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THE GENUS *CYRTANDRA* (*GESNERIACEAE*) IN PENINSULAR MALAYSIA AND SINGAPORE

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Nine species of *Cyrtandra* (*Gesneriaceae*) are recognized in Peninsular Malaysia. Three (*C. cupulata*, *C. pendula* and *C. wallichii*) are common and occur more or less throughout the area; *C. pendula* is also recorded from Singapore. Four (*C. dispar*, *C. gimlettei*, *C. patula* and *C. suffruticosa*) have more restricted distributions, and two (*C. lanceolata* and *C. stonei*) are local endemics. Three species and one variety originally described by Ridley are here reduced to synonymy: *C. barbata* (= *C. cupulata*), *C. falcata* (= *C. suffruticosa*) and *C. rotundifolia* (= *C. pendula*), and *C. cupulata* var. *minor* (= *C. cupulata*). Keys for fieldwork and herbarium use are presented and general information is provided. The appendix by M.H. Bokhari contains descriptions of leaf anatomy for eight of the nine species recognized and a key based on anatomical characters.

Keywords. *Cyrtandra, Gesneriaceae*, leaf anatomy, Malaysia, Singapore, taxonomy.

INTRODUCTION

Cyrtandra J.R. & G. Forst. is the largest genus in the *Gesneriaceae*, containing at least 600 species. It is distributed from the Nicobar Islands in the Indian Ocean, to southern Thailand, throughout Malesia to Taiwan, the southern Ryukyu Islands, southeast to Queensland and the Loyalty Islands, and east to the high islands of the Pacific to Hawaii. Centres of species richness and diversity are Borneo, New Guinea and the Pacific Islands.

Cyrtandra species usually grow as understorey shrubs, herbs, or rarely epiphytes in dense rain forest, often in ravines and gorges characterized by high humidity, very low light intensities, and an almost constant moisture supply (Gillett, 1967). The genus forms a common element of the species-rich Indo-Malayan rain forest, and is remarkable for its capacity to produce local endemics.

The last overall treatment of the genus, describing 167 species, was by C.B. Clarke in 1883, in A. & C. de Candolle's *Monographiae Phanerogamarum*. Clarke had few collections to study and these were often inadequate. All the sections proposed by him contain a mixture of species that would not now be classified together (Burtt,

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1990). Since then, all accounts have been on a regional scale. For example, Schlechter (1923) revised 96 species from New Guinea, and Gillett (1967) revised 35 species from Fiji and (in 1973) 54 species from the South Pacific. Sundaland has been the area of focus of B.L. Burtt, especially the Bornean species (e.g. Burtt, 1978, 1990). In addition, Atkins & Cronk (2001) revised the 12 *Cyrtandra* species of Palawan (Philippines). The Hawaiian species have been the subject of five revisions: Clarke (1883), 34 species; Hillebrand (1888), 29 species; Rock (1917, 1918, 1919a,b), 52 species; St. John (1966), 131 species on Oahu; and Wagner *et al*. (1990, 1999), 53 species. There have also been studies on reproductive biology and hybridization (Roelofs, 1979; Smith *et al*., 1996), (micro)morphology and molecular biology (Smith *et al*., 1999; Kiehn, 2001).

In Peninsular Malaysia the genus is surprisingly poorly represented. It has not diversified as in Borneo, where 120 species have been described, and the Peninsular species are apparently the northwestern outliers of the genus. In his *Flora of the Malay Peninsula*, Ridley (1923) recognized 12 species. Burtt (1978) reduced two species and a variety, *C. grandiflora* Ridl., *C. pilosa* auct. non Blume and *C. decurrens* De Vriese var. *wallichii* C.B. Clarke, to synonymy under *C. wallichii*. *Cyrtandra grandiflora* is a homonym of *C. grandiflora* Gaudich., and specimens treated by Ridley as *C. pilosa* do not match Blume's (1826) Javan *C. pilosa*. Stone (1980) described *C. dispar* DC. var. *glabriflora*, which Burtt (1990) raised to species rank as *C. stonei*, the epithet '*glabriflora*' having already been used for a Hawaiian species (St. John, 1987). These changes maintained the number of species recognized at 12.

In Ridley (1893, 1905) there is some confusion in the citing of specimens: the same specimens are cited under both *C. falcata* Ridl. and *C. suffruticosa* Ridl. This, together with the examination of other specimens and experience in the field, has led us to reduce a further three Ridley species to synonymy, resulting in a current total of nine species.

This study is part of a wider investigation into different ways of treating the large genus *Cyrtandra*. Geographical approaches to the genus include this regional treatment and a local revision of *Cyrtandra* on Mount Kerinci, Sumatra (Bramley & Cronk, 2003). A monographic approach involves a revision of section *Dissimiles* C.B. Clarke (G.L.C. Bramley, in prep.).

Keys and descriptions are presented for the nine *Cyrtandra* species recognized in Peninsular Malaysia.

Notes

Measurements are given for leaves presumed to be mature, and their shape is described following Hickey (1979). When leaf pairs are anisophyllous, the larger member is referred to as the major leaf and the smaller as the minor leaf.

All measurements of floral characters were taken from herbarium material that had been rehydrated and softened in spirit, except for those species illustrated, which were collected by Bramley *et al*. in July 2002.

All details of plant heights and colours in the descriptions are taken from the collection notes of Bramley *et al*. or from observations or photographs by Weber *et al*., unless stated otherwise.

All locations follow the American National Imagery and Mapping Agency's GEOnet Names Server (http://164.214.2.59/gns/html/index.html). Thai specimens are cited for the rarer species only.

Regarding descriptions of stigmas, in dry and rehydrated material, stigma characters are very difficult to see; nevertheless, there seem to be some interesting differences between species. The following terms have been used to describe basic stigma structure:

- bilobed (two lobes present but their shape is unclear);
- semioval lobes (whole structure oval, but divided into two lobes, e.g. Figs 3, 7);
- two triangular lobes with pointed tips (e.g. Fig. 10);
- two triangular lobes with blunt tips (e.g. Fig. 1); and
- two narrowly triangular lobes with pointed tips (e.g. Fig. 11).

The lobes are always median, i.e. each carpel forms a lobe.

All measurements refer to length unless stated otherwise.

Certain species have characteristic fleshy protruberances on bracts and calyx; we follow Ridley (1909) in his use of the term *utricles* for these.

Cyrtandra flowers are protandrous, therefore flowers examined may be:

- immature;
- in the male phase with stamens not yet dehisced and gynoecium not at mature length; or
- in the female phase with stamens recoiled back into corolla tube after dehiscence, and gynoecium at full length.

Efforts have been made to describe the mature male and female organs. However, when not possible this has been noted.

All specimens cited have been seen by the authors, unless stated otherwise.

Where a date cannot be given for a particular specimen, '?' is used.

All the specimens seen for each species have been included on the distribution maps, not only those cited here.

Generic description (for Peninsular Malaysian species only)

Cyrtandra J.R. & G. Forst., Char. gen. pl. 5 (1776).

Terrestrial (rarely epiphytic) perennial herbs, shrubs or small trees. *Leaves* simple, petiolate, opposite, those in each pair being either isophyllous (equal), subequal, anisophyllous (one less than half the size of the other), pseudoalternate (one reduced to leaf-like scale, leaves appearing alternate) or pseudodistichous (those on each stem or branch in a single plane); leaf blades hairy to glabrous above, veins often raised and hairy below. *Inflorescences* usually in upper leaf axils but occasionally

cauliflorous (in axils of fallen leaves); sessile, subsessile or pedunculate; flowers 1 to many in pair-flowered cymes. *Bracts* (the term *bracts* is used here for the first pair of bracteoles [prophylls] of the axillary cyme; in *Cyrtandra* these are usually more prominent than the subsequent bracteoles) often enclosing inflorescence. *Calyx* 5-lobed, sometimes lobes fused and tube appearing 2- or 3-lobed, often hairy, persistent or caducous in fruit. *Corolla* tubular to funnel-shaped, limb zygomorphic, 5-lobed, lobes often subequal, but upper 2 lobes usually distinguishable from lower 3; white or rarely pale yellow or with greenish or pinkish tint, throat often marked with yellow, red, brown or purple. *Fertile stamens* 2; staminodes 3 (not seen in all species but assumed to be present). *Ovary* superior, hairy or glabrous; placentation parietal; style glabrous or with glandular or eglandular hairs, stigma with 2 median lobes. *Disk* cupular or unilateral. *Fruit* a hard (sclerocarpous) or fleshy berry, often tipped by the persistent stylar beak.

Etymology. From Greek *kyrtos* (=curved) and *andros* (=male), apparently referring to the spiral filaments that recoil into the corolla after anther dehiscence.

Chromosome number. $n=17$, $2n=34$ (data for c.50 species with two deviating reports of $2n=32$). See Ratter & Prentice (1964) and Kiehn & Weber (1998) for discussion.

The first key, including both vegetative and floral characters, can be used in the field for the identification of fertile plants. The second key, with vegetative characters, can be used to identify sterile plants and poor herbarium specimens. A third key, by M.H. Bokhari and based on leaf anatomy, is given in the Appendix (see p. 356).

Key based on vegetative and floral characters

1a. Leaves pseudoalternate or pseudodistichous, one in each pair rudimentary — 2
1b. Leaves ± equal, or anisophyllous (although minor leaves longer than 3cm) — 3

2a. Leaves narrowly to widely ovate or elliptic, petioles 8–20cm; peduncle 2–20cm, deflexed — **5. C. pendula**
2b. Leaves elliptic to narrowly elliptic or obovate, petioles 1.5–3cm; peduncle 0–5mm, upright — **8. C. dispar**

3a. Leaves anisophyllous — 4
3b. Leaves equal or subequal, one sometimes slightly reduced — 5

4a. Terrestrial subshrub; major leaves narrowly elliptic to oblanceolate, glabrous; bracts narrowly ovate to lanceolate, glabrous; calyx zygomorphic, upper 3 lobes fused into 3-toothed upper lip, lower 2 divided to base — **7. C. stonei**
4b. Subshrub, sometimes epiphytic; major leaves oblong to narrowly or very narrowly elliptic, (sub)falcate, with scattered hairs; bracts broadly ovate, hairy; calyx very reduced (c.2mm), lobes reduced to 5 small teeth — **6. C. suffruticosa**

5a. Peduncle 2–20cm — **5. C. pendula**
5b. Peduncle absent or less than 2cm — 6

6a. Bracts connate for at least 0.5cm — 7
6b. Bracts free — 8

7a. Bracts usually 3–6cm, forming a wide white cup, sparsely to densely hairy; corolla glabrous, white with pink-brown mark in throat — **1. C. cupulata**
7b. Bracts usually 2–4cm, connate for 0.5cm, purple or green, glabrous or with 1–2mm utricles; corolla silky hairy, white with purple spots in throat — **2. C. wallichii**

8a. Inflorescences at base of stem — **4. C. lanceolata**
8b. Inflorescences on leafy shoots — 9

9a. Leaves entire; corolla mostly glabrous — **6. C. suffruticosa**
9b. Leaves serrate or biserrate; corolla hairy — 10

10a. Leaves oblanceolate, decurrent on stem, serrate; corolla white with two purple bars in throat — **3. C. gimlettei**
10b. Leaves obovate or narrowly elliptic, biserrate; petioles 2–3cm; corolla off-white with brown marking in throat — **9. C. patula**

Key based on leaf characters

1a. Leaves entire — **6. C. suffruticosa**
1b. Leaves to some degree serrate, biserrate or crenate-serrate — 2

2a. Leaves biserrate (especially on young plants) — 3
2b. Leaves serrate or crenate-serrate — 4

3a. Leaves pseudodistichous, one of each pair rudimentary; bark flaky — **8. C. dispar**
3b. Leaves equal or subequal; bark more or less smooth — **9. C. patula**

4a. Leaves anisophyllous or pseudoalternate — 5
4b. Leaves equal or subequal — 6

5a. Major leaves narrowly to broadly ovate or elliptic; petiole 8–20cm — **5. C. pendula**
5b. Major leaves narrowly elliptic to oblanceolate; petiole 3–4cm — **7. C. stonei**

6a. Leaf base decurrent, to 1.5cm wide on either side of petiole base and overlapping opposite leaf base, sometimes partly covering leaf axil — 7
6b. Leaf base sometimes forming narrow wing to 0.5cm wide along petiole, or narrowly cuneate — 9

7a. Leaves less than 25cm long, with shallow serrations — **3. C. gimlettei**
7b. Leaves up to 40cm long, distinctly serrate — 8

8a. Leaf apex acuminate 1–3cm, all veins raised and densely hairy below; bracts to 6cm, white, connate, forming a wide cup, sparsely to densely hairy ——— **1. C. cupulata**

8b. Leaf apex acute or shortly acuminate to 1cm, primary and secondary veins raised and hairy below; bracts to 4cm, purple or green, connate for 0.5cm, sometimes with 1–2mm utricles ——— **2. C. wallichii**

9a. Leaves narrowly to broadly ovate or elliptic, petioles 8–20cm **5. C. pendula**

9b. Leaves narrowly elliptic, elliptic, obovate or oblanceolate, petioles less than 6cm ——— 10

10a. Leaves serrate, inflorescences axillary ——— **1. C. cupulata**

10b. Leaves crenate-serrate, inflorescences at base of stem ——— **4. C. lanceolata**

1. Cyrtandra cupulata Ridl., J. Linn. Soc. 32: 527 (1896). Type: Peninsular Malaysia, Pahang, Tahan Woods, viii 1891, *Ridley* 2150 (lecto. K [chosen here]; isolecto. BM, SING). **Fig. 1.**

Syn. nov.: *Cyrtandra cupulata* var. *minor* Ridl., Fl. Malay Penins. 2: 547 (1923). Type: Peninsular Malaysia, Kelantan, by the river at Chaning and Kwala Lebir, 6 ii 1917, *Ridley* s.n. (K).

Cyrtandra barbata Ridl., J. Straits Branch Roy. Asiat. Soc. 57: 75 (1910). Type: Peninsular Malaysia, Perak, Temengoh, 1909, *Ridley* s.n. (SING [n.v.]).

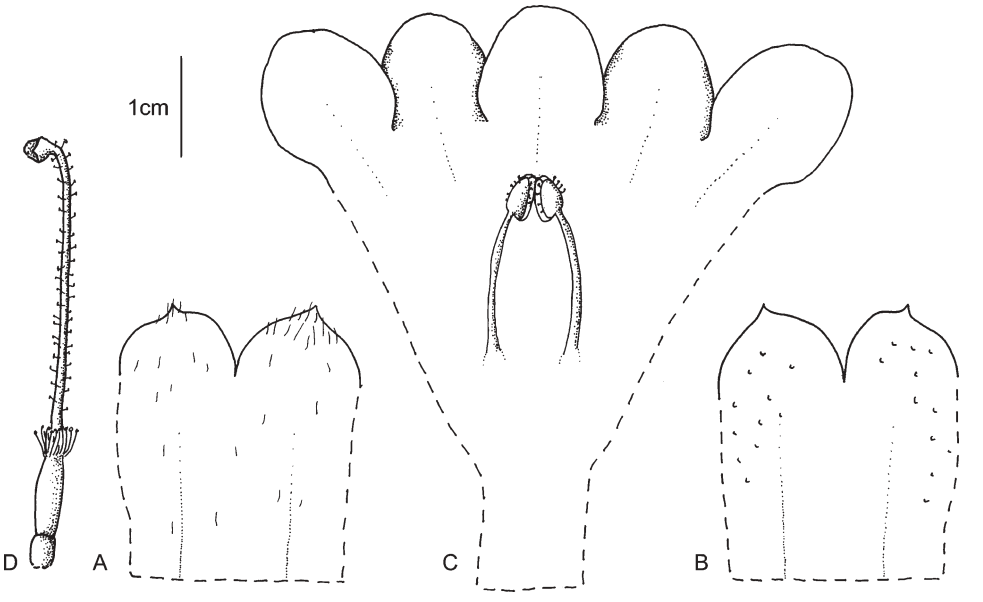

FIG. 1. *Cyrtandra cupulata* Ridl. A, calyx dissected ventrally, outer surface; B, calyx dissected ventrally, inner surface; C, corolla dissected dorsally, showing stamens; D, gynoecium and disk. Drawn from *Bramley et al.* GB28.

Shrub, c.1–1.2m; stems usually unbranched, with dense, coarse, brown hair when young, becoming woody and usually less hairy with age, sometimes hair remaining dense, especially around leaf axils. *Leaves* opposite, equal; petioles hairy 1–4cm, or absent and lamina decurrent on stem or forming a narrow wing along petiole to stem; lamina dark glossy green, pale green below, narrowly elliptic or elliptic to narrowly obovate or obovate, 18–35 × 4–13cm, sometimes asymmetric about midrib, acuminate, narrowly cuneate if not decurrent at base, serrate, sometimes with hooked hairy tips, coarsely red-brown hairy above when young, hair becoming sparse with age, red-brown hairy below, sometimes with tiny pustules; all veins raised, densely hairy, lateral vein pairs 8–12. *Inflorescences* axillary, shortly pedunculate, with up to 10 flowers. *Bracts* to 6cm, pale green when young, becoming bright cream or white, connate for most of their length forming a cup containing the flowers, acuminate, sparsely to densely hairy, serrate. *Bracteoles* c.4cm, white, serrate, hairy. *Peduncle* 0.5–1.5cm, hairy. *Pedicels* to 0.5cm, hairy. *Calyx* white, c.2cm, with occasional hairs near lobe tips outside, inside with scattered papillae; tube c.1.5cm, lobes 2, triangular with rounded tips. *Corolla* white with pink to brown mark in throat, c.3–3.5cm, funnel-shaped, broadening towards mouth, upper 2 lobes 8 × 8mm, lower 3 lobes 7 × 7mm; glabrous. *Filaments* white, c.1cm, connective fringed with glandular hairs. *Anthers* c.2mm. *Gynoecium* c.2.5cm long, ovary with collar of glandular hairs at tip (base of style), style with glandular hairs, stigma with 2 bluntly triangular lobes. *Disk* c.2mm, cupular, margin undulate or dentate. *Fruit* green, 1.2–2 × 0.3–0.5cm, narrow and curved (or shorter and straighter), tapered towards apex, warty, tip with residual tuft of hair at tip; bracts, calyx and style caducous.

Etymology. From Latin *cupulatus* (=cup-shaped), referring to the two large fused bracts embracing the flower cluster.

Ecology. Common in lowland and hill forest; 0–1000m.

Distribution. Peninsular Malaysia, southern Thailand (Fig. 2).

Selection of specimens examined

Vegetatively, *C. cupulata* is very variable, especially in leaf shape and petiole development. The degree of hairiness of leaves, stems and bracts also differs markedly between specimens, as does the fruit shape. To represent this considerable morphological variation, the specimens are cited under five informal groups. The morphological characteristics of each group are listed below.

- *Group 1*. Stems, leaf axils and bracts densely clad in brown hairs; hairs often quite long (3–4mm) and up-curved. Bracts usually less than 3cm.
- *Group 2*. Stems with brown hair concentrated at tips and sometimes in leaf axils: hair never long and dense. Leaf shape variable; upper surface subglabrous; lower

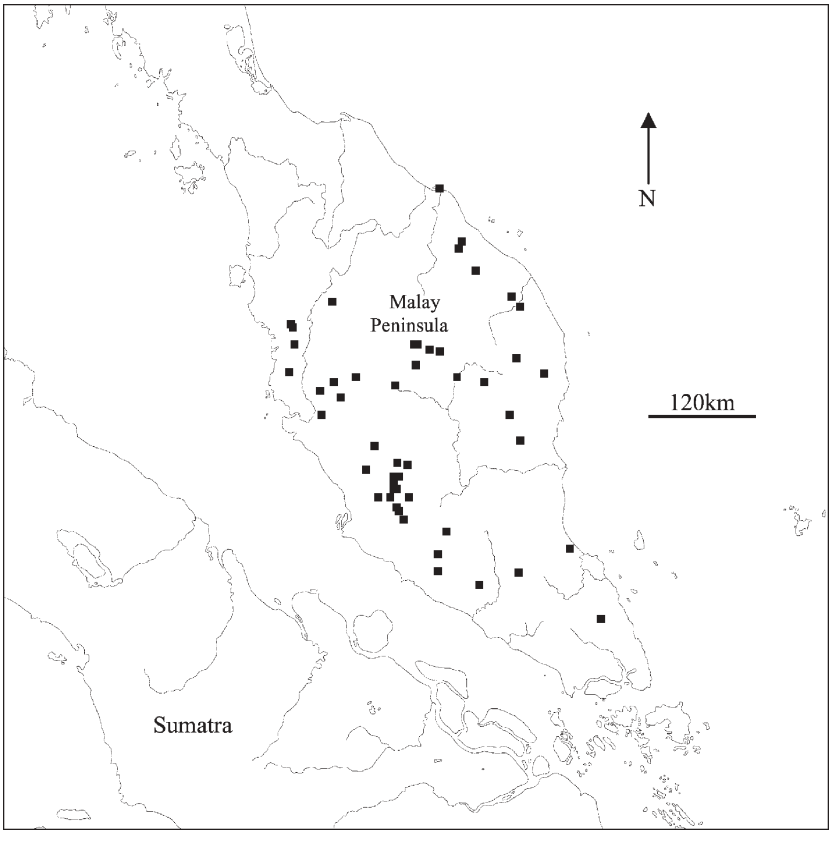

FIG. 2. Distribution map of *Cyrtandra cupulata* Ridl.

surface with red-brown hair on veins. Bracts large, usually 3–6cm, sparsely hairy outside, but not densely so.

- *Group 3*. Fruits small and narrow (c.1.5–2 × 0.2cm), clustered; pedicels c.0.5cm. Leaves are decurrent on to stem. Stems and bracts very densely hairy.
- *Group 4*. Stems and bracts hairy to densely hairy. Bracts to c.3cm. Fruit shorter, straighter and broader than in other groups (1–1.5 × 0.5cm).
- *Group 5*. Plants smaller and more slender, with little hair on stems. Leaves c.12–26 × 3.5–8cm, subglabrous; petioles c.1cm. Bracts also smaller (to c.3cm). Ridley (1923) noted that the flowers are pure white with no brown marking in the throat, as in *C. cupulata*: this has not been observed in this study.

Group 1 (includes type): north of Pahang, and in Perak, Kedah and Kelantan.

PENINSULAR MALAYSIA. Pahang, Teku River, Gunung Tahan, 21 vi 1922, *Haniff & Nur* SFN8056 (SING); Kelantan, Kuala Krai, 23 i 1923, *Haniff & Nur* SFN10133 (SING); Kelantan, Kuala Relai, 31 i 1923, *Haniff & Nur* SFN10226 (SING); Pahang, Tembeling, 13 vii 1929, *Henderson* SFN21847 (BM, SING); Kelantan, Gua Musang-Kuala Betis track, 14 vii

1935, *Henderson* SFN29653 (SING); Kedah, Gunung Lang, 25 iii 1938, *Kiah* SFN35050 (BM, K, L, SING); Pahang, Sungai Tahan, 19 vii 1936, *Kiah* SFN31729 (SING); Perak, Larut, [500ft] 150m, vii 1881, *King's Collector* 2057 (SING); Kedah-Perak, Gunung Bintang, *Nat. Coll. FMS Mus*. 13028 (SING); Pahang, Kuala Tahan, [350ft] 100m, ii 1921, *Seimund* 946 (SING); Pahang, Ulu Sungai Tembeling, 6 iii 1968, *Shah* MS1585 (E, K, L, SING); Pahang, Ulu Sungai Tembeling, 6 iii 1968, *Shah* MS1585 (E, K, L, SING); Pahang, Kuala Teku, [500–1000ft] 150–300m, 5 viii 1905, *Wray & Robinson* 5540 (BM, K, SING).

Group 2 (the most common form of *C. cupulata*): extends much further south than group 1, to the states of Selangor and Negeri Sembilan.

Peninsular Malaysia. Selangor, Kanching Forest Reserve, 140m, 17 vii 2002, *Bramley et al*. GB28 (E, K, KEP, L); Selangor, Ulu Gombak, 520m, 19 vii 2002, *Bramley et al*. GB29 (E, K, KEP, L); Terengganu, Gunung Lawit, [1000–2000ft] 300–600m, 1 iv 1970, *Davidson* 1303 (L); Pahang, Bukit Chintamani, Bentong, 4 x 1931, *Henderson* SFN25042 (K, SING); Negeri Sembilan, Senaling Inas Forest Reserve, 28 xi 1922, *Holttum* 9776 (SING); Negeri Sembilan, Gunung Tampin, 22 xi 1922, *Holttum* 9538 (SING); Pahang, Bentong, Sungai Telom, [c.500ft] 150m, 30 viii 1930, *Kiah & Strugnell* SFN24009 (SING); Selangor, 16th Mile Ulu Gombak, [1000ft] 300m, 24 x 1937, *Nur* SFN34209 (SING); Negeri Sembilan, Bukit Tangga, 19 xii 1920, *Ridley* s.n. (K); Perak, Maxwell's Hill, [c.2600ft] 800m, 16 ix 1949, *Sinclair & Kiah* SFN38781 (SING).

Group 3 (represented by fewer specimens than groups 1 or 2): distribution is northern.

Peninsular Malaysia. Kelantan, Bukit Batu Papan, Sungai Lebir, [500ft] 150m, 6 vii 1935, *Henderson* 29582 (SING); Pahang, Sungai Merapoh, 2 ii 1924, *Nur & Foxworthy* 11928 (SING); Perak, Tapah, xi 1908, *Ridley* s.n. (SING).

Group 4: in the southernmost states of Johore and Malacca.

Peninsular Malaysia. Malacca/Johore, Bukit Besar Ophir, xii 1898, *Ridley* 10086 (SING); Johore, Ulu Sungei Segamat, [1000ft] 300m, 17 ii 1972, *Samsuri & Shukor* SA680 (SING).

Group 5 (represents specimens referable to *C. cupulata* var. *minor* Ridl.): so far recorded from Kelantan only.

Peninsular Malaysia. Kelantan, Gua Ninik, 26 x 1927, *Henderson* 19685 (SING); Kelantan, Chaning, 6 ii –, *Ridley* s.n. (K, type of var. *minor*); Kelantan, Kelantan River, 1 ii 1917, *Ridley* s.n. (K).

Cyrtandra cupulata is easily recognized by its striking white bracts, fused to form a cup containing the flowers. The cup often fills with water, causing the flowering material to rot into a mucilage; the role of this mucilage, and whether it confers any benefit, is not known. Within the bracts one is able to find many larvae and mites, and *Drosophila* spp. are commonly seen around the inflorescence. The bracts dry out and fall before fruiting.

A shortage of specimens with reproductive material in good condition makes recognizing formal infraspecific taxa problematic, so the variation is merely

described here. Future collections may allow new varieties or subspecies to be described.

Cyrtandra cupulata var. *minor* Ridl. is here reduced to synonymy and included as one of the five informal groups within *C. cupulata*.

For a number of reasons, *C. barbata* Ridl. is also reduced to synonymy. The features highlighted by Ridley (1910), abundant and dense red-brown hair on the bract, calyx and veins, certainly fall within the variation found in *C. cupulata*, and indeed match with group 1, which contains the type specimen. Ridley described *C. barbata* as having white cupular bracts, similar to those of *C. cupulata*, and the entity he described as *C. barbata* may since then have been identified as *C. cupulata*, although no specimens with leaves as small as described by Ridley, at $5 \times 3''$ (12.5×7.5cm), have been found.

2. Cyrtandra wallichii (C.B. Clarke) B.L. Burtt, Notes Roy. Bot. Gard. Edinburgh 36(1): 179 (1978). Type: Peninsular Malaysia, Penang, 1830, *Wallich* 807 (holo. K, iso. WU). **Fig. 3.**

Syn.: *Cyrtandra decurrens* de Vriese var. *wallichii* C.B. Clarke in A. & C. DC., Monogr. phan. 5: 232 (1883). Type as above.

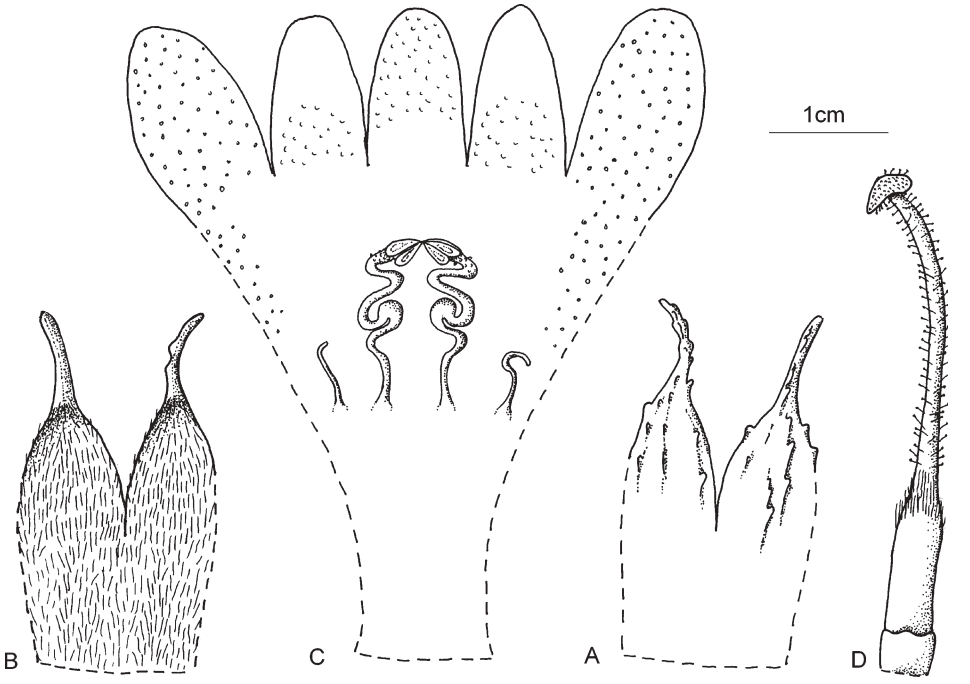

FIG. 3. *Cyrtandra wallichii* (C.B. Clarke) B.L. Burtt. A, calyx dissected ventrally, outer surface; B, calyx dissected ventrally, inner surface; C, corolla dissected dorsally, showing stamens with thickened knees and staminodes; D, gynoecium and disk. Drawn from *Bramley et al*. GB26.

Cyrtandra pilosa auct. non Blume; C.B. Clarke in A. & C. DC., Monogr. phan. 5: 232 (1883), pro parte; Ridl., Fl. Malay Penins. 2: 546 (1923). Type: Pahang, Telom, *Ridley* s.n. (K, SING).

Cyrtandra grandiflora Ridl., J. Fed. Malay States Mus. 4: 52 (1909) – non Gaudich.

Unbranched shrub to c.1.5m; stems woody, glabrous, often distinctively scarred where leaves have fallen. *Leaves* opposite, equal or subequal, petiole 4–7cm, with wings to 1.5cm wide overlapping base of opposite leaf: lamina fleshy, often purplish below, 9–33 × 3.5–13.5cm, narrowly elliptic to oblanceolate, acute or shortly acuminate, decurrent into petiole wing at base, almost sheathing axil, serrate, teeth sometimes with tufts of hair at tips, subglabrous to hairy above, glabrous below or hairy on lamina and raised primary and secondary veins; midrib thickened at base and curving outwards from stem; lateral vein pairs 8–12. *Inflorescences* axillary, shortly pedunculate, flowers 4 or more. *Bracts* green to purple, 2–4 × 1.5–3cm, paired and connate for c.0.5cm, ovate, acuminate, irregularly serrate, outside subglabrous to hairy, sometimes with scattered c.1–2mm utricles, inside with long adpressed hairs. *Bracteoles* c.1 × 0.4cm, narrow ovate, hairy. *Peduncles* c.0.5cm. *Pedicels* 3–5mm. *Calyx* c.2–2.3cm, sparsely hairy outside, sometimes with 1–2mm utricles concentrated on upper part of lobes and dense long hair inside; tube c.1cm, lobes 2, rounded, with c.5mm acuminate tips, or corolla breaking through one side leaving lobes and lobe tips still joined on other side. *Corolla* white with purple dots in throat, 3–4cm, funnel-shaped, upper 2 lobes 1.2–1.5 × 0.8–1.1cm, erect, divided for 0.5–0.8cm, lower 3 lobes spreading 1–1.2 × 0.6–1cm; outside with dense silky hair, inside with stalked glands on upper 2 lobes and some of upper part of throat, otherwise glabrous. *Filaments* white, c.12mm, thickened to form a dark knee at c.4mm from base, glabrous. *Gynoecium* 2–3cm, ovary glabrous except for collar of hairs at tip (base of style), style with glandular hairs, stigma with two semioval lobes. *Disc* c.2mm, cupular. *Fruit* brown, 1.5–2.5 × 0.6–1.2cm, ovoid, warty, calyx and style caducous.

Etymology. Named after Nathaniel Wallich (1786–1854), a distinguished Danish botanist who worked in India, Nepal and the Malay Peninsula. He was the collector of the type specimen.

Ecology. Common in primary, often slightly disturbed, lowland and hill forest; 0–1000(–1500)m.

Distribution. Peninsular Malaysia and southern Thailand (Fig. 4).

Selection of specimens examined

Specimens are cited under two informal groups to highlight the variation between the more common form (group 1) and the '*pilosa*' form (group 2). For further explanation see discussion below.

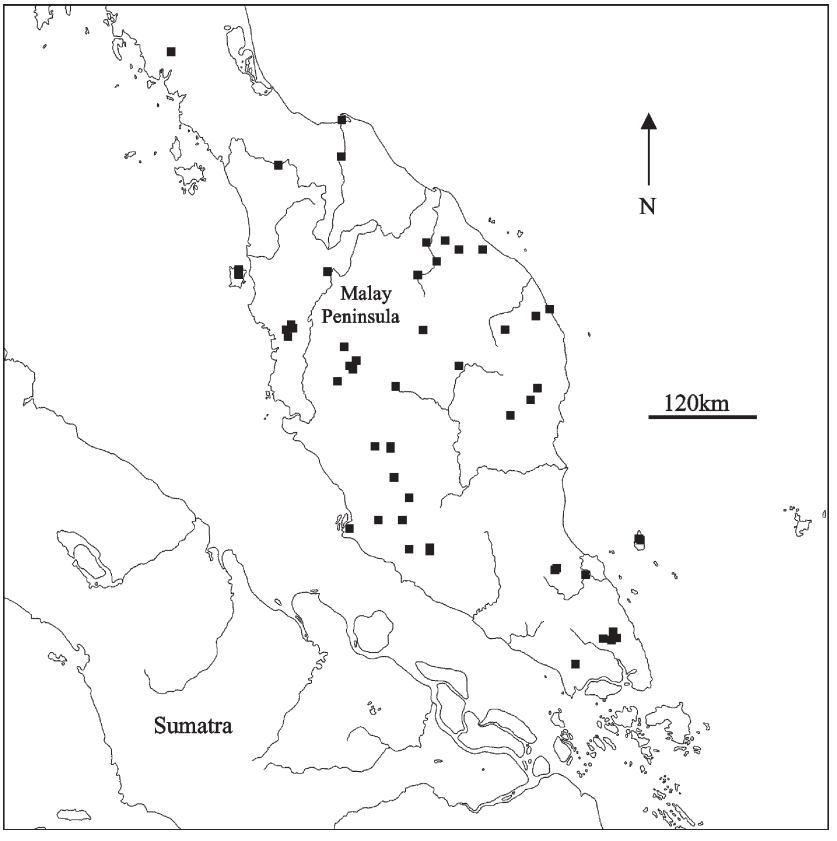

FIG. 4. Distribution map of *Cyrtandra wallichii* Ridl.

Group 1 includes the majority of specimens examined and also plants seen in the field by the authors. Characteristic of this group are the large utricular bracts and a calyx that also bears some utricles. Further explanation is given below.

PENINSULAR MALAYSIA. Selangor, Ulu Semangkok, c.600m, 16 vii 2002, *Bramley et al*. GB25, GB26 (E, K, KEP, L); Selangor, Awana Ecopark, 770m, 29 vii 2002, *Bramley et al*. GB35 (E, KEP); Pahang, Cameron Highlands, Jungle Trail 9, 1280m, 27 vii 2002, *Bramley & Neale* GB33 (E, K, KEP, L); Terengganu, Jeranggau forest reserve, 30 iii 1957, *Chew* CWL75 (K); Penang, Penara Bukit, x 1886, *Curtis* 1018 (K, SING); Pahang, Pulau Tioman, Sungei Ayer Besar, [1000ft] 300m, 9 iv 1962, *Kadim & Noor* KN518 (L); Johore, Sungai Kayu, 26 x 1936, *Kiah* SFN32181 (BM, K); Negeri Sembilan, Bukit Tangga, 1903, *Napier* s.n. (SING); Negeri Sembilan, Gunung Angsi, [2000ft] 600m, 20 xi 1923, *Nur* 11551 (SING); Johore, Gunung Pulai, xii 1904, *Ridley* s.n. (SING); Pahang, Telom, xi 1908, *Ridley* 13673 (BM, SING); Perak, Gunung Bujang Melaka, [c.2000ft] 600m, 12 ii 1975, *Shah & Shukor* MS3403 (SING); Kelantan, Bukit Baka Forest Reserve, 500m, 2 vi 1982, *Stone, Chin et al*. 15271 (L).

Group 2 is the '*pilosa*' form of *C. wallichii* s.1. The plants are generally smaller than those in group 1. Bracts are smaller and not utricular, and likewise the calyx also bears no utricles. Specimens with good flowering material are scarce, but one

recently collected specimen (*Sam* FRI44491, KEP) with flowering material preserved in spirit suggests more evidence that this group may be distinct from *C. wallichii* s.s. (group 1).

PENINSULAR MALAYSIA. Pahang, Cameron Highlands, rd down Gunung Brinchang, 1755m, 26 vii 2002, *Bramley & Neale* GB32 (E); Pahang, Bentong, 7 xi 1924, *Burkill & Haniff* 16670 (SING); Terengganu, Gunung Padang, Ulu Tersat, [3800ft] 1150m, vi 1937, *Moysey & Kiah* SFN33945 (SING); Penang, Penang Hill, [1800ft] 550m, 24 ix 1941, *Nauen* s.n. (SING); Perak, Gunung Kerbau, [1000ft] 300m, 25 iii 1913, *Robinson* s.n. (BM); Kelantan, Nengirri Forest Reserve, Gua Musang, 350m, 1 x 2002, *Sam* FRI44491 (KEP).

Material of *C. wallichii* was originally determined as *C. pilosa* Blume by Ridley, and is still generally referred to as *C. pilosa* in the Malaysian literature. However, Burtt (1970, 1978) noted that true *C. pilosa*, from Java, is a different species, 'the stem of the Javanese plant being more slender, the internodes longer, and the bracts of the inflorescence smaller than in most material in the Malay Peninsula'. Clarke (1883) had earlier recognized Peninsular Malaysian material as *C. decurrens* var. *wallichii.* Although *C. decurrens* is related, it is different from the Peninsular Malaysian species. *Cyrtandra decurrens* is smaller and differs in having a very densely long pilose style (Burtt, 1978). Ridley (1909) also described a *C. grandiflora*, but this is a homonym of *C. grandiflora* Gaudich.; Burtt (1978) therefore raised Clarke's var. *wallichii* to species rank, and reduced *C. pilosa* (auct. non Blume), *C. decurrens* var. *wallichii*, and *C. grandiflora* Ridl. to synonymy.

The description given here is based on the majority of specimens relating to Ridley's *C. grandiflora* in their utricular bracts and broad corolla (group 1). However, there is considerable variation in the leaf shape, degree of lamina decurrence and hairiness. There are specimens more similar to Ridley's description of *C. pilosa*; these are usually smaller and more slender than *C. grandiflora* Ridl. and do not have utricular bracts. These specimens are cited here under '*pilosa*' (group 2), but are mostly sterile and do not provide sufficient evidence to split *C. wallichii*. Therefore, *C. wallichii* remains a large and variable species until more thorough fieldwork can be carried out.

In his notes on *C. wallichii*, Burtt (1978) described the style as glabrous apart from a few scattered hairs towards the top. In all material we examined, the style is covered with glandular hairs, and the ovary topped with a collar of eglandular hairs. Burtt (1978) affiliates *C. wallichii* to a Bornean group of species including *C. erectipila* B.L. Burtt and *C. cuprea* B.L. Burtt.

3. Cyrtandra gimlettei Ridl., J. Straits Branch Roy. Asiat. Soc. 49: 21 (1908). Type: Peninsular Malaysia, Kelantan, Kwala Lebir, s.dat., *Gimlette* s.n. (holo. SING).

Erect herb; stem shortly hairy when young, becoming woody at base. *Leaves* opposite, subequal; petiole absent or to c.1.5cm and then winged to 0.5cm; lamina oblanceolate, 8.5–25 × 4–8cm, rounded and shortly acuminate, decurrent on stem, somewhat sheathing the leaf axil, above with erect hairs with thickened bases, with

short erect hair below, especially dense on veins, shallowly serrate. *Bracts* c.1cm long, ovate, whitish, hairy. *Inflorescences* axillary, almost sessile. *Peduncles* absent or to 3mm. *Pedicels* 2–4mm, hairy. *Calyx* c.1cm, bilobed, divided to approximately one-third of its length, hairy outside, internal surface not seen. *Corolla* c.2cm, (creamy-white with deep purple blotching ending in two purple bars on the lower lip), outside silky hairy, inside papillose with scattered hair on lobe surface. *Filaments* not seen (purple). *Anthers* not seen. *Gynoecium* c.1.5cm, style with glandular hairs. *Disk* not seen. *Fruit* c.0.8–1.5 × 0.3–0.4cm, narrow ovate, warty, style semipersistent leaving a short beak, c.2–3mm.

Note. Flower colours are taken from Ridley (1908).

Etymology. Named after J.D. Gimlette (1867–1934), member of the Duff Company, plant collector, and author of papers and books on Malayan medicinal plants.

Ecology. Probably mainly lowland forest, to 550m; not widely collected or known.

Distribution. Peninsular Malaysia (Perak, Kedah, Kelantan), southern Thailand (Fig. 5).

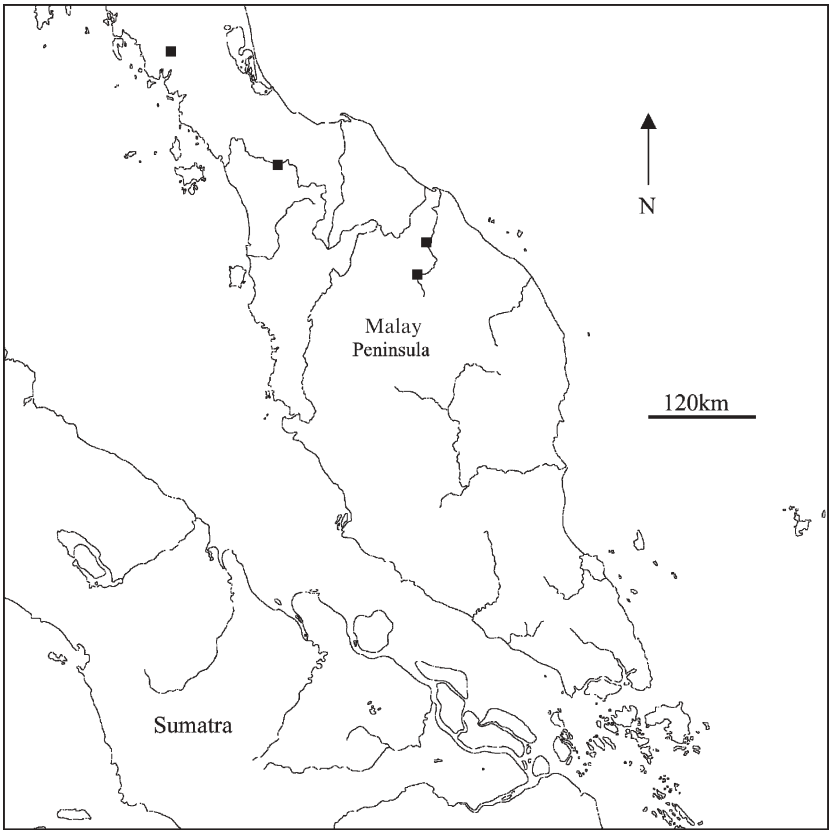

FIG. 5. Distribution map of *Cyrtandra gimlettei* Ridl.

Specimens examined. PENINSULAR MALAYSIA. Kelantan, Pergau, 550m, 7 x 1992, *Karim & Shah* NK48 (SING); Kedah, Koh Mai Forest Reserve, 2 iv 1938, *Kiah* SFN35130 (BM, SING); Kelantan, Kuala Sameh, 23 ii 1924, *Nur & Foxworthy* s.n. (SING); Kelantan, 15 vi 1908, *Ridley* s.n. (K); Perak, Kuala Lebir, ii 1917, *Ridley* s.n. (K); Kelantan, Kampong Gobek, Kerilla est., 28 ii 1959, *Shah & Kadim* MS472 (L, SING).

THAILAND. Trang, Khao Soi Dao, 27 iv 1930, *Kerr* 19155 (BM); Phangnya, Takua Pa, 17 ii 1929, *Kerr* 17122 (BM); Phangnya, Khao Katakwam?, 400m, 7 iii 1930, *Kerr* 18410 (BM); Naratiwat, Sungei Kolok, Nikom Waeng, 1 iii 1974, *Larsen & Larsen* KL32786 (E).

Found only in the northern states of Peninsular Malaysia extending into southern Thailand. Its closest relative is *C. wallichii* s.l. *Cyrtandra gimlettei* can be recognized by its smaller stature, less distinctively serrate leaf margins, and the indumentum of the lamina, which is much shorter, erecter and denser than that of *C. wallichii*. In addition, it has smaller white flowers with purple bars and blotching in the throat; *C. wallichii* has small purple dots towards the mouth of the corolla. It might be confused with *C. wallichii* group 2 ('*pilosa*'), but it is hairier, and the flower markings are distinct.

4. Cyrtandra lanceolata Ridl., J. Linn. Soc. 32: 527 (1896). Type: Peninsular Malaysia, Johore, Gunung Panti, 8 xii 1892, *Ridley* s.n. (holo. SING).

Creeping herb; stem shortly hairy when young, becoming woody towards base, 4-angled. *Leaves* opposite and equal; petioles 2.5–5cm; lamina elliptic to narrowly elliptic to oblanceolate, 14–25 × 5–8.5cm, acute, narrowly cuneate at base, shallowly crenate-serrate, hairy above when young becoming subglabrous, hairy below when young and remaining so on veins but lamina glabrescent; lateral vein pairs 9–12. *Inflorescences* at base of stem in subsessile cymes of 4 or more flowers. *Peduncles* to 5mm. *Pedicels* 0.5–1cm, hairy. *Bracts* small, lanceolate, hairy. *Calyx* c.15mm, outside with short stiff hair, inside with small papillae; tube c.8mm, lobes 3, with narrow lanceolate tips. *Corolla* c.4cm long (lobes not seen intact), white with yellow throat or cream with pink tinges on lobes, lower lobes protruding more than upper, outside with short hair, inside papillose. *Filaments* c.1cm. *Anthers* c.2mm. *Gynoecium* c.2.2cm, ovary papillose/verrucose with collar of hair at tip, style with short hair, stigma bilobed. *Disk* c.3mm, cupular, margin irregular. *Fruit* c.1 × 0.4cm, narrowly elliptic, verrucose, slightly hairy at tip (remains of collar of hair at tip of young ovary).

Etymology. From Latin *lanceolatus* (=lanceolate), referring to the leaf shape.

Ecology. Lowland (and hill?) forest; 'among quartzitic rocks by stream' (*Corner* SFN30651).

Distribution. Endemic to Peninsular Malaysia, Johore, Gunung Panti and Sungai Linggui (Fig. 6).

Specimens examined. PENINSULAR MALAYSIA. Johore, Ulu Segun, Gunung Panti, [500ft] 150m, 2 ii 1936, *Corner* SFN30651 (SING); Johore, Ulu Segun, Gunung Panti, 10 iv 1936,

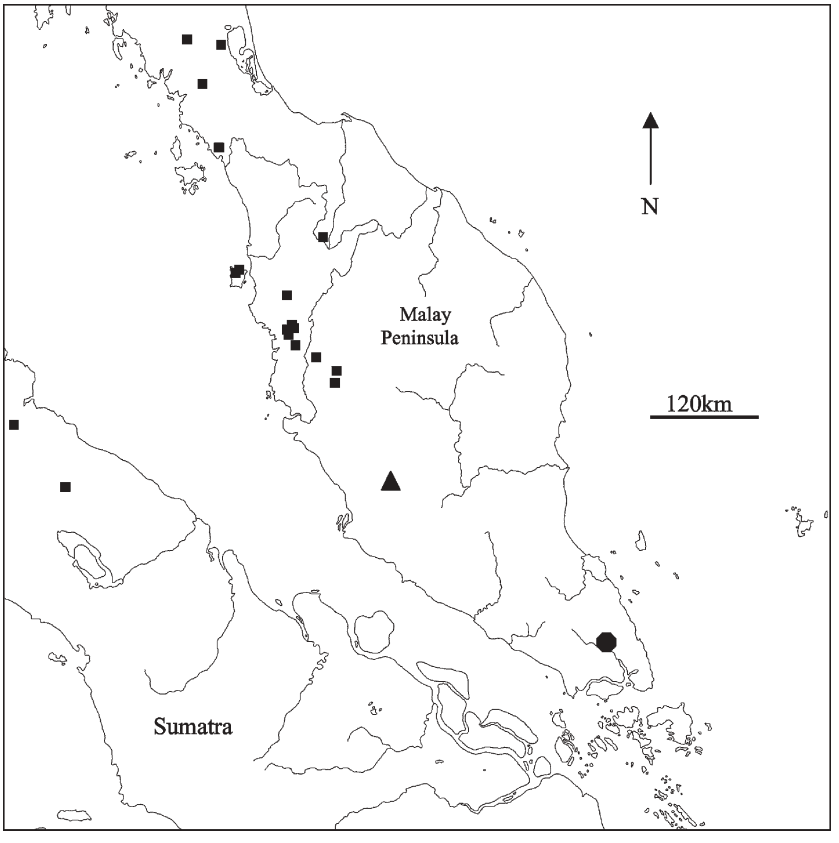

FIG. 6. Distribution map of *Cyrtandra lanceolata* Ridl. (●), *C. stonei* B.L. Burtt (▲) and *C. dispar* DC. (■).

Corner s.n. (SING); Johore, Sungai Linggui, *Tay, Shah & Ali* 91-00049 (SING); Johore, Sungai Linggui, *Tay, Shah & Ali* 91-00059 (SING).

Bract details are taken from Ridley (1896), as none were present on the specimens examined; the same applies to corolla colour. It must be noted that field notes on one specimen examined (*Corner* SFN30651) say that Ridley has the flower colour quite wrong. Corner describes the pedicels as rose red, the calyx as pink with reddish pink hairs, and the corolla tube as pale cream, the lower lobes flushed pink and the upper lobes faintly pink; these differences in corolla colour are included in the description above. In *Corner* SFN30651 the ovary has a collar of hairs at its tip, as do *C. cupulata* and *C. wallichii*, which Ridley did not mention in his original description.

Cyrtandra lanceolata is easily distinguished from other Peninsular Malaysian species because its flowers are at the base of the stem. It is allied to the Bornean *C. radiciflora* C.B. Clarke.

5. Cyrtandra pendula Blume, Bijdr. Fl. Ned. Ind. 770 (1826). Type: Indonesia, Java, *Blume* 2038c (holo. L). **Fig. 7.**
Syn. nov.: *Cyrtandra rotundifolia* Ridl., J. Straits Branch Roy. Asiatic Soc. 57: 76 (1910). Type: Perak, Temengoh, along Sungai Tampan, *Ridley* 14445 (BM, K, SING).

Herb to 60cm, creeping below; stem woody at base, but fleshier and red-brown hairy when young and around leaf axils. *Leaves* usually pseudoalternate (one in each pair reduced to a leafy scale), rarely subequal; petioles 8–20cm; lamina often with white barring above and purple below, narrowly to broadly ovate or elliptic, 13–23 × 7–15cm, shortly acuminate to acute, cuneate to rounded or cordate at base, crenate or crenate-serrate, glabrous or subglabrous above; lower veins with short dense hairs; lateral vein pairs 5–6. *Inflorescences* with up to 20 flowers. *Bracts* purple, warty, enclosing base of inflorescence. *Peduncle* green or purple, 2–20cm, deflexed from leaf axil, sometimes almost to ground. *Pedicels* to 3mm. *Calyx* purple, c.2cm, outside hairy, inside glabrous; tube c.13mm, sometimes bilobed, occasionally upper lobe bifid; lobes with ridges extending to form narrow lobe tips. *Corolla* yellowish white with purple spotting in throat, c.4cm, narrow within the calyx (for c.2cm), broader but somewhat flattened and oval at mouth; upper 2 lobes 7 × 7mm, lower 3 lobes 6 × 5mm; outside hairy, inside glabrous. *Filaments* c.1cm, glabrous,

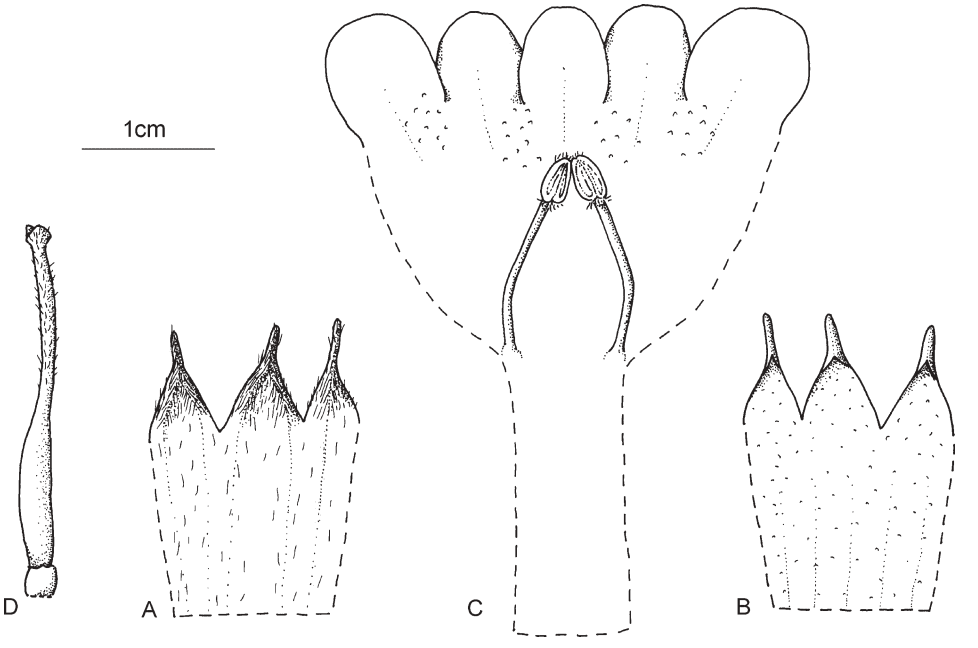

FIG. 7. *Cyrtandra pendula* Blume. A, calyx dissected ventrally, outer surface; B, calyx dissected ventrally, inner surface; C, corolla dissected dorsally, showing stamens; D, gynoecium and disk. Drawn from *Bramley et al.* GB37.

except for cluster of hairs at tip of connective. *Anthers* c.3mm, with cluster of hairs at tip and base. *Gynoecium* c.3cm, ovary glabrous, style with short hairs, stigma with 2 semioval lobes. *Disk* c.2mm, cupular. *Fruit* 1.5–2 × 0.4–0.5cm, very narrowly ovate, warty, style and calyx caducous.

Etymology. From Latin *pendulus* (=pendulous), referring to the down-curved peduncles, which are in fact stiff rather than truly pendulous.

Ecology. Common, mainly in lowland forest, often in marshy places and along streams, 0–800m.

Distribution. Peninsular Malaysia, Indonesia (Java, Sumatra), southern Thailand (Fig. 8).

Selection of specimens examined. PENINSULAR MALAYSIA. Pahang, Bentong Rd. nr Tranum, 11 viii 1939, *Addison* SFN37215 (K); Negeri Sembilan, Bukit Sutu, 29 x 1885, *Alvins* 1881 (SING); Pahang, foot of Gunung Raya, 13 vii 1924, *Best* 13857 (SING); Selangor, Awana Ecopark, 770m, 29 vii 2002, *Bramley et al*. GB37 (E, KEP, L); Perak, Gunung Pondok, 22 vi

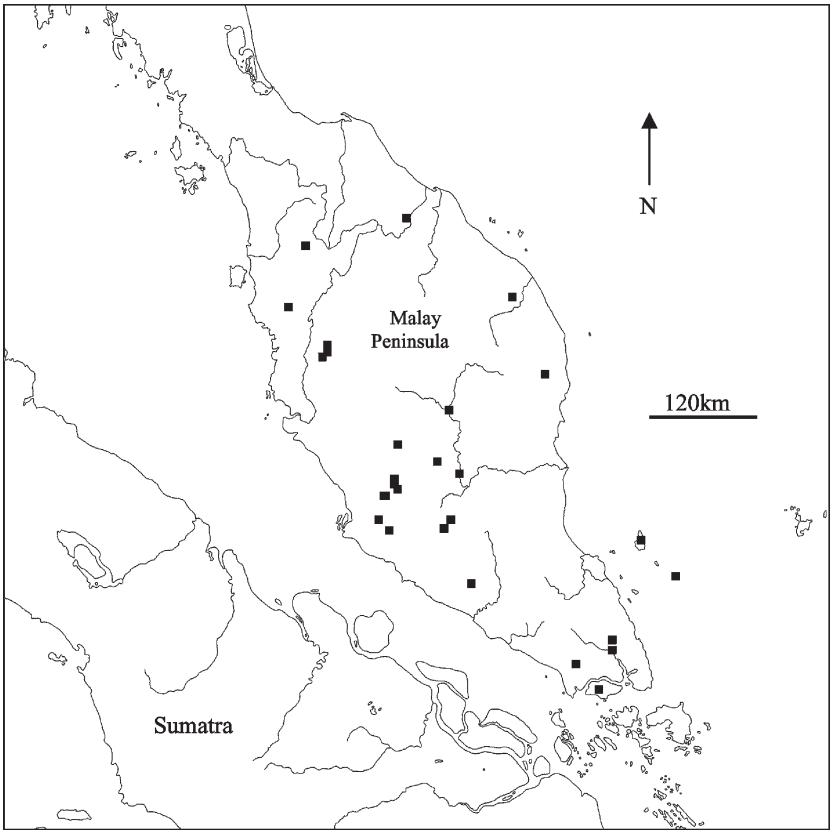

FIG. 8. Distribution map of *Cyrtandra pendula* Blume.

1924, *Burkill* SFN13913 (SING); Perak, nr Tanjong Rambutan, 4 vi 1930, *Henderson* SFN23769 (SING); Selangor, Ulu Gombak, 250m, 3 v 1968, *Mahmud* 813 (L); Pahang, Pulau Tioman, 18 viii 1889, *Ridley* s.n. (SING); Johore, Gunung Pulai, [800ft] 250m, 8 xii 1974, *Samsuri Ahmad* SA1043 (SING).

SINGAPORE. Bukit Timah, 1908, *Ridley* s.n. (BM); Bukit Timah, vi 1889, *Ridley* 67 (K).

THAILAND. Narathiwat, Waeng, 250m, 22 ix 1965, *GP & TS* 1209 [31530] (L); Phangnya, Khao Tala, 50m, 4 ii 1927, *Kerr* 11819 (BM); Pattani, Bannang Sata, 100m, 29 vii 1928, *Kerr* 7342 (BM).

Common throughout the Malay Peninsula, Sumatra and Java, and easily recognized by its glossy, green, long-petiolate leaves, sometimes attractively marked with white, and its inflorescences that trail, sometimes almost to the ground, on long peduncles. *Cyrtandra pendula* is a very variable species; because this variation is continuous among the 77 specimens examined it has not been possible to divide them into groups, as done for *C. cupulata* and *C. wallichii*. Lamina shape is particularly variable; most specimens have an ovate or narrow ovate lamina with a more or less rounded base, but the lamina can also be more elliptic with a cuneate base (*Samsuri* SA1043, SING), cordate (*Burkill* SFN13913, SING), or broadly ovate (almost round) with a rounded base (*GP & TS* 1209 [31530], L). Specimens also occur with different leaf bases on the same plant, for example *Best* 13857 (SING). Peduncle length is also variable and probably extends in fruit. There seems to be no correlation between peduncle length, shape of lamina and geography.

Ridley (1910) described *C. rotundifolia*, which he thought to be a close ally of *C. pendula*, differing in its rounder leaves and greater hairiness. Although specimens with rounder leaves do exist, there is no particular difference in hairiness, and they are found alongside more typical specimens. *Cyrtandra rotundifolia* is therefore not distinct and is here reduced to synonymy.

Cyrtandra pendula is one of the few species in the genus with a distribution spanning different islands. A detailed study throughout its range may identify some congruence between morphology and geography (Burtt, 2001).

6. Cyrtandra suffruticosa Ridl., Trans. Linn. Soc., ser. 2(3): 330 (1893). Type: Peninsular Malaysia, Pahang, Pulau Tioman, 19 viii 1889, *Ridley* s.n. (holo. SING). Syn. nov.: *Cyrtandra falcata* Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 89 (1905). Syntypes: Peninsular Malaysia, Selangor, Batu Cave Woods, *Ridley* 8219 (SING); Perak, *Wray* 2845 (SING), *Scortechini* 142b (SING).

Terrestrial or epiphytic shrub to c.1.5m; stems with fine short hair when young, glabrous and somewhat woody when mature. *Leaves* opposite, usually anisophyllous, sometimes $\pm$ equal at top of stem; major leaf on hairy petiole 1–3cm; lamina oblong to very narrowly elliptic, 16–27 $\times$ 3.7–8cm, acuminate, cuneate at base, asymmetric, entire, with scattered hair above, slightly hairier below with midrib and veins raised; lateral vein pairs 10–12; minor leaf sessile or petiole 1–1.5cm; lamina elliptic to narrowly elliptic, 3–7 $\times$ 1–4cm, apex acuminate, base cuneate, broadly so if

sessile, margins entire, hairy above and below. *Inflorescences* in leaf axils, shortly pedunculate, flowers up to c.6. *Bracts* paired, pale green with red streaks outside, dark red inside, 1.5–2cm, broadly ovate, entire, hairy. *Peduncles* 2–5mm. *Pedicels* 2–5mm. *Calyx* red, c.2mm, hairy outside, with small gland dots inside; tube c.1mm, with 5 small teeth. *Corolla* white with reddish blotches on upper lobes and 2 red stripes extending into throat on the 3 lower lobes, c.2.5cm, glabrous (Ridley, 1893) or shortly papillose in upper part (Burtt, 1999). *Filaments* not seen. *Anthers* not seen. *Gynoecium* c.1cm, ovary glabrous, style shortly hairy, stigma bilobed. *Disk* c.2mm, almost annular but lower on one side and free for c.0.5mm. *Fruit* green with white spots, c.1.5–2 × 0.5cm, sausage-shaped, warty, calyx persistent, style semipersistent.

Etymology. From Latin *suffruticosus* (=subshrubby, somewhat woody), referring to the habit.

Ecology. Lowland forest, often epiphytic on trees or growing on rocks.

Distribution. Perak, Terengganu, Johore, Pahang (Pulau Tioman) (Fig. 9).

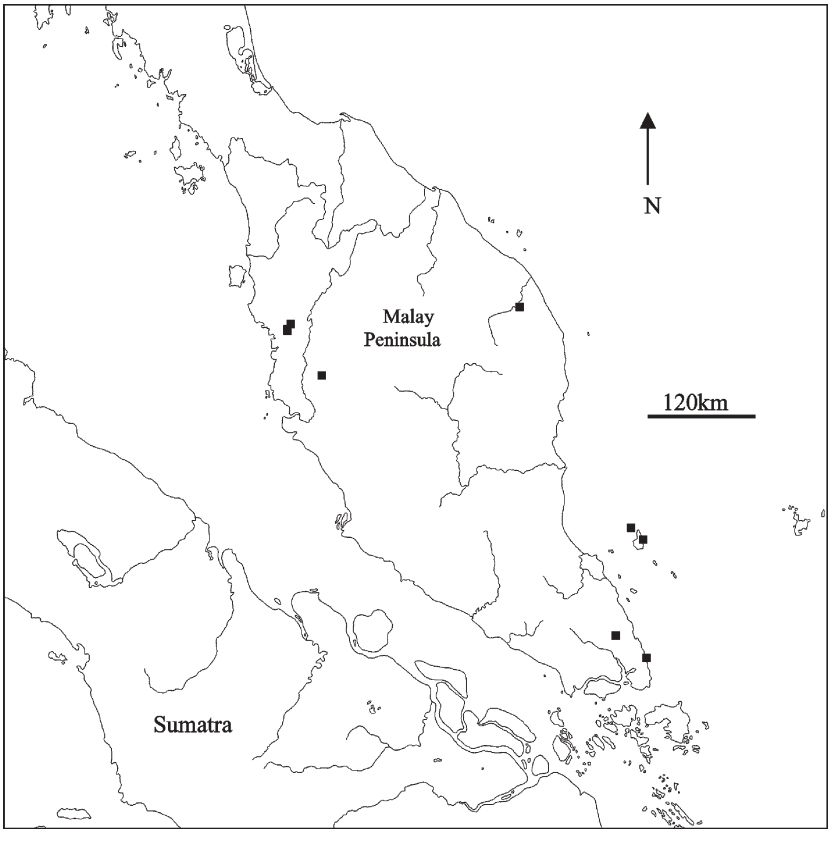

FIG. 9. Distribution map of *Cyrtandra suffruticosa* Ridl.

Specimens examined. PENINSULAR MALAYSIA. Pahang, Pulau Tioman, vi 1916, *Boden Kloss* s.n. (K); Pahang, Sungei Tawa, Java Bay, Pulau Tioman, 26 vi 1915, *Burkill* SFN1028 (BM, K, SING); Johore, Sedili River, xi 1932, *Corner* SFN28416 (SING); Johore, Sungei Berassau, 7 ii 1935, *Corner* SFN28961 (BM, K, SING); Johore, Sungai Sedili, 13 iv 1935, *Corner* SFN29267 (K, SING); Pahang, Pulau Tulai, 27 v 1927, *Henderson* 18511 (SING); Perak, Kota Bahru, viii 188?, *King's Collector* 569 (SING); Perak, Larut, viii 1883, *King's Collector* 4720 (SING); Terengganu, Ulu Brang, vii 1937, *Moysey & Kiah* SFN33655 (BM, K, SING); Perak, Larut, *Scortechini* s.n. (K); Perak, *Scortechini* 142b (SING); Terengganu, Ulu Terengganu, Sekayu waterfalls, 29 viii 1986, *Weber & Anthonysamy* 860829-1/14 (WU 5); Perak, Tupai, *Wray L Jr.* 2845 (SING).

Cyrtandra falcata is here reduced to synonymy. In his original description of *C. falcata*, Ridley (1905) cited *Wray* 2845 and *Scortechini* 142b. However, he also cited these under *C. suffruticosa*, which he had described earlier in 1893. Ridley stated that *C. falcata* is closely allied to *C. suffruticosa*, but has much narrower leaves. No material with consistently narrow leaves matching Ridley's description is discernible among the specimens cited above, which all match *C. suffruticosa*. Because no specimens of *C. falcata* have apparently been collected since it was described, it seems that the name *C. falcata* was applied to specimens with narrower leaves. However, when all the specimens are compared, it is clear that these narrower leaves fall within the variation of *C. suffruticosa*. No further characters have yet been found that distinguish *C. falcata*.

The corolla colour in the description above comes from the observations and photographs accompanying *Weber & Anthonysamy* 860829-1/14 and notes on *Henderson* SFN18511 and *King's Collector* 4720. Notes on *Burkill* SFN1028 are slightly different, describing brown markings on the upper lobes, and purple spotting in the throat. Ridley (1905) noted that Wray describes the inner corolla as dark claret, but this specimen has not been seen. Ridley described the corolla as glabrous, but according to Burtt (1999) and as found in this study, the corolla has short subpapillose hairs in the upper part, and is glabrous below.

Cyrtandra suffruticosa is allied to *C. oblongifolia* (Blume) C.B. Clarke, from Borneo, and belongs to section *Whitia* (Blume) C.B. Clarke, which is a west Malesian group of about 10 species (Burtt, 1999). It has a disjunct distribution, occurring in Pahang and Terengganu in the east, and Perak in the west, separated by the Main Range. It is recognizable by its oblong to very narrowly elliptic anisophyllous leaves, large wide ovate bracts, conspicuous flower colour and sausage-shaped fruits.

Corner SFN28416 is anomalous. Although similar to the other specimens, its leaves are elliptic and slightly broader (16–17 × 7–8cm) and the veins are much more closely packed (12 or 14 compared with 11 or 12 lateral vein pairs) and at a less acute angle.

7. Cyrtandra stonei B.L. Burtt, Edinburgh J. Bot. 47: 229 (1990). Type: Peninsular Malaysia, Pahang, Ulu Kali, path to Gunung Lari Tembakau, [5200ft] 1600m, 18 iii 1979, *Stone* 14051 (holo. KLU; iso. K, KEP, L [n.v.]). **Fig. 10.**

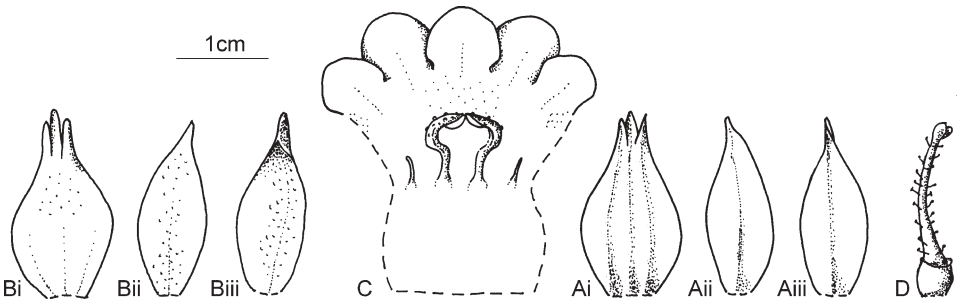

FIG. 10. *Cyrtandra stonei* B.L. Burtt. A, calyx outer surface (i, upper lobe; ii and iii, lower lobes); B, calyx inner surface (i, upper lobe; ii and iii, lower lobes); C, corolla dissected dorsally, showing stamens; D, gynoecium and disk. Drawn from *Bramley et al*. GB34.

Syn.: *Cyrtandra dispar* A. DC. var. *glabriflora* B.C. Stone, Malaysian Forester 43: 262 (1980). Type as above.

Subshrub, c.1–1.5m tall; stem 4-angled, fleshy, glabrous, becoming woody below. *Leaves* markedly anisophyllous; major leaf with petiole 3–4cm; lamina 15–22 × 5–7cm, narrowly elliptic to oblanceolate, acuminate, cuneate and asymmetric at base with wider side up to 1–2cm longer, very shallowly dentate, glabrous; lateral vein pairs 9–12; minor leaf 4–6 × 1.5–2cm, sessile, narrowly ovate to lanceolate, acute, very slightly dentate. *Inflorescences* axillary, more or less sessile, up to 8-flowered. *Bracts* 1–2cm, narrowly ovate to lanceolate, enclosing inflorescence and smaller bracteoles. *Pedicels* c.1cm. *Calyx* white, asymmetric; upper lip of 3 fused lobes, c.1.1cm, narrowly ovate, apex with three acuminate tips; lower 2 lobes c.1cm, divided to base, narrowly ovate; lobes with thickened central ridges outside, upper lobe with papillae on ridges, lower two glabrous; all lobes with scattered papillae inside. *Corolla* white, somewhat translucent, with yellow mark in throat, c.1.7cm long, tube narrow at base, constricted at c.5mm before broadening, all lobes 3.5–4 × 3.5–4mm; outside glabrous, inside with papillae below upper 2 lobes and in throat. *Filaments* c.5mm, glandular hairy especially near anthers. *Anthers* c.1mm. *Gynoecium* c.1cm, style with glandular hairs, stigma with 2 triangular lobes with pointed tips. *Disk* cupular, c.2mm high, margin uneven. *Fruit* ovate to globose, fleshy, green, 1.2–1.5 × 0.9cm with c.2mm apiculus remaining from otherwise caducous style, calyx semipersistent.

Etymology. Named after B.C. Stone (1933–94), a distinguished botanist who worked for many years at KLU.

Ecology. Montane forest, c.1700m, often in open and secondary vegetation.

Distribution. Peninsular Malaysia, endemic to Gunung Ulu Kali in Genting Highlands (Pahang) (Fig. 6).

Specimens examined. PENINSULAR MALAYSIA. Pahang, Rd. to Telekom, Gunung Ulu Kali, 1645m, 29 vii 2002, *Bramley et al*. GB34 (E, K, KEP, L); Pahang, Rd. from Ulu Kali to

Gunung Chin Chin, 6 v 1999, *Chua et al*. FRI40800 (KEP); Pahang, Bentong, Gunung Ulu Kali, 24 ix 1998, *Chua et al*. FRI40581 (KEP); *loc. cit*, 5 viii 1979, 1700m, *Weber & Vogel* 790805 (WU).

The only Peninsular Malaysian representative of section *Dissimiles* C.B. Clarke, which was originally described by Clarke (1883) and lectotypified by Burtt (1990). It is characterized by a zygomorphic calyx (upper lobes fused to form a single lobe, lower two divided to the base) and anisophyllous leaves.

Cyrtandra stonei has a very restricted distribution. It is easily recognizable in the herbarium because the upper surface of the leaf and the veins dry very dark, while the lower surface dries to a paler brown. The fruit is fleshier than the usual hard fruit of west Malesian *Cyrtandra*. In the field, the quadrangular stem is noticeable, as well as the glabrous leaves and the small translucent white corolla with bright yellow throat.

Cyrtandra stonei grows in areas quite unlike the other Peninsular Malaysian species, which inhabit damp and fairly dark areas in the rain forest. *Cyrtandra stonei* grows at higher altitude along the roadside in open vegetation, which includes *Musa* L. spp. and *Dicranopteris linearis* Burm.f.

8. Cyrtandra dispar DC., Prodr. 9: 282 (1845). Type: Peninsular Malaysia, Penang, *Wallich* list no. 807 (lecto. K [chosen here]; isolecto. BM, L, SING).
Syn.: *Cyrtandra frutescens* Wall., list no. 807 (1829), pro parte – non Jack.

Shrub 1–3m tall; stems shortly hairy when young, later with pale brown flaky bark. *Leaves* pseudodistichous, one of each pair reduced to a leaf-like scale; major leaf on petiole 1.5–3cm; lamina elliptic to narrowly elliptic or obovate, 18–40 × 5.5–15cm, asymmetric about midrib, acuminate, cuneate and asymmetric at base; margin biserrate, especially when young; glabrous to subglabrous above, below with red-brown hairs, denser on veins; all veins raised; lateral vein pairs 12–14. *Inflorescences* axillary, sessile, sometimes shortly pedunculate, with 4 or more flowers. *Bracts* clustered around pedicel base, 0.5–1 × 0.2cm, narrowly ovate to lanceolate, entire, red-brown hairy and warty on both surfaces. *Peduncles* (when present) less than 5mm long and with pale brown flaky bark as on stem. *Pedicels* 1–2cm long, hairy. *Calyx* green, 0.7–1.2cm long, shortly red-brown hairy outside, with small gland dots inside; tube 3–6mm, upper 3 lobes divided to c.3mm, lower 2 to c.4mm, all triangular with long fine tips (triangular in transverse section). *Corolla* white or pale pink with dark red to purple stripes in throat, 1–1.2cm, broadening towards mouth, upper 2 lobes 2 × 2mm, central of lower 3 lobes 3 × 3mm, outer two 2 × 2mm; hairy outside, glabrous inside. *Filaments* c.4mm, glabrous. *Anthers* c.1mm. *Gynoecium* c.1cm long, ovary with sparse short hair, style shortly hairy, stigma with two narrowly triangular lobes. *Disk* c.2.5mm, unilateral, margin dentate or undulate. *Fruit* green, ellipsoid, 1–1.3 × 0.3–0.5cm, warty; calyx and style persistent.

Etymology. From Latin *dispar* (=unequal), referring to the strongly unequal leaf pairs.

Ecology. Lowland and hill forest; 100–800(–1700)m.

Distribution. Peninsular Malaysia (Kelantan, Penang, Perak), southern Thailand; north and east Sumatra (Fig. 6).

Selection of specimens examined. PENINSULAR MALAYSIA. Penang, Government Hill, vii 1893, *Curtis* 1204 (SING); Perak, Gunung Bubu Forest Reserve, 570m, 15 viii 1966, *Hou* 633 (K, L, SING); Perak, 5¼ miles Maxwell Hill Rd., 29 x 1969, *Kochummen* FRI2881 (L, SING); Penang, Marriot's Rd., iii 1915, *Ridley* s.n. (K); Perak, Thaiping Hills, *Scortechini* 254b (SING); Perak, Gunung Keledang, 18 viii 1986, *Weber* 860818-2/2 (WU); Kelantan, Tanah Merah district, 23 iv 1987, *Weber* 870423-4/1 (WU).

THAILAND. Trang, Khao Chong, 350m, 13 vi 1974, *Geesink et al.* 7194 (K, L); Betong, Pattani, c.300m, 13 viii 1923, *Kerr* 7602 (BM, K).

Can be distinguished by its pale flaky bark and asymmetric, pseudodistichous, biserrate leaves. These features are characteristic of sect. *Dispares* C.B. Clarke, of which *C. dispar* is the only representative in Peninsular Malaysia. A closely allied species, *C. disparoides* from Borneo (Sarawak, Hose Mountains), was described by Burtt (1978). 'Almost certainly of this affinity' is *C. patula*, which differs in its habit and isophyllous leaves (Burtt, 1978: 165). *Cyrtandra dispar* appears to be confined to northwest Malaysia (Perak and Penang), south Thailand, and north and east Sumatra.

9. Cyrtandra patula Ridl., J. Straits Branch Roy. Asiat. Soc. 86: 303 (1922). Type: Peninsular Malaysia, Negeri Sembilan, Bukit Tangga, xii 1920, *Ridley* s.n. (holo. K, iso. SING). **Fig. 11.**

Spreading shrub to 3m; stems with orange-brown hair when young, becoming woody and mostly subglabrous; stem tips and areas around leaf axils remaining hairy. *Leaves* opposite and equal; petioles 2–3cm, often ridged at edge where lamina narrowed to form slight wing; lamina obovate, sometimes narrowly elliptic, 27–40 × 8–12cm, shortly acuminate, cuneate and narrowly decurrent at base, irregularly biserrate, densely silky hair above and below when young, less dense when mature except on raised midrib and lateral veins below that remain orange-brown

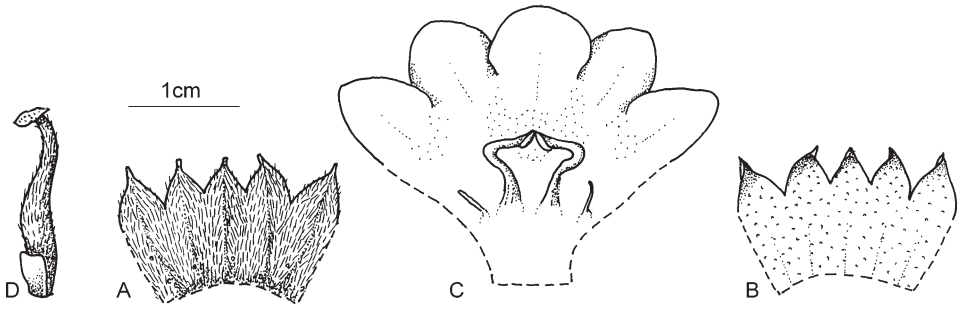

FIG. 11. *Cyrtandra patula* Ridl. A, calyx dissected ventrally, outer surface; B, calyx dissected ventrally, inner surface; C, corolla dissected dorsally, showing stamens; D, gynoecium and disk. Drawn from *Bramley et al.* GB36.

hairy; lateral vein pairs 11–14. *Inflorescences* in leaf axils, shortly pedunculate, with up to 13 flowers. *Bracts* 8–15 × 4–5mm, lanceolate to oblanceolate, entire, both surfaces hairy. *Peduncles* c.2mm. *Pedicels* 1–1.5cm. *Calyx* pale yellow-green, 7–9mm, hairy and somewhat warty around base outside, verrucose inside; tube c.5mm, upper 3 lobes c.2.5mm, lower 3 c.3.5mm, all lobes triangular with c.1mm thickened reflexed tips. *Corolla* off-white with brown mark in throat, c.16mm, lobes all 5 × 5mm; orange-brown silky hair outside, with papillae in upper part of throat inside. *Filaments* c.4mm, sometimes with a few hairs near base of anthers. *Anthers* c.1mm. *Gynoecium* c.12mm, ovary hairy, style with short hairs, stigma with two narrow triangular lobes with pointed tips. *Disk* c.2mm, unilateral, margin undulate. *Fruit* 10–12 × 3–5mm, sausage-shaped, hairy, warty, calyx and style persistent.

Etymology. From Latin *patulus* (=spread, outspread), probably referring to the spreading habit.

Ecology. In hill forest, 800–1000m, often in muddy wet places and by rocky streams.

Distribution. West Peninsular Malaysia and the far south of Thailand (Fig. 12).

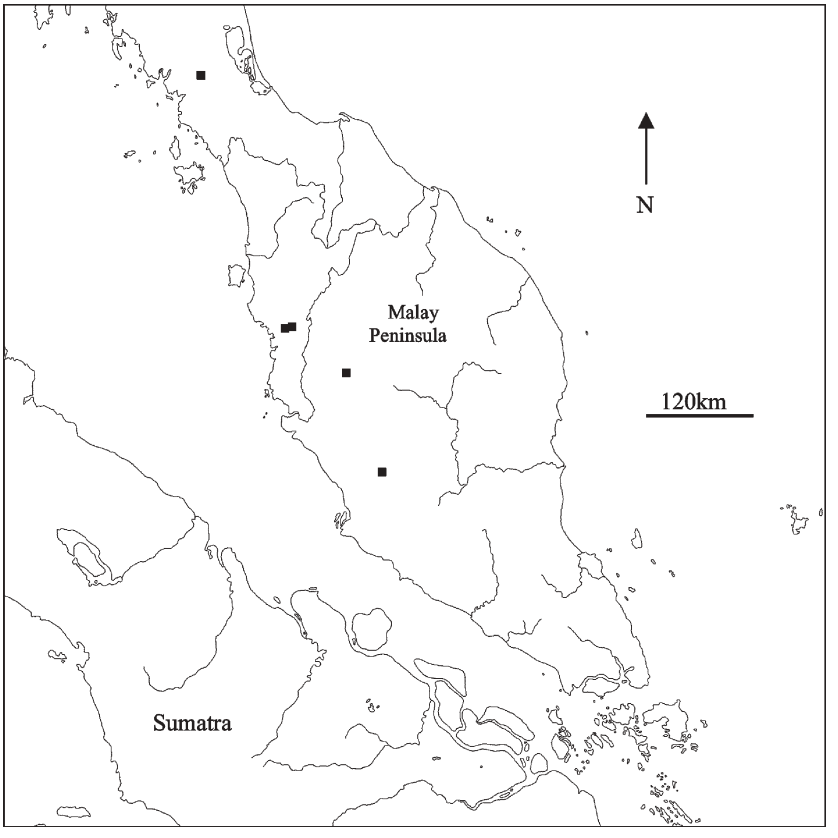

FIG. 12. Distribution map of *Cyrtandra patula* Ridl.

Selection of specimens examined. PENINSULAR MALAYSIA. Perak, Taiping Hills, iii 1911, *Anderson* 124 (SING); Selangor, Awana Ecopark, 770m, 29 vii 2002, *Bramley et al*. GB36 (E, KEP, K, L); Perak, Ulu Batang Padang, ix 1900, *Ridley* 13667 (SING); Perak, stream near 3rd mile below Maxwell's Hill post office, 16 ix 1949, *Sinclair & Kiah* SFN38772 (SING); Pahang, Ulu Batang Kali, [2500ft] 800m, 26 xi 1967, *Whitmore* FRI4553 (K, L, SING).
THAILAND. Surat Thani, Khao Nong, 8 viii 1927, *Kerr* 13223 (BM).

Likely to be closely related to *C. dispar*, based on similarities in leaf and flower form, although it does not have such a wide distribution. It has been rarely collected and often misidentified as *C. dispar*, but it can easily be recognized by its equal pairs of large biserrate leaves, as opposed to the pseudodistichous ones of *C. dispar*, and its much broader calyx lobes. In addition, *C. patula* has a smooth woody stem, compared with the flaky bark of *C. dispar*.

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APPENDIX

LEAF ANATOMY OF THE MALAYSIAN SPECIES OF *CYRTANDRA*

M. H. BOKHARI

The presence, diversity and taxonomic significance of foliar sclereids in *Cyrtandra* has been described by Bokhari & Burtt (1970) and Burtt & Bokhari (1973) for species from Borneo, New Guinea and the Pacific. The results presented here are based on work done at the Royal Botanic Garden Edinburgh in 1998. This investigation used mainly the collections of the second author (AW) and covers all but one species from Peninsular Malaysia. The exception is *C. lanceolata*, for which no material could be obtained. In addition to the anatomical descriptions, a key based on leaf anatomy is presented. The key is designed to enable the

identification of most species from leaf fragments and complements the morphological keys given above.

Key

1a. Sclereids present in lamina — 2
1b. Sclereids absent in lamina — 4

2a. Osteosclereids present in hypodermis — 3
2b. Osteosclereids not present in hypodermis in mesophyll — **C. pendula**

3a. Hypodermis 1- or 2-layered; osteosclereids of different lengths — **C. wallichii**
3b. Hypodermis 3- or 4-layered; osteosclereids of uniform length — **C. gimlettei**

4a. Hypodermis 2-layered — 5
4b. Hypodermis 1-layered — 6

5a. Palisade of closely packed narrow cells; spongy mesophyll 9 or 10 cells thick — **C. stonei**
5b. Palisade of indistinct isodiametric cells; spongy mesophyll less than 9 cells thick — **C. suffruticosa**

6a. Palisade 2- or 3-layered; spongy mesophyll 2 cells thick — **C. cupulata**
6b. Palisade 1-layered; spongy mesophyll more than 3 cells thick — 7

7a. Hypodermal cells 3 times larger than upper epidermal cells, stomatal turrets well developed — **C. dispar**
7b. Hypodermal cells half the size of upper epidermal cells, stomatal turrets not well developed — **C. patula**

Descriptions based on transverse sections of leaf lamina

Cyrtandra cupulata (*Weber* 870720, WU)

Hypodermis 1-layered, of large cells about 3 times larger than upper epidermal cells.
Palisade of 2 or 3 layers.
Spongy mesophyll of only 2 layers.
Stomatal turrets absent.
Druses and *sclereids* absent.

C. dispar (*Weber* 86018-2/2, WU)

Hypodermis 1-layered, of large cells about 2 times larger than upper epidermal cells.
Palisade of 1 compact layer.
Spongy mesophyll 5- or 6-layered.
Stomatal turrets well developed.
Druses and *sclereids* absent.

C. gimlettei (*Ridley* 2199, K)

Hypodermis 3- or 4-layered, with osteosclereids.
Palisade cells with spaces due to them being broader above and ± narrow below.
Spongy mesophyll with short-armed astrosclereids.
Stomatal turrets absent.
Druses absent.

C. patula (*Weber* 840806-2/3, WU)

Hypodermis 1-layered.
Palisade of 1 compact layer of cells.
Spongy mesophyll 6–8 layers.
Stomatal turrets somewhat developed.
Druses and *sclereids* absent.

C. pendula (*Weber* 840762-2/4, WU)

Upper epidermis papillose.
Hypodermis 1- or 2-layered.
Palisade cells narrow compactly arranged.
Spongy mesophyll with long-armed astrosclereids.
Stomatal turrets absent.
Druses absent.

C. stonei (*Weber* 790805, WU)

Hypodermis 2-layered.
Palisade of closely packed cells.
Spongy mesophyll 9 or 10 cells thick.
Stomatal turrets absent.
Druses and *sclereids* absent.

C. suffruticosa (*Weber* 260892-1/4, WU)

Epidermis shortly papillose.
Hypodermis 2-layered.
Palisade of isodiametric cells, not compactly arranged.
Spongy mesophyll less than 9 cells thick.
Stomatal turrets absent.
Druses and *sclereids* absent.

C. wallichii (*Weber* 80615-1/4, WU)

Hypodermis 1- or 2-layered with long and short osteosclereids.
Palisade of narrow compact cells.
Spongy mesophyll with long-armed astrosclereids scattered throughout.
Stomatal turrets absent.
Druses absent.

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