NOTES ON CAULOKAEMPFERIA

KAI LARSEN* & R. M. SMITH

ABSTRACT. A new species of *Caulokaempferia* K. Larsen (Zingiberaceae), *C. alba* K. Larsen & R. M. Smith, is described and *C. yunnanensis* (Gagnep.) R. M. Smith is transferred to this genus from *Camptandra* Ridl.

The flowering at Edinburgh of material of *Camptandra* from the Malay Peninsula (*C. latifolia* Ridl.) and Borneo (*C. angustifolia* Ridl.) has led to the examination of herbarium specimens of two Chinese species originally described in *Kaempferia* and currently placed in *Camptandra*. These plants bear no more than a superficial resemblance to *Camptandra* and their proposed transfer to *Caulokaempferia*, together with the discovery of a new species from Thailand, *Caulokaempferia alba*, necessitates some extension of the generic characters.

Caulokaempferia K. Larsen in Bot. Tidsskr. 60: 165 (1964).

Herbs up to 40 cm; stems with 2–4 bladeless sheaths at base. *Leaves* 3–10, sessile or petiolate, ligule small, bilobed. *Inflorescence* terminal, flowers opening singly. *Primary bracts* 1–10, distichous, lanceolate acuminate, the margins quite free to the base or concave with the margins adnate to the main axis of the inflorescence at the base and with a lamina-like extension at the apex; 1–4-flowered. *Bracteoles* membranous, often not associated with the first flower in those species with cincinni of up to 4 flowers, present or not in species with single-flowered bracts. *Calyx* tubular often 2–3-dentate, not deeply split unilaterally. Corolla tube long, narrow, widening at the mouth; lobes 3, the dorsal broader and a little longer than the laterals. *Lateral staminodes* large, petaloid. *Lip* large, orbicular, entire or bilobed, ± concave. Anther usually with a very short filament (occasionally up to 5 mm long) or sessile on the corolla tube; pollen sacs ± parallel, dehiscing longitudinally; connective produced into a conspicuous, reflexed (always ?), entire or dentate crest. *Epigynous glands* short, ± linear, free from each other. *Ovary* at least partly trilocular. Fruit a capsule.

Distribution: Himalayas, W China, Burma, Thailand and Indo-China. 10 species.

Type: *C. linearis* (Wall.) K. Larsen in Bot. Tidsskr. 60: 170 (1964).

KEY TO THE SECTIONS

Primary bracts boat-shaped, lacking an apical extension; lip usually entire, occasionally ± emarginate . . . . Sect. *Caulokaempferia*

Primary bracts large, concave, each with a lamina-like apical extension, lip bilobed . . . . . Sect. *Pyrgophyllum*

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Caulokaempferia (sect. *Caulokaempferia*) **alba** K. Larsen & R. M. Smith, **species nova** antherae crista laciniato-dentata ab omnibus congeneris disdincta. Fig. 1.

Herba usque ad 30 cm alta; caulis vaginis 2–3 laminis destitutis basi instructus. *Folia* 4–5, vaginis membranaceo-marginatis, ligulis membranaceis bilobis, 0·1–0·2 cm longis; lamina plus minusve sessilia vel petiolo 0·2–0·4 cm longo suffulta, 6·5–13 × 1·3–2 cm (infima 1–4 × 1·3 cm), lanceolato-acuminata, basi rotundata. *Inflorescentia* terminalis, pedunculo 3 cm longo, glabra, 1–5-flora, floribus singillatim et interdum saltem deorsum maturantibus; bracteae primariae distichae, lanceolato-acuminatae, 6–2 × 0·8 cm sursum decrescentes, florem singulum aut perfectum aut abortivum saepe includentes, bracteola floris fertilis 1·5–2·4 × 0·4 cm floris abortivi multo minore. *Calyx* (ovario incluso) c. 2 cm longus, membranaceus, tubulosus, breviter bidentatus. *Corollae* tubus albus, intus circa faucem breviter pubescens, 6 cm longus, basi 0·1 cm diametro sursum gradatim ampliatus ad 0·3 cm; lobi albi, dorsales 2 × 0·8 cm, mucronulati, laterales 2 × 0·5 cm apiculati. *Staminodia* lateralia alba, plus minusve obovata, 3 × 1·5 cm. *Labellum* album, basi pallide flavum et breviter pubescens, orbiculare, 4 cm longum, plus minusve concavum, integrum marginibus crispatis. *Anthera* sessilis c. 0·7 cm longa; crista connectivae 0·6 cm longa, 4-dentata, reflexa. *Stigma* ciliatum. *Glandulae epigynae* lineares, 0·3 cm longae. *Ovarium* triloculare. *Fructus* ignotus. 2n = 24.

Thailand. Phitsanulok, top of Phu Mieng, flat sandstone plateau with open grassland, flowers white, vii–viii 1966, *Larsen, Smitinand & Warncke* 949 (holo. AAU).

In *Caulokaempferia* we know very little as yet about the variability of inforescence structure and we shall not understand the genus and its affinities until our knowledge is improved. The available herbarium material is inadequate for any such study and future collections should include a good sample of inflorescences made through each population.

Two inflorescences of *C. alba* have been dissected and show how marked the variation may be. The first consisted of 2 conspicuous primary bracts, the lowermost supporting a single abortive flower bud and bracteole, the second containing an ebracteolate mature flower beyond which the main axis was prolonged to produce a small third primary bract within which another abortive bud was clearly visible. In the second inflorescence there were 6 distichously arranged primary bracts all but the uppermost (which contained an abortive bud) supporting mature flowers only 3 of which possessed bracteoles. The uppermost flower had opened first, as in *Boesenbergia*, and it is noteworthy that, although 3 of the remaining flowers had opened in sequence downwards, the flower second from the apex was the last to open. Such a mode of flowering has not been previously observed in *Caulokaempferia* and the possibility of affinity with at least some *Boesenbergia* should not be disregarded. *B. pulcherrima* (the lectotype of the genus) also has leafy stems up to 30 cm high, but examination of the flower shows certain marked differences from that of *C. alba* or indeed any *Caulokaempferia*. The labellum of *B. pulcherrima* is strongly basin-shaped, narrowing sharply at the base where it forms a c. 5 mm tube with the lower part of the short filament. Throughout *Caulokaempferia* the labellum, although concave, does not

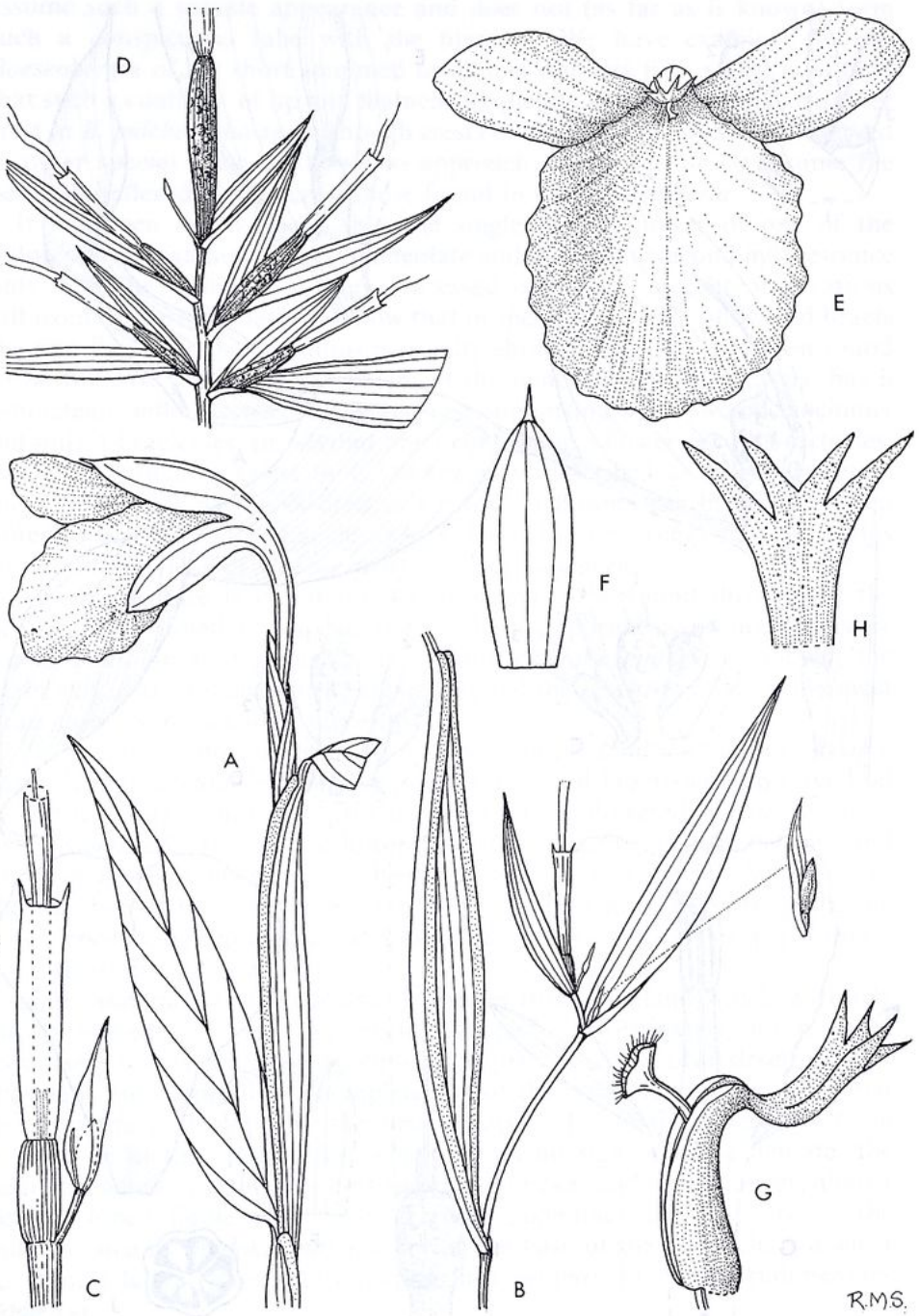

FIG. 1. *Caulokaempferia alba* K. Larsen & Smith. A, flowering inflorescence, x 1; B, the same inflorescence, leaf sheath pulled back, showing bracteole and abortive bud of 1st primary bract, 2nd primary bract and flower and 3rd primary bract, x 1; C, calyx and ovary of mature flower (showing epigynous glands), 3rd primary bract enclosing abortive flower bud and end of main axis, x 2; D, another inflorescence primary bracts spread out showing distichous arrangement, x 1; E, flower from front, x 1; F, dorsal petal, x 1; G, anther, x 3; H, anther crest, x 3 (from dried material).

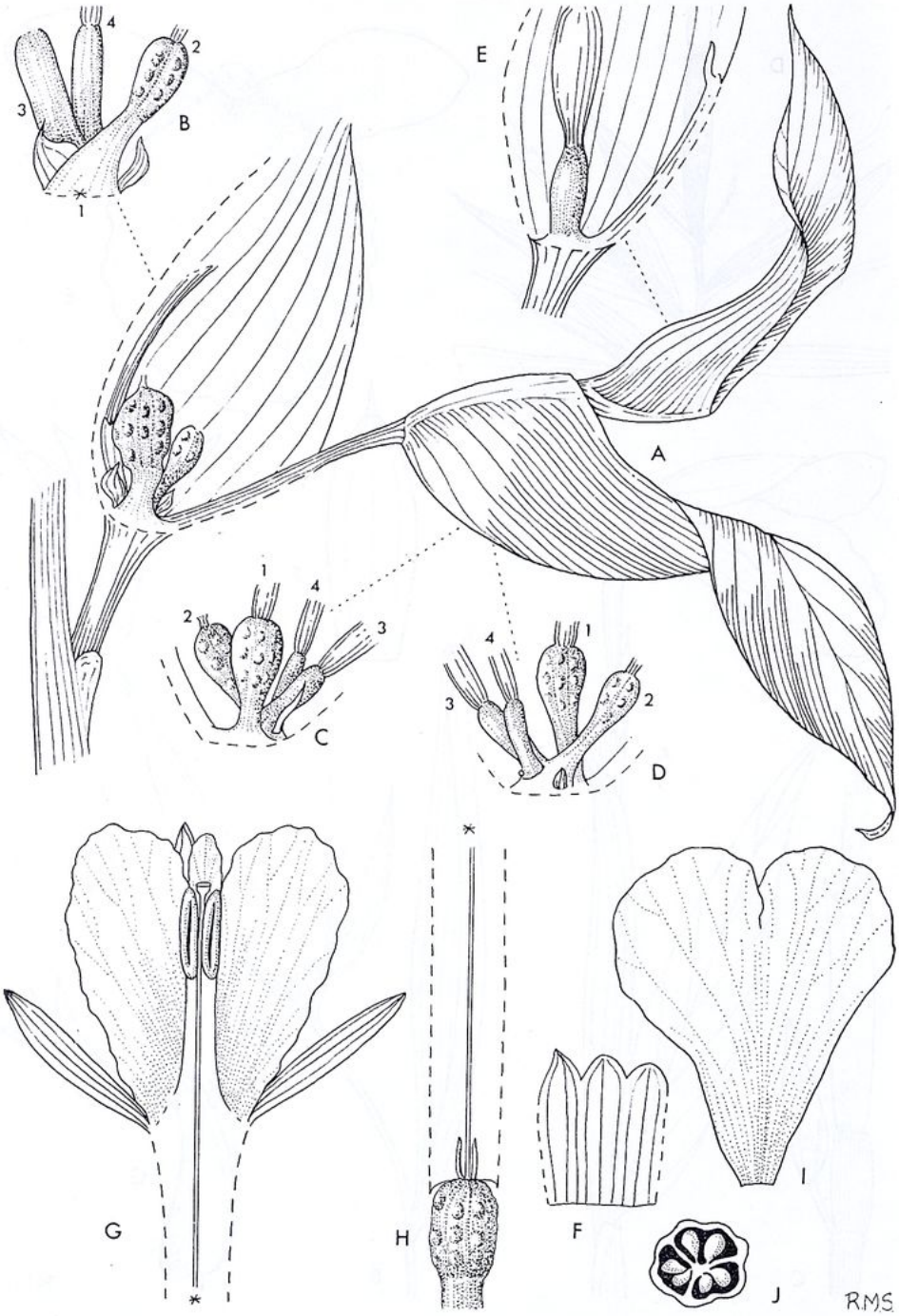

FIG. 2. *Caulokaempferia yunnanensis* (Gagnep.) R. M. Smith. A, inflorescence, 1st primary bract in L.S., x 1; B, arrangement of 1st cincinuus, 1st flower removed, x 2; C, arrangement of 2nd cincinnus, x 2; D, reversed; E, uppermost cincinnus, reduced to a single ebracteolate flower; F, calyx x 2; G, H, flower in L.S. showing petals, lateral staminodes, anther, epigynous glands, x 2; I, lip, x 2; J, ovary in T.S., x 3. (from dried material—A–E, *McLaren* N125, F–J, *Forrest* 12983).

assume such a saccate appearance and does not (as far as is known) form such a conspicuous tube with the filament. We have examined several *Boesenbergia* of the short stemmed or almost stemless type and it is evident that such a coalition of lip and filament frequently occurs. There is no anther crest in *B. pulcherrima* and although crests of varying size have been observed in other species none is known to approach the dimension or assume the petaloid, reflexed character of those found in *Caulokaempferia*.

It has been noted above that the single mature flower of one of the inflorescences examined was ebracteolate and that in the second inflorescence only 3 of the 5 mature flowers possessed bracteoles. Recent observations (all from herbarium material) show that in species with many-flowered bracts the first flower of the cincinnus is usually ebracteolate. This has been found to be the case in *C. linearis* which, in the material examined by us, has a 2-bracteate inflorescence, the lowermost supporting a 4-flowered cincinnus but only 3 bracteoles, the second bract containing 3 flowers and 2 bracteoles. A similar situation exists in *C. sikkimensis* (described as single flowered, but *Cowan* 1923 as represented at E shows 2 flowers per bract), has been noted in *C. coenobialis* (Larsen, Bot. Tidsskr. 60: 177, 1964) and also seems to be characteristic of *C. fongyuensis* and *C. yunnanensis*.

Another feature is of interest for it seems to be found throughout the genus and as noted below, has been hitherto reported as occuring only in *Camptandra*. In that genus, and in many *Caulokaempferia* examined, the main axis of the inflorescence extends beyond the insertion of the uppermost bract into a short slender sterile tip.

The strictly uniflorous bracts of *C. alba* indicate an affinity with *C. kuapii*, *saxicola* and *petelotii* but in these species a second bracteolate abortive bud is said to occur within each primary bract. Single flowered bracts are found in *C. coenobialis*, though the lowermost may contain 2 mature flowers, and abortive flower buds have not been recorded in this species. Variation in the number of flowers per bract is probably common, the type gathering of *C. linearis*, as represented at Edinburgh, shows cincinni of 3–4 flowers, not 2 as originally described.

Spirit material of an undescribed species from Thailand which is clearly closely related to *C. alba* has been examined. Unfortunately this material (*Sorensen, Larsen & Hansen* 6306) is inadequate to allow a full description of the plant but despite the incompleteness of the inflorescence it is clear that the uppermost flowers are the first to open. The main differences from *C. alba* lie in the anther crest which shows no sign of being dentate, the peduncle which is short (c. 1 cm) and much thicker and in the longer, almost acutely lobed ligule. This plant further underlines the diversity of the inflorescence in *Caulokaempferia*, for at the base of the peduncle is a short (c. 2 mm) lateral branch terminating in a primary bract and rudimentary flower(s).

Caulokaempferia sect. **Pyrgophyllum** (Gagnep.) R. M. Smith, **comb. nov.**
Syn.: *Kaempferia* subgen. *Pyrgophyllum* Gagnep. in Bull. Soc. Bot. France 49: 267 (1902).

Camptandra sect. *Pyrgophyllum* (Gagnep.) K. Schum., Pflanzenr. IV, 46: 64 (1904).

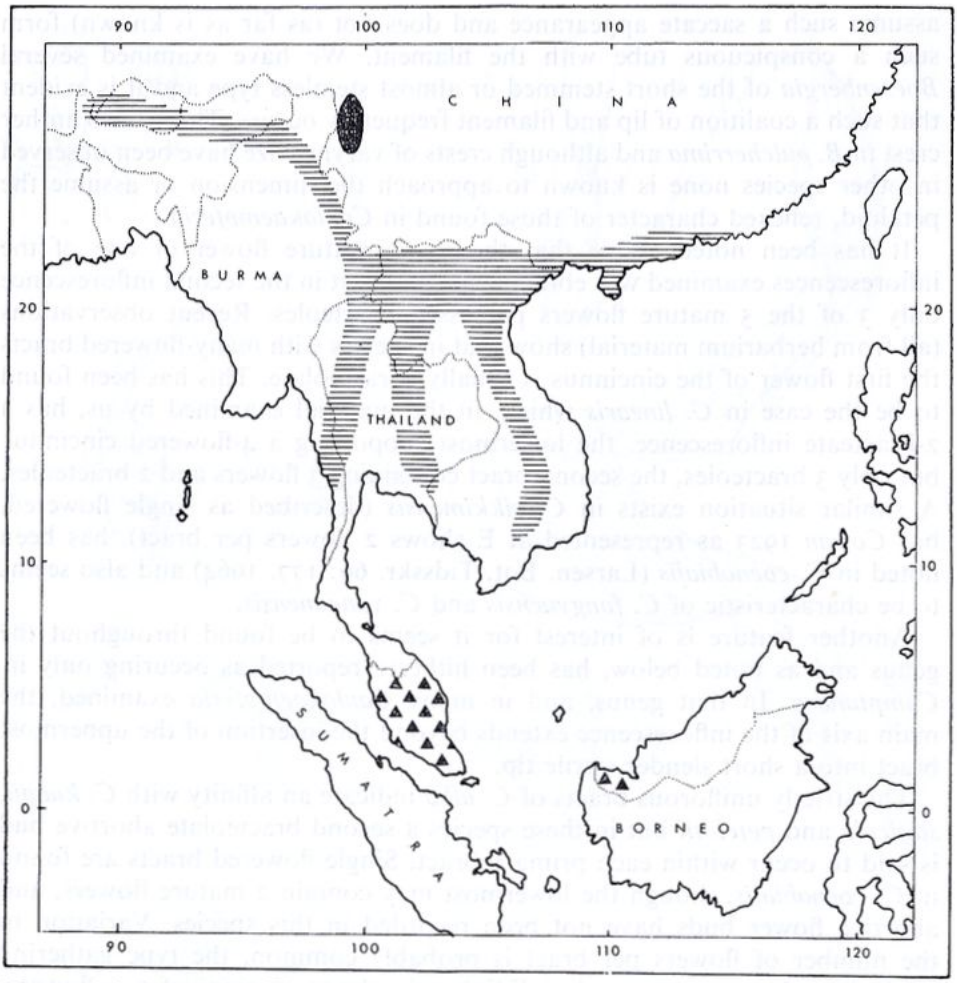

FIG. 3. Distribution of ▒ *Caulokaempferia* sect. *Caulokaempferia*; ▓ *Caulokaempferia* sect. *Pyrgophyllum*; ▲ *Camptandra*.

Caulokaempferia yunnanensis (Gagnep.) R. M. Smith, **comb. nov.** (fig. 2.).
Basionym: *Kaempferia yunnanensis* Gagnep. in Bull. Soc. Bot. France 48: p. LXXVII (1901).
Type: Yunnan, Tsong-so (Ten-tschuan), à 50 km au N de Tali. *Delavay* 2721 (E)
Syn.: *Camptandra yunnanensis* (Gagnep.) K. Schum., Pflanzenr. IV, 46: 64 (1904). Type species of *Kaempferia* subgen. *Pyrgophyllum* Gagnep.
Yunnan: vicinity of Yun-nan-sen, received Nov. 1906, *Maire* 2018; Tong Shan, Yangtze bend, 2500 m, 30–45 cm, flowers pale yellow, viii 1913, *Forrest* 10937; Mekong Valley, 2300 m, 30–45 cm, flowers pale yellow, *Forrest* 12983; Yungpeh, 1920, *Simeon Ten* 264; Yangtze watershed, western slopes of Likiang Snow Range, v–vi 1922, *Rock* 5379; mountains north of Yungpeh, 2700 m, flowers pale yellow, viii 1922, *Forrest* 22089; Yuning, yellow, viii, received 1934, *McLaren* N 125; Chao Chou, Lien Wang mountain, yellow, v, received 1935, *McLaren* L 61A; Szechuan, Muli: 2650–2750

m; flowers pale sulphur, 26 vii 1915, *Handel-Mazzetti* 7254; 2500 m, flowers lemon yellow, 6 viii 1921, *Kingdon Ward* 4577 (all E).

Much of the material cited above has been previously determined as *C. fongyuensis* Gagnep. (type: Yunnan, environs du lac Er Hai, à Tung-yu montagnes 19 Juin, *Prince Henri d'Orleans*). We have not seen the type collections of either, but strongly suspect that only one species is involved.

Gagnepain described *Kaempferia yunnanensis* and the doubtfully distinct *K. fongyuensis* in 1901 and for them proposed a new subgenus, *Pyrgophyllum*. He was aware that the plants displayed most of the characteristics of subgenus *Monolophus* (Wall.) Bak.* (*Caulokaempferia* K. Larsen p.p. but considered the large concave bracts, made so distinctive by the lamina-like extension of the apex, sufficient reason for a separate sub-genus. He further proposed that *K. parvula* King ex Benth. be included in subgenus *Pyrgophyllum*, basing his decision on the large concave bract alone; he was unable to examine the structure of the flowers.

The following year Gagnepain, now aware that Ridley (1899) had described the new genus *Camptandra* for *K. parvula*, maintained his opinion that this species should be placed with *K. yunnanensis* and *K. fongyuensis* and, abandoning subgenus *Pyrgophyllum*, proposed *Kaempferia* subgenus *Camptandra* for all three, also including *C. latifolia* Ridl. He was aware of certain differences in the anther between his Chinese plants and Ridley's Malayan species but considered the large concave bract sufficient reason for his proposed grouping. Schumann (1904) maintained *Camptandra* Ridley, subdividing it into 2 sections: *Eucamptandra* for *C. parvula* (incorrectly described as single-flowered) and *Pyrgophyllum* for *C. yunnanensis*, *C. fongyuensis*, and *C. latifolia*.

Geographically, *C. yunnanensis* and *C. fongyuensis* are much closer to *Caulokaempferia* than to *Camptandra*, which is so far recorded from Borneo and the Malay Peninsula only (see fig. 3). The large concave bract is common to both, but the lamina-like extension, which, although resembling the true leaves in shape and texture bears no ligule, is apparently almost entirely restricted to the Chinese species. This structure has not been reported as occurring in *C. parvula* or *C. latifolia* but the Bornean *C. gracillima* (K. Schum.) Val. has an "abbreviated blade on the bract" (Valeton). In other respects the large concave bracts of *C. yunnanensis* and *C. fongyuensis* resemble those of *Camptandra* closely. The following observations have been made from herbarium material of *C. yunnanensis*.

The inflorescence is 2–3 bracteate, the margins of each bract connate to the axis of the inflorescence for some distance at the base and the axis continues within the uppermost bract where it terminates in a short slender, free tip. Such a termination of the axis also occurs in *Camptandra* where the inflorescence is normally unibracteate.

The main distinction between *C. yunnanensis* and Malaysian *Camptandra* lies in the anther which in *Camptandra* is fertile in the upper part only, the base prolonged into a pair of long spurs which project at right angles to the thecae; it is truly versatile (see fig. 4g, h). In *C. yunnanensis* the anther is not versatile, fertile throughout its length and there are no basal spurs. There is no conspicuous crest in true *Camptandra*, that of *C. yunnanensis* is

* For history and application of this name see above p. 216.

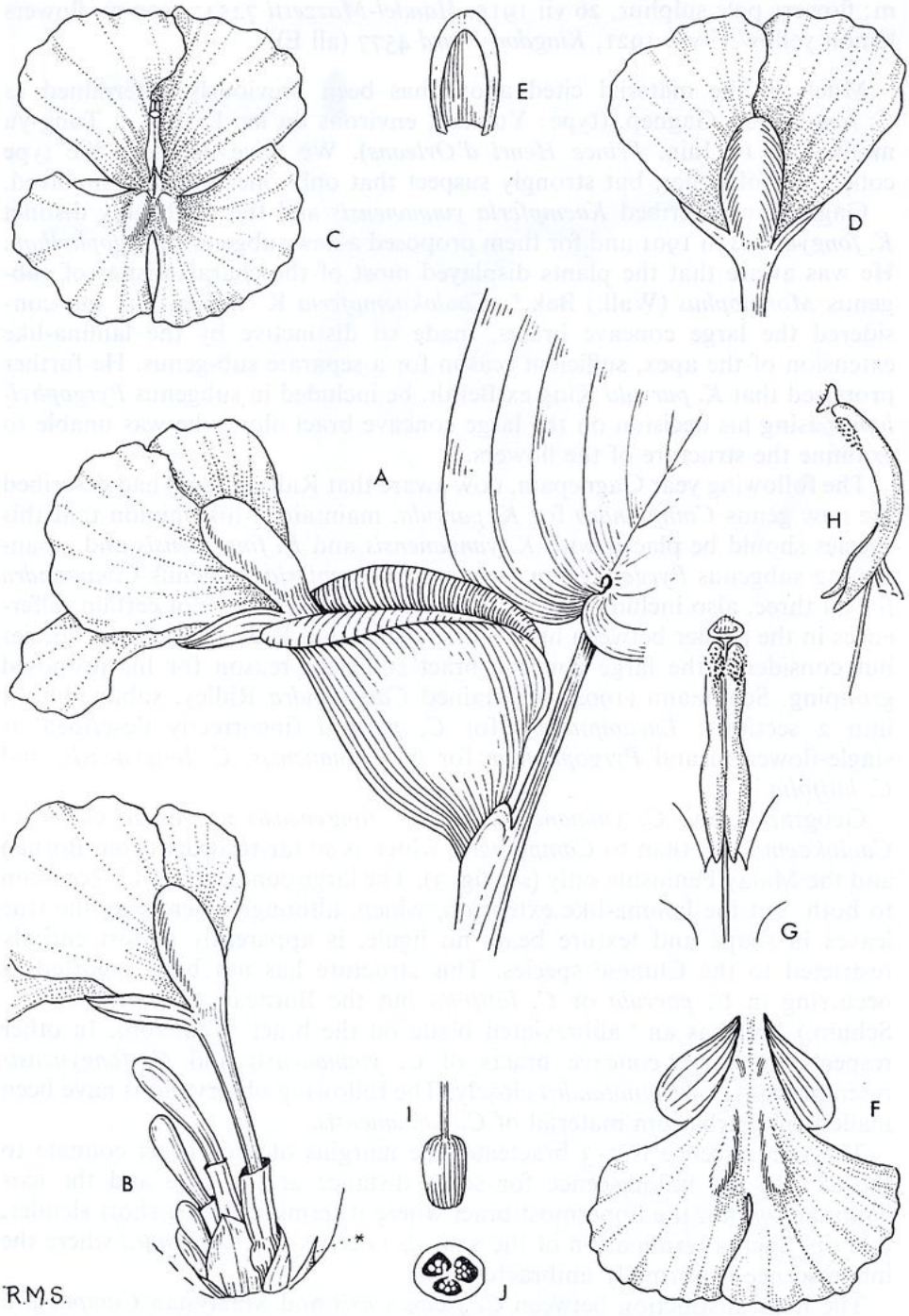

FIG. 4. *Camptandra latifolia* Ridl. A, inflorescence x 1; B, inflorescence with primary bract cut open showing 5-flowered cincinnus each flower accompanied by a bracteole,* indicating termination of main axis, x 1; C, flower from front, x 1; D, flower from back, showing dorsal petal, x 1; E, dorsal petal, x 1; F, lip and lateral petals, x 1; G, anther, x 2; H, anther from side, x 2; I, ovary, x 2; J, ovary in T.S., x 2. (from living material—*Woods* 996).

large and petaloid. Furthermore epigynous glands are absent from all Malaysian *Camptandra*, in *C. yunnanensis* they are clearly present. The first flower of the cincinnus of *C. yunnanensis* appears to lack a bracteole; this character, which may prove to be of some importance in *Caulokaempferia* has been discussed above.

It is clear that *C. yunnanensis* should not remain in *Camptandra*. On the available evidence we believe it to be closer to *Caulokaempferia*, but, the large concave bracts apart, it further differs from previously described species in the longer petioles and filament and in the distinctly bilobed lip. We therefore propose to transfer *C. yunnanensis* to *Caulokaempferia*, taking up Gagnepain's subgeneric name *Pyrgophyllum* at sectional level.