



New species and combinations of *Secamone* (Apocynaceae, *Secamonoideae*) from South East Asia

J. Klackenberg¹

Key words

Apocynaceae
Indonesia
Malaysia
new combinations
new species
Secamone
Toxocarpus

Abstract Five new species of *Secamone* (Apocynaceae, *Secamonoideae*) from Malaysia and Indonesia, viz. *S. lenticellata* from Sarawak, *S. coronata* and *S. longituba* from Kalimantan, *S. sumatrana* from Sumatra, and *S. kunstleri* from the Malayan Peninsula, are described, illustrated and compared with related taxa. Furthermore, ten new combinations are proposed: *Secamone curtisii*, *S. glabrescens*, *S. griffithii*, *S. lagenifera*, *S. langkawiensis*, *S. penangiana*, *S. rhopalophora*, *S. scortechinii*, *S. siamensis* and *S. spirei*.

Published on 19 October 2010

INTRODUCTION

During continuing studies of subfamily *Secamonoideae* (Apocynaceae) for Flora Malesiana I have come across some specimens from Borneo, Sumatra and the Malayan Peninsula that do not fit into any known taxon and are here described as five new species of *Secamone* R.Br. The paleotropic genus *Secamone* is distributed in tropical as well as in southern Africa, being particularly species rich in Madagascar (Goyder 1992, Klackenberg 1992b, 2001). In Asia it is found in Sri Lanka and southern India to the Himalayas, and from southern China in the northwest through Malesia to eastern Australia and New Caledonia (Klackenberg 1992a, Forster 1996). Recent studies from the Malesian region have dealt with new taxa from Borneo and Sulawesi (Klackenberg 2004, 2006). See those papers for a longer introduction to the genus.

The five species here described have elongated style heads, and colleters at the very base of the upper surface of the leaf lamina. These characters would place them in the genus *Toxocarpus* Wight & Arn., one of the genera of *Secamonoideae* that usually has been accepted in Malesia and SE Asia. However, taking into account the broad morphological variation within *Secamone* in Africa, notably Madagascar, Klackenberg (2001, 2004) argued, following Schumann (1895) and Forster (1991, 1996), that *Secamone* (Brown 1810) and *Toxocarpus* (Wight 1834) are congeneric. Consequently, the new taxa are here described in *Secamone*. Furthermore, several new combinations for *Toxocarpus* species from South East Asia are necessary. Below, ten taxa known from the area and discussed in relation to the new species are transferred from *Toxocarpus* to *Secamone*.

Material from the following herbaria has been studied: A, B, BKF, BM, BR, C, CAL, E, FG, G, GH, K, L, MICH, MO, NY, S, SING, U, US, Z.

DESCRIPTION OF NEW TAXA

1. *Secamone lenticellata* Klack., sp. nov. — Fig. 1; Map 1

Species haec *Secamoneae griffithii* (Decne.) Klack., *S. glabrescenti* (M.R.Hend.) Klack. et *S. badiiae* Klack. similis inflorescentiis apicem versus ad ramulis floribus in fasciculos dispositis, sed differt lenticellis prominentibus et lobis corollae ad basim non nisi breve coalescentibus. — Typus: *Chai S.30061* (holo L), Malaysia, Sarawak, G. Api, Ulu Melinau, 4th Division, c. 120 m alt., 2 Sept. 1970.

Suffrutescent twiner; branches furnished with prominent lenticels and covered with appressed reddish hairs. Leaves opposite, herbaceous; blade c. 7–10 by 3–4 cm, elliptic to somewhat obovate, cuneate at base, acute to shortly acuminate at apex, sparsely hairy when young, glabrescent, with 3–6 colleters at the very base above; venation pinnate, looped, only faintly visible when dry; midrib slightly raised on both sides when dry; primary nerves 10–15 pairs, diverging at 70–80° from the mid-nerve, ± straight and parallel; epidermis smooth on both sides; petiole 10–20 mm long, with short reddish hairs when young, glabrescent. Inflorescences extra-axillary, much shorter than the adjacent leaves, 1–4 cm long; cymes irregularly mono- to dichasially branched with longer and shorter axes alternating with the flowers placed in dense clusters apically on spike-like structures, with dense short reddish hairs; axes variable in length from very short to 10 mm long; pedicels short, up to 1 mm long; bracts c. 0.5 mm long, broadly triangular with rounded apex. Calyx lobes longer than the corolla tube, 0.6–0.8 by 0.6–0.8 mm, very broadly ovate, acute but rounded at the very apex, with short reddish hairs outside, glabrous inside. Corolla cylindric in bud, contorted with the left lobe margin overlying and with the lobes fused at base for c. 1/8–1/9 of their length into a tube, twisted to the right, green-white to cream; tube barrel-shaped, 0.4–0.6 mm long, hairy inside; lobes probably ± erect, 3–3.7 by 0.4–0.6 mm, oblong, obliquely rounded at the apex, hairy basally along c. 1/3 of its length in a filled-in triangle. Stamens in a column, inserted at the base of the corolla tube. Staminal column 0.8–1 mm high. Corona lobes entire, at base broad with flat back and somewhat hastate, towards apex laterally compressed and falcate, acute at apex, about as long as thecae to slightly projecting above. Anther wings longer than the thecae, 0.3–0.4 mm long. Pollinia 2 smaller

¹ Naturhistoriska riksmuseet, Sektionen för fanerogambotani, Box 50007, SE-10405 Stockholm, Sweden; e-mail: klack@nrm.se.

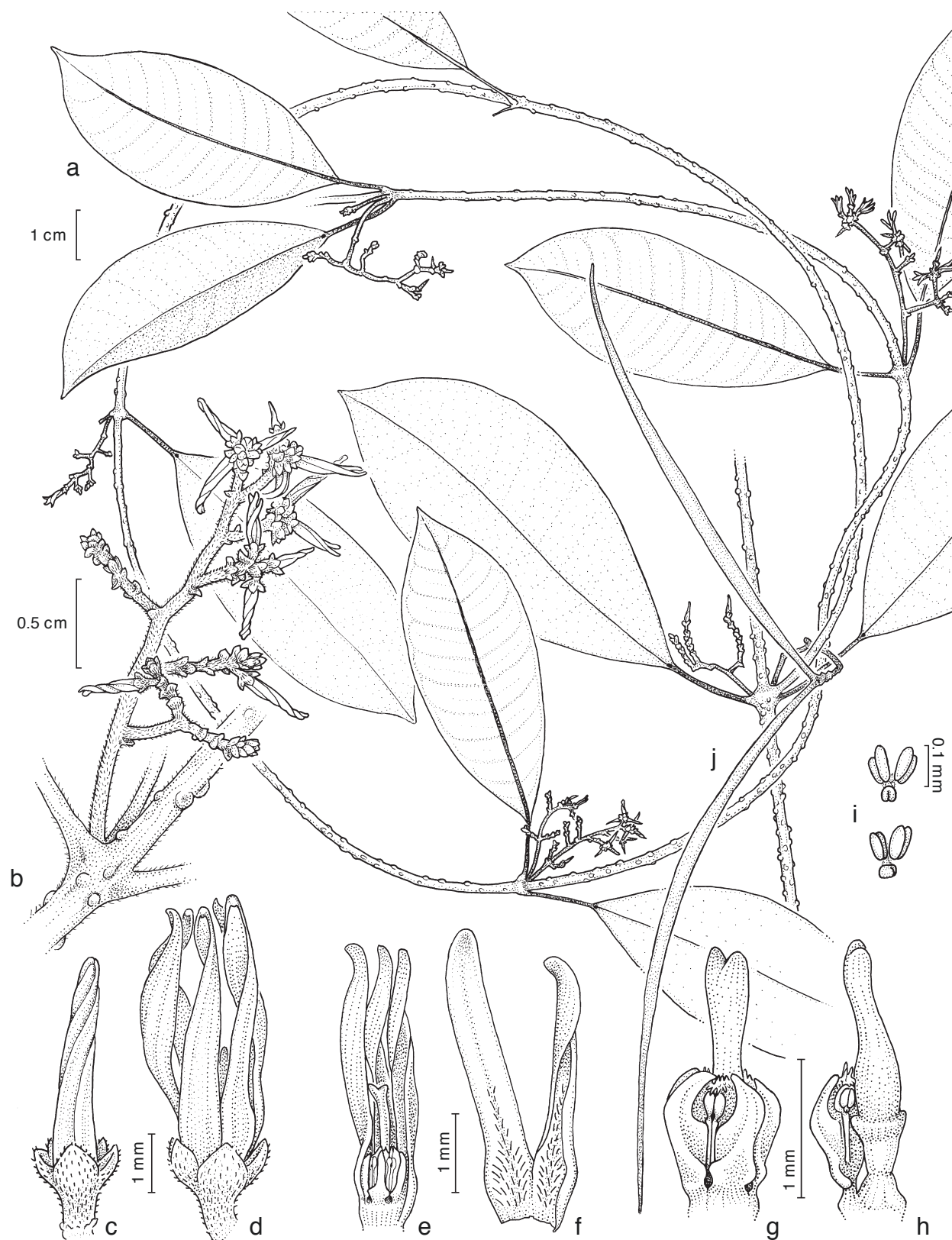


Fig. 1 *Secamone lenticellata* Klack. a. Habit; b. inflorescence; c. flower in bud; d. flower at anthesis; e. flower with calyx and two corolla lobes removed; f. portion of corolla from within; g. gynostegium; h. part of ovary, style head and one stamen; i. pollinaria; j. follicles (all: *Chai S.30061*). — Drawn by Andrea Klintbjer, Stockholm.

and 2 larger, distinctly separated from each other, larger ones c. 0.1 mm long, ellipsoidal. *Ovary* of two mostly separate carpels, subinferior, glabrous. *Style head* projecting about twice as long as the staminal column, distinctly exserted from the corolla tube; apical portion 2–4 times as long as the basal portion, 1.1–1.4 mm long, slightly bifid, cylindric or somewhat broadened near base. *Follicles* c. 11 by 0.4 cm, linear, thin-walled, covered with short reddish hairs, recurved $\pm 45^\circ$. *Seeds* not seen.

Distribution — Malaysia: Sarawak.

Habitat & Ecology — In primary forest at 120 m altitude, on dark alluvium and sandstone. Flowering: September.

Note — This species is distinguished by having flowers in spike-like structures in branched inflorescences and by its prominent lenticels. The staminal corona lobes are entire, not cleft at apex.

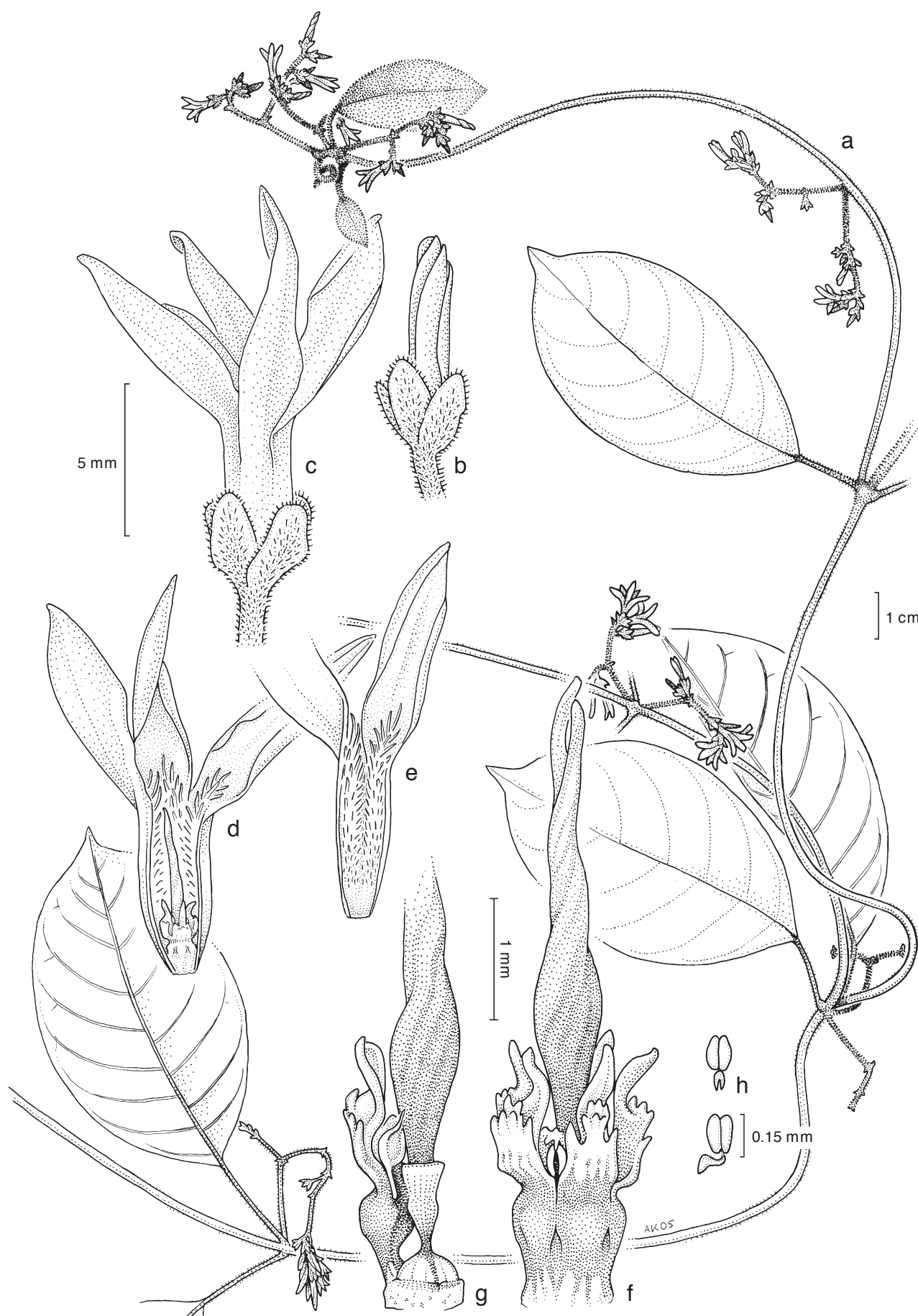


Fig. 2 *Secamone longituba* Klack. a. Habit; b. flower in bud; c. flower at anthesis; d. flower with calyx and two corolla lobes removed; e. portion of corolla from within; f. gynostegium; g. part of ovary, style head and one stamen; h. pollinaria (all: Kato & Wiradinata B-5527). — Drawn by Andrea Klintbjer, Stockholm.

Additional specimen. MALAYSIA, Sarawak, 3th div., Kapit distr., Belaga subdistr., left bank of Rajang river c. 10 km below Belaga, Segaham range, near Belaga airfield, below 500 m alt., 1958, *Jacobs 5416* (L).

2. *Secamone longituba* Klack., *sp. nov.* — Fig. 2; Map 1

Species haec *Secamonae villosae* Blume in structura gynostegii similis sed differt corollae tubo accrescenti et capite gynostegii incluso. — Typus: *Kato & Wiradinata B-5527* (holo L), Indonesia, East Kalimantan, Long Keluh, Berau, 280 m alt., 1981.

Suffrutescent twiner; branches covered with reddish erect hairs. *Leaves* opposite, herbaceous; blade c. 7–9 by 4–5 cm, ovate, cuneate at base, shortly acuminate at apex, with sparse reddish \pm erect hairs on both sides, with few indistinct colleters (but hairy) at the very base above; venation pinnate, indistinctly looped; midrib impressed above at lower half of blade when dry, raised below; primary veins 6–8 pairs, raised below, diverging at 50–60° from the mid-nerve; epidermis smooth on both sides; petiole 10–20 mm long, with dense erect reddish hairs. *Inflorescences* extra-axillary, much shorter than the adjacent leaves, 2–5 cm long; cymes irregularly mono- to dichasially branched, forked at base, with dense erect reddish hairs; axes much varying, 1–15 mm long; pedicels 1–2 mm long; bracts 1–1.5 mm long, triangular. *Flowers* pentamerous, actinomorphic. *Calyx* lobes distinctly shorter than the mature corolla tube, c. 2.7 by 1.9 mm, ovate, rounded at the apex, hairy outside and with ciliate margin, glabrous inside. *Corolla* cylindric in bud, contorted with the left lobe margin overlying and with the lobes fused at base for c. 2/5 of their length into a tube, slightly twisted to the right, glabrous outside, hairy inside tube (densely so at mouth) and at base of lobes; colour not known; tube cylindric, c. 4.7 mm long, with thick walls; lobes c. 7.4 by 2.4 mm, obliquely elliptic, acute at the apex, thick at central part with a central furrow outside when dry. *Stamens* in a column inserted at the base of the corolla tube. *Staminal column* c. 1.8 mm high. *Corona* lobes double but only shallowly cleft; outer part with \pm flat but undulate back and dorsoventrally compressed marginal parts, truncate to rounded at apex but with several smaller irregular lobes, erect, projecting above the thecae; inner part dorsoventrally compressed, narrower, distinctly longer than the outer lobe. *Anther wings* about as long as thecae, c. 0.3 mm long. *Pollinia* 0.15 mm long, oblong. *Ovary* of two mostly separate carpels, subinferior, glabrous. *Style head* projecting about 2 1/2 times longer than the staminal column, hardly exerted

from the corolla tube; apical portion c. 7 times longer than the basal portion, 4 mm long, bifid at apex, narrow and cylindric but spindle-shaped above base. *Fruits* not seen.

Distribution — Indonesia: Kalimantan, known only from the type.

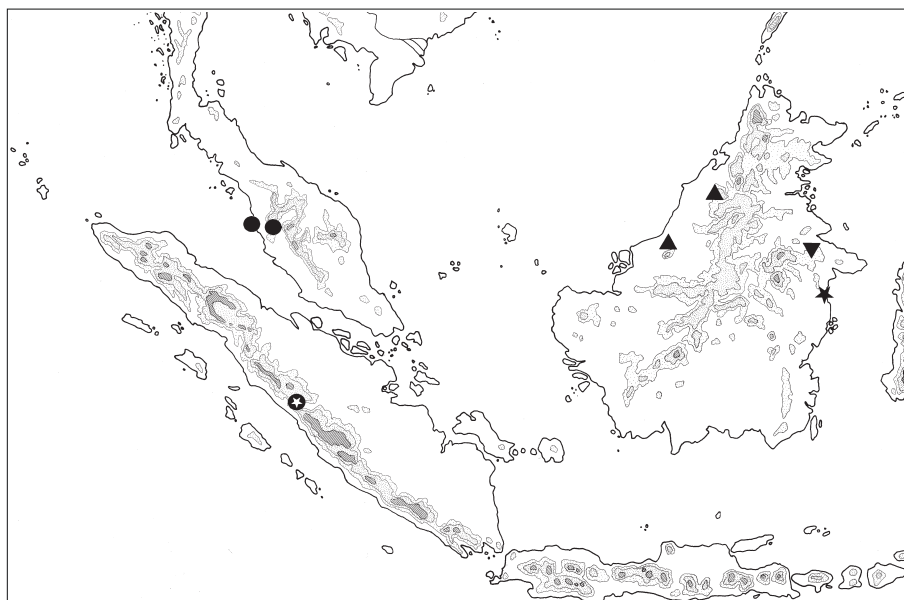
Habitat & Ecology — Lowland rain forest. Flowering: January.

Note — This species is distinguished by its accrescent corolla tube, becoming both longer and thicker in texture with age. The tube is covered inside from base to mouth by hairs, particularly long and dense at the mouth. The upper portion of the style head is long and narrow, spindle-shaped at the base and bifid at the apex. The style head is at first distinctly protruding from but later included in the accrescent tube.

3. *Secamone coronata* Klack., *sp. nov.* — Fig. 3; Map 1

Species haec *Secamonae acuminatae* (Wight) K. Schum. affinis, a qua differt corollae lobis ellipticis, corollis in alabastro anguste ovoideis vel fusiformibus (non obpyriformibus), lobis coronae ad faucem corollae prominentibus et villosis, tubo corollae omnino villosus. — Typus: *Kostermans 10371* (holo L; iso BO), Indonesia, East Borneo, East Kutei, Belajan R. near Long Bleh, 1955.

Suffrutescent twiner; young branches with appressed reddish hairs, glabrescent. *Leaves* opposite, herbaceous; blade c. 6–9 by 2.5–3 cm, elliptic, cuneate at base, acute to shortly acuminate at apex, glabrous, with many colleters at the very base above; venation pinnate, looped, rather faintly visible when dry; midrib \pm flush with the leaf surface to slightly raised on both sides when dry; primary nerves 6–8 pairs, diverging at 60–70° from the mid-nerve, \pm straight; epidermis smooth on both sides; petiole 10–17 mm long, with some short reddish hairs when young, glabrescent. *Inflorescences* extra-axillary, spreading, longer to shorter than the adjacent leaves, 5–12 cm long; cymes lax, irregularly mono- to dichasially branched with longer and shorter axes alternating, with few short reddish hairs, glabrescent; axes varying, usually 0.5–2 cm long, basal ones up to 4 cm; pedicels 4–7 mm long; bracts 0.5–1 mm long, triangular, hairy. *Flowers* pentamerous, actinomorphic. *Calyx* lobes distinctly shorter than the corolla tube, c. 1.3 by 1.0 mm, ovate, rounded at apex, glabrous but with ciliate margin. *Corolla* narrowly ovoid to fusiform in bud, contorted with the left lobe margin overlying and with the lobes fused at base for 1/4–1/3 of their length into a tube, not twisted, glabrous



Map 1 Distribution of *Secamone coronata* (★), *S. kunstleri* (●), *S. lenticellata* (▲), *S. longituba* (▼) and *S. sumatrana* (⊛).

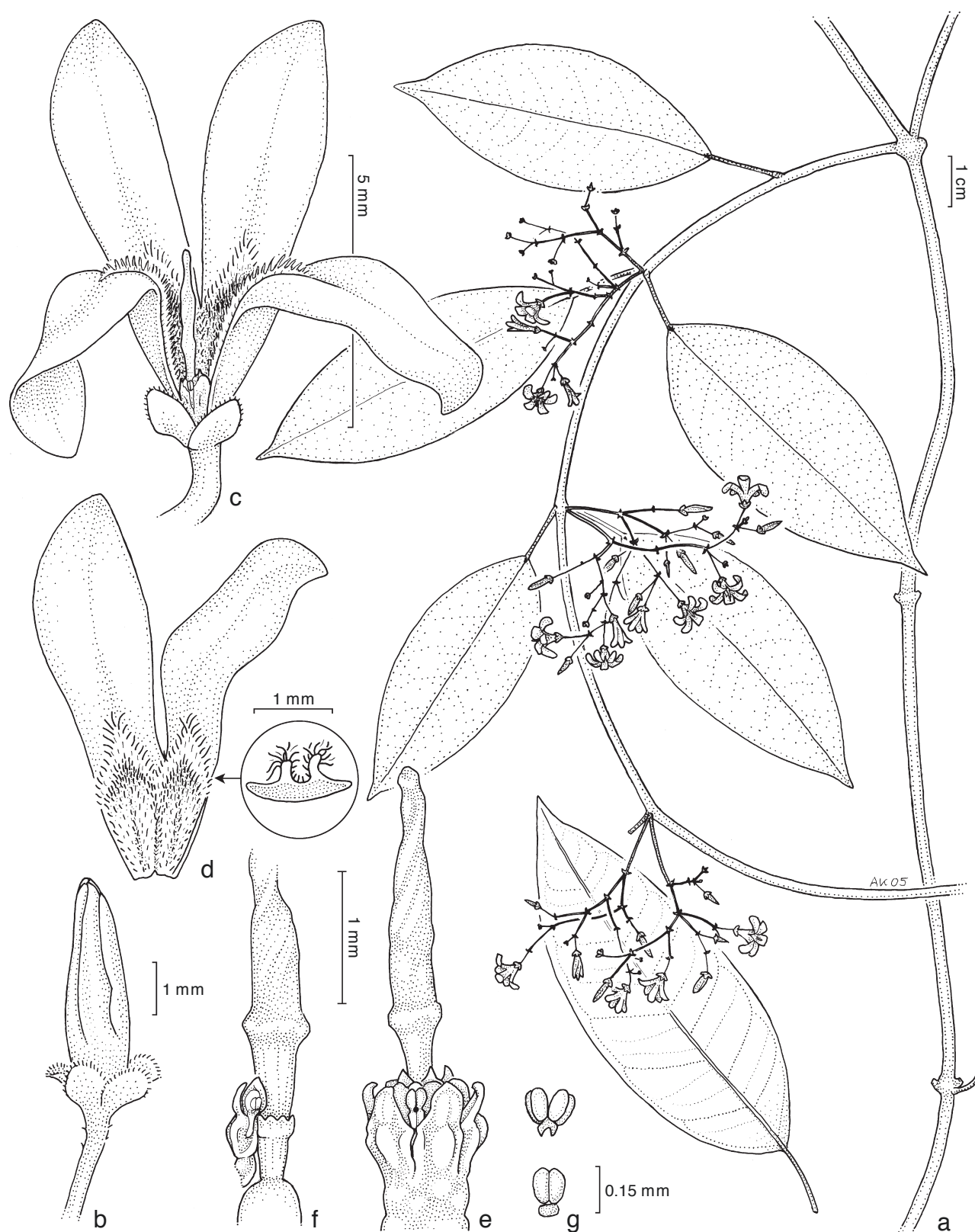


Fig. 3 *Secamone coronata* Klack. a. Habit; b. flower in bud; c. flower with one corolla lobe removed; d. portion of corolla from within and transverse section of lobe with corolline corona; e. gynostegium; f. part of ovary, style head and one stamen; g. pollinaria (all: *Kostermans 10371*). — Drawn by Andrea Klintbjer, Stockholm.

outside, hairy inside tube and at the base of each lobe in the form of a filled-in V bounded by distinctly raised walls (corolline corona); greenish yellow inside, greenish white outside; tube funnel-formed, c. 2.3 mm long; lobes probably \pm bent outwards, c. 5 by 1.8 mm, elliptic, acute but often rounded at the very apex. *Stamens* in a column inserted at the base of the corolla tube. *Staminal column* c. 0.8 mm high. *Corona* lobes single, dorsoventrally compressed, broad with rounded apex

(tounge-shaped), erect, projecting about as long as the thecae. *Anther wings* longer than the thecae, c. 0.2 mm long. *Pollinia* 0.1–0.15 mm, ellipsoidal. *Ovary* of two mostly separate carpels, subinferior, glabrous. *Style head* projecting 3–4 times longer than the staminal column, slightly exserted from the corolla tube; apical portion 5–6 times longer than the basal portion, c. 2.7 mm long, entire, cylindric or somewhat broadened near base. *Fruits* not seen.

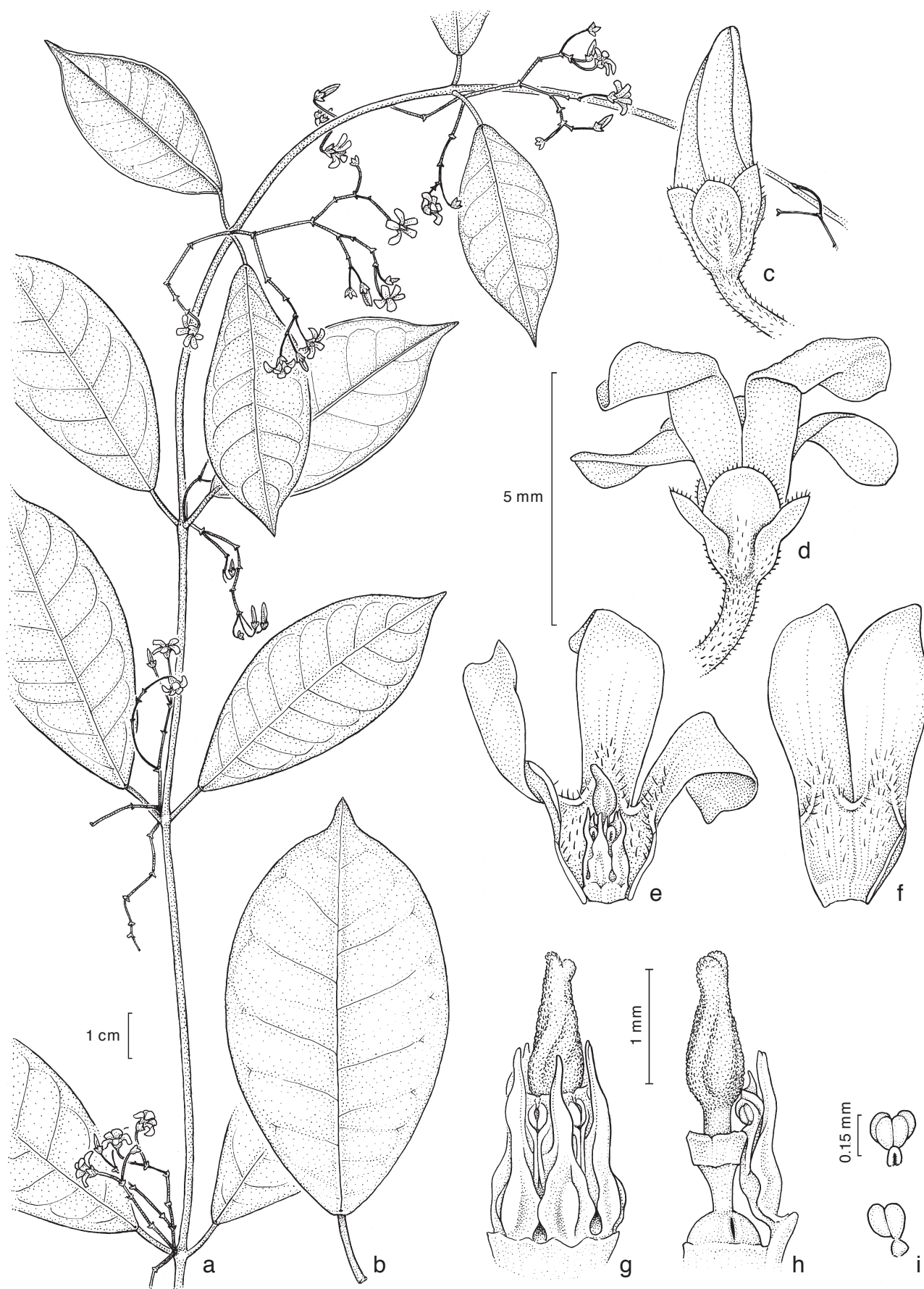


Fig. 4 *Secamone sumatrana* Klack. a. Habit; b. leaf; c. flower in bud; d. flower at anthesis; e. flower with calyx and two corolla lobes removed; f. portion of corolla from within; g. gynostegium; h. part of ovary, style head and one stamen; i. pollinaria (all: *Ichlas Dj.* 96). — Drawn by Andrea Klintbjer, Stockholm.

Distribution — Indonesia: Kalimantan. Known only from the type.

Habitat & Ecology — Low ridges in sandy loam. Flowering: April.

Notes — *Secamone coronata* is distinguished by the presence of a prominent corolline corona in the form of a thick and hairy V-shaped ridge at the base of each corolla lobe, by its short calyx and by the funnel-shaped tube.

The species epithet alludes to the fact that in addition to the staminal corona this species also has a distinctive corolline corona.

4. *Secamone sumatrana* Klack., sp. nov. — Fig. 4; Map 1

Species haec *Secamone acuminatae* (Wight) K.Schum. affinis, a qua differt corollae lobis ellipticis, corollis in alabastro anguste ovoideis (non obpyriformibus), lobis coronae staminalis longe acuminatis. — Typus: *Ichlas Dj.* 96 (holo L), Indonesia, Central Sumatra, Mt Sago near Pajakumbuh, Gunung nan tige, 1956.

Suffrutescent twiner; branches covered with short slightly retrorse reddish hairs. Leaves opposite, herbaceous; blade c. 6–9 by 2.5–5 cm, elliptic, cuneate but at the very base rounded, shortly acuminate at apex, with very sparse adpressed hairs below, glabrous above, with 5–10 colleters at the very base above; venation pinnate, looped, rather faintly visible when dry; midrib impressed above at the lower half, raised below when dry; primary nerves 6–8 pairs, diverging at 60–70° from the mid-nerve; epidermis smooth on both sides; petiole 10–20 mm long, with reddish hairs when young, glabrescent. Inflorescences extra-axillary, shorter than the adjacent leaves, 2–4 cm long; cymes irregularly mono- to dichasially branched with longer and shorter axes alternating, with reddish hairs; axes much varying, very short to 13 mm long; pedicels 5–8 mm long; bracts c. 0.5 mm long, triangular. Flowers pentamerous, actinomorphic. Calyx lobes about as long as the corolla tube, c. 1.7 by 1.5 mm, very broadly elliptic, rounded at the apex, glabrous but with ciliate margin. Corolla narrowly ovoid in bud, contorted with the left lobe margin overlying and with the lobes fused at base for c. 1/4 of their length into a tube, slightly twisted to the right, yellow; tube campanulate, c. 1.5 mm long, slightly hairy at mouth; lobes probably \pm rotate, c. 4.4 by 2.0 mm, oblong to narrowly obovate, obliquely acute but obtuse at the very apex, slightly hairy near base. Stamens in a column inserted at the base of the corolla tube. Staminal column c. 1.4 mm high. Corona lobes single, at base broad and flattened but with a short ridge, towards apex almost subulately narrowed, longer than the thecae. Anther wings about as long as the thecae, 0.3 mm long. Pollinia somewhat unequal in size in pairs, larger ones c. 0.15 mm long, ellipsoidal. Ovary of two mostly separate carpels, subinferior, glabrous. Style head projecting about one half longer than the staminal column, slightly exerted from the corolla tube; apical portion c. twice as long as the basal portion, c. 1.4 mm long, entire at apex, narrowly ovoid with a cylindrical basal part. Follicles not seen.

Distribution — Indonesia: Sumatra. Known only from the type.

Habitat & Ecology — No information. Flowering: April.

Note — *Secamone sumatrana* is characterized by its almost subulate staminal corona lobes, spindle-shaped upper portion of style head, and by its elliptic corolla lobes.

5. *Secamone kunstleri* Klack., sp. nov. — Fig. 5; Map 1

Species haec *Secamone acuminatae* (Wight) K.Schum. affinis, a qua differt corollae lobis ellipticis, corollis in alabastro anguste ovoideis vel fusiformibus (non obpyriformibus), lobis coronae ad faucem corollae distinctis, aliquantum truncatis et fere glabris. — Typus: *H. Kunstler* 6546 (holo G; iso CAL, Z), Malaysia, Malay Peninsula, Perak, Larut, 200–300 ft, Sept. 1884.

Suffrutescent twiner; younger branches covered with short reddish hairs particularly at the nodes, glabrescent. Leaves opposite, herbaceous; blade c. 6–12 by 3–4.5 cm, elliptic, cuneate at base, acute to shortly acuminate at apex, glabrous on both sides, with many colleters at the very base above; venation pinnate, looped, rather faintly visible when dry; midrib raised on both sides when dry; primary nerves 7–12 pairs, diverging at 60–70° from the mid-nerve; epidermis smooth on both sides; petiole 15–30 mm long, glabrous. Inflorescences extra-axillary, lax, shorter to longer than the adjacent leaves, 7–12 cm long; cymes irregularly mono- to dichasially branched with longer and shorter axes alternating, with some reddish hairs mostly at the nodes; axes much varying, very short to 6 cm long; pedicels 4–8 mm long; bracts c. 0.5 mm long, triangular. Flowers pentamerous, actinomorphic. Calyx lobes about half as long as the corolla tube, 1.1–1.4 by 1.1–1.3 mm, circular to very broadly elliptic, rounded at the apex, glabrous. Corolla narrowly ovoid to fusiform in bud, contorted with the left lobe margin overlying and with the lobes fused at base for c. 1/3 of their length into a tube, not twisted, pale yellow, inside red toward apex; tube cylindric, 2.5–3 mm long, glabrous except for along the edge of the corolline corona at mouth; lobes probably \pm rotate, 5.0–5.4 by 2.0–2.5 mm, oblong to elliptic, obtuse at apex, glabrous. Stamens in a column inserted at the base of the corolla tube. Staminal column 0.6–0.8 mm high. Corona lobes single, dorsiventrally compressed, rectangular with truncate to rounded apex, about as long as the thecae. Anther wings about as long as the thecae, 0.25 mm long. Pollinia somewhat unequal in size in pairs, larger ones c. 0.1 mm long, ellipsoidal. Ovary of two mostly separate carpels, subinferior, glabrous. Style head projecting 3–5 times longer than the staminal column, slightly exerted from the corolla tube; apical portion 6–7 times as long as the basal portion, 2.5–3.4 mm long, entire at apex, fusiform, at least when dry wrinkled lengthwise. Follicles c. 15 by 1.5 cm, fusiform, slightly bent, thick-walled, glabrous. Seeds c. 2 cm long; hairs c. 3 cm long.

Distribution — Malaysia: Penang, Perak.

Habitat & Ecology — Dense mixed forest up to 400 m. Flowering specimens seen from April, July and September.

Notes — Ridley (1923) confused *Secamone kunstleri* with *Secamone acuminata* (Wight) K.Schum. but it is distinguished by its elliptic corolla lobes and spindle-shaped corolla buds, by its only shallowly V-shaped rather thick and almost glabrous corolline corona. This species has the largest seeds known in *Secamone*.

This species is named in honour of Hermann Kunstler who collected about 11 000 plant specimens in Malaysia, mostly in Perak, for the Calcutta Botanic Garden in the 1880s (Van Steenis-Kruseman 1950), and was the first to collect this species (as King's collector).

Additional specimens. MALAYSIA, Penang, Govt. hill (Bukit Kerajaan), 1885, *Curtis* 244 (K); *ibid*, 1886, *Curtis* 244 (CAL, K); *ibid*, 1890, *Curtis* 244 (SING); Malay Peninsula, Pulau Penang, 1902, *Curtis* 244 (K); Malay Archipelago, Perak, Larut, 1881, *King's Collector* 2590 (K); Malay Peninsula, Perak, 1884, *King's Collector* 6686 (E, K, P); *ibid*, 1886, *King's Collector* 10490 (K, Z).

NEW COMBINATIONS

Several species of *Secamonoideae* have been described from the area treated in this article, i.e. Peninsular Malaysia, the Greater Sunda Islands, and Thailand. Among those the following ten taxa were described in the genus *Toxocarpus*, viz. *T. curtisii* King & Gamble, *T. glabrescens* M.R.Hend., *T. griffithii* Decne., *T. lagenifer* Kerr, *T. langkawiensis* King & Gamble, *T. penangianus* King & Gamble, *T. rhopalophorus* Backer, *T. scortechinii* King & Gamble, *T. siamensis* Schltr. and *T. spirei* Costantin. In a discussion below these taxa are compared to



Fig. 5 *Secamone kunstleri* Klack. a. Habit; b. flower in bud; c. flower with calyx and two corolla lobes removed; d. gynostegium; e. part of ovary, style head and one stamen; f. pollinaria; g. follicle; h. seed (a–f: *Kunstler 6546*; g, h: *King's Collector 6686*). — Drawn by Elizabeth Binkiewicz, Stockholm.

the five new species described above. However, they cannot by any diagnostic floral character be distinguished from African *Secamone* and are here transferred to this genus. See also discussion in Schumann (1895), Forster (1991, 1996) and Klackenberg (2001, 2004). They are all accepted species in the ongoing revision.

Secamone curtisii* (King & Gamble) Klack., *comb. nov.

Basionym: *Toxocarpus curtisii* King & Gamble, J. Asiat. Soc. Bengal, Pt 2, Nat. Hist. 74 (1908) 521. — Type: *Curtis 3787* (holo CAL, photograph seen, with fragment at K, see note 1), coll. Haniff, Malay Peninsula, Pulau Langkawi. *Toxocarpus pauciflorus* M.R.Hend. (1933) 110. — Type: *Henderson 25034* (not seen), Malaysia, Pahang, Bukit Chintamani, between Bentong and Karak.

Notes — 1. There is one complete specimen of the type specimen *Curtis* 3787 at CAL. A fragment of this specimen consisting of a dissected flower with the original drawing by Gamble is deposited at K.

2. The illustration and description in the protologue of *Toxocarpus pauciflorus* correspond well to *Secamone curtisii*.

***Secamone glabrescens* (M.R.Hend.) Klack., comb. nov.**

Basionym: *Toxocarpus glabrescens* M.R.Hend., Gard. Bull. Straits Settlement. 7 (1933) 109. — Type: *Holtum* 24937 (not seen), Malaysia, Johore, Tanah Abang, Endau river.

Note — *Toxocarpus glabrescens* was placed into synonymy of *T. griffithii* by Tsiang (1939: 77). Although similar in the structure of the inflorescence, with the flowers clustered on short pedicels, as well as having long corolla tubes, the style head in *S. glabrescens* differs considerably from the rather short and bifid style-head which is observed in *S. griffithii*. According to the description and illustration in the protologue by Henderson (1933), the style head in *S. glabrescens* is 3.5–4 mm long with the upper 1/3 flattened and flexuous. With the data available at present this species is accepted.

***Secamone griffithii* (Decne.) Klack., comb. nov.**

Basionym: *Toxocarpus griffithii* Decne., Prodr. 8 (1844) 505 (*T. griffithsii* sphalm.) — Type: *W. Griffith* 339 (lecto P, here selected), Inde and (iso E, K), Mergui.

Note — Decaisne (1844: 505) stated in the protologue that this species was based on a specimen *W. Griffith* 339 from “Ind. circa Madras” in the Paris herbarium. No such sheet can be found. However, there is one specimen in Paris donated to the museum by Decaisne and with an annotation “*Toxocarpus griffithsii*” which must be considered the type, although the label of this sheet gives “Inde” as provenance without the more precise “circa Madras”. However, other specimens of *Griffith* 339 in the Edinburgh and Kew herbaria are stated to be from Mergui in Burma. The statement of provenance on the Paris sheet and in the protologue is probably a mistake.

***Secamone lagenifera* (Kerr) Klack., comb. nov.**

Basionym: *Toxocarpus lagenifer* Kerr, Kew Bull. 52 (1938) 449. — Type: *Put* 2292 (lecto K, selected here; iso BM, P), Siam, Prachuap, Kan Kradai.

***Secamone langkawiensis* (King & Gamble) Klack., comb. nov.**

Basionym: *Toxocarpus langkawiensis* King & Gamble, J. Asiat. Soc. Bengal, Pt 2, Nat. Hist. 74 (1908) 523. — Type: *Curtis* 2616 (holo CAL, photograph seen, with fragment at K), Malaysia, Kedah, Langkawi.

Note — There is one complete specimen of the type *Curtis* 2616 at CAL with a copy of a drawing by Gamble of a dissected flower. Gamble's original drawing is deposited at K together with a fragment of this specimen consisting of a dissected flower.

***Secamone penangiana* (King & Gamble) Klack., comb. nov.**

Basionym: *Toxocarpus penangianus* King & Gamble, J. Asiat. Soc. Bengal, Pt 2, Nat. Hist. 74 (1908) 522. — Type: *Curtis* 2303 (holo CAL, photograph seen, with fragment at K; iso K, SING), Malaysia, Penang, at Moniot's road.

Note — There is one complete specimen of the type *Curtis* 2303 at CAL including a copy of a drawing of a dissected flower by Gamble. In addition to a complete isotype specimen, a fragment of the holotype consisting of a dissected flower with the original drawing by Gamble is deposited at K.

***Secamone rhopalophora* (Backer) Klack., comb. nov.**

Basionym: *Toxocarpus rhopalophorus* Backer, Blumea 6 (1950) 371. — Type: *Winckel* s.n. (holo L; iso K), Java, Preanger Regencies, Tjidadap, SW of Tjibeber.

***Secamone scortechinii* (King & Gamble) Klack., comb. nov.**

Basionym: *Toxocarpus scortechinii* King & Gamble, J. Asiat. Soc. Bengal, Pt 2, Nat. Hist. 74 (1908) 521. — Type: *Curtis* 3706 (2706, sphalm.) (lecto K, selected here; iso CAL, K (two sheets, one with fragments only of dissected flowers and drawings), SING), coll. R. Derry, Malay Peninsula, State of Perak, Larut Hill, 1900.

Note — King & Gamble mentioned two collections in the protologue, *Scortechini* 630 and *Curtis* 2706 (a misprint for 3706), both examined and with drawings by Gamble deposited at K. Of the latter specimen there is ample material at Kew and one of the sheets is chosen as the lectotype.

***Secamone siamensis* (Schltr.) Klack., comb. nov.**

Basionym: *Toxocarpus siamensis* Schltr., Repert. Spec. Nov. Regni Veg. 3 (1907) 307, non *Secamone siamica* Kerr (1938) 448. — Type: *Schmidt* 725 (holo C), Siam, Klong Sarlakpet.

***Secamone spirei* (Costantin) Klack., comb. nov.**

Basionym: *Toxocarpus spirei* Costantin, Fl. Indo-Chine 4, 1 (1912) 51. — Type: *Spire* 4 (holo P), Laos, Cua-rao.
Toxocarpus gagnepainii Tsiang (1939) 84. — Type: *Spire* 879 (A, BM, BO, BR, G, MO, NY, SING), Vietnam, Dalat and vicinity.

DISCUSSION

Secamone lenticellata* and *S. longituba

Several taxa of subfamily *Secamonoideae* are known from Peninsular Malaysia, Java and Borneo. *Secamone lineata* Blume and *S. auriculata* Blume (syn. *Toxocarpus insularis* Miq. and *T. longipetalus* Merr.) were both described from Java. The former, however, differs from the new species described in this article by its lax and very delicate inflorescences, the latter by having finely but clearly auriculate leaves.

Two other Javanese species are similar to *S. longituba*, viz. *S. villosa* Blume (syn. *Toxocarpus villosus* (Blume) Decne.) and *S. rhopalophora*. *Secamone villosa* and *S. longituba* have a similar structure of the staminal column where the apex of the outer and distinctly shorter corona lobe consists of several smaller lobes (Fig. 2f). However, the corolla tube remains short in *S. villosa* and the usually distinctly tuberculate style head remains long protruding. *Secamone rhopalophora*, similar to *S. longituba* in having a long, cylindric corolla tube, differs by having outer and inner corona lobes of about the same size and shape with acute tips. Furthermore, *S. rhopalophora* has leaves with 16–20 pairs of straight primary veins diverging at c. 80° from the mid-nerve, different from *S. longituba*, which has leaves with 6–8 distinctly curved veins that diverge at c. 60° from the mid-nerve.

Secamone lanceolata Blume, which also was described from Java, is a synonym of *S. elliptica* R.Br. This taxon is distributed over most of the Malesian area, and is characterized by having small flowers, single falcate corona lobes and only shortly protruding style-head (*Secamone* s.str.) (Klackenberg 1992a). Similar corona lobes are found in *S. lenticellata* but this species is distinguished by bearing its flowers in spike-like clusters in a branched inflorescence. This is a rare character in *Secamonoideae* but is characteristic for *Genianthus* Hook.f. sect. *Brachyblastus* Klack. with several species known from SE Asia (Klackenberg 1995). Inflorescences with flowers in clusters

are also observed in *S. badia* Klack. from Borneo as well as in *S. glabrescens* and *S. griffithii* from Peninsular Malaysia. *Secamone lenticellata* differs from the latter two, however, by its very short tube (corolla united into a tube for 1/8–1/9 of its length vs 1/4–1/3 in *S. glabrescens* and *S. griffithii*) in addition to the prominent lenticels (Fig. 1). *Secamone badia* is distinguished by having the lower surface of the leaves densely covered by curled reddish brown hairs (Klackenberg 2004). The seven species of *Genianthus* in sect. *Brachyblastus*, as well as *Genianthus ellipticus* (Blume) Bakh.f. (syn. *Secamone blumei* Decne. and *Toxocarpus borneensis* Schltr.), which is also described from Java but lacks the spike-like inflorescences, all differ from the other taxa discussed in this article by having a corolla that is hairy on the inner surface of the petal lobes (Klackenberg 1995).

Secamone maritima (syn. *Toxocarpus elmeri* Merr.) was described by Blume (1825) from Java but is known also from Borneo and the Philippines. It differs from the new Bornean taxa *S. coronata*, *S. lenticellata* and *S. longituba* by having entire staminal corona lobes that are acute at the apex in dorsal view, but thick and truncate to somewhat mucronate in lateral view. *Secamone coronata* differs by its dorsoventrally compressed corona lobes and the presence of a corolline corona (Fig. 3d, e), and *S. longituba* by its very different double staminal corona lobes where the outer lobe is split into several smaller lobes at the apex (Fig. 2f). *Secamone lenticellata*, having staminal corona lobes similar to what is seen in *S. maritima* but with acute apices both in dorsal and lateral views, differs distinctly by its inflorescences with the flowers arranged in spike-like clusters (Fig. 1b).

Secamone amygdalina was described by Turczaninow (1852) from material collected by Göring and Zollinger from Java and Sumatra. The type material has not been seen. According to the good description in the protologue, however, this is most probably *S. lineata*. It differs from the five here described species (except for *S. kunstleri*) by having a glabrous corolla.

Secamone kunstleri*, *S. sumatrana* and *S. coronata

The new species *S. kunstleri*, *S. sumatrana* and *S. coronata* from the tropical rain forest area of Malaysia and Indonesia, are morphologically similar to *S. acuminata* (syn. *Goniostemma acuminatum* Wight and *Toxocarpus acuminatus* (Wight) Hook.f.), *S. lagenifera* and to *S. siamensis* from the monsoon areas of Thailand and Bangladesh. *Secamone acuminata* has been interpreted as a species with a disjunct distribution in Sylhet in NE Bangladesh (type collection) and in Penang and Perak in Peninsular Malaysia (Ridley 1923). However, the specimens from the evergreen forests of Penang and Perak, formerly identified as *S. acuminata*, differ in several characters from the type of Wight, e.g. by the corolla lobes being broadest at the middle (vs broadest at the base), by its fusiform corolla buds (vs obpyriform), by its only shallowly V-shaped almost glabrous corolline corona (vs distinctly V-shaped and hairy). These specimens are here recognized as a separate species, *S. kunstleri*. The only remaining known material of *S. acuminata* is the type collection.

Secamone kunstleri is also similar to *S. sumatrana*, but is easily distinguished by its much longer corolla tube (vs about as long as the calyx) and short and rounded staminal corona lobes (vs distinctly longer than the staminal column and acuminate). *Secamone sumatrana* differs from *S. acuminata* and *S. siamensis* by its almost subulate corona lobes (Fig. 4g) (vs broad and rounded at apex). The corolla tube is about as long as the calyx lobes, about twice as long as the calyx in *S. acuminata*. The mid-nerve is impressed above, slightly raised in *S. acuminata*. *Secamone sumatrana*, however, is probably more closely related to *S. lagenifera* from Thailand, with its narrowly

ovoid style-head and acuminate corona lobes, but is distinguished by its elliptic corolla lobes that are distinctly broadest near the middle of the lobe, in contrast to the oblong lobes of *S. lagenifera* that usually are broadest at base. Furthermore, the corolla lobes in *S. sumatrana* are hairy only near the base, in *S. lagenifera* to about 1/3 or more of the lobe. The calyx lobes are very broadly elliptic and about as long as the corolla tube in contrast to the longer and oblong lobes of *S. lagenifera*.

The distinguishing characters of the six morphologically similar species of *Secamone* including the three new ones discussed above, inter alia characterized by a protruding and often fusiform style head and single staminal corona lobes, can be summarized in a key as follows:

1. Corolla lobes broadest at base; buds obpyriform. — Monsoon SE Asia 2
1. Corolla lobes broadest at the middle of the lobe; buds narrowly ovoid to fusiform. — Malesia 4
2. Staminal corona with acuminate lobes, longer than the staminal column. — Thailand *S. lagenifera*
2. Staminal corona with shorter obtuse lobes, protruding about as long as thecae or shorter 3
3. Leaves cuneate to attenuate at base; primary veins in 10 pairs or more at a distance of about 0.5 cm from each other, slightly raised above when dry. — Bangladesh *S. acuminata*
3. Leaves truncate at base; primary veins in 6–8 pairs at a distance of about 1 cm or more from each other, flush with the leaf-surface above when dry. — SE Thailand *S. siamensis*
4. Corolla tube about as long as the calyx lobes; staminal corona with acute lobes longer than the staminal column. — Sumatra 4. *S. sumatrana*
4. Corolla tube distinctly longer than the calyx lobes; staminal corona with rounded to truncate lobes, about as long as the staminal column 5
5. Corolline corona shallowly V-shaped, glabrous to slightly hairy; corolla tube glabrous; style-head fusiform. — Peninsular Malaysia 5. *S. kunstleri*
5. Corolline corona acutely V-shaped, distinctly hairy; corolla tube distinctly hairy; style-head ± cylindric. — Borneo 3. *S. coronata*

The types of *S. kunstleri* and of *S. scortechinii* were both collected at Bukit Larut in Perak. *Secamone scortechinii*, however, although being similar in the anther and corona structures, differs distinctly from *S. kunstleri* by its large flowers (largest in the genus), short inflorescences, and short and broad style head. Furthermore, the style head in *S. scortechinii* is distinctly bifid as being topped by two horns.

Secamone curtisii and *S. langkawiensis* are known from the limestone areas of Perak and the northern part of Peninsular Malaysia. They differ from the new species described here by the few-nerved leaves, having only two to three pairs of distinctly curved nerves that diverge at c. 45° or less from the midrib.

Secamone penangiana is only known from the type collected on Penang. It differs from the new species here described by having the corolla lobes fused for about half of its length into a campanulate tube. Furthermore, it has reddish brown corollas. Although the tips of the corolla lobes are tinged with red inside in *S. kunstleri*, the basic corolla colour in this species, as well as in *S. coronata*, *S. lenticellata* and *S. sumatrana*, is yellow, greenish yellow to white (colour unknown in *S. longituba*).

Secamone spirei was described from Laos, but is known also from Vietnam and Thailand, and from a fruiting specimen collected in Selangor, Malaysia. Being in habit similar to *S. villosa*,

it differs, however, from this species, as well as from the five new species described in this article, by several floral characters, particularly by the shape of the gynostegium. The style head is topped by a distinctly bifid upper portion which is expanded to a lobed and conspicuous disc above the anthers. This structure has not been observed in other *Secamone* species.

Acknowledgements I would like to thank Sunil Srivastava at CAL for kindly supplying me with digital images of type material.

REFERENCES

- Backer CA. 1950. *Toxocarpus rhopalophorus*. In: Bakhuizen van den Brink RC, Notes on the Flora of Java, VI. *Blumea* 6: 363–406.
- Blume CL von. 1825. *Bijdragen tot de Flora van Nederlandsch Indië*. Ter Lands Drukkerij, Batavia.
- Brown R. 1810. *Prodromus florae Novae Hollandiae et Insulae Van Diemen* 1. Jonson Co., London.
- Costantin J. 1912. *Asclépiadacées*. In: Lecomte PH (ed), *Flore Générale de l'Indo-Chine* 4, 1: 1–154. Masson & Cie, Paris.
- Decaisne J. 1844. *Asclepiadaceae*. In: De Candolle AP (ed), *Prodromus systematis naturalis regni vegetabilis* 8: 490–665. Fortin, Masson & Sociorum, Paris.
- Forster PI. 1991. Additions to *Secamone* R.Br. (*Asclepiadaceae*: *Secamonoideae*) in Australia. *Austrobaileya* 3: 541–547.
- Forster PI. 1996. *Asclepiadaceae*. *Flora of Australia* 28: 197–283. Australian Biological Resources Study, Canberra.
- Goyder D. 1992. *Secamone* (*Asclepiadaceae* subfam. *Secamonoideae*) in Africa. *Kew Bulletin* 47: 437–474.
- Henderson MR. 1933. Additions to the Flora of the Malay Peninsula. *Asclepiadaceae*. *Gardens' Bulletin*. Straits Settlements 7: 109–113.
- Kerr AF. 1938. Contributions to the Flora of Siam. *Kew Bulletin* 52: 445–454.
- King G, Gamble JS. 1908. Flora of the Malayan Peninsula. *Journal of the Asiatic Society of Bengal*. Part 2. Natural History 74: 387–625.
- Klackenberg J. 1992a. Taxonomy of *Secamone* (*Asclepiadaceae*) in Asia and Australia. *Kew Bulletin* 47: 595–612.
- Klackenberg J. 1992b. Taxonomy of *Secamone* s. lat. (*Asclepiadaceae*) in the Madagascar region. *Opera Botanica* 112: 1–127.
- Klackenberg J. 1995. Taxonomy and phylogeny of the SE Asian genus *Genianthus* (*Asclepiadaceae*). *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 117: 401–467.
- Klackenberg J. 2001. Notes on *Secamonoideae* (*Apocynaceae*) in Africa. *Adansonia*, ser. 3, 23: 317–335.
- Klackenberg J. 2004. A new species of *Secamone* (*Apocynaceae*, *Secamonoideae*) from Borneo. *Blumea* 49: 129–133.
- Klackenberg J. 2006. Four new species of *Secamone* (*Apocynaceae*, *Secamonoideae*) from Indonesia. *Blumea* 51: 587–597.
- Merrill ED. 1929. *Plantae Elmerianae Borneense*. University of California Publications in Botany 15: 1–316.
- Ridley HN. 1923. The Flora of the Malay Peninsula 2. Reeve & Co, London.
- Schlechter R. 1907. *Asclepiadaceae novae Asiae australis et orientalis* 1. *Repertorium Specierum Novarum Regni Vegetabilis* 3: 305–315.
- Schumann K. 1895. *Asclepiadaceae*. In: Engler A, Prantl K (eds), *Die natürlichen Pflanzenfamilien* 4, 2: 189–306. Engelmann, Leipzig.
- Tsiang Y. 1939. Notes on the Asiatic Apocynales IV. *Sunyatsenia* 4: 31–94.
- Turczaninow PKNS. 1852. *Asclepiadeae quaedam hucusque indscriptae* 2. *Bulletin de la Société Imperiale des Naturalistes de Moscou* 25, 2: 310–325.
- Van Steenis-Kruseman MJ. 1950. Malaysian plant collectors and collections. *Flora Malesiana Series I*, vol. 1: 1–606.
- Wight R. 1834. Contributions to the botany of India. Parbury, Allen & Co., London.