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THE GENUS *SCAPHOCHLAMYS* (ZINGIBERACEAE – ZINGIBEREAE): A COMPENDIUM FOR THE FIELD WORKER

R. J. Searle

Scaphochlamys Baker (Zingiberaceae – Zingibereae) is found in southern Thailand, Peninsular Malaysia and Borneo. In this treatment 31 species and six varieties are recognised. A new combination is made for *Scaphochlamys anomala* (Hallier f.) R.J.Searle; *Scaphochlamys mat-kilau* C.K.Lim, *Scaphochlamys biloba* (Ridl.) Holttum var. *lanceolata* (Ridl.) Holttum and *Scaphochlamys longifolia* Holttum are placed in synonymy. Included in this compendium is an analysis of the morphology of the genus, a brief historical review, a key to the species and a generic outline, as well as full generic and specific descriptions, maps, illustrations, and a full list of all names and types.

Keywords. Ginger, *Scaphochlamys*, Southeast Asia, Zingiberaceae, Zingibereae.

Introduction

Scaphochlamys Baker is a genus of 31 species in the Zingibereae tribe of the Zingiberaceae, distributed from southern Thailand, through Peninsular Malaysia, to northern Borneo and Sumatra. It belongs to a small group of genera that are so similar morphologically that their generic status has long been debated (Holttum, 1950; Smith, 1987; Newman, 1995). This group, originally referred to as the '*Kaempferia* group' by Holttum in 1950, included *Camptandra* Ridl., which was omitted by later authors, *Kaempferia* L., *Scaphochlamys*, *Boesenbergia* Kuntze and *Haplochorema* K.Schum., which Holttum considered 'all nearly related' (Holttum, 1950). This group was further discussed by Smith (1987) who compared and contrasted key inflorescence and floral characters. Her table of characters was updated by Newman (1995) who listed five genera: *Kaempferia* (c.40 species), *Boesenbergia* (c.50), *Distichochlamys* (3), *Haplochorema* (4) and *Scaphochlamys*. The newly described genus *Myxochlamys* A.Takano & Nagam. (2007) forms a small clade of closely related taxa together with *Distichochlamys* and *Scaphochlamys* based on DNA phylogenetic analyses (Takano & Nagamasu, 2007). Each of these genera is defined by a set of morphological characters *in combination* rather than any single key character. Each of these character traits on its own can be shared by more than one genus, so one has to consider the presence or absence of all these

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characters together before trying to allocate a species to a genus. As more species are discovered, the boundaries of these genera are likely to be tested, and, in the end, they may need redefining.

The revision of this genus has epitomised many of the taxonomic problems within the family: historical collections are depauperate, flowers are ephemeral and do not preserve well, and much of the literature comprises weakly written descriptions in various languages. Under such circumstances the identification of fresh material can only be frustrating and difficult. I have, to the best of my ability, produced an up-to-date compendium on the genus. The morphology section carefully explains to the non-specialist the structure and terminology of this small, but complex, plant. The key, built upon herbarium specimens, has been kept as simple as possible, primarily using morphological characters (as inspired by Holttum). The descriptions have been based on material seen by the author, and where this has not been possible the original protologues have been utilised (this is indicated where appropriate). I hope that this work will aid those working in the field, and help them to correctly identify the species.

Morphology of *Scaphochlamys*

The main growth structure is called the rhizome. It tends to grow horizontally either over the ground surface, through the leaf litter, or through the soil, and terminates by growing vertically upwards to form first the peduncle and then the rachis of the inflorescence. The rhizome is a modified 'stem' from which both the roots and leaves develop. Two main types of rooting systems are shown by species in this genus: either they produce a thick mat of fine roots or they produce long 'string-like' prop roots that appear to act as an anchoring mechanism, helping to keep a surface-growing plant upright and stable (though they are finer than those usually called stilt-roots).

Vegetative growth consists of the development of a series of successive shoots or 'elements' (Holttum, 1950) by the continued growth of the rhizome from a bud either at the base of a leaf or at the base of a scale leaf further back on the rhizome. Each element forms an individual shoot that comprises one to several leaves in a clump. The leaf develops straight from the rhizome and is subdivided into clearly defined structures that develop in a set order: sheath, ligule, petiole and lamina. At the very base of the leaf is the leaf-sheath. Recent studies in Borneo have shown the existence of a swelling, or pulvinus, just above the point of emergence of the leaf-sheath from the rhizome (Shafreena, 2006). More obvious in fresh than dried material, it may be a crucial identification character for sterile material in the field. The leaf-sheath is crescent-shaped in cross-section with two fine, membranous edges. The leaf-sheath terminates in the ligule, which is paired, membranous and delicate and can be several centimetres long (it can also decay very quickly). Above the ligule the petiole is much thinner, without the thin membranous edging, and terminates in the lamina (Fig. 1A). The lamina is characterised by the midrib running its length, with parallel secondary venation leading off the midrib towards the margins. There is a distinct

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abaxial and adaxial surface. A highly reduced version of the leaf is called a leafless-sheath where only the sheath develops.

The inflorescence is attached to the rhizome by the leafless peduncle which terminates at the first bract, after which the main axis is called a rachis (Larsen *et al.*, 1999). The bracts are arranged in a spiral pattern up the rachis and each one subtends a structure called a cincinnus of bracteoles and flowers (Fig. 1B). In 1950 Holttum used the terms 'bracteoles' and 'secondary bracts' interchangeably in his species descriptions. The terminology was clarified in a later paper, however, where a detailed analysis of the morphology of the family was carried out (Holttum, 1974). These days 'bracteole' is the more generally accepted term. The first bracteole arises opposite the bract with a single flower in its axis (Fig. 1C). Successive bracteoles arise within and at 180° to the preceding one, again each with its own flower. The inflorescence can build up to consist of many bracts each containing many bracteoles and flowers. On the other hand reduction to one or a few bracts can occur, as well as reduction to one bracteole and flower per bract. In the case of extreme reduction it can be hard to interpret what is bract and what is bracteole.

The floral structures comprise a short tubular calyx and a corolla tube that splits distally into three petals or lobes. The petals tend to be small and hidden. The showy part of the flower is derived from the androecium and is comprised of two lateral staminodes and a labellum (Fig. 1D). Each lateral staminode is derived from a sterile stamen and the bilobed labellum is derived from two fused sterile stamens (Kirchoff, 1988, 1991). In the centre is a single fertile stamen that is subdivided into the filament, which is attached to the corolla tube, the two thecae and at the apex a small extension to the back of the anther called the crest. The gynoecium comprises an inferior ovary surmounted by a pair of epigynous glands (or nectaries). The long thin style is held in place between the two thecae and terminates in a small cup-like stigma with a ring of cilia around the rim (Kirchoff, 1988).

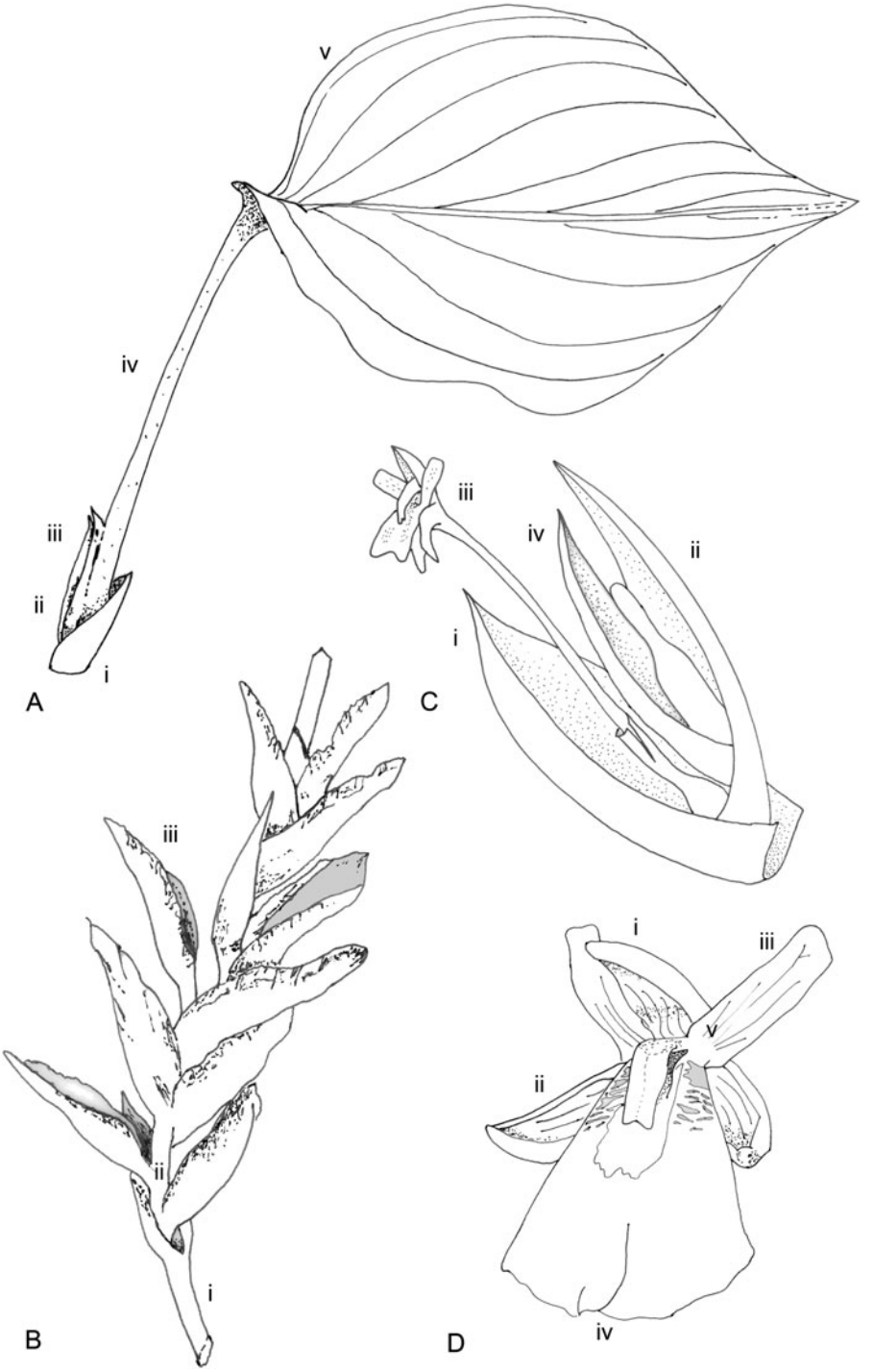
Key Diagnostic Characters

It can be hard to distinguish *Scaphochlamys* from its most closely related genera (*Boesenbergia*, *Distichochlamys*, *Kaempferia* and *Haplochorema* for example). The following combination of characters defines the boundaries of this genus: leaf-sheath base pulvinate (Borneo only); bract arrangement spiral; flowering mode from base to apex; first bracteole keeled, arising opposite to bract; bracteole split to base; thecae with free basal spurs.

Distribution

Scaphochlamys has a relatively restricted distribution. Four species occur in southern Thailand, three of them being endemic there. Eight species are known from Borneo, where many more may be expected, and one species has been recorded in Sumatra, though this too may be an underestimate. The majority of species are found in Peninsular Malaysia.

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Taxonomic History

Scaphochlamys was established by Baker (1890) with a single species, *S. malaccana* Baker. At the same time two other species, now included in this genus, were published as *Kaempferia concinna* Baker and *Curcuma kunstleri* Baker. Early publications of species now in *Scaphochlamys* included *Curcuma sylvestris* Ridl. and *Gastrochilus biloba* Ridl. (Ridley, 1893) and *Kaempferia anomala* Hallier f. (Hallier, 1898). In 1899 Ridley transferred *Scaphochlamys malaccana* to *Gastrochilus* Wall., thereby synonymising the genus, but gave it a new and thus illegitimate epithet, *Gastrochilus scaphochlamys* Ridl. He also combined some of the other *Scaphochlamys* species in this genus, such as *Gastrochilus concinna* (Baker) Ridl., and described several new species such as *G. biloba* Ridl., *G. lancifolius* Ridl. and *G. oculata* Ridl. Over the next two decades he went on to name and describe several more *Scaphochlamys* species in the genus *Gastrochilus*. *Gastrochilus* Wall. is a later homonym of *Gastrochilus* D.Don so all these names are illegitimate. Ridley then decided that several of these species were more '*Curcuma*-like' and placed them in a new genus *Hitcheniopsis* (Baker) Ridl., a name he decided to adapt from one of Baker's sections of *Curcuma*: *Curcuma* section *Hitcheniopsis* Baker. Thus *Hitcheniopsis kunstleri* (Baker) Ridl., *H. lanceolata* Ridl. and *H. sylvestris* Ridl. were published (Ridley, 1924). It is worth noting, however, that *Curcuma kunstleri* Baker had been in *Curcuma* section *Mesantha* Horan., not *Curcuma* section *Hitcheniopsis* (Baker, 1890). The confused generic delimitations remained through Schumann's revision of the Zingiberaceae in 1904 and Loesener's in 1930 where different *Scaphochlamys* species appeared in *Curcuma*, *Kaempferia* and *Gastrochilus*. In 1918 Valeton carried out detailed analyses of representatives of various genera of Zingiberaceae based on living material from the Bogor Botanical Gardens in Java. He developed a better understanding of the inflorescence and floral structures, which he carefully explained. Within a discussion of the salient features of *Gastrochilus* he made a special note of the *Scaphochlamys* inflorescence but decided that there were insufficient differences in the floral characters to reinstate Baker's genus. Instead, he defined a '*Scaphochlamys* group' within *Gastrochilus* which he managed to squeeze into a rather complicated subgeneric classification based on both inflorescence and anther structures (Valeton, 1918). Valeton's use of fresh material inspired Holttum who in 1950 not only reinstated *Scaphochlamys* as a genus in its own right but also described nine new species from Peninsular Malaysia. In the 1970s and 1980s

FIG. 1. General morphology of a 'typical' *Scaphochlamys* plant. A. The leaf with i. a single leafless-sheath at its base, ii. leaf-sheath, iii. paired ligules, iv. petiole, v. lamina. B. Inflorescence with overlapping bracts (e.g. an immature *S. erecta*): i. peduncle, ii. rachis, iii. bract. C. Stylised image of a dissected cincinnus within a single bract: i. bract, ii. first bracteole (facing 180° to bract), iii. first flower (fully opened), iv. second bracteole encasing a flower bud. D. A typical flower consisting of i. the dorsal petal, ii. 2 lateral petals, iii. 2 lateral staminodes, iv. bilobed labellum, v. downward-bending stamen (not to scale).

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extensive taxonomic work was carried out at the Royal Botanic Garden Edinburgh (e.g. Burtt & Smith, 1972a, 1972b) and further species were transferred or were newly described from Sarawak (Smith, 1987). New species are continually being discovered throughout its range. As it grows in number of species and complexity, the genus is becoming better understood and the relationships with its sister genera are being clarified.

Taxonomic Treatment

Scaphochlamys Baker in Hooker, Fl. Brit. India 6: 252 (1892); Holttum, Gard. Bull. Singapore 13: 82 (1950); Smith, Notes Roy. Bot. Gard. Edinburgh 44: 207 (1987); Larsen et al. in Kubitzki, Fam. Gen. Vasc. Pl. 4: 485 (1998). – Type species: *Scaphochlamys malaccana* Baker.

Ground-dwelling, perennial, rhizomatous herbs. *Rhizome* normally horizontally creeping, sometimes obliquely ascending or upright; generally thin and woody, never fleshy or tuberous. *Successive shoots* either crowded together or widely spaced, composed of 1 to many leaves normally encased by leafless-sheaths, glabrous to densely hairy, often scarious and decaying with age. *Leaf-sheath* with broad membranous margin, hairy or glabrous. In Bornean species pulvinus base present (see morphology section above). *Ligule* bilobed, membranous and delicate, generally triangular in shape, occurring anywhere from the base of the leaf hidden among leafless-sheaths up to just below the base of the lamina depending on the species. *Petiole* thin, canaliculate and occasionally terete, hairy or glabrous. *Lamina* obovate to oval, ovate, lanceolate or linear, commonly elliptic, symmetric or, more often, slightly asymmetric; base nearly always decurrent, usually attenuate, rounded or cordate; apex acute to acuminate, sometimes mucronulate, or broadly pointed. Upper surface dark green, occasionally with white markings. Lower surface either pale green or flushed with purple, usually hairy or pilose along the midrib. Venation parallel, branching from primary mid-vein (reticulate in *Scaphochlamys reticosa*). *Inflorescence* composed of spirally arranged bracts (occasionally distichous) with base to apex (indeterminate) flowering; compact and ovoid or ellipsoid, or lax with rachis visible between the bracts; often elongating with age. *Bract* broad and pouched to ovate, boat-shaped, spathulate and linear, firm to thin, glabrous to densely hairy, green, red-brown, red, or flushed with purple, not connate laterally, base amplexicaul. First *bracteole* at 180° to bract, generally boat-shaped to linear, 2-keeled, margins overlapping but never fused, apex acute to trilobed, sometimes tufted, usually just shorter than the bract, glabrous to finely hairy; successive bracteoles decreasing in size. *Ovary* inferior, trilocular to unilocular, small, creamy-white, glabrous to finely hairy. Epigynous glands 2, fine, needle-like, surmounting ovary; creamy yellow. *Calyx* tubular, split down one side, apex usually dentate, shorter than first bracteole. *Corolla* tube slender at base, widening towards apex, sometimes finely hairy; corolla lobes linear, usually white, glabrous, dorsal corolla

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lobe normally stiff with an acute, hooded apex; the 2 lateral corolla lobes linear with rounded apices; corolla usually white, sometimes pale yellow to yellow or pale green. *Lateral staminodes* oblong to obovate, with rounded apex, spreading obliquely. *Labellum* obovate to clawed, flat, usually bilobed (sometimes entire), the lobes often overlapping, white with a yellow median band, this band often flanked on either side by variously coloured markings, for example pink, purple or red, sometimes with strongly coloured blotches near the base, slightly grooved in the middle towards the base, this groove more or less hairy. *Fertile stamen* bent forward over labellum, facing down; filament broad, pollen sacs 2, linear, with longitudinal dehiscence, each theca terminating in a short spur at the base, apex of anther terminated by a short reflexed rounded to trilobed crest; all androecial members (i.e. staminodes, labellum and back of the anther) sometimes covered with tiny glandular hairs. *Style* very fine, sometimes held in a groove inside the corolla tube. *Stigma* held just above apices of thecae, backed by the crest; rounded cup-shaped, the ostiole edged by a single row of cilia of varying lengths and thicknesses. *Fruit* ellipsoid, thin-walled, enclosed by persistent bracts. *Seeds* ellipsoid, dark brown to black with a white aril, lacerate to the base.

Key to species

1a. Each shoot consisting of a single leaf; shoots tend to be distinct and widely spaced _____ 2
1b. At least some shoots, and usually all, consisting of more than 1 leaf; shoots tend to be clustered and may be indistinct _____ 19

2a. Bracts distichous _____ **8. S. calcicola**
2b. Bracts arranged spirally _____ 3

3a. Inflorescence lax; rachis visible between the bracts _____ 4
3b. Inflorescence compact; rachis not visible between the bracts _____ 7

4a. Leaf-sheath and petiole $\leq$ 10 cm; peduncle $\leq$ 6 cm long _____ 5
4b. Leaf-sheath and petiole $\geq$ 15 cm; peduncle $\geq$ 9 cm long _____ 6

5a. Bracts $\geq$ 3 cm with open apex; lamina apex broad and rounded; Malay Peninsula _____ **4. S. atroviridis**
5b. Bracts $<$ 3 cm with narrow acute apex; lamina apex acuminate and pointed; Borneo _____ **12. S. gracilipes**

6a. Lamina apex acuminate with a distinct 'drip tip'; lamina base strongly cordate; size of largest bract up to 2.2 $\times$ 1.2 cm _____ **10. S. cordata**
6b. Lamina apex shortly cuspidate; lamina base rounded and shortly attenuate; size of largest bract up to 2.5 $\times$ 1.6 cm _____ **17. S. laxa**

7a. Single flower in the axis of each bract _____ **5. S. biloba**
7b. More than 1 flower per bract _____ 8

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8a. Lower lamina surface pale green _____ 9
8b. Lower lamina surface purple _____ 14

9a. Lamina ≥ 12 cm in length; Malay Peninsula _____ 10
9b. Lamina ≤ 12 cm in length; Borneo _____ 11

10a. Lamina narrowly elliptic in shape, ≤ 8 cm wide; peduncle ≥ 4 cm long _____ **1. S. abdullahii**
10b. Lamina elliptic to ovate in shape, ≥ 8 cm wide; peduncle < 4 cm long _____ **6. S. breviscapa**

11a. Upper lamina surface densely covered with a raised network of reticulate venation _____ **26. S. reticosa**
11b. Upper lamina surface with parallel venation, may or may not be raised _____ 12

12a. Lamina oblong to oval in shape; upper surface with prominent silver venation _____ **3. S. argentea**
12b. Lamina ovate to lanceolate in shape; upper surface with indistinct venation _____ 13

13a. Leaf-sheath and petiole < 10 cm in length; labellum white with central yellow mark; Kalimantan, Indonesia _____ **2. S. anomala**
13b. Leaf-sheath and petiole > 10 cm in length; labellum suffused purple with central yellow mark; Sarawak _____ **24. S. petiolata**

14a. Leaf-sheath and petiole ≤ 10 cm long _____ 15
14b. Leaf-sheath and petiole ≥ 10 cm long _____ 16

15a. Lamina broadly elliptic to obovate, upper surface green with white 'feather-like' markings either side of the midrib; inflorescence 2 × 1 cm _____ **22. S. pennipicta**
15b. Lamina elliptic, upper surface green with a row of silver spots flanking either side of the midrib; inflorescence 4 × 2 cm _____ **27. S. rubescens**

16a. Bracts ≤ 2.5 cm, 5–6 flowers per bract; lamina narrowly elliptic _____ **1. S. abdullahii**
16b. Bracts ≥ 2.5 cm, fewer than 5 flowers per bract; lamina not elliptic _____ 17

17a. Lamina < 8 cm in width, lanceolate and with distinctive cordate base _____ **9. S. concinna**
17b. Lamina ≥ 8 cm in width, ovate and with rounded base _____ 18

18a. Peduncle < 6 cm long; labellum with yellow centre, flanked either side by crimson markings _____ **21. S. oculata**
18b. Peduncle > 6 cm long; labellum with yellow centre, flanked either side by violet markings _____ **30. S. sylvestris**

19a. Bracts as wide as long or wider forming open pouches on the rachis _____ 20

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19b. Bracts always much longer than wide _____ 22

20a. Flowers with burgundy, red or orange coloration **15b. S. kunstleri** var. **rubra**
20b. Flowers pale: yellow or white _____ 21

21a. Flowers overall light to saffron yellow; labellum may also have transverse pink stripes at either side of base _____ **15a. S. kunstleri** var. **kunstleri**
21b. Flowers overall white; labellum with yellow central band and transverse pink stripes at either side of base _____ **15c. S. kunstleri** var. **speciosa**

22a. Inflorescence lax; rachis clearly visible between the bracts _____ 23
22b. Inflorescence compact; bracts overlapping, rachis not clearly visible _____ 30

23a. Inflorescence 15–25 cm long; bracts 1.5–2 cm apart, narrow and closely appressed to the rachis _____ **31. S. tenuis**
23b. Inflorescence ≤ 16 cm long; bracts arranged otherwise _____ 24

24a. Leaf-sheath covered in a dense layer of fine hairs; ligule and petiole may or may not also be hairy _____ **14b. S. klossii** var. **glomerata**
24b. Leaf-sheath glabrous; ligule and petiole usually also glabrous _____ 25

25a. Lamina obovate to oblanceolate in shape and more or less symmetric _____ **20. S. obcordata**
25b. Lamina elliptic to lanceolate in shape, usually asymmetric _____ 26

26a. Bract edges inflexed to the apex; apex narrowly acute _____ **29. S. subbiloba**
26b. Bract edges spreading near the apex; apex broadly pointed to spathulate _____ 27

27a. Each shoot consisting of 1–2 leaves; inflorescence with ≤ 8 bracts _____ 28
27b. Each shoot consisting of 2 to many leaves; inflorescence with ≥ 8 bracts _____ 29

28a. Bracts < 3 cm long and < 1 cm wide; flower labellum with red blotches _____ **28. S. rubromaculata**
28b. Bracts ≥ 3 cm long and > 1 cm wide; flower labellum coloured otherwise _____ **18. S. malaccana**

29a. Lamina < 16 cm long; bracts ≤ 3 cm long; Borneo _____ **25. S. polyphylla**
29b. Lamina > 16 cm long; bracts ≥ 3 cm wide; Malay Peninsula _____ **11. S. erecta**

30a. Peduncle ≥ 7 cm long _____ 31
30b. Peduncle < 7 cm long _____ 32

31a. Two flowers per bract; labellum c.5 mm long; Narathiwat Province, Thailand _____ **19. S. minutiflora**
31b. Three to four flowers per bract; labellum > 8 mm long; Perak, Terengganu, Malaysia _____ **23. S. perakensis**

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32a. Leaf-sheath, ligule and petiole glabrous to sparsely hairy ____ 33
32b. Leaf-sheath covered in a dense layer of fine hairs; ligule and petiole may or may not also be hairy ____ 35

33a. Successive shoots comprising 8–10 leaves; labellum with yellow and lilac markings ____ **11. S. erecta**
33b. Successive shoots comprising 2–4 leaves; labellum with yellow marking ____ 34

34a. Upper lamina surface with white stripes either side of the midrib; inflorescence $<$ 5 cm long with fewer than 5 bracts ____ **16. S. lanceolata**
34b. Upper lamina surface plain green; inflorescence $>$ 5 cm long with more than 5 bracts ____ **20. S. obcordata**

35a. Lamina $>$ 30 $\times$ 9–10 cm ____ **13. S. grandis**
35b. Lamina $\leq$ 30 $\times$ 10 cm ____ 36

36a. Leaf-sheath and petiole $>$ 15 cm long ____ **14a. S. klossii** var. **klossii**
36b. Leaf-sheath and petiole $<$ 15 cm long ____ 37

37a. Elongated inflorescence with 8 to many bracts **14b. S. klossii** var. **glomerata**
37b. Short inflorescence with 5–8 bracts ____ 38

38a. Petiole glabrous; bracts awl-shaped ____ **7. S. burkillii**
38b. Petiole densely hairy; bracts lanceolate ____ **14c. S. klossii** var. **minor**

1. Scaphochlamys abdullahii Y.Y.Sam & Saw, Gard. Bull. Singapore 57: 253 (2005). – Type: Peninsular Malaysia, Terengganu, Setiu, Ulu Setiu Forest Reserve, 17 i 2005, *Sam, Aidil & Arif* FRI 49130 (holo KEP; iso SAN, SING).

Rhizome robust, 5–6 mm in diameter, creeping underground, flesh purple. *Successive shoots* close together, 1 leaf per shoot, rarely 2. *Leafless-sheaths* 3, longest sheath 6–10.5 cm, red to brownish red, densely hairy especially when young, drying out with age. *Leaf-sheath* 1.5–3 cm long; ligule lobes small. *Petiole* (5.5–)9–29 cm long, terete, channelled only terminally, purplish brown towards the base, glabrous. *Lamina* upper surface green, lower surface red to purplish-red when young and covered with densely appressed hairs, narrowly elliptic, asymmetric, 12–33 $\times$ 3.5–8 cm, base narrowly rounded or decurrent, sometimes oblique, apex narrowly acute. *Peduncle* 4–13 cm long, covered entirely by leafless-sheath when young. *Inflorescence* ovoid, 4–8 cm long, bright rosy red when young; rachis 3–5.5 cm in length, bearing 8–25 bracts imbricating and hiding the rachis entirely. *Bracts* rosy red when young, turning to reddish brown or green, 1.9–2.5 $\times$ 1.3–2 cm, decreasing in size up the inflorescence, spathulate, margins thin and slightly wavy, apex reflexed. *Bracteoles* tinged red, shorter than bract, first bracteole 1–1.6 $\times$ 0.5–0.7 cm, apex bilobed and tufted. *Flowers* 5–6 in each bract, white except calyx. *Ovary* ellipsoid, trilocular, epigynous glands c.5 mm long. *Calyx* tinged red, 4–7 mm long, split 2–3.5 mm on one side from apex, apex blunt. *Corolla* tube 17–25 mm long; dorsal corolla lobe

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lanceolate, 10–12 × 3–4 mm, apex hooded, tinged red distally; lateral corolla lobes lanceolate, 7–10 × 2–4 mm, apex tinged pink to red. *Staminodes* slightly yellowish, oblong, 8.5–11 × 2–3 mm, apex blunt. *Labellum* recurved, linear-oblong, slightly flared towards apex, 13–14 × 7–11 mm, apex bilobed by almost a third, median band yellow, both sides with purple streaks, with fine glandular hairs. *Stamen* flushed purple, covered with glandular hairs on abaxial surface; filament c.2 mm long; thecae 2.5–4 mm long, yellow; anther crest 1.5–2 mm long, recurved. *Seed* ellipsoid, 8 × 3 mm, dark brown. (Adapted from Sam & Saw, 2005.)

Distribution. Peninsular Malaysia (Terengganu) (Fig. 2).

Habitat and ecology. Found at the fringes of lowland forest. Altitude c.40 m.

2. Scaphochlamys anomala (Hallier f.) R.J.Searle, **comb. nov.** – *Kaempferia anomala* Hallier f., Bull. Herb. Boissier 6: 357 (1898). – *Gastrochilus hallieri* (Hallier f.) Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 109 (1899), nom. illegit.; Turner, Asian J. Trop. Biol. 4(1): 43 (2000). – *Gastrochilus anomalum* (Hallier f.) K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 92 (1904); Valeton, Bull. Jard. Bot. Buitenzorg 27: 104 (1918). – *Boesenbergia anomala* (Hallier f.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 315 (1913); R.M.Sm., Notes Roy. Bot. Gard. Edinburgh

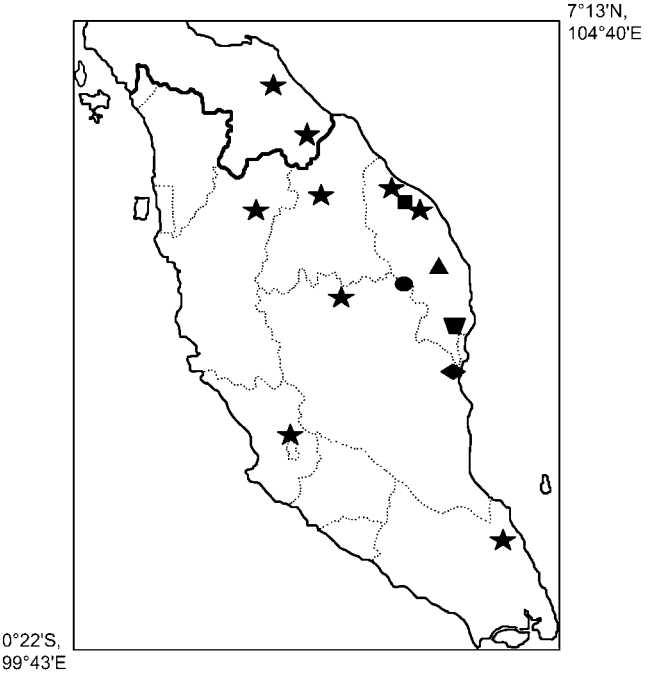


FIG. 2. Distribution of *Scaphochlamys abdullahii* Y.Y.Sam & Saw (■), *S. cordata* Y.Y.Sam & Saw (▲), *S. laxa* Y.Y.Sam & Saw (●), *S. biloba* (Ridl.) Holttum (★), *S. burkillii* Holttum (◆) and *S. grandis* Holttum (▼).

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44: 210 (1987). – Type: Cult. Bogor, originally from Borneo [Kalimantan], *Hallier* s.n. (holo BO, presumed lost (Valeton, 1918)). Lectotype: Figure drawn from *Hallier* s.n. (holo BO) cult. Bogor, originally from Borneo [Kalimantan], published as t. IX, fig. 3., Bull. Herb. Boissier 6: 357 (1898), designated here. **Fig. 3.**

Rhizome creeping, with short internodes, young rhizomes glossy green turning bone white with age; roots thread-like, non-tuberous, white and slightly branched. *Successive shoots* congested, short, up to 20 cm high, 1–2 leaves per shoot. Outer *leafless-sheath* short, c.1 cm long, oval, apex acute, scarious (thin, dry and membranous); inner leafless-sheath long, 3 cm long, cylindrical, apex acute, completely green, veins visible as pale parallel lines, opaque, margin pale and membranous; older sheaths paler, becoming scarious, parallel-veined. *Petiole* 7 cm long, obliquely erect, rigid, slender, semi-smooth, upper surface deeply furrowed, green, sub-opaque, lined with pale parallel veins. *Lamina* upper surface uniform glossy grass-green, 8 secondary veins, lower surface paler, glaucous–green, thickly covered in minute blue-green spots, covered in a scattering of fine appressed hairs, concentrated towards the midrib, ovate to lanceolate, symmetric, to 11 × 5 cm, base rounded, apex acute, recurved. *Inflorescence* terminal, sessile within the sheaths, highly reduced with only 3 bracts. *Bracts* 1.7 cm long, apex acute. *Flowers* small. *Corolla* tube slender, 15 × 1 mm, emerging 6 mm above the sheath, white, 3 equal corolla lobes, each 7 × 2–3 mm at the base, lanceolate, hooded, white, semi-transparent with 3 dark parallel veins inside. *Lateral staminodes* 2, petaloid and small, about half the size of the corolla lobes, 4 × just over 1 mm, lanceolate, curved, papillose, apex acute, green and lined with 3 transparent veins. *Labellum* slightly above the petals, deeply cleft, claw 4 × 3 mm, lobes c.4 mm long and just as wide,



FIG. 3. *Scaphochlamys anomala* (Hallier f.) R.J.Searle. A. Habit. B. Inflorescence with a single open flower. Drawing exactly as in Hallier (1898).

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somewhat cuneate with broadly obovate lobes, white with a yellow central mark. *Stamen* with very short filament, anther obovate and erect, thecae yellow, 3 × 1 mm, the margins wrapped around the style apex, crest truncate. *Stigma* white, ostiole containing erect cilia. *Fruit* unknown. (Adapted from Hallier, 1898.)

Distribution. Borneo, Kalimantan, 'in the jungle at the base of Mt Liang Gagang' [Bukit Liangkungkam 00°04′01″S, 113°11′00″E?]. With current exploration of the flora of Borneo, it may not be long before this species is rediscovered (Fig. 6).

The above description is taken directly from Hallier who has also provided a clear and detailed drawing of the plant. Together these provide enough evidence to convince me of the position of this species in *Scaphochlamys*. *Gastrochilus hallieri* is an illegitimate name because it is homotypic with the name that should have been taken up. To quote Ridley from his 1899 paper, 'There being nothing anomalous in this plant, I have taken the liberty of altering its specific name as well as its generic one' – an action that is not considered acceptable.

3. Scaphochlamys argentea R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 44: 209 (1987); Newman et al., Blumea Suppl. 16: 146 (2004). – Type: Borneo, Sarawak, 1st Division, Lundu, near base of G. Perigi, 6 viii 1962, *Burtt & Woods* B2700 (holo E!).

Rhizome thin, 1–2 mm in diameter when dry, creeping, with long fine trailing roots. *Successive shoots* 2–3 cm apart, comprising a single leaf surrounded by 3 leafless-sheaths, the longest reaching up to 3.8 cm in length (enclosing the scape), scarious, glabrous with a hairy tuft at the acute apex. *Leaf-sheath* only a few mm long, the ligule positioned at the base of the leaf; ligule c.5 mm, membranous, bilobed and acuminate. *Petiole* thin, glabrous, 3–6 cm long. *Lamina* upper surface green with prominent silver venation, lower surface paler and sparsely hairy along midrib towards the leaf base, oblong to oval, symmetric, 6–10 × 3–4 cm, base subcordate to rounded, apex broadly acute to shortly acuminate (may be tufted). *Peduncle* 3–5 cm long, slender, almost glabrous. *Inflorescence* small, round, 2 × 1 cm, with 3–4 tightly congested bracts. *Bracts* 2.5 × 0.2 cm, long and thin, broadening towards the base, glabrous, apex acute and tufted. First *bracteole* slightly shorter than the bract, 1.8 cm long, the next shorter. *Flowers* 2 per bract. *Ovary* 2 mm long, hairy near the apex, unilocular with few basal ovules. *Calyx* 8 mm long, with a single split to at least midway down its length, minutely tridentate at the apex. *Corolla* tube 25 mm long, lightly hairy, lobes pale green, recurved, lateral lobes 10 × 2–3 mm wide, dorsal lobe broader and with a more pointed apex. *Staminodes* obovate, 5 mm long. *Labellum* small, rounded, appearing entire (in dried material), 10 × 8 mm wide, clawed, with tiny glandular hairs, white to light mauve, with a pale greenish yellow/yellow central mark. *Stamen* white, filament very short, thecae to 4 mm long with short free spurs; crest truncate. *Style* hairy. *Stigma* cup-like with ciliate margin. *Fruit* yellow green.

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Distribution. Malaysia (Sarawak) (Fig. 6).

Habitat and ecology. Very common on damp forest floor, near streams; has been found on igneous-derived brownish-yellow sandy soil. Altitude c.200 m.

Additional specimens examined. MALAYSIA. **Sarawak**: 1st Division, Lundu, viii 1912, *Andersen* 131 (SING); 1st Division, Lundu, iv 1924, *Mjoberg* 229 (K, SAR); Lundu, Mt. Gading, 11 ix 1929, *Clemens & Clemens* 7385 (K, SAR); G. Buri, Ulu Simunian, 15 ix 1975, *Chai* 36753 (K, L, SAR).

4. Scaphochlamys atroviridis Holttum, Gard. Bull. Singapore 13: 93 (1950); Newman et al., Blumea Suppl. 16: 146 (2004). – Type: Malaysia, Terengganu, Kemaman, Bukit Kajang, 4 xi 1935, *Corner* SFN 30240 (holo SING!; iso E!, K!, L!, P).

Rhizome thin, horizontally creeping. *Successive shoots* 1.5 cm or less apart, each with 1 leaf surrounded by 3 leafless-sheaths, the sheaths at most 4–5 cm long, delicate, sparsely hairy and more or less flushed with purple. *Leaf-sheath* c.1.5 cm long, the ligule broad and positioned near the leaf base. *Petiole* 5–8 cm long. *Lamina* dark green on the upper surface, the lower surface paler and sparsely hairy, ovate to elliptic, symmetric, c.16 × 6 cm; base cuneate to narrowly rounded; apex rounded or mucronulate. *Peduncle* 3–6 cm long, glabrous to semi-glabrous. *Inflorescence* open with few bracts; rachis 2–5 cm long, quite flexible and supporting a lax inflorescence composed of 2–7 bracts, each bract extending from the rachis at an angle of c.45°. *Bracts* green, sometimes flushed red, more or less glabrous, 3–3.5 × 1.5 cm, elliptic when flattened; margins not thinned, broadly undulating; base of the bract concave, becoming flatter towards the apex; the apex rounded or obtuse with a minute apiculum covered with hairs. First *bracteole* 10 mm long, the rest no more than 5 mm long, broadly oblique and apiculate. *Flowers* 2–5 in the axil of each bract, fragrant, white except for the labellum. *Calyx* with ovary c.13 mm long, ovary glabrous. *Corolla* tube to 36 mm long, corolla lobes unequal, 14–15 × 4 mm at the base. *Staminodes* as long as the corolla lobes, almost oblong, widening slightly from the base towards the rounded apex, maximum width 5 mm just below the apex. *Labellum* 18 × 15 mm, halfway bilobed, the lobes rounded and overlapping, with a yellow median band, flanked on either side by a lilac stripe, and towards the base, near the insertion of the filament, a pale lilac spot. *Stamen* with thecae 3 mm long; crest rounded, reflexed, trilobed, the mid-lobe largest, and when flattened is 4 × 4 mm. *Fruit* ellipsoid, 12 × 7 mm.

Distribution. Peninsular Malaysia (Johore, Terengganu) (Fig. 4).

Habitat and ecology. Altitude c.150 m.

Additional specimen examined. MALAYSIA. **Johore**: Kluang, 23 ix 1970, *Shah* MS 2164 (SING).

5. Scaphochlamys biloba (Ridl.) Holttum, Gard. Bull. Singapore 13: 89 (1950); Newman et al., Blumea Suppl. 16: 146 (2004). – *Gastrochilus biloba* Ridl., Trans.

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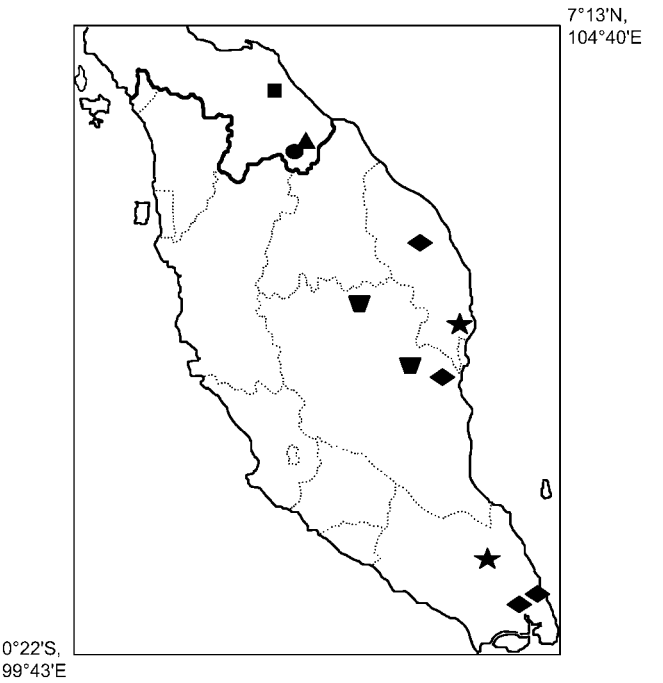


FIG. 4. Distribution of *Scaphochlamys obcordata* Sirirugsa & K.Larsen (■), *S. minutiflora* Jenjitt. & K.Larsen (▲), *S. rubescens* Jenjitt. & K.Larsen (●), *S. atroviridis* Holttum (★), *S. sylvestris* (Ridl.) Holttum (▼) and *S. erecta* Holttum (◆).

Linn. Soc. 3: 379 (1893); Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 116 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 19 (1907); Ridl., Fl. Malay Penin. 4: 251 (1924); Turner, Asian J. Trop. Biol. 4(1): 23 (2000). – *Kaempferia biloba* (Ridl.) K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 81 (1904). – *Boesenbergia biloba* (Ridl.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 315 (1913). – Type: Malaysia, Pahang, Kuala Tenok, 26 vii 1891, *Ridley* s.n. (lecto K!, designated by Holttum, 1950).

Gastrochilus calophylla Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 115 (1899); Turner, Asian J. Trop. Biol. 4(1): 23 (2000). – *Kaempferia calophylla* (Ridl.) K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 80 (1904). – *Boesenbergia calophylla* (Ridl.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 315 (1913). – Type: Malaysia, Selangor, *Ridley* s.n. (n.v.). This species was placed into synonymy by Holttum (1950). Since then the type has not been seen by anyone.

Gastrochilus biloba Ridl. var. *lanceolata* Ridl., J. Straits Branch Roy. Asiat. Soc. 54: 102 (1910); Turner, Asian J. Trop. Biol. 4(1): 23 (2000). – *Scaphochlamys biloba* (Ridl.) Holttum var. *lanceolata* (Ridl.) Holttum, Gard. Bull. Singapore 13: 90 (1950). – *Gastrochilus minor* auct. non Baker: Ridl., Fl. Malay Penin. 4: 252 (1924); Holttum, Gard. Bull. Singapore 13: 90 (1950). – Type: Malaysia, Perak, Temango, vii 1909, *Ridley* 14422 (lecto K!, designated by Turner, 2000). Ridley (1924)

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identifies *Gastrochilus minor* Baker with *Gastrochilus biloba* Ridl. var. *lanceolata* Ridl., but in fact *G. minor* Baker is the basionym for *Boesenbergia minor* (Baker) Kuntze based on a separate specimen.

Scaphochlamys longifolia Holttum, Gard. Bull. Singapore 13: 91 (1950); Larsen, Bot. Tidsskr. 58: 192 (1962); Turner, Asian J. Trop. Biol. 4(1): 24 (2000); Newman et al., Blumea Suppl. 16: 148 (2004). – *Gastrochilus longifolia* Ridl., Fl. Malay Penin. 4: 252 (1924), nom. illegit., non (Lindl.) Kuntze (1891). – Type: Malaysia, Selangor, Ulu Gombak, xii 1920, *Ridley* s.n. (holo K!).

Rhizome long, thin, horizontally creeping, 3–4 mm in diameter when dry, yellow. *Successive shoots* usually 1 cm apart, sometimes 3–5 cm apart in less congested specimens, consisting of a single leaf (2-leaved shoots appear rarely); each shoot usually surrounded by 3 leafless-sheaths ranging from 1 cm, 2–5 cm and 4–10 cm long, the longest often wrapped around the inflorescence. *Leaf-sheath* generally short, 2–5 cm, ligule only a few mm long, sometimes densely hairy. *Petiole* slender, length extremely variable even within a population: short-petioled plants range from 2–5 cm long, whereas tall-petioled plants can reach 15(–20) cm in length; glabrous to well covered in long fine hairs. *Lamina* upper surface dark green, and usually with 2 white bands on each side of the midrib about halfway towards the edge, lower surface from pale green to flushed purple at the tips to dark purple throughout, usually glabrous but hairy along the midrib. Size variable even within a population; in small-leaved specimens 7 × 3 cm, lanceolate to elliptic; in large-leaved specimens 15–25 × 3–8 cm, narrowly elliptic to linear; base cuneate, sometimes narrowly rounded or shortly attenuate; apex acute to broadly pointed. *Peduncle* almost sessile to very short, 1–5(–7) cm long, slender, usually hairy. *Inflorescence* small and compact, ovoid, consisting of many tightly packed overlapping bracts, to 4 × 2.5 cm. *Bracts* reddish-brown, small, thin (and papery in dried material), 1.5–2 × 0.8 cm, narrowly lanceolate; broad-based with involute edges; apex acute to mucronulate, generally glabrous. *Bracteoles* can be either 0.5 cm shorter or longer than the bracts. *Flowers* unusual in this genus by having just a single flower and bracteole per bract. *Ovary* hairy, 3 mm long. *Calyx* 1.3 cm long, split by 0.5 cm from apex, apex trilobed. *Corolla* tube 30 mm long, widening towards the apex; dorsal corolla lobe 17 × 3 mm, linear, apex hooded, lateral corolla lobes slightly shorter. *Staminodes* white, oblong with rounded apex, 15 × 5 mm, covered in minute glandular hairs. *Labellum* obovate, clawed, deeply bilobed to about half its length, c.21 × 18 mm, usually white with just a pale yellow central blotch, sometimes with pink or crimson coloration towards the throat; covered in minute glandular hairs. *Stamen* c.8 mm long with filament 3 mm long and thecae 4 mm long with rounded bases; crest only a few mm long, reflexed. *Stigma* extending just beyond crest. *Fruit* unknown.

Distribution. The most widespread species within the genus, *Scaphochlamys biloba* is unusual in having such a large range compared with the very local ranges of the majority of species. It ranges from Pattani and Narathiwat Provinces of Thailand, throughout Peninsular Malaysia to Johore (Fig. 2).

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Habitat and ecology. Found in leaf litter of evergreen forest in both deep shade and more open light areas. Altitude 70–1000 m.

Additional specimens examined. THAILAND. **Narathiwat**: S. Kolok, Nikom Waeng, 3 iii 1974, *Larsen* 32957 (AAU). **Pattani**: Cultivated, 15 x 1931, *Kerr* 20572 (K); Bulait, 7 vii 1923, *Kerr* 7881 (K); Bacho, 14 vii 1923, *Kerr* 7881A (K); Bacho, 10 vi 1930, *Kiah* 24293 (K); Bacho National Park, 11 x 1991, *Larsen et al.* 42331 (AAU).

MALAYSIA. **Johore**: Hutan Simpanan Lenggor, Mersing, 4 v 1982, *T. & P.* KL3346 (K, L, SING). Cultivated material: 95KL47002 (AAU). **Kelantan**: Sungai Ketil, *Henderson* 19663 (SING); Sungai Ketil, *Md. Nur* 12098 (SING). **Pahang**: G. Tahan, 16 ix 1937, *Corner* s.n. (SING); Kuala Tenuk, 26 vii 1891, *Haniff* 8048 (SING). **Terengganu**: Ulu Setui, F.R. Kg. Buloh, Besut, 3 viii 1977, *Lewis* 73 (E, K); G. Tebu, 31 v 1974, *Shah* MS 3275 (SING).

This is a widespread species that has adapted to different habitats and perhaps that is why it is so morphologically variable. In addition to regional variations it also shows great diversity within single populations as seen on individual herbarium sheets (see Larsen, 1962). Subdivision of this species on such morphological characters as petiole or lamina length is untenable, although more detailed study of regional variation may result in a robust infraspecific classification.

6. Scaphochlamys breviscapa Holttum, Gard. Bull. Singapore 13: 95 (1950); Newman et al., Blumea Suppl. 16: 146 (2004). – Type: Malaysia, Terengganu, Kemaman, Ulu Bendong, 29 xi 1935, *Corner* 30021 (holo SING!; iso BO, E!, L!, K!, P).

Rhizome c.6 mm in diameter when dry, horizontally creeping. *Successive shoots* quite close together, generally 2–3 cm apart, each consisting of a single leaf surrounded by 3 leafless-sheaths to 14 cm in length, scarious with age. *Leaf-sheath* short, 2–3 cm long, ligule lobes broadly triangular, 4 mm long with appressed hairs. *Petiole* 20–30(–35) cm long, sparsely hairy to glabrous. *Lamina* upper surface green, lower surface paler but never purple, hairy along midrib and thinning towards the apex; elliptic to somewhat ovate, more or less symmetric, 20–26 × 8–12.5 cm; base rounded, somewhat decurrent; apex acuminate. *Peduncle* 1–3.5 cm long, hidden when young. *Inflorescence* ellipsoid, compact, c.6 × 2.5 cm, composed of 10–15 densely imbricating bracts. *Bracts* 2.5–3 × 1.5 cm wide, covered in short spiky hairs, thickening towards the base; margins inflexed, flushed red, spreading towards the apex; apex obtuse when flattened. *Bracteole* 2.1 × 0.8 cm. *Flowers* 3 (or 4?) per bract. *Calyx* with ovary 16 mm long, ovary short, pilose, calyx deeply cleft. *Corolla* tube to 24 mm long, lobes 12 mm long, white, dorsal lobe 5–6 mm wide at the base, lateral lobes narrower. *Staminodes* oblong, almost as long as corolla lobes, 5 mm wide with rounded apex. *Labellum* obovate, 6 mm long, bilobed 1/3 towards the base, the rounded lobes imbricating, a pale yellow streak running down the middle, flanked by lilac streaks on each side. *Stamen* filament 3 mm long, anther 5 mm long, base of thecae free, acute, connective crest 4 mm wide and reflexed. *Fruit* unknown.

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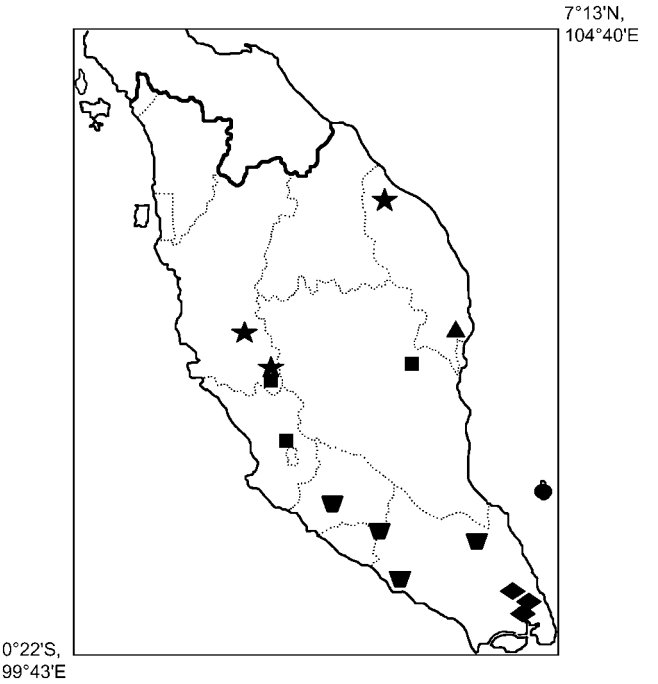


FIG. 5. Distribution of *Scaphochlamys concinna* (Baker) Holttum (■), *S. breviscapa* Holttum (▲), *S. subbiloba* (Burkill ex Ridl.) Holttum (●), *S. perakensis* Holttum (★), *S. malaccana* Baker (▼) and *S. klossii* (Ridl.) Holttum (◆).

Distribution. Peninsular Malaysia (Terengganu) (Fig. 5).

Habitat and ecology. 'Very common on all hillsides, but mostly sterile' (*Corner* 30021). Altitude 350 m.

7. Scaphochlamys burkillii Holttum, Gard. Bull. Singapore 13: 102 (1950); Newman et al., Blumea Suppl. 16: 146 (2004). – Type: Peninsular Malaysia, Pahang, Barlok, Bukit Kapis, 21 vi 1913, *Burn-Murdoch* 210 (lecto SING!, designated here; isolecto K!).

Rhizome 2–6 mm in diameter when dry, occasionally ascending and anchored by vertically growing prop roots. *Successive shoots* crowded together, each comprising 1–3 leaves with purple outer sheaths. *Leaf-sheath* 4–6 cm long with thin broad margins covered in long fine hair; ligule lobes broad and short. *Petiole* 4–5 cm long, glabrous. *Lamina* 15–20 × 4–7.5 cm, slightly asymmetric, elliptic, both base and apex equally narrow, apex acute (occasionally mucronulate), base cuneate-decurrent, lower surface green (pale purple in young leaves) and sparsely hairy. *Peduncle* < 2 cm long, hidden within the leaf sheaths. *Inflorescence* 5–6 × 2 cm wide, ellipsoid,

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the few bracts held upright and overlapping. *Bracts* purple, 2.5–3.5 × up to 1.5 cm wide, awl-shaped, the outside almost entirely covered in a scattering of fine appressed hairs, apex narrowly pointed, slightly incurved, acute, margins thin but not crisped. First *bracteole* to 2.8 cm long, firm, 2-keeled, trilobed, the mid-lobe apiculum covered with 2 mm long fine hairs; subsequent bracteoles 1.1–1.2 cm long. *Flowers* 4–5 within each bract. *Ovary* with calyx 16 mm long, apex cleft by 5 mm and short toothed, densely hairy. *Corolla* tube and lobes white, corolla lobes 16–18 × 4 mm wide at the base. *Staminodes* shorter than the corolla lobes, blunt and white. *Labellum* c.20 mm long and wide, obovate, bilobed halfway up the labellum, white with a pale lemon yellow median band, flanked on either side by reddish-purple streaks. *Stamen* white or faintly purple, filament 3 mm long; thecae 3.5 mm long; crest 4 mm wide, reflexed. *Fruit* unknown.

Distribution. Peninsular Malaysia (Pahang) (Fig. 2).

Habitat and ecology. Altitude 70–100 m.

Additional specimen examined. MALAYSIA. **Pahang**: *Beserah, Burkill & Haniff* 16133 (SING).

In the protologue Holttum (1950) cites two specimens as types without clearly defining any one as a holotype. I have lectotypified *Burn-Murdoch* 210 (SING) here.

8. Scaphochlamys calcicola A.D.Poulsen & R.J.Searle, Gard. Bull. Singapore 57: 29 (2005). – Type: Borneo, southwest Sarawak, 20 vi 2003, *Poulsen, Jugah & Clausager* 2022 (holo SAR; iso AAU, E!, K, L).

Rhizome robust, c.7 mm in diameter when dried, creeping above the ground, sometimes forking, with well-developed prop roots. *Successive shoots* 2–20 cm apart, distinctly unifoliate; laminate leaf tightly enclosed by 3(–5) leafless-sheaths, the longest to 18 cm long, cream at base, flushed green towards apex or purple, becoming scarious with age and finally decaying away. *Leaf-sheath* to 3 cm long, together with ligule hidden by leafless-sheaths, margin thin and densely hairy; ligule membranous, more or less obscure, bilobed, to 5 mm long. *Petiole* 10–27(–39) cm long, canaliculate. *Lamina* upper surface plain green, lower surface very pale green and villose (up to 1 mm long, appressed, white hairs scattered throughout the lower surface but most dense near and on the sides of the midrib), broadly elliptic to lanceolate, slightly asymmetric, plicate, 15–37 × 9–18 cm, base rounded to slightly cordate and attenuate, apex distinctly acuminate. *Peduncle* slender, to 1.5 cm long, glabrous, hidden by the leaf bases. *Inflorescence* bilaterally flattened, 7–10 × 1.5–2 cm wide and 0.5–0.6 cm deep, tapering towards a pointed apex, with 8–13 distichously arranged bracts each 0.3–0.7 cm apart on an elongated spike. *Bracts* pale green, 2.5–3.2 × 0.9 cm near the base, held stiffly upright, boat-shaped, edges involute and overlapping, outer surface glabrous or covered in short spiky hairs, and apex acute. *Bracteole* 2–3.3 cm (first; second and third decreasing in size), 2-keeled, generally longer and opposite the bract, wrapped tightly around the flower, slit to the base, edges overlapping, covered in short spiky hairs. *Flowers* usually 2, sometimes

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3 per bract. *Ovary* 2 mm long, glabrous; epigynous glands 4–5.5 mm, bilobed, needle-shaped. *Calyx* with ovary 12–13 mm long, covered in a scattering of short spiky hairs, otherwise glabrous, split 4 mm from apex, with rounded to acute, irregularly tridentate apex. *Corolla* tube 24–40 mm long, glabrous; corolla lobes white, linear, 15 × 5 mm, apex mucronate and hooded. *Staminodes* oblong, 12 × 3–4 mm, with minute glandular hairs, apex obtuse. *Labellum* spathulate, 14–17 × 9–11 mm, apex bilobed (indented 3–4 mm), lobes overlapping, white with pale yellow-green centre. *Stamen* filament 5–7 × 2 mm, thecae 4–5 × 1.5 mm, not spurred; crest rounded, 2 mm long. *Stigma* 1 mm across, club-shaped with 2 dorsal knobs, ostiole ciliate and forward-facing. *Fruit* unknown.

Distribution. Malaysia (Sarawak) (Fig. 6).

Habitat and ecology. Lowland forest; tends to occur at the base or shoulder of limestone hills, on boulders near streams. Altitude 50 m.

This species possesses an unusual set of characters: a distichous inflorescence, a two-keeled bracteole, and lack of thecae spurs, but DNA analysis confirms its placement in *Scaphochlamys* (Poulsen & Searle, 2005).

9. Scaphochlamys concinna (Baker) Holttum, Gard. Bull. Singapore 13: 94 (1950); Newman et al., Blumea Suppl. 16: 146 (2004). – *Kaempferia concinna* Baker in Hooker, Fl. Brit. India 6: 221 (1890); K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20):

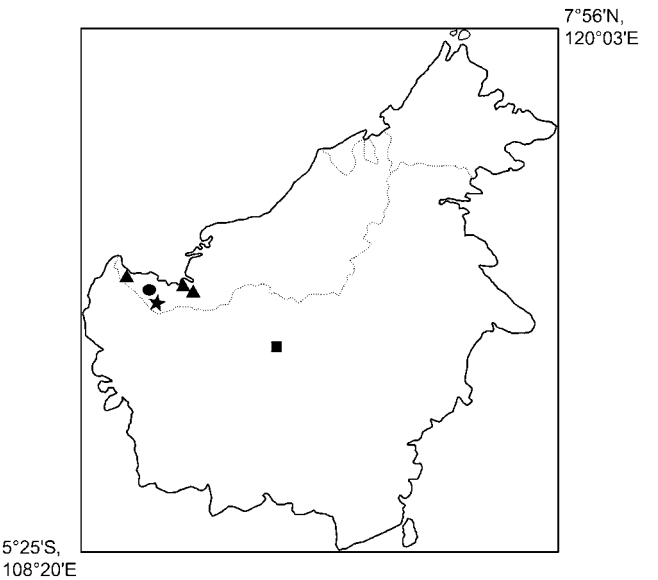


FIG. 6. Distribution of *Scaphochlamys anomala* (Hallier f.) R.J.Searle (■), *S. argentea* R.M.Sm. (▲), *S. calcicola* A.D.Poulsen & R.J.Searle (●) and *S. gracilipes* (K.Schum.) S.Sakai & Nagam. (★).

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80 (1904). – *Gastrochilus concinna* (Baker) Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 116 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 20 (1907); Ridl., Fl. Malay Penin. 4: 251 (1924); Turner, Asian J. Trop. Biol. 4(1): 43 (2000). – *Boesenbergia concinna* (Ridl.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 316 (1913). – Type: Peninsular Malaysia, Perak, Ulu Bubong, vi 1886, *King's collector* [*Kunstler*] 10135 (holo K!; iso SING!).

Rhizome thin, 2–5 mm in diameter when dried, horizontally to obliquely creeping, sending out a tangle of long stringy roots. *Successive shoots* unifoliate and relatively close together (generally 1 cm apart), each leaf surrounded by 3 leafless-sheaths, longest to 15 cm long, flushed purple and, when dried, brown and papery, glabrous. *Leaf-sheath* 2–5 cm long; ligule lobes small, obscure. *Petiole* long, thin, 25–48 cm long, glabrous. *Lamina* lower surface purple, generally glabrous, except for a scattering of long fine hairs along the midrib, thinning towards the apex, lanceolate, symmetrical, 14–18 × 4.5–6.5 cm, base distinctly cordate, apex narrowly acuminate. *Peduncle* 8–15 cm long, slender, glabrous, enclosed by the leaf-sheath. *Inflorescence* compact, tulip-shaped, c.3 × 1.5 cm. *Bracts* sometimes flushed purple towards the apex, 2.5–3 × c.1 cm, boat-shaped with very thin edges, glabrous, apex acute to narrowly pointed, sometimes tufted, c.6 in number. *Flowers* 2 within each bract. First *bracteole* 2.2 × 0.7 cm, second shorter, glabrous. *Calyx* and ovary 12 mm long, calyx very dark red, waxy, with a bidentate apex. *Corolla* tube 30 mm long, corolla lobes c.14 mm long. *Staminodes* 9 × 2 mm, apex rounded. *Labellum* c.20 mm long, white with 2 dark red stripes towards the throat. *Anther* crest short and broad, entire and reflexed. *Fruit* unknown.

Distribution. Peninsular Malaysia (Pahang, Perak, Selangor) (Fig. 5).

Habitat and ecology. Altitude c.100–300 m.

Additional specimens examined. MALAYSIA. **Pahang**: Gunong Tapis Ridge, 13 vi 1934, *Symington* 28813 (K, SING). **Selangor**: Bukit Ulu Gombak, 14 ix 1974, *Willis* s.n. (L) & v 1974, *Littke* s.n. (L). Cultivated material: Selangor, 10 xi 1994, *Theilade* C55 (AAU).

10. Scaphochlamys cordata Y.Y.Sam & Saw, Gard. Bull. Singapore 57: 256 (2005). – Type: Peninsular Malaysia, Terengganu, Dungun, Jengai Forest Reserve, 17 x 2002, *Sam & Mustapa* FRI 47155 (holo KEP; iso E, SAN).

Rhizome creeping over ground surface. *Successive shoots* close together, unifoliate. *Leafless-sheaths* reddish brown, apex mucronulate, longest sheath 11–17 cm long. *Leaf-sheath* 1–2 cm long, ligule lobes small, c.1 mm. *Petiole* slender, 30–60 cm long, terete. *Lamina* with prominently raised veins on upper surface, lower surface brownish-red when young, densely hairy towards the base, slightly asymmetric, 14–30 × 8–15 cm, base strongly cordate, sometimes with overlapping auricles, apex narrowly acuminate with distinct 'drip tip'. *Peduncle* 10–18 cm long, hidden within bladeless sheath when young. *Inflorescence* slender, lax, with 4–10 bracts 1.5–2 cm

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apart, rachis 5–9 cm long. *Bracts* red when young, turning green, 1.5–2.2 × 0.6–1.2 cm when flattened, spathulate, covered with simple hairs towards apex on both surfaces, apex acute and reflexed. *Bracteoles* shorter than bract, narrowly lanceolate, 6–11 × 1–3 mm with inflexed margin, apex pointed, hairy throughout, first bracteole largest, enclosing subsequent bracteoles and flowers. *Flowers* more than 15 per bract, small and white except for the calyx. *Calyx* 7.5–9 mm long, red and hairy, split 2.5–4 mm down one side. *Corolla* tube 11–14 mm long, dorsal corolla lobe lanceolate with strongly inflexed margin, 6–8.5 × 1.5–2 mm, apex hooded, pinkish distally; lateral corolla lobes lanceolate with strongly inflexed margin, 5–7 mm long, pinkish distally. *Staminodes* oblong, 3–7.5 × 1–2 mm, apex rounded, with tiny glandular hairs on adaxial surface. *Labellum* clawed, 7–10 × 5–9.8 mm wide, bilobed, lobes overlapping, cleft c.4 mm from apex, median band faint yellow, purple blotches on both sides. *Stamen* 3.5–4.3 mm, tinged purple; filament short, 1 mm long; thecae 2.5 mm long; crest short, < 1 × 1.5 mm. *Stigma* small, cup-shaped, yellowish, papillose. *Fruit* unknown. (Adapted from Sam & Saw, 2005.)

Distribution. Peninsular Malaysia (Terengganu) (Fig. 2).

Habitat and ecology. Found primarily on ridges. Altitude 80–140 m.

11. Scaphochlamys erecta Holttum, Gard. Bull. Singapore 13: 99 (1950); Newman et al., Blumea Suppl. 16: 147 (2004). – Type: Peninsular Malaysia, Johore, Sungai Sedili, Mersing Road, 30 ix 1936, *Corner* SFN 31941 (holo SING!; iso BO, E!, K!, L!).

Rhizome erect to semi-erect, anchored by vertically growing prop roots, sometimes creeping step-wise through the accumulating leaf litter. *Successive shoots* 1.5 cm apart, comprising 8–10 leaves when fully developed, each arising in the axil of a foliar leaf below the inflorescence, originally bearing leafless-sheaths up to 10 cm long. *Leaf-sheath* 6–9(–15) cm long, glabrous, margins thin; ligule triangular, apparently long, but very frequently damaged. *Petiole* glabrous, 1–8 cm long. *Lamina* upper surface green, lower surface paler and glabrous, linear to elliptic, asymmetric, 18–32(–50) × 3–5.5(–7) cm, narrowing gradually towards an acute apex, and to a long, narrow, decurrent base. *Peduncle* generally 4–5(–15 cm) long, semi-glabrous to glabrous. *Inflorescence* 5–6 cm long, bearing 8–12 (occasionally to 25) imbricating bracts becoming more elongated and lax with age. *Bracts* green, 3–4 × 1.2–1.5 cm, linear to boat-shaped, base inflexed, becoming more flattened towards the apex; apex widely acute to apiculate, margins thin and slightly frilled; outer surface glabrous, tufted at the apex, sometimes sparsely hirsute along edge, inner surface hairy. First *bracteole* 2 cm long, the rest 0.9 cm long. *Flowers* without scent, white, 2–4 per bract. *Ovary* unilocular with 3 basal ovules; calyx with ovary 12 mm long, slightly swollen, the apex slightly dentate and glabrous. *Corolla* tube 28 mm long, slender, widening slightly towards apex, lobes 10 mm long, the dorsal lobe 4 mm wide at base, apex acute, lateral lobes narrower. *Staminodes* outspreading, 8 × 4 mm, oblong with rounded apex. *Labellum* obovate, 13 × 12 mm, 1/3 bilobed (rounded

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imbricating lobes), white with a median yellow band flanked by 2 lilac streaks developing towards the base. *Stamen* filament 2.5 mm long; thecae 3 mm long, free and pointed at base; crest rounded, reflexed, 2 × 3 mm. *Fruit* ellipsoid, unilocular, seeds 1–3.

Distribution. Peninsular Malaysia (Johore, Pahang, Terengganu) (Fig. 4).

Habitat and ecology. Primary forest, often near rivers; on granite hillside or sandstone ridges. Altitude 200–300 m.

Additional specimens examined. MALAYSIA. **Johore**: Bagan Kijang, Sungai Sedili, 29 i 1933, *Corner* s.n. (K, SING); Jemakang Road, 14 xii 1935, *Corner* s.n. (K, SING); Gunung Ledang, Ulu S. Belemang, 14 vii 1969, *Whitmore* 12288 (K, L). **Pahang**: Gunung Serudom F.R., 26 x 1975, *Shah et al.* MS3750 (C, SING). **Terengganu**: Bukit Bauk F.R., 28 iv 1962, *Unknown collector* 5058 (K); Sungai Terengganu near Kuala Kerbat, 25 vi 1971, *Whitmore* 20246 (K, L, SING).

12. Scaphochlamys gracilipes (K.Schum.) S.Sakai & Nagam., Blumea 51: 110 (2006). – *Haplochorema gracilipes* K.Schum., Bot. Jahrb. 27: 332 (1899); K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 90 (1904). – *Boesenbergia gracilipes* (K.Schum.) R.M.Sm., Bot. J. Linn. Soc. 85: 43 (1982); R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 44: 221 (1987). – Type: Borneo, Sarawak, 1st Division, Gunung Wah (G. Wan?), xi 1866, *Beccari* 2839 (holo FI; iso K!, P).

Rhizome thin, c.3 mm in diameter when dried, horizontal to obliquely ascending, anchored by long fine trailing roots. *Successive shoots* clumping, no more than 1 cm apart, unifoliate. Longest *leafless-sheath* tightly enveloping when young, but rapidly drying out and decaying with age. *Leaf-sheath* to 1 cm long, ligule tiny, obscure. *Petiole* 4–8 cm long, glabrous. *Lamina* upper surface dark green, lower surface finely hairy along midrib towards apex, elliptic to ovate, symmetric, 11–17 × 4–6 cm, base acute to slightly decurrent, apex acuminate, sometimes mucronulate. *Peduncle* and inflorescence together to 7 cm long, very slender, the inflorescence becoming more lax as it elongates with age and composed of c.5 spirally arranged bracts. *Bracts* held at an acute angle and almost imbricating when young, becoming more open as the spike elongates; each bract c.1 cm in length, narrow, linear to boat-shaped, glabrous. *Flowers* and *fruit* unknown.

Distribution. Malaysia (Sarawak) (Fig. 6).

The transfer of the basionym into *Scaphochlamys* by Sakai & Nagamasu (2006) is based solely on the type specimen. Other material identified by Rosemary Smith as *Boesenbergia gracilipes* may still belong within *Boesenbergia* (see Smith, 1987).

13. Scaphochlamys grandis Holttum, Gard. Bull. Singapore 13: 101 (1950); Newman et al., Blumea Suppl. 16: 147 (2004). – Type: Peninsular Malaysia, Terengganu, Kemaman, Ulu Bendong, 30 x 1935, *Corner* SFN 30030 (holo SING!; iso BO, E!, K!, L!, P).

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Rhizome robust, 1 cm in diameter or thicker when dry, obliquely ascending, anchored by long vertically growing prop roots. *Successive shoots* of 5 or more leaves, each new rhizome element arising in the axil of the second or third foliar leaf below the inflorescence. Longest *leafless-sheath* to 18 cm long and covered in coarse hairs. *Leaf-sheath* to 18 cm long, short-haired, with broad, thin margins; ligule lobes broad, 10 mm or longer, triangular. *Petiole* short or non-existent, covered in woolly hairs. *Lamina* upper surface green with prominent veins, lower surface pale green, densely hairy both on and alongside the lower surface midrib, becoming finer towards the apex, otherwise sparsely hairy, narrow elliptic shape with straight-sided linear leaves, asymmetric, to 50 × 10 cm, base long decurrent, apex mucronulate. *Peduncle* to 7 cm long, covered in short woolly hairs. *Inflorescence* 7–12 cm long, with c.15 spirally arranged bracts, held at an acute angle and imbricating. *Bracts* green when young, becoming red with age, c.4.5 × 1–1.5 cm near the base, boat-shaped, margins inflexed, not crisped, densely covered in short woolly hairs, apex acute to mucronulate. First *bracteole* 2–2.5 cm long, densely hairy, the second 8 mm long. *Flowers* for the most part 2 per bract (occasionally several?). *Ovary* hairy; calyx with ovary 17–20 mm long. *Corolla* tube 40 mm long; corolla lobes white, 16 mm long, dorsal corolla lobe no more than 4 mm wide. *Staminodes* white, as long as the dorsal corolla lobe and 5 mm wide. *Labellum* 22 mm long, bilobed almost to the middle, lobes generally irregular, wide yellow midband becoming dark lilac-margined with a few lilac streaks spreading towards the base. *Stamen* filament 3 mm long; thecae 5 mm long; crest pale lilac, strongly reflexed (the apex almost reaching the back of the anthers), the margins stiff, 6 mm wide. *Fruit* ellipsoid, 16 mm long, shiny. *Seeds* 2 or 3, black, ellipsoid.

Distribution. Peninsular Malaysia (Terengganu) (Fig. 2).

Habitat and ecology. 'Very abundant in swamps in stream valleys' (*Corner* 30030). Altitude 350 m.

This is the largest species in the genus, reaching almost 1 m in height.

14. Scaphochlamys klossii (Ridl.) Holttum, Gard. Bull. Singapore 13: 100 (1950); Newman et al., Blumea Suppl. 16: 147 (2004). – *Gastrochilus klossii* Ridl., Mat. Fl. Malay. Penins. 2: 16 (1907); Ridl., Fl. Malay Penin. 4: 248 (1924); Turner, Asian J. Trop. Biol. 4(1): 24 (2000). – *Boesenbergia klossii* (Ridl.) Loesen. in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 15A: 571 (1930). – Type: Malaysia, Johore, near Gunong Pantai, 1904, *Kloss* s.n. (holo K!).

14a. Scaphochlamys klossii var. **klossii**

Rhizome robust, 0.6–1 cm in diameter when dried, horizontal or obliquely ascending, anchored by vertical prop roots. *Successive shoots* rather close together (0.5–2 cm apart), with more or less 4 leaves per shoot. Surrounding sheaths densely covered in woolly hairs. *Leaf-sheath* 8–12 cm long, broad and fine, covered in a dense

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layer of woolly hair; ligule lobes broad, triangular, 6–10 mm long. *Petiole* almost absent to 15 cm long, covered in a thick layer of woolly hair; combined leaf-sheath and petiole length to 18(–26) cm. *Lamina* slightly fleshy, upper surface dark green, lower surface pale green and sparsely covered in fine hairs; midrib densely covered in woolly hairs, becoming glabrous towards the apex, elliptic to narrowly elliptic, somewhat asymmetric, 20–30 × 4–10 cm, base narrowly cuneate or shortly decurrent, apex acute (sometimes acuminate). *Peduncle* 2–6 cm long, hidden among the bases of the leaf sheaths, covered in woolly hair. *Inflorescence* ovoid when young, commonly 4 × 2 cm, becoming elongated with age, to 8–11 cm long, the many bracts closely imbricating, but never becoming lax. *Bracts* green, more or less densely hairy all over but especially on the margins, which may, or may not, be thin and crisped, ovate (occasionally narrowly ovate), apex acute or mucronate, c.2.5 × 1.5 cm. *Bracteoles* oblong-mucronate, 0.6–0.8(–1.2) cm long, sparsely hairy. *Flowers* 3–8 within each bract. *Ovary* finely hairy; calyx and ovary 0.8–1.2 cm long. *Corolla* tube slender, 1.8 cm long, corolla lobes 0.7 × 0.4 cm, dorsal lobe with acute apex. *Staminodes* about as long as the corolla lobes and 5 mm wide, the rounded ends slightly reflexed. *Labellum* c.1.2 cm long and wide, almost round, shortly bilobed, with rounded reflexed lobes, white with a median longitudinal pale lemon yellow band, flanked by pale lilac lines especially towards base. *Stamen* filament broad, 2 mm long; thecae 3 mm long, their basal ends free and acute; crest 2 × 3 mm, reflexed, crisped and slightly lobed. *Fruit* ellipsoid, 1.2 cm long. *Seeds* 1–3, ellipsoid with aril laciniate to the base.

Distribution. Peninsular Malaysia (Johore), Singapore (Fig. 5).

Habitat and ecology. 'Common in the swampy forest round the Sedili and tributaries, generally gregarious in damp hollows' (*Corner*, 14 v 1935). Altitude 50–200 m.

Additional specimens examined. MALAYSIA. **Johore**: 11 xii 1935, *Vesterdal* 78 (C); Kota Tinggi District, Gunong Panti, 23 vi 1963, *Stone et al.* 4806 (L); S. Berassau, Mawai–Jemaluang Road, 14 v 1935, *Corner* s.n. (SING); S. Berassau, Mawai–Jemaluang Road, 7 ii 1935, *Corner* 28965 (K); Sungai Kayu Ara, 3 i 1936, *Corner* 29983 (K, L, SING); Gunung Muntahak, 2 iii 1928, *Holttum* 19952 (K, SING); Sungai Kayu Sedili, 6 x 1936, *Kiah* 31963 (K, L, SING); Bandar Tenggara, Lingiu–Sindora Forest, 24 vii 1991, *Lesmy* 35938 (K, KEP); Kota Tinggi Waterfall area, 22 iv 1978, *Maxwell* 78-212 (L); Sungai Kayu, 6 x 1936, *Ngadiman* 31963 (L, SING).

SINGAPORE. Bukit Timah Forest Reserve, Taban Path, 26 xii 1949, *Sinclair* 6289 (E); 30 xi 1981, *Shah et al.* MS 4145 (SING).

14b. Scaphochlamys klossii var. **glomerata** Holttum, Gard. Bull. Singapore 13: 101 (1950); Newman et al., Blumea Suppl. 16: 147 (2004). – Type: Malaysia, Johore, Gunong Panti, west, *Corner* 30952 (holo SING!; iso E!, K!, L!).

Rhizome slightly thinner than in type variety, 0.5 cm wide when dried. *Successive shoots* 1–2-leaved, and close together; leafless-sheaths densely hairy. *Leaf-sheath*

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1.5–4.5 cm long, broad, covered in woolly hair; ligule triangular, c.3 mm long. *Petiole* 2.5–5 cm long, sparsely hairy to glabrous; leaf-sheath and petiole 7–9(–15) cm long. *Lamina* upper surface pale green, occasionally with a silver band near margin, narrowly elliptic, asymmetric, to 24 × 5 cm, lower surface sparsely covered in fine hairs, becoming glabrous towards apex, base cuneate, apex acute. *Peduncle* 1.5–4 cm long, hidden within leaf-sheaths, glabrous. *Inflorescence* small, ovoid when young, the many bracts closely imbricating, appressed to the rachis, becoming slightly more lax as the inflorescences age. *Bracts* 3–4 cm long, less broad than in type, lightly covered in fine hairs to glabrous, margins thin or not, each subtending c.7 flowers.

Distribution. Peninsular Malaysia (Johore).

Habitat and ecology. Found in drier conditions than the type variety. Altitude 0–50 m.

Additional specimen examined. Peninsular Malaysia. **Johore**: Gunong Panti, west, *Corner* 30951 (L, SING).

14c. Scaphochlamys klossii var. **minor** Holttum, Gard. Bull. Singapore 13: 101 (1950); Newman et al., Blumea Suppl. 16: 147 (2004). – Type: Malaysia, Johore, Ulu Segun, Gunong Panti, 20 i 1936, *Corner* SFN 30743 (lecto SING!, designated here; isolecto K!).

Rhizome horizontally creeping, 0.5–0.8 cm in diameter when dried. *Successive shoots* 0.5–1 cm apart; number of leaves per shoot variable, ranging from 1 to 5. *Leaf-sheath* c.3 cm long, thin-edged, hairy; ligule obscure. *Petiole* 10 cm long, densely hairy. *Lamina* elliptic, distinctly asymmetric, to 20 × 5 cm, lower surface covered in fine hairs, densely hairy along midrib, base cuneate, apex acute. *Peduncle* c.1 cm long. *Inflorescence* smaller than in type, small, ovoid when young, elongating with age to 7 cm long. Few overlapping *bracts* each subtending 2–3 flowers; bracts 2.5–3 cm long, densely covered in fine hairs, apex long, thin, pointed and tufted.

Distribution. Peninsular Malaysia (Johore).

Habitat and ecology. 'Common, often gregarious, in the swamp or on the hillsides' (*Corner* 30743). Altitude 0–250 m.

Additional specimen examined. Peninsular Malaysia. **Johore**: Bukit Tinjau Laut, 5 viii 1937, *Ngadiman* s.n. (SING).

In the protologue Holttum (1950) quotes two specimens as types without clearly defining any one as a holotype. *Corner* SFN 30743 (SING) has been designated as the lectotype.

15. Scaphochlamys kunstleri (Baker) Holttum, Gard. Bull. Singapore 13: 96 (1950); Lim, Folia Malaysiana 2(2): 122 (2001); Newman et al., Blumea Suppl. 16: 147

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(2004). – *Curcuma kunstleri* Baker in Hook.f., Fl. Brit. India 6: 214 (1890); Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 120 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 22 (1907). – *Gastrochilus kunstleri* (Baker) Valeton, Bull. Jard. Bot. Buitenzorg 27: 104, pl. 14 (1918); Turner, Asian J. Trop. Biol. 4(1): 20 (2000). – *Hitcheniopsis kunstleri* (Baker) Ridl., Fl. Malay Penin. 4: 252 (1924); Turner, Asian J. Trop. Biol. 4(1): 44 (2000). – Type: Malaysia, Perak, Larut, Gopeng, *Kunstler* 4413 (neo K!, designated here).

Kaempferia lutea C.H.Wright, Bull. Misc. Inform. Kew 1907: 60 (1907). – Type: Cultivated material: 3 x 1906, *Wright* 181-03 (holo K!).

15a. Scaphochlamys kunstleri var. **kunstleri**

Rhizome thick, fleshy, 0.8–1 cm in diameter when dried. *Successive shoots* closely spaced, to 8 cm apart, each shoot comprising 2 leaves and a terminal inflorescence enclosed by 3 surrounding leafless-sheaths flushed with purple, the longest reaching 20 cm. *Leaf-sheath* 7.5(–14) cm long; ligule broad and rounded. *Petiole* 2–7 cm long, terete. *Lamina* upper surface dark green, lower surface either paler green or dark purple, sparsely covered in fine hairs, oval, symmetric to asymmetric, 30–40(–60) × 17 cm, base cuneate to deeply attenuate, apex with a distinct, abrupt triangular tip 1 cm long. *Peduncle* 6–10 cm long, glabrous. *Inflorescence* cylindrical, sometimes greatly elongated, number of bracts ranging from 6 to 60, bracts distinctly pouched in appearance and overlapping (in the larger inflorescences very much like *Curcuma*, but bracts not connate). *Bracts* pale green to creamy-yellow, sometimes flushed red, 3–4 cm long, almost as broad as wide (in the larger inflorescences wider than long), glabrous, apex broadly acute to rounded. *Bracteole* to 2.2 cm long, successively decreasing in size. *Flowers* 3–6 per bract. *Ovary* partially trilocular; calyx with ovary 18 mm long; calyx split 5 mm down one side, apex bidentate. *Corolla* tube 34–36 mm long, corolla lobes 16 × 6 mm, dorsal corolla lobe boat-shaped with small hooded apex, pale yellow to yellow. *Staminodes* shorter than the dorsal petal, 11 × 4 mm, pale yellow to yellow, linear with rounded apex. *Labellum* 15–23 × 19 mm, bilobed to about 1/3 of its length, pale yellow to saffron yellow with a clear lemon yellow median band, which may be flanked by reddish-pink streaks towards the throat. *Stamen* filament white, 3–4 mm long; thecae pale yellow or slightly suffused with pink, 6 mm long; crest very short, fleshy and hardly reflexed. *Fruit* unknown.

Distribution. Peninsular Malaysia (Perak), Singapore (or these only cultivated?) (Fig. 7).

Habitat and ecology. Deep shade near streams and on rocky outcrops. Altitude 30–100(–500) m.

Additional specimens examined. MALAYSIA. **Perak**: Sungai Siput, *Burkill* 6323 (SING); Lubok Merbau, *Burkill & Haniff* 13592 (SING); Kuala Kangsan, viii 1936, *Corner* 31674 (K, L, SING); Base of Gaa Badak, Leggong, 12 vi 1930, *Henderson* 23840 (K, SING); Larut, xi 1881, *Kunstler* 2542 (K); Upper Perak, *Wray* 3388, 3662, 3702 (SING); Kedah/Perak boundary, vi 1917, *Mus* s.n. (K); Gunung Tungal, iii 1894, *Ridley* 7228 (K, SING); Waterloo (Estate), xii 1895, *Curtis* 2719 (SING).

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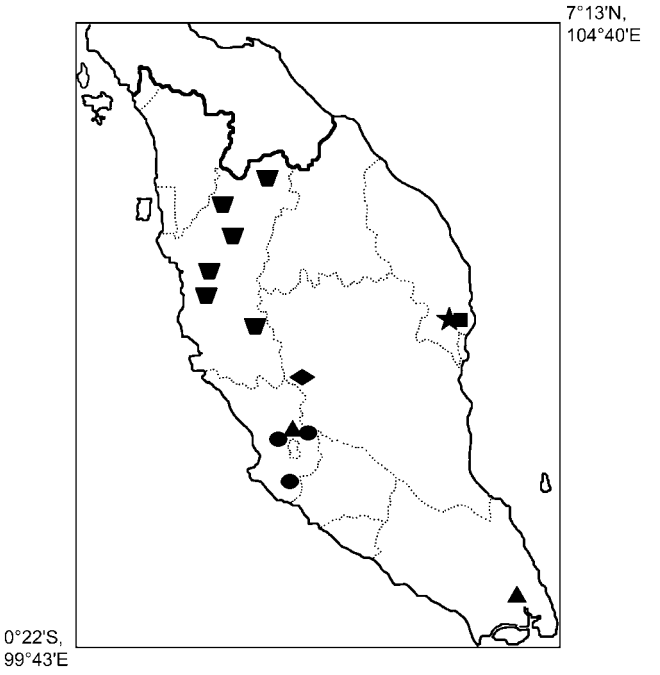


FIG. 7. Distribution of *Scaphochlamys tenuis* Holttum (■), *S. lanceolata* (Ridl.) Holttum (▲), *S. oculata* (Ridl.) Holttum (●), *S. rubromaculata* Holttum (★), *S. kunstleri* (Baker) Holttum (▼) and *S. pennipicta* Holttum (◆).

SINGAPORE. Botanic Gardens, 30 iv 1929, *Holttum* 7258 (K, SING); in waterfall gardens: 10 xi 1917, *Burkill* 1299 (SING) & 31 viii 1920, *Burkill* 6110 (SING). Cultivated material: from Ipoh, 1 x 1969, *Bradford* C8003 (E).

At Kew, where Baker worked, there are two specimens that were received in 1888 from 'Herb. Hort. Bot. Calcuttensis Flora of the Malay Peninsula'. The first is *Kunstler* 2542 from Larut dated November 1881 and the second is *Kunstler* 4413 from Perak, Larut, Gopeng dated June 1883. In the absence of a specimen dated 1882, cited by Baker, probably mistakenly (Newman, 2004), as being from Pegu, I have decided to neotypify one of the other specimens at Kew that Baker would have seen.

15b. Scaphochlamys kunstleri var. **rubra** (Ridl.) Holttum, Gard. Bull. Singapore 13: 97 (1950); Lim, Folia Malaysiana 2(2): 123 (2001); Newman et al., Blumea Suppl. 16: 147 (2004). – *Curcuma kunstleri* var. *rubra* Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 120 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 22 (1907); Turner, Asian J. Trop. Biol. 4(1): 20 (2000). – *Hitcheniopsis kunstleri* var. *rubra* (Ridl.) Ridl., Fl. Malay Penin. 4: 253 (1924); Turner, Asian J. Trop. Biol. 4(1): 44 (2000). – Type:

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Peninsular Malaysia, Perak: Kuala Dipang, x 1894, *Curtis* s.n. (lecto SING!, designated here).

Vegetative and floral characters the same as the type variety except in the following: bracts dark pink or creamy-green tinged pink at the edges; corolla cream or white; labellum and staminodes dark red; labellum also dark red with yellow or orange central mark; anther dark red or yellow. (Adapted from Lim, 2001.)

Distribution. Peninsular Malaysia (Perak).

Habitat and ecology. Forms abundant colonies in dense damp forest.

Additional specimen examined. MALAYSIA. **Perak**: Tapah, *Wray* 193 (SING).

In the protologue dated 1899 Ridley cites from a specimen 'Perak. Kwala Dipang, at the base of limestone hills'. The only specimen at SING to which he could be alluding is the above Curtis specimen currently held in the general collection and seen by the author. Therefore as this is generally accepted as the original material I have now designated it as the lectotype. It is also the Curtis specimen quoted by Holttum (1950) for this variety. The neotypification by Lim (2001) is superfluous as original material is still available.

15c. Scaphochlamys kunstleri var. **speciosa** C.K.Lim, Folia Malaysiana 2(2): 123 (2001); Newman et al., Blumea Suppl. 16: 148 (2004). – Type: Peninsular Malaysia, Perak, Bintang Hijau Forest Reserve, *Lim* L4791 (holo KEP; iso SING).

Vegetative and floral characters the same as the type variety except in the following: bracts variable in colour (usually cream but may also be tinged with pink on the upper edges, sometimes red); flowers with white corolla and staminodes; labellum white with central yellow mark and pink transverse stripes at the sides towards the base; bract colours vary independently of floral colours. (Adapted from Lim, 2001.)

Distribution. Peninsular Malaysia (Perak).

Habitat and ecology. Forming profuse colonies in wet valleys near streams. Has been found to occur alongside colonies of *Scaphochlamys kunstleri* var. *kunstleri* (e.g. the type location). Perhaps more detailed infraspecific studies may shed some interesting light on this species?

16. Scaphochlamys lanceolata (Ridl.) Holttum, Gard. Bull. Singapore 13: 99 (1950); Newman et al., Blumea Suppl. 16: 148 (2004). – *Gastrochilus lanceolata* Ridl., Mat. Fl. Malay. Penins. 2: 16 (1907); Ridl., Fl. Malay Penin. 4: 250 (1924); Turner, Asian J. Trop. Biol. 4(1): 24 (2000). – Type: Malaysia, Johore, Gunung Panti, xii 1892, *Ridley* s.n. (holo K!).

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Rhizome slender, c.3 mm thick when dried, horizontal to somewhat ascending. *Successive shoots* close together, 0.5–1 cm apart, comprising 1–2 leaves surrounded by 2–3 leafless-sheaths to 3 cm long, glabrous. *Leaf-sheath* rather broad, to 3 cm long; ligule lobes triangular, c.4 mm long. *Petiole* 3.5–7 cm long, glabrous. *Lamina* upper surface light green with a white stripe running parallel with the mid-vein on each side of the leaf, lower surface paler and sparsely hairy, elliptic, asymmetric, 8–12(–15) × 3–4 cm, apex acute. *Peduncle* 1–2 cm long, hidden within the leaf-sheaths, glabrous. *Inflorescence* short, < 5 cm long, bearing 3–5 overlapping suberect bracts. *Bracts* green, 2.5–3.5 × 0.6 mm, linear to boat-shaped, glabrous, the edges firm, apex apiculate. *Bracteole* much smaller, 1.5 cm long, linear, glabrous with acute apex. *Flowers* 2–3 per bract. *Ovary* with calyx 12 mm long, unidentate and cleft, both glabrous. *Corolla* tube slender at base, widening towards the apex, 27 mm long; dorsal corolla lobe 10 × 4 mm, hooded; lateral corolla lobes slightly longer, 12 mm, white. *Lateral staminodes* white, narrowly obovate, 10 × 3 mm, apex rounded. *Labellum* 15 × 14 mm, deeply bilobed to 7 mm, splash of yellow in centre. *Stamen* filament broad; thecae long, thin, papillose, 3 × 0.5 mm with free basal spurs; crest broad and reflexed, 1–2 × 3 mm. *Fruit* unknown.

Distribution. Peninsular Malaysia (Johore) (Fig. 7).

Additional specimens examined. MALAYSIA. **Johore**: Cultivated material: iii 1980, C12761 & C8488 (E).

17. Scaphochlamys laxa Y.Y.Sam & Saw, Gard. Bull. Singapore 57: 258 (2005). – Type: Malaysia, Terengganu, Dungun, Jengai Forest Reserve, *Sam & Apok* FRI 49136 (holo KEP; iso SAN, SING).

Scaphochlamys mat-kilau C.K.Lim, Folia Malaysiana 6(1–2): 43 (2005). – Type: Peninsular Malaysia, Terengganu, Ulu Dungun, Kubu Mat Kilau, *Lim* L6822 (holo UKMB; iso SING).

Rhizome robust, growth horizontal. *Successive shoots* 1–3 cm apart, unifoliate, 3 leafless-sheaths red when young, longest sheath to 7–13 cm in length. *Leaf-sheath* 3–5 cm; ligule obscure. *Petiole* 13–36 cm long, red when young. *Lamina* upper surface dark green, sometimes with white bands between midrib and leaf margin, lower surface red when young, turning pale green with age, broadly elliptic or ovate, 13–22 × 10.5–14 cm, base slightly decurrent on the petiole, never cuneate, apex cuspidate. *Peduncle* 9–12 cm long, red when young. *Inflorescence* elongate and lax, rachis 6–11 cm long supporting c.5–8 bracts, each bract 0.4–2 cm apart. *Bracts* dark green, 1.7–2.5 × 0.8–1.6 cm, spathulate and broadly elliptic when flattened, margin hairy when young, apex acute, distally reflexed. *Bracteoles* smaller than bract, 5–7 × 4.5–6 mm, hairy towards apex. *Flowers* more than 2 per bract. *Ovary* 2 mm long, trilocular; 2 epigynous glands 4 mm long, yellow. *Calyx* tinged red, 6–7 mm long, apex bilobed, split 3–4 mm down one side. *Corolla* tube 13–17 mm long; dorsal corolla lobe lanceolate, 8–13 × 3–4 mm with inflexed margin, apex hooded and

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pointed, faintly yellow; lateral corolla lobes narrowly lanceolate with incurved margins, 7–11 × 2–3 mm, apex hooded and pointed. *Lateral staminodes* oblong, 9–11.5 × 1–3 mm, apex blunt, faint yellow towards apex, papillose on abaxial surface. *Labellum* flared towards apex, 11.5–22 × 10–20 mm, bilobed, cleft 6 mm from the apex, papillose, with yellow median band and purple streaks on both sides. *Stamen* with filament 2.5–3 mm long, some with purple blotches; thecae 2–2.5 mm long; crest 0.5 mm, cup-shaped, covered with brown papillae. *Fruit* unknown. (Adapted from Sam & Saw, 2005.)

Distribution. Peninsular Malaysia (Terengganu) (Fig. 2).

Habitat and ecology. Found on undulating land and slopes of lowland dipterocarp forest under heavy shade. Altitude 65–130 m.

Having compared the protologues of these two new names, it is quite obvious that they refer to the same species – in fact they are so similar they could be describing the same specimen. *Scaphochlamys laxa* Y.Y.Sam & Saw takes precedence being the first published. It is worth noting at this point that *Folia Malaysiana* volume 6(1–2) was not available on the library shelves until well into 2006.

18. Scaphochlamys malaccana Baker in Hook.f., Fl. Brit. India 6: 252 (1892); Holttum, Gard. Bull. Singapore 13: 104 (1950); Larsen, Bot. Tidsskr. 58: 196 (1962); Newman et al., Blumea Suppl. 16: 148 (2004). – *Gastrochilus scaphochlamys* Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 112 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 16 (1907); Ridl., Fl. Malay Penin. 4: 250 (1924); Turner, Asian J. Trop. Biol. 4(1): 27 (2000), nom. illegit. (*Scaphochlamys malaccana* Baker cited as synonym). – *Kaempferia malaccana* (Baker) K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 81 (1904). – *Boesenbergia scaphochlamys* (Ridl.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 317 (1913), nom. illegit.; Loesen. in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 15A: 572 (1930). – *Boesenbergia malaccana* (Baker) Govaerts, World Checklist Seed Pl. 3: 9 (1999); Lim, Folia Malaysiana 2(3): 206 (2001). – Type: Peninsular Malaysia, Malacca, Guning Ledang, 1863–64, *Griffith* 5761 (lecto K!, designated here; isolecto AAU!, P).

Gastrochilus lancifolius Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 112 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 16 (1907); Ridl., Fl. Malay Penin. 4: 250 (1924); Turner, Asian J. Trop. Biol. 4(1): 24 (2000). – *Kaempferia lancifolia* (Ridl.) K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 80 (1904). – *Boesenbergia lancifolia* (Ridl.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 316 (1913). – Type: Peninsular Malaysia, Johore, Kuala Sembrong, 1892, *Lake & Kelsall* s.n. (holo K!).

Kaempferia cumingii K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 80 (1904); Larsen, Bot. Tidsskr. 58: 196 (1962). – Type: Peninsular Malaysia, Malacca, Gunung Ledang, 1841, *Cuming* 2356 (lecto K!, designated here; isolecto E!, L!, P).

Rhizome obliquely ascending, 0.4 cm thick when dried, anchored by vertically growing prop roots. *Successive shoots* 2 cm apart, usually 2-leaved; longest leafless-sheath long,

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to 12 cm in length, purple. *Leaf-sheath* 4–8 cm long, narrow and glabrous; ligule small, rounded, petiole 4–8 cm long; combined leaf-sheath and petiole length 10–15 cm. *Lamina* with dark green upper surface, pale green lower surface, lower surface sparsely hairy towards the base and alongside midrib, elliptic, asymmetric, c.20 × 4.5 cm, base cuneate, shortly decurrent, apex acute, acuminate, or mucronulate. *Peduncle* long, flexuous, 4–12 cm long, glabrous or hairy. *Inflorescence* elongate, 8–16 cm long, the 3–8 bracts widely spaced, 0.7–2.5 cm apart, lax. *Bracts* large, green, stiff, 3–5 × 1.2–1.7 cm, narrowly elliptic to linear, involute at the base, spreading towards the apex, generally glabrous but sometimes with a fine covering of long fine white hairs, margins not thin. First *bracteole* 1.2 cm long, the rest much shorter. *Flowers* fragrant, 3–7 within each bract. *Calyx* with ovary 10 mm long, apex dentate and split 3 mm on one side. *Corolla* tube slender at base, widening towards apex, 25 mm long; corolla lobes white, 13 × 4–5 mm at the base, edges inflexed towards the acute apex. *Staminodes* white, as long as the corolla lobes, oblong with rounded tips, c.4 mm wide. *Labellum* obovate, bilobed to halfway, to c.18 × 14 mm, white with a yellow median band, sometimes with a pale lilac or purple line on either side of it towards the base, the lobes rounded and slightly overlapping. *Stamen* filament barely 3 mm long, broad; thecae c.3 mm long, the basal ends free and acute; crest broad, 2.5 × almost 4 mm, rounded, trilobed, the margin somewhat crisped, reflexed. *Fruit* 10 mm long, 3-seeded.

Distribution. Peninsular Malaysia (Johore, Malacca, Negri Sembilan) (Fig. 5).

Additional specimens examined. MALAYSIA. **Johore**: Bukit Muar, x 1892, *Fielding* s.n. (SING); Gunong Buidong, 3 vi 1923, *Holttum* 10994 (K). **Malacca**: *Hullett* 764 (K); ibid., 1871, *Maingay* 1579 (K); ibid., 11 xii 1935, *Vesterdal* 79, 101 (C); Gunong Ledang, *Ridley* 3141 (SING). Cultivated material: RBGE C8488: raised from plants collected at Johore, Gunung Panti, 1978, *Burtt* 11692 (E). **Negri Sembilan**: Senaling–Inas F.R., 28 xi 1922, *Holttum* 9783 (SING); Gunung Angsi, 24 xi 1923, *Nur* 11690 (K, SING); Gunung Angsi, ii 1904, *Ridley* 5761, 9895, 11690 (AAU, SING).

Baker, in the protologue of *Scaphochlamys malaccana*, lists '*Cuming, Griffith* (K. d. 5761), *Maingay* (Kew Distrib. 1579), *Hullett*' all from Mount Ophir, Malacca. The Cuming syntype is also the type collection for the synonym *Kaempferia cumingii* K.Schum. *Griffith* 5761 (K) has been chosen here as the lectotype for *Scaphochlamys malaccana* Baker.

19. Scaphochlamys minutiflora Jenjitt. & K.Larsen, Nordic J. Bot. 22: 35 (2002); Newman et al., Blumea Suppl. 16: 148 (2004). – Type: Thailand, Narathiwat Province, Hala Bala Nature Reserve, near Chatwarin waterfall, 17 ii 2000, *Tiptabiarnkarn* 4407 (holo BKF; iso AAU).

Tufted herb to 30 cm high, with short creeping rhizome. *Shoot* comprising 2–3 leaves surrounded by 2–3 leafless-sheaths. *Petiole* 12–24 cm long, grooved; ligule bilobed, rounded triangular, 10 × 5 mm, wing-like at base. *Lamina* upper surface glossy green

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with grooved mid-vein, lower surface paler green, appressed white hairs along either side of the mid-vein, oblanceolate, 22–35 × 7–11 cm, base cuneate, apex acute. *Peduncle* up to 15 cm long. *Inflorescence* with densely imbricating bracts; each bract pale green, 2.7–3.5 × 0.8–1.3 cm, lanceolate-triangular, with thin, wavy margins and acute apex, enclosing 2 flowers; bracteole broadly lanceolate. *Ovary* ellipsoid, 2 mm long, yellowish, hairy; epigynous glands linear, 2 mm long, yellowish. *Calyx* c.6 mm long, hairy, apex acute, split from the apex on one side. *Corolla* tube white, 15 mm long, glabrous; dorsal corolla lobe linear, c.4.5 × 1.5 mm, apex rounded, glabrous; lateral corolla lobes narrowly oblong, 5 × 1.5 mm, apex broadly acute, hooded, white. *Staminodes* white, narrowly triangular, 1.5–2 × 0.5–0.7 mm. *Labellum* clawed with a rounded, shallowly bilobed apex, c.5 × 3–5 mm, 2 mm wide at the base, white with a V-shaped, purplish band. *Stamen* filament c.1 mm long; thecae 3 × 1 mm, white, base spurred with a shallow hole behind the apex of each pollen sac; anther crest 0.5 mm long with rounded, wavy or emarginate apex. *Fruit* unknown. (Adapted from Jenjittikul & Larsen, 2002.)

Distribution. Thailand (Narathiwat Province) (Fig. 4).

Habitat and ecology. Found along a small stream in evergreen forest. Altitude c.200 m.

Although an isotype is said to be deposited at AAU no material has been located there as yet.

20. Scaphochlamys obcordata Sirirugsa & K.Larsen, Nordic J. Bot. 11: 93 (1991); Newman et al., Blumea Suppl. 16: 148 (2004). – Type: Thailand, Narathiwat Province, Budo National Park, Bacho Falls, 8 x 1988, *Sirirugsa* 1173 (holo PSU, flowers in spirit only). Epitype: Same locality, 18 xiii 1995, *Larsen et al.* 45778 (epi AAU!, designated here).

Rhizome fleshy, horizontally creeping, white. *Successive shoots* 5–10 cm apart, each shoot comprising 2 (sometimes up to 4) leaves surrounded by 3 leafless-sheaths, the longest reaching to 9 cm long, pale at the base becoming greener towards the apex, glabrous. *Leaf-sheath* 6–9 cm long, sparsely hairy to glabrous; ligule membranous, broad, truncate. *Petiole* 2–4 cm long, sparsely hairy. *Lamina* upper surface light green, lower surface paler and sparsely hairy, obovate to oblanceolate, asymmetric, 15–30 × 9–12 cm, base shortly attenuate and somewhat rounded, apex acuminate to mucronulate. *Peduncle* subsessile, no more than 2 cm long. *Inflorescence* quite large becoming more open towards the apex, rachis 2–6 cm long, with 10–20 overlapping bracts, elongating with age. *Bract* 5.5 × 1.5 cm, linear to boat-shaped, pink, finely hairy to hairy, apex acute to mucronulate. First *bracteole* 4 × 1.9 cm, thereafter decreasing in size, linear, sparsely hairy, apex acuminate. *Flowers* 3–5 per bract. *Ovary* 6 mm long, glabrous; calyx 28 mm long, hairy, apex bidentate, cleft down one side by 11 mm. *Corolla* tube 45 mm long, glabrous; dorsal corolla lobe 25 × 7 mm, apex

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hooded; lateral corolla lobes 21 × 6 mm, apex acute. *Staminodes* white, oblong, 16 × 5 mm, apex rounded. *Labellum* obcordate, 28 × 20 mm, apex bilobed almost to the middle, white with a central yellow mark. *Stamen* filament 2 mm long, thecae 6 mm long, back of stamen covered in distinct glandular hairs; crest 1 × 2 mm, trilobed. *Fruit* unknown.

Distribution. Thailand (Narathiwat Province) (Fig. 4).

Habitat and ecology. Scattered throughout dipterocarp forest near Bacho Falls. Altitude 100–150 m.

Taxonomic notes. The original holotype material, *Sirirugsa* 1173 (PSU), has decayed and been lost (pers. obs.) except for some flowers in spirit. According to the protologue, an isotype was deposited at AAU but this seems never to have happened. In response to this lack of type material further material was sought at the type locality and distributed to AAU, BKF, E, K, L, PSU and SING (Larsen, 2001). The specimen at AAU has been chosen here as an epitype.

Additional specimen examined. Cultivated material: 95KL47007 (AAU).

21. Scaphochlamys oculata (Ridl.) Holttum, Gard. Bull. Singapore 13: 92 (1950); Newman et al., Blumea Suppl. 16: 148 (2004). – *Gastrochilus oculata* Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 117 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 19 (1907); Ridl., Fl. Malay Penin. 4: 251 (1924); Turner, Asian J. Trop. Biol. 4(1): 26 (2000). – *Boesenbergia oculata* (Ridl.) Schltr., Repert. Spec. Nov. Regni Veg. 12: 316 (1913). – Type: Malaysia, Selangor, Pahang Track, 1500 ft, 1897, *Ridley* 8484 (lecto K!, designated by Holttum, 1950).

Rhizome thin, 3 mm in diameter when dried. *Successive shoots* widely spaced, unifoliate, leafless-sheaths to 10 cm long, broad, a light covering of short spiny hairs from the base part way up the sheath. *Leaf-sheath* short, c.5 cm long, ligule lobes triangular, petiole quite slender, glabrous, to 28 cm long. *Lamina* lower surface flushed with purple and almost glabrous, ovate, to 23(–25) × 8–12 cm, base rounded to subcordate, somewhat decurrent, apex broadly acute. *Peduncle* 2–5 cm long, short-haired towards the apex. *Inflorescence* compact, ovoid, c.4 × 2 cm, including up to 15 closely packed bracts. *Bracts* 2.5–3.5 × 1.5 cm, oval, slightly spreading but not recurved, with narrow, thin, smooth edges, apex sometimes with a spiky-haired mucronule, otherwise bluntly pointed, glabrous except for a scattering of short spiny hairs towards the apex. First *bracteole* to 2.5 × 1.2 cm, trilobed and lightly tufted, the rest shorter. *Flowers* c.3 per bract. *Calyx* with ovary 15 mm long. *Corolla* tube 25–30 mm long; lobes 15 mm long, the dorsal corolla lobe 6 mm wide at base, apex hooded, acute. *Staminodes* white, as long as the corolla lobes, 5 mm wide with rounded ends. *Labellum* 22 mm long, bilobed nearly halfway to the base, > 15 mm wide, white with yellow centre and 2 crimson patches at the base. *Stamen* bent forward; thecae hardly 5 mm long and free at the base; crest short and hardly reflexed. *Stigma* apex densely ciliated. *Fruit* unknown.

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Distribution. Peninsular Malaysia (Johore, Selangor) (Fig. 7).

Habitat and ecology. Reported from ridge forest dominated by *Shorea curtisii* Dyer ex King. Altitude 250–500 m.

Additional specimens examined. MALAYSIA. **Johore**: Gunung Janeng, 20 x 1892, *Lake & Kelsall* s.n. (SING). **Selangor**: Selinsing, *Machado* s.n. (K); Bukit Batu Berinding, Kanching, 2 xi 1937, *Nur* 34353 (SING); Gunung Sempah, 25 v 1975, *Balgooy* 2624 (L).

22. Scaphochlamys pennipicta Holttum, Gard. Bull. Singapore 13: 93 (1950); Newman et al., Blumea Suppl. 16: 149 (2004). – Type: Malaysia, Pahang, Fraser's Hill, 30 ix 1923, *Md. Nur* SFN 11181 (holo SING!; iso K!).

Rhizome thin, 3 mm in diameter when dried, long-creeping, 3–10 cm between successive shoots; shoots unifoliate, leafless-sheaths to 6 cm long, broad, glabrous, rapidly dying away with shoot development. *Leaf-sheath* short, thin and delicate, 1–5 cm long; ligule lobes triangular, 3 mm long, glabrous and delicate. *Petiole* 4–8.5 cm long, glabrous; overall length of leaf-sheath and petiole 7–10 cm. *Lamina* upper surface dark green with feather-like white markings, lower surface flushed reddish purple and glabrous, broadly elliptic to obovate, symmetrical, 15–18 × 7–9 cm, base cuneate-decurrent, apex broadly pointed with tufted mucro. *Peduncle* 3–6 cm long, slender and glabrous. *Inflorescence* compact, ovoid, c.2 × 1.2 cm, with c.10 bracts. *Bracts* thin and papery when dry, c.1.4 × almost 1 cm, ovate, thin-edged, glabrous except for the apex, the apex slightly recurved and ending in a short tufted apicule. *Bracteole* slender, shorter than the bracts, of which the first is 1.2 cm long. *Flowers* generally 2 within each bract. *Calyx* with ovary 10 mm long. *Corolla* tube 13 mm long; corolla lobes 8 mm long, white. *Staminodes* white, as long and narrow as the dorsal corolla lobe. *Labellum* white (possibly with additional yellow or claret colour?), 10 mm long or somewhat longer. *Stamen* filament very short; thecae 3 mm long; crest short and reflexed. *Fruit* unknown.

Distribution. Peninsular Malaysia (Pahang) (Fig. 7).

Habitat and ecology. Found on rich soil among rocks in dense jungle. Altitude 1300 m.

Additional specimen examined. MALAYSIA. **Perak**: Sine loc., ix 1886, *Kunstler* 10931 (K).

23. Scaphochlamys perakensis Holttum, Gard. Bull. Singapore 13: 97 (1950), nom. nov.; Newman et al., Blumea Suppl. 16: 149 (2004). – *Curcuma lanceolata* Ridl., Mat. Fl. Malay. Penins. 2: 22 (1907); Turner, Asian J. Trop. Biol. 4(1): 20 (2000). – *Hitcheniopsis lanceolata* (Ridl.) Ridl., Fl. Malay Penin. 4: 253 (1924); Turner, Asian J. Trop. Biol. 4(1): 44 (2000). – Type: Malaysia, Perak, Gunung Bujong, viii 1898, *Curtis* 2522 (holo SING!, iso K! – 2 sheets at each herbarium).

Rhizome robust, c.6 mm in diameter when dry, horizontally creeping. *Successive shoots* distant, to 12 cm or more apart, consisting of 2 leaves, a terminal inflorescence

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and surrounded by 3 sparsely hairy leafless-sheaths, of successive lengths: 4, 6 and to 12 cm. *Leaf-sheath* 9–15 cm long, with a distinct broad thin margin, glabrous to covered with long fine hairs; ligule lobes broadly triangular, to 5 mm long, thin. *Petiole* 10–30 cm long, also may or may not be hairy; overall leaf-sheath and petiole length to 40 cm. *Lamina* upper surface dark green, lower surface pale green, either glabrous or covered in long, quite coarse hair, particularly along the midrib, broadly elliptic to oblanceolate, slightly asymmetric, 25–45 × 5–11 cm. *Peduncle* 7–18 cm long, slender, densely hairy. *Inflorescence* elongates with age, typically tulip-shaped, although can range from small and ovoid when young to cylindrical when old, usually 3–8 × 2.5 cm; the many bracts congested on the spike, their tips curling open. *Bracts* green, sometimes with pinkish edges (as in the type), thin, papery when dry, 2.5–3 × 1 cm, boat-shaped, apex acuminate with a tufted apiculum, generally glabrous. First *bracteole* 1.3–2 cm long, the rest smaller. *Flowers* 3–4 per bract. *Calyx* with ovary 1.2 cm long. *Corolla* tube white, slender, 2 cm or more long, corolla lobes 8 mm long and white. *Staminodes* shorter than corolla lobes, white, apparently reflexed. *Labellum* obovate, a little longer than corolla lobes, white with pink markings on either side near the base and a median yellow patch near the apex, or sometimes without the pink markings. *Stamen* filament short; thecae 4 mm long, with short free acute tips at the base; crest not much wider than anther, ovate-acute and short. *Fruit* unknown.

Distribution. Peninsular Malaysia (Perak, Terengganu) (Fig. 5).

Habitat and ecology. Altitude 100–200 m.

Additional specimens examined. MALAYSIA. **Perak**: Bidor, Sungei Gepai, 4 viii 1936, *Corner* 31690 (E, K, L, SING); Larut, iii 1884, *Kunstler* 6788 (K); Tapah, xi 1901, *Ridley* 14031 (K, SING). Cultivated material: RBGE, ii 1966, *Bradford* C4962 (E). **Terengganu**: Gunong Lauit, 12 iii 1975, *Shah* MS3474 (C).

24. Scaphochlamys petiolata (K.Schum.) R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 44: 210 (1987); Newman et al., Blumea Suppl. 16: 149 (2004). – *Haplochorema petiolatum* K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 90 (1904); Newman et al., Blumea Suppl. 16: 149 (2004). – Type: Borneo, Sarawak, 1st Division, Gunung Senggi (G. Sengayoh?), 11 xii 1892, *Haviland* 2026 (lecto K!, designated here; isolecto SAR!).

Rhizome fine, just over 1 mm in diameter when dried, supporting a network of fine roots. *Successive shoots* unifoliate, clumping, 0.5–1.5(–7) cm apart, each shoot encased by 3 leafless-sheaths, 2.5–3 cm long, tightly appressed against the leaf stem or scape, reddish-brown when young, becoming dry and brown with age, outer surface covered in long fine hairs, apex acute. *Leaf-sheath* short, 0.5–2 cm long; ligule small, obscure. *Petiole* 10–20 cm long, more or less glabrous. *Lamina* small and dainty, 10 × 4–5 cm, lanceolate, symmetric, base rounded, apex acute to mucronulate and tufted, upper surface shiny bright green, lower surface pale green and lightly

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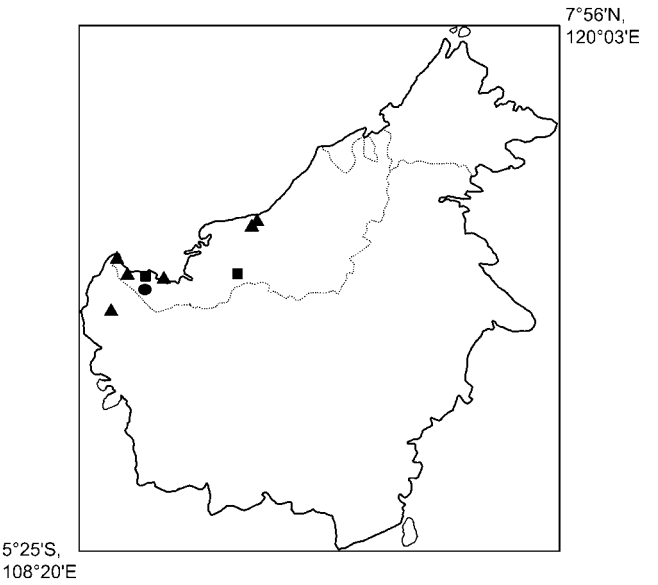


FIG. 8. Distribution of *Scaphochlamys petiolata* (K.Schum.) R.M.Sm. (■), *S. polyphylla* (K.Schum.) B.L.Burtt & R.M.Sm. (▲) and *S. reticosa* (Ridl.) R.M.Sm. (●).

covered in fine hairs. *Peduncle* 3 cm long, slender, glabrous. *Inflorescence* small, greatly reduced, bracts 2–3, hidden within the primary leafless-sheath. *Bracts* pale, thin and papery when dried, 1.6 cm long, boat-shaped, narrow, glabrous, apex acute (may be tufted), held at a stiff angle. First *bracteole* as long as bract, the second 1.2 cm long. *Flowers* 2–3 per bract. *Ovary* hairy; calyx with ovary 10 mm long; calyx apex truncate and tufted, cleft on one side. *Corolla* tube white, 22 mm long and covered in upwardly directed fine hairs; dorsal corolla lobe 7 mm long, hooded, apex acute; lateral corolla lobes 6 × 2 mm, linear, bluntly pointed, all lobes a pale translucent yellow colour. *Staminodes* short, oblong shape, apex blunt, and with a yellow tinge, with tiny glandular hairs. *Labellum* 6 × 6 mm, clawed, with central yellow mark, surrounded by dark lilac area, the rest of the labellum a pale lilac colour, bilobed up to a third, edges overlapping, with glandular hairs. *Stamen* overall white; thecae 4 mm long; crest 1–2 mm long, bidentate. *Fruit* unknown.

Distribution. Malaysia (Sarawak) (Fig. 8).

Habitat and ecology. Kerangas forest, flat area near river. Altitude c.50 m.

Additional specimens examined. MALAYSIA. **Sarawak**: 1st Division, Sungei Rayu, 26 iv 2004, *Poulsen* 2309 (E); West Borneo, 7 xii 1924, *Winkler* 629 (L). Cultivated material: RBGE acc. no. 20040945, 1 viii 2005, *Poulsen* C2381 (E).

25. Scaphochlamys polyphylla (K.Schum.) B.L.Burtt & R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 31: 315 (1972); R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 44:

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208 (1987); Newman et al., Blumea Suppl. 16: 149 (2004). – *Haplochorema polyphyllum* K.Schum., Bot. Jahrb. 27: 332 (1899); K.Schum. in Engler, Pflanzenr. IV, 46 (Heft 20): 88 (1904). – Type: Borneo, Sarawak, 1st Division, Lundu, *Beccari* 2324 (holo FI!).

Gastrochilus bractescens Ridl., J. Straits Branch Roy. Asiat. Soc. 54: 57 (1910); Valeton, Bull. Jard. Bot. Buitenzorg 27: 103 (1918); Turner, Asian J. Trop. Biol. 4(1): 23 (2000). – *Boesenbergia bractescens* (Ridl.) Merr., Bibl. Enum. Born. Pl. 122 (1921). – Type: Borneo, Sarawak, 1st Division, Lundu, *Foxworthy* 42 (holo SING!).

Gastrochilus laxiflorum Valeton, Bull. Jard. Bot. Buitenzorg 27: 100, pl. 13 (1918). – *Boesenbergia laxiflora* (Valeton) Loesen. in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 15A: 572 (1930). – Type: Borneo, Kalimantan, Monterado, Opi Mountains, *Teysmann* 10916 (holo BO; iso FI!).

Rhizome creeping obliquely or vertical, consisting of short internodes of 0.5 cm. *Successive shoots* indistinct, tightly clumped together giving a tufted appearance to the plant, 2–6 leaves per shoot. *Leaf-sheaths* broad, distinct, c.3–4 × 3–4 mm, ligule bilobed, 1.5–2 mm long, membranous, petiole 4–5 cm long, thin, leaf-sheath and petiole together 6–9 cm long, glabrous. *Lamina* upper surface dark green, lower surface paler, sometimes flushed purple, glabrous to sparsely hairy along the midrib, linear to elliptic, slightly asymmetric, 7–15 × 2–3 cm, base attenuate, apex acuminate and apiculate. *Peduncle* 2–5 cm long, generally glabrous, sometimes hairy. *Inflorescence* 9 cm long, with 8–12 bracts, closely imbricating when young, becoming more lax (and glabrous) as spike elongates and ages. *Bracts* stiff, linear with an inflexed base becoming open towards apex, 2–3 × 0.7 cm, apex acute to mucronulate, sometimes purple, outer surface covered in long fine hairs becoming glabrescent with age; margins thin, slightly crisped, sometimes tinged with purple. First *bracteole* 1–2 cm long, linear, glabrous, apex acute. *Flowers* 4 per bract. *Ovary* 2 mm long, glabrous; calyx 9 mm long, cleft on one side. *Corolla* tube 12 mm long, corolla lobes 8–9 mm long. *Staminodes* obtuse, 8 mm long. *Labellum* 10 mm long, deeply bilobed. *Stamen* thecae 7–8 mm long; connective crest shortly obtuse. *Fruit* unknown.

Distribution. Indonesia (Kalimantan Barat), Malaysia (Sarawak) (Fig. 8).

Habitat and ecology. Lowland, kerangas forest on sandy soil, also found on white sandy podsol. Altitude c.20–35 m.

Additional specimens examined. MALAYSIA. **Sarawak**: 1st Division: Lundu, *Yii & Othman* 46244 (K); Lundu, 15 vi 1991, *Yahud* 61966 (AAU, E, K, L); Rumah Temenggong, S. Begrih, S. Bawan, Balingian, 20 x 1963, *Chai* S19483 (K); Bako National Park, 14 v 1980, *Ching* S42269 (AAU, K, L); Selepong Berangan, Sri Aman, 15 viii 1991, *Runi* 59662 (AAU, E, K); Bako National Park, 17 v 1956, *Purseglove* 4949 (K, SING).

26. Scaphochlamys reticosa (Ridl.) R.M.Sm., Notes Roy. Bot. Gard. Edinburgh 44: 209 (1987); Newman et al., Blumea Suppl. 16: 149 (2004). – *Gastrochilus reticosa*

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Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 195 (1905); Turner, Asian J. Trop. Biol. 4(1): 27 (2000). – *Boesenbergia reticosa* (Ridl.) Merr., Bibl. Enum. Born. Pl. 122 (1921). – Type: Cultivated Singapore Botanic Gardens, originally from Borneo, Sarawak, 1st Division, Bidi, 22 ix 1904, *Ridley* s.n. (holo SING!).

Small clumping ground herb, 10 cm tall. *Rhizome* slender, creeping through the soil. *Successive shoots* clumping, c.2 cm apart, unifoliate; each shoot encased by 2 leafless-sheaths, the outer 1.5 cm long, the inner reaching 4 cm, both tightly appressed against the leaf stem, pale green when young, becoming scarious with age, glabrous, apex mucronulate. *Leaf-sheath* 2 cm long, ligule thin and membranous, triangular, 1–2 mm long, but not always visible as it rapidly decays with age, petiole 6–8 cm long, glabrous. *Lamina* upper surface dark green, mid-vein sunken, all other venation raised, giving the surface a distinctly ridged and reticulate texture, lower surface paler and glabrous, ovate, 6–10 × 4.5–6 cm, base slightly cordate to rounded, shortly attenuate, apex acute, tufted. *Peduncle* pale green, c.2 cm long. *Inflorescence* reduced, compact, with 5 imbricating bracts. First *bract* 1.8 × 0.5 cm, glabrous, open to base, boat-shaped, edges incurving, apex acute. First *bracteole* 1.5 cm long, 2-keeled, second smaller. *Flowers* 2 per bract. *Ovary* and calyx 14 mm long, covered in long fine hairs, calyx apex bidentate and deeply cleft. *Corolla* tube 18 mm long, white; dorsal corolla petal 7 × 3 mm, with hooded apex; lateral corolla lobes 6 mm long, linear, edges incurling somewhat, apex rounded; lobes pale translucent yellow. *Staminodes* short, white, 5 × 2 mm, club-shaped, apex rounded, narrowing towards the base, with glandular hairs. *Labellum* with pale central yellow mark on pale lilac background, 9 × 8 mm, clawed, apex rounded, with cleft 3 mm deep and overlapping, with glandular hairs. *Stamen* overall white; thecae 4 mm long with rounded bases; crest 1–2 mm long and bidentate. *Stigma* held just above the thecae, cup-shaped, edge shortly ciliate. *Fruit* unknown.

Distribution. Malaysia (Sarawak) (Fig. 8).

Habitat and ecology. Found on limestone rocks.

Additional specimens examined. MALAYSIA. **Sarawak**: 1st Division, Bidi, 15 vii 1915, *Unknown collector* s.n. (K). Cultivated material: RBGE acc. no. 20040949, 1st Division, 1 viii 2005, *Poulsen* C2382 (E).

A small and dainty plant with unusual and striking reticulate veined leaves. This is the only *Scaphochlamys* species so far found with such distinct venation, although there is a strong likelihood that further reticulate species may still be found in Borneo. Although Turner (2000) indicates that he saw the isotype of this species at K, I was unable to find it despite careful searching.

27. Scaphochlamys rubescens Jenjitt. & K.Larsen, Nordic J. Bot. 22: 37 (2002); Newman et al., Blumea Suppl. 16: 149 (2004). – Type: Thailand, Narathiwat Province, Sukirin, 17 ii 2000, *Tiptabiarnkarn* 5080 (holo BKF; iso AAU).

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Small, densely tufted herb, to 8 cm high with short succulent rhizome. *Successive shoots* unifoliate, surrounded by 2 reddish leafless-sheaths. *Petiole* to 8 cm long, canaliculate, ligule not seen. *Lamina* upper surface dull green with 1 row of silver spots on either side of the midrib, lower surface purple, elliptic, 15–19 × 9.5–13.5 cm, base acute, apex broadly acute. *Peduncle* to 5 cm long. *Inflorescence* fusiform to elliptic, to 4 × 2 cm. *Bracts* white to pale pinkish, each bract subtending 2–4 flowers. *Bracteole* to 1.4 cm long, broadly ovate, apex trilobed. *Ovary* pale green, conical to obovoid, 2.5 mm long; epigynous glands linear, 7–8 mm long, cream-coloured to pale yellow. *Calyx* 12 mm long, glabrous, split on one side, apex unequally bilobed. *Corolla* tube 20–25 mm long, glabrous, white; dorsal corolla lobe oblong, apex hooded, acute, 8 × 3–4 mm; lateral corolla lobes linear oval, apex broadly acute, shortly hooded, 7.5–8 × 1.5–3 mm and white. *Lateral staminodes* reflexed, linear, 5 × 1.8 mm, white, with glandular hairs. *Labellum* obovate, base of labellum triangular, 7–8 × 10 mm, deeply bilobed to 3/4 of its length, white with a yellow band near inner margin of overlapping lobes. *Stamen* filament c.2 mm long, furrowed, white; thecae 5 × 1 mm, base shortly spurred; crest bilobed, lobes rounded, ciliate. *Fruit* unknown. (Adapted from Jenjittikul & Larsen, 2002.)

Distribution. Thailand (Narathiwat Province) (Fig. 4).

Habitat and ecology. Lowland evergreen forest.

28. Scaphochlamys rubromaculata Holttum, Gard. Bull. Singapore 13: 103, fig. 11A (1950); Newman et al., Blumea Suppl. 16: 150 (2004). – Type: Malaysia, Terengganu, Kemaman, Ulu Bendong, 700 ft, 29 x 1935, *Corner* SFN 30031 (lecto SING!, designated here; iso BO, E!, K!).

Rhizome 2–5 mm in diameter when dried, obliquely ascending, supported by a dense network of vertical prop roots. *Successive shoots* short, crowded, 1–1.5 cm apart, with 1–2 leaves. *Leafless-sheaths* to 12 cm long, glabrous, rapidly dying back with age. *Leaf-sheath* and petiole together 7–11 cm long, glabrous, ligule not seen. *Lamina* upper surface pale green, lower surface paler and almost glabrous, elliptic, distinctly asymmetric, 15–20 × 4.5–5 cm, base decurrent, apex acute. *Peduncle* 4–6 cm long, glabrous to sparsely hairy. *Inflorescence* somewhat elongate and open, rachis 4 cm long, glabrous to semi-glabrous, slightly flexible with 6–8 bracts. *Bracts* green, lax, diverging from the rachis at an angle of c.45°, the base clasping round the rachis, but spreading flat towards the apex, 2–2.5 × 0.7 cm, elliptic to linear, glabrous, apex rounded, minutely apiculate, margins not thin. First *bracteole* 8 mm long, the rest shorter. *Flowers* 4 (or more) per bract. *Corolla* tube no more than 20 mm long, corolla lobes 8 mm long, narrow, white. *Staminodes* white, 6 × 2 mm, spreading and slightly reflexed. *Labellum* 11 × 8 mm, bilobed by not more than halfway; lobes rounded, imbricating, white with pale yellow median band flanked on both sides towards the base by a blood-red blotch. *Stamen* filament with thecae c.3.5 mm long, crest reflexed, rounded, 2.5 mm wide. *Fruit* 12 mm long, ellipsoid with thin pericarp. *Seeds* 10 mm long.

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Distribution. Peninsular Malaysia (Terengganu) (Fig. 7).

Habitat and ecology. Altitude 250 m.

Additional specimens examined. MALAYSIA. **Terengganu**: Kemaman, Ulu Bendong, 29 x 1935, *Corner* 30011 (para E, K, L, SING).

SINGAPORE. Cultivated material: Bukit Timah F.R., 26 xi 1949, *Sinclair* 6290, 38855 (E, L, SING).

Holttum (1950) quotes two specimens as types in the protologue without defining either as the holotype. However, on the herbarium specimen, *Corner* 30031 in SING, he clearly labels it as the type of the species. This specimen, therefore, is designated as the lectotype here.

29. Scaphochlamys subbiloba (Burkill ex Ridl.) Holttum, Gard. Bull. Singapore 13: 105 (1950); Newman et al., Blumea Suppl. 16: 150 (2004). – *Gastrochilus subbilobus* Ridl., Fl. Malay Penin. 4: 250 (1924); Valeton, Bull. Jard. Bot. Buitenzorg 27: 87 (1918); Turner, Asian J. Trop. Biol. 4(1): 27 (2000). – Type: Malaysia, Johore, Pulau Tioman, Joara Bay, 25 vi 1915, *Burkill* SFN 1002 (lecto K!, designated by Turner, 2000).

Rhizome creeping horizontally, sometimes obliquely, 4–5 mm in diameter when dried. *Successive shoots* close together, to 1 cm apart, each shoot with 1 or 2 leaves surrounded by 3 leafless-sheaths, the longest sheath to 10 cm long, tinged with red, becoming brown, thin, papery when dried, glabrous but for (usually) hairy margin towards apex. *Leaf-sheath* to 6(–12) cm long, narrow, ligule small and usually broken. *Petiole* 3–6 cm long; leaf-sheath and petiole together 6–15 cm, glabrous. *Lamina* dark green above, lower surface paler, glabrous, elliptic, generally asymmetric, 13–24 × 4–8 cm (longest leaf not always the widest), base cuneate to slightly decurrent, apex acute, sometimes mucronulate. *Peduncle* 4–6 cm long, rather slender, fine-haired. *Inflorescence* rachis 5–10 cm long, more or less flexuous, hairy, bearing 5–10 bracts, which are c.1 cm apart and held somewhat upright. *Bracts* 2.2–2.8 × 0.6–0.8 cm when flattened, stiffly boat-shaped with thin edges inflexed throughout, elliptic, apex long thin acute, sparsely hairy when young, sometimes glabrous when old. First *bracteole* 1.3 cm long, the others shorter. *Corolla* tube 2.5 cm long, corolla lobes 1 cm long, white. *Staminodes* about the same length as the dorsal corolla lobe and about as wide, oblong, white. *Labellum* a little longer, shortly bilobed, white with a median pale yellow band and no other colour. *Fruit* unknown.

Distribution. Peninsular Malaysia (Pahang) (Fig. 5).

Habitat and ecology. Deep shade in forest in rocky soil. Altitude 0–400 m.

Additional specimens examined. MALAYSIA. **Pahang**: Pulau Tioman: Joara Bay, 25 vi 1915, *Burkill* 1143 (para K, SING); near Tanah Runto, 12 v 1927, *Henderson* 18380 (K, SING); Ayer Surin, 18 iv 1929, *Henderson* 21701 (K, SING).

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30. Scaphochlamys sylvestris (Ridl.) Holttum, Gard. Bull. Singapore 13: 91 (1950); Newman et al., Blumea Suppl. 16: 150 (2004). – *Curcuma sylvestris* Ridl., Trans. Linn. Soc. ser. II, 3: 378 (1893); Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 121 (1899); Ridl., Mat. Fl. Malay. Penins. 2: 22 (1907); Turner, Asian J. Trop. Biol. 4(1): 20 (2000). – *Hitcheniopsis sylvestris* (Ridl.) Ridl., Fl. Malay Penin. 4: 253 (1924); Turner, Asian J. Trop. Biol. 4(1): 44 (2000). – Type: Malaysia, Pahang, 1891, *Ridley* 2400 (lecto K, on 2 sheets!, designated by Holttum, 1950).

Rhizome creeping, 6 mm in diameter when dry. *Successive shoots* c.3 cm apart, unifoliate, surrounded by 2 broad, glabrous, stiff leafless-sheaths to 16 × 2 cm. *Leaf-sheath* comparatively short, glabrous, 2–7.5 cm long, ligule small, 2 mm long, triangular, petiole 30–45 cm long, glabrous at base, becoming sparsely hairy towards base of lamina; leaf-sheath and petiole together 30–55 cm. *Lamina* lower surface purple, hairy along the midrib, but otherwise almost glabrous, ovate to narrowly ovate, symmetrical, 18–26 × 8–14 cm, the longest leaf not always the widest, base rounded to subcordate, apex acuminate. *Peduncle* long and slender, c.15 cm in length, glabrous. *Inflorescence* ovoid or ellipsoid, 5 × 2.5–3 cm, with up to 15 tightly packed bracts. *Bracts* short, broad, 2.5–3 × 1.5 cm, glabrous, apex broadly pointed to rounded, sometimes mucronulate, tinged with red, curved outward; edges thin, sometimes slightly crisped. First *bracteole* 1.8 × 1 cm when flattened, the rest decreasing in size up the rachis. *Flowers* c.3 per bract. *Calyx* with ovary 11 mm long. *Corolla* tube somewhat shorter than bract; corolla lobes 1.2 cm long, white. *Lateral staminodes* white, about as long as the corolla lobes, oblong with rounded ends. *Labellum* a little longer than the corolla lobes, oblong to ovate with bilobed apex, white with median yellow patch and violet streaks on either side of it. *Stamen* thecae 3 mm long with short acute free basal spurs; crest broad, recurved and violet. *Fruit* unknown.

Distribution. Peninsular Malaysia (Pahang) (Fig. 4).

Habitat and ecology. Altitude 400 m.

Additional specimens examined. MALAYSIA. **Pahang**: Gunung Tahan, 16 ix 1937, *Corner* s.n. (SING); Sungai Teku, 10 xi 1922, *Haniff & Nur* 8104 (K); Sungai Teku, 18 vii 1936, *Kiah* 31707 (K); Sungai Teku, 2 ii 1968, *Shah* MS1385 (K, L, SING); Kuala Teku, 1911, *Ridley* s.n. (K); Gunung Tapis ridge, near Kuantan, *Symington* 28813 (SING).

31. Scaphochlamys tenuis Holttum, Gard. Bull. Singapore 13: 98 (1950); Newman et al., Blumea Suppl. 16: 150 (2004). – Type: Malaysia, Terengganu, Kemaman, Sungai Nipa, 22 xi 1935, *Corner* 30543 (holo SING!; iso BO, E!, L!, K!).

Rhizome robust, creeping horizontally above ground, anchored by vertically growing prop roots. *Successive shoots* crowded together, c.1 cm apart and for the most part touching, each consisting of 1–2 leaves surrounded by 3 glabrous leafless-sheaths to 12 cm long. *Leaf-sheath* 3–8 cm long, ligule lobes 3 mm long, triangular

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and somewhat brittle when dry, petiole 12–18 cm long, leaf-sheath and petiole together to 25 cm long. *Lamina* entirely green, elliptic, slightly asymmetric, 15–25 × 5–7 cm, base narrowly rounded to cuneate and slightly decurrent, apex acute to acuminate. *Peduncle* 4–5 cm long, slender, glabrous. *Inflorescence* greatly elongated, 15–25 cm long, slender, comprising 10–20 bracts, 1.5–2 cm apart, tightly appressed to the rachis; rachis glabrous and flexible. *Bracts* green, with thin brown edges which are not crisped, 2–3 × 1 cm, apex narrowly acute to apiculate, base amplexicaul, glabrous. First *bracteole* 1.7 × 0.6 cm. *Flowers* white, lightly scented, 3–5 per bract. *Ovary* glabrous, unilocular, sometimes with only a single ovule, calyx with ovary 12–13 mm long. *Corolla* tube 32 mm long, lobes 10 mm long. *Staminodes* slightly shorter than the corolla lobes. *Labellum* 13 mm long, the lobes rounded, imbricating, split nearly halfway to the base, white with a central pale yellow mark, flanked by 2 purple streaks. *Stamen* filament 2 mm long, thecae 4 mm long; crest short, trilobed, with a slight lilac tint, reflexed. *Fruit* ellipsoid, 13 mm long, unilocular, sometimes containing a single seed. *Seed* 11 mm long, ellipsoid.

Distribution. Peninsular Malaysia (Terengganu) (Fig. 7).

Habitat and ecology. Forms large but localised colonies.

Additional specimens examined. MALAYSIA. **Terengganu**: 38th mile Besut road, west side, 15 vii 1953, *Sinclair* 39957 (SING).

SINGAPORE. Cultivated material: Bukit Timah F.R., 26 xi 1949, *Sinclair* 6291 (E).

Sometimes the bracts may appear regularly two-ranked, but are usually spiral in arrangement (Holttum, 1950).

UNPLACED SPECIMENS

Scaphochlamys sp. Holttum: MALAYSIA. Pahang: Karak Forest Reserve, Bentong, *Best* SFN 13882 (SING). Although Holttum (1950) included a morphological description in his revision for this specimen which he referred to as *Scaphochlamys* sp., he did not feel that he had sufficient floral characters to complete a proper protologue. Perhaps one day further material may be found.

There are a number of specimens from Borneo that have been identified under various names. Because the location of these plants is so far from their normal distribution I feel that quite a few herbarium specimens may belong to new local species which so far have not been properly described and I am disinclined to include them under the current nomenclature system. See list below.

Scaphochlamys breviscapa Holttum: MALAYSIA. Sarawak: Kampong Segu, limestone hill, 26 v 1975, *Burtt* 8198 (E, K, L). Although this specimen appears very similar to *S. breviscapa* Holttum it lies too far from the normal distribution range, in Terengganu in northern Malaysia, for me to be totally convinced of its position in this species.

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Scaphochlamys sp. aff. *concinna*: MALAYSIA. Sarawak: 1st Division, Lundu, Biawak Rd, 6th mile, in Kerangas forest, 9 v 1981, *R. George* S.41740 (E, K, SAN). In general morphology very similar to *S. concinna* (Baker) Holttum, in particular in the strongly cordate lamina base. However, the inflorescence terminates a very short peduncle.

Boesenbergia gracilipes (K.Schum.) R.M.Sm.: MALAYSIA. Sarawak: 4th Division, Gunung Mulu, National Park, nr Tarikan, 14 iv 1975, *Burtt* 8281 (E); 5th Division, Gunung Merapok, *Native Collector* s.n. (UC 316011). Sabah: Crocker Range above Kallang Falls, by stream in primary forest, ii 1985, *Lamb* 6/85 (E); Tenom Orchid Centre, cult. A. Lamb, 11 vi 1986, *R.M. Smith* 8/86 (E). INDONESIA. Kalimantan: between Long Bawan and Panado, Gunung Paris, 6 vii 1981, *Geesink* 8934 (L). These specimens are quite variable and were originally determined by R. M. Smith to *B. gracilipes* (K.Schum.) R.M.Sm. As the basionym is now transferred to *Scaphochlamys* Baker based on the type specimen the remaining specimens now require further identification.

Scaphochlamys petiolata (K.Schum.) R.M.Sm.: MALAYSIA. Sabah: Tawau, Sepulut Forest Dev., 17 xii 1984, *Aban* 107545 (SAN); Ulu Sungei Pinahgah, 17 x 1984, *Lideh et al.* 107218 (SAN); Telupid, above Sungei Melian, 31 xii 1990, *Meijer* 98839 (SAN). BRUNEI. Belait District, Ulu Ingei, Bukit Batu Patam, 8 vi 1986, *Boyce et al.* 272 (K); Temurong Amo, 15 vii 1993, *Cowley* 59 (K). Most of the species within this genus have small restricted ranges. Probably potentially new species to be described when fresh material becomes available.

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REFERENCES

BAKER, J. G. (1890–92). Scitamineae. In: HOOKER, J. D. (ed.) *Flora of British India* 6: 198–264 [pp. 198–224 (1890), pp. 225–264 (1892)]. London: Reeve & Co.

BURTT, B. L. & SMITH, R. M. (1972a). Key species in the taxonomic history of Zingiberaceae. *Notes Roy. Bot. Gard. Edinburgh* 31: 177–227.

BURTT, B. L. & SMITH, R. M. (1972b). Notes on Malesian Zingiberaceae. *Notes Roy. Bot. Gard. Edinburgh* 31: 307–316.

HALLIER, H. (1898). Neue und Bemerkenswerte Pflanzen. *Bull. Herb. Boissier* 6: 348–561.

HOLTTUM, R. E. (1950). The Zingiberaceae of the Malay Peninsula. *Gard. Bull. Singapore* 13: 1–249.

HOLTTUM, R. E. (1974). A commentary on comparative morphology in Zingiberaceae. *Gard. Bull. Singapore* 27: 155–165.

https://doi.org/10.1017/S0960428609990254 Published online by Cambridge University Press

JENJITTIKUL, T. & LARSEN, K. (2002). Two new species of *Scaphochlamys* (Zingiberaceae) from Thailand. *Nordic J. Bot.* 22: 35–38.
KIRCHOFF, B. K. (1988). Floral ontogeny and evolution in the ginger group of the Zingiberales. In: LEINS, P., TUCKER, S. C. & ENDRESS, P. K. (eds) *Aspects of Floral Development*, pp. 45–56. Berlin: Cramer.
KIRCHOFF, B. K. (1991). Homeosis in the flowers of the Zingiberales. *Amer. J. Bot.* 78(6): 833–837.
LARSEN, K. (1962). Studies in Zingiberaceae II. Notes on two Malayan species of *Scaphochlamys*. *Bot. Tidsskr.* 58: 191–197.
LARSEN, K. (2001). *Scaphochlamys obcordata* Sirirugsa & Larsen (Zingiberaceae) – topotype in cultivation. *Thai Forest Bull., Bot.* 29: 40–42.
LARSEN, K., IBRAHIM, H., KHAW, S. H. & SAW, L. G. (1999). *Gingers of Peninsular Malaysia and Singapore*. Kota Kinabalu: Natural History Publications (Borneo).
LIM, C. K. (2001). Notes on *Scaphochlamys kunstleri* (Zingiberaceae) and its varieties. *Folia Malaysiana* 2(2): 117–126.
LOESENER, T. (1930). Zingiberaceae. In: ENGLER, A. & PRANTL, K. (eds) *Nat. Pflanzenfam*. ed. 2, 15A, pp. 541–640.
NEWMAN, M. (1995). *Distichochlamys*, a new genus from Vietnam. *Edinburgh J. Bot*. 52(1): 65–69.
NEWMAN, M. F., LHUILLIER, A. & POULSEN, A. D. (2004). *A Checklist of the Zingiberaceae of Malesia*. Blumea Suppl. 16. Leiden: Nationaal Herbarium Nederland.
POULSEN, A. D. & SEARLE, R. J. (2005). *Scaphochlamys calcicola* (Zingiberaceae): a new and unusual species from Borneo. *Gard. Bull. Singapore* 57: 29–35.
RIDLEY, H. N. (1893). On the flora of the Eastern coast of the Malay Peninsula. *Trans. Linn. Soc*. ser. II, 3: 267–408.
RIDLEY, H. N. (1899). The Scitamineae of the Malay Peninsula. *J. Straits Branch Roy. Asiat. Soc.* 32: 85–184.
RIDLEY, H. N. (1924). *Flora of the Malay Peninsula* 4. London: L. Reeve & Co.
SAKAI, S. & NAGAMASU, H. (2006). Systematic studies of Bornean Zingiberaceae V. Zingiberoideae of Lambir Hills, Sarawak. *Blumea* 51: 95–115.
SAM, Y. Y. & SAW, L. G. (2005). New species of *Scaphochlamys* (Zingiberaceae) from Peninsular Malaysia. *Gard. Bull. Singapore* 57: 253–261.
SCHUMANN, K. (1904). Zingiberaceae. In: ENGLER, A. (ed.) *Das Pflanzenreich* IV, 46 (Heft 20): 64–88. Leipzig: Verlag von Wilhelm Engelmann.
SHAFREENA, A. (2006). A hitherto overlooked field identification character for Borneo *Scaphochlamys* Baker (Zingiberaceae: Zingibereae). *Gard. Bull. Singapore* 58: 47–54.
SMITH, R. M. (1987). A review of Bornean Zingiberaceae: III (Hedychieae). *Notes Roy. Bot. Gard. Edinburgh* 44: 203–232.
TAKANO, A. & NAGAMASU, H. (2007). *Myxochlamys* (Zingiberaceae), a new genus from Borneo. *Acta Phytotax. Geobot*. 58: 19–32.
TURNER, I. M. (2000). The plant taxa of H. N. Ridley, 3. The Zingiberales. *Asian J. Trop. Biol.* 4(1): 1–47.
VALETON, T. (1918). New Notes on Zingiberaceae of Java and Malaya. *Bull. Jard. Bot. Buitenzorg* 27: 1–167.

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Index of Scientific Names

Accepted names are given in roman script, synonyms in italics and the new combination in bold. The number in parentheses is the number of the accepted taxon.

Boesenbergia anomala (Hallier f.) Schltr. (2)
Boesenbergia biloba (Ridl.) Schltr. (5)
Boesenbergia bractescens (Ridl.) Merr. (25)
Boesenbergia calophylla (Ridl.) Schltr. (5)
Boesenbergia concinna (Ridl.) Schltr. (9)
Boesenbergia gracilipes (K.Schum.) R.M.Sm. (12)
Boesenbergia klossii (Ridl.) Loesen. (14a)
Boesenbergia lancifolia (Ridl.) Schltr. (18)
Boesenbergia laxiflora (Valeton) Loesen. (25)
Boesenbergia malaccana (Baker) Govaerts (18)
Boesenbergia oculata (Ridl.) Schltr. (21)
Boesenbergia reticosa (Ridl.) Merr. (26)
Boesenbergia scaphochlamys (Ridl.) Schltr., nom. illegit. (18)
Curcuma kunstleri Baker (15a)
Curcuma kunstleri var. *rubra* Ridl. (15b)
Curcuma lanceolata Ridl. (23)
Curcuma sylvestris Ridl. (30)
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Gastrochilus biloba Ridl. (5)
Gastrochilus biloba Ridl. var. *lanceolata* Ridl. (5)
Gastrochilus bractescens Ridl. (25)
Gastrochilus calophylla Ridl. (5)
Gastrochilus concinna (Baker) Ridl. (9)
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Gastrochilus kunstleri (Baker) Valeton (15a)
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Gastrochilus lancifolius Ridl. (18)
Gastrochilus laxiflorum Valeton (25)
Gastrochilus longifolia Ridl. (5)
Gastrochilus minor sensu Ridl. (5)
Gastrochilus oculata Ridl. (21)
Gastrochilus reticosa Ridl. (26)
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Kaempferia calophylla (Ridl.) K.Schum. (5)
Kaempferia concinna Baker (9)

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Kaempferia lutea C.H.Wright (15a)
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Scaphochlamys argentea R.M.Sm. (3)
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Scaphochlamys kunstleri var. speciosa C.K.Lim (15c)
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Scaphochlamys oculata (Ridl.) Holttum (21)
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Scaphochlamys petiolata (K.Schum.) R.M.Sm. (24)
Scaphochlamys polyphylla (K.Schum.) B.L.Burtt & R.M.Sm. (25)
Scaphochlamys reticosa (Ridl.) R.M.Sm. (26)
Scaphochlamys rubescens Jenjitt. & K.Larsen (27)
Scaphochlamys rubromaculata Holttum (28)
Scaphochlamys subbiloba (Burkill ex Ridl.) Holttum (29)
Scaphochlamys sylvestris (Ridl.) Holttum (30)
Scaphochlamys tenuis Holttum (31)

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