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## A TAXONOMIC REVISION OF THE GENUS *STACHYTARPHETA* VAHL (VERBENACEAE)\* IN AUSTRALIA

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### Abstract

A taxonomic revision of *Stachytarpheta* in Australia is presented. The following six species, two of which are putative hybrids are recognised: *S. australis*, *S. cayennensis*, *S. jamaicensis*, *S. mutabilis*, *S. xadulterina* and *S. xtrimenii*. The putative hybrid *S. xtrimenii* is recorded from Australia for the first time. The following two species are typified: *S. cayennensis* and *S. mutabilis*. A range of material including specimens from South America and Malesia was examined.

Affinities and distribution are considered for the genus and each species. A key to the species and hybrid taxa is provided and a detailed description of each species is supplemented by a habit sketch of a flowering branch and analytical drawings of the flowers.

### Taxonomic History of the Genus

The genus *Stachytarpheta* was described by Vahl (1804) with twelve South American species. It was placed in "Diandria Monogynia" where it was retained by Willdenow (1809), Roemer & Schultes (1817), Link (1821), Sprengel (1825), Dietrich (1839) and a few others. Persoon (1807) placed it in "Didynamia Angiospermia" and Reichenbach (1828) referred it and other related genera to the Labiatae. Within the "Diandria Monogynia", Link (1821) placed *Stachytarpheta* in the Verbenaceae, but misspelt it as "Stachytarpha". Later, the same spelling was used for this genus by Schauer (1847), Miquel (1858) and Thwaites (1861).

In 1829, Dumortier divided the Verbenaceae into two tribes: Verbeneae and Viticeae, with *Stachytarpheta* in the tribe Verbeneae. This tribe was accepted for the genus by Bartling (1830), Bentham (1839), Spach (1840), Schauer (1847) and Miquel (1858). Endlicher (1838) reunited *Stachytarpheta*, *Bouchea* and *Melasantus* with *Verbena*. He also divided the family into three tribes: Lippieae, Lantaneae, and Aegiphileae, with *Stachytarpheta* and other related genera in the tribe Lippieae. This tribe was accepted for the genus by Meisner (1840) and Walpers (1845, 1847). In 1847, Schauer reclassified the Verbenaceae into three tribes: Verbeneae, Viticeae and Avicenniae, with *Stachytarpheta* in the tribe Verbeneae. He also split the genus into two sections: *Abena* and *Tarphostachys*, based chiefly on the thickness of their spikes, depressions in the rachis, shape of corolla, length of calyx and corolla-tube and the protrusion of style above the corolla-tube. Schauer (1847) further subdivided the section *Abena* into two subsections: *Lepturae* and *Pachyurae*, and section *Tarphostachys* into four subsections: *Longispicatae*, *Brevispicatae*, *Subspicatae* and *Capitatae*. These sections and subsections were adopted by Moldenke (1959, 1971). Bentham (1876) divided the Verbenaceae into eight tribes, with *Stachytarpheta* in the tribe Verbeneae. This tribe was accepted for the genus by C.B. Clarke (1885), Durand (1888), Bailey (1901, 1913), King & Gamble (1909), Ridley (1923), L  m  e (1943) and a few others.

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\*The present treatment of the genus *Stachytarpheta* is the eleventh in the series of taxonomic revisions in the family Verbenaceae in Australia. (See Munir, 1982, 1984a, 1984b, 1985, 1987a, 1987b, 1989, 1990a, 1990b, 1991).

In 1895, Briquet reclassified the Verbenaceae and upgraded the tribe Verbenaeae to a subfamily Verbenoideae. The latter consisted of six tribes with *Stachytarpheta* in the tribe Lantaneae. This classification was adopted by Dalla Torre & Harms (1904), H.J. Lam (1919), Junell (1934), Moldenke (1959, 1971), Melchior (1964), Lopez-Placios (1977) and Raj (1983). In the same treatment, Briquet (1895) divided the genus *Stachytarpheta* into two sections: *Abena* and *Melasanthus* (Sect. *Tarphostachys* Schauer), each characterised chiefly by the arrangement of flowers and bracts in a spike, angular or terete rachis, size of depressions in the rachis and presence or absence of scale-like bracts. He further subdivided the section *Melasanthus* into four subsections, previously proposed by Schauer (1847) for the section *Tarphostachys*. These sections and subsections were adopted by Dalla Torre & Harms (1904). The majority of botanists, however have not divided this genus into sections or subsections, but have retained it in the Verbenaceae without reference to any subfamily or a tribe. In view of the sectional division of the genus by Schauer (1847) and Briquet (1895), the majority of Australian species seem to belong to the section *Abena*. The study of the few Australian species, however, does not allow speculation on the supra- and infra-generic structure of the genus.

### Australian History of the Genus

The first Australian record of naturalised *Stachytarpheta* was made by Bailey (1883, 1890) who listed *S. jamaicensis* from Queensland. Subsequently, Bailey (1901, 1913) published another two naturalised species *S. dichotoma* and *S. mutabilis* from Queensland but without any mention of *S. jamaicensis*. In 1917, Ewart & Davies for the first time recorded *S. dichotoma* from Northern Territory. The first comprehensive list of naturalised *Stachytarpheta* taxa in Australia was published by Moldenke (1959) who listed one hybrid and three species namely *S. xadulterina*, *S. jamaicensis*, *S. mutabilis* and *S. urticaefolia*. Burbidge (1963) mentioned 3-4 naturalised species from the north-east and south-east of Queensland. In 1971, Moldenke added *S. australis* to his previous records. In 1972, Chippendale reported two species from the Northern Territory: *S. dichotoma* and *S. jamaicensis*. Subsequently, Moldenke (1980) maintained the number of taxa in Australia to five but replaced *S. australis* with *S. dichotoma*. Stanley (1986) recorded three species from south-eastern Queensland: *S. cayennensis*, *S. jamaicensis* and *S. mutabilis*. Recently, Dunlop (1987) listed four species from Northern Territory: *S. cayennensis*, *S. jamaicensis*, *S. dichotoma* and *S. urticaefolia*. In the present revision of *Stachytarpheta* in Australia, the following four species and two hybrids are recognised: *S. australis*, *S. cayennensis*, *S. jamaicensis*, *S. mutabilis*, *S. xadulterina* and *S. xtrumeni*.

### STACHYTARPHETA M. Vahl, nom. cons.

*Stachytarpheta* M. Vahl, Enum. Pl. 1 (1804) 205; Pers., Syn. Pl. 2 (1807) 139, no. 1228; Willd., Enum. Pl. Hort. Berol. (1809) 30; Kunth, Nov. Gen. 2 (1817) 279; Roemer & Schultes, Syst. Veg. 1 (1817) 57; Link, Enum. Hort. Berol. 1 (1821) 18 — "Stachytarpha"; Sprengel, Syst. Veg. 1 (1825) 53; Reichb., Cons. Reg. Veg. part 1 (1828) 117, no. 2896; Dumort., Anal. Fam. Pl. (1829) 22; Bartling, Ord. Nat. Pl. (1830) 180; Endl., Gen. Pl. 1 (1838) 633, no. 3685a; D. Dietr., Synop. Pl. Vol. 1 (1839) 32, 99; Meissner, Pl. Vasc. Gen. Vol. 1, "Tab. Diag." (1840) 290; Vol. 2, "Commentarius" (1840) 198; Walp., Repert. Bot. Syst. 4 (1845) 4; Schauer in A. DC., Prod. 11 (1847) 561 — "Stachytarpha"; Walp., Repert. Bot. Syst. 6 (1847) 686; Miq., Fl. Ind. Bat. 2 (1858) 907 — "Stachytarpha"; Thwaites, Enum. Pl. Zeyl. (1861) 241 — "Stachytarpha"; Pfeiffer, Nom. Bot. 2 (1874) 1256; Benth. in Benth & Hook.f., Gen. Pl. 2 (1876) 1145; Bailey, Synop. Qld Fl. (1883) 376; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a (1895) 154; Bailey, Qld Fl. 4 (1901) 1172; Dalla Torre & Harms, Gen. Siphon. (1904) 430, no. 7151; King & Gamble, Mat. Fl. Malay. Penins. 4 (1909) 1008; Bailey, Comp. Cat. Qld. Pl. (1913) 382; H.J. Lam, Verbenac. Malay. Archip. (1919) 19; Ridley, Fl. Mal. Penins. 2 (1923) 613; Danser, Ann. Jard. Bot. Buitenzorg. 40

(1929) 1-43; F. Went, Ann. Jard. Bot. Buitenzorg. 43 (1933) 1-24; Fedde, Just's Bot. Jahresber 57 (1938) 890 — "*Stachytarpheta*"; Mold., Lilloa 4 (1939) 298; Mold. in Pulle (ed.), Fl. Suriname 4 (1940) 271; Publ. Carnegie Inst. Wash. No. 522 (1940) 177; Lemée, Dict. Descrip. Syn. Gen. Pl. Phan. 6 (1935) 248; ib. 8b (1943) 653; Steyerl., Bol. Soc. Venez. Ci. Nat. 10 (1946) 279 — "*Stachytarphaeta*"; Brenan, Kew Bull. No. 2 (1950) 223; Mold. in Humbert, Fl. Madagascar (1956) 20; Mold., Résumé Verbenac. etc. (1959) 227, 277, 320, 344, 353, 356, 379; Angely, Liv. Gen. Bot. Bras. (1960) 35, 55 — "*Stachytarpheta*"; J.F. Macbr., Fl. Peru (1960) 657; N. Burb., Dic. Aust. pl. Gen. (1963) 278; Backer & Bakh.f., Fl. Java 2 (1965) 597; Gooding et al., Fl. Barbados (1965) 363; T. Cooke, Fl. Pres. Bombay 2, repr. edn (1967) 500; D. Gibson in Stanley & L.O. Williams, Fl. Guatemala (1970) 224; Mold., Fifth Summary Verbenac. etc. 1 & 2 (1971) 377, 473, 571, 620, 626, 640, 647, 708; Adams, Fl. Pl. Jamaica (1972) 631; Mold., Ann. Missouri Bot. Gard. 60 (1973) 73; Lopez-Pal., Fl. Venezuela Verbenac. (1977) 512; Mold. in Dassan. & Fosb. (eds), Fl. Ceylon 4 (1983) 246; Ros Fernandes, Bol. Soc. Sér. 2, 57 (1984) 87-111; Stanley in Stanley & Ross, Fl. S.E. Qld 2 (1986) 366; Jansen-Jacobs, Fl. Guianas, part 4 (1988) 65; R. Howard, Fl. Lesser Antilles, part 3 (1989) 238; Wagner et al., Man. Fl. Pl. Hawaii 2 (1990) 1321.

*Type species*: *S. jamaicensis* (L.)M. Vahl, Enum. Pl. 1 (1804) 206, based on *Verbena jamaicensis* L., Sp. Pl. edn 1, 1 (1753) 19., "*typ. cons.*".

*Sherardia* Adans., Fam. Pl. 2 (1763) 198, not *Sherardia* L., 1753, nor Dill. 1754, nor Miller 1759, nor Boehmer 1760.

*Type species*: non designatus.

*Valerianoides* Medikus, Phil. Bot. 1 (1789) 177, *nom. rejic.*; Britton & Wilson, Sci. Surv. Puerto Rico & Virgin Isl. 6 (1925) 143; Kuntze, Rev. Gen. Pl. 1 (1891) 509 — "*Valerianodes*"; Britton, Fl. Bermuda (1918) 313 — "*Valerianodes*".

*Type species*: *Verbena jamaicensis* L.

*Avena* Necker, Elem. Bot. 1 (1790) 296; Hitchc., Ann. Rep. Missouri Bot. Gard. 4 (1893) 117.

*Type species*: non designatus.

*Vermicularia* Moench, Meth. Suppl. (1802) 150, *nom. rejic.*, not *Vermicularia* Tode 1790.

*Type species*: *V. decurrens* Moench, loc. cit. & *V. lancifolia* Moench, loc. cit.

*Cymburus* Salisb., Parad. Lond. Pl. (1806) 49.

*Type species*: *C. mutabilis* (Jacq.)Salisb. loc. cit., based on *Verbena mutabilis* Jacq., Collectanea 2 (1789) 334.

*Melasantus* Pohl, Pl. Bras. Ic. 1 (1827) 75, t. 60.

*Type species*: non designatus.

*Tarpheta* Raf., Fl. Tellur. 2 (1837) 103.

*Type species*: non designatus.

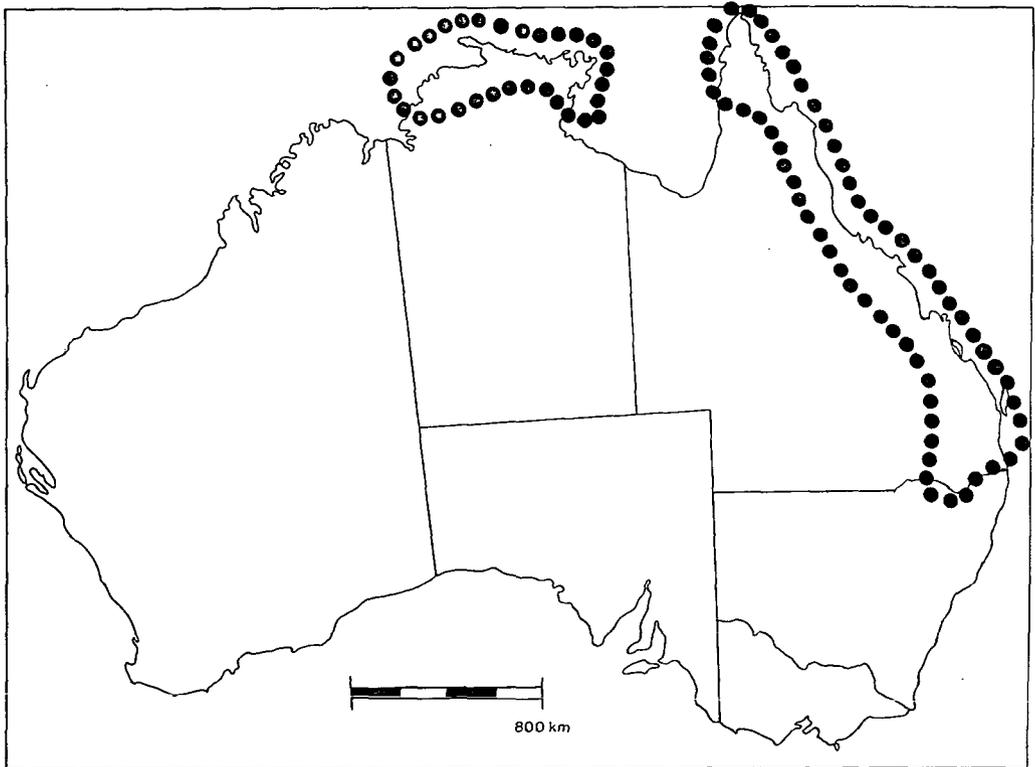
Herbs or low shrubs, glabrous or variously pubescent to tomentose with simple hairs. *Stem* and branches almost terete or tetragonal. *Leaves* simple, mostly decussate-opposite, petiolate or sometimes subsessile, the lamina dentate to serrate, somewhat rugose. *Inflorescence* terminal, spicate, pedunculate; spikes mostly elongate, indeterminate, (sometimes short in non-Australian species), densely or loosely flowered. *Flowers* bracteate, sessile or semi-immersed in depressions or furrows in the rachis of the spike, zygomorphic, bisexual, hypogynous, each flower solitary in the axil of a bract; bracts small, sessile. *Calyx* persistent, tubular, 5-lobed or 5-dentate at the apex, each ridged, the teeth equal or unequal, usually not accrescent. *Corolla* deciduous, tubular below, 5-lobed; tube cylindrical, straight or curved, slender throughout or broadened apically; lobes sub-equal, spreading, often orbicular, obtuse or retuse at the apex. *Stamens* 4, included, inserted above the middle of the corolla-tube, the anterior 2 fertile, with small filaments and unappendaged anthers, the posterior (or lateral) 2 sterile, reduced to small staminodes. *Ovary* bicarpellary, syncarpous, 2-locular, each with one parietal ovule; style elongate, filiform, with capitate

stigma. *Fruit* a schizocarp, oblong-linear, enclosed in fruiting-calyx, splitting at maturity into 2 hard mericarps each 1-seeded. *Seeds* linear, without endosperm.

*Number of species*: World  $\pm$  65 species and many infraspecific and hybrid taxa; Australia: 6 species, 2 of which are putative hybrids, introduced from tropical America but now naturalised in Australia.

#### *Derivation of name*

The generic name is derived from the Greek *stachys*, a spike; *tarpheios*, thick; referring to the thick flower spikes of these plants.



Map 1. Distribution of the genus *Stachytarpheta* Vahl in Australia

#### *Distribution (Map 1)*

The genus *Stachytarpheta* is widely distributed in tropical and subtropical America, with a few species (mostly naturalised) in tropical and subtropical Australia, Asia, Africa and Oceania.

In Australia six species have been introduced and are now naturalised in the coastal areas

of Queensland and Northern Territory. All of them are also known from Papua New Guinea and neighbouring Indonesian Islands. One species, *S. jamaicensis* (L.)M. Vahl, is the most widespread in the whole genus and has been recorded from both tropical and subtropical America and introduced in several countries of the world.

### Comments

The original spelling of the genus was *Stachytarpheta*. Link (1821) amended it to "*Stachytarpha*" and subsequently the same spelling was used by Schauer (1847) and a few others. This may be a technical improvement, but cannot be upheld under the Rules. In fact, the genus has been variously spelled by different botanists namely "*Stachytarpha*", "*Stachytarpenta*", "*Stachytarpetha*", "*Stachytarphaeta*", "*Stachytarfetta*", "*Stachytarphetha*" and "*Stachytarpheia*". None of these orthographic variants can supersede the validly published original spelling of this genus.

The year of publication for *Stachytarpheta* has been recorded by several botanists as "1805". According to Stafleu & Cowan (1986), however, the first volume of Vahl's *Enumeratio Plantarum*, where this genus originally appeared was published on 4th July 1804, and the second volume on 15th October 1805.

The type species of the genus was recorded by Péi (1932) and Moldenke (1940) as *S. angustifolia* (Miller)M. Vahl, which is based on *Verbena angustifolia* Miller. [*Gard. Dic.* edn 8 (1768) no. 15]. In the *Index Nominum Genericorum (Plantarum)* 1979, however, *S. jamaicensis* (L.)M. Vahl is given as the "typ. cons.", which is based on *Verbena jamaicensis* L. [*Sp. Pl.* edn 1, 1 (1753) 19]. The majority of botanists have accepted *S. jamaicensis* as the type of this genus because it is based on the oldest validly published basionym.

In Australia, all *Stachytarpheta* species are naturalised and most of them are cultivated as ornamental or hedge plants.

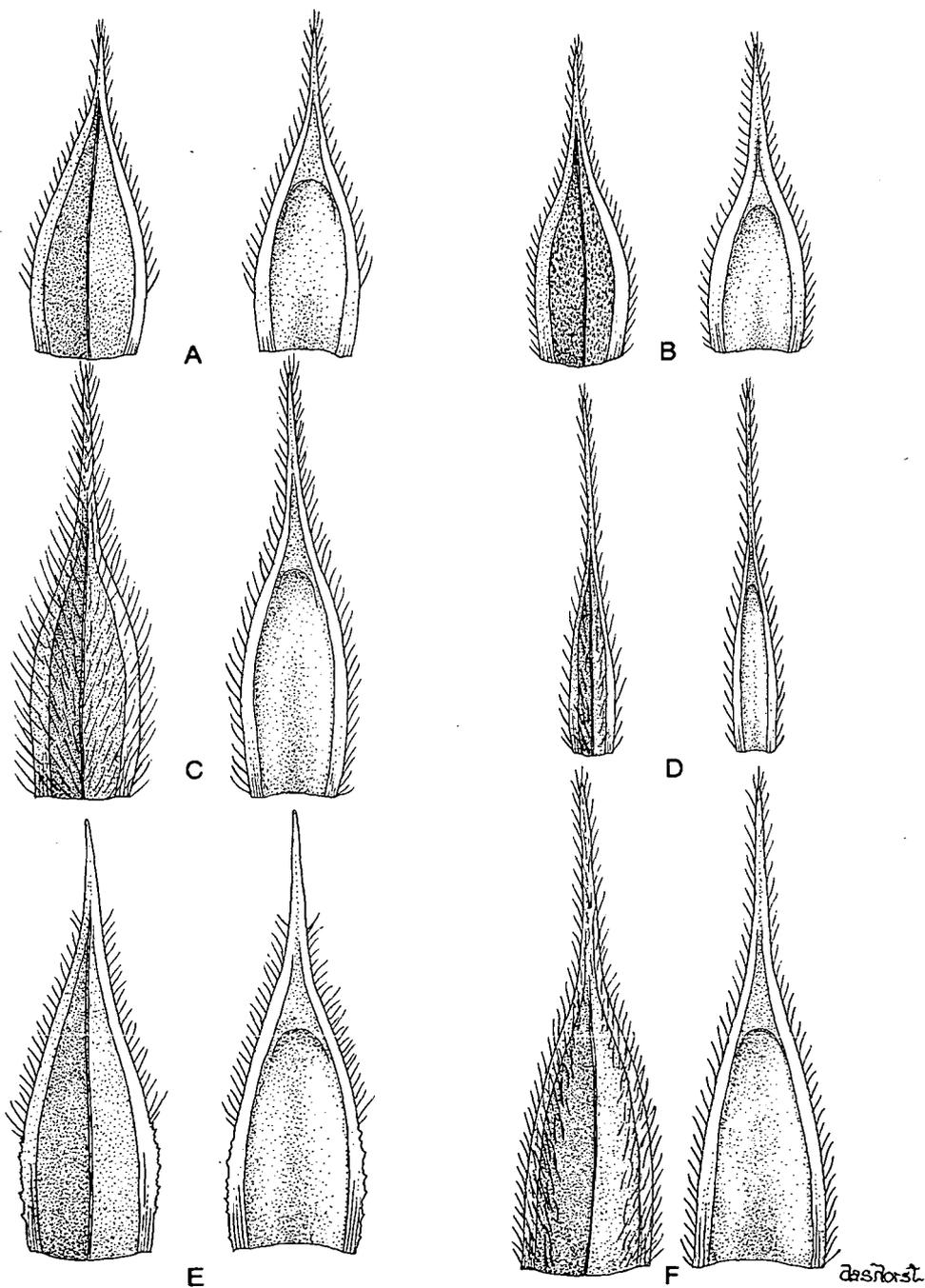
Moldenke (1959, 1971) strongly suggested (1971, p. 744) that the genus *Stachytarpheta* and other closely related genera "probably ought to be split into several genera each through the elevation in rank of present subgeneric groupings". In the same publication (p. 791) he again pointed out "that at least some of the present subgeneric groupings in *Premna*, *Stachytarpheta* ... ought to be raised to generic status".

Several infraspecific taxa have been described from outside Australia for the species treated in this paper. Since I have not been able to distinguish them clearly from the typical forms, infraspecific taxa were ignored for this Australian treatment of the genus.

According to Backer & Bakhuizen (1965), "only few flowers of a same spike are open simultaneously. They are ephemeral, expanding in the early morning, falling off in the afternoon of the same day. Moreover they are traumatochorous, that is, after a spike or a flower has been separated from the plant the unfaded corolla is shed within a few minutes. When collecting and identifying the plant, one should take notice of this fact. If a cut stem is placed in water in time new flowers will expand the following morning".

Cytological studies in the genus seems to have been carried out in only a few species. According to Fedorov (1974), the number of chromosomes known in the genus ranges from  $2n = 48$  in *S. cayennensis* to  $2n = 160$  in *S. indica*.

Where two or more species of this genus grow together hybrids often occur. In Australia, the following two hybrids have been found in the wild: *S. xadulterina* Urb. & E. Ekman (*S. jamaicensis* x *S. mutabilis*) and *S. xtrimenii* Rich. (*S. cayennensis* x *S. mutabilis*).



**Fig. 1.** Range of flower bracts showing respectively abaxial and adaxial views: A, *S. jamaicensis* (L.)M. Vahl, *S.T. Blake* 23537: L; B, *S. cayennensis* (Rich.)M. Vahl, *S.L. Everist* 5081: BRI; C, *S. mutabilis* (Jacq.)M. Vahl, *J.R. Clarkson* 7262: AD; D, *S. australis* Mold., *S. Pickering* 2: DNA; E, *S. xadulterina* Urb. & E. Ekman, *N.L. Britton* 3241: NY, holotype; F, *S. xtrimenii* Rech., *L.J. Brass* 33493: BRI.

The term peduncle used in this paper is for the naked basal part of the inflorescence (spike) between the upper-most pair of leaves and the lower-most flowers and bracts on the rachis. The calyx of *Stachytarpheta* is shortly bilobed with two larger and one smaller central tooth above and two larger ones below. Sometimes, the small dorsal tooth opposite to the axis is minute or absent.

In almost all Australian species, the hairs, when present, are mostly septate.

### Affinities

*Stachytarpheta* is closely related to *Aloysia* Ortega ex Pers. and *Bouchea* Cham. in its leaves being simple; inflorescence spicate; calyx much longer than broad, easily visible; ovary bilocular and fruit comprising 2 mericarps. Nevertheless, *Stachytarpheta* may easily be distinguished by its perfect stamens being 2, with a posterior pair of staminodes; axis of spike (i.e. rachis) with furrows or depressions and anther-loculi widely divergent in the lower half.

Palynological investigation by Raj (1983) showed that the pollen grains of *Stachytarpheta* and *Bouchea* resemble each other very closely. Both are 3-colpate with an exine sculpture made up of verrucae (warts), which distinguishes them from the remaining genera of the family.

### Key to the species

- 1a. Lower leaf surface, rachis and calyx pubescent or densely tomentose. Mature rachis tends to be glabrescent in *S. xadulterina* and *S. xtrimenii*..... 3
- b. Lower leaf surface, rachis and calyx glabrous or leaf-blades glabrous but sparsely strigose on veins below ..... 2
- 2a. Rachis stout and firm, (2-) 3-5 (-7) mm diam.; furrows from the immersed flowers narrower than the rachis; leaves somewhat fleshy; bracts 4-8 × 1.5-2.5 mm ..... 1. *S. jamaicensis*
- b. Rachis slender and erect to flexuose, 1-3 mm diam.; furrows from the immersed flowers nearly as wide as the rachis; leaves membranous; bracts 3-5 × 1-2 mm ..... 2. *S. cayennensis*
- 3a. Lower leaf surface densely tomentose; spikes 6-8 (-10) mm diam. without open flowers, tomentose; bracts 8-12 × 2-3 mm; corolla red or bright rose-pink, the limbs exceeding 12 mm across ... 3. *S. mutabilis*
- b. Lower leaf surface pubescent or strigose; spikes 2-5 (-6) mm diam. without open flowers, pubescent or glabrescent; bracts 4-8 (-9) × 0.5-2 mm; corolla blue, purplish-blue or violet, the limbs not exceeding 10 mm across ..... 4
- 4a. Bracts subulate to linear-lanceolate, pubescent abaxially, 4-5 × 0.5-1 mm; calyx 4-6 mm long; corolla pale blue or whitish-mauve..... 4. *S. australis*
- b. Bracts oblong-ovate, glabrous or sparsely pubescent abaxially, 7-9 × 2 mm; calyx 8-10 mm long; corolla purplish-blue, pinkish-lilac or violet-purple..... 5
- 5a. Spikes c. 10 mm diam. after anthesis; rachis 3-4.5 mm diam.; bracts glabrous except ciliate margin; calyx equally 4-toothed..... 5. *S. xadulterina*
- b. Spikes less than 10 mm diam. after anthesis; rachis 2.5-3 (-3.5) mm diam.; bracts sparsely pubescent to glabrescent abaxially; calyx unequally 4-toothed..... 6. *S. xtrimenii*

1. *Stachytarpheta jamaicensis* (L.)M. Vahl, Enum. Pl. 1 (1804) 206; Sims, Curtis's Bot. Mag. 44 (1817) t. 1860; Walp., Rep. Bot. Syst. 4 (1845) 4; Schauer in DC., Prod. 11 (1847) 564; Miq., Fl. Ind. Bat. 2 (1858) 907; Bailey, Synop. Qld Fl. (1883) 376; Bailey, Cat. Indig.

& Nat. Pl. Qld (1890) 35; Briq. in Engl. & Prantl, Nat. Pflanzenfam. 4, 3a (1895) 154; King & Gamble, Mat. Fl. Malay. Pen. 4 (1909) 1008; H.J. Lam, Verbenac. Malay. Archip. (1919) 22, p.p., excl. syn. *S. indica* (L.)M. Vahl; H.J. Lam in H.J. Lam & Bakh., Bull. Jard. Bot. Buitenzorg Ser. 3, 2 (1921) 6, p.p., excl. syn. var. *indica* H.J. Lam; Bakh. & H.J. Lam, Bull. Jard. Bot. Buitenzorg Ser. 3, 4 (1922) 283; Merr., Enum. Philip. Fl. Pl. 3 (1923) 381, p.p., excl. syn. *S. indica* (L.)M. Vahl & *Verbena indica* L.; Ridley, Fl. Mal. Penin. 2 (1923) 613; Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 7-9; Péi, Verbenac. China (1932) 11, p.p., excl. syn. *S. indica* (L.)M. Vahl; F. Went, Ann. Jard. Bot. Buitenzorg 43 (1933) 2-3, fig. 2 & 3; Fletcher, Kew Bull. Misc. Inform. No. 10 (1938) 404, 411, p.p., excl. syn. *S. indica* (L.)M. Vahl; Mold., Lilloa 4 (1939) 300; Publ. Carnegie Inst. Wash. No. 522 (1940) 179; in Pulle (ed.), Fl. Suriname 4 (1940) 276; Brenan, Kew Bull. 1950 (1951) 223-226; Mold., Fl. Madag. Fam. 174 (1956) 22, fig. III, 1-2; Leon & Alain, Fl. Cuba 4 (1957) 296, fig. 126B; Mold., Résumé Verbenac. etc. (1959) 210, 469; Backer & Bakh.f., Fl. Java 2 (1965) 598; Gooding et al., Fl. Barbados (1965) 363; D. Gibson in Stanley & L.O. Williams (eds), Fl. Guatemala (1970) 227; Mold., Fifth Summary Verbenac. etc. 1 & 2 (1971) 348, 908; Adams, Fl. Pl. Jamaica (1972) 632; Mold., Ann. Missouri Bot. Gard. 60 (1973) 74; H. St. John, List & Summary Fl. Pl. Hawaii Isl. (1973) 291; López-Pal., Revista Fac. Farm. Univ. Los Andes Merida No. 15 (1974) 82; Mold., Phytologia 28 (1974) 433; López-Pal., Fl. Venezuela Verbenac. (1977) 531; Mold., Sixth Summary Verbenac. etc. (1980) 327, 329, 330, 332, 339, 340-343, 575; in Dassan. & Fosb., Fl. Ceylon 4 (1983) 253; Raj, Rev. Palaeobot. Palynol. 39 (1983) 352, 365, 398; Ros. Fernandes, Bol. Soc. Brot. Ser. 2, 57 (1984) 100; Stanley in Stanley & Ross, Fl. S.E. Qld 2 (1986) 366, fig. 51G; Dunlop, Checklist Vasc. Pl. N.T. (1987) 80; Jansen-Jacobs in Görts-Van Rijn (ed.), Fl. Guianas 4 (1988) 69, fig. 20; Howard, Fl. Lesser Antilles 6, part 3 (1989) 239, fig. 97; Wagner et al., Man. Fl. Pl. Hawaii 2 (1990) 1322.

**Lectotype:** *P. Browne s.n.*, Jamaica in the herbarium of Linnaeus (S, microfiche no. 7.13 lectotype!; S, fiche 7.9 & 7.11, LINN 35.2 —isolectotypes!. Lectotypification was made by Ros. Fernandes in Bol. Soc. Brot. Sér. 2, 57 (1984) 96-98.

*Verbena jamaicensis* L., Sp. Pl. edn 1 (1753) 19 **basionym**; Jacq., Observ. 4 (1771) 6, t. 85; Willd., Sp. Pl. edn 4, 1 (1797) 115.

**Type:** As for *Stachytarpheta jamaicensis* (L.)M. Vahl.

*Abena jamaicensis* (L.)A. Hitchc., Ann. Rep. Missouri Bot. Gard. 4 (1893) 117.

**Type:** As for *Stachytarpheta jamaicensis* (L.)M. Vahl.

*Stachytarpheta bogoriensis* Zoll. & Moritzi in Moritzi, Syst. Verz. Zoll. (1845) 52.

**Type:** "In glareosis et dumitis prope Bogor (Buitenzorg) (P, n.v.)."

*S. friedrichsthalii* Hayek, Feddes Repert. Sp. Nov. 3 (1907) 273.

**Types:** *Friedrichsthal 466*, St Juan de Nicaragua, Central America (GB, syntype, n.v.); *Fendler 219*, Charges, Isthmus of Panama, Central America (GB, syntype, n.v.).

*S. indica* sensu Schauer in DC., Prodr. 11 (1847) 564, p.p.; Miq, Fl. Ind. Bat. 2 (1856) 907, p.p.; C.B. Clarke in Hook.f., Fl. Br. Ind. 4 (1885) 564, p.p. quoad syn. *S. jamaicensis* (L.)M. Vahl, *S. villosa* Turcz. and *Verbena jamaicensis* L.; Baker in Dyer, Fl. Trop. Afr. 5 (1900) 284, p.p. excl. spec. *Scott Elliot 4162*; Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 5; Brenan, Kew Bull. 1950 (1951) 225, p.p.; Hutch. & Dalziel in Hepper (ed.), Fl. W. Trop. Afr. edn 2, 2 (1963) 434, p.p. quoad spec. *Mann 89*, *Scott Elliot 3833*, *T. Vogel 30* and fig. 305M to R.

*S. indica* var. *jamaicensis* (L.)Razi, J. Mysore Univ. 7 (1946) 63.

**Type:** As for *Stachytarpheta jamaicensis* (L.)M. Vahl.

*S. jamaicensis* f. *albiflora* Standley, Field Mus. Bot. 4 (1929) 320.

**Type:** *P.C. Standley 53814*, in sandy thicket along the beach, Tela, Dept. Atlantida, Honduras, 28.xii.1927 (F 583934, n.v.).

*S. marginata* M. Vahl, Enum. Pl. 1 (1804) 207; Pers., Synop. Pl. 2 (1806) 139.

**Type:** *Rohr s.n.*, India Occidentali (C, n.v.).

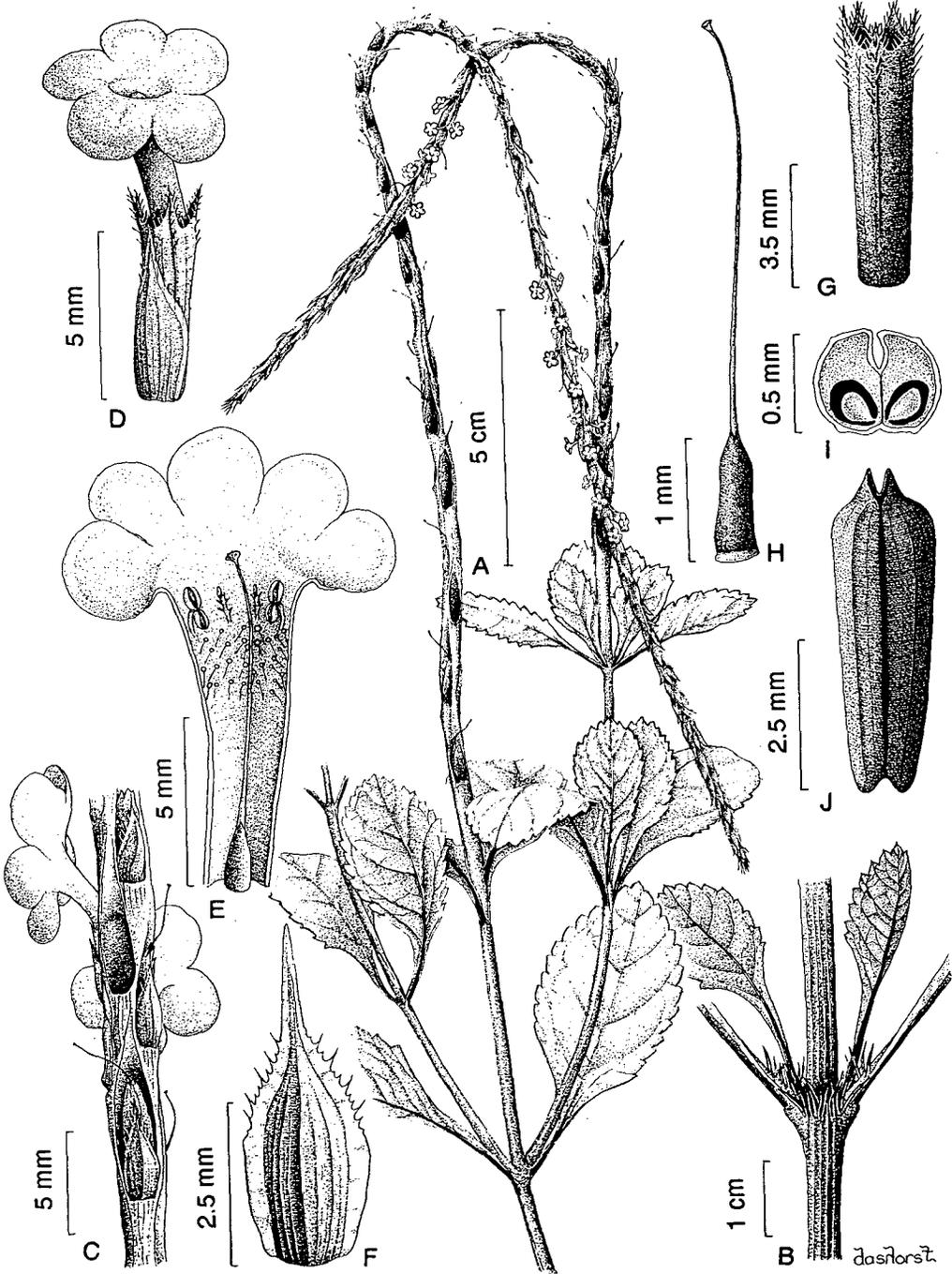


Fig. 2. *Stachytarpheta jamaicensis* (L.) M. Vahl (A-J, I.R. Telford 9959: CBG). A, habit sketch of a flowering branch; B, hairy stem node; C, enlarged portion of rachis showing furrows, bracts and flowers; D, flower with bract; E, cut open flower showing androecium, gynoecium and hairy corolla-throat; F, flower-bract; G, calyx; H, gynoecium; I, transverse section of ovary; J, fruit.

*S. pilosiuscula* Kunth, Nov. Gen. & Sp. Pl. 2 (1817) 279.

Type: "Crescit in ripa Orinoci juxta urbem Angustora" (P, n.v.).

*S. surinamensis* Miq. ex Pulle, Enum. Vasc. Pl. Surinam (1906) 402.

Type: ?U, n.v.

*S. villosa*, Turcz., Bull. Soc. Nat. Mosc. 36 (1863) 197.

Type: Porrotet 407, Pondichery, India (KW, n.v.).

*Valerianodes jamaicense* (L.)Kuntze, Rev. Gen. Pl. 2 (1891) 509; Britton, Fl. Bermuda, repr. edn (1965) 313, fig. 334; Britton & Millsp., Bahama Fl. (1920) 366; Britton & P. Wilson, Sci. Surv. Puerto Rico & Virgin Isls 6 (1925) 144.

Type: As for *Stachytarpheta jamaicensis* (L.)M. Vahl.

*V. jamaicense* var. *indicum* (L.)Kuntze f. *glabrum* Kuntze, Rev. Gen. Pl. 2 (1891) 510.

Type: Trinidad, Puerto Rico (NY, n.v.).

*V. jamaicense* var. *spathulatum* Kuntze, Rev. Gen. Pl. 2 (1891) 510.

Type: Port Lemon, Costa Rica (NY, n.v.).

*Vermicularia decurrens* Moench, Suppl. Meth. Pl. (1802) 150.

Type: Unknown. "No longer extant" (Stafleu & Cowan, 1981).

*Zapania jamaicensis* (L.)Lam., Tab. Encycl. Méth. Bot. 1 (1791) 59; J. St. Hill, Expos. Fam. 1 (1805) 250.

Type: As for *Stachytarpheta jamaicensis* (L.)M. Vahl.

### Description (Fig. 1A & 2)

Low sprawling herb or small shrub, (20-) 50-120 (-200) cm tall, c. 1 m diameter, often purplish throughout. *Stem* dichotomously branched, terete or obscurely tetragonal, usually glabrous except for the lanuginous-pilose nodes, often purplish or yellowish-brown. *Leaves* opposite, subsessile to shortly petiolate, green; lamina obovate to oblong-elliptic, (20-) 30-80 (-100) mm long, (10-) 20-45 (-50) mm wide, coarsely serrate-dentate, somewhat obtuse at the apex, more or less decurrent or attenuate into the petiole, often bluish, greyish-green or dark green above, paler below, somewhat fleshy or succulent when fresh, membranous-chartaceous or subcoriaceous in drying, glabrous or sometimes sparsely hairy on the veins below; petiole 5-20 (-30) mm long, glabrous. *Spikes* terete, stout, often flexuous, (15-) 20-45 (-50) cm long; rachis thick, glabrous, (2-) 3-5 (-7) mm diam., the furrows of the half-immersed flowers much narrower than the mature rachis; peduncle short, glabrous, (5-) 10-25 (-35) mm long. *Flowers* sessile, bracteate, at first erect, later immersed in the thickened rachis; bracts narrowly ovate-elliptic or oblong-lanceolate, almost as long as the calyx, 4-6 (-8) mm long, 1.5-2.5 mm wide at base, glabrous, striate, scabrous, with scarious and obscurely ciliate margins, setaceous-acuminate at apex. *Calyx* completely embedded in rachis furrows, somewhat compressed, 5-7 mm long, 1.5-2 mm wide, glabrous except some short pubescence near the apex, the rim bilobed with 4 equal teeth and 1 small tooth, the teeth triangular-ovate. *Corolla* pale mauve-blue, violet or purple, hypocrateriform, glabrous outside, with sparsely gland-tipped pilose hairs inside the upper half of the tube, 2-lipped, the upper-lip 2-lobed, the lower 3-lobed; lobes subequal, rounded, 1-3 mm long, 2-3 (-5) mm wide; tube cylindrical, slightly curved, 7-11 mm long, c. 1 mm diam. *Stamens* inserted in corolla-throat, included; filaments puberulous, c. 1 mm long; anthers pale-yellow, 0.5-1 mm long, lobes divergent; staminodes filiform, puberulous, c. 1 mm long. *Ovary* oblong, glabrous, 1-2 mm long, 0.5-1 mm diam.; style included, filiform, glabrous, 6-9 mm long; stigma capitate. *Fruit* oblong, glabrous, 3-5 (-7) mm long, 1.5-2 mm across, striate and pustulate, dark purplish- to blackish-brown.

*Representative specimens* (collections seen: Australian 90, non-Australian 30)

AUSTRALIA: QUEENSLAND *Batianoff 1303 & McDonald s.n.*, between Half Moon Creek and Earl Hill near Cairns, 6.x.1979 (BRI); *Blake 19901*, The Gap, 17.iii.1956 (BRI, K, L); *Blake 23537*, Cooktown, 24.x.1970 (BRI,

K, L); *Boylard & Gillieatt 375*, c. 22.52km N of Mossman, 15.xi.1969 (BRI, GH, L); *Clarkson 3823*, Thursday Island, 18.x.1981 (BRI, K, QRS); *Coveny 6920*, 9.2km SW Cannonvale on Proserpine-Shute Harbour road, 3.ix.1975 (BRI, K, L); *Everist 5121*, Port Douglas, 20.v.1952 (BRI, CANB, K, NY); *Everist s.n.*, near Townsville, 17.x.1958 (BRI, CANB, K, NY); *Flecker 8074*, Collins Av. Edge Hill, Cairns, 1.v.1943 (NSW 231737, NY 3711 p.p.); *Halliday 355*, 8km N Rockhampton, 5.iv.1975 (BRI, HO); *McDonald 3274*, Bulburin State Forest, just W of junction of Pine and Granite Creeks, 17.iv.1980 (BRI); *Michael 707*, Proserpine, undated (BM, GH); *Morton 708*, Weipa, 13.iii.1980 (MEL); *Phillips s.n.*, Bowen, 29.ix.1970 (BRI 141638, CBG 041757); *Powell SP30*, 1.6km W Bamaga, 30.vi.1973 (CBG); *Sharpe & Batianoff 3874*, Noosa National Park, Noosa, 50 m SW of Boiling Pot, 6.ix.1985 (BRI, MEL); *Skerman s.n.*, Iron Range Mission, -viii.1955 (JCT S-2429); *Smith 12457*, West of Bamaga, c. 2.7km SW of Cape York, 26.x.1965 (BRI, GH, L); *Stanley 507*, N Rockhampton, 18.ii.1980 (BRI); *Stanley 897*, Bundaberg, near city centre, 17.iii.1980 (BRI); *Stoddart 4084*, Bewick Island, 29.vii.1973 (BRI, K, L); *Wannan & Quinn UNSW 20357*, hilltop above southern end of Conway Beach, 11.x.1988 (BRI, UNSW); *White s.n.*, Enoggera, 17.iii.1912 (BRI 274754, NSW 231746); *Wollaston & Hindmarsh s.n.*, Horn Island, 17.xi.1966 (JCT).

NORTHERN TERRITORY: *Rankin 2515*, Sadgrove Creek area, Winnellie, Darwin, 4.vii.1980 (BRI, DNA); *Russell-Smith & Lucas 2883*, Groote Eylandt, Angurugu, 22.vii.1987 (DNA); *Specht 924*, Melville Bay, Arnhem Land Aboriginal Reserve, 17.viii.1948 (AD, BRI, CANB, DNA, GH, K, L, MEL, PERTH); *Weber 10125*, c. 1km from Stuart Highway on road to Batchelor at creek crossing, 11.vi.1988 (AD, BRI, CANB, CBG, DNA, MEL, NSW, PERTH).

COCOS (KEELING) ISLANDS: *George 16235*, West Island (Pulo Panjang), 28.iv.1983 (AD, CBG, K).

PAPUA NEW GUINEA: *Benjamin MB1A*, University Port Moresby, 26.x.1974 (L).

INDONESIA: *Hiepko & Schultze-Motel 502*, Jayapura, West Irian, 29.i.1976 (B, L); *Hallier 267*, Java, Buitenzorg, 8.iii.1893 (BO, L); *Binnemeyer 3251*, Sumatra, Mangani, 24.vi.1918 (BO, L).

NEW CALEDONIA: *Franc 2229*, Naumia, -1926 (L, P).

PHOENIX ISLANDS: *Fosberg & Stoddart 54895*, Canton Island, Central Pacific, 10.vi.1973 (L, US).

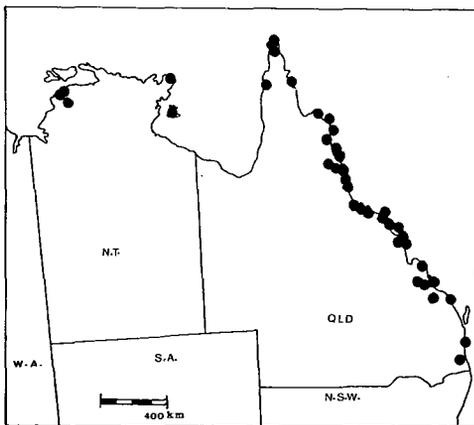
THAILAND: *Iwatsuki & Fukuoka T3487*, Payap, Chiangrai, interior of Ban Lang, 25.xii.1965 (BKF, KYO, L).

INDIA: *Bhargava 2837*, Long Island, Middle Andamans, 28.vii.1975 (L).

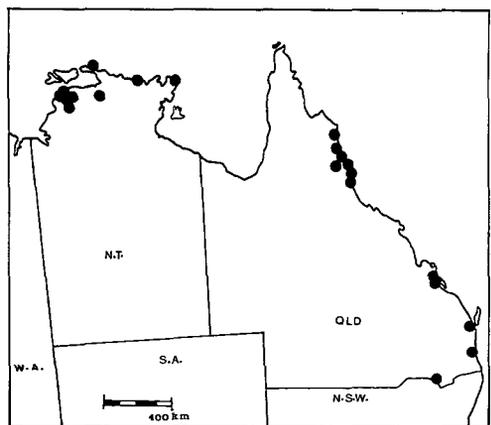
COSTA RICA: *Burger, Visconti & Gentry 10362*, Caribbean Coast between the Rio Bananito and Cahuita, Limon Province, 9-14.ii.1977 (AD, F).

CHINA: *Chow 78221*, Janfengling, Hainan, -1978 (AD, PE).

HAWAIIAN ISLANDS: *Herbst 6109*, Kapapa Islet, Oahu, 24.v.1978 (BISH).



Map 2. Distribution of *S. jamaicensis*



Map 3. Distribution of *S. cayennensis*

### *Distribution and ecology* (Map 2)

*S. jamaicensis* is widely distributed throughout tropical and subtropical America (including West Indies) and introduced in parts of tropical Africa, Madagascar, the islands of Indian Ocean, tropical Asia, Australia and Oceania. In Australia, it is naturalised and chiefly distributed in the coastal areas of Northern Territory and Queensland. In Northern Territory, most localities are from Darwin southwards to the township of Batchelor along the Stuart Highway. Outside this area, one known locality is near Melville Bay and another on Groote Eylandt in the Gulf of Carpentaria.

Distribution in Queensland is mainly along the east coast. It has most commonly been recorded from the areas between Cooktown and Bundaberg. The northern-most locality on mainland Queensland is around Bamaga near the tip of Cape York Peninsula and the southern-most in the Brisbane area. On the Gulf-side, it has been recorded from the coastal area near Weipa. Besides, this species has been recorded from several off-shore islands in the Torres Strait and along the Great Barrier Reef.

According to collectors' field notes, *S. jamaicensis* in Australia is a common weed of disturbed soil on roadside, vacant land and waste places, especially in pastures and sandy thickets near the sea. The main habitat is alluvial, gravel-loam and sandy soils of grassland and beach ridge plain.

### *Comments*

According to Moldenke (1983), this species "has been widely confused with *S. indica* (L.)M. Vahl and *S. urticaefolia* (Salisb.)Sims. It hybridises readily with the latter species when they grow in close proximity, as well as with other species in the genus." Accordingly Danser (1929) described the following hybrids between *S. jamaicensis* and other species of the genus: *S. xgracilis* Danser (*S. cayennensis* × *S. jamaicensis*), *S. xintercedens* Danser (*S. indica* × *S. jamaicensis*) and *S. xspeciosa* Danser (*S. mutabilis* × *S. jamaicensis*). Urban & Ekman (1929), however, proposed the name *S. xadulterina* Urb. & Ekman for the hybrid between *S. mutabilis* and *S. jamaicensis*. Wagner et al. (1990) hold the view that "*S. jamaicensis* hybridises with *S. urticifolia* [*S. xintercedens* Danser]" and "in general the hybrids resemble *S. jamaicensis* more closely than *S. urticifolia*, but the corollas are darker in colour than typical in *S. jamaicensis*, the habit is more erect, and the leaves are usually more ovate, darker green, and with more divergent teeth similar to *S. urticifolia*". The above mentioned colour character in leaves and corolla seems less reliable as it often tends to fade in dry specimens. Moreover, as indicated above, the hybrid *S. xintercedens* Danser was evolved by the hybridisation of *S. indica* and *S. jamaicensis*, not between *S. urticifolia* and *S. jamaicensis*.

The field note on *Clarkson 6397* reads: "Only a single flower opens per spike at any one time".

Moldenke (1940a, 1940b, 1973, 1983) and Wagner et al. (1990), described the leaves as "alternate or opposite". However, the leaves as on all Australian and overseas specimens examined are found to be opposite.

The attenuate lamina is decurrent and is often not demarcated from the petiole. Where the petiole is not distinct, the leaf is considered to be sessile. The petiole measurements, are only taken from those leaves where it is fairly distinct from the lamina.

Of all the specimens examined, the thickest ( $\pm 7$  mm diam.) spike is noticed in a collection by *Burger, Visconti & Gentry 10362* from Costa Rica. The peduncles of terminal

spikes are often almost double the length of lateral ones.

According to Moldenke (1983), "the juice of the leaves, roots, or the entire plant is used in many countries as a tonic, emetic, expectorant, ... stimulant, ... purgative ... and cooling agent. It is used locally in various parts of its range in the treatment of headaches, earaches, malaria, tertian fever, yellow fever, ... syphilis, jaundice ... and wounds caused by blows, liver trouble ... intestinal worms, and nervous pains. It is widely used in the treatment of eye troubles such as cataracts and of sores in children's ears and the leaves in the treatment of heart troubles and as an adulterant in tea. In Java it is fed to horses and cattle as fodder. In Indonesia the stem-tips are eaten as a flavouring. ... In Malaya a decoction of the leaves is employed against ulcers in the nose and as an antiperiodic in cases of malaria. In Cuba the juice is used as a bath in treating skin diseases ... In Jamaica it is used to treat stomach-ache ... and ulcers ... In fact, writers assert that in Jamaica "It is very much in repute among the Indian and negro doctors for the cure of most diseases"."

Among its 100 or more popular names in various parts of the world are: "Blue Porterweed", "Blue snakeweed", "Jamaica vervain", "Verbena azul", "Jamaica false vervain", "Verbena manza", "Bastard-Vervain" and "Vervain".

### Affinity

Amongst Australian *Stachytarpheta* species, *S. jamaicensis* seems closely related to *S. cayennensis* in its stems, leaves and inflorescence being glabrous. For differences and other similarities see "Key to the species" and "affinities" under the latter.

2. ***Stachytarpheta cayennensis*** (Rich.)M. Vahl, Enum. Pl. 1 (1804) 208 — "*S. cajanensis*"; E. Steudel, Nomencl. Bot. 2 (1841) 629 - "*S. cajanensis*"; Walp., Rep. Bot. Syst. 4 (1845) 5 - "*S. cajanensis*"; Schauer in A.D.C., Prod. 11 (1847) 562; Briq. in Engler & Prantl, Pflanzenfam. 4, 3a (1895) 154; Hallier f., Meded. 'sRijks Herb. 37 (1918) 20; C. White, Qld Agric. J. N.Ser. 16 (1921) 195; Mold., Lilloa 4 (1939) 299; Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 2; F. Went, Ann. Jard. Bot. Buitenzorg 43 (1933) 1-2, fig. 1; Benth., Ann. Nat. Hist. 2 (1839) 447; Mold., Fl. Suriname 4 (1940) 274; Mold., Publ. Carnegie Inst. Wash. No. 522 (1940) 180; A.D.J. Meeuse, Blumea 5 (1942) 69; Brennan, Kew Bull. 1950 (1951) 223-225; Mold., Résumé Verbenac. etc. (1959) 468; J.F. Macbr., Fl. Peru 13 (1960) 658; Hepper, Fl. W. Trop. Afr. 2 (1963) 434, fig. 305 G-K; Backer & Bakf.f., Fl. Java 2 (1965) 598; Gooding et al., Fl. Barbados (1965) 363 p.p. excl. descr.; D.N. Gibson in Standley & L.O. Williams, Fl. Guatemala (1970) 225; Mold., Fifth Summary Verbenac. etc. 1 & 2 (1971) 907; Adams, Fl. Pl. Jamaica (1972) 632; H. St. John, List & Summary Fl. Pl. Hawaii Isl. (1973) 291; Mold., Ann. Missouri Bot. Gard. 60 (1973) 77; Al. Fed., Chromosome number Fl. Pl. (1974) 716; Mold., Phytologia 28 (1974) 462; Lopez-Pal., Fl. Venezuela Verbenac. (1977) 520, fig. 123; Mold., Fifth Summary Verbenac. etc. (1980) 341; Mold., Phytologia 50 (1982) 264; Stanley in Stanley & Ross, Fl. S.E. Qld. 2 (1986) 366; Dunlop, Checklist Vasc. Pl. N. Terr. (1987) 80; Jansen-Jacobs in A.R.A. Gorts-van Rijn, Fl. Guianas 4 (1988) 67, fig. 19; Howard, Fl. Lesser Antilles Part 3 (1989) 239.

**Lectotype:** *M. Leblond* 356, Cayenne, French Guyana, 1792 (G, lectotype designated here; K, P, n.v. isolectotypes).

*Verbena cayennensis* Rich., Actes Soc. Hist. Nat. Paris 1 (1792) 105, **basionym**.  
Type: As for *Stachytarpheta cayennensis* (Rich.)M. Vahl.

*S. dichotoma* (Ruíz Lopez & Pavón)M. Vahl, Enum. Pl. 1 (1804) 207; Steudel, Nomencl. Bot. 2 (1841) 629; W.F. Hillebrand, Fl. Hawaiian Isl. (1888) 341; Briq. in Engl. & Prantl, Pflanzenfam. 4, 3a (1895) 154; Bailey, Qld Fl. 4 (1901) 1172; Compr. Cat. Old Pl. (1913) 382; Ewart & Davies, Fl. N.Terr. (1917) 236; H.J. Lam, Verbenac. Malay. Archip. (1919) 21; Bull. Jard. Bot. Buitenzorg, Sér. III, 3 (1921) 6; C. White, Qld Agric. J. 16 (1921) 194,

t. 38; Mold., Fl. Suriname 4 (1940) 272 excl. descr.; Webb, Bull. Council Sci. Industr. Res. No. 232 (1948) 169; Chippendale, Proc. Linn. Soc. N.S.W. 96 (1972) 256; Mold., Phytologia 28 (1974) 462; Al. Fed., Chromosome Numbers Fl. Pl. (1974) 714; Lopez-Pal., Fl. Venezuela Verbenac. (1977) 528, p.p. excl. syn. *S. australis* Mold.; Mold., Sixth Summary Verbenae etc. (1980) 317, 327, 332, 339, 341, 342; Mold. in Dassan. & Fosb., Fl. Ceylon 4 (1983) 261; Dunlop, Checklist Vasc. Pl. N.Terr. (1987) 80; Wagner et al., Man. Fl. Pl. Hawaii 2 (1990) 1321 excl. descr.

Type: *Dombey s.n.*, Cochero, Peru, undated (P, lectotype! designated here, MA 5 spec., isolectotypes!).

*Verbena dichotoma* Ruiz Lopez & Pavón, Fl. Peruv. Chil. 1 (1798) 23, t. 34.

Type: As for *Stachytarpheta dichotoma* (Ruiz Lopez & Pavón)M. Vahl.

*S. urticaefolia* (Salisb.)Sims, Bot. Mag. 43 (1816) t. 1848 - "*urticifolia*"; Mold., Résumé, Verbenac. etc. (1959) 199, 202, 204-207, 210, 212; Santapau, Rec. Bot. Surv. Ind. 16 (1960) 188; Fifth Summary Verbenac. etc. 1 (1971) 327, 331, 333, 334, 337, 340-342, 344, 348, 351-353, 473; Sixth Summary Verbenac. etc. Phyt. Mem. II (1980) 329, 330-334, 339, 341-344; in Dassan & Fosb., Fl. Ceylon 4 (1983) 257; Dunlop, Checklist Vasc. Pl. N.Terr. (1987) 80; Howard, Fl. Lesser Antilles 6 (1989) 240; Wagner et al., Man. Fl. Pl. Hawaii 2 (1990) 1322, t. 194.

Type: *Isaac Swainson s.n.*, collection from cultivated material near London in or before 1806 (BM, n.v.).

*Cymburus urticaefolius* Salisb., Parad. Lond. (1806) t. 53.

Type: As for *S. urticaefolia* (Salisb.)Sims.

*S. hirta* Kunth, Nov. Gen. & Sp. 2 (1817) 280; Walp., Repert. Bot. Syst. 4 (1845) 5.

Type: "Crescit in collibus aridis Regni Novo-Granatensis prope Olleros et Sondorillo, alt. 800-1000 hex", undated (?P, n.v.).

*S. veronicaefolia* Cham., Linnaea 7 (1832) 246; Walp., Repert. Bot. Syst. 4 (1845) 8; Steudel, Nom. Bot. 2 (1841) 629.

Type: E. Brasilia misit Sellowius, (?LE, n.v.).

*S. guatemalensis* Mold., Publ. Carnegie Inst. Wash. No. 522 (1940) 181; Ann. Missouri Bot. Gard. 60 (1973) 76.

Type: *Hans von Türckheim 11-1823*, at Coban, alta Verapaz, Guatemala, June 1907 (NY, holotype!).

*S. guatemalensis* Mold., f. *albiflora* Mold., Phytologia 9 (1963) 99.

Type: *Elias Contreras 1579*, in an airfield clearing at Dos Lagunas, El Petén, Guatemala, 3.xi.1960 (LL, n.v.).

*S. tabascanana* Mold., Phytologia 1 (1940) 437.

Type: *Eizi Matuda 3218*, at Reforma, Balancan, Tabasco, Mexico, 22-26.v.1939 (NY, n.v.).

*S. indica* auct. non (L.)M. Vahl: sensu Cooke, Fl. Pres. Bombay, repr. edn 2 (1967) 501.

*Lippia cylindrica* Scheele, Linnaea 17 (1843) 246.

Type: "*Hartelbem 1832*, In provincia Minarum generalium, Brazil" (Present location unknown, probably in Herb. B and was destroyed during the war).

*Valerianodes cayennense* (Rich.)Kuntze, Rev. Gen. Pl. 2 (1891) 510; Brittan & P. Wilson, Sci. Surv. Puerto Rico & Virgin Isls 6 (1925) 143.

Type: As for *Stachytarpheta cayennensis* (Rich.)M. Vahl.

*Abena cayennensis* (Rich.)Hitchc., Ann. Rep. Missouri Bot. Gard. 4 (1893) 117.

Type: As for *Verbena cayennensis* Rich., loc. cit.

### Typeification

*S. cayennensis* is based on *M. Leblond 366*, known from at least 3 specimens one each in Herb. G, K and P. Since the author of the basionym did not specify a holotype, a lectotype is selected here. Of the three syntypes, the one in Herb. P could not be found. Between the remaining two, the one in Herb. G has the collector's label indicating collector's name and his collection number, the locality name and the year of collection. Moreover, the basionym *Verbena cayennensis* is hand-written on the label and the specimens appear to have been used by the author in preparing the protologue of this species. The specimen seems to be a better representative of this taxon and is chosen here as the lectotype of this species.

The synonym *S. dichotoma* (Ruiz Lopez & Pavón)M. Vahl is based on *Dombey's* unnumbered collection from Peru comprising at least six duplicates. Five duplicates are

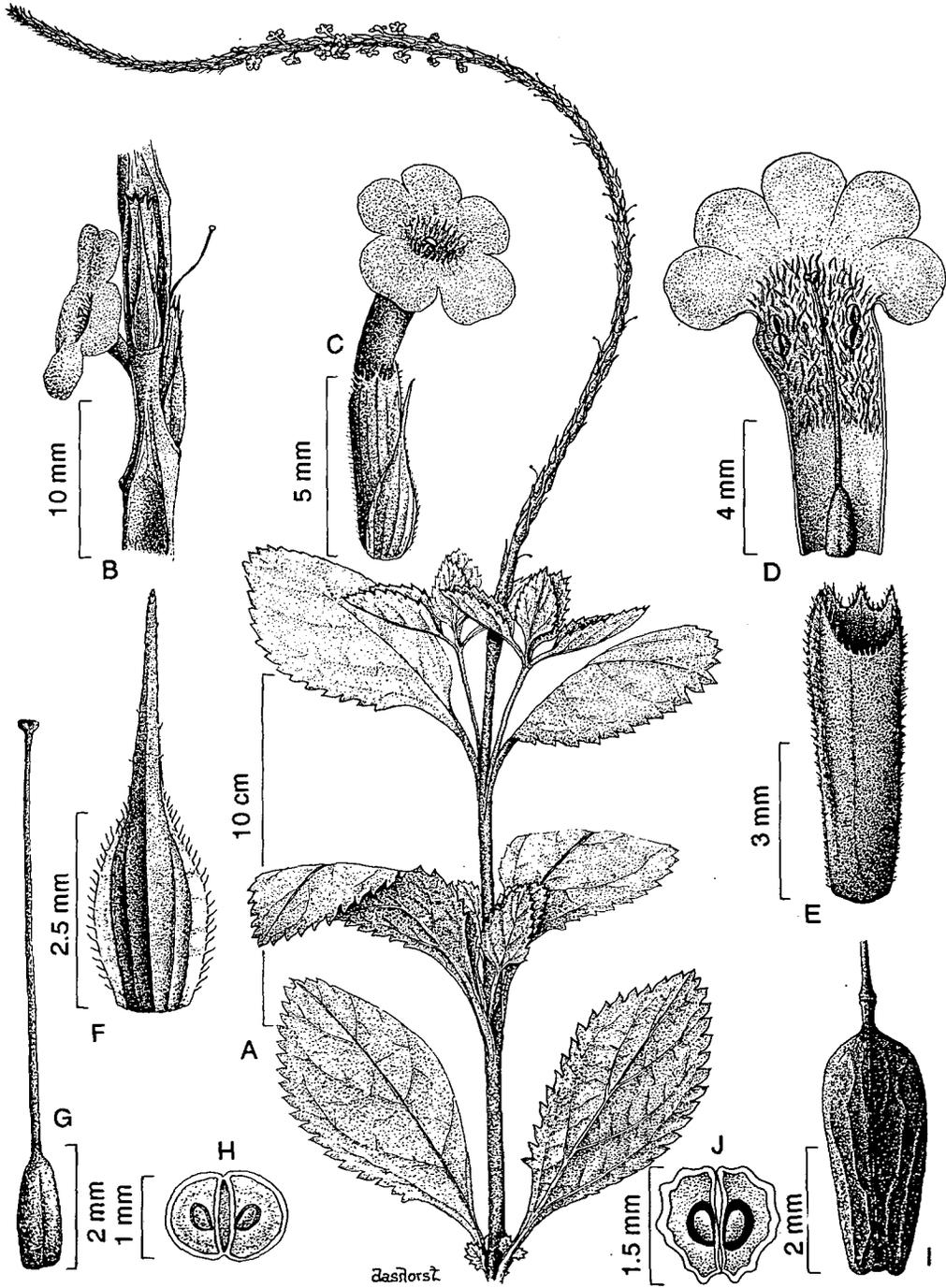


Fig. 3. *Stachytarpheta cayennensis* (Rich.)M. Vahl (A-J, I. Cowie 204: CANB). A, habit sketch of a flowering branch; B, part of rachis showing bracts, flowers and furrows; C, flower with bract; D, corolla vertically cut open showing androecium, gynoecium and hairy inside; E, calyx; F, flower-bract; G, gynoecium; H, transverse section of ovary; I, fruit; J, transverse section of fruit.

preserved in Herb. MA and one in Herb. P. Since the author of its basionym did not select a holotype, a lectotype is chosen here. Of all the syntypes, the one preserved in Herb. P seems to be a better representative of this taxon and is selected here as a lectotype.

### *Description* (Fig. 1B & 3)

Herb or subshrub (0.5-) 1-2 (-2.5) m high. *Stem* dichotomously branched, subterete or weakly tetragonal; branches and branchlets glabrescent-puberulous, hairy on nodes, dark purplish-blue when alive. *Leaves* petiolate, bright green; lamina ovate-elliptic or oblong-elliptic, acute at the apex, long attenuate or decurrent into petiole, with crenate-serrate margin, (2-) 3-8 (-10) cm long, (1-) 2-4 (-5) cm wide, glabrous or sparsely strigose on veins below, membranous-chartaceous when dry; petiole glabrescent or puberulous-strigose (2-) 5-15 (-20) mm long. *Spikes* slender, flaccid, (10-) 15-40 (-45) cm long, subglabrous or puberulous; peduncle puberulous when young, almost glabrous when old, (5-) 10-20 (-30) mm long; rachis puberulous or subglabrous, 1-3 mm diameter, with the furrows from half immersed flowers as wide as the rachis; bracts ovate or ovate-subulate, subglabrous, 3-5 mm long, 1-2 mm wide near base, the margins scarious in the lower half, the upper subulate half with apices setaceous acuminate. *Flowers* sessile, spreading during anthesis. *Calyx* compressed, 4-costate, about equalling or surpassing the subtending bracts, 4-6 mm long, 1-2 mm diam., shortly puberulous or subglabrous outside, glabrous inside, the rim bifid with 4 equal teeth; teeth subulate, 0.5-1 mm long. *Corolla* pale blue to blue, pale violet, purple, violet or lavender, occasionally white, salver-shaped, glabrous outside, villous inside the upper half of the tube and throat; tube cylindrical, curved, longer than calyx, 6-7 mm long, 1-2 mm diam.; lobes subequal, with limb spreading to about 5 mm diam., rounded or very broadly ovate-orbicular, 1-4 mm long, 3-5 mm wide. *Stamens* included, inserted in corolla-throat; filaments 0.5-1 mm long, pubescent; anthers  $\pm$  1 mm long with divergent lobes; staminodes filiform, pubescent. *Ovary* oblong, glabrous, 1-2 mm long, c. 1 mm diam.; style included, filiform, glabrous, 4-7 mm long; stigma capitate. *Fruit* oblong, glabrous, somewhat compressed, 3-4 mm long, 1.5-2 mm wide, dark brown to blackish.

### *Representative specimens* (collections seen: Australian 50, non-Australian 35).

AUSTRALIA: QUEENSLAND: *Batianoff 1138 & Donald s.n.*, S of Buchan Point and 0.5km W of Palm Cove near Cairns, 3.x.1979 (BRI); *Beaglehole 3288*, Tinana Creek, 8.vi.1955 (MEL); *Boylard 375 & Gillieatt s.n.*, c. 6.43km N of Mossman on roadside, 15.xi.1969 (BRI, K); *Brass 33491*, Kuranda, 7.viii.1966 (BRI, K, QRS); *Briggs 1972*, Barron Falls railway station, 16.09km NW of Cairns, 3.viii.1968 (NSW); *Clarkson 7265*, Kuranda, Myolla Road, 14.vii.1987 (AD, BRI, MBA, NSW, QRS); *Everist 5081*, 8.4km N Tully, 16.v.1952 (BRI, CANB, K, LAE); *Everist 5094*, 14.48km N Babinda, 17.v.1952 (BRI, CANB, K, LAE); *Everist 6038*, South Johnstone, 8km W of sugar mill, 9.x.1958 (BRI, CANB); *Everist 7962*, Barrets Lagoon, c. 24km SE Tully, 11.xii.1966 (BRI); *Everist 8109*, camping reserve, 25km ESE of Rockhampton, 4.x.1968 (BRI); *Everist s.n.*, Wellington Point, 1.vi.1980 (BRI); *Flecker 8093*, Collin Av., Edge Hill, 1.v.1943 (NSW 231737, NY 3711); *Hauser s.n.*, Redlands, 27.i.1983 (BRI); *Hyland 1804*, Smithfield R1073, 24.iii.1961 (BRI); *Johnson 3719A*, Pebbly Beach, on Cairns - Mossman Road, 15.vi.1977 (BRI, CANB); *Robinson s.n.*, 24km E Rockhampton, 22.xii.1974 (BRI); *White 11737*, Innisfail, 6.xii.1941 (BRI, GH, K).

NORTHERN TERRITORY: *Allen 449*, Darwin, -ii.1920 (NSW); *Cowie 204*, East Jabiru, 20.x.1984 (DNA, CANB); *Dunlop s.n.*, Nightcliff, Darwin, 7.vii.1980 (BRI, DNA); *Fox 826*, East Point Reserve, 2.iv.1975 (AD); *Munir 6193*, Adelaide River Township, 12.vi.1988 (AD, BRI, CANB, DNA); *Must 1367*, Kemp Airstrip, 14.iv.1977 (CBG, DNA); *Pickering s.n.*, Meneling, 24.ii.1987 (DNA); *Rankin 2686*, Rum Jungle, 7.iv.1983 (DNA); *Russell-Smith 3635 & Lucas s.n.*, Croker Island, Baniwumldalk, 7.x.1987 (DNA); *Turely 58*, Middle Pt. Village, Coastal Plains, 18.v.1989 (DNA); *Waldeck s.n.*, Fogg Dam Area, 9.vii.1980 (BRI, DNA); *Wightman 4274*, Nhulunbuy, NE Arnhem Land, 21.ii.1988 (DNA); *Wightman 4401*, Milingimbi, Arnhem Land, 15.iv.1988 (DNA).

WESTERN AUSTRALIA: *Mead s.n.*, Cockatoo Island, 11.vii.1967 (PERTH).

CHRISTMAS ISLAND: *Mitchell 35*, Cemetery Road, North East Point, 12.vi.1984 (AD, CBG, K); *Stokes 18*, Dales Track, 14.viii.1983 (CBG).

PAPUA NEW GUINEA: WEST NEW BRITAIN: *Barker & Vinas LAE 66732*, seashore at Wongonokai Village,

subdistrict Talasea, 27.x.1974 (AD, BISH, BRI, E, GH, K, L, LAE, M, NSW, QRS, US); *Sohmer et al.* LAE 75326, rainforest on ridges of left bank of Kapiura River, c. 3km up stream from the confluence of the Aum River, Hoskins subprov., 17.v.1979 (BRI, CANB, CBG, L, LAE, UPNG).

HAWAII: *Degener* 21483, Kauai, Hanabi Valley, 29.xii.1951 (BISH).

CHINA: *Chow & Wan* 80167, Yunnan Prov., Xishuanbanna, alt 700 m on slopes, -1980 (AD, PE).

FRENCH GUIANA: *Leblond* 356, Cayenne, 1792 (G!, K!, P, syntypes of *S. cayennensis* (Rich.)M. Vahl).

PERU: *Dombey s.n.*, Cochero, undated (MA!, P!, syntypes of *S. dichotoma* (Rufz Lopez & Pavón)M. Vahl).

### *Distribution and ecology* (Map 3)

*S. cayennensis* is a native of tropical America now widely introduced into other parts of the tropics. In Australia, it is known to occur chiefly in the coastal regions of Northern Territory and Queensland. In the Northern Territory, the distribution is restricted to the botanical province "Darwin and Gulf Region" where most localities are around Darwin and southwards in Rum Jungle and Adelaide River township area. It has also been recorded from Jabiru in Kakadu National Park. Along the northern coast, it is reported to occur on Croker Island and around the townships of Milingimbi and Nhulunbuy.

Distribution in Queensland is mainly in the coastal area of Atherton Tableland between Cooktown and Ingham. Elsewhere, it has been recorded from near Rockhampton, Maryborough and Brisbane. Within this State, the southern-most locality is at Smithfield near the New South Wales border. So far, this species has not been recorded from the northern half of Cape York Peninsula, any off-shore island of this state or from the Gulf of Carpentaria.

Only one "horticultural" collection is known from Western Australia where it is said to be "used as a hedge". It is likely that it will be found naturalised in the Kimberley region.

Collections from overseas have been seen from Christmas Island, Papua New Guinea, Hawaiian Islands, China, French Guiana and Peru. According to Moldenke (1973), "the species is widely distributed throughout tropical and subtropical America from Alabama through the West Indies, Mexico, and Central America to Ecuador and Brazil; introduced in parts of tropical Africa, Madagascar, the islands of the Indian Ocean, tropical Asia, Australasia, and Oceania".

In Australia, collectors have recorded this species from a variety of habitats. Generally, it grows in disturbed roadside clearings, old mined land, as a weed in wasteland and horse paddocks. It has been recorded from monsoon forest edge, base of inland seacliffs, secondary rainforest, beach ridge plains, *Melaleuca* open forest, edge of water and on fringes of open forest with dense understorey among pasture grasses. The collections examined came from one of the following soil types namely "clay loam", "red loam", "stony red clay loam", "sandy plain", "swamps", "grey loam" and "black soil plain". In Queensland, *S. cayennensis* is said to grow "strongly around Kuranda and beating *Lantana* in growth in some places". According to Adams (1972), this species is common in Jamaica, especially in rough pastures and damp waste places". In Guatemala, Gibson (1970) recorded it from "Damp thickets, forest, or swamps, sometimes in pine forest, often a weed in waste places, sea level to 1,500 meters".

### *Comments*

Brenan (1950) attributed the combination of this species to Schauer (1847) instead of M. Vahl (1804). In his opinion: "Richard's original spelling of the epithet, '*cayennensis*', must

be retained. My colleague Mr R. Milne-Redhead has kindly pointed out that M. Vahl, to whom the combination under *Stachytarpheta* is usually attributed, spelt the epithet '*cajanensis*' — a version so different from the original as in effect to constitute a new name, and a quite unjustified one. Link's later 'compromise' — '*cayanensis*' — does not affect the problem. The binomial *Stachytarpheta cayannensis* is therefore here attributed to Schauer, who was the first to transfer Richard's epithet to *Stachytarpheta*". The above opinion was accepted by Hepper (1963), but the majority of botanists have attributed the combination to M. Vahl (1804). Vahl's spelling of the epithet "*cajanensis*" is considered only an orthographic error which was corrected by Schauer (1847) and subsequently accepted by the majority of botanists. The orthographic error in the specific epithet is somewhat similar to the orthographic error made by Link (1821) in the generic name from *Stachytarpheta* to *Starchytarpha*, which was accepted by Schauer (1847). However, this orthographic error has not been accepted by Brenan (1950) himself because in his opinion it "cannot be upheld under the rules" and, therefore, accepted the corrected version without alteration of the authority. Similarly, the orthographic error in the specific epithet by M. Vahl (1804) has been corrected by Schauer (1847) but the combination under *Stachytarpheta* should be attributed to M. Vahl (1804) who was the first to transfer it from *Verbena* to *Stachytarpheta*.

Bailey (1901) recorded *S. mutabilis* and *S. dichotoma* from Queensland. In 1940, Moldenke regarded *S. cayennensis* and *S. dichotoma* as distinct species and included *S. urticaefolia* in the synonymy of *S. dichotoma*. Subsequently, Moldenke (1973) recognised *S. cayennensis* and *S. dichotoma* as conspecific and placed *S. dichotoma* in the synonymy of *S. cayennensis*. In Flora of Ceylon, however, Moldenke (1983) reinstated *S. urticaefolia* as a distinct species. During the present investigation, a range of material identified as *S. cayennensis* and *S. dichotoma* has been examined and found to belong to the same taxon. The types of these two taxa have also been examined and are found to be conspecific. The type of *S. urticaefolia*, based on cultivated material from near London, was probably not kept. However, if it was preserved in the British Museum (Natural History), it has not been found there by the present author, or by the herbarium staff at the BM. All material in the British Museum (Natural History) and at Kew, identified as *S. urticaefolia*, seems to match well with *S. cayennensis* and *S. dichotoma*. In the present treatment, therefore, *S. cayennensis*, *S. dichotoma* and *S. urticaefolia* are treated as conspecific. Of these three, the binomial *S. cayennensis* being based on the oldest valid name is retained and the other two names are placed in synonymy.

In some herbaria, the names *S. cayennensis* and *S. urticaefolia* have been erroneously used for the pubescent specimens of *S. frantzii* Palak. Similarly, material of *S. cayennensis* has been distributed in some herbaria as *S. dichotoma*, *S. indica*, *S. jamaicensis* and *S. urticaefolia*. According to Moldenke (1974), material of *Bouchea prismatica* (L.)Kuntze has sometimes been misidentified as *S. cayennensis*. The genus *Bouchea*, however, is not known to occur wild in Australia.

Rosette B. Fernandes (1984) typified a few *Stachytarpheta* species with somewhat elaborate notes on the typification of *S. jamaicensis*. However, she did not typify *S. cayennensis* though she saw and annotated its type in Herb. G during 1984. In the present treatment, therefore, this species has been lectotypified.

In his "Illustrated notes on the weeds of Queensland", White (1921) described this species under the name "SNAKE WEED (*Stachytarpheta dichotoma*)" but the illustration accompanying it is of *S. urticaefolia* previously published in Curtis's Botanical Magazine (1816) Plate 1848. A clear reference to the source of illustration has been given by White (1921) who seems to have treated these taxa as synonyms.

*S. cayennensis* is reported to hybridise with a few other species within the genus.

Accordingly, Danser (1929) described the following three hybrids: *S. xdebilis* Danser (*S. cayennensis* × *S. indica*), *S. xgracilis* Danser (*S. cayennensis* × *S. jamaicensis*) and *S. xabortiva* Danser (*S. cayennensis* × *S. mutabilis*). Wagner et al. (1990) recorded *S. dichotoma* and *S. urticaefolia* as distinct taxa and noted their following hybrids: *S. xgracilis* (*S. dichotoma* × *S. jamaicensis*) and *S. xintercedens* Danser (*S. urticaefolia* × *S. jamaicensis*). It may be of interest to note that the original hybrid *S. xintercedens*, described by Danser (1929), was the result of the cross between *S. indica* and *S. jamaicensis*. As noted earlier in the synonymy, *S. dichotoma* and *S. urticaefolia* are now regarded here as synonyms of *S. cayennensis*, therefore, the above noted hybrid record by Wagner et al. (1990) is in fact applicable to *S. cayennensis*.

In Australia, *S. cayennensis* is known by the popular names "Bluetop" or "Snake Weed", an illusion to the long narrow blue spikes. Elsewhere, it is known by common names "Rat-tail", "Blue Snake-Weed", "Dark Blue Snake-Weed", "Snake-Weed" and by many other regional or local names. J.C. Loudon in his "Encyclopaedia of Plants" gives "Bastard Vervain" as a common English name. According to D.N. Gibson (1970) the species is called "Mozote" in Honduras and "Wild Verbena" and "Camacola" in British Honduras.

Normally, the rim of each calyx has 4 teeth but in Robinson's (s.n.) collection from Rockhampton, some calyces are found to be 5- or 6-toothed.

Chromosome number in *S. dichotoma* has been reported by Wagner et al. (1990) as "[2n = 18, ca 112]".

### Affinities

*S. cayennensis* is apparently close to *S. australis* in its leaves being more or less similar in shape, membranous, with sharply toothed margins; inflorescence slender and flexuose; rachis up to 3 mm diam. and flowers more or less similar in shape, size and colour. Nevertheless, *S. cayennensis* may easily be distinguished by its stem, leaves and inflorescence being glabrous or very minutely puberulous-glabrate; bracts ovate or ovate-subulate, glabrous, 1-2 mm wide. The stems, leaves and inflorescence in *S. australis* are pubescent; bracts linear-lanceolate, pubescent abaxially and 0.5-0.8 (-1) mm wide. *S. cayennensis* is also near to *S. jamaicensis* in its stems, leaves and inflorescence being glabrous. The latter, however, may readily be identified by its rachis being stout and firm, (2-) 3-5 (-7) mm diam.; furrows from half-immersed flowers narrower than the rachis; leaves somewhat fleshy; bracts larger, 4-8 × 1.5-2.5 mm. Moreover, in comparison to *S. jamaicensis*, the leaves in *S. cayennensis* are sharp toothed and with very sparse short hairs on the veins below, inflorescence subglabrate, bracts with scarious margins in the lower halves only and subulate in the upper halves, hairs inside the corolla-throat not gland-tipped and flowers not completely immersed inside the rachis.

3. *Stachytarpheta mutabilis* (Jacq.)M. Vahl, Enum. Pl. 1 (1804) 208; Sims, Curtis's Bot. Mag. 25 (1807) t. 976; Sprengel, Syst. Veg. 1 (1825) 53; Steudel, Nomenc. Bot. 2 (1841) 629; Walp., Repert. Bot. Syst. 4 (1845) 7; Schauer in A.D.C., Prod. 11 (1847) 565; Miq., Fl. Ind. Bat. 2 (1856) 907; Griseb., Fl. Brit. W. Ind. Isls (1864) 494; Briq. in Engl. & Prantl, Nat. Pflanzenfam. 4, 3a (1895) 154; Trimen, Handb. Fl. Ceylon 3 (1895) 349; Baker in Dyer, Fl. Trop. Afr. 5 (1900) 284; Bailey, Qld Fl. 4 (1901) 1172; Gamble in King & Gamble, J. As. Soc. Beng. 74 (1908) 799; Bailey, Compr. Cat. Qld Pl. (1913) 282; H.J. Lam, Verbenac. Malay. Archip. (1919) 20; Bull. Jard. Bot. Buitenzorg, Sér III, 3 (1921) 6; Ridley, Fl. Mal. Penin. 2 (1923) 613; Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 10; Mold., Lilloa 4 (1939) 301; Mold. in Humbert, Fl. Madagascar (1956) 25; Gamble, Fl. Pres. Madras, repr. edn (1957) 763; Mold., Résumé Verbenac. etc. (1959) 191, 195, 199, 202, 207, 210, 277, 344, 346-349, 356, 370, 394, 469; Haines, Bot. Bihar & Orissa reprint edn 2

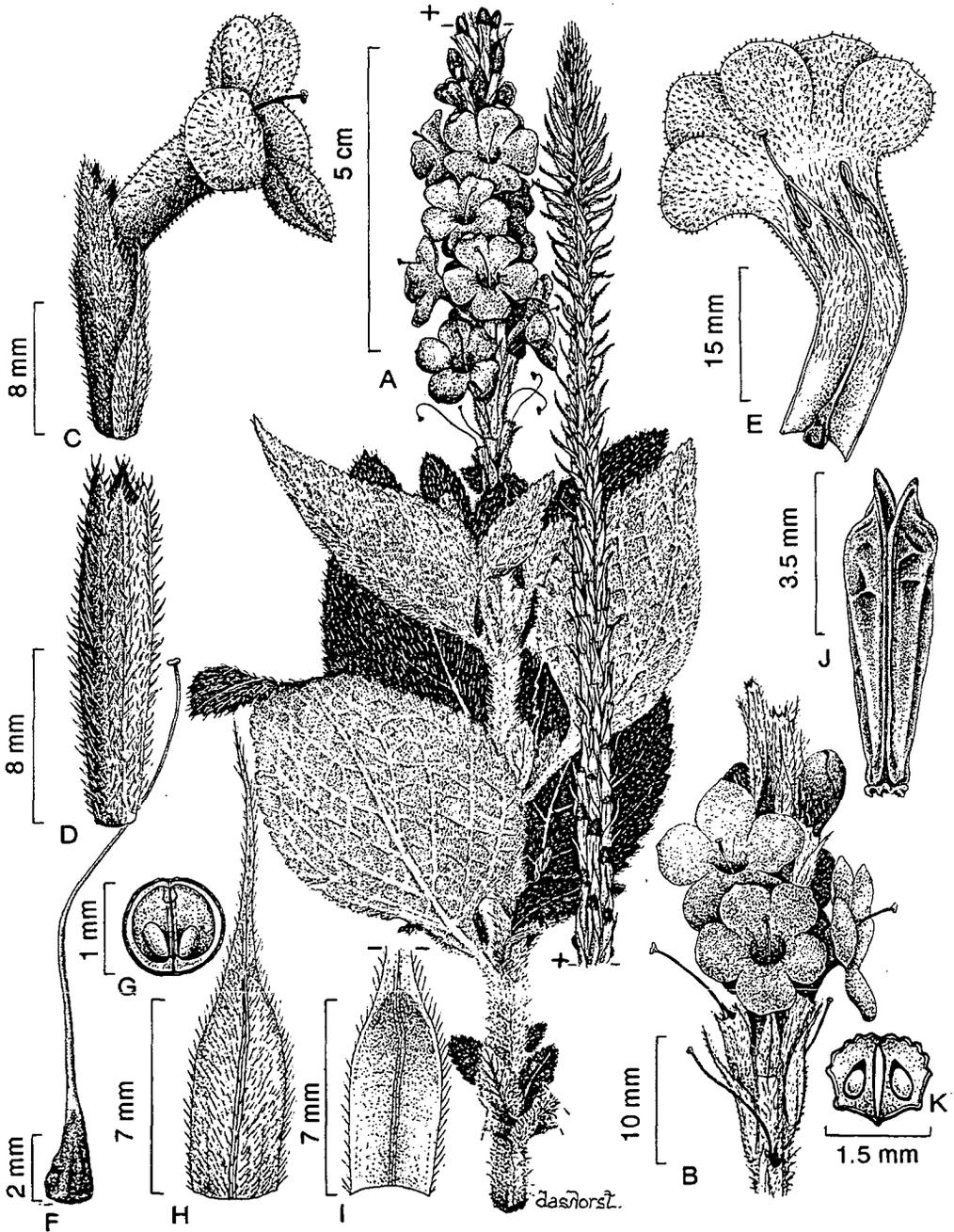


Fig. 4. *Stachytarpheta mutabilis* (Jacq.)M. Vahl (A-K, J.R. Clarkson 7262: AD). A, habit drawing of a flowering branch; B, portion of spike; C, flower with bract; D, calyx; E, corolla vertically cut open showing androecium, gynoecium and hairs inside the corolla-tube; F, gynoecium; G, transverse section of ovary; H, bract showing abaxial view; I, bract showing adaxial view; J, fruit; K, transverse section of fruit.

(1961) 741; Nair & Rehman, Bull. Nat. Bot. Gard. Lucknow 76 (1962) 11; Backer & Bakh.f., Fl. Java 2 (1965) 598; Gunawar., Gen. Sp. Pl. Zeyl. (1968) 146; Mold., Fifth Summary Verbenac. etc. 1 & 2 (1971) 327, 333, 337, 344, 348, 351, 368, 473, 632, 646-648, 684, 737; Adams, Fl. Pl. Jamaica (1972) 631; Lopez-Pal., Revista Fac. Farm. Univ. Los Andes-Merida No. 15 (1974) 84, fig. 16; Fl. Venezuela Verbenac. (1977) 537, fig. 126; Mold., Sixth Summary Verbenac. etc. Phytologia Mem. II (1980) 269, 297, 318, 323, 327, 333, 339, 341, 396, 439-441, 446, 462; Lord & J.H. Willis, Shrubs & Trees Aust. Gard, rev. 5th edn (1982) 264; Mold. in Dassan & Fosb., Fl. Ceylon 4 (1983) 248; Ros. Fernandes, Bot. Soc. Brot. Sér. 2, 57 (1984) 103; Stanley in Stanley & Ross, Fl. S.E. Qld 2 (1986) 366; Jansen-Jacobs, Fl. Guianas part 4 (1988) 71; Wagner et al., Man. Fl. Pl. Hawaii 2 (1990) 1322.

*Lectotype: Jacquin s.n.*, from a plant cultivated in the Hortus Schönbrunnensis, originally from the West Indies, undated (W, lectotype designated here!; BM, isolectotype!).

*Verbena mutabilis* Jacq., [Icon. Pl. Rar. 2 (1786) t. 207, nom. inval.], Collectanea 2 (1789) 334; Willd., Sp. Pl. 1 (1797) 115; Vent., Jard. Malmaison (1804) t. 36; Andrews, Bot. Repos. 7 (1806) t. 435.

*Type: As for Stachytarpheta mutabilis* (Jacq.)M. Vahl.

*Zapania mutabilis* (Jacq.)Lam., Tab. Encycl. Meth. Bot. (1791) 59.

*Type: As for Stachytarpheta mutabilis* (Jacq.)M. Vahl.

*Cymburus mutabilis* (Jacq.)Salisb., Parad. Lond. 1 (1805) t. 49.

*Type: As for Stachytarpheta mutabilis* (Jacq.)M. Vahl.

*Stachytarpheta zuccagni* Roemer & Schultes, Syst. Veg. edn 15, 1 (1817) 205.

*Type: non designatus.*

*S. elegans* Welw., Apont. Phytogeogr. Angola (1858) 588.

*Type: n.v.*

*Valerianodes mutabilis* (Jacq.)Kuntze, Rev. Gen. Pl. 2 (1891) 510.

*Type: As for Stachytarpheta mutabilis* (Jacq.)M. Vahl.

*Stachytarpheta cayennensis* (Rich.)Vahl var. *schiedeana* Loes., Bot. Jahrb. Syst. 23 (1896) 119 & 129.

*Type: n.v.*

*S. variabilis* Saunders, Floral Morphol. 2 (1939) 446.

*Type: n.v.*

### Typification

The type of *Verbena mutabilis* was collected by Jacquin from a plant "growing in the hot house" at Hortus Schönbrunnensis near Vienna. It originally came from the West Indies where it is believed to be native. No known collection made directly from the West Indies was involved in preparing the protologue of this species. The type collection from the cultivated plant comprises at least two specimens one each in Herb. BM and Herb. W. Both specimens are in good condition and are annotated by the author.

Of the two syntypes, there was no type designated by the author nor any lectotypification made subsequently. Of the two syntypes, the one in Herb. W seems to be a better representative of this taxon and is, therefore, chosen here as the lectotype of this species.

### Description (Fig. 1C & 4)

Shrub (1-) 2-4 (-5) m tall. *Stem* dichotomously branched, tetragonal, densely tomentose or villous throughout; branches ascending and leafy. *Leaves* petiolate; lamina ovate, ovate-elliptic or oblong-elliptic, cuneate and long-decurrent on petiole, acute or acuminate at apex,

crenate or serrate along margin from just above the base to the apex, (4-) 5-12 (-14) cm long, (2.5-) 3-6 (-8) cm wide, thick and leathery or membranous-chartaceous, often rugose, sparsely villous to scaberulous above, densely canescent-tomentose or villous-velutinous beneath, primary and secondary veins flat above, prominent beneath; petiole canescent-tomentose, (5-) 10-25 (-30) mm long. *Spikes* stout, terete, erect, (15-) 20-40 (-60) cm long, 6-8 (-10) mm diam. without open flowers, densely strigose-tomentose or hirtellous, the furrows shallow; peduncles pubescent-tomentose, (5-) 10-30 (-40) mm long; rachis pubescent-tomentose, 3-4 mm diam.; bracts divergent, narrowly ovate-elliptic, lanceolate or oblong-lanceolate, setaceous or somewhat subulate, acuminate, 8-12 mm long, 2-3 mm wide in the lower half, pubescent-hirsute abaxially, glabrous adaxially, ciliate along the margins, membranous, rigid, striate, the awn-like acumination often divergent or reflexed. *Flowers* sessile, half-immersed in the rachis-furrows. *Calyx* somewhat compressed, subequalling or more often longer than the subtending bract, recurved during anthesis, later completely immersed in the rachis-furrows, 8-14 mm long, 2-3 mm diam., pubescent-hirsute outside, glabrous inside, shortly 2-lobed at the apex with 4 unequal minute teeth of c. 0.5-1 mm long. *Corolla* red, purple-violet, scarlet, reddish-pink, blue-red or fading to pink, large, showy, hypocrateriform with minute and sparse glandular hairs on lobes and outside the tube, villous inside the upper half of the tube and throat; tube curved, cylindrical, dilated at the throat, much longer than the calyx, (13-) 15-20 (-25) mm long, 1.5-3 mm diam.; lobes subequal, spreading to about 13 mm diam., rounded, 3-6 mm long, (3-) 5-8 mm wide. *Stamens* inserted in corolla-throat, included; filaments filiform, pubescent, 2-3 mm long; anther-lobes completely divergent, slightly unequal, 1-2 mm long; staminodes filiform, pubescent, 2-3 mm long. *Ovary* ovoid-elliptic to oblong-elliptic, glabrous, 1.5-2 (-2.5) mm long, 1-1.5 mm diam.; style almost included or slightly exerted above the corolla-tube, filiform, glabrous, 13-16 mm long; stigma capitate. *Fruit* elliptic-oblong, subcylindrical but somewhat compressed, glabrous, shorter than the calyx, 5-7 mm long, 1.5-2 mm wide, somewhat striate and pustulate.

*Representative specimens* (collections seen Australian 21, non-Australian 30)

AUSTRALIA: QUEENSLAND: *Beaglehole* 3327, Port Douglas, 16.vi.1955 (MEL); *Blake* 13316, Mackay, 19.iii.1938 (BRI, CANB, MO); *Brass* 33493, Kuranda, 7.viii.1966 (BRI, QRS 3 spec.); *Clarkson* 5099, Mareeba, 22.xii.1983 (AD, BRI, K, MO, PERTH, QRS); *Clarkson* 7262, Kuranda, Myolla Road, 14.vii.1987 (AD, BRI, MBA, QRS); *Shire Clerk s.n.*, Cardwell, 9.iii.1921 (BRI); *Everist* 5074, 3.2km N of Cardwell, 16.v.1952 (BRI, CANB 2 spec., LAE); *Everist* 5122, Port Douglas, 20.v.1952 (BRI, CANB 2 spec., LAE); *Flecker* 1983, Double Island Road, Smithfield, 5.vii.1936 (QRS); *Gittons* 572, Ayton, -.vi.1962 (BRI, NSW 2 spec.); *Hatfield s.n.*, Roseville via Cooktown, 20.iv.1956 (BRI); *Hopkinson s.n.*, Chewko Road, Mareeba, 14.iv.1973 (QRS); *Hopkinson* 3C, Myola, 8.iii.1973 (QRS); *Hunt s.n.*, Kuranda, -.xi.1939 (BRI); *Johnson* 3730, Mareeba-Atherton Road, 12km S Mareeba, 16.vi.1977 (BRI); *Lahey s.n.*, Cairns, -.ix.1924 (BRI); *Persieh s.n.*, Endeavour River, -1887 (MEL 583733); *Stanley* 419, North Mackay, Roadcutting, 17.ii.1980 (BRI); *Stanley* 1065, Southern Bundaberg, 18.iii.1980 (BRI); *Stephens* 11724, Smithfield, 18.x.1947 (QRS); *Storr* [*F.A. Rodway No. 15044*], Cooktown, -.i.ii.1949 (NSW).

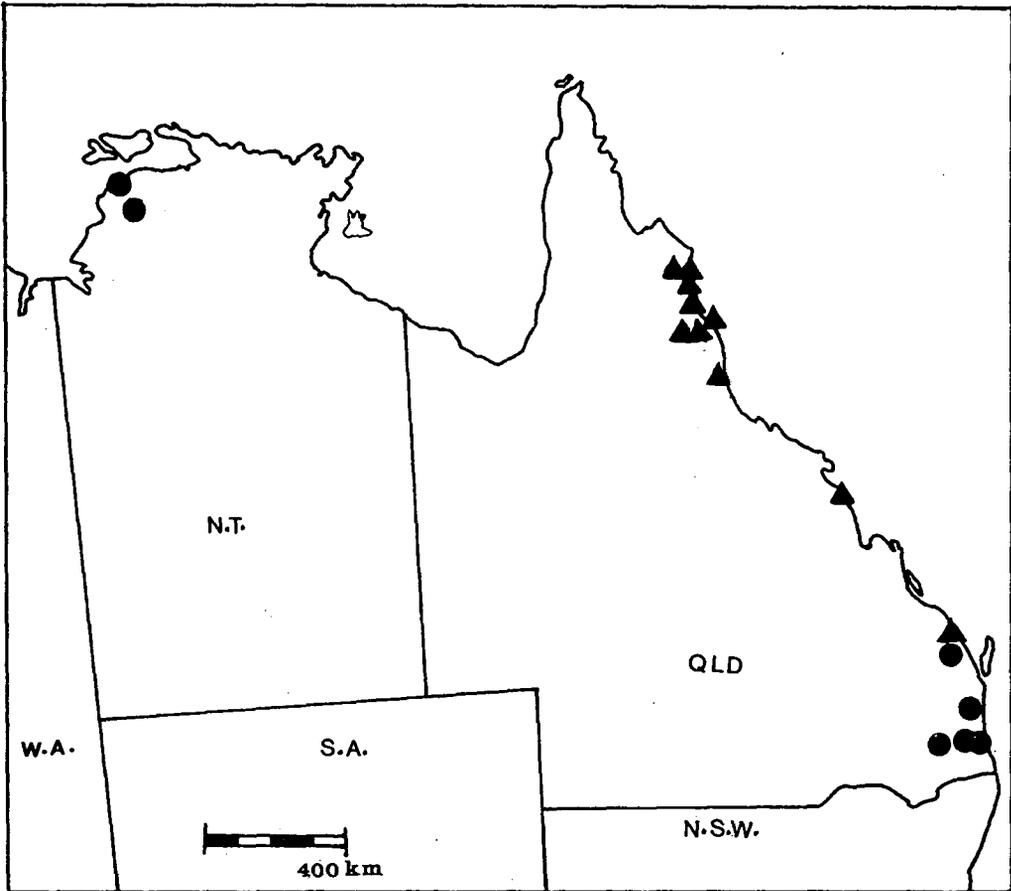
PAPUA NEW GUINEA: *Streimann & Kairo NGF* 30753, Junction Magere & Sogeri Roads, Central District, 15.viii.1967 (A, BISH, BO, BRI, BUL, CANB, K, L, LAE, SING); *Gebo UPNG* 307, Sogeri, Corner of Hombrum Bluff Road, Sogeri Subdistrict, Central District, 28.iii.1970 (B, BUL, L, LAE); *Benjamin & Wiakabu LAE* 67846, Itikunumu Estate, Subdistrict Moresby, 25.v.1977 (A, BRI, CANB, E, K, L, LAE, M).

INDONESIA: *Osberger* 402, Sumatra, West Coast, -.viii.1953 (A, BRI, BISH, CAL, K, L, BM, LE, NY, P, PNH, SING). *Koorders* 19539, Celebes, 1914 (BO, L); *Seorten* 716, Java, 1.vii.1922 (BO, L).

MALAYSIA: *J. Carrick* 1546, Penang Hill, 18.i.1967 (K, L, SING).

HAWAIIAN ISLANDS: *Herbst* 5300, Kauai, in pasture at Hanalei end of the Pole Line Trail, 15.v.1975 (BISH); *Forbes* 459, roadside between Honabi and Rilawa, -.ix.1913 (BISH, L).

VENEZUELA: *Schomburgk s.n.*, Caracas, undated (AD).



Map 4. Distribution of *S. mutabilis* ▲, *S. australis* ●

*Distribution and ecology* (Map 4)

*S. mutabilis* is a native of South America naturalised in Australia in the tropical areas of north-eastern Queensland. The main distribution is on the coastal area between Cardwell and Cooktown, particularly along the eastern part of Atherton Tableland. Outside this area, it has been recorded only from near the township of Mackay and Bundaberg.

According to Moldenke (1983), "this species is rather widespread in the American tropics from Mexico and Cuba, through Central America and the West Indies, to northern South America and Central Brazil. It has been introduced in Angola, Madagascar, Mauritius, Réunion, India, Pahang, the Lingga Archipelago, Java, Amboina, Fiji and elsewhere. It is widely cultivated in Europe (since 1801), America, and Australia".

Collectors in Australia have found this species growing along "roadside in disturbed soil", "in weedy horse paddock" and "occasionally in *Lantana* thickets on formerly rain forested

slopes". According to Lord and J.H. Willis (1982), this species is "fast growing on warmer east coast in sheltered location". In Jamaica, it is "generally dispersed on banks, pathsides and in open areas in hilly districts" (Adams, 1972).

### Comments

Moldenke (1983) states that this species is often employed to make fences and hedges in the American tropics. Lord (1964) asserts that it was originally imported to Australia to serve as an adulterant to tea. According to Wagner et al. (1990), "*Stachytarpheta mutabilis* hybridises with *S. urticifolia* [*S. xtrimenii* Rech.]. The hybrids are very similar to *S. mutabilis* but are usually lower in habit with smaller leaves that are less densely pubescent, as is the rachis, and the corolla varies from purplish pink to purple, dark purple, or dark violet". In Australia, *S. mutabilis* hybridises with *S. jamaicensis* [*S. xadulterina* Urban & E. Ekman]. The other species with which *S. mutabilis* is said to hybridise are *S. cayennensis* (Rich.)M. Vahl and *S. indica* (L.)M. Vahl (Danser, 1929).

Of all species of *Stachytarpheta* in Australia, *S. mutabilis* is the tallest in habit, measuring up to 5 m in height. It has much larger and thicker leaves, robust and thick tomentose spikes of up to 10 mm diameter and large corolla of up to 2.5 mm long. Due to its large showy flowers, *S. mutabilis* is a very decorative garden plant.

According to Moldenke (1983), this species is known by many vernacular names in various parts of its vast range. In Australia it is known as "Pink Snakeweed" and in Sri Lanka as "Verbena rosada".

According to Adams (1972) the flowering and fruiting takes place "most of the year". Stanley (1986), however, has recorded the flowering period from "spring to autumn".

### Affinity

Amongst Australian *Stachytarpheta* species, *S. mutabilis* is closely related to *S. australis* in its stems, leaves and inflorescence being always hairy. However, *S. mutabilis* may easily be identified by its stems, leaves and inflorescence being densely tomentose; rachis thick, 3-4 mm diam.; bracts large, tomentose abaxially, 8-12 by 2-3 mm; calyx about twice the size of *S. australis*, 8-14 by 2-3 mm; corolla large, 13-25 by 1.5-3 mm, bright red to scarlet or reddish-pink. In *S. australis*, the indumentum is thinner and shorter, and all the above named plant organs are almost half the size of *S. mutabilis*.

4. *Stachytarpheta australis* Mold., Phytologia 1 (1940) 470; Résumé Verbenac. etc. (1959) 188, 190, 195, 202, 203, 206, 468; Neal, Gard. Hawaii (1965) 725; Mold., Fifth Summary Verbenac. etc. 1 (1971) 327, 337, 342, 348, 351, 352, 907; H. St John, List & Summary Fl. Pl. Hawaii Isl. (1973) 291; López-Pal., Revista. Fac. Farm. Univ. Los Andes-Merida No. 15 (1974) 79; Mold., Phytologia 28 (1974) 426; Raj, Rev. Palaeobot. Palynol. 39 (1983) 398.

*Type: Schreiter s.n., Herb. BA 26/1347, at Tartagal, in the department of Oran, Salta, Argentina, 28.ix.1925 (NY, holotype!). [See comments].*

*S. dichotoma* auct. non (Ruíz Lopez & Pavón)M. Vahl: sensu Lopez-Pal., Verbenaceae Fl. Venezuela (1977) 528, p.p. quoad syn. *S. australis* Mold.; Mold., Sixth Summary Verbenac. etc. Phytologia Mem. II (1980) 440, p.p. quoad syn. *S. australis* Mold.; Mold. in Dassan & Fosb., Fl. Ceylon 4 (1983) 262, p.p. quoad syn. *S. australis* Mold.

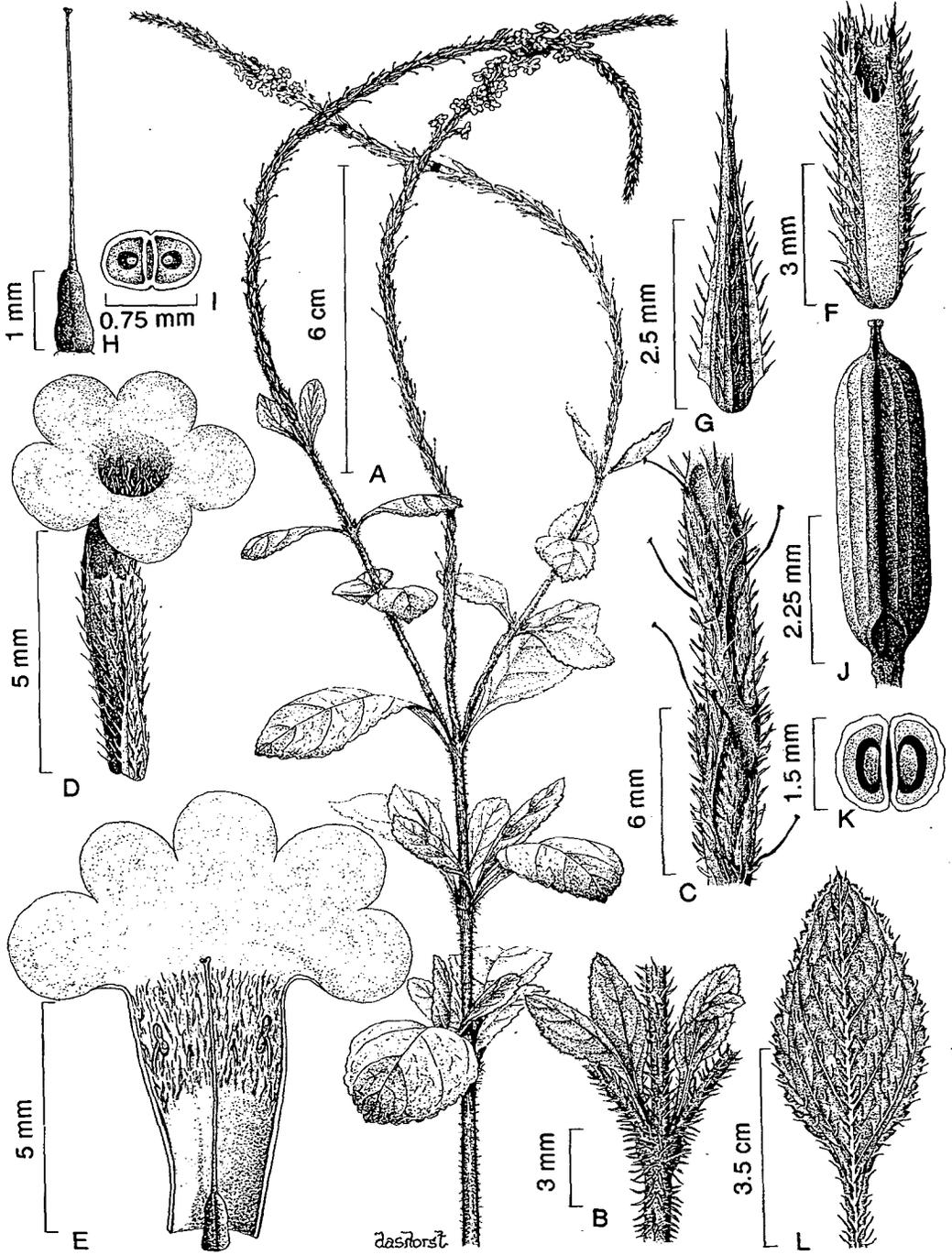


Fig. 5. *Stachytarpheta australis* Mold. (A-K, S. Pickering 2: DNA). A, habit drawing of a flowering twig; B, portion of stem showing hairs; C, portion of mature spike with corolla fallen off; D, flower with bract; E, corolla vertically cut open showing androecium and gynoecium; F, calyx; G, bract showing abaxial view; H, ovary; I, transverse section of ovary; J, fruit; K, transverse section of fruit.

*Description* (Fig. 1D & 5)

Erect and spreading shrub (0.6-) 0.8-1 (-1.5) m high. *Stem* dichotomously branched, slender, subterete or obscurely tetragonal; branchlets very slender, brownish, more or less densely pilose-pubescent. *Leaves* petiolate; lamina ovate, elliptic-ovate or oblong-elliptic, acute to subacute at the apex, cuneate-attenuate at base and prolonged into the petiole, crenate-dentate along the margin, (15-) 25-80 (-110) mm long, (10-) 15-40 (-50) mm wide, scabrous-puberulous or strigose-pubescent above, appressed pubescent beneath, chartaceous, somewhat brownish above in drying; petiole winged, pubescent, (3-) 5-20 (-30) mm long. *Spikes* slender, flaccid, pubescent, (12-) 18-30 (-45) cm long; rachis pubescent, 1-2 (-2.5) mm diam., furrows as wide as the rachis; peduncle short, pubescent, 3-12 mm long; bracts subulate to narrowly linear-lanceolate, pubescent abaxially, glabrous adaxially, 4-5 mm long, 0.5-0.8 (-1) mm wide, shortly ciliate and scarious along the lower margins, setaceous acuminate towards apex. *Flowers* sessile, half embedded in the furrows. *Calyx* compressed, surpassing the subtending bract, 4-6 (-7) mm long, 1-1.5 mm wide, pubescent outside, glabrous inside, bilobed at the top; teeth short, subulate, 0.5-1 mm long. *Corolla* pale blue or almost white with a trace of mauve, hypocrateriform, glabrous outside, shortly villous inside the upper half of the tube; tube cylindrical, (4-) 5-7 mm long, c. 1 mm diam.; lobes subequal, spreading, rounded or broadly ovate-orbicular, 1-2.5 (-3) mm long, 1-2 (-2.5) mm wide. *Stamens* included, inserted in corolla throat; filaments filiform, c. 1 mm long; anthers c. 1 mm; staminodes filiform, pubescent, 1-1.5 mm long. *Ovary* oblong, glabrous, somewhat compressed, 1-1.5 mm long, 0.5-1 mm in diam.; style included, filiform, glabrous, (3.5-) 4-6 mm long; stigma capitate. *Fruit* oblong, compressed, glabrous, faintly striate and postulate, 3-4 (-5) mm long, 1-1.5 mm wide.

*Specimens examined* (collections seen: Australian 17; non-Australian 20)

AUSTRALIA: NORTHERN TERRITORY: *Pickering s.n.*, Rapid Creek, Macmillans Road, Darwin, 9.vii.1980 (BRI, DNA); *Pickering s.n.*, Cameron Downs, 12.viii.1986 (DNA); *Pickering s.n.*, Eva Valley, 24.ii.1987 (DNA); *Pickering 2*, 9km S. Batchelor along railway line, 18.iii.1983 (BRI, CANB, DNA); *Rankin 2523*, Rapid Creek, McMillans Road, Darwin, 7.vii.1980 (BRI, DNA); *Rankin 2656*, Holms Jungle, 20.x.1982 (DNA).

QUEENSLAND: *Clarke s.n.*, Dayboro Road, Petrie, 24.vi.1976 (BRI); *Douglas s.n.*, Woombye, 15.xii.1955 (BRI); *Everists.n.*, Buderim Mt., 6.i.1955 (BRI); *Kansella Bros s.n.*, Kallangur, Brisbane, 20.iii.1970 (BRI); *Lebler s.n. & Durrington 3*, around Huxley Dam, 1.6km N Childers, 21.i.1970 (BRI); *Lomax s.n.*, Aspley, Brisbane, 18.iii.1970 (BRI); *Mann s.n.*, Childers, -iv.1952 (BRI, CANB, NY); *Mann s.n.*, Petrie, 11.xii.1955 (BRI); *Rankin 2656*, Holmes Jungle, 20.x.1982 (DNA).

INDONESIA: *Hochreutiner 1104*, Java, Kotta batoe pres Buitenzorg, 1.v.1904 (L); *Lörzing 16639*, N. Sumatra, Upper Langkat, to the left of the river Wampu, 22.i.1933 (L).

PAPUA NEW GUINEA: *Stevens 54761*, Busama, Lae subdistrict, Marobe district, 1.i.1972 (BRI, CANB, GH, K, L, NSW); *Womersley 6860*, Dagua near Wewak, Sepik district, 7.xii.1954 (L, LAE).

NEW HEBRIDES: *McKee RSNH 24288*, Espiritu Santo, Big Bay (Malao), 14.ix.1971 (L).

HAWAIIAN ISLANDS: *O. & I. Degener 34415*, Mt Miles, 26.vii.1977 (AD, BISH); *Fosberg 53654*, Lawai Valley, Kauai, 3.iv.1971 (BISH, L). *Spence 321*, North end Munro trail, Lanaihale, 20.x.1973 (BISH, L).

FRENCH GUIANA: *Sagot 467*, Cayenne, 1857 (W); *Richard s.n.*, loc. cit., undated (P).

GUATEMALA: *Dzieskanowski 3360 & al.*, 8km E of Jutiapa, 7-26-1979 (AD).

*Distribution and ecology* (Map 4)

In Australia, *S. australis* Mold. occurs in the tropical parts of Northern Territory and Queensland. Distribution in Northern Territory is in the Darwin region where it has been

recorded from near Darwin and Batchelor township. In Queensland this species is restricted to the south-eastern part of the state between 25° and 28°S and between 152° and 154°E. Most localities are around Brisbane but further north it has been collected from near Buderim and Childers townships.

In the protologue, this species is noted to occur in southern South America, Brazil, Paraguay, Uruguay, Argentina, Hawaii and Java. In addition to the above distribution, Moldenke (1971) has recorded it from Cuba, Jamaica, Leeward Islands, Trinidad and Tobago, Columbia, Venezuela, Surinam, Peru, Bolivia, Sierra Leone, Assam (India), Perak (West Malaysia), and Samoan Islands.

According to collectors' field notes, this species has been found growing in lateritic soil, red-brown loam soil and black-grey soil on top of creek-banks.

### Comments

The occurrence of this species in Australia was first reported by Moldenke (1971) with cautious comments: "Is *Stachytarpheta australis* perhaps conspecific with *S. dichotoma*? Re-examination of the type of the latter would be required to settle this". In 1974, he confirmed his suspicion by regarding them as conspecific and wrote that "wherever the name '*Stachytarpheta australis* Moldenke' occurs, it should be changed to *S. dichotoma* (Ruíz Lopez & Pavón)M. Vahl". This view was later followed by Lopez-Palacios (1977) and Moldenke (1980) himself. During the present investigation, although a detailed study could not be undertaken, the types of *S. australis* and *S. dichotoma* have been examined and found to differ so greatly as to belong to two distinct species. *S. dichotoma* is regarded as a synonym of *S. cayennensis*.

In Australia, this species has been misidentified as *S. cayennensis* or *S. urticaefolia*. *S. australis* differs by its stem, leaves and inflorescence (spikes) being pubescent, flower-bracts narrowly subulate and mostly less than but sometimes up to 1 mm wide. To the naked eye, specimens of both taxa appear almost identical but the above mentioned differences become obvious when examined under a dissecting microscope.

In the protologue, the given collecting date for the type specimen is "September 29, 1925". The handwritten date on the herbarium label of the type sheet, however, is "28.ix.1925".

According to *Lomax s.n.* (BRI) and *Kansella Bros. s.n.* (BRI), the plant is suspected of killing cattle in Queensland, Australia.

### Affinities

*S. australis* is closely allied to *S. cayennensis* and *S. mutabilis*. For similarities and differences see "Key to the species" and "affinities" under both the species.

***S. Stachytarpheta xadulterina*** Urban & E. Ekman in Urban, Ark. Bot. 22A (1929) 105; Mold., Résumé Verbenac. etc. (1959) 188, 190, 210, 468; Fifth Summary Verbenac. etc. 1 & 2 (1971) 327, 348, 630, 631, 647, 907; Adams, Fl. Pl. Jamaica (1972) 631; Mold., Sixth Summary Verbenac. etc. Phytologia Mem. II (1980) 317, 339, 441, 574; in Dassan. & Fosb., Fl. Ceylon 4 (1983) 252.

*Type: N.L. Britton 3241*, between Mandeville and Brown's Town, Manchester, Jamaica, 3-7.ix.1908 (NY, holotype!).

*Valerianoides jamaicensis* (L.)Kuntze x *V. mutabilis* (Jacq.)Kuntz: Britton in Bull. Torr. Bot. Club 37 (1910) 356, hybrid formula.

*Stachytarpheta xtrimenii* auct. non Rech.: sensu Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 19 [See comments].

*S. jamaicensis* (L.)M. Vahl x *S. mutabilis* (Jacq.)M. Vahl: Britton ex Mold., Prelim. Alph. List Invalid Names (1940) 42 in syn.

*S. mutabilis* (Jacq.)M. Vahl x *S. jamaicensis* (L.)M. Vahl: H.J. Lam, Bull. Jard. Bot. Buitenzorg Sér. III, 3 (1921) 6; Alston in Trimen, Handb. Fl. Ceylon 6 (1931) 230.

This hybrid formula is based on C.A. Backer's 1909 collection from Gunung Bunder, West Java, Indonesia. The specimen is most likely *Backer 31842*, noted as the type of *S. xspeciosa* Danser.

### Description (Fig. 5E)

Shrub with stout branches, 0.6-3 m tall. *Stem* and branches obscurely tetragonal, pubescent but tending to be glabrescent when old. *Leaves* ovate-elliptic, broadly cuneate at base extending into petiole, acute at tip, coarsely crenate, (3-) 4-10 (-13) cm long, (2.5-) 3-5 (-7) cm wide, pubescent on both sides, somewhat hispid on veins beneath, dull-green, not as bullate as those of *S. mutabilis*; petiole winged, pubescent, 5-20 mm long. *Spikes* as thick as that of *S. jamaicensis* but thinner than *S. mutabilis*, (25-) 35-75 (-80) cm long, 5-6 mm diam.; rachis up to 4.5 mm diam., pubescent but tends to be glabrescent when mature; bracts oblong-ovate with scarious margins and extended tip, long acuminate, 7-9 mm long,  $\pm$  2 mm wide, glabrous but ciliate along margins, somewhat striate. *Calyx* sunken in the rachis-furrow, 8-9 mm long, c. 2 mm wide, puberulous-glabrescent and with a few glands outside, glabrous inside, equally 4-toothed. *Corolla* deep purplish-blue, pinkish-lilac or with some shade of violet, 11-16 mm long, 8-12 mm diam. at rim, protrudes c. 5 mm or more beyond calyx-tube; tube cylindrical, somewhat dilated at the top end, sparsely glandular hairy or almost glabrous outside, villous-pubescent inside the upper half. *Stamens* inserted in the corolla-throat, included; filaments 1.5-2.5 mm long, pubescent; anther-lobes divergent, unequal; staminodes 1.5-2.5 mm long, pubescent. *Ovary* elliptic-oblong, glabrous, 1-2 mm long,  $\pm$  1 mm diam.; style filiform, glabrous, included, 10-13 mm long; stigma capitate. *Fruit* not known.

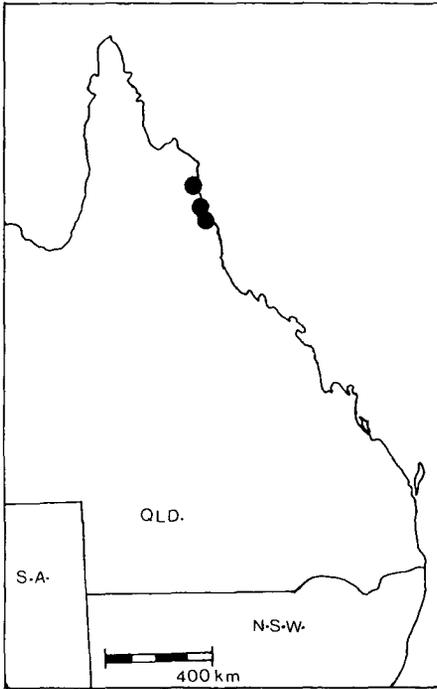
### Specimens examined (collections seen: Australian 3; non-Australian 2)

AUSTRALIA: QUEENSLAND: *Everist 5123*, Port Douglas, 20.v.1952 (BRI, CANB 2 spec., LAE, NY); *Hatfield s.n.*, Rossville, via Cooktown, 20.iv.1956 (BRI 004812); *Stephens 11725*, Smithfield, 11.x.1947 (QRS).

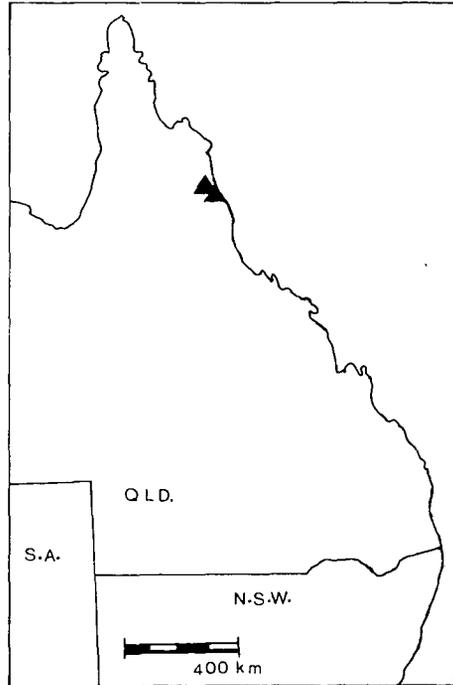
JAMAICA: *Britton 3241*, between Mandeville and Brown's Town, Manchester, 3-7.ix.1908 (NY, holotype!).

### Distribution (Map 5)

In Australia, *S. xadulterina* is known only from the east coast of Cape York Peninsula where it is known to occur in the area between Cooktown and Cairns. From overseas, one collection is known from Papua New Guinea and the type collection from Jamaica was the only other specimen available for examination. In addition to this, Moldenke (1983) has recorded its occurrence in Sumatra (Indonesia), Haiti, Cuba, the Seychelles Islands and New Zealand. According to Moldenke (1983), this hybrid "is thought to have been introduced in New Zealand from the Seychelles Islands". The cold climate of New Zealand, otherwise is not suitable for its natural growth.



Map 5. Distribution of *S. xadulterina*



Map 6. Distribution of *S. xtrimenii*

*Comments*

Adams (1972) has expressed the view that *S. xadulterina* "is intermediate in character between *S. mutabilis* and *S. jamaicensis* and is strongly suspected to have originated as a hybrid between these two species".

According to Moldenke (1983), "the natural hybrid between *S. jamaicensis* (L.)M. Vahl and *S. mutabilis* (Jacq.)M. Vahl has the height of *S. mutabilis*, but the general facies of *S. jamaicensis*. Danser (1929) gives a detailed description of its variable morphologic characters, but unfortunately uses the name, *S. xtrimenii* Rech., for it by mistake. Both Danser and Rechinger described their respective plants as hybrids between "*S. indica*" and *S. mutabilis*. However, Rechinger's "*S. indica*" was actually *S. urticaefolia* (Salisb.)Sims, while Danser's was *S. jamaicensis*. Danser's plant, therefore, was not *S. xtrimenii*, but was *S. xadulterina*".

In his comments on Danser's cross pollination, Moldenke (1983) states: "Danser notes that the description of Rechinger's plant does not agree in all particulars with his plant, but the curator of the Rechinger herbarium in Vienna regarded both plants as the same when he submitted some material of his plant to them. Danser never found *S. xadulterina* wild in Java; he produced his plants by artificial pollination in 1926. He predicts, however, that the hybrid is likely to be found wherever the two parental species grow in proximity, either in the wild or in cultivation. He secured no fruit when he pollinated *S. mutabilis* pistil with *S. jamaicensis* pollen, but the reciprocal cross was very successful, yielding 30 plants. Of these, 14 were typical *S. jamaicensis* and 16 were the hybrid."

Similar to Danser's hybrid, one of Hatfield's (s.n.) collection from Rossville, Queensland, was also "produced by deliberate hand pollination of *S. mutabilis* with *S. jamaicensis*". The collection from Smithfield by S.E. Stephens 11725, however, seems to be the first natural hybrid collected in Australia. A better collection was subsequently made by S.L. Everist 5123 from Port Douglas, Queensland.

According to collectors' field notes, all hybrid collections from Australia have been found in places where the two parent species were growing close to each other.

### Affinities

*S. xadulterina* is intermediate in character between *S. mutabilis* and *S. jamaicensis*. It is nearest to *S. xtrimenii* in its stem and rachis being pubescent-glabrescent; leaves pubescent; flower-bracts oblong-ovate, with scarious margins, up to 9 x 2 mm; calyx about the same length, pubescent-glabrescent outside and corolla purplish-blue to pinkish-lilac. However, *S. xadulterina* can be distinguished by its spikes being c. 10 mm diam. after anthesis; rachis thicker, up to 4.5 mm diam.; flower-bracts glabrous and calyx equally 4-toothed. The spikes in *S. xadulterina* are generally as thick as that of *S. jamaicensis* but thinner than *S. mutabilis*. The spikes in *S. xtrimenii* are less than 10 mm diam. after anthesis; rachis 2.5-3 (-3.5) mm diam.; bracts sparsely pubescent to glabrescent abaxially and calyx unequally 4-toothed.

6. *Stachytarpheta xtrimenii* Rech. in Feddes, Repert. Sp. Nov. Regni Veg. 11 (1913) 189; Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 18-19; Alston in Trimen, Handb. Fl. Ceylon 6 (1931) 230; Alston, Kandy Fl. (1938) 64; Mold., Amer. Midl. Naturalist 59 (1958) 341; Résumé Verbenac. etc. (1959) 191, 199, 222, 349; Fifth Summary Verbenac. etc. 1 & 2 (1971) 281, 327, 333, 351, 369, 630-632; Sixth Summary Verbenac. etc. Phytologia Mem. II (1980) 265, 269, 318, 323, 341, 360, 439, 441; in Dassan. & Fosb., Fl. Ceylon 4 (1983) 251.

*Type: Rechinger 2285, Kandy, Ceylon, -xi.1905 (W, holotype n.v.).*

*S. indica* (L.)M. Vahl x *S. mutabilis* (Jacq.)M. Vahl: Rech. in Feddes, Repert. Spec. Nov. Regni Veg. 11 (1913) 189, hybrid formula for *trimenii* Rech.; Alston in Trimen, Handb. Fl. Ceylon 6 (1931) 230.

*S. xabortiva* Danser, Ann. Jard. Bot. Buitenzorg 40 (1949) 15, syn. nov.; Mold., Résumé Verbenac. etc. (1959) 155, 190, 222, 347-349; Fifth Summary Verbenac. etc. 1 & 2 (1971) 258, 327, 368, 629, 631; Sixth Summary Verbenac. etc. Phytologia Mém. II (1980) 248, 317, 360, 440, 441.

*Type: Produced by the author (Danser) by artificial hybridisation in 1927 (?BO, n.v.).*

*S. xspeciosa* Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 21, fig. 9, tables 1 & 10 [not *S. speciosa* Pohl, 1847]; Mold., Résumé Verbenac. etc. (1959) 349, in syn.; Backer & Bakh.f., Fl. Java 2 (1965) 597; Mold., Fifth Summary Verbenac. etc. 2 (1971) 631, in syn.; Sixth Summary Verbenac. etc. Phytologia Mém. (1980) 439 in syn.

*Type: Backer 31842, Goenoeg Boender, Buitenzorg, Java, Indonesia, 1909 (BO or L, syntype n.v.); Bakhuizen 5302, loc. cit. 16.iv.1921 (L, syntype!).*

*S. jamaicensis* (L.)M. Vahl x *S. mutabilis* (Jacq.)M. Vahl: Danser, Ann. Jard. Bot. Buitenzorg 40 (1929) 21, in syn., hybrid formula for *S. xspeciosa* Danser.

*S. trimenii* Fedde, Just's Bot. Jahresber. 57 (1938) 890, sphalm.

### Description (Fig. 5F)

Shrub branching from the base, tending to be subscaudent, 0.7-2 (-3) m high. *Stem* woody towards the base, sparsely pubescent; branches tetragonal, pubescent. *Leaves* elliptic or ovate-elliptic, cuneate at base; lamina merging into petiole, crenate-serrate, acute at tip, 5-10

cm long, 2.5-6 cm wide, dark-green when alive, somewhat blackish when dry, sparsely hairy above, pubescent below; petiole winged, pubescent, 5-20 mm long. *Spikes* erect, thinner and less pubescent than *S. mutabilis* but thicker and more hairy than *S. cayennensis*, becoming glabrous or sparingly pilose, 40-80 cm long, 5-6 mm diam.; rachis sparingly short pilose, 2.5-3 (-3.5) mm diam.; bracts oblong-ovate, with scarious ciliate margins and long slender tip, acuminate, striate, almost as long as the calyx, 8-9 mm long, c. 2 mm wide, glabrous or sparsely pubescent abaxially. *Calyx* sunken in the rachis-furrow, 4-toothed on top, with a short slit on adaxial side, 9-10 mm long, 2 mm wide, pubescent outside, glabrous inside. *Corolla* varies from bright blue to violet-purple, purplish-pink, deep purple or dark violet, glabrous outside, villous inside the tube in the upper half, the lobes  $\pm$  rounded, spreading to 15 mm diam.; tube cylindrical, slightly curved, somewhat dilated at the top, 12-15 mm long, 1.5-2.5 mm diam. *Stamens* inserted in the corolla-throat, included; filaments filiform, 1-2 mm long, pubescent; anthers with divergent lobes, 1-2 mm long,  $\pm$  1 mm wide; staminodes filiform, villous, 1.5-2 mm long. *Ovary* elliptic-oblong, glabrous, 1.5-2 mm long,  $\pm$  1 mm diam.; style almost included or slightly protruding above the corolla-tube, filiform, glabrous, 12-14 mm long; stigma capitate. *Fruit* oblong,  $\pm$  cylindrical, glabrous,  $\pm$  4 mm long, c. 1.5 mm diam.

*Specimens examined* (collections seen: Australian 2, non-Australian 8)

AUSTRALIA: QUEENSLAND: *Brass 33493*, Kuranda, 7.viii.1966 (BRI, L); *Hopkinson 2*, Black Mountain road c. 3km from Kuranda, 8.iii.1973 (BRI, QRS).

INDONESIA: *Bakhuizen 5302*, Goenoeg Boender, Buitenzorg, Java, 16.iv.1921 (L); *Bakhuizen 6581*, Java, Batavia, Buitenzorg, 19.xii.1924 (BO, L); *Danser 6664*, Java Buitenzorg, 1.vii.1927 (BO); *Danser 6665*, loc. cit. 1.vii.1928 (L); *Danser 6904*, loc. cit. -xi.1928 (L); *Rant 234*, hills behind Saja Road, Karang Pandjang, Ambon, Molucca, 11.vi.1929 (BO, 2 spec.).

HAWAIIAN ISLANDS: *Degener 21485*, Hanalei Valley, Kauai, 29.xii.1951 (BISH, 2 spec.).

### *Distribution* (Map 6)

In Australia, the hybrid *S. xtrimenii* is known only from Kuranda, north of Cairns in Queensland. Collections from overseas have been examined from the Indonesian Islands Java and Ambon, and the Hawaiian Island Kauai. In addition to this, Moldenke (1983) has recorded it in the wild from Mysore in southern India and from Kandy and Matale districts in Sri Lanka.

### *Comments*

The hybrid *S. xtrimenii* is recorded here for the first time from Australia. Previously it was identified as "*S. mutabilis*", "*S. urticaefolia*" or as a probable hybrid between *S. mutabilis* and *S. urticaefolia*.

According to Moldenke (1983) "This natural hybrid is very similar to *S. mutabilis* in its general characters, but the plant is usually lower in growth, the leaves are usually smaller, often more obtuse apically, and less densely pubescent, the rachis is only sparingly short-pilose, and the corollas vary from purplish-pink to purple, deep purple or dark violet and are very hairy within. It is actually a hybrid between *S. urticaefolia* (Salisb.)Sims [*S. cayennensis*] and *S. mutabilis* (Jacq.)M. Vahl-the ancestry given by Rechinger, by Danser, and by Trimen is incorrect because Danser consistently misused the name "*S. jamaicensis*" for what is actually *S. urticaefolia*, while Trimen, Rechinger, and Alston misused the name "*S. indica*" for the same plant."

Moldenke (1983) further states that "the hybrid has a more slender but stronger stem than does *S. mutabilis*, and with a little pruning can be trained to form a small treelet which will bloom profusely all year and make a splendid addition to tropical gardens. Its pollen is more fertile than one would expect from parental species so very different in appearance. Pistil fertility, however, is not so good — usually only 2 or 3 seeds are formed on an entire spike and from 150 seeds only 5 seedlings were secured by Danser. These he was able to grow to maturity in Java and found that they differed notably from each other, with the two sets of parental characters present in different degrees and combinations of each."

Danser (1929) described *S. xabortiva* as a hybrid between *S. cayennensis* (Rich.) Vahl and *S. mutabilis* (Jacq.) Vahl. As mentioned under *S. cayennensis*, this taxon is synonymous with *S. urticaefolia* (Salisb.) Sims. Danser crossed *S. mutabilis* with *S. cayennensis* and *S. cayennensis* with *S. mutabilis*. According to Danser, the pollination of a spike of *S. mutabilis* with pollen of *S. cayennensis* in October 1926 had no success. Hardly any seeds were produced and the few, which were completely developed, did not germinate. In reciprocal pollination in April 1926, Danser pollinated 4 spikes of *S. cayennensis* with pollens of *S. mutabilis* and obtained about 200 seeds. The exact counting of such seeds was not possible because the border between developed and not developed seeds could not be drawn. The result was strange as out of 98 plants obtained only 4 looked like the hybrids, the remaining ones were pure *S. cayennensis*.

"A strange property of the 4 hybrid-plants was that their leaves, especially the ones produced in the first month, were mainly abnormal. Their edges grew slower than the middle part of the lamina resulting in irregularly umbonate leaves with margins often irregularly torn. When the hybrids grew to about half a metre tall they developed only few centimetre long spikes during rainy season and even less in the dry season. In both cases, the spikes dried out at a stage of their development."

*S. xtrimenii* is less densely tomentose than *S. mutabilis* but much more hairy and robust than *S. cayennensis* (= *S. urticaefolia*). According to Wagner et al. (1990), "the hybrids are very similar to *S. mutabilis* but are usually lower in habit with smaller leaves that are less densely pubescent, as is the rachis, and the corolla varies from purplish pink to purple, dark purple, or dark violet."

### Affinities

*S. xtrimenii* is intermediate in character between *S. mutabilis* and *S. cayennensis*. In general appearance, however, it seems to be nearest to *S. xadulterina*. For similarities and differences see "Key to the species" and "Affinities" under *S. xadulterina*. Also see under "Comments" the similarities and differences of *S. xtrimenii* with *S. mutabilis* and *S. cayennensis*.

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