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THE GENUS ELETTARIOPSIS (ZINGIBERACEAE) IN MALAYA

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ABSTRACT. The genus *Elettariopsis* Baker in Malaya is reviewed. Four species are recognized, of which two, *E. burttiana* and *E. smithiae* are described for the first time; a fifth species, *E. exserta* (Scort.) Bak. remains uncertain. The circumscription of the genus and its affinities with *Amomum* are discussed. The chromosome number for the genus is n = 24.

The genus *Elettariopsis* was first published by Baker (1892), however, little is known about it still. Circumscription of the genus has been uncertain and controversial. In Schumann's account of the Zingiberaceae (1904), *Elettariopsis* was treated as a section of the genus *Cyphostigma* Benth., consisting of a confusing array of species belonging to several other genera. A subsequent account by Loesener (1930), proved to be equally unsatisfactory with the genus circumscribed to include members of *Elettaria* Maton and *Amomum* Roxb.

At present, *Elettariopsis* is considered to be closely related to *Cyphostigma* and *Amomum*. *Cyphostigma* differs in having tubular bracteoles and an anther-crest which matches or exceeds the labellum in width. It is a Sri Lankan genus and is not known to occur in Malaya. *Amomum* and *Elettariopsis*, which are both South East Asian genera, do bear a striking similarity in floral structure and apparently are not easy to discriminate (Holttum, 1950). A comprehensive and up-to-date study of *Amomum* is essential in order to understand fully the limits of the genus *Elettariopsis* and the relationship between these two genera.

Elettariopsis is a genus of small herbs. Holttum (1950) discussed the genus and chose *E. curtisii* as the lectotype. The rhizomes are slender and wide-creeping, so that the plants are rather spread out. The habit is fairly distinctive. Leaf-shoots are relatively short (below 100 cm), and consist of one to eight long-petiolate leaves. In *E. curtisii* and *E. burttiana* the leaf-sheaths are loosely clasping so that a pseudostem is not formed. In *E. triloba* and *E. smithiae* the leaf-sheaths are closely clasping to form a distinct pseudostem. A true stem is not present as the shoot apical meristem is found at the base of the leaf-shoot. The basal three-quarter portion of the pseudostem is bladeless and the leaf-blades, which have long slender petioles, are clustered in the top quarter of the pseudostem. The interval between the leaves is so short that a distinct two-ranked leaf arrangement is sometimes not well-marked.

The inflorescence arises at the base of the leaf-shoot. In all Malayan species except *E. triloba* the main inflorescence axis extends horizontally, and is either simple or branched. Solitary flowers, each with its own bract and open bracteole, are borne along the main as well as lateral inflorescence axes. This inflorescence form is strikingly different from that seen in *Amomum*, but resembles that of *Elettaria*. In *E. triloba* the inflorescence is a compact head borne at the end of a short scape.

In all species of *Elettariopsis* seen so far the bracteoles are non-tubular. The structure of the stamen and the stigma is distinctive and remarkably constant.

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The anther-crest is thin, expanded, as long as, or a little longer than, the anther-thecae. In *E. triloba* it is straight, and somewhat quadrate with a truncate apex and two small lateral teeth at the base; whereas in the other three species it is slightly concave and obliquely reflexed with a broadly acute apex, while the lateral margins are incurved to face one another. The stigma is borne distinctly beyond the anther-thecae, although it does not overtop the crest. It is obconic, with a wide triangular mouth fringed with short hairs. Fruits (first record known) are capsular, roundish, and shallowly ridged.

As currently known, *Amomum* is a rather large genus occurring from Southern China through South East Asia and Australia and extending to the Central Pacific. It includes a central, homogeneous group of species which possess the characters that are commonly recognizable as the distinguishing features of *Amomum*. These are: (1) a basal inflorescence which tends to elongate after flowering and which lacks an involucre of sterile bracts; (2) flowers borne singly in the axil of a bract; (3) tubular bracteoles; (4) well-developed anther-crests which may be distinctly three-lobed or entire; (5) tall, clumped leaf-shoots (1–5 m tall) which are produced by short rhizome elements; and, (6) short-petiolate or sessile leaves.

There are some Malaysian species which on overall similarity belong to *Amomum* but differ in one or two of these distinguishing features. Instead they show one or two *Elettariopsis* characters. For example, the bracteoles are non-tubular in *A. xanthophlebium* Ridl., the inflorescence arises at intervals along a prostrate reproductive axis in *A. biflorum* Jack, and in *A. micranthum* Ridl. the vegetative rhizomes are wide-creeping so that the leaf-shoots which they produce are not clumped. Moreover, there is a superficial resemblance between the flowers of *Elettariopsis* and those of many *Amomum* species in the broad white labellum which has a narrow base and a yellow median band bordered by two red stripes. There is good evidence to suppose that the closest ally of *Elettariopsis* is *Amomum*. It is not possible, nor is it sound practice, to look for single diagnostic characters that will differentiate these two genera. But it is possible, by using a combination of vegetative and reproductive characters, to define *Elettariopsis* and to recognize it in the field.

Elettariopsis Bak. in Hook. f., Fl. Brit. Ind. 6: 251 (1892); Loesen. in Pflanzenfam. 2 Aufl., 15a, 602 (1930); Holtt. in Gard. Bull. Sing. 13: 214 (1950).

Rhizomatous herbs up to 1 m tall. *Rhizomes* slender, wide-creeping, bearing leaf-shoots at intervals of 8–30 cm. *Roots* not tuberous. *Leaf-shoots* with 1–8 leaves. *Leaves* long-petiolate, either radical, or clustered in top quarter of pseudostem; lamina lanceolate to elliptic and up to c. 4–8 times as long as broad, glabrous, apex acuminate to caudate, base decurrent or cuneate; ligule small, up to 7 mm long, or prominent, deeply bilobed and up to 3.7 cm long; sheaths either loosely clasping, or closely clasping to form a pseudostem. *Inflorescence* arising at base of leaf-shoot, either unbranched and with flowers in a close erect pedunculate head, or with prostrate branched axis bearing well-spaced solitary flowers. *Bracts* each subtending a single flower or a 2-flowered cincinnus; bracteole not tubular. *Calyx* white or flushed pale pink. *Corolla* tube slender, longer than calyx, white; lobes elliptic, hooded. *Labellum* not forming a tube with the filament, distal portion broad, basal portion narrow, held erect, white with a yellow median band bordered by a red stripe on either side. *Lateral*

staminodes absent or very short in known species. *Stamen*: filament short and broad; anther-thecae parallel; connective prolonged into a thin, expanded, almost quadrate crest without spreading lateral lobes. *Stigma* obconic, the aperture a ciliate, broad triangle. *Epigynous glands* 2, separate, slender, lobed, not surrounding the style. *Ovary* glabrous or sparsely short hairy, trilocular, multi-ovulate. *Fruit*, where known, globular, shallowly ridged, without hairs or spines, pale pink mottled with darker dots.
Distribution: South East Asia.
Lectotype: *Elettariopsis curtisii* Bak.

Three species of *Elettariopsis* have been recorded for Malaya, but the identity of one of them, *E. exserta* (Scort.) Bak., remains uncertain (Holttum, 1950). Two new species are proposed here, *E. burttiana* and *E. smithiae*, named in honour of Mr B. L. Burtt and Miss R. M. Smith of the Royal Botanic Garden, Edinburgh, who have contributed much to our knowledge of the Zingiberaceae.

1a. Only one leaf-blade on each leaf-shoot, blade to 100 cm long ....1. *E. exserta*

1b. Usually more than one leaf-blade on each leaf-shoot, blades much smaller 2.

2a. Leaf-sheaths loosely clasping, pseudostem not apparent.....3.

2b. Leaf-sheaths closely clasping to form a pseudostem, basal three-quarters of pseudostem bladeless .....4.

3a. Ligule not prominent, up to 0.7 cm long; leaf-base decurrent ....2. *E. curtisii*

3b. Ligule prominent, up to 3.7 cm long, bilobed; leaf-base cuneate 3. *E. burttiana*

4a. Leaf-blades held erect on slender petioles; inflorescence a compact head of 4–8 flowers terminating a short basal scape; flowers often in cincinni .....4. *E. triloba*

4b. Leaf-blades held laxly on slender petioles; flowers single and well-spaced along a basal, horizontal, branched or unbranched axis5. *E. smithiae*

1. Elettariopsis exserta (Scort.) Bak. in Hook. f., Fl. Brit. Ind. 6: 251 (1892); Ridl., Fl. Mal. Pen. 4: 274 (1925); Holtt. in Gard. Bull. Sing. 13: 217 (1950).
Type: Perak, Kinta Valley, *Scortechini* 1947 (n.v.).
Basionym: *Cyphostigma exsertum* Scort. in Nuov. Giorn. Bot. Ital. 18: 310, t. 13 (1886).

The following comments rely entirely on Scortechini's description and figure.

The leaf-shoots were said to consist of solitary leaves measuring 1.2–2 m tall including the petiole, with the blade 1 m long by c. 30 cm wide. The erect basal scape bore a single flower which had the coloration of an *Elettariopsis*.

This species is probably an *Elettariopsis*, perhaps allied to *E. curtisii*. Its gigantic leaves appear to be very distinct, but the species has not been collected again. Subsequent accounts of the species after Scortechini's description merely tended to copy and repeat the description, often not very accurately. Unless further collections are obtained, it is clearly not possible to comment other than that this species remain uncertain, although it seems to be close to *E. curtisii*.

2. Elettariopsis curtisii Bak. in Hook. f., Fl. Brit. Ind. 6: 252 (1892); Ridl., Fl. Mal. Pen. 4: 274 (1925); Holtt. in Gard. Bull. Sing. 13: 217 (1950). Fig. 1.
Type: Penang, West Hill, alt. 800m, *Curtis* 1578 (n.v.).
Syn.: *E. serpentina* Bak., *l.c.* Type: Penang, *King's collectors* (n.v.).
E. latiflora Ridl. in Journ. Str. Br. R. As. Soc. 32:154 (1899). Syntypes: Singapore, Bukit Timah, *Ridley* s.n.; Bujong Malacca, *Ridley* s.n. (n.v.); Perak, Larut, *King's collectors* 2886 (n.v.).

Rhizomes slender, bearing leaf-shoots at intervals of 6–20 cm. *Leaf-shoots* with 1–5 leaves. *Leaves* erect, radical, with loosely clasping sheaths of length 5–30 cm; lamina more or less elliptic, widest at or above middle, 24 × 4–68 × 10 cm, glabrous, apex acuminate to slightly caudate, base decurrent; petiole 5–18 cm long; ligule short, to 7 mm tall, shallowly bilobed. *Inflorescence* from base of leaf-shoot, horizontal, just below ground surface, extending to about 18 cm long, with sterile sheaths along non-floriferous portion, often producing lateral branches near base; lateral branches arising later than the apical part of inflorescence, in the axil of sterile sheaths and breaking through them; sterile sheaths open, 2-ranked, appressed to axis, up to 1.5 cm long. *Bract* c. 1.5 cm long, open, ovate, broadly pointed, glabrous, pinkish, bearing in its axil a flower on a pedicel 0.1–1.5 cm long; bracteole c. 0.8–1.3 cm long, split to the base on one side, apex broadly rounded and slightly notched. *Calyx* up to 3 cm long, white, cleft a third of its length down one side, apex with 3 short blunt teeth. *Corolla* tube 1–3 cm longer than calyx, slender; lobes 1.2–1.6 cm long, transparent or white, concave at distal part and cucullate, c. 6–7 mm wide, lateral lobes narrower. *Labellum* c. 3 × 2.7 cm, base narrow and widening abruptly, apex reflexed and crinkled at edges, median band thickened and yellow, bordered by a lateral red stripe on either side,sides white. Lateral staminodes small, fleshy, c. 3 mm long. *Stamen*: filament c. 4 mm long and broad; anther-thecae 5 mm long; anther-crest thin, about 4.5–5.5 mm long and broad, concave and obliquely reflexed, lateral margins incurved slightly to face each other, apex broadly acute. *Stigma* raised well above anther-thecae but not overtopping the crest, obconic, c. 2 mm wide, with broad triangular mouth fringed with short hairs. *Epigynous glands* 3.5–4 mm long, needle-shaped, and lobed. *Ovary* glabrous, trilocular. *Fruit* a globular capsule, c. 3 cm diameter, shallowly ridged, pink speckled with dark red dots; seeds white, covered entirely with gelatinous aril. n = 24.

PENANG. Near Crag Hotel, 600m, S.F.N. 751, *Burkill* (SING); Pantai Kerachut, 21 iii 1975, *Kam* s.n. (KLU); Moniot Road West, Penang Hill, 20 iii 1975, *Kam* s.n. (KLU); Ayer Itam Catchment Area, 5 vi 1975, *Kam* 227 (KLU, E); cultivated, Penang Waterfall Garden, origin unknown, 26 iv 1978, *Kam* 352 (KLU, E); on path to Pantai Krachut, 19 vi 1980, *Kam et al.* s.n. (E).

PROVINCE WELLESLY. Sungei Bakap, Relau F.R., 28 iv 1976, *Beltran* s.n. (KLU).

PERAK. Bujong Malacca, *Ridley* 9789 (SING); Kledang Range, Ipoh, iv 1976, *Beltran* 127 (KLU).

SELANGOR. Klang water catchment forest, 12 iii 1922, S.F.N. 6828, *Burkill* (SING); Sungei Buloh, 7 iv 1976, *Beltran* 100 (KLU); Templer Park, iv 1976, *Beltran* 116 (KLU).

TRENGGANU. Ulu Bendong, Kemaman, 200m, 29 x 1935, S.F.N. 30014, *Corner* (SING).

PAHANG. Taman Negara, Bukit Teresek, 28 iv 1975, *Kam* 221 (KLU).

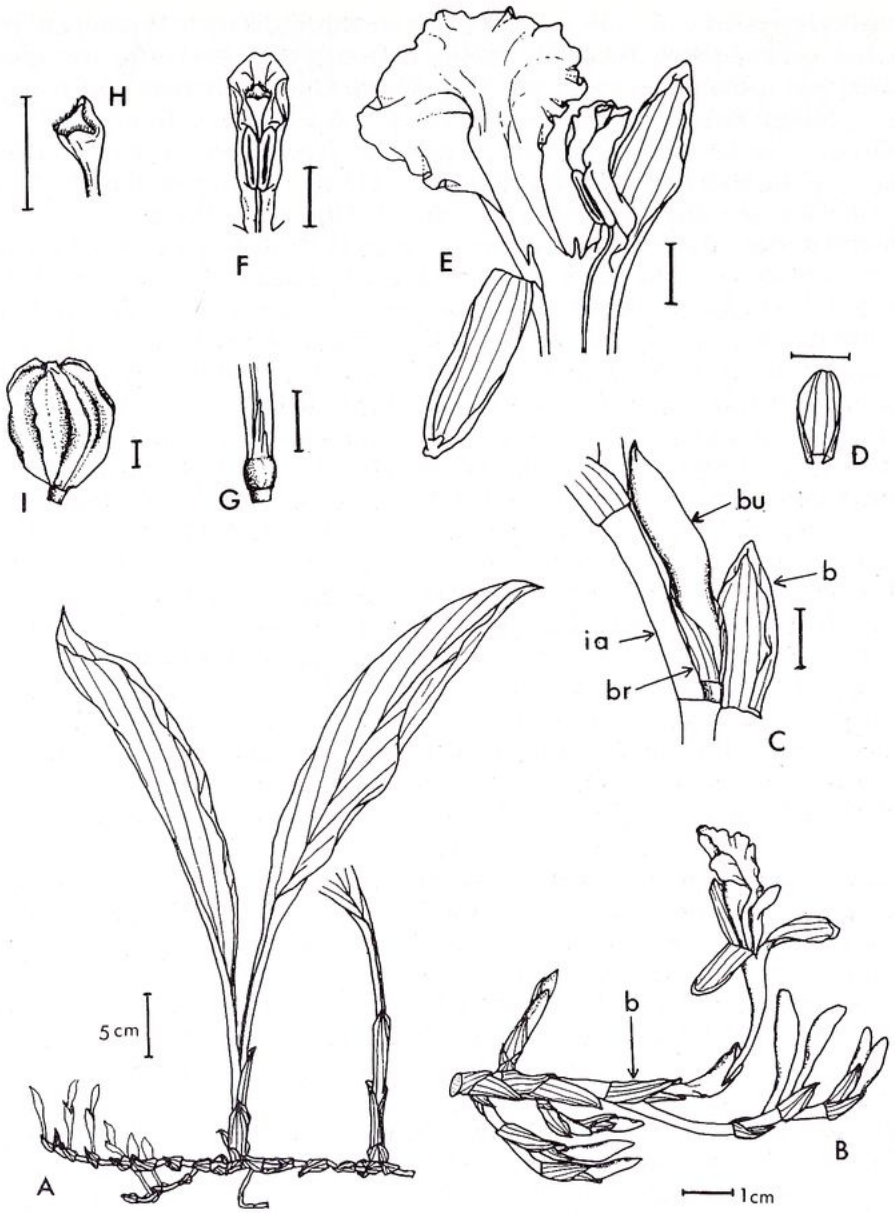

FIG. 1. *Elettariopsis curtisii* Bak. A, habit; B, partial inflorescence; C, partial inflorescence to show arrangement of bracts and bracteoles (bracts spread open); D, bracteole; E, flower, dissected, with one lateral corolla lobe removed; F, stamen; G, ovary and epigynous glands; H, stigma; I, fruit. b, bract; br, bracteole; bu, bud; ia, inflorescence axis. Lines represent 5 mm unless otherwise stated. (From live material, *Kam* 227).

JOHORE. 14th mile Mawai–Jamaluang road, 8 ix 1935, *Corner* s.n. (SING.); Kluang Forest Reserve, 15 xi 1922, S.F.N. 9219, *Holttum* (SING).
SINGAPORE. Bukit Timah, 1890, *Ridley* s.n. — syntype of *E. latiflora* (SING); 1893, *Ridley* 5027 (SING).

The range in size of the vegetative forms is very striking. The Penang collections (*Kam* 227; *Kam* s.n. from Pantai Krachut and Penang Hill) have

smaller leaves (24 × 6 — 38 × 8 cm) which are either solitary or in groups of two to four per leaf-shoot. The total plant height from ground level to the apex of the tallest leaf commonly varies from 30 to 55 cm. Other collections (*Beltran* s.n. from Sungei Bakap; *Beltran* 100; *Beltran* 127; S.F.N. 9219, *Holttum*; S.F.N. 30014, *Corner*) are distinctly larger. Leaves vary from 35 × 8 cm to a strapping 68 × 10 cm, with leaf-shoots reaching up to 115 cm, which gives these plants in the field a very striking and different aspect. However, there is no detectable discontinuous variation in size and morphology in the different populations that have been studied. The shape of the leaves is very similar, varying from four to seven times as long as broad, with an acuminate apex and decurrent base. Type material of *E. latiflora* Ridl. from Singapore (*Ridley* s.n. from Bukit Timah) has leaves which are intermediate in size. The structure of the inflorescence, flower, anther-crest and stigma is remarkably similar in all specimens. There are size variations in the floral parts, such as length of calyx and corolla tube and dimensions of labellum and anther-crest, but these are not correlated with the size of the vegetative plant parts, nor are they correlated with one another.

Two other collections (*Kam* 221, *Beltran* 116) are further different in emitting a very pungent stink-bug odour from the leaves when they are crushed. This character has so far not been correlated with other features. The size of the vegetative plants is intermediate between the large and the small forms of the species. In a herbarium specimen, the smell is, of course, not detectable.

Present studies indicate that while there exist differences in size and smell between different populations, these differences are not distinct enough and do not correlate with other features to warrant the status of distinct varieties. The haploid chromosome number of this species, and of other Malayan species of *Elettariopsis*, is n = 24 (Dr I. C. Beltran, pers. comm.).

3. Elettariopsis burttiana Kam, **sp. nov.** Fig. 2.

Inflorescentia et structura floris *E. curtisii* Bak. valde similis sed habitu, forma foliorum et ligula longiore atque bilobata facile recedit.

Rhizomata tenuia, repentia 0.5–0.8 cm diam., surculos foliatos inter se 10–15 cm distantes emittentia. *Radices* haud tuberosi. *Surculi* folia 2–5 gerentes; vaginae foliorum laxe amplectentes, longissimae, 23–35 cm longae. *Folia*: lamina ovata, 35 × 12.6–42 × 14 cm, utrinque glabra, apice acuto, basi cuneata haud decurrente sed in petiolum abrupte angusta; petiolus 14–28 cm longus, purpurascens; ligula 2.5–3.7 cm longa, papyracea, profunde biloba lobis angustis acutis. *Inflorescentia* e basi surculi foliati, axi horizontali 8–15 cm longo paulo hypogaeo saepe ramos laterales emittente in parte haud florifera vaginis apertis bifariis praedito, flores solitarios ad apicem emittens; inflorescentiae laterales post terminalem productae. *Bracteae* ovatae, late acutae, 1–1.4 cm longae. *Bracteola* unilateraliter ad basin aperta, 0.8–1.2 cm longa, apice late acuto sed leviter emarginato, e summo pedicello oriens. *Calyx* (ovario excluso) c. 3.5–4 cm longus, dentibus 3 approximatis praeditus, ad 1.4 cm uno latere fissus, leviter roseo-tinctus. *Corollae* tubus 2–2.7 cm calyci longior, gracilis; lobus dorsalis cucullatus, 1.2–1.4 × 0.5–0.6 cm, lobi laterales paulo breviores angustiores; corollae tubus et lobi albi vel hyalini. *Labellum* c. 2.5 cm longum, ad apicem 1.3 cm latum fere rotundatum inferne abrupte angustatum ad basin 6 × 4 mm; pars apicalis plus minusve erecta, marginibus crispatis, zona media incrassata flava utrinque ad basin linea kermesina notata. *Staminodia lateralia* nulla. *Stamen*: filamentum c. 3 mm longum et latum, leviter

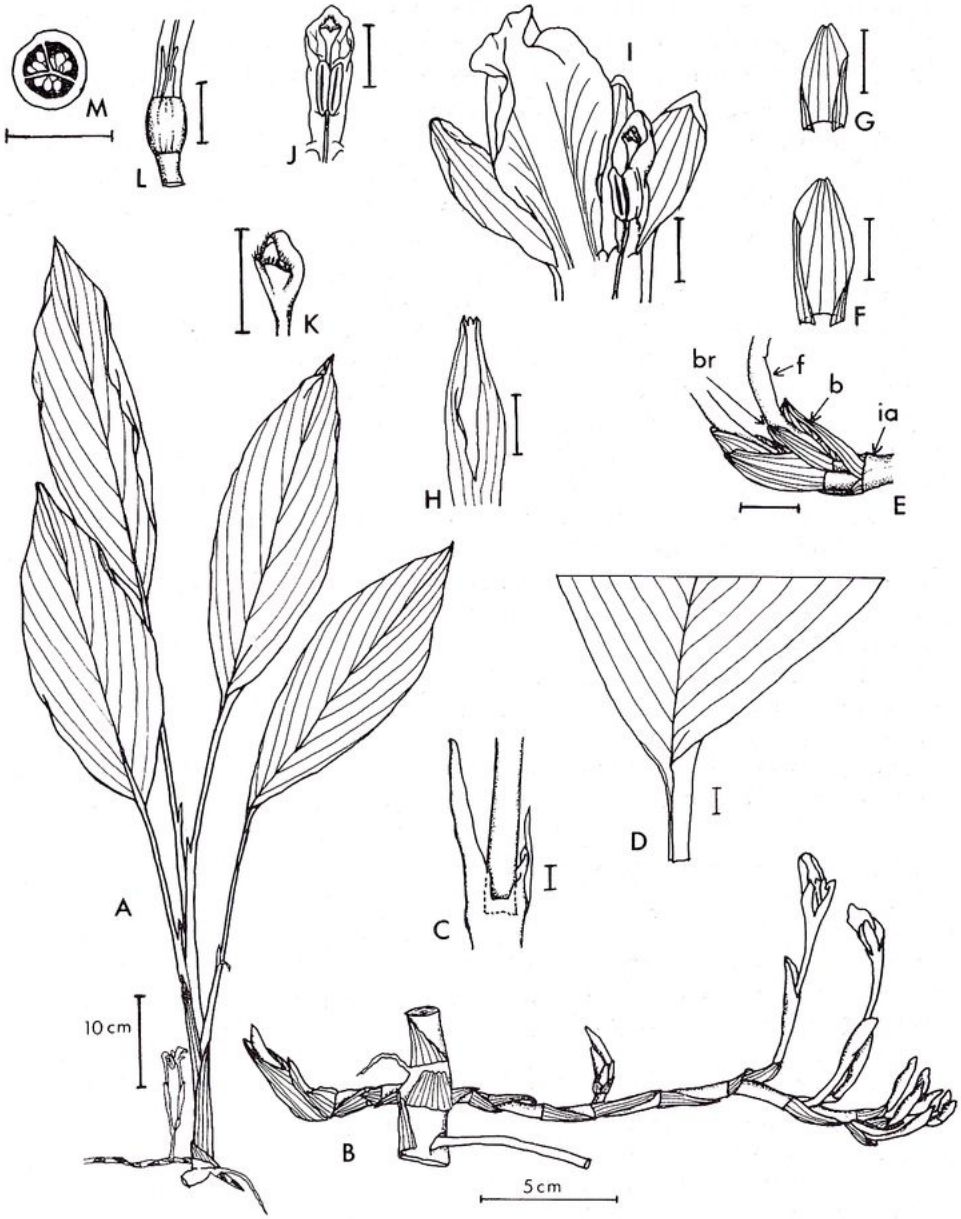

FIG. 2. *Elettariopsis burttiana* Kam. A, habit; B, partial inflorescence; C, ligule; D, leaf-base; E, distal end of inflorescence to show arrangement of bracts and bracteoles; F, bract; G, bracteole; H, apex of calyx; I, flower, dissected; J, stamen; K, stigma; L, ovary with epigynous glands; M, ovary, transverse section. b, bract; br, bracteole; f, flower; ia, inflorescence axis. Lines represent 5 mm unless otherwise stated. (From live material of holotype, *Kam* 353).

curvatum; antherae thecae c. 4 mm longae; crista dilatata, oblique reflexa, c. 4.5 × 5 mm, marginibus coram incurvatis, apice late acuta. *Glandulae epigynae* 2, tenues, 2.5 mm longae, lobatae, stylum haud circumcingentes. *Stigma* obconicum, c. 2 mm altum et latum, ore late triangulari ciliato ultra antherae thecas conspicue elevatum. *Ovarium* 5 × 3 mm, pedicello 2.5 mm, triloculare, ovulis multis axilibus praeditum. *Fructus* ignotus. n = 24.

Type: PENANG. Cultivated in open disturbed forest in Penang Waterfall Garden, site of original collection not known, 26 iv 1979, *Kam* 353 (holo. KLU, iso.E).
PERAK. Bukit Berapit, disturbed forest, iv 1976, *Beltran* 130 (KLU).

Elettariopsis burttiana resembles *E. curtisii* closely in inflorescence and floral structure. But it is easily distinguished by its habit, leaf shape and remarkably long, bilobed ligule. The leaves are somewhat ovate, and their bases, instead of being decurrent as in *E. curtisii*, are clearly and abruptly demarcated from the long slender purplish petiole. The ligule varies from 2.5 to 3.7 cm long and is papery and deeply bilobed, the lobes being very narrow. When fresh, the leaves of the larger forms of *E. curtisii* are rather coriaceous whereas those of *E. burttiana* are thinner and more glossy. This feature is lost in herbarium specimens.

4. Elettariopsis triloba (Gagnep.) Loesen. in Pflanzenfam. 2 Aufl., 15a: 603 (1930); Holtt. in Gard. Bull. Sing. 13: 219 (1950). Fig. 3.
Type: Cultivated in garden of the Museum of Natural History, Paris, originally from Indo-China (n.v.).
Basionym: *Amomum trilobum* Gagnep., Bull. Soc. Bot. Fr. 51:453 (1904); Fl. Gen. Indoch. 6: 108. pl. IID, f. 24–30 (1908).

Rhizomes slender, wide-creeping, horizontal, bearing leaf-shoots at 8–15 cm intervals. Plants not tufted. *Roots* not tuberous. *Leaf-shoots* of 1–5 leaves; pseudostem of tightly clasping leaf-sheaths up to 35 cm tall; margins of leaf-sheath not papyraceous. *Leaves*: lamina lanceolate, to about 30 × 5–8 cm, both surfaces glabrous; apex distinctly caudate with cauda 1.5–3 cm long; base acute-attenuate; petiole of lowest leaf 1–3 cm long, of uppermost to 10 cm; ligule glabrous, c. 2 mm long, slightly bilobed. *Inflorescence* from base of leaf-shoot, with short, c. 3 cm, scape arising close to leaf-shoot and upturned to terminate in an inflorescence. Inflorescence of 4–8 bracts in a compact head of width 2 cm, all bracts and calyx suffused pink. *Bracts* broadly pointed, up to 3 × 1.8 cm, each subtending 1 or 2 flowers. Bracteoles open to the base on one side, up to 2 × 1.5 cm, enclosing the younger flower of each pair of flowers, bracteole absent when a single flower only is produced. *Calyx* (excluding ovary) up to 4 × 0.6 cm, split down one side to 1 cm, the other side with 2 or 3 small blunt teeth of 1 mm height, close together, glabrous. *Corolla* tube as long as calyx or up to 1.5 cm longer; lobes transparent, up to 2 cm long; dorsal lobe 7 mm broad, hooded; lateral lobe 6 mm broad, hood smaller. *Labellum* c. 2.8 cm long, distal portion broad, of width c. 2.3 cm, reflexed, 3-lobed with middle lobe slightly emarginate, edges thin and crisped, cream with broad yellow median band bordered by a red stripe on either side towards the throat, median yellow portion thick, fleshy and hairy towards the throat. *Lateral staminodes* nil. *Stamen*: filament 5 × 4.5 mm; anther-thecae c. 5 mm long; crest 7.5 × 5 mm, more or less quadrate, thin, expanded, with a small (1.5 mm long) tooth-like lobe at the base on each side. *Epigynous glands* 2, slender c. 3 mm long, lobed, not surrounding the style. *Stigma* obconic, about 2 mm long and wide, with broad triangular ciliate mouth, held 2 mm beyond anther-thecae. *Ovary* 4 × 3 mm, on pedicel 1.5 mm long, trilocular, multiovulate, with axile placentation. *Fruit* unknown. n = 24.
PENANG. Cultivated in open disturbed forest in Penang Waterfall Garden, site of original collection not known, 24 ii 1979, *Beltran* 204 (KLU).
PERAK. Larut, 200–500m, *King's collector* 2886 (SING).

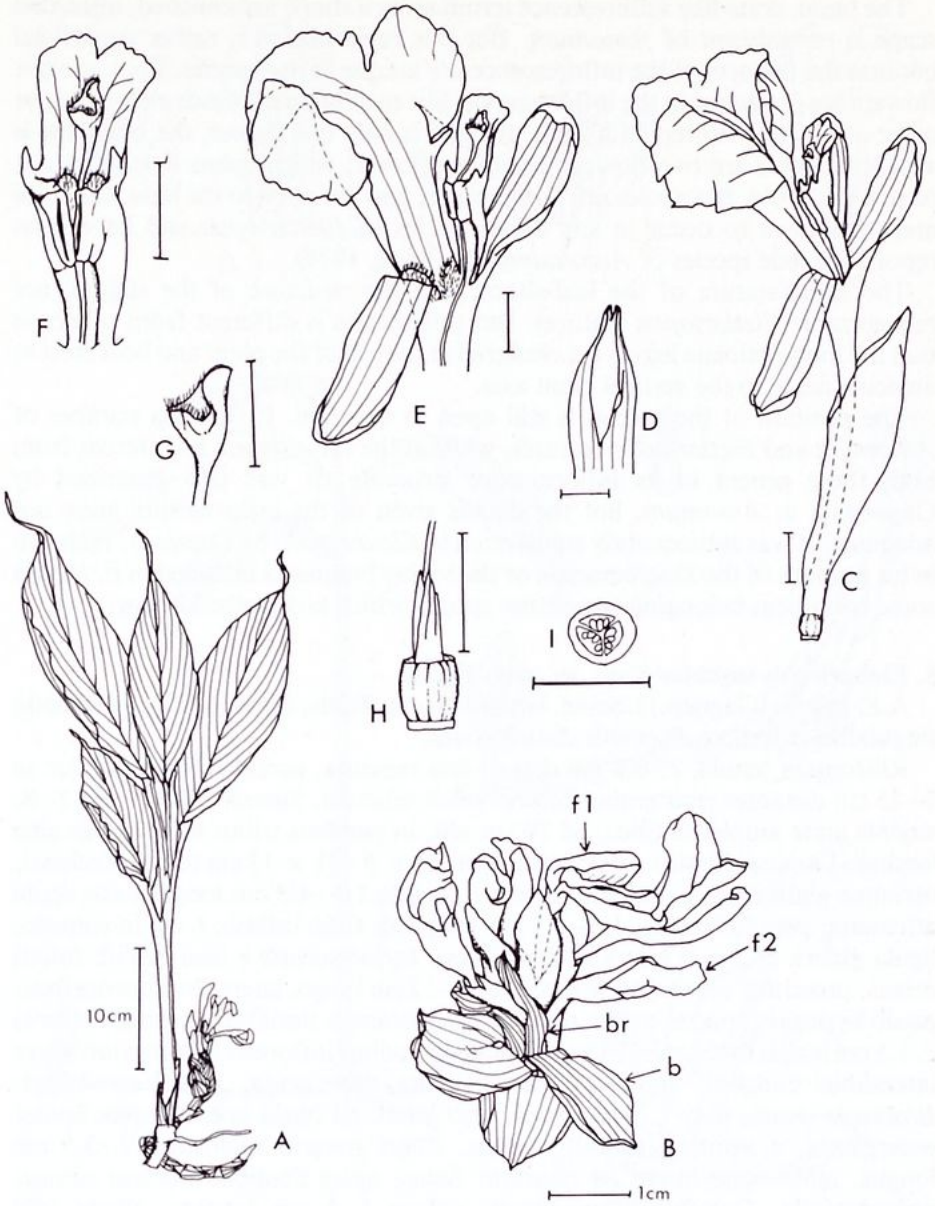

FIG. 3. *Elettariopsis triloba* Gagnep. A, habit; B, inflorescence, the labelled flowers and bracts & bracteoles forming one cincinnus; C, flower; D, apex of calyx; E, flower, dissected, with one lateral corolla lobe removed; F, stamen; G, stigma; H, ovary and epigynous glands; I, ovary, transverse section. b, bract; br, bracteole; f1, flower 1; f2, flower 2. Lines represent 5 mm unless otherwise stated. (From live material: B, from *Kam* 329; all other drawings from *Beltran* 204).

SELANGOR. 22nd mile Gombak/Genting road, disturbed forest, 6 vii 1978, *Kam* 329 (KLU).

PAHANG. Tanah Runto, Pulau Tioman, 400m, 12 v 1927, S.F.N. 18381, *Henderson* (SING).

JOHORE. Kuala Rompin, collected 16 ix 1978, cultivated and flowered 21 iii 1979, *Beltran* 182 (KLU).

The basal, cone-like inflorescence terminating a short, unbranched, upturned scape is reminiscent of *Amomum*. But this resemblance is rather superficial because the features of the inflorescence are unique to the species. Four to eight flowers are produced in the inflorescence, but each bract subtends either one, or more often two, flowers in its axil. If there is only one flower, the bracteole is absent. If there are two flowers, the outer flower, which opens first, does not have a bracteole. Bracteoles are non-tubular, and are open to the base. Cincinni are not known to occur in any other species of *Elettariopsis* and have been reported in one species of *Amomum* only (Fang, 1978).

The short stature of the leaf-shoot, and the structure of the stigma, are recognizable *Elettariopsis* features. But this species is different from others in that the long-petiolate leaves are clustered at the top of the plant and held erect at an acute angle to the vertical plant axis.

The position of the species is still open to question. It shares a number of *Amomum* and *Elettariopsis* features, while at the same time it is different from both these genera in its inflorescence structure. It was first described by Gagnepain in *Amomum*, but the details given of the inflorescence were not adequate. It was subsequently transferred to *Elettariopsis* by Loesener. Holttum in his account of the Zingiberaceae of the Malay Peninsula included in *E. triloba* some specimens belonging to another species which is described below.

5. Elettariopsis smithiae Kam, **sp. nov.** Fig. 4.

A *E. triloba* (Gagnep.) Loesen. laminis laxe suffultis, floribus in inflorescentia singulatim et remote dispositis distinguenda.

Rhizomata tenuia, c. 0.8 cm diam., late repentia, surculos foliatos inter se 8–25 cm distantes emittentia. *Radices* haud tuberosi. *Surculi* foliati foliis 3–8, vaginis arcte amplectentibus, ad 70 cm alti, in partibus tribus inferioribus sine laminis. Lamina elliptica vel oblanceolata, 24 × 5–31 × 13 cm (cauda exclusa), utrinque glabra; apex distincte caudatus, cauda 1.5–4.5 cm longa; basis acute attenuata; petiolus tenuis, 1.5–2.5 cm longus in folio infimo, 6 cm in summo, ligula glabra c. 2 mm longa leviter biloba. *Inflorescentia* e basi surculi foliati oriens, prostrata, axi majori horizontali 8–12 cm longo, lateralibus brevioribus, paulo hypogaea; partes axium non florentes bracteis sterilibus appressis bifariis c. 1.5 cm longis instructae. Flores distaliter in axibus inflorescentiae majoribus et lateralibus congesti, solitarii. *Bractea* ovata, late acuta, 1–1.8 cm longa. *Bracteola* ovata, 0.4–1.2 cm longa, uno latere ad basin aperta, apice leviter emarginata, e summo pedicello oriens. *Calyx* (ovario excluso) 2.2–3.5 cm longus, albus, uno latere ad quartam fissus, apice dentibus duobus obtusis approximatis. *Corollae* tubus tenuis, calyce 1–3 cm longior, albus; lobi cucullati, dorsali maximo 1.5 × 0.7 cm, lateralibus paulo brevioribus et angustioribus. *Labellum* ad 3 cm longum, parte distali lata rotundata 1.8 cm lata, ad basin 5–9 mm latam abrupte angustata, zona media excepta album; apex marginibus crispatis; zona media incrassata, flava, faucem versus linea rubra utrinsecus notata. *Staminodia lateralia* absentia vel parva, acicularia, c. 2 mm longa. *Stamen*: filamentum c. 4 × 3 mm; antherae thecae c. 4 mm longae; crista tenuis, expansa, late triangularis, paulo oblique reflexa, c. 6 × 5.5 mm marginibus incurvis inclusis, apice rotundato vel late acuto. *Glandulae epigynae* 2, tenues, 4 mm longae, lobatae, stylum non circumcingentes. *Stigma* obconicum, 2 × 2.5 mm, ore late triangulari pilis brevibus ciliato, supra thecas conspicuum, cristam haud superans. *Ovarium* 3 × 2.5 mm, pedicello 2 mm

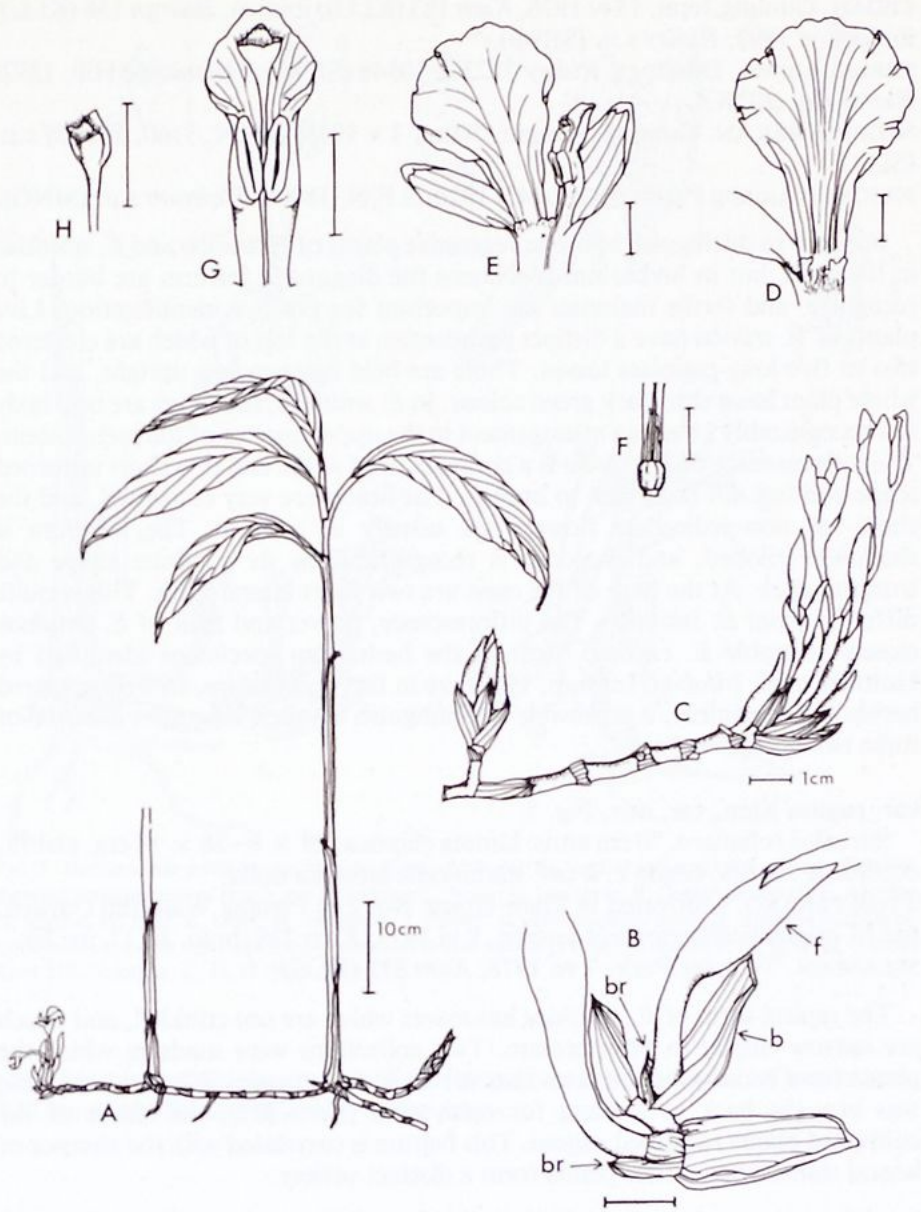

FIG. 4. *Elettariopsis smithiae* Kam. A, habit; B, partial inflorescence to show arrangement of bracts and bracteoles; C, partial inflorescence; D, labellum; E, flower, dissected, with one lateral corolla lobe removed; F, ovary and epigynous glands; G, stamen; H, stigma. b, bract; br, bracteole; f, flower. Lines represent 5 mm unless otherwise stated. (From live material: A, B, E, F, G, H from *Beltran* 110, holotype; C, D from *Kam* 183).

longo, parce pubescens, triloculare, ovulis multis axilibus. *Capsula* globosa, 3 cm diam., late costata, pallide erubescens fusco-maculatis. n = 24.
Type: SELANGOR. Ulu Gombak, disturbed forest, collected 7 iv 1976, cultivated and flowered iii & iv 1979, *Beltran* 110 (holo. KLU, iso.E).
SELANGOR. Templer Park, iv 1976, *Beltran* 121 (KLU).

KEDAH. Gunung Jerai, 15 iv 1976, *Kam* 183 (KLU); ibidem, *Beltran* 136 (KLU); ibidem, vi 1893, *Ridley* s.n. (SING).
PERAK. Lumut, Dindings, *Ridley* 7223 & 10348 (SING); Hermitage Hill, 1892, *Ridley* s.n. (SING).
NEGRI SEMBILAN. Gunung Tampin, 500m, 1 v 1918, S.F.N. 3160, *Burkill* s.n. (SING).
JOHORE. Gunung Panti, 500m, 14 ii 1926, S.F.N. 18088, *Holttum* s.n. (SING).

It is easy to distinguish between vegetative plants of *E. triloba* and *E. smithiae* in the field, but in herbarium specimens the diagnostic features are harder to recognize, and fertile materials are important for positive identification. Live plants of *E. triloba* have a distinct pseudostem at the top of which are clustered two to five long-petiolate leaves. These are held more or less upright, and the whole plant has a rich, dark green colour. In *E. smithiae*, the leaves are held laxly in a recognizably 2-ranked arrangement in the upper quarter of the pseudostem. The inflorescence of *E. triloba* is a compact head at the end of a short upturned scape and has not been seen to branch. The bracts are very congested, and the short- or non-pedicellate flowers are usually in cincinni. The labellum is shallowly trilobed, and the crest is recognizable by its quadrate shape and truncate apex. At the base of the crest are two short lateral teeth. This is quite different from *E. smithiae*. The inflorescence, flower and fruit of *E. smithiae* closely resemble *E. curtisii*. Most of the herbarium specimens identified by Holttum as *E. triloba* (Holttum, 1950) are in fact *E. smithiae*. In well-prepared herbarium specimens, it is possible to distinguish between vegetative material of these two species.

var. **rugosa** Kam, **var. nov.** Fig. 5.

Surculus foliatus c. 70 cm altus; lamina elliptica, 29 × 8–38 × 14 cm, glabra, conspicue rugosa; cauda c. 2 cm; staminodia lateralia nulla.
Type: PENANG. Cultivated in Plant House No. 2 in Penang Waterfall Garden, site of original collection not known, 9 vi 1975, *Kam* 228 (holo. KLU, iso.E).
SELANGOR. Templer Park, 7 vii 1978, *Kam* 332 (KLU).

The typical form of *E. smithiae* has leaves which are not crinkled, and which are narrow-elliptic to oblanceolate. Two collections were made in which the plants have broad-elliptic leaves that are strikingly rugose. When the rhizome was brought back to Penang for cultivation (*Kam* 332), the leaves of the cultivated plants remained rugose. This feature is correlated with the absence of lateral staminodes. These plants form a distinct variety.

Elettariopsis does not lend itself easily to herbarium studies. Many of the diagnostic vegetative features seen in living plants are hard to detect in herbarium specimens. The extreme range of morphological variations, and our lack of knowledge regarding it, adds to the problems general in studies of Zingiberaceae. The variation in the length of the inflorescence axis, the relative lengths of corolla and calyx tubes, and the size of other floral parts, are not dependable taxonomic characters but are affected by the amount of debris covering the inflorescence. When a collection of *E. curtisii* (*Kam* 101) was transplanted and cultivated in the ground of the Universiti Sains Malaysia campus, the plants produced a terminal inflorescence. The ground was cleared of debris, but the soil was heavy clay. This

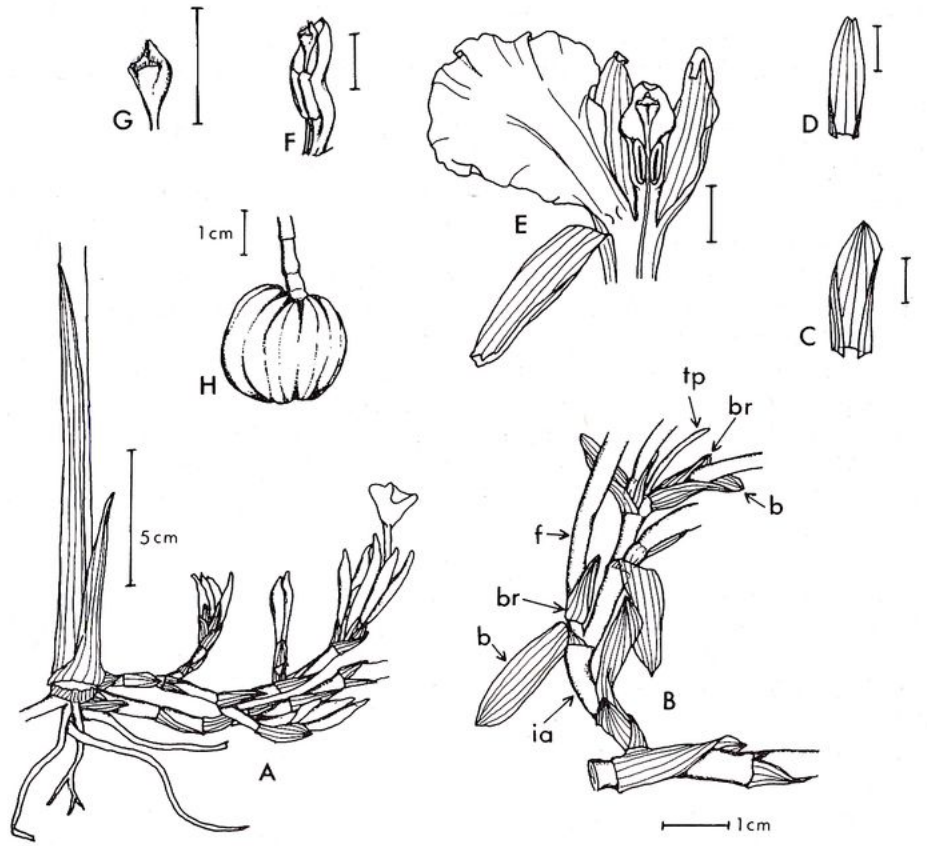

FIG. 5. *Elettariopsis smithiae* var. *rugosa* Kam. A, habit; B, partial inflorescence of four flowers, showing arrangement of bracts and bracteoles; C, bract; D, bracteole; E, flower, dissected; F, stamen; G, stigma; H, fruit. b, bract; br, bracteole; f, flower; ia, inflorescence axis; tp, terminal portion of inflorescence. Lines represent 5 mm unless otherwise stated. (From live material: A, B, E, F, G from *Kam* 228, holotype; C, D, H from *Kam* 332).

could have prevented the growth of the lateral basal subterranean inflorescences that are normally characteristic of the genus.

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