bremekamp did not observe this character when describing his *Semnostachya deliensis* although Imlay noted it in the protologue of *Strobilanthes alboviridis*.

Strobilanthes alboviridis *J. B. Imlay*, Bull. Misc. Inform., Kew 1939: 117 (1939). Type: Thailand, Chumphon, *Kerr* 11493 (holotype K, isotype BM). Fig. 4A – K.

Semnostachya alboviridis (J. B. Imlay) Bremek., Dansk Bot. Ark. 20: 71 (1961).
S. deliensis Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 203 (1944). Type: Indonesia, Sumatra, *Loerzing* 5541 (holotype U, isotype L).

Strobilanthes alboviridis is a distinctive, anisophyllous species with terminal and axillary panicles. It is easily recognised because of its calyx, which is bicoloured white and green and because of its subentire leaves. The bracts are persistent and sticky-glandular and the flowers are often clustered towards the tips of the panicle branches though they are not arranged in true heads. This has led some botanists to misidentify it as *Strobilanthes rex* C. B. Clarke or *S. pentstemonoides* T. Anderson while others noting a more lax, spicate arrangement in some specimens at the other extreme have confused it with *S. lancifolia* T. Anderson.

HABITAT AND DISTRIBUTION. Distributed sparingly from Sumatra through the Malayan peninsula to southern Thailand. It is a plant of evergreen forest at low altitudes below 450 m. Map 4.

CONSERVATION STATUS. Insufficient data but probably low risk.

INDONESIA. Sumatra: Sibilangit, Bukit Sernak, 5 Aug. 1921, *Mohamed Nur* 7356 (K, SING); Simeloengen [2°50'N, 99°00'E], Tinggi Radja, 450 m, 15 Aug. 1926, *Yates* 2149 (L, MICH, NY, UCLA, US); Sibolangit [3°19'N, 98°35'E], 400 m, *Loerzing* 5541 (L, U n.v.).

PENINSULAR MALAYSIA. Kelantan: Gua Setir [5°38'N, 101°53'E], 19 May 1990, *Kiew & Anthonymamy* 3033 (C).

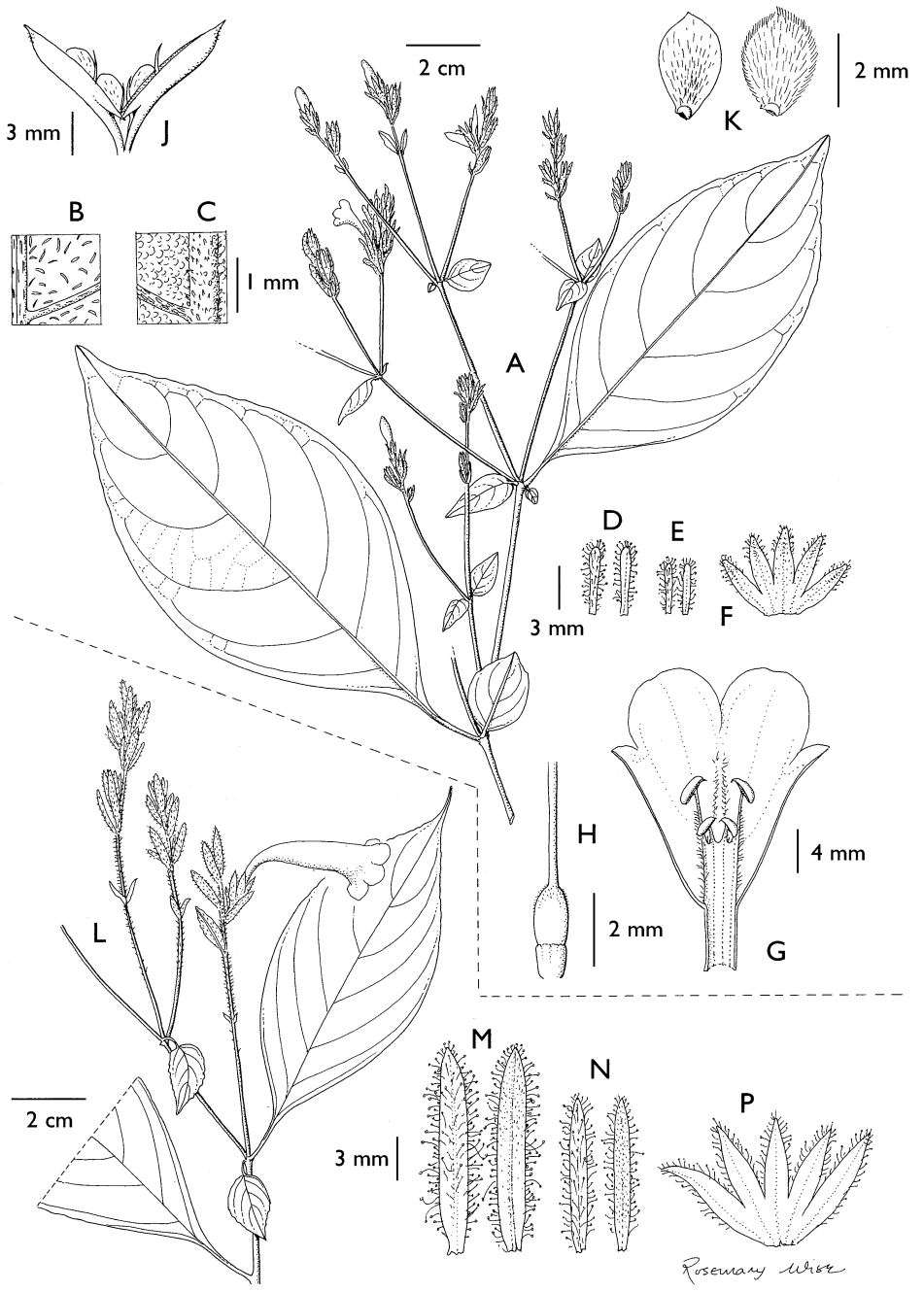
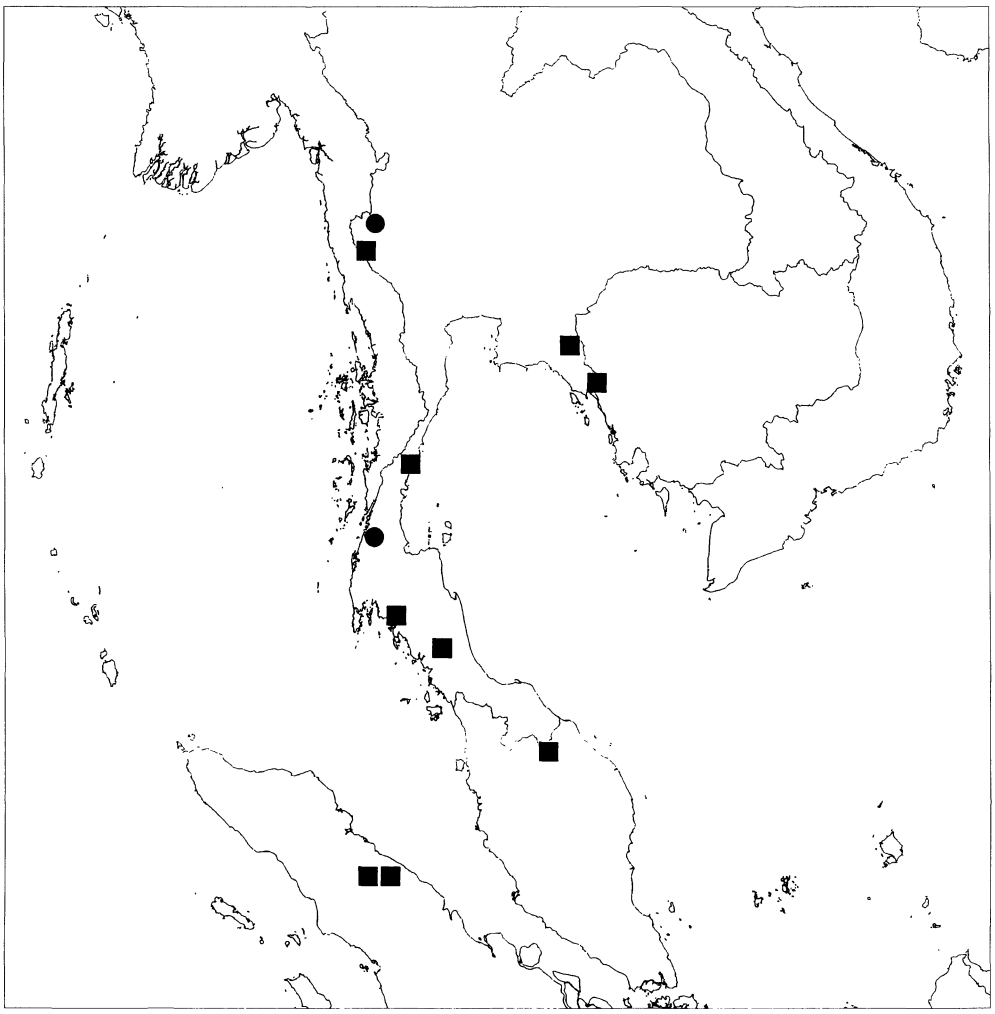


FIG. 4. **A – K** *Strobilanthes alboviridis*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract, upper and lower surfaces; **E** bracteole, upper and lower surface; **F** calyx; **G** corolla; **H** ovary; **J** capsule; **K** seeds. **L – P** *Strobilanthes maxwellii*. **L** habit with inflorescence; **M** bract, upper and lower surfaces; **N** bracteole, upper and lower surface; **P** calyx (**A** drawn from *Kerr* 17678, **B – F** and **H – K** from *Kerr* 18675, **G** from *Yates* 2149, **L** from *Soi Jai* 11 and **N – P** from *Maxwell* 94-33). Drawn by Rosemary Wise.



MAP 4. Distribution of *Strobilanthes alboviridis* (■) and *S. maxwellii* (●).

THAILAND. Phuket: Krabi [8°04'N, 99°5'E], Panom Bencha, 700 m, 26 March 1930, *Kerr* 18675 (BM, K, KYO). Nakhon Si Thammarat: Patalung, Klawng Hui Kao [7°30'N, 99°55'E], 300 m, 10 April 1928. *Kerr* 15286 (BM, K). Chumphon: Ban Ta Ngaw [10°50'N, 99°20'E], 100 m, 17 Jan. 1927, *Kerr* 11493(BM, K). Trat: Dan Chumpon [12°20'N, 102°45'E], 100 m, 22 Dec. 1929, *Kerr* 17678 (BM, K). Chantaburi: Foot of Khao Soi Dao [13°00'N, 102°15'E], 400 m, 11 Nov. 1969, *von Beusekom & Smitinand* 2118 (BKF, E, L, P). Kanchanaburi: Ta Kanun [14°40'N 98°30'E], 400 m, 19 Jan. 1926, *Kerr* 10267 (BM, K).

Fang *et al.* (1997: 31) have described a new Chinese species, *Strobilanthes truncata* D. Fang & Lo, which they have compared with *S. alboviridis*. We have not seen specimens of this plant but the spicate inflorescence and caducous bracts suggest

that it is not closely related to *Strobilanthes alboviridis*. However, *Strobilanthes alboviridis* is similar morphologically and in geographical distribution to *S. farinosa* C. B. Clarke and *S. lancifolia* T. Anderson, having a very similar inflorescence and the same kind of leaves that are whitish below although the leaves are clearly toothed and the calyx lobes are all free to the base. Even closer to *Strobilanthes alboviridis* is the following new species:

Strobilanthes maxwellii *J. R. I. Wood,* **sp. nov.** affine *S. alboviridis* sed floribus in capitulis dispositis, bracteis grandibus usque 24 mm longis 4 mm latis, corolla c. 4.2 cm longa statim dignoscenda. Typus: Thailand, Kanchana Buri, *Soi Jai* 11 (holotypus CAS, isotypus CMU, n.v.). Fig. 4L – P.

Anisophyllous shrub 1.5 – 3 m high; *stems* 1.5 – 3 cm wide at base, hollow, rounded, sulcate above, glabrous but with some pustular excrescences. *Leaves* petiolate, very unequal in each pair, the smaller a quarter to a third the size of the larger; petioles 0.3 – 4 cm long, scabrid to scabrous-pubescent; blades 2.5 – 16 × 1 – 8 cm, the larger in each pair oblong-elliptic, acuminate at both ends, the smaller ovate-elliptic, acute at the apex, broadly cuneate at the base, margins undulate or subentire, above glabrous, beneath paler, puberulent especially on the vein, with scattered pustules, cystoliths small and inconspicuous on both surfaces. *Inflorescence* of pedunculate axillary heads, mostly with a single peduncle arising from one axil of each leaf pair; peduncles 2 – 7 cm long, glandular-pilose, simple or forked, commonly bearing a pair of reduced leaves at the branching point; heads 3 – 5 × 1.5 – 2 cm; *bracts* 12 – 24 × 2 – 4(– 6) mm wide, oblong or oblong-oblanceolate, acute, densely sticky-glandular-pilose; bracteoles 11 – 16 × 1 – 2 mm, narrowly oblong, glandular-pilose and ± ciliate; *calyx* pale and somewhat cartilaginous, sparsely glandular-pilose on the exterior, glabrous inside, 5-lobed to just above the base, the lobes tardily separating below, the lower two slightly longer than the upper three, narrowly ovate, broadest at just below the middle, 9 – 12 × 2 – 2.5 mm; *corolla* c. 4.2 cm long, glabrous outside, tube white, the basal cylindrical portion straight, c. 10 mm long and 2 mm wide, then gradually widened to 15 mm and curved c. 60°, lobes blue, broadly ovate, c. 8 mm wide and 3 mm long, rounded; *stamens* 4, all fertile, didynamous, filaments glabrous, the two longer c. 7 mm long, the two shorter c. 3 mm long, anthers oblong, 2 – 3 × 1 – 1.5 mm, glabrous, included; *pollen* ellipsoid, ribbed; style pubescent, white; ovary glabrous. *Capsule* 14 – 15 × 4 mm, oblong, glabrous, 4-seeded; seeds 2.5 × 2 mm wide, lenticular, pubescent with mucilaginous hairs.

HABITAT AND DISTRIBUTION. Endemic to western Thailand where it is known from two localities in disturbed mixed forest between 300 and 1050 m. Map 4.

CONSERVATION STATUS. Insufficient data but probably vulnerable.

THAILAND. Ranong: Kaper, Khao Pawta Luangkeao, 900 – 1050 m, 9 Dec. 1979, *Shimizu et al.* 26673 (BKF, K). Kanchanaburi: Sangklaburi, Lai Wo, Ban Saneh Pawng, Toong Yai Naresuan Wildlife Reserve, 250 m, 8 Oct. 1993, *Soi Jai* 11 (CAS, CMU); ibid, 300 m, 13 Jan. 1994, *Maxwell* 94-33 (CMU, CAS, A).

This species is named after J. F. Maxwell, who has made numerous collections of *Strobilanthes* and other species from northern Thailand, all of high quality and with

outstanding field data. His material has been a delight to work with. *Strobilanthes maxwellii* is clearly closely related to *S. alboviridis*. It is readily distinguished by having the flowers arranged in heads, which are enclosed by large, sticky-glandular bracts. The dimensions of all flower parts are larger and the plant appears to be a vigorous shrub.

Triaenacanthus

The genus, *Triaenacanthus* (misspelt *Triaenanthus* on page 169 of the *Prodromus*, but written correctly on page 100 in accordance with the spelling Nees had used for other genera in *Acanthaceae*) was described in De Candolle's *Prodromus* in 1847. The genus had the same calyx structure as *Adenacanthus*, in which the three upper calyx lobes are united for about half their length while the two lower lobes are free to the base. However, it is not clear how Nees thought the new genus was different but he perhaps thought the zigzag flower spikes were important. Although the species in this group have the ellipsoid, ribbed pollen with crossbars similar to that in *Adenacanthus* they are in other ways very different. The inflorescence is glandular-pilose and consists of lax, axillary spikes massed to form a terminal panicle. The spikes are sometimes zigzag with a bend at each flower node where one flower of each flower-pair has aborted. The filaments are hairy and the linear bracts equal or overtop the flowers giving the flowers an eared appearance. There appear to be five species in this assemblage, the first two so closely related that they may eventually prove to be distinguishable only at subspecific level.

Strobilanthes denticulata (*Nees*) *T. Anderson*, J. Linn. Soc., Bot. 9: 483 (1867). Fig. 5A – K.

Asystasia denticulata Nees in Wall., Pl. Asiat. Rar. 3: 89 (1832). Type: India, Pundua in the Khasi Hills, *F. da Silva* in *Wallich* 2418 (syntypes BM, K-W).

Strobilanthes flaccidifolia Nees in DC., Prod. 11: 194 (1847). Type: India, "Assam", *Griffith* in Herb. Hook. (holotype K).

Triaenacanthus ("Triaenanthus") griffithianus Nees in DC., Prod. 11: 169 (1847). Type: India, Khasi Hills, *Griffith* in Herb. Hook. (holotype K). *Strobilanthes griffithiana* (Nees) T. Anderson, J. Linn. Soc., Bot. 9: 481 (1867).

Many of the distinctive features of this species are not apparent on immature specimens such as the type of *Strobilanthes denticulata*, which consists of some leafy shoots with one or two, immature spikes with unopened corollas and no capsules. This explains why Nees was only able to describe certain characters in his original description and also perhaps why he placed it initially in *Asystasia* and kept it there in his later account in De Candolle's *Prodromus*. Anderson (1867: 483) correctly transferred it to *Strobilanthes* but placed it in his list of *species incertae sedis*. Nees did, however, note the distinctive hairy filaments and pubescent, yellow corolla.

When Nees (1847: 169) came across another, better developed specimen from the same locality he noted the 2-lipped calyx with the 3 lobes of the upper lip connate for part of their length and erected the new genus, *Triaenacanthus* to accommodate his species, naming it *T. griffithianus*. Comparison of this material

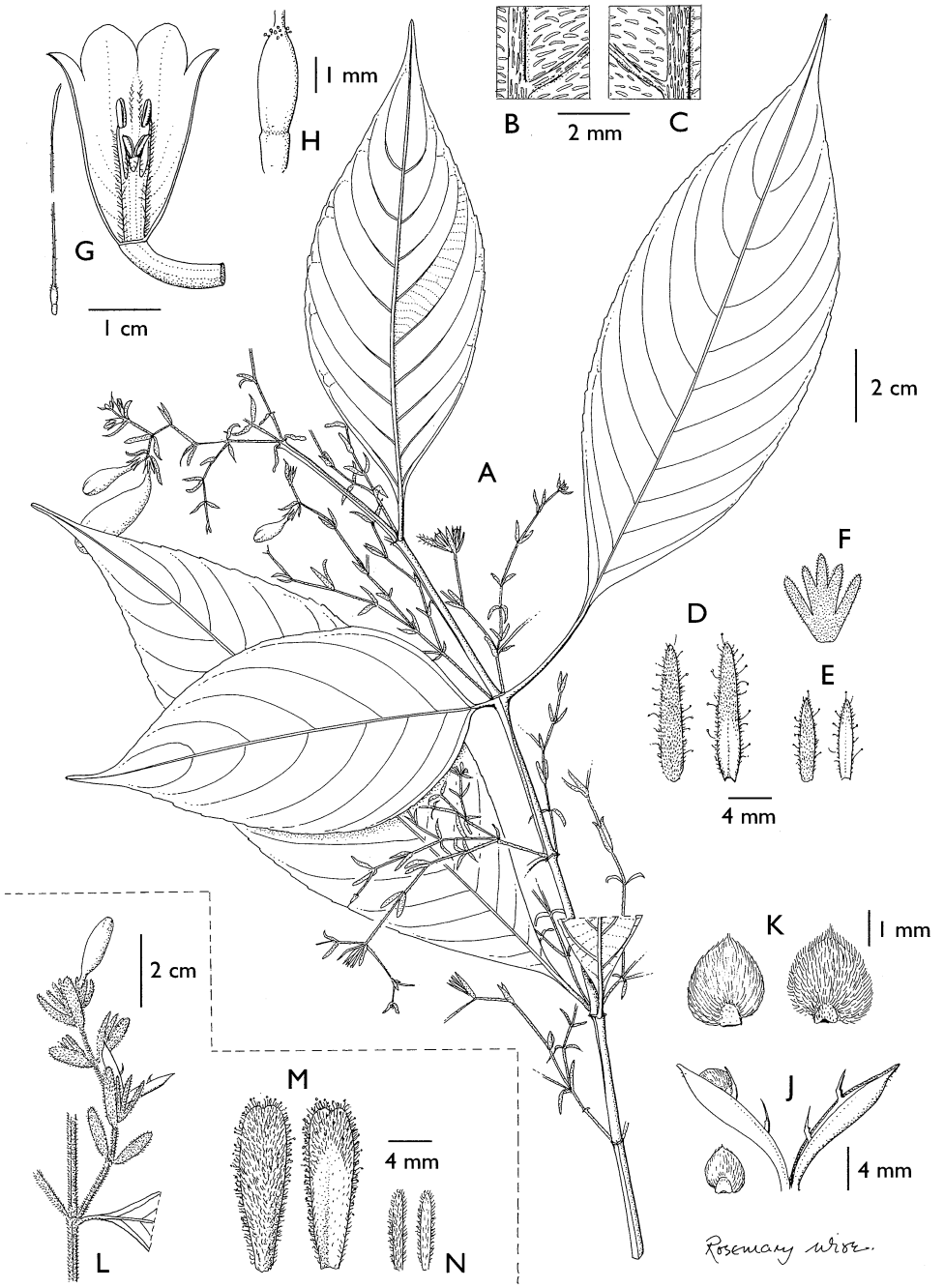
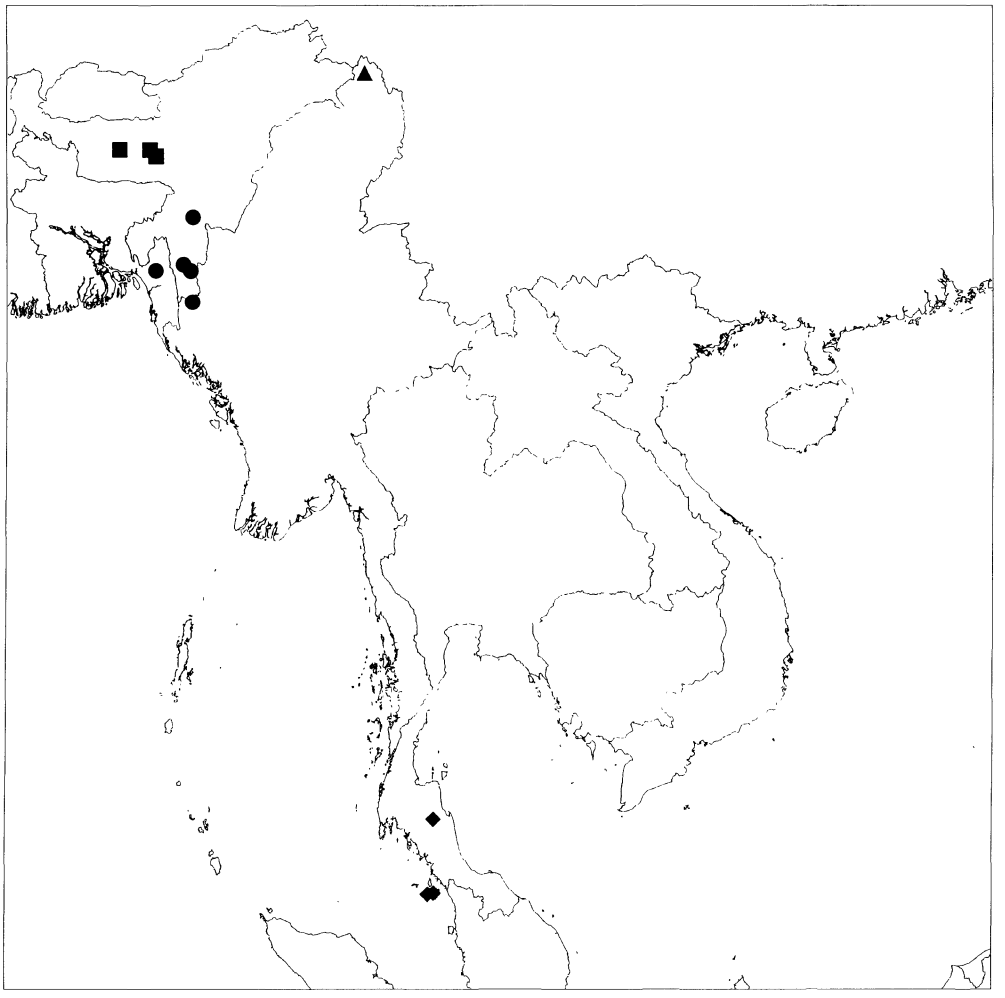


FIG. 5. **A – K** *Strobilanthes denticulata*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract, upper and lower surfaces; **E** bracteole, upper and lower surface; **F** calyx; **G** corolla and style; **H** ovary; **J** capsule; **K** seeds. **L – N** *Strobilanthes parryorum*. **L** portion of inflorescence; **M** bract, upper and lower surfaces; **N** bracteole, upper and lower surface. **A** drawn from coll. illeg. (?*G. Mann*) ex Herb. Cal., **B – K** from *Clarke* 14475, **L – N** from *Parry* 449. Drawn by Rosemary Wise.

with type material of *Strobilanthes denticulata* confirms that they are conspecific as we were able to find the distinctive upper lip of the calyx on the most advanced flower available to us in the type of *S. denticulata.*

Nees complicated an already confused situation by describing the same species under a third name, in the same work (1847: 194), placing it in *Strobilanthes* as *S. flaccidifolia.* Anderson (1867: 481) added further to the confusion by applying the name *Strobilanthes flaccidifolia* to the Assam dye plant, correctly *S. cusia* (Nees) Kuntze. This wrong application was taken up by Clarke in the *Flora of British India* and remained current well into the 20th century.

One curious aspect of *Strobilanthes denticulata* has been the inability of various botanists to see the distinctive upper calyx lip in the specimens at their disposal. In the *Prodromus,* Nees described the same species twice, once in *Triaenacanthus* as *T.*



MAP 5. Distribution of *Strobilanthes denticulata* (■), *S. parryorum* (●), *S. tripartita* (▲) and *S. peninsularis* (♦).

griffithianus and once in *Strobilanthes* as *S. flaccidifolia*, even though the type collection of the latter, annotated by Nees himself, quite clearly shows that the calyx has an upper lip with the three lobes united. Clarke (1884: 470) categorically denied the existence of this feature, even though it is plainly visible to the naked eye in one of his own collections (*Clarke* 42750) from the area of the type locality of *Triaenacanthus griffithianus*. No mention is made of it, either, in the description of the very closely related *Strobilanthes parryorum* by C. E. C. Fischer.

HABITAT AND DISTRIBUTION. Restricted to the Khasi and Jaintea Hills of Meghalaya State in India, where it grows at low altitudes below 650 m. Map 5.

CONSERVATION STATUS. Probably endangered and possibly extinct as we have only seen the 19th century collections cited below, although it is described as "common" by Haridasan & Rao (1987).

INDIA. "Assam", *Griffith* s.n. (K). Meghalaya: Khasi Hills, *Wallich* 2418 (K-W, BM); ibid, *Griffith* (K, W); ibid, *Hooker & Thomson* (K, BM, W); Sharla, Khasi Hills, 650 m, 9 Dec. 1871, *Clarke* 14475 (K); Jyntenpore, Jaintea Hills, 330 m, 12 Dec. 1885, *Clarke* 42458 (K, BM); Theria, Khasi Hills, 230 m, 21 Jan. 1886, *Clarke* 42750 (K); Theriaghat (?), Khasi Hills, 6 July 1886, coll. illeg.(?*G. Mann*) ex Herb. Cal. (K).

Strobilanthes parryorum *C. E. C. Fisch.*, Bull. Misc. Inform., Kew 1928: 142 (1928). Type: India, Mizoram, *N. E. Parry* 155 (holotype K). Fig. 5L – N.

Pteracanthus parryorum (C. E. C. Fisch.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41(1): 199 & 282 (1944).

This is closely related to *Strobilanthes denticulata*, differing essentially in its dense fuscous indumentum and the slightly larger, oblanceolate bracts. It might be best treated as a subspecies of *Strobilanthes denticulata* as there exists a specimen intermediate in character from the Chittagong Hills in Bangladesh (*Khan* 1122 (E, DACB)) but in the absence of further material it is difficult to assess the significance of this plant.

HABITAT AND DISTRIBUTION. Apparently restricted to forest in the Lushai Hills of NE India from 1300 – 1900 m. According to the field notes it is a plietesial species. Map 5.

CONSERVATION STATUS. Insufficient data but certainly vulnerable.

INDIA. Manipur, Laimatak, 1600 – 1900 m, Feb. 1906, *Meebold* 4865 (K,?B). Mizoram, South Lushai, 1300 m, Sept. 1928, *Wenger* 236 (K); Darzo, Lushai Hills, March 1927, *Parry* 155 (K); Chinchupp, Lushai Hills, 1300 m, Oct. 1927, *Parry* 398 (K); Phongpui, 1900 m, Lushai Hills, Jan. 1928, *Parry* 398A (K); Sherkoi, Lushai Hills, 1300 m, Jan. 1928, *Parry* 449 (K).

Strobilanthes peninsularis *Terao*, Acta Phytotax. Geobot. 34 (4 – 6): 123 (1983). Type: Peninsular Malaysia, Langkawi Island, *Corner* 37827 (holotype L, isotypes A, K, SING).

This species has the denticulate leaves, weakly zigzag spikes and hairy filaments of the previous species but is very distinctive because of the long setose glands, which

cover all parts of the inflorescence. The corolla is rather small and only reaches about 1.5 cm in length. It bears a strong superficial resemblance to *Strobilanthes microcarpa* T. Anderson but is immediately distinguished by its calyx structure and the persistent bracts.

HABITAT AND DISTRIBUTION. On limestone rocks at low altitudes in peninsular Thailand and Langkawi Island (Malaysia). Map 5.

CONSERVATION STATUS. Data insufficient.

THAILAND. Pulao Pong Pinang, 12 Dec. 1928, *Mohamed Haniff & Mohamed Nur* 4024 (ABD, BM, SING); Nakhon Si Thammarat, Thung Song [8°18'N, 99°43'E], 13 Feb. 1929, *Put* 2370 (BM, K).

MALAYSIA (WEST). Langkawi Island: Pulau Timun, c. 30 m, 23 Nov. 1934, *Henderson* SFN 29096 (BO, K, L, SING); Kuala Kelim, 4 May 1938, *Symington* 46794 (SING); Batu Ayam, 19 Nov. 1941, *Corner* SFN 37827 (A, K, L, SING).

Strobilanthes tripartita *J. R. I. Wood*, **sp. nov.** labia calycis superiore tridentata *S. denticulatae* similis sed corolla glabrescente arcuata, bracteis (usque 8 mm longis) quam calyce (usque 18 mm longo) brevioribus, ramis inflorescenciae non flexuosis, floribus in paribus oppositis dispositis dignoscenda. Typus: Burma (Myanmar), (Burma-Tibet frontier), *Kingdon Ward* 9184 (holotypus BM, isotypus E). Fig. 6.

Robust undershrub to c. 1.25 m, mostly leafless when flowering; *stems* strongly angled, sulcate, obscurely bifariously hirsute with very short, large-celled spreading hairs. *Leaves* petiolate; petioles 0.2 – 2.8 cm long, sparsely to densely hirsute with large-celled hairs; blades 4.5 – 11 × 1.4 – 4.5 cm, narrowly elliptic, acuminate at both ends or basally cuneate, margin serrulate, sparsely to moderately pilose on both surfaces, especially on the veins, with stiff, large-celled, apparently brownish hairs, cystoliths present but not very prominent on both surfaces. *Inflorescence* of simple or, very rarely, forked axillary spikes developing into a terminal panicle of spikes; spikes 3 – 20 cm long, very lax, the flowers arranged in opposite pairs,1.5 – 3.5 cm apart; rhachis glandular-pilose with brownish hairs; flowers sessile or with short pedicels to 3 mm long; *bracts* 5 – 8 × 1 – 2 mm, lanceolate, pilose with large-celled hairs, some gland-tipped, persistent; bracteoles 4 – 6 × 1 mm, linear-oblong, pilose with large-celled hairs, some gland-tipped, persistent; *calyx* 12 – 18 mm long, pilose with large-celled hairs, some gland-tipped, the two lower lobes free, 10 – 16 × 1.25 mm, narrowly lanceolate, acuminate, the 3 upper lobes remaining fused to form a 3-toothed upper lip, the teeth narrowly triangular, 4 – 6 mm long; *corolla* 3 – 3.5 cm long, "white, faintly mottled all over with violet" (*fide* Kingdon Ward), arcuate, abruptly ventricose from a short basal tube c. 5 mm long, pubescent on the lobes in bud but soon glabrescent outside, inside glabrous except for the hairs retaining the style, which are duplicated forming four lines of hairs, lobes ovate, rounded, c. 6 × 7 mm; *stamens* 4, all fertile, didynamous, included; filaments pilose, the shorter pair c. 1.5 mm long, the longer pair c. 4 mm long; anthers with unusually long oblong thecae, 3.5 × 1.5 mm; *pollen* ellipsoid, ribbed, scalariform, 61 – 83 × 36 – 54 mm; style c. 18 mm long, sparsely glandular-pilose; ovary glabrous except for a few sessile glands at the tip. *Capsule* 15 – 18 × 2.5 – 3 mm, oblong-oblanceolate in outline,

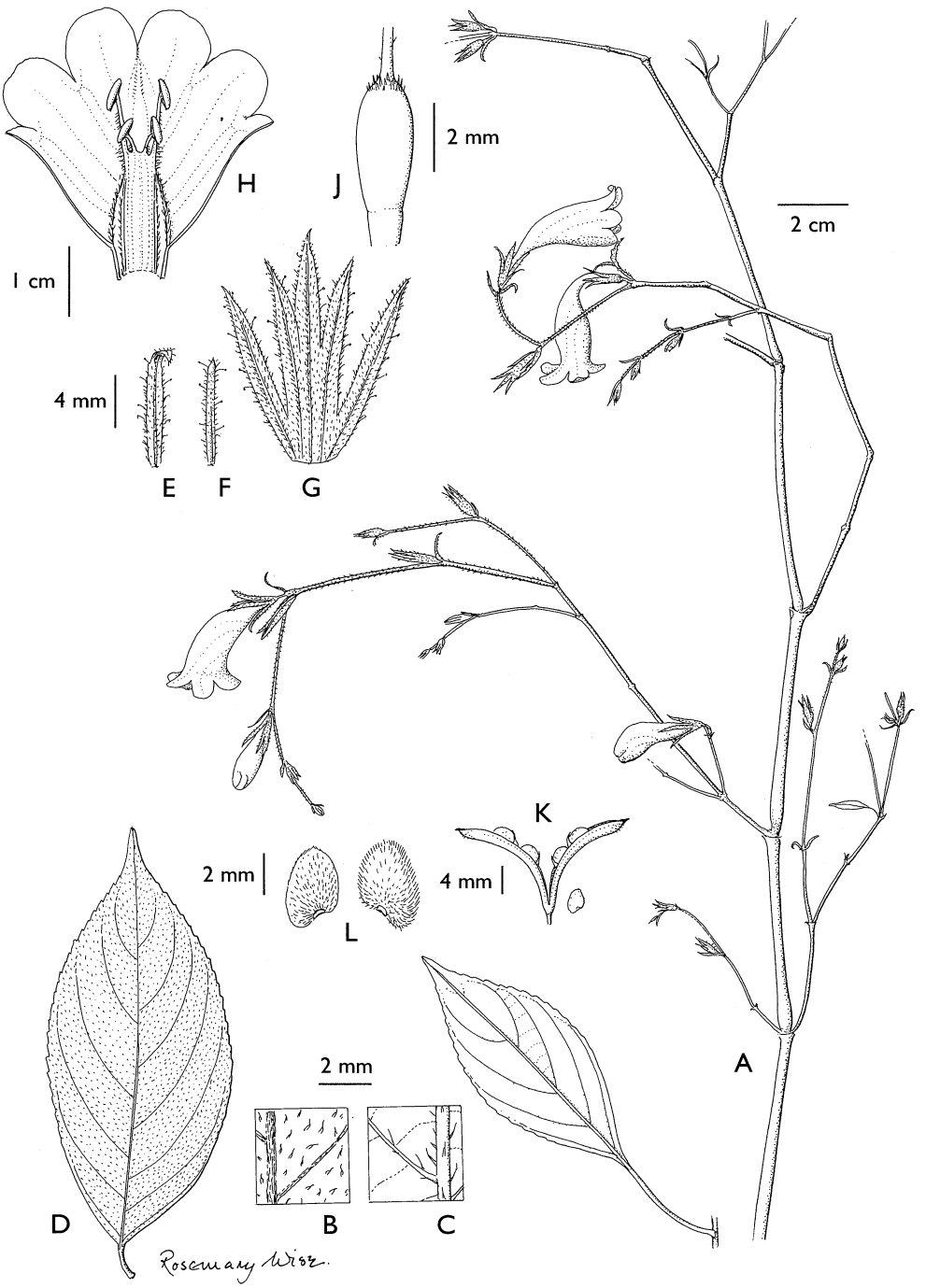


FIG. 6. **A – L** *Strobilanthes tripartita*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** detached leaf; **E** bract; **F** bracteole; **G** calyx; **H** corolla; **J** ovary; **K** capsule; **L** seeds. Drawn from *Kingdon Ward* 9184 by Rosemary Wise.

glabrous except for a few glandular hairs at tip, (2–)4-seeded; seeds 3 × 2 mm, lenticular, basally asymmetric, shortly pubescent with hygroscopic hairs.

HABITAT & DISTRIBUTION. Only known from the type collection made between 1300 and 1600 m in the Adung River valley [28°05'N, 97°40'E approx.] in Upper Burma. Map 5.

CONSERVATION STATUS. Insufficient data.

BURMA (MYANMAR). Adung R., 1300 – 1600 m, 2 Feb. 1931, *Kingdon Ward* 9184 (BM, E).

Strobilanthes tripartita is so called for two reasons. In the first place the calyx is divided into three segments, the two free lower lobes and the upper lip of fused lobes. Secondly the upper lip is itself 3-partite and remains so until it falls after fruiting. *Strobilanthes tripartita* shows an obvious similarity to *S. denticulata* in its calyx structure, hairy filaments, persistent bracts and glandular inflorescence formed of lax axillary spikes covered in glandular hairs but differs in many characters including the shorter bracts, glabrescent corolla and spikes with flowers in opposite pairs. It bears a superficial resemblance to species like *Strobilanthes tenax* Dunn, with which it was originally identified but can be distinguished by the persistent bracts, arcuate corolla and distinctive calyx structure. The duplicated lines of hairs inside the corolla are a very peculiar feature but in the absence of further collections it is impossible to decide whether they are a freak of a particular collection or a distinctive characteristic of the species.

Strobilanthes adpressa *J. R. I. Wood*, **sp. nov.** quoad folias superiores amplexicaules et lobos labii superioris calycis infra connatos ad *S. auriculatam* accedens sed bracteis oblongis-lanceolatis, floribus ad rhachim adpressis in spicis terminalibus dispositis distinctissima. Typus: Vietnam (N), Chapa, *Petelot* 7289 (holotypus P, two sheets). Fig. 7A – H.

Anisophyllous perennial undershrub of unknown height. *Stems* woody, up to 1 cm in diameter, young parts, sulcate and strongly angled, nearly glabrous apart from a few large-celled hairs and some scurfy pubescence at the internodes and in the grooves. *Leaves* unequal in each pair, sessile above, shortly petiolate below; petioles 0 – 15 mm long, sparsely pubescent near the base; blades 2 – 11 × 0.6 – 3.3 cm, oblong-elliptic to oblanceolate, apex acute, gradually narrowed to a rounded or cuneate base, margins obscurely serrate, sparsely pilose above, on the margins and on the veins beneath, cystoliths prominent above. *Inflorescence* of terminal spikes 4 – 13 cm long, the flowers erect and ± adpressed to the rhachis, rhachis quadrangular, glandular-pilose; *bracts* 20 – 30 × 7 – 10 mm, oblong-lanceolate, shortly acuminate, glandular pilose, somewhat imbricate, tardily deciduous as the flowers open; bracteoles 15 × 1.2 – 1.5 mm, linear-oblong, acute, glandular-pilose, persistent, resembling calyx lobes in colour, texture, shape and size; *calyx* 15 – 16 mm long, lobes subequal, linear-oblong, 12 – 14 × 1.5 – 1.6 mm, somewhat accrescent, the two lower free to the base, the three upper united for c. 4 mm and then free; *corolla* 3.5 – 4 cm long, "mauve" (*fide* Petelot), outside glabrous, inside glabrous except for the hairs retaining the style, the cylindrical basal portion of the tube c. 10 mm long, then gradually ventricose, strongly bent c. 2.5 cm

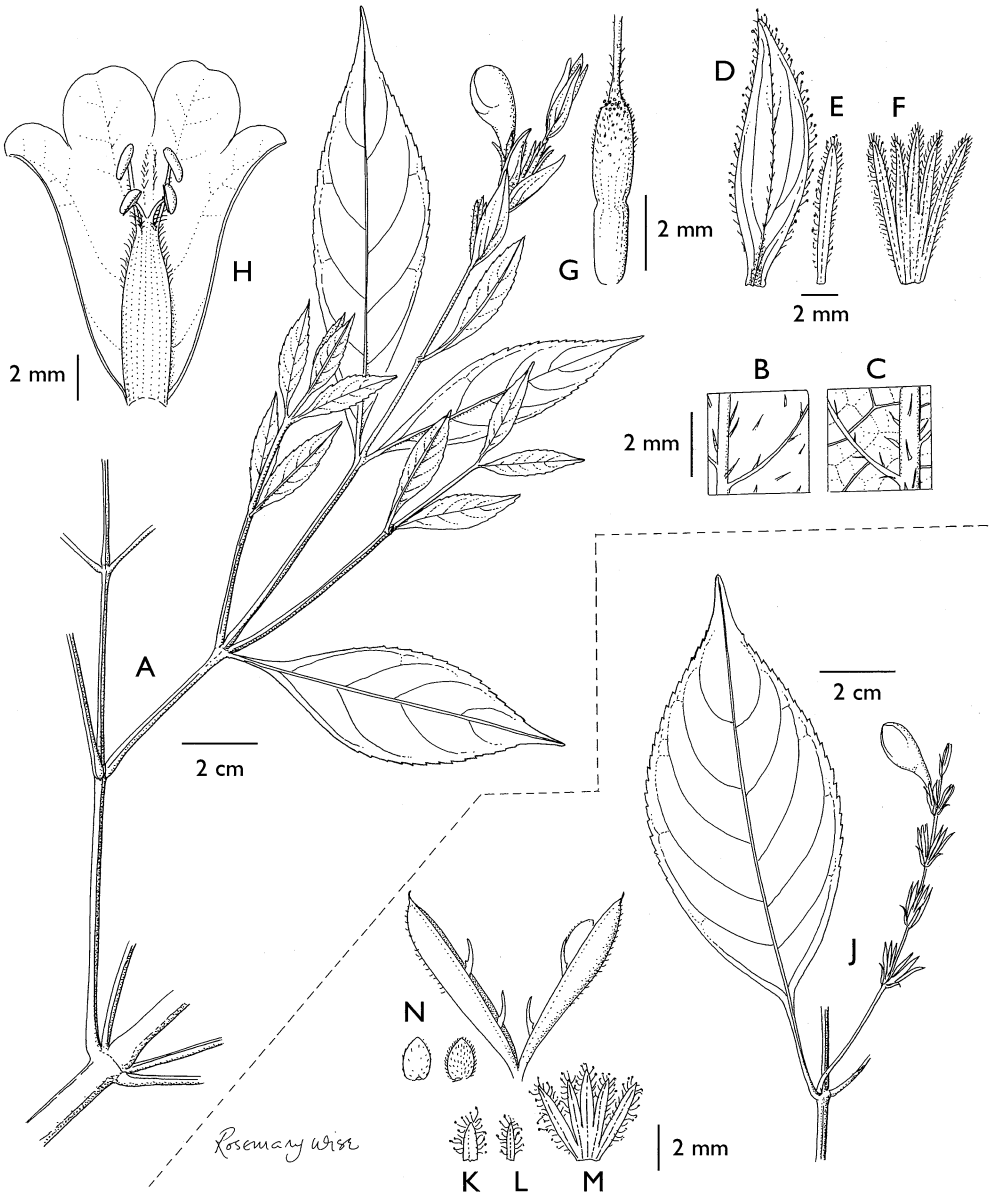


FIG. 7. **A – H** *Strobilanthes adpressa*. **A** habit; **B** adaxial leaf surface, **C** abaxial leaf surface; **D** bract; **E** bracteole; **F** calyx; **G** ovary; **H** corolla opened out. **J – N** *Strobilanthes dryadum*. **J** portion of inflorescence with leaf; **K** bract; **L** bracteole; **M** calyx; **N** capsule and seeds. **A – H** drawn from *Petelot* 7286 and **J – N** from *Delavay* 4142 by Rosemary Wise.

above the base, lobes c. 6 × 5 mm, ovate, obtuse; *stamens* 4, didynamous, all fertile, included, filaments sparsely pilose, the longer pair 4 mm long, the shorter pair 2 mm long, anthers 1.5 × 0.5 mm, oblong; style c. 21 mm long, minutely and sparsely pilose; ovary comose with shortly stipitate glands. *Capsule* not seen.

HABITAT AND DISTRIBUTION. Only known from the type collection made in forests in north Vietnam.

CONSERVATION STATUS. Insufficient data but presumably vulnerable.

VIETNAM. Chapa, c. 1500 m, April 1935, *Petelot* 7286 (P).

Although the sessile, oblong-oblanceolate leaves bear a strong resemblance to those of *Strobilanthes auriculata* we do not believe that this species is related in any way. The inflorescence is quite different having the flowers arranged in terminal spikes with the bracts, bracteoles and calyx adpressed to the rhachis. The bracts are tardily deciduous but the bracteoles are persistent and very distinct from them resembling the calyx lobes in every way. The corolla is relatively large, and bent about the middle. In the form of the inflorescence *Strobilanthes adpressa* resembles *S. lamium* C. B. Clarke ex W. W. Sm. and *S. cognata* Benoist from China, both of which have flowers arranged in spikes with relatively large imbricate bracts, but it differs from both in the structure of the calyx where the three upper lobes are fused for about a quarter of their length.

In a recent paper, Fang *et al.* (1997) have described five new species, *Strobilanthes ferruginea* D. Fang & Lo, *S. longgangensis* D. Fang & Lo, *S. longzhouensis* Lo & D. Fang, *S. myriostachya* D. Fang & Lo and *S. botryantha* D. Fang & Lo, all diagnosed against *S. denticulata* (under the name *S. griffithiana)* and all reported to have the distinctive upper calyx lip with fused lobes. Although we have not been able to see any of these plants we suspect they are not closely related to *Strobilanthes denticulata* or *S. parryorum,* which are narrow endemics of NE India, nor to *S. tripartita,* which differs in its much longer calyx, nor to *S. adpressa* because of its distinctive bracts. However these newly described Chinese species may well be related to *Strobilanthes dryadum* Benoist, which is the only species from the Chinese mainland that we have seen, in which the upper the three calyx lobes are fused (Fig. 7). We cannot elucidate its relationship with the newly described Chinese species until we have had the opportunity to see authentic material of these.

The Strobilanthes mogokensis complex

This consists of a pair of similar species, unrecognised by Nees or Bremekamp but with the characteristic connate upper calyx lobes typical of *Triaenacanthus.* Both species have the exserted stamens of *Strobilanthes renschiae,* discussed on page 117 below but differ in their corolla shape and ellipsoid pollen.

Strobilanthes decipiens *J. R. I. Wood,* **sp. nov.** *S. mogokensi* maxime similis sed spicis interruptis, corolla parviore, bracteis obovatis, apice dentata et praesertim granis pollinis ellipsoideis costis transtrumisque instructis distincta. Typus: India, Nagaland, *Kingdon Ward* 12507 (holotypus BM). Fig. 8.

Gregarious anisophyllous undershrub 0.3 – 1.2 m high; *stems* somewhat sulcate, woody below, bifariously pilose with large-celled hairs, eventually glabrescent. *Leaves* unequal in each pair, the smaller about half the size of the larger, petiolate; petioles 0.2 – 3 cm long, pilose; blades 1.5 – 12 × 1 – 6 cm, ovate, acute to shortly acuminate and commonly falcate, base attenuate and ± decurrent onto the petiole, margin crenate or crenate-dentate, thinly to rather densely pilose with large white hairs on both surfaces and especially on the veins, below paler and with prominent cystoliths. *Inflorescence* of short, bracteate, simple or branched spikes terminal on the main branches and short, lateral shoots; spikes 1 – 4 cm long with 1 – 5 flower pairs, distant below but becoming confluent above; rhachis pilose; *bracts* at inflorescence branching points and at base of spike resembling reduced, sessile leaves, broadly ovate to suborbicular, acute, cordate at the base, 0.2 – 6 cm long and wide, very variable in size; lower floral bracts 7 – 10 mm long, obovate with a dentate foliose, green tip and a paler basal portion, the basal portion 1.5 – 3 mm wide, densely pilose with a mixture of gland-tipped and eglandular hairs, the tip 2.5 – 5 mm wide, more sparsely pilose with eglandular hairs and some sessile glands; upper floral

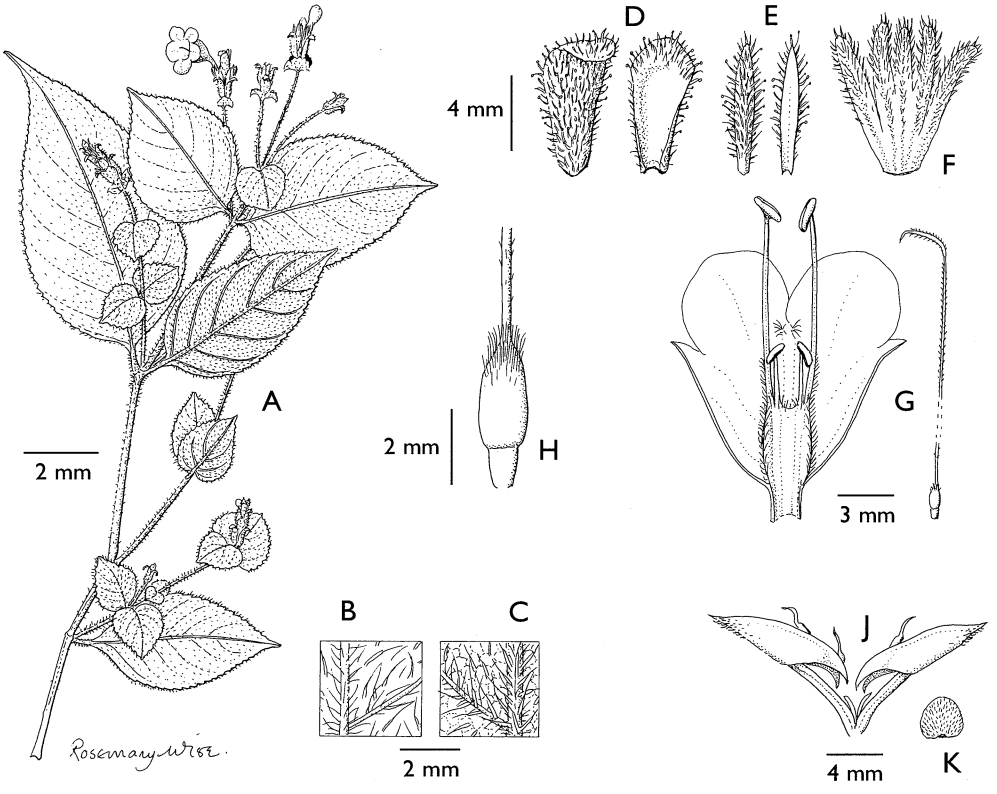


FIG. 8. **A – K** *Strobilanthes decipiens*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract, upper and lower surfaces; **E** bracteole, upper and lower surface; **F** calyx; **G** corolla and style; **H** ovary; **J** capsule; **K** seeds. **A – F** and **H** drawn from *Kingdon Ward* 18201, **G** from *Bor* 6739 and **J – K** from *Kingdon Ward* 18369 by Rosemary Wise.

bracts 7 – 10 mm long, obovate to cuneate, truncate or obtuse, densely pilose with gland-tipped and eglandular hairs; bracteoles 5 – 8 × 1 mm, oblong-lanceolate, obtuse, densely pilose with a mixture of gland-tipped and eglandular hairs; *calyx* 8 – 12 mm long. the two lower lobes free almost to the base and the three upper lobes connate for half their length so forming a 3-fid upper lip, free lobes 7 – 11 × 1 – 2 mm, slightly exceeding the upper lip, linear, narrowed at both ends, ciliate-margined and ± pilose on the dorsal surface with gland-tipped and eglandular hairs, inside glabrous; *corolla* c. 2 cm long, white, outside glabrous except the pilose lobes, inside glabrous except for the hairs retaining the style, infundibuliform, the basal cylindrical part 6 – 7 mm long and 2 mm wide, then bent sharply c. 90°and abruptly widened for 5 – 7 mm, 5-lobed, the lobes broadly ovate, 4 – 6 mm long, rounded; *stamens* 4, all fertile, didynamous, filaments sparsely pilose, inserted at base of expanded part of tube, the shorter pair 2 – 3 mm long, anthers included, the longer pair c. 9 mm long, the anthers exserted, thecae 1.5 – 2 × 0.5 mm wide, oblong, glabrous; *pollen* ellipsoid, ribbed, scalariform; style c. 2 cm long, pilose; ovary comose. *Capsule* 10 – 11 × 2 – 3 mm, oblong, narrowed at both ends, comose, 4-seeded; seeds 1.5 mm long and broad, ovate to suborbicular, pilose with mucilaginous hairs.

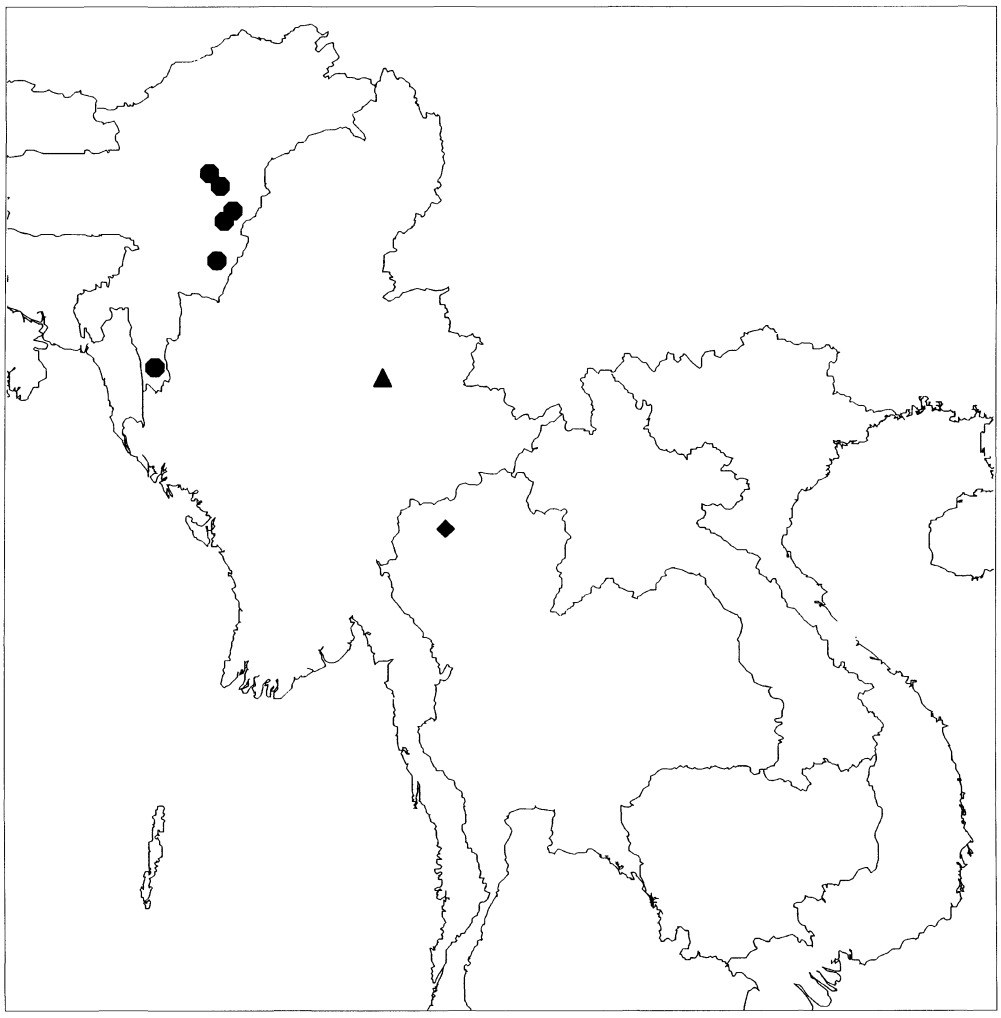
HABITAT AND DISTRIBUTION. Endemic to the Naga and Lushai Hills of eastern India where it is apparently uncommon but gregarious by tracks in hill forests growing between 1150 and 2150 m. It flowers in the autumn and is presumably plietesial. Map 6.

CONSERVATION STATUS. Insufficient data but certainly vulnerable.

INDIA. Nagaland/Manipur: Nerhena [25°47'N, 94°08'E], 1250 m, 18 Sept. 1935, *Bor* 6166 (K); Kekrima [25°36'N, 94°14'E], 1700 m, 12 Nov. 1935, *Kingdon Ward* 12507 (BM); shore of Lacham Lake [?24°33'N, 93°50'E], 1150 m, 18 Nov. 1935, *Bor* 6739 (K); Sirhoi [25°10'N, 94°29'E], 1300 – 1600 m, 11 Oct. 1948, *Kingdon Ward* 18201 (BM, NY); between Ukhrul [25°07'N, 94°22'E] and Tusom Khulen, 1700 m, 10 Dec. 1948, *Kingdon Ward* 18369 (BM, NY); Takubama, Naga Hills, 2150 m, 4 Sept. 1950, *Koelz* 26043 (W, ?MICH). Mizoram: Lushai Hills: Blue Mt [22°38'N, 93°03'E], 950 – 1300 m, Dec. 1931, *Wenger* 384 (K); spur of Blue Mt, 1300 m, Jan. 1931, *Wenger* 401 (K).

Strobilanthes decipiens is superficially very similar to *S. mogokensis* and appears to differ only in rather trivial characters. The spikes are distinctly narrower, more interrupted and the corolla is smaller, reaching only about 2 cm in length. The bracts towards the middle of the spike are slightly shorter with an obovate or subspathulate, dentate, foliose tip and their yellowish glandular indumentum is less obvious than in *Strobilanthes mogokensis*. However the really decisive character lies in the pollen, which in *Strobilanthes decipiens* is the common ribbed scalariform kind whereas in *S. mogokensis* it is echinulate.

Although pollen has been widely used by Lindau, Bremekamp and others to define genera in *Acanthaceae*, less attention has been paid to its value in species delimitation. In the case of *Strobilanthes decipiens* and *S. mogokensis* and that of *S. boholensis* Merr. and *S. axilliflora* C. B. Clarke ex S. Moore from Java it is really decisive as the two species in each pair can only otherwise be distinguished on quite



MAP 6. Distribution of *Strobilanthes decipiens* (●), *S. mogokensis* (▲) and *S. lilacina* (♦).

minor characters. Pollen has also proved decisive in distinguishing another species pair, *Strobilanthes flexicaulis* and *S. tashiroi* discussed below, although in this case there are also good, gross morphological characters to distinguish the two species.

Strobilanthes mogokensis *Lace*, Bull. Misc. Inform., Kew 1915: 406 (1915). Type: Burma (Myanmar), Ruby Mines Distr., *J. H. Lace* 6018 (holotype E). Fig. 9.

Superficially almost identical to the last species but the pollen is very different and most unusual. It is ellipsoid, pseudocolpate with rather long, blunt spines arranged in rows along the longitudinal ridges (Fig. 12C). *Strobilanthes labordei* H. Lév. from China is one of the very few other species with a similar kind of pollen but

the ornamentation is also not dissimilar to that of *S. renschiae* which is illustrated in Wood *et al.* (2003: 143).

HABITAT AND DISTRIBUTION. Only known from the type collection made at 1850 m between Bernardmyo and Mogok in the Ruby Mines Distr. of Burma.

Strobilanthes mogokensis and *S. decipiens* also resemble *S. lilacina* C. B. Clarke from Thailand quite closely. Like *Strobilanthes decipiens*, *S. lilacina* has the common banded, scalariform, ellipsoid pollen found in the majority of species of *Strobilanthes* although the cross bars are relatively few (Fig. 12D). The calyx is somewhat intermediate with the common type as the three upper calyx lobes are free to the base, although shorter than the two lower lobes. However, the additional characters, which distinguish *Strobilanthes lilacina* are interesting. It has a large, lilac corolla reaching 4 cm in length, the whole inflorescence is sticky-glandular hairy and the bracts are 1.5 cm long, oblong and without a foliose tip. This places *Strobilanthes mogokensis* exactly midway both geographically and in superficial morphology between *S. lilacina* and *S. decipiens*. Map 6.

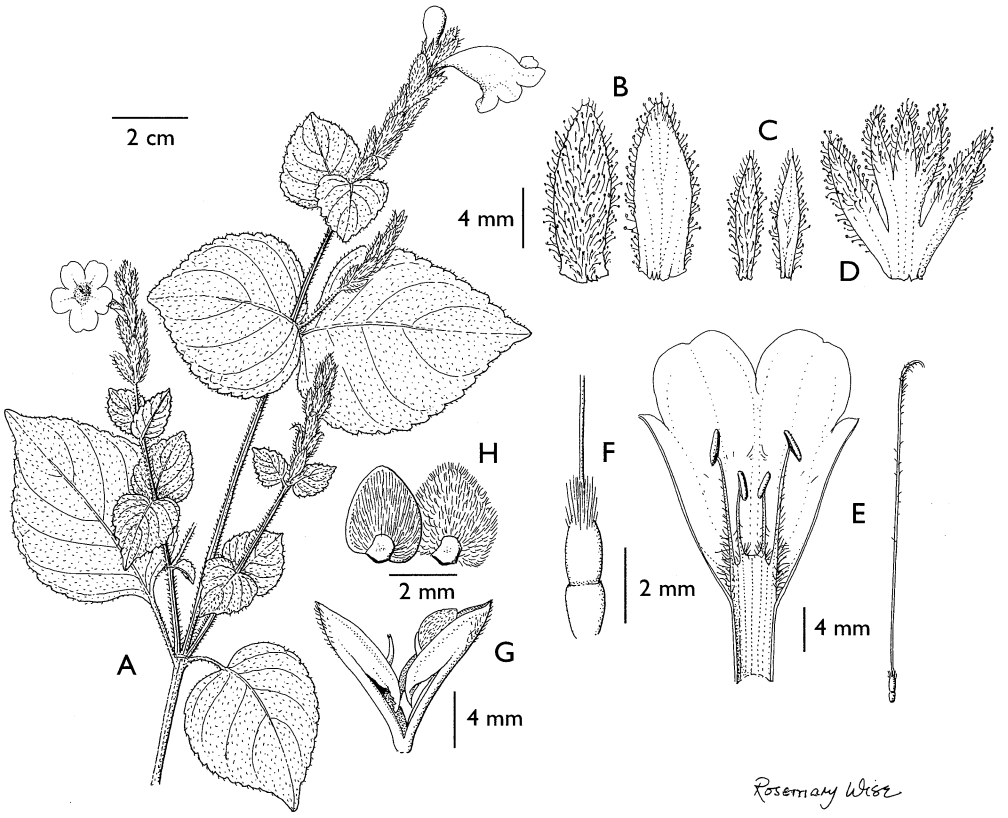


FIG. 9. **A – H** *Strobilanthes mogokensis*. **A** habit; **B** bract, upper and lower surfaces; **C** bracteole, upper and lower surface; **D** calyx; **E** corolla and style; **F** ovary; **G** capsule; **H** seeds. **A – H** drawn from *Lace* 6018 by Rosemary Wise.

Strobilanthes lilacina itself is similar to *S. argentea* J. B. Imlay and *S. corrugata* J. B. Imlay (in which we include *S. viscida* J. B. Imlay). All three species have all five calyx lobes free to the base, although the lower lobes are longer than the three upper ones. All three are very local species of the Chiangmai area of Thailand with *Strobilanthes lilacina* and *S. corrugata* apparently restricted to the same single mountain, Doi Chiang Dao. All three species are, in fact transitional in terms of their calyx structure to the common kind in which all five lobes are subequally divided to the base.

Strobilanthes renschiae and its allies

Bremekamp (1944: 294) expanded the concept of the previously monotypic genus, *Lamiacanthus* Kuntze, by including in it the following species whose calyx he described as bilabiate.

Strobilanthes renschiae (*Bremek.*) *J. R. I. Wood & J. R. Benn.*, Kew Bull. 58: 142 (2003).

Lamiacanthus renschiae Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 296 (1944). Type: Indonesia, Lombok, *I. Rensch* 368 (holotype B).

Strobilanthes renschiae is only known from two collections, which both show the distinctive calyx described by Bremekamp with the lobes of the upper lip fused to half way. However it differs from all other species discussed earlier in this paper by having its flowers arranged in small, shortly pedunculate heads with an infundibuliform corolla. The pollen is globose with small spines on raised longitudinal flanges similar to that of *Strobilanthes autapomorpha* J. R. Benn. (*Lamiacanthus viscosus* Kuntze), which led Bremekamp to place it in *Lamiacanthus* (Wood *et al.* 2003: 142). This kind of pollen is also found in *Strobilanthes calcicola*, in which the calyx is subequally lobed to the base, and, according to Bremekamp, in the species represented by *Bunnemeyer* 11852 (L), collected in the SW of Sulawesi (Celebes) in Indonesia. We cannot confirm this statement as the specimen now has no flowers or fruit but we have no reason to doubt Bremekamp on this. The species is very distinct with the two lower calyx lobes fused as well as the three upper ones, a feature only found elsewhere in *Strobilanthes rufescens* and *S. bipartita*.

The pollen of *Strobilanthes renschiae* and its allies is, however, only a variation on the common "*Sympagis*" pollen type discussed elsewhere (Wood *et al.* 2003) and, apart from the calyx structure, *S. renschiae* and the species represented by *Bunnemeyer* 11852 are typical of this group of around 30 species. In most of the group the calyx is subequally 5-lobed to the base, but in several species there is a tendency for the three upper calyx lobes to be basally fused with the central lobe slightly longer than the laterals, thus being intermediate in calyx structure. This can be seen in *Strobilanthes autapomorpha* from Java, which has similar pollen to *S. renschiae*, as well as in *S. teraoi* from Timor, and *S. cycla* from China.

Parachampionella

This genus was established by Bremekamp to accommodate a small group of species with globose, echinulate pollen, four stamens and the three lobes of the upper lip of the calyx fused for most of their length. He included two species, *Strobilanthes rankanensis* from Taiwan and *S. tashiroi* from the Ryukyu Islands, to which was added a third, *S. flexicaulis*, also from Taiwan, by Hsieh & Huang (1978). Examination of the three species confirms that they all share the distinctive upper calyx lip with three fused lobes but they are otherwise not very closely related as noted below.

Strobilanthes flexicaulis *Hayata,* Icon. Pl. Formos. 5: 135 (1915). Type: China, Taiwan, *H. Hayata & S. Sasaki* s.n. (holotype TI, n.v.).

Triaenacanthus flexicaulis (Hayata) C. F. Hsieh & T. C. Huang, Taiwania 19 (1): 22 (1974). *Parachampionella flexicaulis* (Hayata) C. F. Hsieh & T. C. Huang, Fl. Taiwan 4: 652 (1978).

Strobilanthes prionophylla Hayata, Icon. Pl. Formos. 9: 84 (1920). Type: China, Taiwan, *U. Mori* 2150 (holotype TI, n.v.).

Strobilanthes faurei Benoist, Bull. Mus. Natl. Hist. Nat. 28: 187 (1922). Type: China, Taiwan, *Faurie* 1473 (holotype P, isotypes A, G, BM).

Strobilanthes glandulifera Hatus., Sci. Bull. Agric. Div. Univ. Ryukyus 3: 22 (1956). Type: Japan, Ryukyu Islands, *T. Amano* 1670 (Herb, not cited). *Parachampionella glandulifera* (Hatus.) S. S. Ying, Quart. J. Chin. Forest. 21 (2): 113 (1988).

Strobilanthes flexicaulis is distinguished from the other species placed in *Parachampionella* by its pollen, which is the common ribbed, ellipsoid, scalariform kind, thus indicating that it should never have been placed in *Parachampionella* at all (Fig. 13A). The only oddity about the pollen grain is the presence of rather large lips around the pores. It is also distinct in having secondary membranes outside the decurrent bases of the outer two filaments, the characteristic feature of another of Bremekamp's genera, *Pteryptychia*. However once again its pollen places it outside this group. Its affinities are not obvious but it resembles *Strobilanthes wallichii* in facies, with which it shares a similarly variable inflorescence. The flowers are usually arranged in short spikes, which sometimes appear 1-sided and are often reduced to one or two flowers. The lowest bract is rounded, toothed and leaf-like but the upper bracts on well-developed spikes are much reduced in size and merely oblong or oblanceolate. The corolla, however, is almost straight and the stems are sometimes winged and often zigzag.

These comments and the extensive synonymy cited above indicate that *Strobilanthes flexicaulis* is a very variable species and further collections and field studies are clearly needed. However we agree with T. Yamazaki (1991: 303ff) that *Strobilanthes glandulifera* should be reduced to synonymy with *S. flexicaulis*.

HABITAT AND DISTRIBUTION. Endemic to Taiwan (China) and the southern Ryukyu Islands (Japan), where it grows in forest from about 300 to 2200 m.

Strobilanthes rankanensis *Hayata,* Icon. Pl. Formos. 9:84 (1920). Type: China, Taiwan, *B. Hayata* s.n. (holotype ?TI, n.v.).

Parachampionella rankanensis (Hayata) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 151 (1944).

Strobilanthes rankanensis is the type of Bremekamp's *Parachampionella* and has the globose, echinulate pollen he described for the genus (Fig. 13B). It is an unusual species in *Strobilanthes* because of its creeping habit and inflorescence, which recall *Hemigraphis.* The flowers are borne in the leaf axils but the corolla is quite large, reaching over 3 cm in length and is quite straight in all specimens we have seen.

HABITAT AND DISTRIBUTION. Endemic to the island of Taiwan (China), where it grows in forest from about 1400 to 2050 m.

Strobilanthes tashiroi *Hayata,* Icon. Pl. Formos. 9: 85 (1920). Type: Japan, Ryukyu Islands, Okinawa, *Tashiro* (holotype TI, n.v.). Fig. 10L – P.

Parachampionella tashiroi (Hayata) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 151 (1944). *Strobilanthes flexicaulis* var. *tashiroi* (Hayata) T. Yamaz., J. Jap. Bot. 66 (5): 305 (1991).

Strobilanthes tashiroi was treated as a variety of *S. flexicaulis* by Yamazaki (1991: 305) but there is no doubt that it is a distinct species. The pollen of *Strobilanthes tashiroi* is globose and echinulate (Fig. 13C), resembling that of *S. rankanensis,* rather than that of *S. flexicaulis.* Additionally the flowers are in terminal spikes and the corolla is distinctly bent. The leaves are narrowly oblong-elliptic, very coarsely toothed and always hairy beneath. It would not appear to be closely related to either *Strobilanthes flexicaulis* or to *S. rankanensis,* but quite unexpectedly shows a striking resemblance to the following, hitherto undescribed species.

HABITAT AND DISTRIBUTION. Endemic to the Ryukyu Islands from Okinawa northwards. A map of its distribution is shown by Yamazaki (1991: 304).

Strobilanthes perplexa *J. R. I. Wood,* **sp. nov.** granis pollinis spinulosis sphaericis, spicis laxis subterminalibus ad *S. tashiroi* Hayata adscedens, sed calyce breviore (usque 13 mm longo), bracteis lanceolatis et foliis infra glabris ab ea recedens. Typus: Indonesia, Sumatra, *H. C. Robinson & C. B. Kloss* 67 (holotypus BM). Fig. 10A – K.

Strongly anisophyllous perennial herb 50 – 60 cm high; *stems* glabrous except for some scurfy pubescence at the nodes, pustulate, sulcate above, cystoliths prominent. *Leaves* very unequal in each pair, the smaller one tenth to one sixth the size of the larger, petiolate; petioles 3 – 10 mm long, glabrous; blades of larger leaves 5 – 17 × 1.5 – 6 cm, oblong-elliptic, apex acuminate, base attenuate, margin serrate, glabrous on both surfaces, cystoliths prominent above, paler beneath with prominent veins covered in cystoliths, blades of smaller leaves broadly to narrowly elliptic, 1.5 – 4 cm long. *Inflorescence* of few, lax spikes 5 – 9 cm long, arising in the uppermost leaf axils, never forming a panicle; sterile *bracts* below flowers linear-oblanceolate, 7 – 9 mm

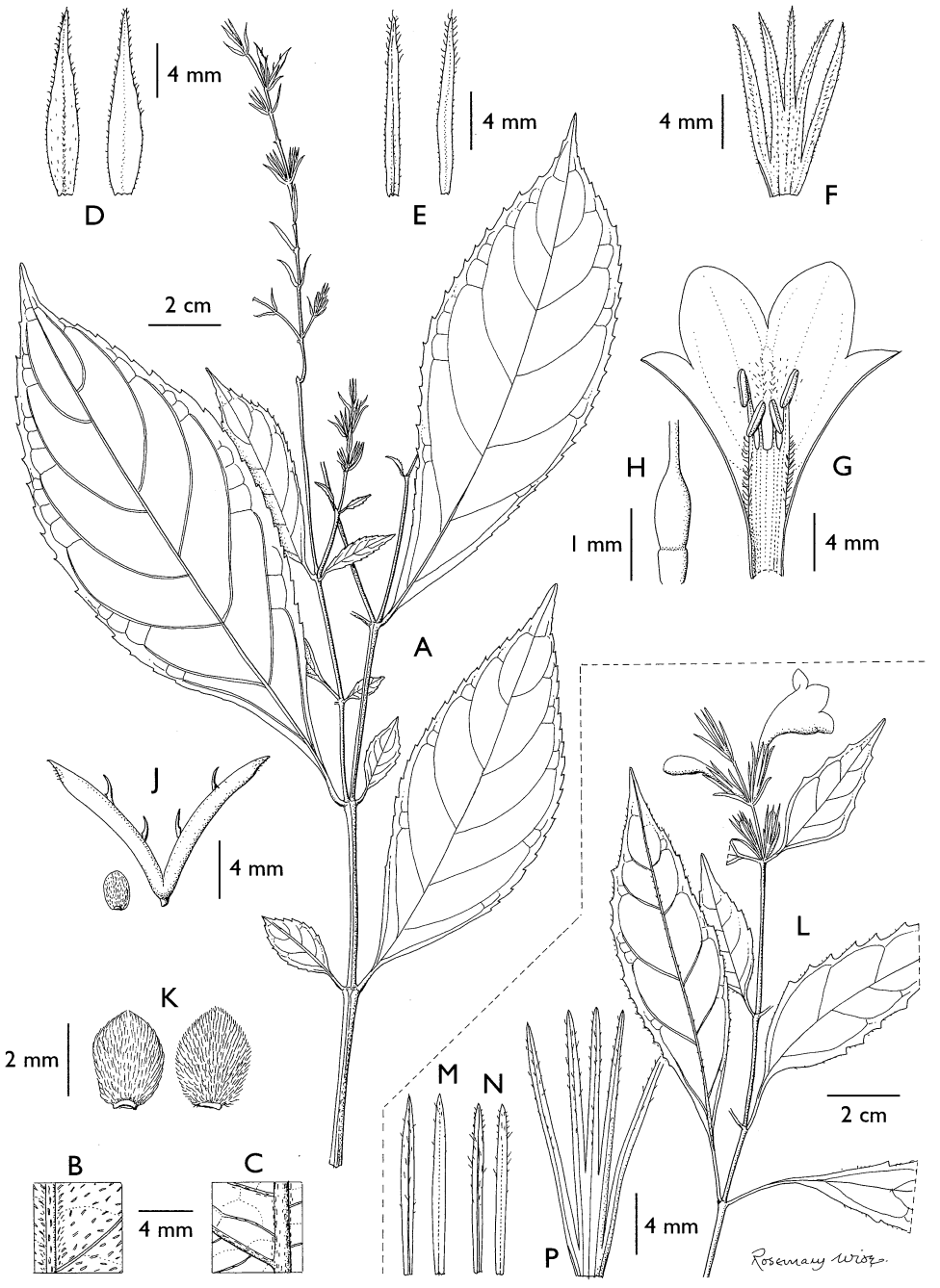


FIG. 10. **A – K** *Strobilanthes perplexa*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract, upper and lower surfaces; **E** bracteole, upper and lower surface; **F** calyx; **G** corolla; **H** ovary; **J** capsule; **K** seeds. **L – P** *Strobilanthes tashiroi*. **L** habit with portion of inflorescence; **M** bract, upper and lower surfaces; **N** bracteole, upper and lower surface; **P** calyx. **A – E** and **J – K** drawn from *Forbes* 138k, **F – H** from *Robinson & Kloss* 67 and **L – P** from *Amano* 7134 by Rosemary Wise.

long, floral bracts 9 – 12 × 2 mm, lanceolate, narrowed to a ± obtuse apex, subglabrous to pubescent with brownish hairs, cystoliths prominent on dorsal surface; bracteoles 11 – 13 × 1 mm, linear, similar in indumentum to the bracts; *calyx* subglabrous to pubescent with brownish hairs, cystoliths prominent on the exterior, 2-lipped, the upper lip 12 – 13 mm long, with 3 triangular teeth 3 – 4 mm long, the lobes connate for c. 9 – 10 mm, not splitting in fruit, lower lip 2-lobed to the base, the lobes 12 – 13 mm long, linear-lanceolate, acuminate; *corolla* blue, glabrous outside and inside except for hairs retaining the style, 2 – 2.2 cm long, straight, basal cylindrical portion of the tube c. 8 mm long and 1.5 mm wide, then strongly ventricose, lobes ovate, emarginate, c. 2.5 mm long and wide; *stamens* 4, fertile, didynamous, included, filaments glabrous, the longer pair c. 4 mm long, the shorter pair c. 2 mm long; anthers oblong c. 2 mm long; *pollen* globose, echinulate (Fig. 13D); style glabrous; ovary puberulent at tip. *Capsule* 12 mm long, narrowly oblong-ellipsoid, minutely glandular, the glands sessile or very shortly stalked, 4-seeded; seeds pilose with mucilaginous hairs, suborbicular, c. 2.5 mm long and wide.

HABITAT AND DISTRIBUTION. Known from two collections, one from Sumatra and the other apparently from the Cocos Keeling Islands.

CONSERVATION STATUS. Insufficient data but possibly extinct.

INDONESIA. Sumatra: Sandaran Agong, Kerintje ("Thorinchi"), 800 m, 25 April 1914, *Robinson & Kloss* 67 (BM).

COCOS KEELING ISLANDS (*fide* Spencer Moore (1925: 79). *H. O. Forbes* 138 k (BM).

We have used the epithet *perplexa* for this plant for two good reasons. In the first place the location of one of the two collections (*Forbes* 138 k) cited above is odd. If it is correct it is the only *Strobilanthes* known from the Cocos Keeling Islands and the occurrence of a Sumatran hill species on a flat oceanic island seems highly improbable. It seems much more likely that *Forbes* 138 k was collected on Sumatra, which Forbes also visited, but we cannot be certain of this. Secondly it is amazingly similar in terms of pollen, inflorescence, calyx form and leaf shape to *Strobilanthes tashiroi* from the Ryukyu Islands. These two very local species from opposite ends of the range of *Strobilanthes,* several thousand kilometres apart, pose an interesting problem for plant geographers.

Spencer Moore identified the Forbes collection with *Strobilanthes sumatrana* Miq. and both specimens were filed under this name at the BM. *Strobilanthes sumatrana* is, in fact, a species with ellipsoid, ribbed, scalariform pollen unrelated to *S. perplexa* but part of the complex of species close to *S. pentstemonoides* (Nees) T. Anderson and with a quite different inflorescence, in which the flowers are in small heads with broadly elliptic bracts.

Tetragompha

This genus was first described by Bremekamp (1944: 213) to accommodate two species characterised by having dense, bracteate flower heads, the anther connective extended as an awn and a 2-lipped calyx with the three upper lobes connate for nearly half their length. The only distinction between this genus and another of

Bremekamp's creation, *Tetraglochidium*, lies in the calyx structure. The distinctive awn-like extension of the anther connective can be seen in most species placed by Bremekamp in both genera though it is more marked in *Tetragompha korthalsii* than in other species and is absent from *Strobilanthes bibracteata* Blume placed by Bremekamp in *Tetraglochidium*.

The oldest of the two species placed by Bremekamp in *Tetragompha*, *Strobilanthes crassifolia* Miq. is known from two isotypes (L, U) both of which are sterile. Examination of the protologue indicates that Miquel did not see flowers or fruit and Bremekamp's placement of this species in *Tetragompha* was, therefore, simply a guess. He cannot have known the structure of either the calyx or the anthers. No other material available matches the sterile type material at all well and it is clear that *Strobilanthes crassifolia* has to be treated as a *species non satis nota* and is therefore excluded from discussion.

The other species, *Strobilanthes korthalsii*, is also known only from the type but the material is much better and the plant has the distinctive upper lip of the calyx with the three lobes fused in the lower half.

Strobilanthes korthalsii (*Bremek.*) [*Terao ex*] *J. R. I. Wood*, **comb. nov.**

Tetragompha korthalsii Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 41 (1): 214 (1944). Type: Indonesia, Sumatra (west), *Korthals* s.n. H.L.B. 897.280.261 (holotype and various isotypes L). Fig. 11J – M.

No details or further collections are known.

This species is obviously unrelated to any of those discussed earlier in this paper, but the dense bracteate heads recall *Strobilanthes echinata* Nees and its allies, which Bremekamp placed in the genus *Tetraglochidium*. None of the species in this "genus" that we have examined have the distinct calyx structure of *Strobilanthes korthalsii* but the following new species from Laos has an even more strikingly extreme calyx structure, resembling that of *Strobilanthes rufescens*. The calyx is clearly two-lipped with the two lower and three upper lobes fused almost completely creating a bidentate lower calyx lip and a tridentate upper lip. The shortly extended anther connective and the axillary, bracteate, flower heads support a presumed affinity with *Strobilanthes korthalsii*.

Strobilanthes bipartita *Terao ex J. R. I. Wood*, **sp. nov.** floribus in capitulis bracteatis dispositis et connectivo supra antheram in acumine breve producto ad species *Tetraglochidii Tetragomphae*que Bremek. congruens sed floribus axillaribus et calyce bilabiato, lobis connatis distinctissima. Typus: Laos, *Poilane* 26244 (holotypus P).

Much branched undershrub to c. 0.75 m; stem rounded, glabrous. Leaves slightly unequal in each pair, petiolate; petioles 0.7 – 1.5 cm long, sparsely pilose with large-celled brownish hairs; blades 6 – 22 × 3.5 – 10 cm, elliptic, shortly acuminate, attenuate at the base, margin obscurely serrulate, pilose with rather large rigid hairs on both surfaces and the margin and particularly on the veins below, cystoliths prominent on the upper surface. Inflorescence of shortly pedunculate, axillary

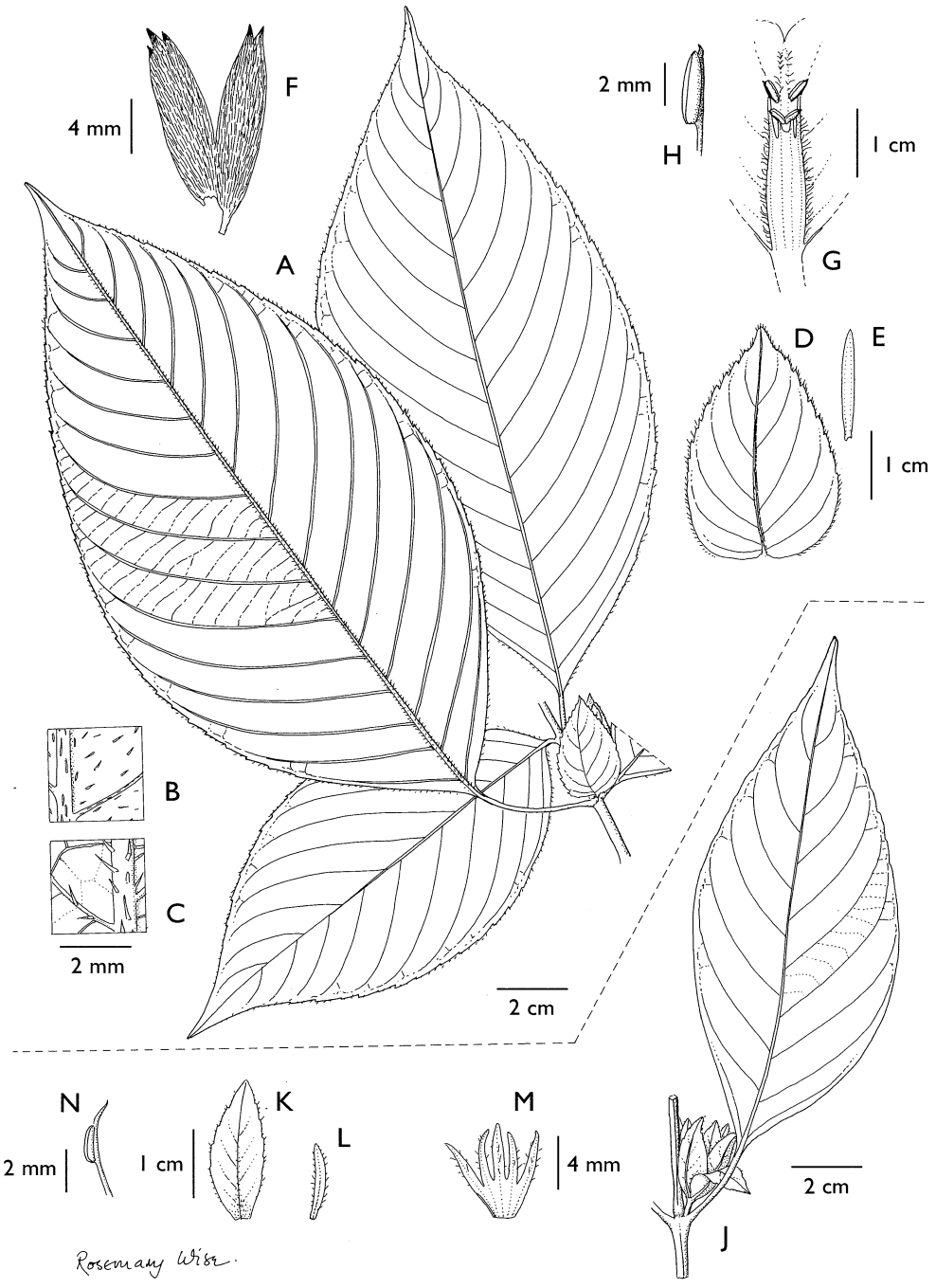
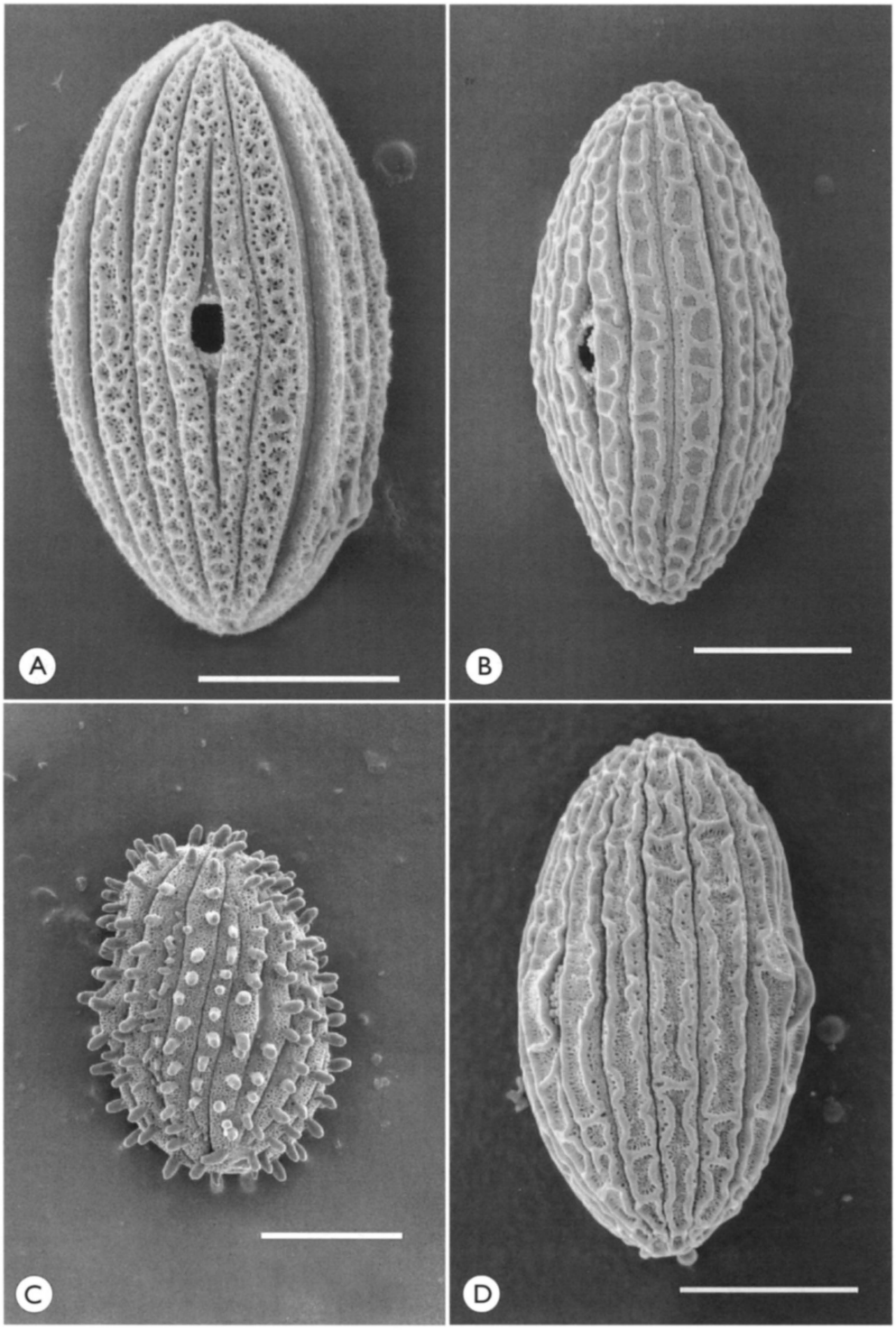


FIG. 11. **A – H** *Strobilanthes bipartita*. **A** habit; **B** adaxial leaf surface; **C** abaxial leaf surface; **D** bract; **E** bracteole; **F** calyx; **G** corolla, opened out, **H** anther showing connective. **J – M** *Strobilanthes korthalsii*. **J** leaf and flower head; **K** bract, **L** bracteole, **M** calyx, **N** anther showing connective. **A – H** drawn from *Poilane* 26244, **J – M** from *Korthals* s.n. by Rosemary Wise.



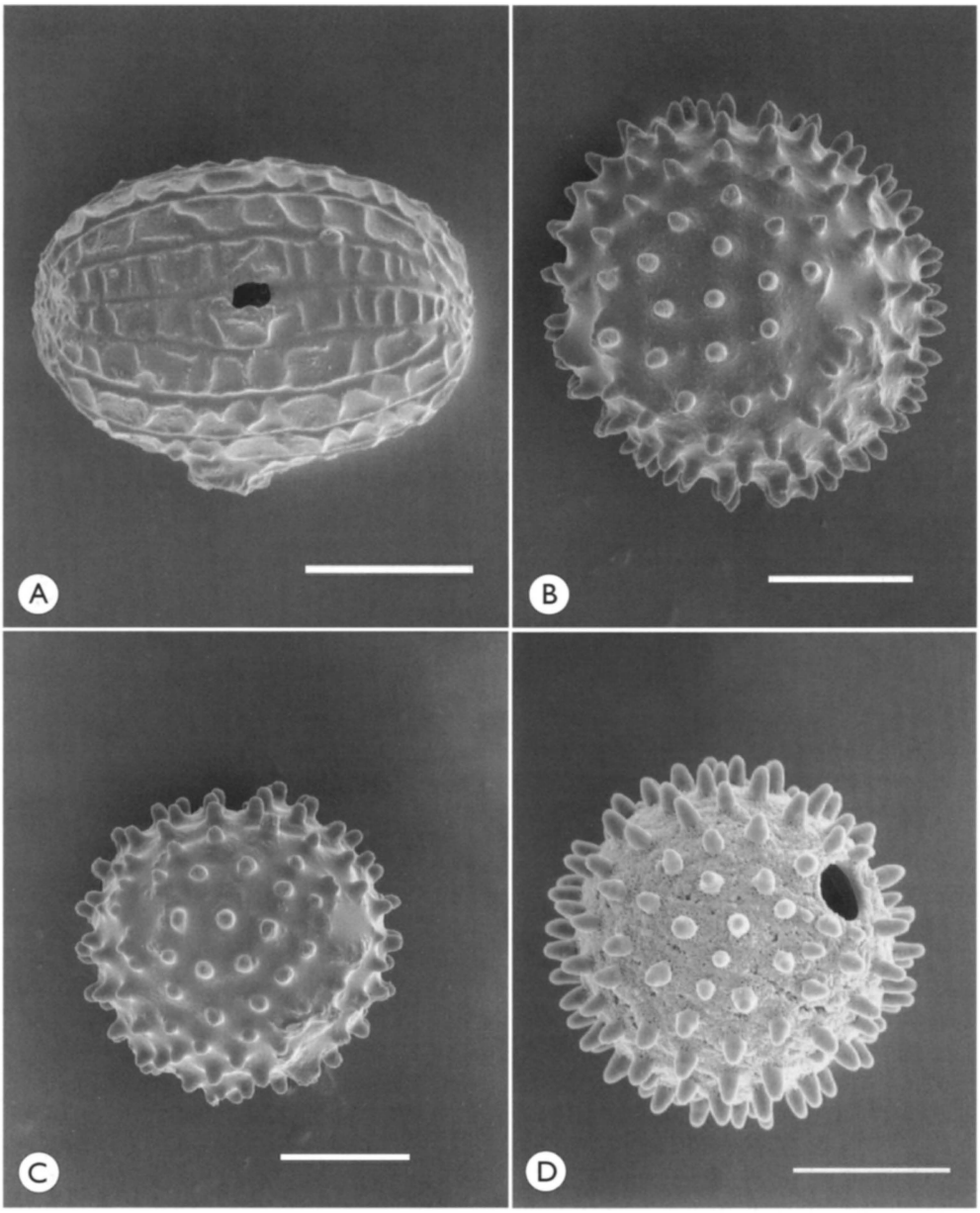


FIG. 12 (left). *Strobilanthes* pollen (SEM). **A** *Strobilanthes rufescens* from *Kingdon Ward* 11232; **B** *S. auriculata* from *Henderson* 29140; **C** *S. mogokensis* from *Lace* 6018; **D** *S. lilacina* from *Hosseus* 402a. Scale bars: **A, B** = 25 μm; **C, D** = 20 μm.

FIG. 13 (above). *Strobilanthes* pollen (SEM). **A** *Strobilanthes flexicaulis* from *Foroze* 2071; **B** *S. rankanensis* from *Shimizo & Kao* 11689; **C** *S. tashiroi* from *Amano* 7134; **D** *S. perplexa* from *Robinson & Kloss* 67. Scale bars = 20 μm.

bracteate flower heads; peduncles 2 – 4 mm long, roughly pilose with brownish hairs; bracts 3 – 3.5 × 1.2 – 1.7 cm, ovate, shortly acuminate, entire or obscurely dentate near apex, glabrous except for the ciliolate margin; bracteoles 1.5 × 0.3 – 35 cm, oblong, glabrous; calyx adpressed-silky-hairy on both surfaces, 2-lipped, the lower lip c. 12 mm long formed of two fused lobes making a bidentate tip with acute triangular teeth c. 1.5 mm long and wide, the upper lip formed of three fused lobes, the central lobe c. 13 mm long and 1 mm longer than the two laterals, forming a tridentate tip; corolla c. 4 cm long, violet-blue (*fide* Poilane), glabrous outside and inside except for the hairs retaining the style, strongly symmetrically ventricose from a short basal cylindrical tube, the lobes c. 5 × 7 mm, ovate, obtuse; stamens 4, all fertile, included, didynamous, the two longer (outer) filaments 4.5 mm long, thinly pilose, the two shorter filaments 2 mm long, glabrous; anthers c. 3 × 1.25 mm, oblong, the connective of the two longer filaments extended as a short awn above the anthers; style pilose, ovary not examined. Capsule not seen.

HABITAT AND DISTRIBUTION. Only known from the type collection made at 1000 m in Laos. No exact details of habitat are available.

CONSERVATION STATUS. Insufficient data but presumably very vulnerable.

LAOS. Between Luong Nam Tha Mt [20°57'N, 101°24'E] and Sing Mt, 1000 m, 20 May 1936, *Poilane* 26244 (P).

Strobilanthes bipartita is so named because of its remarkable calyx structure, which is the most extremely two-lipped in the whole genus.

The information presented above under separate headings is summarised in Appendix 1 on pages 128 – 129. It is clear that the distinctive calyx with the upper lobes fused occurs randomly within individual species and in small species clusters in widely dispersed geographical areas and with little or no correlation with other important systematic characters in *Strobilanthes* such as pollen morphology or inflorescence shape. The character itself intergrades with the more normal subequally 5-lobed calyx in a number of the species clusters discussed in this paper and is of little value except at the level of species delimitation. No support for the genera created by Nees and Bremekamp can be found in this character.

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Appendix 1. Differences between selected *Strobilanthes* species having an upper calyx lip with fused lobes.

	Pollen	Corolla	Bracts	Inflorescence	Miscellaneous
S. rufescens	Ellipsoid, ribbed, reticulum mosaic-like, not scalariform	Straight, ventricose from a basal tube	Oblong or elliptic, with long, reddish hairs	Sessile or shortly pedunculate, axillary spikes	Two lower calyx lobes also united; Stem often with shaggy rufous hairs
S. auriculata	Ellipsoid, ribbed, scalariform	Bent above a basal tube, then ventricose	Oblong-obovate, often with long, white hairs, bracteoles 0	Shortly pedunculate, bracteate axillary spikes	Calyx lobes soon free; leaves oblong, sessile, often auriculate
S. decumbens	As above	Weakly bent above a basal tube, strongly ventricose	Suborbicular, with long, white hairs, bracteoles 0	Long spikes terminal on leafy shoots	Calyx lobes soon free; stem decumbent
S. alboviridis	As above	Curved, ventricose from basal tube	Oblong, sticky-glandular-pilose	Axillary panicles with flowers clustered towards tips	Calyx lobes soon free; leaves entire
S. repanda	As above	Straight or nearly so, ventricose from basal tube	Oblong to obovate, retuse with sessile or stalked glands	Long- pedunculate axillary spikes	Leaves undulate to deeply crenate
S. denticulata	As above	Curved, ventricose from basal tube, yellow	Oblong, densely glandular-pubescent	Branched, axillary, zigzag spikes, forming a panicle	Filaments hairy; leaves denticulate
S. tripartita	As above	Arcuate, ventricose from a basal tube	Lanceolate, glandular-pilose	Mostly simple axillary spikes, forming a panicle	Filaments hairy, filament curtain duplicated

S. decipiens	As above	Ventricose and strongly bent from a short tube	Obovate, shortly glandular-pubescent	Short spikes terminal on leafy axillary branches	2 anthers exserted, 2 included
S. mogokensis	Ellipsoid, pseudocolpate with a row of blunt spines along ridges	Ventricose and strongly bent from a short tube	Oblong, otherwise as for *S. decipiens*	Short spikes terminal on leafy axillary branches	2 anthers weakly exserted, 2 included
S. renschiae	Globose, echinulate, spines on slightly raised ridges	Funnel-shaped from basal tube	Lanceolate, shortly glandular	Dense bracteate, pedunculate heads	4 anthers exserted; capsule 2-seeded
S. flexicaulis	Ellipsoid, ribbed, scalariform	Straight, ventricose from a basal tube	Below broadly ovate, foliose, above reduced glabrous	Axillary, one-sided spikes	Basal extension of filament winged
S. rankanensis	Globose, echinulate, spines not on ridges	Straight, gradually widened from the basal tube	Leaf-like	Solitary in the leaf axils	Decumbent rooting herb
S. tashiroi	As above	Curved, ventricose from a short basal tube	Linear, glabrous or thinly hairy	Lax, terminal spikes	Leaves very coarsely dentate, thinly pilose
S. perplexa	As above	As above, but ?straight	As above but lanceolate	As above	As above but subglabrous
S. korthalsii	Ellipsoid, ribbed, ?scalariform	Campanulate from short, basal tube, very small	Oblong-elliptic, large, ciliate, eglandular	Shortly pedunculate, bracteate heads	Anthers with long awn