

**A TAXONOMIC REVISION OF THE ASIATIC GENUS PENTASACME
(ASCLEPIADACEAE)**

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SUMMARY

A complete revision of the Asiatic genus *Pentasacme* Wall. ex Wight is given with a key to the four species. The distribution, ecology, and comparative morphology of the genus are discussed and the variation in diagnostic features within the genus is shown by illustration. Two sections are recognized in the genus, one of which is new, and one species is reduced to synonymy.

INTRODUCTION

The rheophytic genus *Pentasacme* is characterized by the presence of lateral cymes borne on alternating sides of the axis at the nodes between the petioles, glandular calyx lobes, and beaked pollinia with median attachment to caudicles. It is a completely Asiatic genus consisting of four species, although previously eight species were recognized (Airy Shaw, 1973), distributed from the western Himalaya, Nepal, Bhutan, the Khasia Hills of India, Bangladesh, Burma, southern China, and Hong Kong through Thailand to the Malay Peninsula. The genus was originally established by Wallich with two species from Sylhet (Bangladesh) in Wight's Contr. Bot. India (1834). Its gender is feminine, not neuter as traditionally treated (Grierson & Long, 1982). The two non-*Pentasacme* species, ?*P. glaucescens* and ?*P. stauntonii*, described with a question mark by Decaisne (1844) from China have already been transferred to *Cynanchum* by Handel-Mazzetti (1936). Bentham (1853) added a third species to the genus from Hong Kong, and Hooker f. (1883) noted the presence of the genus in the western Himalaya and Burma. Ridley (1893) described a monotypic genus, *Spiladocorys*, from the Malay Peninsula, which he himself later treated as a synonym of Wallich's *Pentasacme caudatum* in Fl. Malay Penins. (1923). Another non-*Pentasacme* species, *P. esquirolii*, was also described from China by Léveillé (1914–1915) and has been transferred to *Heterostemma*. MacGregor & Smith (1914) described one new species, *P. shanensis* (= *P. shanense*), from Shan state of Burma, and the most recent addition was *P. pulcherrima* by Grierson & Long (1982) from Bhutan and Nepal. The name *P. brachyantha*, used for Chinese elements by Handel-Mazzetti in 1924, is a synonym of *Cynanchum stauntonii* (Decne.) Hand.-Mazz. The genus has never been subject to a taxonomic revision (Rahman, 1990a) and, as noted by Van Steenis (1981), in the absence of a revision species distinction is more or less tentative.

A critical examination of all the available material of *Pentasacme*, including types, in ABD, BM, CAL, CGE, DACB, E, K, K- W, L, and P showed that the genus is represented by only four species, and that the material of *P. championi* Benth. belongs to the same species as *P. caudatum* Wall. ex Wight. Bentham (1853), while describing that species from Hong Kong, mentioned that "it may possibly prove to be a mere variety of *P. caudatum*, but the floral characters do not agree sufficiently well with those described by Decaisne for me to venture to unite them, without better materials than I now possess to enable me to judge of the variations of the Sylhet plant."

Some specimens from China and Hongkong, identified as *P. championi* Benth. as their leaf morphology and habitat are strikingly similar to that species, do not belong to this genus, however. Close examination of the flowers of these specimens indicates that they have pendulous (not erect) pollinia and that these specimens should be transferred from the Marsdenieae to the Asclepiadeae. In addition, the coronal scales in all these specimens are attached to the staminal column and not to the corolla. The correct name for these specimens is being investigated as part of our study of the family in tropical Asia (Rahman & Wilcock, 1989a, 1989b, 1990).

PENTASACME

Pentasacme Wall. ex Wight, Contr. Bot. India (1834) 60; Hook. f., Fl. Brit. India 4 (1883) 28; Ridley, Fl. Malay Penins. 2 (1923) 383; Tsiang & Li, Fl. Reip. Pop. Sinic. 63 (1977) 413. — Type species: *Pentasacme caudatum* Wall. ex Wight.
Spiladocorys Ridley, Trans. Linn. Soc. ser. II, 3 (1893) 332.

Erect or sometimes pendulous, rheophytic, perennial herbs. Stems mostly slender, branching nearly from the base. Leaves linear-lanceolate or ovate-elliptic, acuminate, base cuneate, subsessile, glands present at the junction of petiole and lamina. Cymes umbelliform, solitary at the nodes, on alternate sides of the axis, glabrous; peduncles very short (less than 2 mm); pedicels filiform; bracts glabrous. Flowers white, small or large. Calyx lobes ovate-acuminate or ovate-lanceolate, tip acute, glabrous, glandular within at the angles. Corolla campanulate; tube very short; lobes ovate-acuminate with long narrow apices or oblong-lanceolate, tip obtuse, glabrous, overlapping to the right in bud. Corona cup-shaped or reduced to scales, adnate to the corolla tube. Staminal column very short; anthers fleshy, tips membranous; stigma sessile, conical or beaked. Pollinia beaked, with median attachment to caudicles, erect, solitary in each anther loculus. Follicles slender, terete, glabrous. Seeds with a tuft of hairs at one end.

Distribution — The genus is distributed throughout the western Himalayan region including Nepal and Bhutan, and the Khasia Hills of India, Bangladesh, Burma, and southern China including Hong Kong, and through Thailand to the Malay Peninsula (figs. 3 & 6).

Ecology — The genus *Pentasacme* has a unique ecology within the family Asclepiadaceae. The species inhabit damp rock ledges in waterfalls, moist banks, and stream beds, and are rheophytic. The peculiar environmental conditions occupied by this genus impose marked effects on leaf form. The leaves are distinctly thin and, when

dry, very fragile. Linear and broader leaved forms occur within the genus, species with elliptic or ovate-elliptic leaves are found as erect or hanging perennials in very moist conditions, while the species with long linear or linear-lanceolate leaves live as erect perennials in stream beds or waterfalls.

COMPARATIVE MORPHOLOGY

Stems — *Pentasacme* stems are slender and about 30–60 cm long and branched nearly from the base. Two species have glabrous stems, but those of *P. shanensis* are sparsely hairy at the nodes, while the stems of *P. pulcherrima* are pubescent all over.

Leaves — There are two distinct types of leaves. In *P. caudatum* and *P. shanensis* they are long, narrow or linear-lanceolate (figs. 1 & 2) whereas in two other species, *P. pulcherrima* and *P. wallichii*, they are elliptic-ovate (figs. 4 & 5).

Inflorescences — Inflorescences are interpetiolar, a specific character of asclepiads (Nolan, 1969), and borne on alternate sides of the axis. Nolan showed that the apical dome of *Asclepias syriaca* bifurcates giving rise to an inflorescence from one apex and a continuing functional apex on the other. The bifurcation appears to be slightly unequal accounting for the displacement of the peduncle. These bifurcations are not associated with subtending organs and therefore, according to Nolan, the branching of the stem does not conform to the expected monopodial or sympodial systems of angiosperms. The inflorescence, therefore, is clearly non-axillary and in the fresh material gives the impression of being alternate. Pedicels are very short (1–2 mm). Peduncles of *P. caudatum* are short (less than 1 cm) whereas they are longer (1–3 cm) in the other three species. Each peduncle of *P. pulcherrima* produces 3–5 pedicels, but these are more than 5 in the other three species.

Flowers — Flowers are 5-merous and radially symmetrical with imbricate aestivation in bud. Calyx lobes free, glandular within at the angles, and of two types: 1) ovate-acuminate in *P. caudatum*, and 2) ovate-lanceolate in the other three species. Corolla white with two types of lobes: ovate-acuminate with long narrow apices in *P. caudatum*, and oblong-lanceolate in the three other species (figs. 1, 2, 4 & 5).

Corona — The corona is corollin in origin and largely variable in structure. Two types of corona are present in *Pentasacme*. In *P. shanensis* it is fleshy and cup-shaped with five rounded lobes (fig. 2c) at the base of the corolla tube, but in the other species the corona is represented only by five separate scales borne on the tube between the lobes. The coronal scales in *P. caudatum* are denticulate (fig. 1c), whereas in *P. pulcherrima* and *P. wallichii* they are with either obtuse (fig. 4c) or acute (fig. 5b) tips.

Pollinia — Pollinia are ovate to ovate-lanceolate, beaked with median attachment to the caudicles. The variation in shape of the pollinia and corpuscles, and the attachment of the pollinia to the translator arms, are shown in figures (figs. 1e, 2b, 4d & 5b). Pollinia with beaks at the tips and median attachment to caudicles are characteristic of the genus (Rahman, 1990b).

INFRAGENERIC CLASSIFICATION

Within the Asclepiadaceae, *Pentasacme* is placed in the Tribe Marsdenieae of subfamily Asclepiadoideae. The four species recognized in this genus fall in two readily distinct groups; the species with narrow leaves and small flowers in one group and the species with broad leaves and large flowers in the other group. Grierson & Long (1982), while describing a new species of *Pentasacme*, have already suggested the subdivision of the genus into two groups based on leaf and flower size, and we are inclined to divide the genus into two sections. The residual section *Pentasacme* includes *P. caudatum* and *P. shanensis*. The two other species, *P. pulcherrima* and *P. wallichii*, are placed in a new section. The two sections are readily separable and are described below:

PENTASACME Wall. ex Wight

Section 1. Pentasacme

Leaves linear or linear-lanceolate, less than 13 mm broad. Flowers small; corolla lobes less than 10 mm long. — Type species: *Pentasacme caudatum* Wall. ex Wight.

Section 2. Wallichiana Rahman, *sect. nov.*

Foliis ellipticis vel elliptico-ovatis, latioribus quam 15 mm. Floribus grandibus; lobis corollae longis quam 10 mm. — Typus sectionis: *Pentasacme wallichii* Wight.

Leaves elliptic or elliptic-ovate, more than 15 mm broad. Flowers large; corolla lobes more than 10 mm long. — Type species: *Pentasacme wallichii* Wight.

KEY TO THE SPECIES

- 1a. Leaves linear or linear-lanceolate, less than 13 mm broad. Flowers small; corolla lobes less than 10 mm long 2
- b. Leaves elliptic or ovate elliptic, more than 15 mm broad. Flowers large; corolla lobes more than 10 mm long 3
- 2a. Stems glabrous. Pedicels of cymes 0.4–0.8 cm long. Corolla lobes 6–8 mm long. Coronal scales 5, denticulate **1. *P. caudatum***
- b. Stems sparsely hairy at the nodes. Pedicels of cymes 2–3 cm long. Corolla lobes 4–5 mm long. Corona cup-shaped with 5 rounded lobes
2. *P. shanensis*
- 3a. Stems pubescent. Corolla lobes 20–30 mm long. Coronal scales with obtuse tips **3. *P. pulcherrima***
- b. Stems glabrous. Corolla lobes 10–13 mm long. Coronal scales with acute tips
4. *P. wallichii*

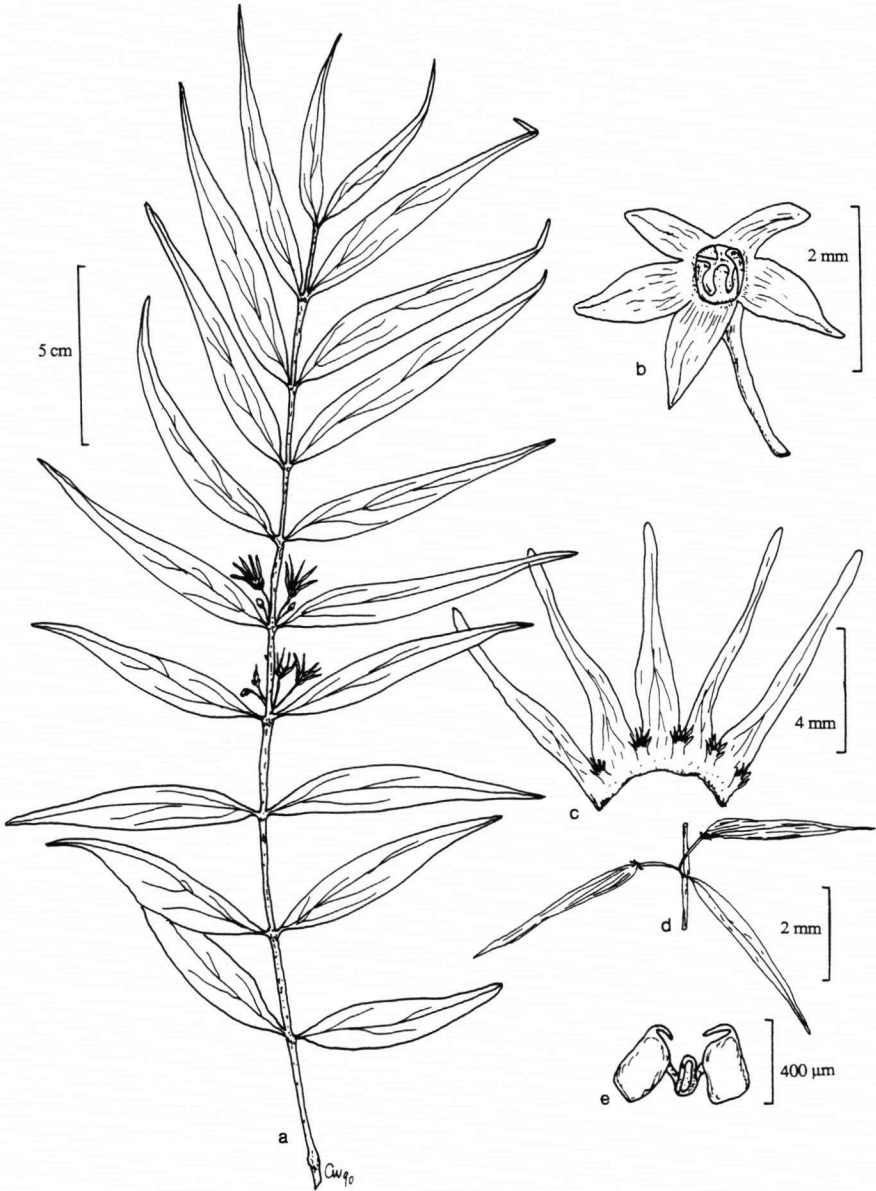


Fig. 1. *Pentasacme caudatum* Wall. ex Wight. a. Habit; b. gynostegium and sepals; c. corolla with coronal scales; d. fruits; e. pollinarium (Lamont 464, BM).

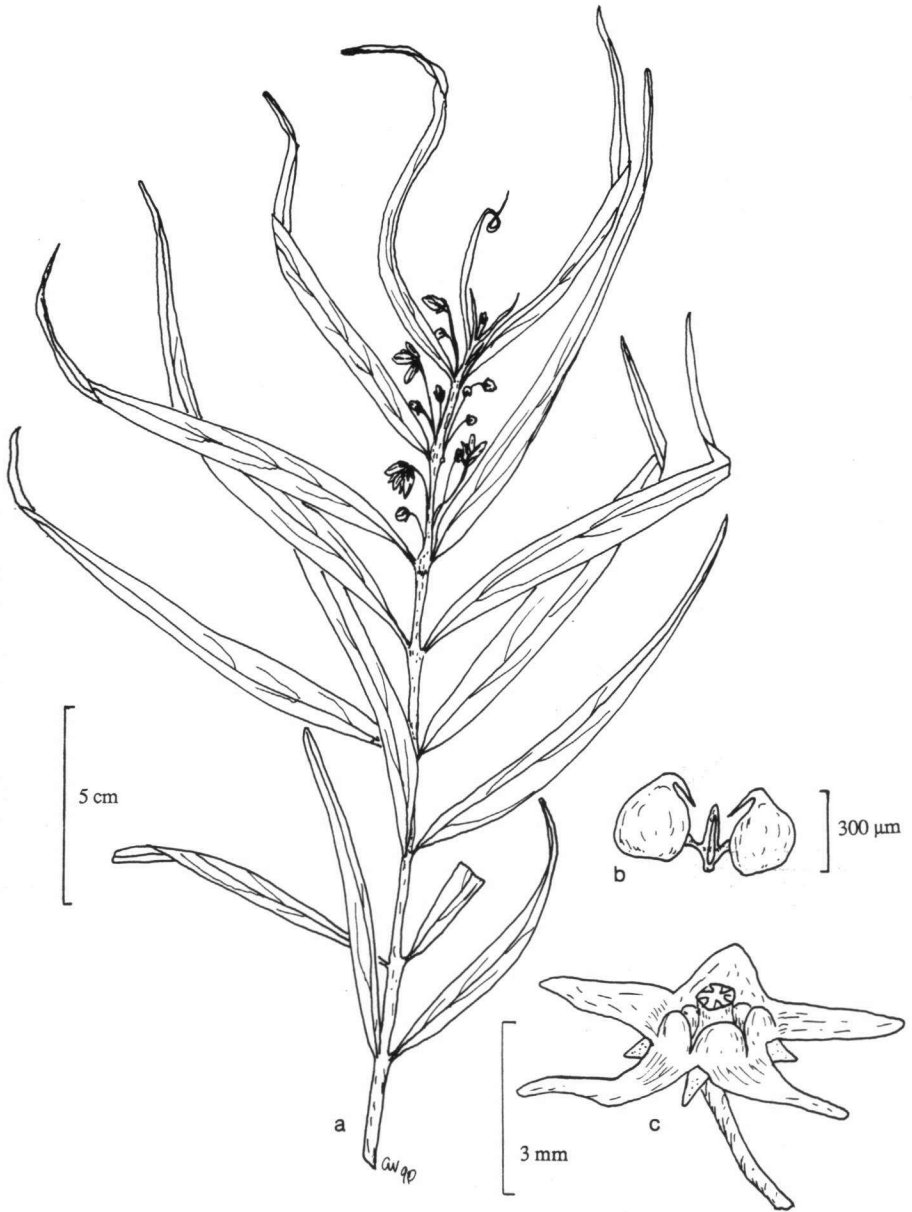


Fig. 2. *Pentasacme shanensis* MacGregor & Smith. a. Habit; b. pollinarium; c. open flower showing exserted stigma, corolla and coronal scales, and calyx lobes (Parkinson 1184, K).

TAXONOMY

Section *Pentasacme*1. *Pentasacme caudatum* Wall. ex Wight – Fig. 1.

- Pentasacme caudatum* Wall. ex Wight, Contr. Bot. India (1834) 60; Decne. in DC., Prodr. 8 (1844) 627; Hook. f., Fl. Brit. India 4 (1883) 28; Ridley, Fl. Malay Penins. 2 (1923) 383; Kerr, Fl. Siam. 3, 1 (1951) 19; Hundley, List Burma (1961) 169; Rahman, J. Asiatic Soc. Bangladesh 14, 2 (1988) 96. — Type: Bangladesh, Sylhet, *Wallich, Asclep. no. 75* (K-W, holo; E, K, iso).
Spiladocorys angustifolia Ridley, Trans. Linn. Soc. ser. II, Bot. 3 (1893) 322, t. 63. — Type: Malay Peninsula, Perak, waterfall, 1892, *Ridley 2885* (BM).
Pentasacme championi Benth., J. Bot. Kew 5 (1853) 54; Tsiang & Li, Fl. Hainanica 3 (1974) 264; Fl. Reip. Pop. Sinic. 63 (1977) 415. — Type: Hong Kong, Mount Gough, Happy Valley Waterfall, *Champion 192* (K).

A small, erect herb. Stem slender, glabrous, 30–50 cm long. Leaves almost sessile, linear-lanceolate, tip acute, lamina 6–9 × 0.8–1 cm, glabrous on both sides, midrib and margin hairy; pedicels 4–8 mm long, capillary; bracts 2 × 1 mm, ovate-lanceolate, tips acute. Calyx lobes 2–3 × 1 mm, ovate-acuminate. Corolla lobes ovate-acuminate, c. 2 mm wide at base, narrow above with long (6–8 mm) filiform apices. Coronal scales 5, adnate to the corolla tube between the lobes, fleshy, broadly ovate, margin denticulate, never exceeding the staminal column. Anthers with obtuse tips. Pollinia ovate. Corpuscles narrow, longer than translator arms. Stigma obtuse. Gynostegium almost sessile. Follicle single, slender, 5–7.5 cm long. Seeds ovate or oblong spatulate, convex on both sides.

Distribution – From the Khasia Hills of India, Bangladesh, Burma, southern China and Hong Kong through Thailand to the Malay Peninsula (fig. 3).

Ecology – Common in forest streams, alt. 0–1300 m. Flowering and fruiting between June and September.

Representative specimens: BANGLADESH. Sylhet, locality not attached, *Wallich Cat. no. 8234A* (BM, CGE, K, K-W) and *Wallich Asclep. no. 75a & 75c* (E, isotype). — BURMA. Tara Hka, *Kaulback 355* (BM). — CHINA. Hainan, Canton, *McClure 8555* (BM); Chem Shan, Fan Maan Ts'uen, *Fung 20207* (BM, K); Po-ting, *Haw 72172* (BM). — HONG KONG. Mount Cough, Happy Valley Waterfall, *Champion 192* (K); same locality, *Lamont 464* (BM), *Herb. Hance 720* (BM). — INDIA. Khasia Mt, alt. 2000–4000 ft, *J.D.H. & T.T. s.n.* (BM, CGE, K, L); same locality, *C.B. Clarke 5562* (BM), *Griffith 162* (CCE), *Rupchand 6361* (L); Cherra punji, alt. 4000 ft, 16.6.1952, *Walter 30287* (L). Assam, Notneng, *Biswas 3839* (CAL); Behover, *Reporter on Econ. Prod. Ind. 11108* (BM, CAL). — MALAY PENINSULA. Perak, Sira Rimau, 1989, *Yapp 538* (ABD); Waterfall Hill, *Ridley 2885* (BM); Pahang, Sungai Teku, 20.11.68, *Mohmd. Shah 1344* (L), *Kiah 31703* (BM). — THAILAND. Chantaburi, Krat, Takum, *Pui 2892* (BM); Dan Champon, *Kerr 17666* (ABD); Nakawn Sritamarat, Kao Ram, *Smith 597* (K).

2. *Pentasacme shanensis* MacGregor & Smith – Fig. 2.

- Pentasacme shanensis* MacGregor & Smith, Rec. Bot. Surv. India 6 (1914) 101; Hundley, List Burma (1961) 169. — Type: Burma, Southern Shan State, *MacGregor 535* (E, iso).

An erect herb. Stems slender, glabrous, sparsely hairy at the nodes. Petioles very short, less than 2 mm long, pubescent. Leaves linear, tip acute, lamina 4.5–12 × 0.3–

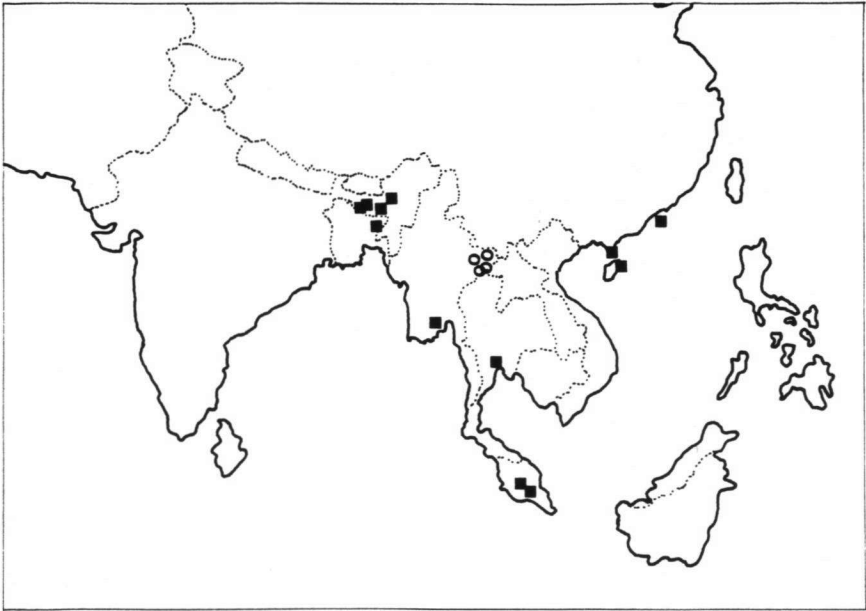


Fig. 3. Geographic distribution of *Pentasacme caudatum* Wall. ex Wight (■) and *P. shanensis* MacGregor & Smith (○).

0.8 cm, glabrous except for the margins; pedicels 2–3 cm long; bracts 2×1 mm, ovate-lanceolate, tips acute. Calyx lobes ovate-lanceolate, $2-3 \times 1.5-2$ mm. Corolla lobes oblong-lanceolate, $4-5 \times 1.5-2$ mm. Corona entire, cup-shaped, fleshy, adnate to the base of the corolla tube; lobes 5, fleshy, rounded, never exceeding the staminal column. Anthers ovate. Pollinia globose. Corpuscles oblong-lanceolate, as long as the translator arms. Staminal column c. 2.5 mm long. Stigma exserted above anthers. Follicles not seen.

Distribution – Burma (fig. 3).

Ecology – Common in forest streams of mountains, from 0–1100 m alt. Flowering between June and August.

Representative specimens: BURMA. Southern Shan State, *MacGregor 535* (E); May Myo Dist., Plateau, alt. 3500 ft, 28.6.1913, *Lace 6239* (K); Laughing water, alt. 3000 ft, 2.7.1925, *Parkinson 1184* (K); Mardacey, alt. 3500 ft, Aug. 1913, *English 48* (K); Northern Shan State, Niansam Talls, alt. 1800 ft, 6.7.1912, *Lace 5846* (K).

Section *Wallichiana*

3. *Pentasacme pulcherrima* Grierson & Long – Fig. 4.

Pentasacme pulcherrima Grierson & Long, Notes Roy. Bot. Gard. Edinb. 40 (1982) 123, fig. 3. — Type: Bhutan, Samdrup Jonkhar to Deothang road, *Grierson & Long 2137* (E, holo; K, iso).

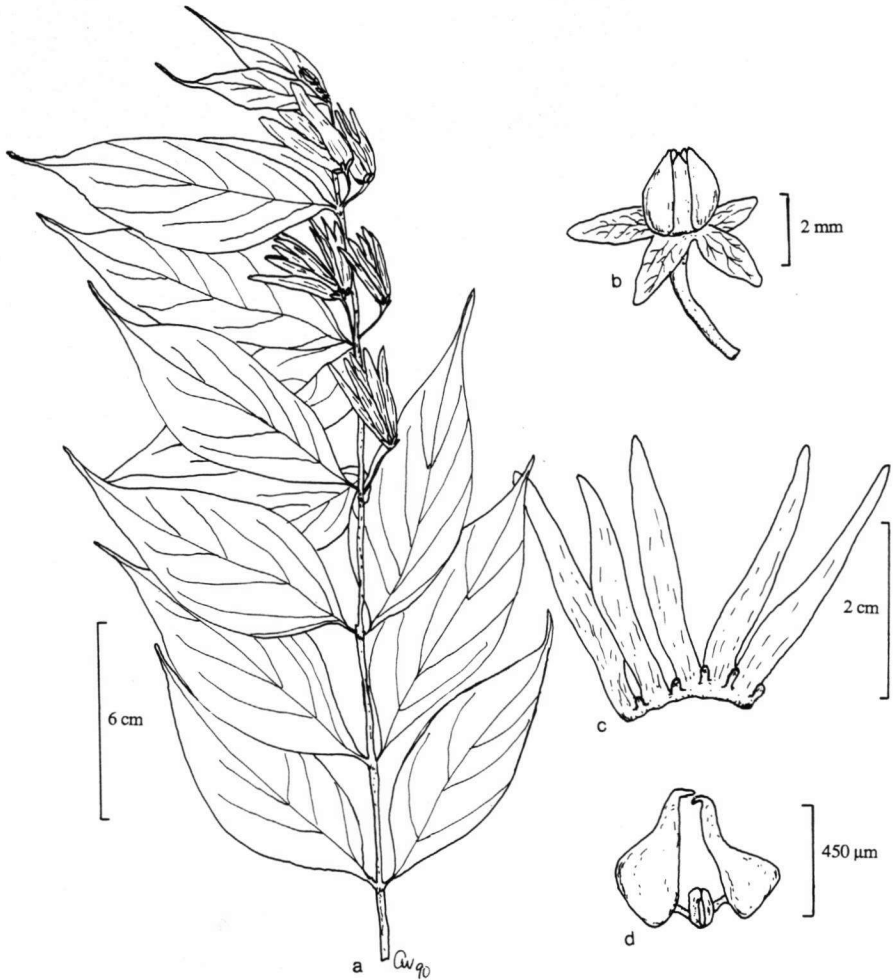


Fig. 4. *Pentasacme pulcherrima* Grierson & Long. a. Habit; b. gynostegium and calyx lobes; c. corolla with coronal scales, d. pollinarium (Grierson & Long 2137, E).

An erect herb. Stems pubescent. Petioles 3–7 mm long. Leaves ovate-elliptic, acuminate, lamina 6–13 × 2–4 cm, margin and midrib pubescent beneath. Cymes 3–5-flowered; pedicels 1–2 cm long; bracts 1.5 × 1 mm, ovate-lanceolate, tips obtuse. Calyx lobes ovate-lanceolate, 2.5 × 2 mm. Corolla lobes oblong-lanceolate, 20–30 × 2.5–3.5 mm. Coronal scales adnate to the corolla tube between the lobes, small, oblong, tip obtuse. Anthers broadly acute. Pollinia ovate. Corpuscles ovate, shorter than translator arms. Gynostegium sessile. Stigma conical, concealed by anthers. Follicles not seen.

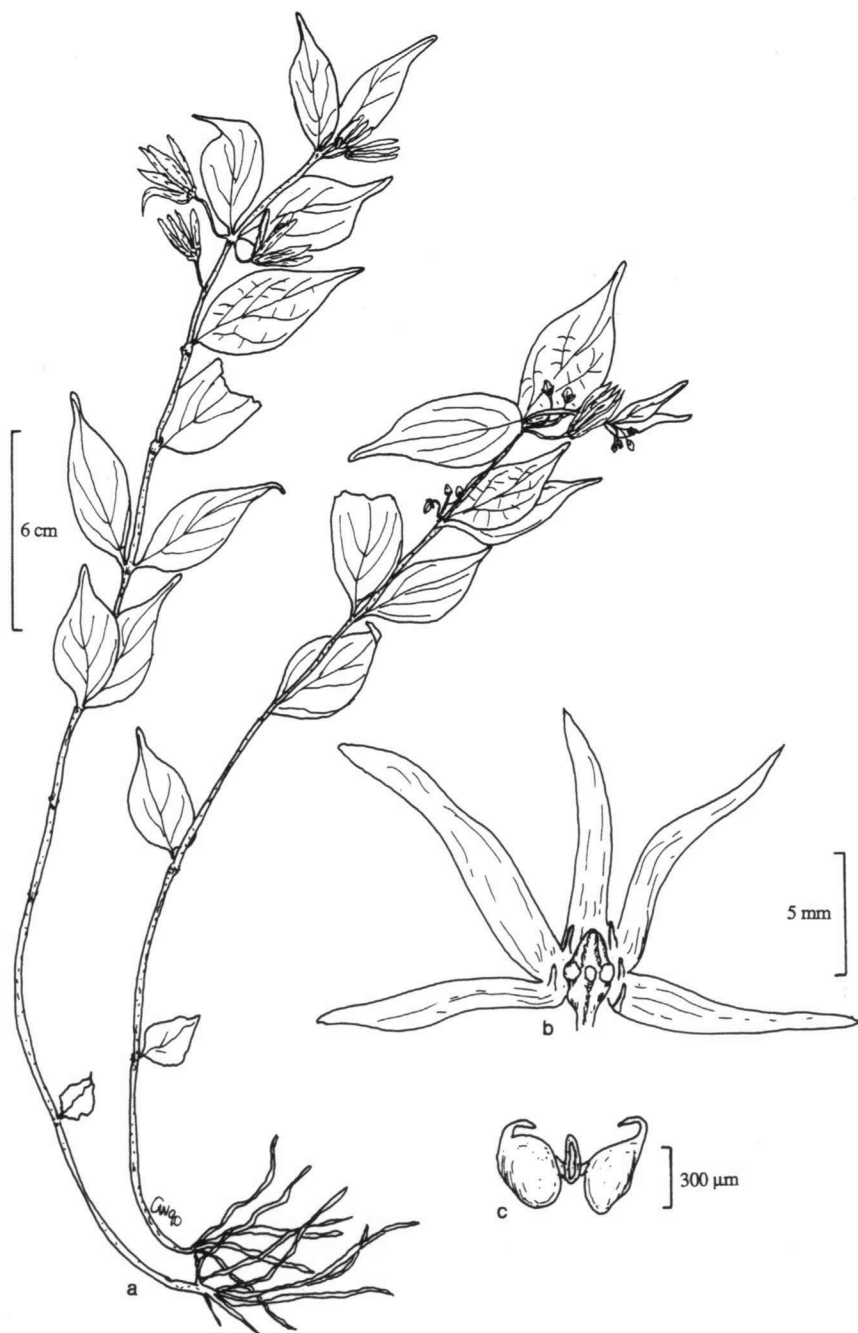


Fig. 5. *Pentasacme wallichii* Wight. a. Habit; b. corolla cut open to reveal coronal scales and gynostegium; c. pollinarium (Stainton 5476, E).

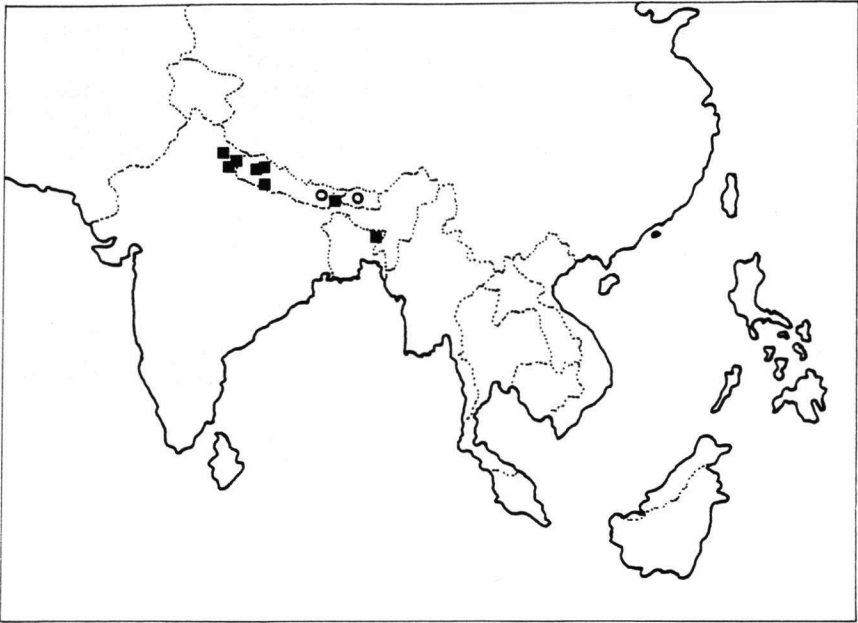


Fig. 6. Geographic distribution of *Pentacacme pulcherrima* Grierson & Long (O) and *P. wallichii* Wight (■).

Distribution – Bhutan and Nepal (fig. 6).

Ecology – Grierson & Long collected this species from a shaded steep bank in hot jungle near Samdrup Jonkhar at 550 m alt. Flowering between June and September.

Representative specimens: BHUTAN. Samdrup Jonkhar to Deothang road, 8 km above Samdrup Jonkhar, alt. 550 m, 21.6.1979, *Grierson & Long 2137* (E, holo; K, iso). — NEPAL. Chula Chuli, alt. 230 m, 15.9.1967, *Williams & Stainton 8499* (BM, K).

4. *Pentacacme wallichii* Wight – Fig. 5.

Pentacacme wallichii Wight, *Contr. Bot. India* (1834) 60; Decne. in DC., *Prodr.* 8 (1844) 627; Delessert, *Icon. Select. Plant.* 5 (1846) t. 87; Hook. f., *Fl. Brit. India* 4 (1883) 28; Hara, *Enum. Flr. Pl. Nepal* 3 (1982) 87; Rahman, *J. Asiatic Soc. Bangladesh* 14, 2 (1988) 97. — Type: Bangladesh, Sylhet, *Wallich Asclep. no. 74* (E).

A small erect or pendulous herb, 40–60 cm long. Stems and branches slightly stout, glabrous. Petioles 2–4 mm long. Leaves ovate-elliptic, acuminate, tip sub-acute, lamina 5–8 × 1.5–2.5 cm, midrib and nerves pubescent beneath. Cymes few-flowered; pedicels 1–1.5 cm long; bracts 2 × 1 mm, linear-lanceolate, tips acute. Calyx lobes ovate-lanceolate, 2.5 × 2 mm. Corolla deeply lobed; lobes oblong-lanceolate, 10–13 × 2–3 mm. Coronal scales adnate to the corolla tube between the lobes, small, never exceeding the staminal column, tip acute. Anthers ovate-acumi-

nate. Pollinia ovate-lanceolate. Corpuscles narrow, longer than translator arms. Stamininal column about 2 mm long. Stigma exerted above anthers. Follicles spindle-shaped, c. 5.2 cm long, tapering at both ends, slightly stout, smooth.

Distribution — Throughout the western Himalayas of India, Nepal and Bangladesh (fig. 6).

Ecology — In clumps or hanging from rocks of cliff ledges by running water. Flowering and fruiting between May and August.

Representative specimens: BANGLADESH. Sylhet, locality not attached, *Wallich Asclep. no. 74* (E, holo; K, iso), *Wallich Cat. no. 8235* (CGE, E, K, K-W); Sylhet, *Wallich s.n.* (K); E Bengal, locality not attached, *Griffith 3774* (K). — INDIA. Western Himalaya, Kumaun: Sarju Valley, alt. 4000–5000 ft, 14.8.84, *Duthie 3147* (E), *Inayet (Duthie's collector) 24687* (CAL, K); near Garua, *Reid s.n.* (E); Khar Bazar, *Bilkasar 2319* (E); W Kapkot, alt. 3500 ft, *Strachey & Winter-Bottom s.n.* (K); locality not attached, *Stewart 21342* (E), *Strachey & Winter-Bottom 239* (CAL). — NEPAL. W Nepal, Bim Khola, east of Kutharpekot, 27.4.1954, *Stainton et al. 272* (BM, E); Jaldi Gad, Bheri Valley, alt. 6500 ft, 28.6.1966, *Stainton 5476* (E); Barpak, 16.10.88, *Stainton 8463* (E).

EXCLUDED TAXA

Pentasacme glaucescens Decne. in DC., Prodr. 8 (1844) 627 = *Cynanchum glaucescens* (Decne.) Hand.-Mazz., Symb. Sin. 7 (1936) 994.

Pentasacme stauntonii Decne., l.c. = *Cynanchum stauntonii* (Decne.) Hand.-Mazz., l.c. 7 (1936) 996.

Pentasacme esquirolii Léveillé, Fl. Kouy-Tcheon (1914–15) 43 = *Heterostemma esquirolii* (Levl.) Tsiang, Sunyatsenia 3 (1936) 189.

Pentasacme brachyantha Hand.-Mazz., Anz. Akad. Wiss. Wien, Math.-Nat. 61 (1924) 168 = *Cynanchum stauntonii* (Decne.) Hand.-Mazz., l.c. (1936).

ACKNOWLEDGEMENTS

We thank Professor D.M. Moore (University of Reading) and Dr. A.R. Berg for going through the manuscript and offering valuable suggestions. We are most grateful to the Directors of the following herbaria for putting their material at our disposal: ABD, BM, CAL, CGE, DACB, E, K, K-W, L, and P. The project was funded by the British Council for which we are gratefully indebted.

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