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THE GARDENS’ BULLETIN, SINGAPORE

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Persson, C. (2000). Phylogeny of Gardenieae (Rubiaceae) based on chloroplast DNA sequences from the *rps* 16 intron and *trnL*(UAA)-F(GAA) intergenic spacer. *Nordic J. Bot.* 20: 257–269.

Ridley, H.N. (1930). *The Dispersal of Plants Throughout the World*. Ashford, U.K.: L. Reeve.

Smith, A.C. & Darwin, S.P. (1988). Rubiaceae. In: Smith, A.C. (ed) *Flora Viliensis Nova, A New Flora of Fiji* 4: 143–193.

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Ornithoboea parishii C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 148 (1883).

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Front cover picture: *Aeschynanthus speciosus* (Photo by J. Leong-Škorničková)

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1 Cluny Road
Singapore 259569

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A revision of *Aeschynanthus* (Gesneriaceae) in Singapore and Peninsular Malaysia

D.J. Middleton

Herbarium, Singapore Botanic Gardens, National Parks Board,
1 Cluny Road, Singapore 259569
david_middleton@nparks.gov.sg

ABSTRACT. The genus *Aeschynanthus* Jack is revised for Singapore and Peninsular Malaysia. Four species for Singapore and fourteen species for Peninsular Malaysia are recognised, keys to the species are given, all names are typified, and detailed descriptions of all species are provided. Conservation assessments are provided for all species. Eleven names are lectotypified here and one epitype is designated.

Keywords. Conservation assessments, Didymocarpoideae, identification key, lectotypifications

Introduction

Aeschynanthus Jack is a large and variable genus with around 160 species from Sri Lanka and India through southern China and Southeast Asia to New Guinea and the Solomon Islands (Weber, 2004; Middleton, 2007). The last complete account of the genus was by Clarke (1883) who included 64 species. More recently, regional revisions have been published for China (Wang et al., 1998), Thailand (Middleton, 2007), Cambodia, Laos and Vietnam (Middleton, 2009), and India (Bhattacharyya & Goel, 2015). Checklists have been published for Singapore (Turner, 1993; Chong et al., 2009), Peninsular Malaysia (Turner, 1997), Myanmar (Kress et al., 2003), Sulawesi (Mendum & Atkins, 2003), and Sumatra (Tjitrosoedirdjo et al., 2009). Several of these checklists are now rather out-of-date due to the discovery of new species and/or due to the synonymisation of names.

A general background to research on *Aeschynanthus* was given in Middleton (2007). For Singapore and Peninsular Malaysia the last comprehensive treatment was by Ridley (1923), in which 14 species of *Aeschynanthus* for the Malay Peninsula were recognised. The checklists for Singapore (Turner, 1993; Chong et al., 2009) both included four native species; the checklist for Peninsular Malaysia (Turner, 1997) included 17 species (one with two varieties).

In preparation for a revision of Gesneriaceae for the *Flora of Peninsular Malaysia* the genus has been revised for Peninsular Malaysia and for neighbouring Singapore. Fourteen species are recognised. All fourteen species are in Peninsular Malaysia and four of these are also in Singapore. One of the species in Singapore is presumed extinct there and the other three are considered Critically Endangered (Chong et al., 2009; Williams, 2014).

An infrageneric classification is not followed in this paper pending a more thorough investigation of the genus using molecular sequence data to compare the morphological characters. A preliminary study by Denduangboripant et al. (2001) found that a phylogeny based on ITS data did not reveal monophyletic clades that corresponded to the existing sections.

All provisional IUCN Conservation Assessments given here, calculated using the methodology of IUCN (2012), are for the species throughout their range rather than only for Peninsular Malaysia and/or Singapore. Additional comments are given under each species when the local situation differs from the global.

Morphological Characters

A more detailed discussion of morphological characters is given in Middleton (2007) and references given therein. Here is a brief discussion of the range of characters found in the species in Singapore and Peninsular Malaysia.

All species are epiphytes or occasionally lithophytes. Species such as *Aeschynanthus speciosus* Hook., *A. fulgens* Wall. ex R.Br. and *A. rhododendron* Ridl. are large with robust stems that arch or hang due to their own weight. Others such as *Aeschynanthus albidus* (Blume) Steud., *A. angustifolius* (Blume) Steud., *A. fecundus* P.Woods, *A. longicaulis* Wall. ex R.Br., *A. longiflorus* (Blume) A.DC., *A. obconicus* C.B.Clarke in A.DC. & C.DC. and *A. wallichii* R.Br. are generally more delicate and are more pendulous, although usually not loosely hanging (as, for example, is found in *A. gracilis* Parish ex C.B.Clarke from Thailand to NE India). *Aeschynanthus dischidioides* (Ridl.) D.J.Middleton has often been reported as growing from ants' nests in trees. *Aeschynanthus pulcher* (Blume) G.Don, *A. radicans* Jack and probably *A. volubilis* Jack either have the habit of the more delicate species previously mentioned, sometimes with long pendent stems, or creep over tree trunks and branches or rocks, rooting at the nodes. The erect habit of species such as *Aeschynanthus andersonii* C.B.Clarke and *A. humilis* Hemsl. from Thailand is not found in Singapore or Peninsular Malaysia.

The leaves of most species are opposite but are always in whorls of three or more in *Aeschynanthus speciosus* and *A. angustifolius*. In *Aeschynanthus angustifolius* the leaf blades are extraordinarily variable in shape (see discussion under that species). In the other species the leaves are generally ovate to elliptic and not particularly variable in shape and size. In most species the margins are entire but they are distinctly toothed in *Aeschynanthus dischidioides*, sometimes slightly so in *A. angustifolius*, and strongly undulate in *A. speciosus*. All species are shortly petiolate and the blades are mostly coriaceous, more rarely thinner and softer.

The structure of the inflorescence is discussed in Middleton (2007) and references therein. In Singapore and Peninsular Malaysia all species either lack a peduncle or the peduncle is so short as to appear absent. The flowers are, therefore, either axillary and solitary, axillary and appearing fasciculate, or subterminal and clustered. In all species in Singapore and Peninsular Malaysia the bracts are fairly small, simple and linear.

The calyx consists of five lobes free to the base (*Aeschynanthus angustifolius*,

A. dischidioides, *A. fecundus*, *A. longicaulis*, *A. longiflorus* and *A. speciosus*), or a very short tube with five long lobes (*A. albidus*), or of a narrow or somewhat widening tube that is around half or more of the length of the calyx with either obvious or obscure lobes at margin (*A. fulgens*, *A. pulcher*, *A. radicans*, *A. rhododendron* and *A. volubilis*), or of an open cup-shaped calyx with obscure lobes at the margin (*A. obconicus* and *A. wallichii*). The colour of the calyx can either be quite fixed within a species (it always appears to be red in *A. obconicus* for example) or very variable within a species (dark purple or red to green in *A. pulcher* for example). The calyx shape and size is very variable in a number of species.

The corolla is zygomorphic, tubular, and weakly to quite strongly curved. The limb is 2-lipped with the upper lip 2-lobed and the lower lip 3-lobed. Visitation by animals has not been observed in most species but pollination is assumed to be by birds for most, possibly all, species (see Middleton (2007) for further discussion). The corolla is red, orange, yellow or green, or a combination of these colours, in the species in Singapore and Peninsular Malaysia. Flower colour is highly diagnostic for most species although is often very subjectively recorded on herbarium specimen labels when it is described at all.

All *Aeschynanthus* species are strongly protandrous with the stamens withering as the style elongates and the stigma enlarges. There are four stamens in two pairs with the anthers of each pair fused at their tips. In Singapore and Peninsular Malaysia no species have all four anthers fused together as is found in *Aeschynanthus chiritoides* C.B. Clarke from Vietnam to NE India. The gynoecium consists of the stipe, the ovary, the style and the stigma. The stipe is short in all species but rather longer in *Aeschynanthus rhododendron*. The dimensions given in the descriptions below reflect the measurements made on specimens to hand. It should be borne in mind though that the absolute and relative lengths of the parts of the gynoecium are enormously variable depending on the age of the flower.

The fruit is a long and narrow capsule in all species. Dehiscence is loculicidal. The basal portion of the capsule, the stipe of the unfertilised gynoecium, lacks seeds and is generally short except in *Aeschynanthus rhododendron* where it forms an obvious narrow stalk.

The seeds have been the principal source of characters for earlier infrageneric classifications of *Aeschynanthus* (see Middleton (2007) and references cited therein). The seeds of *Aeschynanthus* species consist of the seed grain, one apical appendage and one or more hilar appendages. Seeds with two hilar appendages are not found anywhere in Malesia (Mendum et al., 2001). The apical appendage points towards the base of the capsule. In Singapore and Peninsular Malaysia there is one hilar appendage in *Aeschynanthus angustifolius*, *A. fulgens*, *A. longiflorus*, *A. obconicus*, *A. pulcher*, *A. radicans*, *A. rhododendron*, *A. speciosus*, *A. volubilis* and *A. wallichii* and three or more hilar appendages in *A. albidus*, *A. dischidioides*, *A. fecundus* and *A. longicaulis*. Of those with only one hilar appendage, the appendage is long and filiform in all species except *Aeschynanthus rhododendron* where it is short and stout. In a number of species there is a curious cluster of inflated cells, termed bubble cells, at the hilar end of the seed. These are found in *A. obconicus*, *A. pulcher*, *A. radicans*, *A. volubilis* and *A. wallichii*.

Materials studied

Herbarium material was studied from the following herbaria: A, AAU, BISH, BKF, BM, C, CGE, E, FI, G, G-DC, K, KEP, KLU, K-W, L, LAE, M, MEL, MICH, NY, P, PSU, SING, SINU, TI, U, UKMB, US (herbarium codes from Thiers (continuously updated)). All specimens cited have been seen unless otherwise indicated with *nv*. A single standardised name is given for those collectors whose name appears in more than one form, including when abbreviated to initials, on different collections.

The dimensions given in the descriptions are for dried material for vegetative characters and rehydrated or fresh material for floral characters. Dimensions given closely resemble those given in Middleton (2007) for some of the taxa due to the paucity of material collected since and because Malaysian material was used in the Thai descriptions when the Thai material was insufficient (as it was for several taxa).

The vegetation types given in the Habitat and Ecology sections below follow notes on the specimens and observations in the field using the vegetation classification of Saw (2010).

Aeschynanthus Jack

Trans. Linn. Soc. London 14: 42 (1823); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 18 (1883); Ridley, Fl. Malay Penins. 2: 496 (1923); Wang, Fl. Reipubl. Popularis Sin. 69: 498 (1990); Middleton, Edinburgh J. Botany 64: 368 (2007); Middleton, Edinburgh J. Botany 66: 393 (2009). – TYPE: *Aeschynanthus volubilis* Jack.

Trichosporum D.Don, Edinburgh Philos. J. 7: 82 (1822), nom. rej; Blume, Bijdr. Fl. Ned. Ind. (1826). – TYPE: *Trichosporum parviflorum* D.Don (= *Aeschynanthus parviflorus* (D.Don) Spreng.), lectotype designated by Middleton (2007).

Rheizophyllum Hassk., Flora 25 (2): beibl. 56 (1842). – TYPE: *Rheizophyllum subverticillatum* Hassk. (= *Aeschynanthus angustifolius* (Blume) Steud.).

Oxychlamys Schltr., Bot. Jahrb. Syst. 58: 286 (1923). – TYPE: *Oxychlamys pullei* Schltr. (= *Aeschynanthus oxychlamys* Mendum)

Euthamnus Schltr., Bot. Jahrb. Syst. 58: 284 (1923). – TYPE: *Euthamnus papuanus* Schltr. (= *Aeschynanthus papuanus* (Schltr.) B.L.Burtt)

Micraeschynanthus Ridl., Fl. Malay Penin. 5: 324 (1925). – TYPE: *Micraeschynanthus dischidioides* Ridl. (= *Aeschynanthus dischidioides* (Ridl.) D.J.Middleton)

Epiphytic herbs or subshrubs with erect, arching or pendulous stems, these sometimes rooting along their lengths when in contact with a suitable substrate. **Leaves** opposite or verticillate, pedicellate; blades coriaceous to distinctly fleshy, more rarely herbaceous,

simple, margins entire to weakly crenate or weakly dentate, sometimes somewhat undulate, venation pinnate but more often than not obscure. **Inflorescence** an axillary few-flowered cyme, or flowers solitary in the axils of leaves, or a pseudoterminal cluster. **Flowers** strongly protandrous. **Calyx** of 5 sepals, these free or variously fused into a tube for part or most of length, when fused the whole tubular or cup-shaped. **Corolla** zygomorphic, tubular, widening towards lobes, curved to various degrees, sometimes distinctly inflated at the base, glabrous to variously pubescent outside and inside; with 5 lobes, these consisting of a 2-lobed upper lip, 2 lateral lobes and a lower lobe; very variable in colour but most frequently red, orange, yellow or green (or combination of these) and then often with other darker or lighter patterning. **Stamens** 4, in 2 pairs, attached to the inside of the corolla tube and occupying the space in the upper curve of the flowers, included or exerted from corolla tube when mature; vestigial staminode present; anthers of each pair attached by their apices (occasionally all 4 attached together outside this region). **Disk** present, annular to dentate. **Pistil** developing as filaments wither and reflex downwards and also occupying the space in the upper curve of the corolla tube, consisting of a sterile stipe at the base, the fertile ovary section, the style and the peltate stigma; ovules many, anatropous. **Fruit** a long narrow capsule which opens loculicidally by two valves. **Seeds** many, tiny, with short to long appendages at both ends.

About 160 species from India and southern China through Southeast Asia and Malesia to the Solomon Islands. Fourteen species in Peninsular Malaysia, four species in Singapore (of which one is considered to be nationally extinct).

Key to *Aeschynanthus* species recorded from Singapore

- 1a. Corolla predominantly green or yellowish, inside with coarse multicellular hairs; seeds with many hairs at one end ..... 1. *A. albidus*
- 1b. Corolla red, inside without coarse multicellular hairs; seeds with only 1 hair at each end 2
- 2a. Calyx < 7 mm long, in a wide and shallow cup or saucer, much wider at apex than at base ..... 14. *A. wallichii*
- 2b. Calyx > 10 mm long, tube mostly parallel to corolla tube, apex not much wider than base 3
- 3a. Ovary, stipe and style densely pubescent; leaves pubescent beneath ..... 10. *A. radicans*
- 3b. Ovary with sessile glands, only stipe and style pubescent; leaves usually glabrous, more rarely sparsely pubescent beneath ..... 9. *A. pulcher*

Key to *Aeschynanthus* species recorded from Peninsular Malaysia

- 1a. Leaves in whorls of 3 or more 2
- 1b. Leaves opposite 3

- 2a. Corolla predominantly green to yellow, 18–25 mm long; leaves extremely variable from ovate to linear, 1.7–43 times as long as wide ..... 2. *A. angustifolius*
- 2b. Corolla predominantly red and orange, 54–118 mm long; leaves ovate to elliptic, never linear, 2.3–6.1 times as long as wide ..... 12. *A. speciosus*

- 3a. Inside of corolla tube with dense multicellular hairs towards base, often in tufts; leaves sometimes conspicuously variegated; corolla at least in part green, yellow or yellowish green; seeds with > 2 hairs at hilar end 4
- 3b. Inside of corolla tube without dense multicellular hairs towards base; leaves not conspicuously variegated; corolla entirely red or orange, red/orange and yellow, or a combination of colours but never green; seeds with 1 hair at hilar end 7

- 4a. Calyx fused into a short tube at base ..... 1. *A. albidus*
- 4b. Calyx lobes free to base 5

- 5a. Leaves not variegated, 1–2.4 times as long as wide, margin often distinctly dentate ..... 3. *A. dischidioides*
- 5b. Leaves variegated, 1.7–9 times as long as wide, margin entire or very minutely and obscurely dentate 6

- 6a. Corolla predominantly green, 20.5–31 mm long; stamens exserted from corolla tube ..... 7. *A. longicaulis*
- 6b. Corolla red in upper third and on lobes, 14.5–19 mm long; stamens not exserted from corolla tube ..... 4. *A. fecundus*

- 7a. Calyx lobes free to base ..... 6. *A. longiflorus*
- 7b. Calyx fused into a tube for part or most of length 8

- 8a. Calyx in a wide cup, very much wider at apex than at base, lobes often barely discernable but if obvious then much wider than long; seeds with bubble cells 9
- 8b. Calyx tube clasping corolla tube or only gently flaring from base, lobes usually easily discernable, either wider than long or longer than wide; seeds with or without bubble cells 10

- 9a. Calyx red, 8–19 mm long ..... 8. *A. obconicus*
- 9b. Calyx green, 2.5–6.5 mm long ..... 14. *A. wallichii*

- 10a. Calyx lobes usually longer than wide, apex acute to acuminate (tips of lobes sometimes rounded); seeds without bubble cells 11
- 10b. Calyx lobes usually wider than long, apex rounded; seeds with bubble cells ... 12

- 11a. Stamens not or barely exerted from corolla tube; corolla lobes spreading or reflexed ..... 11. *A. rhododendron*
- 11b. Stamens strongly exerted from corolla tube; corolla lobes not reflexed, occasionally slightly spreading ..... 5. *A. fulgens*

- 12a. Corolla 19.5–27 mm long ..... 13. *A. volubilis*
- 12b. Corolla 42–66 mm long 13

- 13a. Ovary, stipe and style densely pubescent; leaves sparsely to densely puberulent beneath ..... 10. *A. radicans*
- 13b. Ovary with sessile glands, only stipe and style pubescent; leaves usually glabrous, more rarely sparsely puberulent beneath ..... 9. *A. pulcher*

1. *Aeschynanthus albidus* (Blume) Steud., Nomencl. Bot. ed. 2 1: 32 (1840); A.DC., Prod. 9: 262 (1845); Bakhuizen van den Brink, Blumea 6: 395 (1950); Backer & Bakhuizen van den Brink, Fl. Java 2: 523 (1965); Burt & Woods, Notes Roy. Bot. Gard. Edinburgh 33: 479 (1975); Turner, Gard. Bull. Singapore 47: 243 (1997 [‘1995’]); Lok & Tan, Nat. Singapore 1: 5 (2008). – *Bignonia albida* Blume, Verh. Batav. Genootsch. Kunsten 9: 195 (1823). – *Trichosporum albidum* (Blume) Nees, Flora 8: 144 (1825). – *Lysionotus albidus* (Blume) Blume, Bijdr. Fl. Ned. Ind. 765 (1826). – *Aeschynanthus purpurascens* Hassk., Cat. Hort. Bot. Bogor. 154 (1844), nom. illegit; Hooker, Bot. Mag. 72: T.4236 (1846); Miquel, Fl. Ned. Ind. 2: 717 (1858); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 37 (1883); Ridley, Fl. Mal. Pen. 2: 497 (1923); Henderson, Malay. Wild. Fl. Dicot. 340 (1959); Turner, Gard. Bull. Singapore 45: 92 (1993). – TYPE: Indonesia, Java, Jawa Barat, Gunung Salak, *Blume, C.L. s.n.* (lectotype L [L0003309], designated here). (Fig. 1, 2)

?*Aeschynanthus atropurpureus* Van Houtte, Hort. Vanhoutte. 1(2): 42 (1846); Miquel, Fl. Ned. Ind. 2: 718 (1858). – TYPE: Not known. No original material known but Miquel’s later description is specific enough to identify the taxon and it has long been placed in synonymy of *Aeschynanthus albidus* by other authors.

Aeschynanthus discolor T. Moore, Paxton’s Fl. Gard. 3: 55 (1852). – TYPE: Not found. Synonymy based on detailed description given in protologue.

Aeschynanthus motleyi C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 20 (1883); Ridley, J. Linn. Soc. Bot. 32: 500 (1896); Ridley, J. Straits Branch Roy. Asiat. Soc. 44: 12 (1905); Ridley, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2): 732 (1909). – *Trichosporum motleyi* (C.B. Clarke) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE:

Indonesia, Kalimantan, Kalimantan Selatan, Banjarmasin, *Motley, J. 916* (lectotype K [K000831891], effectively designated by Burt & Woods (1975)).

Aeschynanthus motleyi var. *sumatrensis* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 20 (1883). – TYPE: Indonesia, Sumatra, Sumatera Barat, Padang, Ayer Mancior, *Beccari, O. 823* (lectotype K [K000831892], designated here; isoelectotypes BM [BM000537118], FI [FI013073], K [K000831893], L [L0281671], MEL).

Aeschynanthus fraserianus Kraenzl., J. Linn. Soc. Bot. 37: 284 (1906). – *Trichosporum fraserianum* (Kraenzl.) Merr., J. Straits Branch Roy. Asiat. Soc. special number: 530 (1921). – TYPE: Indonesia, Kalimantan, Marisinsing, *Fraser 268* (holotype K [K000831890]).

Epiphyte with stems upright, arching or pendulous; stems green flushed purple, glabrous. **Leaves** opposite; petiole 3–13 mm long, purple, glabrous; blade slightly fleshy or coriaceous, obovate, elliptic or ovate, above green and sometimes with paler green or yellow mottling, beneath green with purple-red mottling or completely purple-red, $2.3\text{--}13.7 \times 1.1\text{--}5.5$ cm, 1.5–9.4 times as long as wide, apex acuminate, base rounded to cuneate, glabrous above and beneath, margin very weakly crenate, c. 3 pairs of secondary veins, obscure or weakly visible, tertiary venation obscure. **Inflorescence** subterminal or axillary, 1–5-flowered; peduncle c. 1 mm long; pedicels 7–10 mm long, glabrous. **Calyx** with a short tube at base, lobes free, tube clasping corolla tube at base, often slightly narrower at apex, green, green flushed with purple or red or entirely reddish, glabrous or sparsely eglandular puberulent, total length 14–30 mm long; tube 2–8.5 mm long which is 14–39% of total length, 3–6.5 mm wide at top of tube; lobes linear or narrowly triangular, slightly spreading or erect, $10.5\text{--}22 \times 1\text{--}3.5$ mm, apex acuminate. **Corolla** 16–29 mm long, tube broad at base, slightly curved, externally green or greenish yellow, lobes green or green with faint purple central lines, internally green, lobes green with red speckling or with dark purple chevrons and lines; upper lobes orbicular, not spreading or reflexed, $2.2\text{--}3.1 \times 2.6\text{--}3.5$ mm, sinus 2.5–3 mm deep, apex rounded; lateral lobes orbicular, slightly spreading or not, $2.1\text{--}2.9 \times 2.9\text{--}4.5$ mm, apex rounded; lower lobe ovate or orbicular, slightly spreading, $2.7\text{--}3.5 \times 2.5\text{--}2.8$ mm, apex rounded; glabrous except for ciliate lobes, inside with five tufts of multicellular hairs near base, sometimes with some additional multicellular hairs higher up, sessile glands present at top of tube. **Stamens** long exserted, fused in 2 pairs; filaments cream or green, glandular pubescent, anthers pink; anterior filaments inserted at 9–14.5 mm from corolla base which is 48–53% of corolla length, filaments 21.5–23.5 mm long, anthers $2.7\text{--}3.2 \times 0.8\text{--}1.3$ mm; posterior filaments inserted at 9.5–14 mm from corolla base which is 50–58% of corolla length, filaments 19–20.5 mm long, anthers $1.2\text{--}2.3 \times 0.7\text{--}1.1$ mm; staminode 0.7–1.6 mm long. **Disk** 1.2–1.5 mm high, 5-crenate. **Pistil** 16–26 mm long; stipe c. 2–3 mm long, with sessile glands; ovary 7–12 mm long, with sessile glands; style cream or green, 8–12 mm long, glandular puberulent; stigma pale red, 2 mm across. **Capsule** 11.5–40 cm long, 2.5–4 mm wide. **Seed** grain $1.5\text{--}2.4 \times 0.4\text{--}0.5$ mm, warty, bubble cells absent; apical appendage a filiform hair, 13–21 mm

Fig. 1. **A.** *Aeschynanthus albidus* (Blume) Steud. **B.** *Aeschynanthus fecundus* P.Woods. **C.** *Aeschynanthus fulgens* Wall. ex R.Br. (Photos: A, Saw Leng Guan; B–C, David Middleton)

long; hilar appendages of many (30–40) filiform hairs, 14–19 mm long; appendages papillose.

Distribution. Peninsular Malaysia (Johor, Kelantan, Pahang, Perak, Selangor,

Fig. 2. Distribution of *Aeschynanthus albidus* (Blume) Steud. in Singapore and Peninsular Malaysia (●).

Terengganu), Singapore, Sumatra, Java, Borneo.

Habitat and ecology. In lowland mixed dipterocarp forest, sometimes by streams, or in lower montane forest at 20–1440 m altitude (to 1520 m on Mt Kinabalu).

Provisional IUCN conservation assessment. Least Concern (LC). This species is widespread and locally fairly common. In Peninsular Malaysia it has been collected over a fairly wide area in the last 20 years. In Singapore it is listed as nationally Critically Endangered by Chong et al. (2009). Although it was formerly more widespread it is now known in Singapore only in Nee Soon swamp forest.

Singaporean and Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Johor:** Gunong [Gunung] Ledang VJR, 19 Aug 1974, Kochummen, K.M. FRI16796 (K, KEP, SING); Lenggong Forest Reserve, Jong, K. 9017 (KLU); Batu Pahat, Nov 1891, Nongchi 8

(SING); Kota Tinggi, 1 Oct 1929, *Teruya*, Z. 951 (SING); Bekok, Sungei Bekok, 7 Mar 1971, *Heaslett*, E.A. s.n. (SING); **Kelantan**: Kuala Aring, 7 Sep 1899, *Yapp*, R.H. 161 (CGE, K); Sungai Keteh, 6 Feb 1924, *Md Nur & Foxworthy*, F.W. 11963 (SING); Gua Musang, Lojing FR, 860 m, 27 Apr 2011, *Mohd Hairul*, M.A., *Siti Munirah*, M.Y. & *Mohd Nazri*, A. FRI72324 (KEP); **Pahang**: Jalan Bentong bt. 18, 13 Sep 1973, *MK & AR* 1321 (L, UKMB); Fraser's Hill, 700 m, 10 Mar 1995, *Chin*, S.C. et al. 4533 (SING); Pulau Manis, Jul 1891, *Ridley*, H.N. 2151 (SING); Sabai Estate near Bentong, 26 Jan 1958, *Shah*, M. 155 (K, L, SING); Kuala Lipis, 22 Nov 1924, *Burkill*, H.M. & *Md Haniff* 15750 (SING); Pulau Tioman, Kpg. Juara, 371 m, 25 Apr 2012, *Saw*, L.G. & *Mohd Hairul*, M.A. FRI48326 (E, KEP); **Perak**: Gopeng, 150–240 m, Jun 1883, *Kunstler*, H. 4463 (NY, SING); Dipang, Mar 1885, *Scortechini*, B. 1815 (SING); Kurau, *Wray*, L. 4245 (SING); Taiping, Gunung Hijau, 1440 m, 19 Mar 2007, *Julius*, A. FRI53313 (E, KEP); Taiping, Bukit Larut, Jun 1893, *Ridley*, H.N. s.n. (SING); Kuala Kangsar, Bubu FR, Gunung Bubu, 12 Mar 2010, *Julius*, A., *Coode*, M.J.E. & *Angan*, A. FRI57691 (KEP); **Selangor**: Genting Highlands, Ulu Gombak, 8 Apr 1921, *Hume*, H.L. 9596 (SING); ibidem, 16 Apr 1921, *Hume*, H.L. 9772 (SING); 17 mile Ulu Gombak, 26 Oct 1937, *Md Nur* SFN34254 (SING); **Terengganu**: Gunong [Gunung] Lawit, Old trail along Sungai Kamiah, 300–610 m, 1 Apr 1970, *Davidson*, C. 1292 (L).

SINGAPORE: s.l., 1894, *Ridley*, H.N. s.n. (SING); Seletar, 1894, *Ridley*, H.N. 6244 (SING); ibidem, 3 Sep 1889, *Ridley*, H.N. s.n. (SING); Bukit Mandai, Mar 1890, *Ridley*, H.N. s.n. (SING); Chan Chu Kang, Jul 1891, *Ridley*, H.N. s.n. (SING); ibidem, 1892, *Ridley*, H.N. s.n. (SING); Teban, 17 May 1891, *Goodenough*, J.S. s.n. (SING); Krangi [Kranji], 1894, *Ridley*, H.N. s.n. (SING); Nee Soon Swamp Forest, 22 Nov 2007, *Ng*, H.H. & *Lok*, A.F.S.L. s.n. (SINU); Nee Soon Swamp Forest, 25 Mar 2015, *Lua*, H.K. & *Ibrahim*, H. SING2015-084 (SING).

Notes. A very variable species, particularly in the size and relative dimensions of the calyx.

Burt & Woods (1975) gave the type as “Type: cult. Hort. Bogor (L?)”. However, in the protologue two collections are mentioned, one from “Tjoo” and one from “Salak”. There is no mention of cultivated material from Bogor so the material designated as type by Burt & Woods (1975) cannot be considered original material. A Blume collection from Salak is, therefore, here chosen as lectotype.

This species has generally been called *Aeschynanthus purpurascens* or, less frequently, *A. motleyi*, in the literature from the Malay Peninsula. *Aeschynanthus purpurascens* is an illegitimate name as *Aeschynanthus albidus* and several other earlier combinations are included in synonymy. *Aeschynanthus motley* was described from Borneo but the Peninsular Malaysia, Borneo, Sumatra and Java material cannot be distinguished.

2. *Aeschynanthus angustifolius* (Blume) Steud., Nomencl. Bot. ed. 2 1: 32 (1840); A.DC., Prod. 9: 262 (1845); Miquel, Fl. Ned. Ind. 2: 716 (1858); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 38 (1883); Bakhuizen van den Brink, Blumea 6: 395 (1950); Backer & Bakhuizen van den Brink, Fl. Java 2: 524 (1965); Woods, Kew Mag. 8(1): 22 (1991); Turner, Gard. Bull. Singapore 47(1): 243 (1997 [‘1995’]). – *Bignonia angustifolia* Blume, Catalogus 82 (1823). – *Trichosporum angustifolium* (Blume) Nees, Flora 8: 144 (1825). – *Lysionotus angustifolius* (Blume) Blume, Bijdr. Fl. Ned.

Ind. 765 (1826). – TYPE: Indonesia, Java, Jawa Barat, Bogor, *Reinwardt, C.G.C. s.n.* (lectotype L, designated here). (Fig. 3, 4)

Rheizophyllum subverticillatum Hassk., Flora 25(2): beibl. 56 (1842). – TYPE: Java, Bogor Botanic Garden, 21 August 1840, *Hasskarl s.n.* (not traced). Although the type has not been traced the description of the leaves in the protologue is suitably diagnostic to be certain that it is this taxon.

Aeschynanthus tetraquetrus C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 38 (1883). – *Trichosporum tetraquetrum* (C.B.Clarke) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Indonesia, Sumatra, Sumatera Barat, Gunung Singgalan, 1700 m, *Beccari, O. s.n.* (lectotype FI [FI013076], designated here; isoelectotypes FI [FI013075], K).

Aeschynanthus stenophyllus Ridl., J. Asiat. Soc. Bengal 74 (2): 733 (1909); Ridley, Fl. Mal. Pen. 2: 498 (1923). – *Trichosporum stenophyllum* (Ridl.) Merr., Contr. Arnold Arbor. 8: 152 (1934). – TYPE: Peninsular Malaysia, Perak, Goping [Gopeng], Kinta, 150–240 m, August 1883, *King's Collector 4738* (lectotype SING [SING0035634], designated by Woods (1991); isoelectotype K).

Trichosporum ternifolium Merr., Contr. Arnold Arbor. 8: 153 (1934). – TYPE: Indonesia, Sumatra, in ravines between Baboeli and Paekas, 1200 m, 9 January 1932, *Bangham, W.N. & Bangham, C.M. 781* (holotype A [A00261780]; isotype NY [NY00313032]).

Epiphyte with pendulous or arching stems; stems glabrous. **Leaves** verticillate in whorls of 3–7, rarely opposite; petiole 1–6 mm long, glabrous; blade coriaceous or slightly fleshy, ovate or elliptic to linear, 1–8.6 × 0.15–1.7 cm, 1.7–43 times as long as wide (see note below), apex obtuse to acuminate, base cuneate, mid green above, paler beneath, not variegated, glabrous above and beneath, margin weakly and distantly dentate or entire, secondary veins obscure, tertiary veins obscure. **Flowers** solitary in the axils of leaves, bracts minute; pedicels 9.5–10 mm long, glabrous. **Calyx** of separate lobes free to base, green, glabrous except with very few hairs at tips of lobes; lobes narrowly triangular, 1.5–4.2 × 0.7–0.9 mm, apex acute, glabrous. **Corolla** 18–25 mm long, tube fairly narrow, slightly wider at base, fairly straight, curved at apex, externally yellowish to yellowish green to green, margins of lobes reddish brown, internally yellowish green, reddish brown on margins of lobes and speckled on inner lobes; upper lobes oblong, not spreading or reflexed, 2.2–3.8 × 2.2–3.2 mm, sinus 2.6–2.8 mm deep, apex rounded; lateral lobes oblong, not spreading or reflexed, 3.5–4.3 × 3–3.2 mm, apex rounded; lower lobe oblong, slightly spreading, 3.5–6 × 2.5–4 mm, apex rounded; tube and outside of lobes minutely glandular puberulent, lobes ciliate, inside of lobes and tube with scattered short glandular hairs. **Stamens** shortly exerted, fused in 2 pairs; filaments glandular pubescent; anterior filaments inserted at 11–15 mm from corolla base which is 61–65% of corolla length, filaments 10–12 mm long, anthers 1.2–1.5 × 0.8–0.9 mm; posterior filaments inserted at 12–16 mm from corolla

Fig. 3. *Aeschynanthus angustifolius* (Blume) Steud. **A.** Habit with yellow-flowered form. **B.** Habit with green-flowered form. **C.** Flower dissection with three calyx lobes removed. **D.** Flowers from the front showing stamens in two pairs and developing style and stigma in the flower on the left and a more developed style and the stamens beginning to wither and reflex in the flower on the right. (Photos: A, David Middleton; B–D, Jana Leong-Škorníčková)

Fig. 4. Distribution of *Aeschynanthus angustifolius* (Blume) Steud. in Peninsular Malaysia (●).

base which is 67–73% of corolla length, filaments 8.5–9 mm long, anthers 0.8–1.2 × 0.6–0.7 mm; staminode c. 0.5 mm long. **Disk** 1.2–1.5 mm high, margin 5-crenate. **Pistil** 28–30 mm long, pale green; stipe 5–6 mm long, with sparse sessile glands; ovary 8–9 mm long, with sparse sessile glands; style c. 15 mm long, with short glandular hairs. **Capsule** 13–30 cm long, 2.4–3.3 mm wide. **Seed** grain 1.6–1.9 × 0.3 mm, bubble cells absent; apical appendage a filiform hair 44–50 mm long; hilar appendage a single filiform hair, 28–30 mm long.

Distribution. Peninsular Malaysia (Johor, Pahang, Terengganu), Sumatra, Java, Borneo.

Habitat and ecology. Primary or secondary lowland to lower montane forest. In Peninsular Malaysia recorded from 150–1390 m altitude and in Sumatra recorded up to 1700 m.

Provisional IUCN conservation assessment. Data Deficient (DD). The EOO and AOO for this species using the existing collections would suggest an assessment of Least Concern. However, all of the collections I have seen of this species collected in the last 20 years have been made only in Borneo over a range that would suggest Near Threatened. I have seen no collections from Peninsular Malaysia made since 1930 and its current status there is uncertain. It has never been collected in Singapore.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Johor:** Sedenak, Nov 1909, *Md Nur s.n.* (SING); ibidem, 1909, *Ridley, H.N. s.n.* (SING); **Pahang:** Cameron Highlands, 1390 m, 1 Apr 1930, *Henderson, M.R. s.n.* (NY); **Terengganu:** Kuala Berang, 14 May 1925, *Holttum, R.E. 15312* (K, SING).

Notes. Leaf characters are extremely variable within this species even though most material does show linear leaves > 7 times as long as wide. Wide variation occurs even within individuals as was previously commented upon by Woods (1991). For example, *Poulsen et al. 1566* (KEP) from Long Maga, Ulu Padas, Sabah, has leaves from 1.7–30 times as long as wide on a single branch. In this case there appear to have been two distinct phases of growth with older, shorter and wider leaves on the older part of the branch and then a new flush of growth with linear leaves on the younger part of the branch.

This species has been described as several different species from the different parts of its range due to differences in corolla colour and leaf shape but there are no clear discontinuities in these characters across its range.

3. *Aeschynanthus dischidioides* (Ridl.) D.J.Middleton, *Edinburgh J. Bot.* 64: 425 (2007). – *Micraeschynanthus dischidioides* Ridl., *Fl. Malay Penin.* 5: 325 (1925). – TYPE: Peninsular Malaysia, Pahang, Gunung Tahan, 1670 m, *Ridley, H.N. 16122* (lectotype K, designated by Middleton (2007); isotype SING [SING0089714]). (Fig. 5, 6)

Aeschynanthus myrmecophilus P.Woods, *Notes Roy. Bot. Gard. Edinburgh* 33: 483 (1975); Turner, *Gard. Bull. Singapore* 47(1): 243 (1997 [‘1995’]). – TYPE: Peninsular Malaysia, Pahang, Cameron Highlands, Robinson’s Falls, 1500 m, 16 April 1968, *Woods, P.J.B. 616* (holotype E [E00062778]).

Aeschynanthus hildebrandii auct. non Hemsl. ex Hook.f.: Ridley, *J. Linn. Soc. Bot.* 32: 502 (1896); Ridley, *J. Straits Branch Roy. Asiat. Soc.* 44: 15 (1905); Ridley, *J. Asiat. Soc. Bengal* 74(2): 734 (1909); Ridley, *Fl. Mal. Pen.* 2: 499 (1923).

Epiphyte, often rooted in ants nests, with stems hanging; stems sparsely puberulent or glabrous. **Leaves** opposite (although sometimes appearing whorled due to very short internodes); petiole 1–3 mm long, purple, glabrous; blade thickly coriaceous, green edged with purple above, not variegated, green to reddish purple beneath, ovate

or orbicular, 0.7–2.4 cm long, 0.6–2.6 cm wide, 1–2.4 times as long as wide, apex rounded to acuminate, base rounded or subcordate, glabrous above and beneath, not punctate beneath, margin dentate or entire, undulate or not, secondary veins obscure, tertiary veins obscure. **Inflorescence** axillary or terminal, 1–6-flowered; pedicels 8.5–16 mm long, green or purple, with sparse and minute hairs, smaller ones more or less papillae, hairs (papillae) green or red in life. **Calyx** of separate lobes free to base, green, with sparse and minute hairs; lobes narrowly ovate or narrowly triangular, erect, $2\text{--}6.5 \times 0.6\text{--}1.6$ mm, apex acute. **Corolla** 11–25 mm long, tube broad for all of length, slightly to strongly curved, outside of tube yellow to yellow-orange for most of length and then abruptly turning to dark orange or red on top of tube and lobes, sometimes only on lobes, inside of tube yellow, lobes dark red to orange-red at margin and yellow at base with dark bands on lower 3 lobes, outside sparsely puberulent, denser on ciliate lobes, inside with a ring of robust multicellular hairs in lower half; upper lobes oblong, not spreading or reflexed, conspicuously shorter than neighbouring lateral lobes, $2.6\text{--}4 \times 2.5\text{--}4.8$ mm, sinus 3.2–4.2 mm deep, apex rounded; lateral lobes ovate or oblong, not spreading or reflexed, $3.6\text{--}6 \times 2.9\text{--}5.5$ mm, apex rounded, truncate or retuse; lower lobe oblong, not spreading or reflexed, $4.9\text{--}6 \times 3\text{--}5.8$ mm, apex rounded to truncate. **Stamens** clearly exserted, fused in 2 pairs; filaments various shades of green to red, posterior pair glandular hairy at apex and papillose at base, anterior pair only papillose, anthers grey; anterior filaments inserted at 8–11 mm from corolla base which is 44–62% of corolla length, filaments 12–16 mm long, anthers $1.4\text{--}2 \times 0.6\text{--}1.2$ mm; posterior filaments inserted at 9.5–11.5 mm from corolla base which is 48–69% of corolla length, filaments 10.5–13 mm long, anthers $1.1\text{--}1.6 \times 0.5\text{--}1$ mm; staminode 0.7–1 mm long. **Disk** 1.2–1.5 mm high, 5-dentate. **Pistil** 21–24 mm long; stipe 2.5–3.5 mm long, glabrous or with sparse sessile glands; ovary green, 6–6.5 mm long, with sessile glands, these sometimes sparse; style 13–14 mm long, glandular pubescent. **Capsule** 8–24 cm long, 2.7–3 mm wide. **Seed** grain $1.2\text{--}1.6 \times 0.3\text{--}0.4$ mm, warty, bubble cells absent; apical appendage a filiform hair, 10–50 mm long; hilar appendage of 3–6 filiform hairs, 17–30 mm long.

Distribution. Endemic in Peninsular Malaysia (Pahang, Perak, Selangor).

Habitat and ecology. In lower montane forest at 1100–2000 m altitude, often growing in ant gardens associated with *Lecanopteris* or *Dischidia*.

Provisional IUCN conservation assessment. Vulnerable (VU B1ab(iii)). The known EOO is around 15,000 km² (but see note below) and the locations where it occurs are disturbed by farming, plantations and tourism.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Pahang:** Cameron Highlands, 1390 m, 1 Apr 1930, *Henderson, M.R. s.n.* (NY, SING); ibidem, 9 Mar 1947, *Smith, J.W. 63690* (KEP, SING); ibidem, 14 Oct 1929, *Symington, C.F. 20938* (KEP); ibidem, 1976, *Anthony, S. SA230* (KEP); Cameron Highlands, Along route no. 7 to G. Beremban, 1500 m, 3 Mar 1994, *Perumal, B., Gan, C.L., Shahril, K.Z., Angan, A. & Bedul FRI41631* (KEP, KLU); Cameron Highlands, Gedung FR, Near Sg. Ichat tea plantation, 1365

Fig. 5. *Aeschynanthus dischidioides* (Ridl.) D.J.Middleton. **A.** Habit. **B.** Flower dissection showing multicellular hairs in corolla tube and undeveloped style after two calyx lobes removed. **C.** Flower from below with stamens fused in two pairs. **D.** flower, side view. (Photos: A, David Middleton; B–D, Jana Leong-Škorníčková)

Fig. 6. Distribution of *Aeschynanthus dischidioides* (Ridl.) D.J.Middleton in Peninsular Malaysia (●).

m, 19 Feb 2008, *Syahida-Emiza & Chew, M.Y. FRI57277* (KEP); Cameron Highlands, G. Jasar, 9 Aug 2008, *Rosdi, M. & Phoon, S.N. et al. FRI59872* (KEP); Cameron Highlands, Gunung Batu Berinchang, Kpg. Melayu Brinchang, 22 Feb 2012, *Imin, K. & Syahida-Emiza FRI76065* (KEP); Cameron Highlands, Gunung Batu Berinchang, 2000 m, 20 Jun 1975, *Van Balgooy, M.M.J. 2658* (E, L); Cameron Highlands, Boh Tea Estate, 29 Apr 1937, *Md Nur SFN32980* (SING); ibidem, 28 Jul 1991, *Kiew, R. RK3241* (SING); Cameron Highlands, Tanah Rata, 18 Aug 1986, *Weber, A. s.n.* (KEP); ibidem, 1440 m, 9 Sep 1956, *Burkill, H.M. HMB868* (SING); Cameron Highlands, Tanah Rata, Parit Waterfall, 1457 m, 26 Sep 2012, *Imin, K. et al. FRI77536* (E, KEP, SING); Cameron Highlands, Tanah Rata, Jln Tenkolok, 1489 m, 23 Feb 2012, *Imin, K. & Syahida-Emiza FRI76073* (KEP); Cameron Highlands, Robinson's Falls, 5 Apr 2006, *Kiew, R. RK5307* (SING); Cameron Highlands, en route from Robinson Waterfall to Boh tea plantation, 600–1100 m, 29 Aug 1990, *Okada, H., Darnaedi, D., Akiyama, H., Kawahara, T. & Watano, Y. 1050* (TI); Taman Negara, 1100–1530 m, 18 Aug 1990, *Darnaedi, D., Akiyama, H., Kawahara, T. & Khairuddin, K. 566* (TI); Taman Negara, Kem Bonsai, From Kem Bonsai to Kem Belumut, 1985 m, 8 May 2008, *Yao, T.L. FRI65302* (E, KEP);

Taman Negara, Gunung Tahan, 1820m, 1 Sep 1928, *Holttum, R.E. s.n.* (SING); ibidem, 7 Jul 1905, *Wray, L. & Robinson, H.C. 5483* (BM, K, SING); ibidem, Jul 1911, *Ridley, H.N. s.n.* (SING); Gunung Tahan, Foot of Gunung Gedong, 1520 m, 3 Sep 1928, *Holttum, R.E. 20772* (SING); Gunung Tahan, Skeats Hill, Jul 1911, *Ridley, H.N. s.n.* (SING); Fraser's Hill, Pine tree hill, 1450 m, 19 Apr 1955, *Purselove, J.W. P4222* (K, SING); ibidem, 1450 m, 3 Sep 1966, *Burkill, H.M. HMB4221* (SING); Padang Camp, 1670m, 14 Sep 1937, *Corner, E.J.H. s.n.* (L); Kluang Tabang, 1900, *Barnes, E. s.n.* (SING); **Perak:** Gunong [Gunung] Jasar, 17 Apr 1968, *Woods, P.J.B. 634* (E); Taiping, 1210 m, 14 Feb 1917, *Md Haniff & Md Nur 2469* (K, SING); ibidem, 1240 m, 14 Feb 1917, *Md Haniff & Md Nur 2347* (SING); Taiping, Bukit Larut, Jun 1893, *Ridley, H.N. & Curtis, C. 7365* (SING); Kuala Kangsar, Bubu FR, Gunung Bubu, 1675 m, 20 Dec 2006, *Kamarul Hisham, M., Kueh, H.L., Lim, C.L. & Yao, T.L. FRI52094* (KEP); **Selangor:** Ulu Kali, 1600 m, 2 Mar 1996, *Van Balgooy, M.M.J. 7149* (L).

Notes. This is currently the only species of *Aeschynanthus* considered to be endemic to Peninsular Malaysia. However, considering that most of its distribution closely mirrors that of *Aeschynanthus rhododendron*, suggesting similar habitat requirements, it may also occur in the far south of Thailand and in Sumatra where *A. rhododendron* has been collected.

The combination in *Aeschynanthus* was published by Middleton (2007) when the monotypic *Micraeschynanthus dischidiodes* was synonymised with *Aeschynanthus myrmecophilus*. Middleton (2007) concluded that the type material of *Micraeschynanthus dischidiodes* has only immature and aberrant flowers but that in all other characters it matches *Aeschynanthus myrmecophilus*, thereby requiring synonymisation and a new combination in *Aeschynanthus*.

4. *Aeschynanthus fecundus* P.Woods, Notes Roy. Bot. Gard. Edinburgh 33: 482 (1975); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']); Burt, Thai Forest Bull., Bot. 29: 83 (2001); Smitinand, Thai Pl. Names ed. 2, 14 (2001); Middleton, Edinburgh J. Bot. 64: 379 (2007). – *Aeschynanthus parviflorus* Ridl., J. Fed. Malay States Mus. 4: 48 (1909), nom. illeg. – *Aeschynanthus breviflorus* Ridl., Fl. Mal. Pen. 2: 497 (1923), nom. illeg. – TYPE: Peninsular Malaysia, Pahang, Telom, November 1900, *Ridley, H.N. 13599* (holotype SING [SING0089822]; isotypes BM [BM000537160], K [K000190151]). (Fig. 1, 7)

Epiphyte with erect, arching or pendulous stems; stems green, flushed purplish or reddish brown, glabrous. **Leaves** opposite; petiole green, 2–4 mm long, glabrous; blade slightly fleshy, green with paler green or yellow variegation above, pale green beneath, elliptic, 2.1–8.6 × 0.5–3.7 cm, 1.7–5.3 times as long as wide, apex acuminate, base rounded to cuneate, glabrous above and beneath, not punctate beneath, margin with few minute red-tipped teeth but appearing more or less entire, secondary veins obscure, tertiary venation obscure. **Inflorescences** axillary, 1–2-flowered, peduncle absent; pedicels green, 4–7 mm long, sparsely minutely papillose or glabrous. **Calyx** of separate lobes free to base, yellow-green or green, tips red, glabrous or with sparse sessile glands; lobes linear to narrowly ovate, slightly spreading or erect, 2.3–13.5

Fig. 7. Distribution of *Aeschynanthus fecundus* P.Woods (●) and *Aeschynanthus fulgens* Wall. ex R.Br. (▼) in Peninsular Malaysia

× 0.6–1.5 mm, apex acute or acuminate. **Corolla** 14.5–19 mm long, externally tube yellowish green or yellow in lower two-thirds, brownish red higher, lobes dark red or brownish red, internally tube light yellowish, lobes pale brownish red, tube fairly broad at base; upper lobes oblong or elliptic, not spreading or reflexed, 1.1–2.3 × 1.2–2.3 mm, sinus 1.4–2.6 mm deep, apex rounded; lateral lobes ovate, not spreading or reflexed, 1.1–2.5 × 1.6–2.9 mm, apex rounded; lower lobe elliptic, not spreading or reflexed, 1.3–2.3 × 1–2.6 mm, apex rounded; glabrous or with few sessile glands around top outside, with irregular tufts of multicellular hairs near base and glandular papillose on ventral surface near throat inside. **Stamens** not exserted, fused in 2 pairs, filaments yellow or greenish yellow, with glandular hairs, anthers yellow to grey, pollen cream; anterior filaments inserted at 7–8.6 mm from corolla base which is 45–48% of corolla length, filaments 7–9 mm long, anthers 1–1.3 × 0.6 mm; posterior filaments inserted at 8–12 mm from corolla base which is 55–63% of corolla length, filaments c. 6 mm long,

anthers $0.7\text{--}0.9 \times 0.5\text{--}0.6$ mm; staminode 0.8–2 mm long. **Disk** 1 mm high, a simple annular ring. **Pistil** 17–19 mm long; stipe c. 1.5 mm long, with few sessile glands; ovary green, 4.5–5.5 mm long, with sessile glands; style green or yellowish green, 11–12 mm long, glandular pubescent; stigma pink or purple. **Capsule** 3.6–12 cm long, 1.9–2.8 mm wide. **Seed** grain $2\text{--}2.5 \times 0.2\text{--}0.3$ mm, only weakly warty, bubble cells absent; apical appendage a filiform hair, 19–28 mm long; hilar appendage of 11–18 filiform hairs, 12–17 mm long, appendages papillose.

Distribution. Western and southern Thailand, Peninsular Malaysia (Kedah).

Habitat and ecology. In lowland and hill dipterocarp forest, sometimes on bamboo. Altitude information is not available for the species in Peninsular Malaysia but in Thailand it occurs up to 700 m altitude.

Provisional IUCN conservation assessment. Least Concern (LC). Even though this species has been collected only once in recent years in Peninsular Malaysia, and only twice ever, in Thailand it has a wide distribution and has been collected fairly often.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Kedah:** Baling, Gunung Inas Forest Reserve, Bukit Palong, 2 Nov 2007, *Imin, K. et al.* FRI58593 (K, KEP, SING).

Notes. This species is difficult to tell apart from *Aeschynanthus longicaulis* when in fruit. In Thailand this species was once found in fruit with the seeds already germinating before the seeds had dispersed. It is not known if this was an aberration or common occurrence.

5. *Aeschynanthus fulgens* Wall. ex R.Br., *Cyrtandreae* 115 (1839); Steudel, *Nomencl. Bot.* ed. 2, 1: 32 (1840); Brown in Bennett, *Pl. Jav. Rar.* 115 (1840); A.DC., *Prod.* 9: 261 (1845); C.B.Clarke in A.DC. & C.DC., *Monogr. Phan.* 5(1): 21 (1883); Clarke in Hooker, *Fl. Brit. Ind.* 4: 338 (1884); Burt, *Thai Forest Bull., Bot.* 29: 83 (2001); Smitinand, *Thai Pl. Names* ed. 2, 14 (2001); Kress et al., *Checkl. Myanmar* 261 (2003); Pooma, *Threatened Pl. Thailand* 70 (2005); Middleton, *Edinburgh J. Bot.* 64: 381 (2007); Middleton, *Edinburgh J. Bot.* 66: 414 (2009). – *Trichosporum fulgens* (Wall. ex R.Br.) Kuntze, *Revis. Gen. Pl.* 477 (1891). – TYPE: Burma, Tenasserim Division, Tavoy, *Gomez, W. in Wallich* 797 (lectotype K-W, designated by Middleton (2007); isoelectotypes BM [BM000883874], CGE, E [E00259870, E00259871], G [G00370743], G-DC, K [K000831871, K000831872]). (Fig. 1, 7)

Aeschynanthus evrardii Pellegr., *Bull. Soc. Bot. France* 72: 824 (1926 [1925]); Lecomte, *Fl. Indo-Chine* 4: 499 (1930); Pham Hoang Ho, *Cayco Vietnam* ed. 3, 3 (1): 4 (1993); Newman et al., *Checkl. Vasc. Pl. Lao PDR* 146 (2007). – TYPE: Vietnam, Lam Dong, Ang Kroet, 26 October 1920, *Evrard, F.* 358 (lectotype P [P00492372], designated by Middleton (2007); isoelectotypes P [P00606317, P00606318]).

Aeschynanthus stenosphonius W.T.Wang, Bull. Bot. Res., Harbin 3 (4): 49 (1983); Burtt, Thai Forest Bull., Bot. 29: 84 (2001); Smitinand, Thai Pl. Names ed. 2, 15 (2001). – TYPE: Laos, Vieng Pa Pow Tha Kaw, 2 November 1921, Hayata, B. s.n. (holotype TI; isotype TI).

Hoya pseudolanceolata Costantin, Fl. Indo-Chine 4: 132 (1912). – TYPE: Laos, Sayabouri, Pak Lay, Spire 1490 (lectotype P [P00639825], designated here).

Aeschynanthus macranthus auct. non (Merr.) Pellegr.: Pellegrin, Fl. Indo-Chine 4: 498 (1930) pro parte; Barnett, Fl. Siam. 3 (3): 201 (1962); Burtt, Thai Forest Bull., Bot. 29: 84 (2001).

Epiphyte with stems arching and pendulous or upright, green or dull olive-green, sometimes with purple mottling, glabrous. **Leaves** opposite; petiole 3–20 mm long, glabrous; blade coriaceous to fleshy, elliptic, oblong or ovate, mid to dark green above, paler green beneath, not variegated, $3.3\text{--}17 \times 1\text{--}5.2$ cm, 1.7–7.5 times as long as wide, apex acuminate, base cuneate to rounded, glabrous above and beneath, margin entire, 4–8 pairs of secondary veins, obscure to clearly visible, tertiary venation obscure. **Inflorescences** subterminal or axillary, 3–16-flowered, peduncle absent; bracts deep maroon, ovate or linear, 2.1–11 mm long; pedicels 3.5–24 mm long, green, glandular puberulent or glabrous. **Calyx** with a tube at base, lobes free, tube very variable in width from narrow and clasping corolla tube to quite wide and not clasping corolla, yellowish, greenish or brownish, sometimes with reddish lobes, glabrous except for ciliate lobes, or few hairs only on very tips of lobes, to glandular pubescent all over, total length (7–)10.7–26 mm long; tube (2.4–)6–18.5 mm long which is (34–)50–94% of total length, 3.5–14 mm wide at top of tube; lobes triangular, slightly spreading or erect, $1\text{--}5\text{--}11.5 \times (1.2\text{--})1.6\text{--}6.5$ mm, apex acute, sometimes ultimately with a rounded tip, to acuminate. **Corolla** (41–)49–73 mm long, tube narrow at base, externally bright red to darker red or orange red, sometimes yellowish at base, usually with darker lines on tube, red or orange-red with a black central line on lobes, sometimes yellowish at very base, internally yellowish to pale red in tube, lobes orange-red or red with a dark red or black central line or arrow and pale orange to cream at base; upper lobes slightly falcate, mostly not reflexed or spreading, sometimes slightly spreading but not fully reflexed, $3.2\text{--}7.5 \times 3.3\text{--}7$ mm, sinus 3.5–10.5 mm deep, apex obtuse or rounded; lateral lobes deltoid, not spreading or reflexed, $2.8\text{--}8 \times 5.2\text{--}9.5$ mm, apex rounded or obtuse; lower lobe oblong or elliptic, reflexed, $5.1\text{--}14 \times 3\text{--}6$ mm, apex obtuse or rounded; sparsely to densely glandular puberulent outside or only at top of tube and on lobes or only ciliate on lobes, minutely and sparsely to very sparsely glandular puberulent internally, this sometimes denser towards the upper half, sessile glands present at top of tube. **Stamens** long exserted, fused in 2 pairs or rarely all 4 attached; filaments mostly darker in the upper half and ranging from reddish to purplish and then to white at base, sparsely glandular pubescent to glabrous or with few sessile glands in lower part, anthers dark maroon, purple, yellow, white and purple, or greyish purple; anterior filaments inserted at 26–48 mm from corolla base which is 50–72% of corolla length,

filaments 25–50 mm long, anthers $3\text{--}5.6 \times 0.9\text{--}2.3$ mm; posterior filaments inserted at 32–50 mm from corolla base which is 58–82% of corolla length, filaments 25–42 mm long, anthers $2.5\text{--}5 \times 1\text{--}2.1$ mm; staminode 0.7–11 mm long. **Pollen** ochre or yellow. **Disk** 0.5–2.5 mm high, a simple annular ring, 5-dentate, 5-crenate or strongly 5-lobed. **Pistil** 15.5–80 mm long; stipe 3–26 mm long, glabrous; ovary green or cream, 8–38 mm long, glabrous or with sessile glands; style cream or white, 4.5–41 mm long, glandular pubescent to glabrous. **Capsule** 15.7–42 cm long, 2–5 mm wide. **Seed** grain $0.8\text{--}2 \times 0.2\text{--}0.5$ mm, warty, bubble cells absent; apical appendage a filiform hair, 16–34 mm long; hilar appendage a single filiform hair, 13.5–35 mm long; appendages papillose.

Distribution. Myanmar, Thailand, Cambodia, Laos, Vietnam, Peninsular Malaysia (Kedah). In Peninsular Malaysia only recorded from Gunung Jerai in Kedah.

Habitat and ecology. Across its distribution it has been recorded in a wide variety of habitats including primary or disturbed evergreen, mixed deciduous or mossy forest at 10–1500 m altitude. The ecology and altitude for this species on Gunung Jerai was not recorded on the specimens.

Provisional IUCN conservation assessment. Least Concern (LC). This species has a widespread distribution and is common in parts of its range, particularly in Thailand. In Peninsular Malaysia it has only been collected a few times and at only one locality, Gunung Jerai. Its current status there needs to be clarified.

Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Kedah:** Gunung Jerai, 16 Oct 1976, *Stone, B.C.M.* 12758 (KLU); *ibidem*, 18 Nov 1977, *Lo, Y.N. & Mahmud* 183 (KLU); *ibidem*, 23 Nov 1999, *Kiew, R.* RK4862 (KEP, SING).

Notes. This is a widespread and variable species but in Peninsular Malaysia has only been collected on Gunung Jerai. The description above includes the species from throughout its range as the very few Malaysian specimens are inadequate to write a full description. The material seen from Malaysia has a long and narrow calyx tube with small lobes but elsewhere in the distribution of *Aeschynanthus fulgens* this species is known to be very variable, especially in this character.

6. *Aeschynanthus longicaulis* Wall. ex R.Br., *Cyrtandreae* 116 (1839); Steudel, *Nomencl. Bot.* ed. 2, 1: 32 (1840); Brown in Bennett, *Pl. Jav. Rar.* 116 (1840); A.DC., *Prod.* 9: 262 (1845); Miquel, *Fl. Ned. Ind.* 2: 719 (1858); C.B.Clarke in A.DC. & C.DC., *Monogr. Phan.* 5(1): 19 (1883); C.B.Clarke in A.DC. & C.DC., *Monogr. Phan.* 5(1): 19 (1883); Barnett, *Fl. Siam.* 3 (3): 201 (1962); Burt & Woods, *Notes Roy. Bot. Gard. Edinburgh* 33: 481 (1975), *pro parte*; Chin, *Gard. Bull. Singapore* 32: 147 (1979); Li, *Acta Bot. Yunnan.* 5 (1): 36 (1983); Wang, *Fl. Reipubl. Popularis Sin.* 69: 526 (1990); Turner, *Gard. Bull. Singapore* 47: 243 (1997 [‘1995’]); Wang, Pan, Li,

Weitzman & Skog, Fl. China 18: 385 (1998); Burt, Thai Forest Bull., Bot. 29: 83 (2001), *pro parte*; Smitinand, Thai Pl. Names ed. 2, 14 (2001); Kress et al., Checkl. Myanmar 261 (2003). – *Trichosporum longicaule* (Wall. ex R.Br.) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Burma, Chappedong, *Wallich, N. 888* (lectotype K [K000096741], designated by Middleton (2007); isoelectotypes BM [BM000883859], G-DC, K-W). (Fig. 8, 9)

Aeschynanthus griffithii R.Br., Cyrtandreae 115 (1839); Brown in Bennett, Pl. Jav. Rar. 115 (1840); A.DC., Prod. 9: 261 (1845); Miquel, Fl. Ned. Ind. 2: 719 (1858); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 24 (1883); Clarke in Hooker, Fl. Brit. Ind. 4: 339 (1884); Kress et al., Checkl. Myanmar 261 (2003). – *Trichosporum griffithii* (R.Br.) Kuntze, Revis. Gen. Pl. 477 (1891). – TYPE: Burma, Tenasserim Division, Tavoy, *Griffith, W. s.n.* (holotype BM [BM000883870]).

Aeschynanthus zebrinus Van Houtte, Hort. Vanhoutt. 1(2): 42 (1846). – TYPE: Not located.

Aeschynanthus marmoratus T. Moore, Paxton's Fl. Gard. 3: 56 (1852); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 38 (1883); Ridley, J. Linn. Soc. Bot. 32: 500 (1896); Ridley, J. Straits Branch Roy. Asiat. Soc. 44: 13 (1905); Ridley, J. Asiat. Soc. Bengal 74 (2): 732 (1909); Ridley, Fl. Mal. Pen. 2: 498 (1923); Barnett, Fl. Siam. 3 (3): 202 (1962). – *Trichosporum marmoratum* (T. Moore) T. Moore ex Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Cultivated specimen, October 1851, *Moore, T. s.n.* (holotype K [K000831883]).

Epiphyte with arching and pendulous branches; stems grey-brown or grey, glabrous. **Leaves** opposite; petiole 2–14 mm long, glabrous; blade fleshy, background mid to dark green above but variegated with much paler venation, same but paler beneath, elliptic, 1.9–12.2 × 0.3–4 cm, 2.2–9 times as long as wide, apex caudate to acuminate, base cuneate to acute, margin with few minute teeth but appearing more or less entire, glabrous above and beneath, 5–6 pairs of secondary veins, weakly visible, tertiary venation obscure. **Inflorescences** terminal, peduncle absent; pedicels 9.5–11 mm long, green suffused purple, glabrous. **Calyx** of separate lobes free to base, orange, purple or green flushed maroon-purple, glabrous or with sparse glandular hairs; lobes narrowly elliptic to linear, erect, 8–18 × 0.8–2.4 mm, apex acute to acuminate. **Corolla** 20.5–31 mm long, externally tube green, yellowish green or green with flushes of orange, purple or brown, lobes purple or maroon with an orange or yellow margin or all orange, internally tube dark red, maroon or green, lobes maroon, purple or red with a yellow or orange margin; upper lobes ovate or orbicular, not spreading or reflexed, 2.5–3.8 × 2.4–4.5 mm, sinus 2.2–4.5 mm deep, apex rounded; lateral lobes orbicular or oblique ovate, not spreading or reflexed, 2–3.9 × 3.3–4.8 mm, rounded; lower lobe ovate or squarish, not spreading or reflexed, 2.5–5.8 × 3.6–4.2 mm, apex rounded, outside glabrous except for ciliate lobes, to densely glandular puberulent, inside with five dense tufts of multicellular hairs near base. **Stamens** long exserted; filaments

Fig. 8. **A.** *Aeschynanthus longicaulis* Wall. ex R.Br. **B.** *Aeschynanthus longiflorus* (Blume) A.DC. **C.** *Aeschynanthus obconicus* C.B.Clarke. (Photos: A, Preecha Karaket; B, Jana Leong-Škorničková; C, David Middleton)

green or yellow, with glandular hairs; anthers pale brown or grey; anterior filaments inserted at 12–19.5 mm from corolla base which is 48–52% of corolla length, anthers 2.6–3.2 × 1–1.2 mm; posterior filaments inserted at 12.5–21 mm from corolla base

Fig. 9. Distribution of *Aeschynanthus longicaulis* Wall. ex R.Br. in Peninsular Malaysia (●).

which is 50–55% of corolla length, filaments 23–27.5 mm long, anthers $1.8\text{--}2.8 \times 0.7\text{--}1.3$ mm; staminode 0.9 mm long; pollen greenish grey. **Disk** 0.9–1.3 mm high, a simple annular ring. **Pistil** 14–45 mm long; stipe 1.5–4 mm long, glabrous; ovary 5.5–12 mm long, glabrous or with sessile glands; style yellow or green flushed purple towards apex, 7–31 mm long, glandular pubescent; stigma purple or yellow. **Capsule** 5.4–37 cm long, 1.8–3.2 mm wide. **Seed** grain $1.6\text{--}2.2 \times 0.1\text{--}0.6$ mm, warty, bubble cells absent; apical appendage a filiform hair, c. 22.5 mm long; hilar appendages of many (13–25) filiform hairs, 10–25 mm long; appendages papillose.

Distribution. Eastern Myanmar, western and southern Thailand, Peninsular Malaysia (Kedah, Kelantan, Penang, Perak, Perlis).

Habitat and ecology. In primary and secondary lowland forest, reaching to upper dipterocarp forest, sometimes on limestone, at 360–1150 m in Peninsular Malaysia.

Most Malaysian material does not have good habitat and altitude notes but in Thailand it has also been collected in rubber plantations.

Provisional IUCN conservation assessment. Least Concern (LC). This species has a wide distribution and has been recorded from a variety of habitats. However, it should be noted that it has been collected rather infrequently in Peninsular Malaysia in recent years and only once since 2000 so its status should be monitored.

Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Kedah:** Langkawi, Gunung Raya, 880 m, 13 Sep 1988, *Tay, E.P.* 125 (SING); Weng Road near Baling, 2 Nov 1929, *Best, G.A.* 21255 (SING); **Kelantan:** Jeli, Upper Sungai Pergau, 25 Sep 1986, *Latiff, A. et al.* ALM1813 (PSU, UKMB); **Penang:** Government Hill, 760 m, Sep 1889, *Curtis, C.* 2142 (SING); ibidem, Mar 1889, *Ridley, H.N.* 1700 (BM, SING); Penang Hill, 760 m, 8 Sep 1982, *Kochummen, K.M.* FRI29332 (K, KEP, L); **Perak:** Gunong [Gunung] Chabang, *Scortechini, B.* 35 (SING); Ulu Temengor, Jul 1909, *Ridley, H.N.* 14280 (BM, SING); Grik, 19 Jun 1924, *Burkill, H.M. & Md Haniff* 12542 (SING); Taiping, Bukit Larut, 1150 m, 12 May 2009, *Yao, T.L.* FRI57961 (KEP); ibidem, *Heng, H.P. et al.* HP10 (SINU); **Perlis:** Kaki Bukit, 1962, *Cultivated* C4877 (E); Bukit Bintang Forest Reserve, 360 m, 25 Apr 1962, *Burt, B.L. & Woods, P.J.B.* B1739 (E).

Notes. This species is difficult to distinguish from *Aeschynanthus fecundus* when not in flower. The name has also been applied widely to species from other parts of Asia that are now recognised as distinct taxa such as *Aeschynanthus membranifolius* and *A. sinolongicalyx* W.T.Wang. These species all share characteristic variegated leaves. Flowering material is needed to assess whether *Aeschynanthus longicaulis* occurs further north into northern Thailand than previously suspected or whether other related species rather have the wider distribution.

The name *Aeschynanthus marmoratus*, originally described from cultivated material, was long applied to the material from Peninsular Malaysia but the type material is indistinguishable from that of *Aeschynanthus longicaulis*.

7. *Aeschynanthus longiflorus* (Blume) A.DC., *Prod.* 9: 262 (1845); Hooker, *Bot. Mag.* 73: t.4328 (1847); Zollinger, *Syst. Verz.* 3: 57 (1855); Miquel, *Fl. Ned. Ind.* 2: 717 (1858); C.B.Clarke in A.DC. & C.DC., *Monogr. Phan.* 5(1): 32 (1883); Ridley, *J. Linn. Soc. Bot.* 32: 499 (1896); Ridley, *J. Straits Branch Roy. Asiat. Soc.* 44: 14 (1905); Ridley, *J. Asiat. Soc. Bengal* 74 (2): 734 (1909); Ridley, *Fl. Mal. Pen.* 2: 498 (1923); Backer & Bakhuizen van den Brink, *Fl. Java* 2: 524 (1965); Turner, *Gard. Bull. Singapore* 47: 243 (1997 [‘1995’]); Burt, *Thai Forest Bull., Bot.* 29: 83 (2001); Smitinand, *Thai Pl. Names* ed. 2, 15 (2001); Middleton, *Edinburgh J. Bot.* 64: 400 (2007). – *Lysionotus longiflorus* Blume, *Bijdr. Fl. Ned. Ind.* 766 (1826). – *Trichosporum longiflorum* (Blume) Kuntze, *Revis. Gen. Pl.* 478 (1891); Merrill, *Contr. Arnold Arbor.* 8: 151 (1934). – TYPE: Indonesia, Java, *Blume, C.L.* 247 (lectotype L [Leiden number 903,307-102], designated by Middleton (2007); isoelectotypes L [2 sheets]). (Fig 8, 10)

Aeschynanthus perakensis Ridl., J. Linn. Soc. 32: 499 (1896); Ridley, J. Straits Branch Roy. Asiat. Soc. 44: 15 (1905); Ridley, J. Asiat. Soc. Bengal 74 (2): 734 (1909); Ridley, Fl. Mal. Pen. 2: 498 (1923); Henderson, Malay. Wild. Fl. Dicot. 340 (1959); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – TYPE: Peninsular Malaysia, Perak, Taiping, Bukit Larut, 1891, *Ridley, H.N. s.n.* (lectotype SING [SING0035528], designated by Middleton (2007)).

Epiphyte with arching stems; stems glabrous. **Leaves** opposite; petiole 3–16 mm long, glabrous; blade slightly fleshy or coriaceous, dark to mid green above, pale green beneath, ovate or elliptic, not variegated, $3.7\text{--}17.5 \times 1.6\text{--}6.7$ cm, 1.5–6.1 times as long as wide, apex acuminate to caudate, base rounded to cuneate, glabrous above and beneath, margin entire, secondary veins obscure to weakly visible, 3–8 pairs, tertiary venation obscure. **Inflorescences** terminal, 2–5-flowered, peduncle absent, bracts linear, 3–6 mm long; pedicels 11–16 mm long, brownish green or purplish, glabrous. **Calyx** of separate lobes free to base, often differing quite substantially in length even within a single flower, green to dark red or purplish, with sparse glandular hairs or glabrous, sometimes with ciliate lobes or with just a few hairs only on very tips, 4.8–23 mm long; lobes linear, narrowly triangular, narrowly ovate or oblong, erect, $4.8\text{--}23 \times 1\text{--}2.2$ mm, apex obtuse to acuminate. **Corolla** 43–90 mm long, tube narrow at base; externally tube bright red or dark red, lobes bright red or dark red, internally tube cream-coloured, lobes bright red on upper 2 lobes and bright red at margin with a darker W-shaped line on lower 3 lobes; upper lobes orbicular, oblong or ovate, not spreading or reflexed, $3.2\text{--}8.1 \times 3.2\text{--}5$ mm, sinus 3–5.8 mm deep, apex rounded; lateral lobes oblique ovate or deltoid, not spreading or reflexed, $3.2\text{--}7.5 \times 5.5\text{--}9$ mm, apex rounded; lower lobe ovate, not spreading or reflexed, $6\text{--}12 \times 4\text{--}6.2$ mm, apex rounded; outside glabrous to sparsely glandular puberulent, usually with ciliate lobes, inside with sparse glandular hairs throughout, sometimes very sparsely so, and sessile glands below lobes. **Stamens** long exserted, fused in 2 pairs; filaments reddish, purple or pink, with small glandular hairs, anthers pale pink; anterior filaments inserted at 49–60 mm from corolla base which is 72–77% of corolla length, filaments 29–50 mm long, anthers $3.3\text{--}5 \times 1\text{--}2$ mm; posterior filaments inserted at 50–64 mm from corolla base which is 77–81% of corolla length, filaments 23–37 mm long, anthers $2.4\text{--}3.8 \times 0.9\text{--}2$ mm; staminode 0.7–5 mm long. **Disk** 1–1.5 mm high, 5-crenate. **Pistil** 45–83 mm long; stipe 13–20 mm long, glabrous to sparsely minutely papillose; ovary 19–29 mm long, minutely papillose puberulent or with few sessile glands; style purple or purplish pink, 13–34 mm long, glandular pubescent to papillose, sometimes sparsely so. **Capsule** 21–57 cm long, 3.5–4 mm wide. **Seed** grain $1\text{--}1.8 \times 0.3\text{--}0.4$ mm, warty, bubble cells absent; apical appendage a filiform hair, 15–24 mm long; hilar appendage a single filiform hair, 15–24 mm long; appendages papillose.

Distribution. Peninsular Thailand, Peninsular Malaysia (Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Selangor, Terengganu), Sumatra, Java, Borneo.

Fig. 10. Distribution of *Aeschynanthus longiflorus* (Blume) A.DC. in Peninsular Malaysia (●).

Habitat and ecology. This species is recorded most commonly in lower montane forest up to 1535 m altitude and occasionally from lowland or hill dipterocarp forest. However, in Peninsular Malaysia it is also recorded from as low as 90 m altitude.

Provisional IUCN conservation assessment. Least Concern (LC). This species is widely distributed in the region.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Kelantan:** Jeli, Upper Sungai Pergau, 25 Sep 1986, *Latiff, A. et al.* ALM1789 (PSU, UKMB); Kuala Krai, Stong Tengah FR, Sungai Kenerong, 564 m, 4 Apr 2009, *Rosdi, M., Phoon, S.N., Ong, P.T. & Imin, K.* FRI66272 (KEP); **Negeri Sembilan:** Jekebu, Bkt Tangga, G. Telapak Burok, 9 Apr 2008, *Phoon, S.N. & Imin, K.* FRI60648 (KEP); **Pahang:** Tahan River, 1520 m, 1891, *Ridley, H.N.* 2167 (K, SING); Fraser's Hill, Nov 1976, *Keng, H. et al.* 4755 (SINU); ibidem, 1210 m, 18 Apr 1955, *Purseglove, J.W.* P4164 (E, K, L, SING); ibidem, 1210–1320 m, 16–30 Sep 1922, *Burkill, H.M. & Holttum, R.E.* 7888 (K, SING); ibidem, 1500 m, 16 Apr

1962, *Burt, B.L. & Woods, P.J.B. B1644* (E, SING); ibidem, 13 Mar 1986, *Anthony, S. SA481* (KEP); ibidem, 1270 m, 4 Oct 1961, *Burkill, H.M. HMB2812* (SING); ibidem, 1210 m, 20 Mar 1929, *Holttum, R.E. 21528* (SING); ibidem, 25 Oct 1959, *Mitchell s.n.* (SING); ibidem, 27 Aug 1991, *Kiew, R. RK3293* (SING); Fraser's Hill, Rompin Trail, 1218 m, 26 Oct 2010, *Julius, A. FRI73605* (K, KEP, SING); Fraser's Hill, Bishop's Trail, 1275 m, 31 Mar 2007, *Kiew, R., Lindsay, S. & Middleton, D.J. FRI57497* (KEP); Fraser's Hill, Raub, 1260 m, 21 Mar 1994, *Perumal, B., Gan, C.L., Shahril, K.Z., Angan, A. & Bedul FRI41512* (KEP); Fraser's Hill, Tras Valley, 1090 m, 27 Sep 1922, *Burkill, H.M. 8859* (SING); ibidem, 1150 m, 25 Mar 1929, *Holttum, R.E. s.n.* (SING); 3rd Mile Genting Highlands Road, 910 m, 2 Oct 1970, *Kochummen, K.M. FRI16215* (KEP); Cameron Highlands, 48th Mile Blue Valley, 23 Mar 1963, *Mohd. Kassim bin Rajab 488* (KLU); Cameron Highlands, Gunung Berembun, Nov 1908, *Ridley, H.N. 13603* (SING); Cameron Highlands, Nov 1940, *Quaife s.n.* (SING); Telom, Nov 1908, *Ridley, H.N. s.n.* (SING); Cameron Highlands, G. Siku FR, 1430 m, 21 Jan 2010, *Mohd Hairul, M.A., Ong, P.T., Siti Munirah, M.Y. & Kueh, H.L. FRI69946* (KEP); Cameron Highlands, G. Siku FR, Beside the road to G. Siku FR, 1535 m, 25 Oct 2007, *Imin, K. & Kueh, H.L. et al. FRI58561* (KEP); Cameron Highlands, Robinson's Falls, 24 Mar 2007, *Julius, A., Middleton, D.J. & Lindsay, S. et al. FRI57479* (KEP); **Penang:** *unknown s.n.* (E); **Perak:** Gunung Korbu, 1210–1300 m, 11 Mar 1913, *Robinson, H.C. s.n.* (K); Taiping, 910–1210 m, Nov 1885, *King's Collector 8314* (K); Taiping, Bukit Larut, 790 m, 18 Sep 1949, *Sinclair, J. & Kiah SFN38800* (E, K, SING); ibidem, 1270 m, 25 Nov 1980, *Keng, H. et al. 85* (SINU); ibidem, Dec 1902, *Ridley, H.N. 11447* (K, SING); ibidem, 1060–1210 m, Dec 1884, *King's Collector 7022* (K, SING); ibidem, 18 Sep 1949, *Sinclair, J. 6198* (E); ibidem, *Anderson, J.W. 95* (SING); ibidem, 910 m, 29 Oct 1968, *Smith, G. 443* (KLU); ibidem, 1290–1330 m, 8 Mar 1939, *Spare, G.H. 2114* (SING); Caulfield's Hill, *Wray, L. 625* (K, SING); Gunung Bintang, Bukit Kuala Bintang, 18 Apr 1928, *Md Haniff 21088* (SING); Taiping, Gunung Hijau, Sep 1889, *Curtis, C. s.n.* (SING); ibidem, 1300 m, 20 Oct 1992, *Saw, L.G. FRI37667* (KEP); **Selangor:** Genting Highlands, Gunung Bunga Buah, 1090 m, 5 May 1999, *Chua, L.S.L. FRI 40785* (KEP); Semangkok Pass, 1909, *Ridley, H.N. s.n.* (SING); Gombak, Gunung Bungah Buah, Trail to Gunung Bunga Buah, 1250 m, 31 Oct 2010, *Yao, T.L., Kiew, R. & Wen, J. FRI65495* (E, KEP); Hulu Langat, Gn. Nuang, Above Pacat Camp, 1418 m, 12 Dec 2013, *Yao, T.L., Imin, K., Mohd Nazri, A. & Kueh, H.L. FRI77335* (KEP); **Terengganu:** Ulu Brang, Gunong [Gunung] Padang, Near Kampong Lallang, 90 m, 16 Sep 1969, *Whitmore, T.C. FRI12601* (K, KEP, L, SING).

Notes. This species is most similar to *Aeschynanthus speciosus*, particularly those forms with redder flowers, but is easily distinguished by the opposite leaves of *A. longiflorus* and the whorled leaves of *A. speciosus*.

The calyx pubescence character used by Ridley (1923) to distinguish *Aeschynanthus perakensis* from *A. longiflorus* does not hold up to scrutiny and this character is very variable in the species. As noted by Middleton (2007) the type of *Aeschynanthus perakensis* is cited by Ridley as 'Perak, on Gunong Hijan; Thaiping Hills, at an altitude of 5,000 feet'. No Ridley material has been found which has this locality information on the label and only one specimen has been found which could possibly be original material. This specimen is labelled 'Maxwell's Hill', now known as Bukit Larut of which Gunung Hijau (the modern name for Gunong Hijan) is a part. This specimen was lectotypified by Middleton (2007). A second Ridley specimen from the area cannot be counted as original material as Ridley explicitly says he has seen no fruiting material and the specimen has fruits.

8. *Aeschynanthus obconicus* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 50 (1883); Clarke in Hooker, Fl. Brit. Ind. 4: 343 (1884); Ridley, J. Linn. Soc. Bot. 32: 501 (1896); Ridley, J. Asiat. Soc. Bengal 74 (2): 737 (1909); Ridley, Fl. Mal. Pen. 2: 500 (1923); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – *Trichosporum obconicum* (C.B.Clarke) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Peninsular Malaysia, Selangor, Klang, 26 December 1878, Beccari, O. 36 (holotype FI [FI013085]). (Fig. 8, 11)

Epiphytic, stems mostly hanging, green, mostly glabrous, occasionally sparsely puberulent only around nodes. **Leaves** opposite; petiole 3–10 mm long, glabrous or rarely sparsely puberulent; blade coriaceous, ovate or elliptic, 2.5–10.7 × 0.9–6 cm, 1.5–3.1 times as long as wide, apex acuminate or acute, base cuneate to rounded, mid green above, paler beneath, not variegated, glabrous above and beneath, occasionally with few marginal hairs at margin base, margin entire, sometimes undulate, 4–7 pairs of secondary veins, weakly visible or obscure, tertiary venation obscure. **Inflorescences** axillary or subterminal, 1–6-flowered; peduncles 4 mm long; bracts elliptic, 1.3–4 mm long; pedicels 6–12 mm long, dark red, sparsely to densely eglandular puberulent. **Calyx** with a tube and short and broad lobes or barely any lobes at all, the whole broadly cup-shaped, dark red or dark red at base and becoming bright red higher, sometimes purplish brown, outside densely to sparsely pubescent with red hairs, these varying degrees of eglandular and glandular, very rarely glabrous, inside sparsely pubescent to glabrous, total length 8–19 mm long; tube 7–15 mm long which is 74–94% of total length, 15–27 mm wide at top of tube; lobes semicircular or a weak curve of the upper rim, erect, spreading or recurved, 0.7–6.5 mm long, 9–16 mm wide, apices rounded. **Corolla** 23–35 mm long, tube broad at base, externally bright to dark red, internally cream, lobes externally bright red with cream at base of lower 3 lobes, internally red with cream and dark red markings on lower 3 lobes; upper lobes ovate, oblong or slightly falcate, spreading, 4.2–10 × 1.7–6 mm, sinus between lobes 3–5 mm deep, apices rounded; lateral lobes ovate to oblong, spreading to reflexed, 4.2–12.5 × 4.2–9.8 mm, apices rounded; lower lobe ovate or elliptic, spreading, 5–11.4 × 5.6–6.7 mm, apex rounded; outside densely pubescent or rarely glabrous except for ciliate lobes, inside with scattered short glandular hairs with robust base, sessile glands at lobe sinuses. **Stamens** not or only slightly exerted, fused in 2 pairs, filaments cream to bright red, papillose, anthers cream or yellow; anterior filaments inserted at 9–15 mm from corolla base which is 32–58% of corolla length, filaments 15–18.5 mm long, anthers 2.4–2.7 × 1.2–1.5 mm; posterior filaments inserted at 12–17 mm from corolla base which is 43–63% of corolla length, filaments 12.8–16 mm long, anthers 1.6–2.5 × 0.9–1.6 mm; staminode c. 1 mm long. **Disk** 0.5–1 mm high, a simple annular ring. **Pistil** 18.5–36.5 mm long; stipe 6–13 mm long, with few sessile glands or glabrous; ovary cream to pale green, 9.5–26 mm long, with sessile glands; style 2–7.5 mm long, glandular pubescent, sometimes these sparse. **Capsules** 18–41 cm long, 2.8 mm wide. **Seed** grain 0.8 mm × 0.3 mm, papillose, bubble cells present at base of hilar appendage; apical appendage a filiform hair, 12.5 mm long; hilar appendage a single filiform hair, 10 mm long; appendages not papillose.

Fig. 11. Distribution of *Aeschynanthus obconicus* C.B.Clarke in Peninsular Malaysia (●).

Distribution. Peninsular Malaysia (Kedah, Kelantan, Kuala Lumpur, Pahang, Perak, Selangor, Terengganu), Sumatra, Borneo.

Habitat and ecology. Epiphytic in lowland dipterocarp forest, often on trees by rivers, occasionally in lower montane forest, at 0–1300 m altitude.

Provisional IUCN conservation assessment. Least Concern (LC). This species is widespread and occurs in a variety of forest types.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: unknown loc., 21 Nov 1932, *unknown collector* FMS17068 (K, KEP); unknown state, Belau Tajor, Wray, L. 1772 (SING); **Kedah:** Gunong [Gunung] Bintang, 8 Apr 1968, Sidek bin Kiah S.277 (L, SING); **Kelantan:** Kpg. Bihai, Sg. Kerchit, 13 Feb 2003, Kiew, R. RK5239 (SING); Kuala Krai, Stong Tengah FR, Sg. Kenerong, 4 Apr 2009, Imin, K., Phoon, S.N., Ong, P.T. & Rosdi, M. et al. FRI68188 (KEP); **Kuala Lumpur:** Feb 1890, Curtis, C. s.n. (SING); **Pahang:**

Sungai Telom, 450 m, 24 Aug 1930, *Kiah* 23943 (NY, SING); Puku, Kuala Teku, 150 m, 21 Feb 1921, *Seimund, E.* 459 (SING); Kuala Terla Forest Reserve, Trail from Kg. Sg. Jarik, 540 m, 23 Mar 2007, *Julius, A.* FRI57451 (KEP, SING); Gunung Tahan, Teku, 21 Jun 1922, *Md Haniff & Md Nur* 8046 (SING); Taman Negara, Sg. Tahan, Kem Teku, 283 m, 12 May 2008, *Lim, C.L. & Kueh, H.L.* FRI64886 (KEP); **Perak:** unknown loc., Jan 1886, *King's Collector* 10179 (SING); Gunong [Gunung] Inas, Sira Rimau, 27 Dec 1899, *Yapp, R.H.* 547 (CGE); Larut Matang, Bkt. Larut, Sungai Bt. Tugoh, 72 m, 28 Jul 2011, *Imin, K. & Asmarayani, H.S.* FRI76004 (KEP); Taiping, Bukit Larut, 610 m, 1901, *Curtis, C. s.n.* (SING); Taiping, Dec 1902, *Ridley, H.N. s.n.* (SING); ibidem, 25 Aug 1971, *Kochummen, K.M.* FRI16427 (KEP); ibidem, 450 m, Sep 1889, *Curtis, C. s.n.* (SING); ibidem, Jul 1881, *King's Collector* 2012 (SING); ibidem, 1000–1300 m, Dec 1882, *King's Collector* 3641 (SING); ibidem, Jul 1881, *King's Collector* 2049 (SING); ibidem, 9 Mar 1924, *Burkill, H.M. & Md Haniff* 12798 (SING); ibidem, 4 Mar 1965, *Hardial, S. & Samsuri Ahmad* 290 (SING); ibidem, Mar 1882, *King's Collector* 2849 (SING); ibidem, Mar 1892, *Ridley, H.N.* 2905 (BM, SING); ibidem, 760–790 m, 16 Sep 1949, *Sinclair, J. & Kiah* SFN38805 (E, SING); ibidem, 610 m, 25 Aug 1971, *Whitmore, T.C.* FRI20392 (K, KEP, L, SING); Gunong [Gunung] Bubu, 600 m, 18 Aug 1966, *Ding Hou* 657 (K, KEP, L, SING); ibidem, 610 m, 16 Aug 1966, *Chew, W.-L.* CWL1213 (K, KEP, SING); Kampong Sekam, 510 m, 19 Oct 1982, *Avé, W.* 165 (K, L); Dinding, 1888, *Curtis, C.* 1388 (K, SING); Kinta, Kinta Dam, Trail to G. Korbu, 450 m, 10 Jun 2010, *Imin, K. et al.* FRI71615 (K, KEP); Gunung Korbu, 610 m, 20 Mar 1913, *Robinson, H.C. s.n.* (K); Kuala Dipang Forest Reserve, 30–210 m, 19 Feb 1976, *Sidek bin Kiah* SK515 (C, KEP, SING); Sg. Siput, Chior Forest Reserve, Sungai Legap, 180 m, 9 Oct 1967, *Ng, F.S.P.* FRI5813 (KEP); Chenderiang, Gunong [Gunung] Bujang Melaka, Sungai Rias, 610 m, 12 Feb 1975, *Shah, M., Ahmad & Mahmud* MS3407 (C, KEP, SING); Bujang Melaka, Aug 1898, *Curtis, C.* 3335 (SING); Batu Kurau, *Curtis, C.* 2990 (SING); Pondok Tanjong Forest Reserve, 14 Feb 1939, *Spare, G.H.* SFN36226 (SING); Sungei Merbau, 10 Dec 1929, *Symington, C.F.* 21390 (SING); Bleinja [?Belanjar], *Wray, L.* 149 (SING); *Scortechini, B.* 46a (SING); Ijok Forest Reserve, 11 Feb 1939, *Aziz Budin* 48644 (KEP [2 sheets]); Dinding, *Curtis, C. s.n.* (SING); Tapah, Nov 1908, *Ridley, H.N.* 14063 (SING); Bujang Melaka, Sep 1898, *Ridley, H.N. s.n.* (SING); Dinding, 1892, *Curtis, C. s.n.* (SING); Gunung Bintang, Bukit Kuala Bintang, 17 Apr 1928, *Md Haniff* 21074 (SING); Bintang Hijau FR, Sg. Tebing Tinggi, 317 m, 26 Aug 2009, *Chan, Y.M., Norzamli, A. & Norazmi, A.* FRI70603 (KEP); **Selangor:** Petaling, 5 Jul 1889, *Ridley, H.N. s.n.* (SING); Kanching Reserve, 17 Sep 1925, *Strugnell, E.J.* 10515 (K); Kanching River, 250 m, 3 Oct 1974, *Van Balgooy, M.M.J.* 2118 (E, L, NY); Templer National Park, Bukit Perangin, 1110 m, *Cultivated* C7650 (E); Gombak, Bukit Lagong FR, Sg. Kepong, 392 m, 6 Sep 2007, *Chan, Y.M.* FRI49298 (KEP); Bukit Lagong Forest Reserve, 300 m, 24 Sep 1980, *Kochummen, K.M.* FRI29126 (K, KEP, L, SING); Genting Highlands, Gombak F.R., 580 m, 23 Nov 1939, *Wong, Y.K.* KEP93272 (K); Ridge above Gombak Road, 4 Oct 1970, *Stone, B.C.M.* 9566 (KLU); Sungei Buloh, Aug 1908, *Ridley, H.N.* 13372 (BM, SING); ibidem, 80 m, 4 Dec 1960, *Poore, M.E.D.* 1064 (KLU); Kanching, Sg. Bangkap, 10 Oct 1974, *Stone, B.C.M. & Badaruddin* 12068 (BKF, KLU); Genting Sempah ridge, 800 m, 21 May 1982, *Stone, B.C.M.* 15167 (KLU); ibidem, 760 m, 6 Mar 1973, *Stone, B.C.M.* 11091 (KLU); ibidem, 850 m, 18 Aug 1974, *Stone, B.C.M. s.n.* (KLU); **Terengganu:** Ulu Sungei Setiu, 28 Apr 1986, *Kiew, R.* RK2262 (KEP); Hulu Terengganu, Tembat Forest Reserve, 364 m, 1 Apr 2009, *Mohd. Hairul, M.A.* FRI60925 (KEP, SING); Besut, Sungai Kemia, 210 m, 29 Aug 1996, *Chua, L.S.L.* FRI26700 (KEP).

Notes. This is one of the most readily identified species of *Aeschynanthus* in Peninsular Malaysia due to its wide cup-shaped red calyx. It is most similar to *Aeschynanthus*

tricolor Hook. from Borneo but that species mostly has a shorter corolla and has dark lines extending down the corolla tube (absent in *A. obconicus*). It is also similar to *Aeschynanthus wallichii* but that species has a smaller, more open and green calyx.

9. *Aeschynanthus pulcher* (Blume) G.Don, Gen. Syst. 4: 656 (1838); A.DC., Prod. 9: 262 (1845); Zollinger, Syst. Verz. 3: 56 (1855); Miquel, Fl. Ned. Ind. 2: 721 (1858); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 43 (1883); Middleton, Edinburgh J. Bot. 64: 412 (2007); Middleton, Edinburgh J. Bot. 66: 437 (2009). – *Trichosporum pulchrum* Blume, Bijdr. Fl. Ned. Ind. 764 (1826). – TYPE: Indonesia, Java, *Blume, C.L. s.n.* (lectotype L [Leiden number 903,307-167], designated by Middleton (2007)). (Fig. 12, 13)

Aeschynanthus parvifolius R.Br., Cyrtandreae 115 (1839); Brown in Bennett, Pl. Jav. Rar. 115 (1840); A.DC., Prod. 9: 262 (1845); Miquel, Fl. Ned. Ind. 2: 720 (1858); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 42 (1883); Ridley, Fl. Mal. Pen. 2: 500 (1923); Henderson, Malay. Wild. Fl. Dicot. 342 (1959); Chin, Gard. Bull. Singapore 32: 147 (1979); Stone, Fed. Mus. J. 26 (1): 98 (1981); Turner, Gard. Bull. Singapore 45: 92 (1993); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']); Smitinand, Thai Pl. Names ed. 2, 15 (2001). – *Trichosporum parvifolium* (R.Br.) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Indonesia, Sumatra, Pulau Bangka, 1813, *Horsfield, T. s.n.* (lectotype BM [BM000847144], designated by Middleton (2007)).

Aeschynanthus boschianus de Vriese, Ann. Soc. Agric. Bot. Gand 1: 403 (1845); Van Houtte, Hort. Vanhoutt. 1 (2): 31 (1846). – *Trichosporum boschianum* (de Vriese) Kuntze, Revis. Gen. Pl. 477 (1891); Merrill, Contr. Arnold Arbor. 8: 151 (1934). – TYPE: Cultivated plant grown by Jacob-Makoy in Belgium from plant collected on Mt Gede in Java (untraced).

Aeschynanthus lobbianus Hook., Bot. Mag. 72: t.4260 (1846); Miquel, Fl. Ned. Ind. 2: 721 (1858); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 44 (1883); Clarke in Hooker, Fl. Brit. Ind. 4: 343 (1884); Ridley, J. Linn. Soc. Bot. 32: 501 (1896); Ridley, J. Straits Branch Roy. Asiat. Soc. 44: 16 (1905); Ridley, J. Asiat. Soc. Bengal 74 (2): 735 (1909). – *Trichosporum lobbianum* (Hook.) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Indonesia, Java, *Lobb, T. s.n.* (holotype K).

Aeschynanthus javanicus Rollinson ex Hook., Bot. Mag. 76: t.4503 (1850); Miquel, Fl. Ned. Ind. 2: 721 (1858); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 44 (1883). – *Trichosporum javanicum* (Hook.) Kuntze, Revis. Gen. Pl. 477 (1891). – TYPE: Indonesia, Java, *unknown s.n.* (holotype K).

Aeschynanthus neesii Zoll. & Moritzi in H.Zollinger, Syst. Verz. 3: 56 (1855), nom. nud. – Based on *Zollinger, H. 1546* (P).

Fig. 12. A–D. *Aeschynanthus pulcher* (Blume) G.Don showing the variation in flower morphology and colour, particularly in the calyx. E. *Aeschynanthus radicans* Jack. F. *Aeschynanthus wallichii* R.Br. (Photos: A, David Middleton; B–D, Jana Leong-Škorníčková; E, Preecha Karaket; F, Ali Ibrahim)

Fig. 13. Distribution of *Aeschynanthus pulcher* (Blume) G.Don in Singapore and Peninsular Malaysia (●).

Aeschynanthus lampongus Miq., Fl. Ned. Ind., Eerste Bijv. 563 (1861); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 42 (1883). – *Trichosporum lampongum* (Miq.) Burkill, Kew Bull. 1935: 319 (1935). – TYPE: Indonesia, Sumatra, Lampung, Radjabassa, 910 m, *Teijsmann, J.E. HB4482* (lectotype U, designated by Middleton (2009); isoelectotype L).

Aeschynanthus beccarii C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 47 (1883). – *Trichosporum beccarii* (C.B.Clarke) Kuntze, Revis. Gen. Pl. 477 (1891). – TYPE: Indonesia, Sumatra, Sumatera Barat, Padang, *Beccari, O. 796* (lectotype K, designated by Middleton (2009); isoelectotypes BM [BM000537111], FI n.v., K, MEL).

Aeschynanthus zollingeri C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 44 (1883). – *Trichosporum zollingeri* (C.B.Clarke) Kuntze, Revis. Gen. Pl. 478 (1891). –

TYPE: Indonesia, Java, *Zollinger, H. 1512* (lectotype BM [BM001125703], designated by Middleton (2009); isoelectotypes B [presumably destroyed], P [P00492368]).

Aeschynanthus lanceolatus Ridl., J. Bot. 62: 299 (1924); Ridley, Fl. Malay Penin. 5: 324 (1925); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – TYPE: Peninsular Malaysia, Pahang, Fraser's Hill, 1210–1320 m, 16 October 1922, *Burkill, H.M. & Holttum, R.E. 8418* (holotype K).

Aeschynanthus lampongus var. *parvifolius* Ridl., Fl. Malay Penin. 5: 324 (1925); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – TYPE: Peninsular Malaysia, Pahang, Puku, Kuala Teku, 20 December 1920, *Seimund, E. s.n.* (lectotype K, designated by Middleton (2007); isoelectotype SING).

Lithophytic or epiphytic, hanging or creeping, stems dark purple to green, sparsely puberulent to glabrous. **Leaves** opposite; petiole 1–3(6) mm long, sparsely puberulent or glabrous; blade coriaceous or slightly fleshy, elliptic or ovate, dark green to purplish above and beneath, not variegated, $0.9\text{--}5.9 \times 0.25\text{--}2.9$ cm, 1.3–5.6 times as long as wide, apex rounded to acuminate, base subcordate to cuneate, glabrous above, glabrous to very sparsely puberulent all over beneath, margin entire, secondary veins weakly visible or obscure, c. 3 pairs, tertiary venation obscure. **Inflorescences** subterminal or axillary, 1–2-flowered; peduncle 0–12.5 mm long; bracts elliptic or ovate, $3\text{--}6.5 \times 2\text{--}5.5$ mm; pedicels 6–13 mm long, green, sparsely puberulent to densely long hairy. **Calyx** with a tube for most of length and free lobes, dark red to purplish or purplish brown, mostly sparsely eglandular puberulent, more rarely densely puberulent, glabrous or with a few hairs only on very tips, 11.5–29 mm long; tube 10–25 mm long, 89–96% of total length, 6–21 mm wide at top of tube; lobes triangular, semicircular or merely a weak curve of the upper rim, slightly spreading or erect, $1\text{--}5 \times 4\text{--}7$ mm, apex rounded or obtuse. **Corolla** 42–66 mm long, inflated at base, externally tube dark or bright red, often white at extreme base inside calyx tube, lobes bright red, internally lobes bright red with cream and dark markings on lower 3 lobes; upper lobes oblong or ovate, spreading or not, $5.7\text{--}13 \times 1.9\text{--}6.5$ mm, sinus 2.2–4.6 mm deep, apex rounded; lateral lobes deltoid or ovate, spreading or not, $6.1\text{--}11.5 \times 6.5\text{--}10.5$ mm, apex rounded; lower lobe elliptic or ovate, spreading or not, $7.6\text{--}13 \times 6.5\text{--}8$ mm, apex rounded; outside sparsely to densely puberulent, inside glabrous or with scattered papillae or small glandular hairs which are denser in the upper half, sessile glands below lobes. **Stamens** reaching end of corolla or slightly exserted, fused in 2 pairs; filaments red, glabrous or with very few sessile glands or papillose; anterior filaments inserted at 29–47 mm from corolla base which is 54–68% of corolla length, filaments 21–27 mm long, anthers $2.4\text{--}3.3 \times 0.8\text{--}1.6$ mm; posterior filaments inserted at 33.5–41 mm from corolla base which is 60–70% of corolla length, filaments 17.5–21 mm long, anthers $2.3\text{--}2.9 \times 0.8\text{--}1.9$ mm; staminode 0.5–1.6 mm long. **Disk** 0.8–1.5 mm high, strongly 5-lobed, 5-crenate or a simple annular ring. **Pistil** 37–58 mm long; stipe 16–27 mm long, puberulent; ovary pale yellow, 14–30 mm long, minutely papillose or with sessile glands; style pale yellow, 4.5–14 mm long, densely pubescent. **Capsule**

18–40 cm long, 2–4 mm wide. *Seed* grain $0.6\text{--}0.9 \times 0.2\text{--}0.3$ mm, papillose, bubble cells present at base of hilar appendage; apical appendage a filiform hair, 7–9.5 mm long; hilar appendage a single filiform hair, 6–9 mm long; appendages not papillose.

Distribution. Extreme south of Thailand, southern Vietnam, Peninsular Malaysia (Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor, Terengganu), Singapore, Sumatra, Java, ?Borneo. See also note below.

Habitat and ecology. Epiphytic or clambering over rocks, most common in lower montane forest, sometimes in lowland, hill dipterocarp or upper montane forest, in peat swamp forest or in forest on quartzite or sandstone, at 0–2100 m altitude.

Provisional IUCN conservation assessment. Least Concern (LC). This species is widespread and locally common. In Singapore it was long thought to be nationally extinct but has been rediscovered in Nee Soon Swamp (Williams, 2014).

Additional Singaporean and Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: unknown loc., Jan 1882, *Kunstler, H.* 2636 (NY); **Johor:** unknown loc., May 1924, *Franck, C.W.* 209 (C); ibidem, 6 Jun 1965, *Jumali K2077* (SINU); Pontian, Pengkalan Raja, 25 Jun 1939, *Corner, E.J.H. & Henderson, M.R.* SFN36611 (K, P), SFN36612 (SING); western tip of Gunong [Gunung] Panti West, 560 m, 18 Jul 1981, *Maxwell, J.F.* 81-166 (AAU, KLU, SING); Gunong [Gunung] Panti, 1 Aug 1960, *unknown s.n.* (SINU); ibidem, 480 m, 4 Feb 1981, *Collenette, I.S.* 2253 (E); ibidem, 520 m, 5 Jul 1970, *Samsuri Ahmad S.311* (BKF, C, G, K, KLU, L [2 sheets], LAE, SING); ibidem, 460 m, 31 Jul 2008, *Yao, T.L., Lim, C.L., Rosdi, M. & Ayau, K.* FRI65387 (KEP); Kuala Sedili Road, 26 May 1961, *Burkill, H.M.* HMB2665 (K, SING); Kota Tinggi, Kuala Sedili New Road, 23 Jun 1959, *Kadim & Noor, M.* 135 (E, K, L, LAE, SING); Mawai-Sedili Road, 8 Feb 1961, *Chew, W.-L.* CWL224 (C, E, K, L, SING); 8th mile Mawai-Kuala Sedili New Road, 8 Feb 1961, *Sinclair, J.* 10568 (E, L, SING); Mersing, Lombong Batu, 6 Jun 1965, *Keng, H. & Jumali K2077* (L); Kulai FR, Gunung Pulai, 29 Jun 1987, *Zainudin, A. et al.* AZ2438 (UKMB); Penggaram, Nov 1900, *Ridley, H.N.* s.n. (SING); Batu Pahat, 1892, *Nongchi s.n.* (SING); Tanjong Kupang, 1894, *Ridley, H.N.* s.n. (SING); Tanah Runto, 14 Feb 1890, *Goodenough, J.S.* s.n. (SING); ibidem, 22 Apr 1890, *Ridley, H.N.* s.n. (SING); Batu Pahat, Nov 1900, *Ridley, H.N.* s.n. (SING); Tempayang River, Apr 1909, *Ridley, H.N.* s.n. (SING); Kulai Hutan Simpan, Gunung Pulai, 24 Apr 1922, *Md Nur & Kiah* 7783 (SING); Jambu Larang, Oct 1892, *Fielding, J.* s.n. (SING); Sungei Tukong, 0 m, 20 Dec 1931, *Spare, G.H.* 991 (SING); Segamat, Gunung Chabang Tiga, Gunung Chabang Tiga South Peak, 935 m, 25 Aug 2007, *Chew, M.Y. & Rosdi, M.* FRI55583 (KEP); Gunong [Gunung] Bekok, 18 Aug 1968, *Jumali & Heaslett, E.A.* KJ732 (SINU); Gunung Ledang, 7 Dec 2010, *Yeo, C.K.* s.n. (SINU); ibidem, 24 Feb 1980, *Zainal Mustafa ZM64* (UKMB); ibidem, 26 Apr 1972, *Year III students FSC312* (KLU); Gunung Ledang, Above Bukit Besar, 12 Jun 1892, *Ridley, H.N.* s.n. (SING); **Kedah:** unknown loc., 24 Apr 1868, *Maingay, A.C.* K.D.1218 (K); Langkawi, Gunong [Gunung] Raya, Sep 1890, *Curtis, C.* 2503 (SING); Kedah Peak, 1060 m, Dec 1915, *Robinson, H.C. & Kloss, C.B.* 5997 (K, SING); ibidem, 910 m, 2 Dec 1915, *Robinson, H.C. & Kloss, C.B.* 6049 (K, SING); ibidem, 1000–1400 m, 21 Jan 1983, *Davis* 69431 (E); ibidem, 1893, *Ridley, H.N.* s.n. (SING); ibidem, 910–1210 m, 3 Jun 1971, *Keng, H. et al.* 67 (SING, SINU); ibidem, Aug 1893, *Ridley, H.N.* 5513 (BM, SING); Gunung Jerai, 850 m, 12 Feb 1961, *Yong KEP99330* (K, KEP); ibidem, 1200 m, 14 Sep 1979, *Rao & et al.* 167

(L); ibidem, 8 Nov 1962, *Samsuri Ahmad* 309 (SING); ibidem, 1121 m, 9 Feb 2010, *Imin, K., Nor Ezzawanis, A.T., Hovenkamp, P. & Angan, A.* FRI66493 (KEP); ibidem, 3 Sep 1995, *Choo, J.P.S., Chua, D.W.S., Lian, S.H.L., Lim, P.Y. & Wong, J.Y.* PYL2 (SINU); ibidem, 1200 m, 14 Sep 1979, *Rao & et al.* 167 (SINU); ibidem, 850 m, 15 May 1969, *Smith, G.* 513 (KLU); ibidem, 1060 m, 10 Jul 1977, *Lo, Y.N. & Mahmud* 83 (KLU); ibidem, 1150 m, 13 May 1969, *Stone, B.C.M. & Mahmud* 8500 (KLU); **Kelantan:** S. Lebir, Sungai Terang, 8 Jul 1935, *Henderson, M.R.* SFN29643 (K, SING); Gua Musang, 3 Aug 1962, *UNESCO limestone expedition* 239 (SING); Gua Musang, Gua Batu Boh, 300 m, 12 Aug 1971, *Chin, S.C.* 1441 (L); Kuala Krai, Gunung Stong Utara Forest Reserve, VJR Gunung Stong Utara, 180 m, 19 Jun 2001, *Sam, Y.-Y.* FRI46602 (KEP); Dabong, Gunung Setong, 15 May 1988, *Kiew, R.* RK2727 (SING); **Melaka:** unknown loc., 7 Oct 1865, *Maingay, A.C.* K.D.1219 (K); Ayer Panas, Nov 1893, *Ridley, H.N.* 1578 (BM, SING); Jus, Oct 1893, *Goodenough, J.S.* 1711 (SING); Jasin, Bkt. Senggeh FR, Batu Lebah, Kg. Bkt. Senggeh, 175 m, 28 Aug 2007, *Chan, K.Y.* FRI49293 (KEP); **Negeri Sembilan:** Serting Ulu Forest Reserve, 4 Jun 1992, *Saw, L.G. & Mustafa, D.* FRI37514 (K, KEP); Jelevu, Gunung Telapa Buruk, 1000 m, 21 Apr 1988, *Kiew, R.* RK2641 (KEP); Rembau, Gunung Datuk, 400 m, 10 Jul 1979, *Asmali* 22 (UKMB); Tampin, Tampin Forest Reserve, Hutan Lipur G. Tampin, 351 m, 5 May 2009, *Chan, K.Y.* FRI64737 (KEP, SING); Jelevu, Bkt Tangga, G. Telapak Burok, 1038 m, 11 Apr 2008, *Rosdi, M. & Rafidali, A.R.* FRI59837 (KEP); **Pahang:** Genting Highlands, 1150 m, 11 Jun 1978, *Stone, B.C.M.* 13764 (KLU); ibidem, 25 Nov 1984, *Kiew, R.* RK1548 (KEP); ibidem, 1450 m, 14 Mar 1982, *Stone, B.C.M.* 15134 (KLU); ibidem, 15 Nov 1966, *Stone, B.C.M.* 6543 (G, KLU, L); ibidem, 910 m, 9 May 1972, *Kochummen, K.M.* FRI16516 (KEP); Genting Highlands, Gunung Ulu Kali, 1600 m, 9 Apr 1978, *Maxwell, J.F.* 78-90 (L); Genting Sempah ridge, Nov 1970, *Stone, B.C.M.* s.n. (KLU); Kuantan, Bukit Berserah Forest Reserve, 3 Sep 1933, *Mahmood* KEP17216 (K, KEP, L); Kuantan [Kuantan], Sep 1889, *Durnford, L.* s.n. (SING); Pekan, Jul 1917, *Evans, J.H.N.* s.n. (K); ibidem, 1 Apr 1890, *Haviland, G.D.* s.n. (SING); ibidem, 30 Nov 1924, *Burkill, H.M. & Md Haniff* 17258 (SING); Bukit Cheras, 150 m, 11 Oct 1931, *Henderson, M.R.* 25065 (SING); Rompin, 19 May 1919, *Gerb* 3257 (SING); ibidem, 15 Nov 1929, *Mahammud* 17178 (SING); Gunung Mengkuang, 29 Mar 1959, *unknown* KEP78844 (KEP); Temerluh, Krau GR, Trail to Batu Bergambar from Batu Gajah, 550 m, 4 Jun 2000, *Chua, L.S.L., Damahuri, S., Ayau, K. & Ramli, P.* FRI45633 (KEP); Gunung Senyum, 29 Jul 1929, *Henderson, M.R.* s.n. (SING); Fraser's Hill, 1210 m, 18 Apr 1955, *Purseglove, J.W.* P4182 (K, L, LAE, SING); ibidem, 4 Oct 1961, *Burkill, H.M.* HMB2811 (K, L, LAE, SING); ibidem, 1300 m, 19 Apr 1955, *Purseglove, J.W.* P4202 (E, K, L, SING); ibidem, 1210 m, 24 Sep 1959, *Shah, M. & Noor, M.* MS607 (E, K, SING); ibidem, 16 Jul 2002, *Bramley, G. & Sam, Y.-Y.* GB27 (E, KEP); ibidem, 450 m, 16 Apr 1962, *Burt, B.L. & Woods, P.J.B.* B1643 (E); ibidem, 22 Dec 1979, *Bremer, B. & Bremer, K.* 1808 (KLU, L); ibidem, 1240–1270 m, 3 Oct 1987, *Worthington, R.D.* 13326 (L); ibidem, 16 Dec 1979, *Kiew, R.* RK832 (KEP); ibidem, 21 Nov 1980, *Kiew, R.* RK1002 (KEP); ibidem, 13 Feb 1986, *Kiew, R.* RK2160 (KEP); ibidem, 13 Mar 1986, *Anthony, S.* SA482 (KEP); ibidem, 10 Nov 1987, *Anthony, S.* SA897 (KEP); ibidem, 1030 m, *Kassim, M.* 550 (UKMB); ibidem, 25 Oct 1979, *Zainudin, A.* AZ40 (UKMB); ibidem, 31 Oct 1991, *Kiew, R.* RK3356 (SING); ibidem, 1210 m, 13 Jul 1957, *Hawkins, A.S.M.* s.n. (SING); ibidem, 1210 m, 25 Aug 1923, *Henderson, M.R.* FMS11263 (SING); ibidem, 14 Jun 1930, *Kalong* 22423 (SING); ibidem, 13 Nov 1981, *Keng, H. et al.* 86 (SING); ibidem, 21 Jun 2006, *Phoon, S.N., Kamarudin S., Kueh, H.L. & Rafidah, A.R.* FRI51576 (KEP); ibidem, *Mendum, M.* s.n. (E); ibidem, 26 Aug 1991, *Kiew, R.* RK3264 (SING); ibidem, 1240 m, 25 Aug 1959, *Burkill, H.M.* HMB1996 (SING); ibidem, 1210–1320 m, 16–30 Sep 1922, *Burkill, H.M. & Holttum, R.E.* s.n. (SING); ibidem, 21 Nov 1977, *Keng, H. et al.* 97 (SINU); ibidem, 5 Nov 1973, *Keng, H. et al.*

54 (SINU); ibidem, 28 Oct 1974, *Keng, H. et al.* 93 (SINU); ibidem, 13 Nov 1981, *Keng, H. et al.* CTV86 (SINU); ibidem, Dec 1970, *Mahmud bin Sidek s.n.* (KLU); ibidem, Sep 1940, *Addison, G.H. s.n.* (SING); ibidem, 1120 m, 29 Aug 1923, *Md Nur 11138* (SING); ibidem, 1210 m, 29 Aug 1923, *Henderson, M.R. FMS11453* (SING); Fraser's Hill, Jeriau Road, 1060–1210 m, 20 Aug 1960, *Burkill, H.M., Shah, M. & Noor, M. HMB2430* (SING); ibidem, 1090 m, 17 Jun 1972, *Stone, B.C.M. 10798* (KLU); Fraser's Hill, Mager Trail, 1390 m, 3 May 2007, *Chew, M.Y., Imin, K., Kiew, R. & Nooteboom, H.P. FRI53648* (E, KEP, SING); Fraser's Hill, Jalan High Pines, 1200 m, 13 Nov 2006, *Phoon, S.N. FRI51987* (KEP, KLU, SING); Fraser's Hill, Pine tree hill, 1450 m, 19 Sep 1922, *Burkill, H.M. & Holttum, R.E. 8549* (SING); Fraser's Hill, Richmond, 27 Oct 2010, *Imin, K., Utteridge, T.M.A. & Julius, A. FRI71855* (KEP); Fraser's Hill, Nuri Trail, 3 Dec 1991, *Kiew, R. & Anthony, S. RK3414* (KEP); Fraser's Hill, Gunong [Gunung] Peninjau, 1300 m, 26 Aug 1959, *Burkill, H.M. HMB2038* (K, SING); Cameron Highlands, 1450 m, 1 Apr 1930, *Henderson, M.R. s.n.* (NY, SING); ibidem, 1976, *Anthony, S. SA233* (KEP); ibidem, 1450 m; 18 Jan 1924, *Henderson, M.R. 11713* (SING); ibidem, 10 Jul 1979, *Everard, B. & Young, D. 94* (K); Cameron Highlands, Tanah Rata, 1450 m, 23 Nov 1925, *Henderson, M.R. SFN17921* (K, SING); Cameron Highlands, Sungai Palas Estate, 1520 m, 8 Sep 1956, *Burkill, H.M. HMB856* (K, L, SING); Cameron Highlands, Sungai Ichat, 19 Feb 2008, *Rafidah, A.R., Imin, K. & Ummul Nazrah, A.R. FRI55631* (KEP, SING); Cameron Highlands, 1 km to Sg. Bisik Waterfall from Ringglet road, 1201 m, 19 Nov 2009, *Imin, K., Ong, P.T., Kueh, H.L. & Paiman, N. FRI66402* (KEP); Rompin, Endau-Rompin State Park, Trail to Gunung Keriong, 260 m, 20 Aug 2002, *Sam, Y.-Y., Apok, K. & Markandan, M. FRI47150* (KEP); Cameron Highlands, Sungai Ichat, 12 Aug 1931, *Jaemat 25181* (KEP); Cameron Highlands, G. Siku FR, Trail to G. Siku, 1545 m, 21 May 2007, *Rosdi, M., Imin, K. & Ummul Nazrah, A.R. et al. FRI58753* (KEP); Cameron Highlands, Gunung Siku Forest Reserve, 1535 m, 25 Oct 2007, *Imin, K. et al. FRI58557* (KEP, SING); Cameron Highlands, Path to Taman Sedia, 6 Apr 1934, *Symington, C.F. 36073* (KEP); Cameron Highlands, Jln Kamunting 44th mile, 1520 m, 21 Jul 1965, *Khoo, R. & Ng, S.M. 074* (KLU); **Penang:** Government Hill, Jul 1894, *Curtis, C. s.n.* (SING); **Perak:** unknown loc., *Scortechini, B. 36a* (SING); Ulu Kinta, 620 m, 19 Apr 1961, *Castle-Smith, P.M. 15* (K); Gunung Korbu, 610 m, 24 Mar 1913, *Robinson, H.C. s.n.* (K); Waterfall north of Tana Rata acc. no. 19680649 vouchered as , *Cultivated C7431* (E); Kuala Kangsar, Bubu FR, Gunung Bubu, 938 m, 10 Mar 2010, *Julius, A., Coode, M.J.E. & Angan, A. FRI57716* (KEP); Kuala Kangsar, 850 m, 8 Apr 1995, *Chua, L.S.L. FRI39082* (KEP); Sunga Ryah, *Scortechini, B. 39* (SING); Gunung Batu Puteh, *Wray, L. 873* (SING); Bujang Melaka, 1898, *Ridley, H.N. s.n.* (SING); Taiping, 910 m, 12 Feb 1917, *Md Haniff & Md Nur 2314* (K, SING); ibidem, Mar 1911, *Anderson, J.W. 156* (SING); ibidem, Dec 1902, *Ridley, H.N. s.n.* (SING); ibidem, Nov 1952, *Carter s.n.* (SING); Taiping, Gunung Hijau, 14 Jul 1906, *Ernst, A. 1189* (L); ibidem, 8 Oct 1899, *Fox, W. s.n.* (SING); Taiping, Bukit Larut, Oct 1908, *Long, F.R. 14* (K); ibidem, 24 Nov 1999, *Kiew, R. RK4869* (SING); ibidem, 9 Mar 1939, *Spare, G.H. 2139* (SING); ibidem, 1130–1240 m, 9 Sep 1949, *Sinclair, J. SFN38609* (BM, E, K, L, SING); ibidem, *Wray, L. 655* (K, SING); ibidem, 20 Oct 1992, *Kamarudin S. FRI34629* (K); ibidem, Birch Hill, 1330 m, 9 Sep 1977, *Lewis, G.P. 251* (K, KEP); ibidem, 1060–1210 m, 3 Dec 1965, *Shah, M. & Sidek MS1064* (E, L, SING); ibidem, Sep, *Wray, L. 3217* (SING); ibidem, 1210 m, 22 Nov 1980, *Keng, H. et al. 27* (SINU); ibidem, Aug 1967, *unknown K6502* (SINU); ibidem, 4 Sep 1995, *Heng, H.P. et al. HP12* (SINU); ibidem, 1090 m, 2 Mar 1924, *Burkill, H.M. & Md Haniff 12971* (SING); ibidem, 28 Feb 1924, *Burkill, H.M. & Md Haniff 12833* (SING); ibidem, 1210–1360 m, 6 Mar 1939, *Spare, G.H. 2018* (SING); ibidem, Mar 1884, *Scortechini, B. 291* (SING); ibidem, 1000 m, 29 Oct 1969, *Everett, B. FRI13553* (KEP); ibidem, 16 Jan 1994, *Anthonyamy, S. SA1155* (KEP); ibidem, 880–1060 m, 15 May 1992,

Rahimatsah Amat N12 (KEP); ibidem, 1060 m, 23 Oct 1962, *Merton, L.F.H. 004194* (KLU); ibidem, 1080 m, 20 Mar 2007, *Julius, A. FRI54942* (KEP, SING); ibidem, Sep 1889, *Curtis, C. s.n.* (SING); ibidem, 25 Oct 1972, *Hons. Students 1* (SING); ibidem, 910 m, 29 Oct 1968, *Smith, G. 448* (KLU); **Perlis:** Bukit Bintang Forest Reserve, 7 May 1988, *Latiff, A. & Zainudin, A. ALM2764* (UKMB); **Selangor:** Klang, Bukit Changgang, 1 Oct 1937, *Md Nur SFN33963* (SING); Klang Gates Rridge, 4 Oct 1981, *Kiew, R. RK1081* (KEP); Chemara, 3 Jan 1959, *Carrick, J. 607* (KLU); Telok Forest Reserve, 21 Feb 1969, *Kochummen, K.M. FRI2654* (KEP); ibidem, 18 Jul 1963, *unknown 4636* (KLU); Sungei Buloh, 30 Nov 1889, *Goodenough, J.S. s.n.* (SING); ibidem, 1890, *Goodenough, J.S. s.n.* (SING); Gunong [Gunung] Bunga Bua, 28 May 1966, *Ng, F.S.P. FRI1136* (KEP, SING); Semangkok Pass, Feb 1904, *Napier, W. s.n.* (SING); Tanjong Karang, Sungei Tinggi, 30 m, 27 Sep 1975, *Samsuri Ahmad SA1125* (SING); Hulu Langat, Gn. Nuang, Above Pacat Camp, 1416 m, 12 Nov 2013, *Yao, T.L., Imin, K., Mohd Nazri, A. & Kueh, H.L. FRI77328* (KEP); Gombak, Klang Gates Ridge, Quartz Ridge, 270 m, 6 Apr 2007, *Syahida-Emiza & Angan, A. FRI55108* (KEP); Kanching, Bukit Takun, 300–400 m, 19 Mar 1972, *Chin, S.C. 1812* (KLU); ibidem, 300 m, 11 Jul 1965, *Stone, B.C.M. 5889* (KLU); Ulu Besut, Bukit Tangga, 610 m, 20 Jul 1984, *Shah, M. & Mahmud MS4978* (E, SING); Kuala Selangor, Sg. Karang FR, 26 m, 1 Jul 2013, *Lim, C.L. FRI73033* (KEP); Kuala Selangor, Sungai Tinggi, 14 Oct 1937, *Md Nur SFN34079* (BM, K, L, MICH, P, SING); Kanching, Bukit Takun, 150 m, 3 Nov 1937, *Md Nur SFN34400* (K, MICH, SING, US); Telok Forest Reserve, Mar 1965, *Whitmore, T.C. FRI227* (K, KEP, L, SING); Genting Highlands, Gunung Bunga Buah, 10 May 1991, *Tan, W.K. et al. TWK12* (SING); Genting Highlands, Old trail to Gunung Bunga Buah, 1095 m, 18 Jan 2008, *Chan, Y.M. & Kiew, R. et al. FRI60504* (KEP); Genting Highlands, Ulu Gombak, 910 m, 14 Jun 1973, *Mohd Shah & Mohd Ali MS 3046* (C, SING); **Terengganu:** Ulu Besut, Bukit Tangga, 910 m, 18 Jul 1984, *Shah, M. & Mahmud MS4895* (E, KEP, SING); Bundi, Feb 1904, *Rostado 64* (SING); Hulu Terengganu, Sg. Cicir, 4 Aug 2007, *Jutta, M. & Kueh, H.L. FRI59583* (KEP).

SINGAPORE: Changi, 10 Dec 1889, *Ridley, H.N. 2706* (K); MacRitchie Reservoir, 4 Dec 1948, *Sinclair, J. 5376* (E); Bukit Timah, 18 May 1964, *Hardial, S. & Samsuri Ahmad 18* (C, L, LAE, SING); Krangi, 30 Nov 1899, *Ridley, H.N. s.n.* (L); Krangi, 1891, *Goodenough, J.S. 2705* (SING); Krangi, 29 Nov 1889, *Goodenough, J.S. 2706* (BM, SING); Tuas, 1 May 1891, *Goodenough, J.S. s.n.* (SING); Chan Chu Kang, May 1889, *Corporal s.n.* (SING); Bukit Timah, 7 Jun 1974, *Noor, M. MN.1913* (SING); Krangi, 10 Dec 1889, *Goodenough, J.S. s.n.* (SING); Tengeh Reservoir, 4 Aug 1890, *Goodenough, J.S. s.n.* (SING); Krangi, 2 Nov 1889, *Goodenough, J.S. s.n.* (SING); Krangi, 7 Dec 1889, *Ridley, H.N. s.n.* (SING); Krangi, 8 Apr 1890, *Goodenough, J.S. s.n.* (BM); Krangi, 1909, *Ridley, H.N. s.n.* (BM); Nee Soon Swamp Forest, 8 Aug 2010, *Gwee, A.T. SING2010-443* (SING); Nee Soon Swamp Forest, 17 Feb 2009, *Staples, G., Leong, P., Chew, P.T. & Ibrahim, A. et al. SING2009-157* (KEP, SING); Nee Soon Swamp Forest, 17 Apr 2012, *Leong, P., Yam, T.W., Liew, D. & Rodda, M. et al. SING2012-165* (SING); Tengeh Reservoir, 1891, *Ridley, H.N. 2710* (SING); Mandai Road, Aug 1920, *Burkill, I.H. 6102* (SING); Nee Soon Swamp Forest, 8 May 2013, *Ibrahim, H., Lua, H.K. & Saiffudin, S. SING2013-093* (SING); Nee Soon Swamp Forest, 8 May 2013, *Ibrahim, H. & Lua, H.K. SING-2013-092* (SING).

Notes. This is a very widespread and variable species in both leaf and flower characters. Although it already has many synonyms further investigation is required as to whether a number of other species in Borneo should also be included in synonymy. In Peninsular Malaysia and Singapore this species has most commonly gone by the name *Aeschynanthus parvifolius* but was previously synonymised in Middleton (2007) as it

falls within the range of variation of the species. Likewise, *Aeschynanthus lanceolatus* is not distinct from this variable species.

There are a small number of specimens with pubescent leaves, reminiscent of *Aeschynanthus radicans* but with the ovary pubescence of *A. pulcher*. Further studies should be undertaken to see if there is any possibility of hybridisation between these two similar species.

10. *Aeschynanthus radicans* Jack, Trans. Linn. Soc. London 14: 43 (1823); Brown, Cyrtandreae 115 (1839); Steudel, Nomencl. Bot. ed. 2, 1: 32 (1840); Brown in Bennett, Pl. Jav. Rar. 115 (1840); A.DC., Prod. 9: 262 (1845); Zollinger, Syst. Verz. 3: 56 (1855); Miquel, Fl. Ned. Ind. 2: 720 (1858); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 41 (1883); Clarke in Hooker, Fl. Brit. Ind. 4: 343 (1884); Ridley, J. Linn. Soc. Bot. 32: 501 (1896); Ridley, J. Asiat. Soc. Bengal 74 (2): 736 (1909); Ridley, Fl. Mal. Pen. 2: 500 (1923); Bakhuizen van den Brink, Blumea 6: 395 (1950); Merrill, J. Arnold Arb. 33: 214 (1952); Barnett, Fl. Siam. 3 (3): 202 (1962); Backer & Bakhuizen van den Brink, Fl. Java 2: 524 (1965); Chin, Gard. Bull. Singapore 32: 148 (1979); Turner, Gard. Bull. Singapore 45: 92 (1993); Turner, Gard. Bull. Singapore 47: 244 (1997 ['1995']); Burt, Thai Forest Bull., Bot. 29: 84 (2001); Smitinand, Thai Pl. Names ed. 2, 15 (2001); Middleton, Edinburgh J. Bot. 64: 414 (2007). – *Trichosporum radicans* (Jack) Nees, Flora 8: 144 (1825); Merrill, Contr. Arnold Arbor. 8: 152 (1934). – TYPE: Indonesia, Sumatra, Lampung, Gunung Rati Telanggaran, 400 m, 14 November 1921, Iboet 57 (neotype L, designated by Middleton (2007)). (Fig. 12, 14)

Trichosporum ovatum D. Don ex C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 41 (1883), nom. nud.

Aeschynanthus radicans var. *robustior* C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 41 (1883). – TYPE: Kalimantan, Kalimantan Selatan, Banjarmasin, Motley, J. 715 (lectotype K, designated here).

Aeschynanthus radicans var. *lanuginosa* Ridl., J. Asiat. Soc. Bengal 74 (2): 736 (1909); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – TYPE: Peninsular Malaysia, Perak, *Scortechini*, B. 330 (not traced). This variety is placed in synonymy based on the fact that the characters used to distinguish it are continuously variable in the species.

Epiphytic and hanging to lithophytic and creeping or even epiphytic and climbing by adventitious roots on the stem; stems sparsely to densely puberulent or with longer hairs. **Leaves** opposite; petiole 1–4.5 mm long, sparsely to densely puberulent; blade slightly fleshy, ovate, mostly green above and beneath, not marbled, orbicular or elliptic, 1–5 × 0.8–2.6 cm, 1.1–2.6 times as long as wide, apex rounded and apiculate or acute to acuminate, base subcordate to obtuse; glabrous to sparsely puberulent all over above, sparsely to densely puberulent all over beneath, margin entire; secondary

Fig. 14. Distribution of *Aeschynanthus radicans* Jack in Singapore and Peninsular Malaysia (●).

veins obscure, tertiary venation obscure. **Inflorescences** axillary, generally 1-flowered; peduncle 0–3 mm long, bracts elliptic to ovate, 5–6 mm long; pedicels 7–14 mm long, sparsely to densely puberulent or with longer hairs. **Calyx** with a tube for most of length and free lobes, rarely slightly zygomorphic, purple, green with red veins, or green, puberulent, sometimes with quite long hairs, 19.5–26 mm long; tube 13–22 mm long which is 65–91% of total length, 6.5–9 mm wide at top of tube; lobes narrowly triangular, ovate or oblong, erect, $2-8 \times 2.6-5$ mm, apex rounded. **Corolla** 47.5–58 mm long, inflated at base, externally tube bright red, lobes bright red, internally tube yellowish, lobes red with yellowish at base and darker red markings on lower 3 lobes; upper lobes oblong or ovate, slightly spreading or not, $6.5-10 \times 2-4.4$ mm, sinus 2.4–6.7 mm deep, apex rounded; lateral lobes ovate or deltoid, slightly spreading or not, $7-10 \times 6.2-7.5$ mm, apex rounded; lower lobe elliptic or oblong, slightly spreading or not, $6.5-10.7 \times 5.6-7.7$ mm, apex rounded, outside densely puberulent, inside glabrous

or with sessile glands and short stalked glandular hairs throughout, sessile glands below lobes. **Stamens** reaching to end of upper corolla lobes or slightly exerted, fused in 2 pairs, filaments with very few glandular hairs or sessile glands; anterior filaments inserted at 27–36 mm from corolla base which is 52–63% of corolla length, filaments 22–27 mm long, anthers $2.1\text{--}3.4 \times 1.5\text{--}1.9$ mm; posterior filaments inserted at 31–38.5 mm from corolla base which is 59–70% of corolla length, filaments 15.5–21 mm long, anthers $2.1\text{--}3 \times 1.2\text{--}1.7$ mm; staminode 0.5–5 mm long. **Disk** 1–8 mm high, a simple annular ring. **Pistil** 45.5–61 mm long; stipe 18–28 mm long, densely puberulent, often with a mix of glandular and eglandular hairs; ovary 14–28 mm long, densely puberulent, often with a mix of glandular and eglandular hairs; style 6–15 mm long, densely puberulent, often with a mix of glandular and eglandular hairs. **Capsule** 19–35 mm long, 2.5–3 mm wide. **Seed** grain $0.8\text{--}0.9 \times 0.15\text{--}0.3$ mm, papillose, bubble cells present at base of hilar appendage; apical appendage a filiform hair, 7–8 mm long; hilar appendage a single filiform hair, 6–8 mm long; appendages not papillose.

Distribution. Southern Thailand, Peninsular Malaysia (Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Penang, Perak, Selangor, Terengganu), Singapore (but currently considered to be nationally extinct), Sumatra, Borneo.

Habitat and ecology. Epiphytic or clambering over rocks in lowland or hill dipterocarp forest, often by streams, occasionally in swamp forest, at 0–1000 m altitude.

Provisional IUCN conservation assessment. Least Concern (LC). This species is widespread and locally common although there are rather few recent collections of it from Malaysia. The last collection made of this species in Singapore was in 1931 on Bukit Timah. It has since been listed as nationally extinct by Chong et al. (2009). At one time *Aeschynanthus pulcher* was also listed as nationally extinct in Singapore and has since been rediscovered (Williams, 2014). *Aeschynanthus radicans* may also still occur in Singapore in small numbers in the forest canopy or may come back in from Peninsular Malaysia or Sumatra.

Additional Singaporean and Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Johor:** Kota Tinggi, 20 Aug 1954, *Sinclair, J.* 8151 (E); ibidem, 20 Aug 1954, *Sinclair, J.* SFN40358 (SING); Bekok, Endau State Park, Sungai Selai, 200 m, 16 Aug 2002, *Sam, Y.-Y.* FRI47104 (KEP); Bekok, Endau State Park, Sungai Selai, 200 m, 16 Aug 2002, *Sam, Y.-Y.* FRI47104 (KEP); **Kedah:** Weng, 3 Aug 1985, *Bogner* 1699 (M); Gunung Inas Recreation Park, 29 May 2001, *Sam, Y.-Y.* FRI46549 (KEP); Baling, Gunung Inas Forest Reserve, Bukit Iboi, 2 Nov 2007, *Imin, K., Kueh, H.L. & Phoon, S.N. et al.* FRI58594 (KEP, SING); **Kelantan:** Gua Panjang, 7 Aug 1962, *UNESCO limestone expedition* 440A (K, L, SING); Gua Musang, Kuala Betis, 8 Oct 1985, *Latiff, A. & Zainudin, A.* ALM1033 (L); Sg. Ketil, May 1991, *Davison, G.W.H. s.n.* (KEP); Jeli, Kuala Yong, 22 Sep 1986, *Latiff, A., Zainudin, A. & Miran, S.* ALM1644 (UKMB); Kelumpor, 3 Feb 1923, *Md Haniff & Md Nur* 10390 (SING); Kuala Krai, Stong FR, 8 Aug 2009, *Julius, A. & Imin, K.* FRI56237 (KEP); **Melaka:** unknown loc., *Cuming, H.* 2387 (K); ibidem, *Griffith, W. s.n.* (K); ibidem, 20 Aug 1916, *Burkill, I.H.* 2159 (SING); Sungei Rambei River, Jun 1889, *Derry, R.* 205 (SING); ibidem, Oct 1889, *Derry, R.* 305 (SING);

Selandar, Oct 1893, *Goodenough, J.S. 1518* (SING); **Negeri Sembilan:** Gunung Angsi, 7 Sep 1937, *Franck, C.W. 1150* (C); Selam Forest Reserve, 27 Nov 1922, *Holttum, R.E. 9715* (SING); Bukit Sutu, 1 Nov 1885, *Alvins, M.V. 1942* (SING); Jelevu, Berembun FR, Jeram Toi, 446 m, 8 Apr 2008, *Yao, T.L., Angan, A. & Norazmi, A. FRI57913* (KEP); **Pahang:** Tahan River, 150 m, 8 Sep 1937, *Corner, E.J.H. s.n.* (L); Sungei Takan, Aug 1891, *Ridley, H.N. s.n.* (SING); Puku, Kuala Teku, 21 Dec 1920, *Seimund, E. 390* (SING); Sungai Sat, 18 Jul 1929, *Henderson, M.R. SFN21928* (BM, NY, SING); Jerantut, Tekam Forest Reserve, 3 Oct 2002, *Sam, Y.-Y. FRI44492* (KEP); Tasek Bera, 16 Mar 1939, *Mashall 35847* (KEP); Jerantut, Tekam Forest Reserve, 3 Oct 2002, *Sam, Y.-Y. FRI44492* (KEP); **Penang:** Government Hill, Jul 1894, *Curtis, C. s.n.* (SING); Penang Hill, 500 m, 14 Aug 1986, *Weber, A. s.n.* (KEP); Beside Hill railway, 14 Aug 1925, *Flippance, F. s.n.* (SING); **Perak:** Changkat Mentri, Sep 1918, *Kloss, C.B. 6476* (K); Kuala Kangsar, Bubu Forest Reserve, Sungei Kenas, 410 m, 22 Oct 1992, *Saw, L.G. FRI37684* (KEP); Sunkai, 24 Feb 1987, *Anthony, S. SA740* (KEP); Perak River, 14 Jan 1963, *Allen, B.M. 4852A* (SING); Sungai Ryah, *Scortechini, B. 37* (SING); Temengor, 1909, *Ridley, H.N. 14281* (SING); ibidem, Jul 1909, *Ridley, H.N. 14282* (BM); Taiping, Bukit Larut, Sep 1908, *Long, F.R. 13* (K); ibidem, *Keng, H. et al. 1* (SINU); **Selangor:** Ulu Langat, 19 Aug 1959, *Gadoh anak Umbai for A.H. Millard KL1680* (K, KEP, L, SING); ibidem, 23 Aug 1958, *Gadoh anak Umbai for A.H. Millard KL781* (KEP); Genting Sempah, 21 Oct 1921, *Hume, H.L. 9228* (SING); Semenyih, 23 Jul 1921, *Hume, H.L. 8253* (SING); Genting Highlands, Ulu Gombak, 10 Oct 1921, *Hume, H.L. 8943* (SING); Sungei Buloh, Oct 1899, *Goodenough, J.S. s.n.* (SING); **Terengganu:** Bukit Besar, 760 m, 25 Aug 1901, *Annandale, N. & Robinson, H.C. s.n.* (CGE, K); ibidem, 910 m, 3 May 1899, *Gwynne-Vaughan, D.T. 410* (CGE); Hulu Terengganu, Sg. Cicir, 4 Aug 2007, *Jutta, M. & Kueh, H.L. FRI59582* (KEP); Hulu Terengganu, Tembat Forest Reserve, 5 Apr 2010, *Mohd Hairul, M.A., Ong, P.T., O'Byrne, P. & Mohd Nazri, A. et al. FRI70936* (KEP); ibidem, 30 Jul 2009, *Rosdi, M., Kamarul Hisham, M. & Angan, A. FRI66336* (KEP). SINGAPORE: Bukit Timah, 12 Sep 1948, *Sinclair, J. s.n.* (P); ibidem, 26 Feb 1931, *Md Nur SFN24637* (NY, SING); ibidem, 1891, *Ridley, H.N. 2704* (K); ibidem, 12 Sep 1948, *Sinclair, J. 5090* (E); ibidem, 1891, *Ridley, H.N. 2704* (SING); ibidem, 1900, *Ridley, H.N. s.n.* (BM).

Notes. *Aeschynanthus radicans* is rather similar to rare forms of *A. pulcher* with hairs on the leaves but can be distinguished from it by the hairs on the ovary (glands only in *A. pulcher*).

11. *Aeschynanthus rhododendron* Ridl., J. Linn. Soc. 32: 500 (1896); Ridley, J. Straits Branch Roy. Asiat. Soc. 44: 15 (1905); Ridley, J. Asiat. Soc. Bengal 74 (2): 735 (1909); Ridley, Fl. Mal. Pen. 2: 499 (1923); Turner, Gard. Bull. Singapore 47: 244 (1997 ['1995']); Middleton, Edinburgh J. Bot. 64: 418 (2007). – TYPE: Peninsular Malaysia, Perak, Taiping, Gunung Hijau, 1520 m, 1892, *Ridley, H.N. s.n.* (lectotype SING [SING0035553], designated by Middleton (2007)). (Fig. 15, 16)

Aeschynanthus longicalyx Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 16 (1905); Ridley, J. Asiat. Soc. Bengal 74 (2): 735 (1909); Ridley, Fl. Mal. Pen. 2: 499 (1923); Henderson, Malay. Wild. Fl. Dicot. 341 (1959); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – TYPE: Malaysia, Selangor, Semangkok Pass, February 1904, *Burn-Murdoch s.n.* (lectotype SING [SING0035404], designated by Middleton (2007); isotype K).

Aeschynanthus longicalyx var. *superbus* Ridl., J. Fed. Malay States Mus. 5: 43 (1914); Stone, Fed. Mus. J. 26 (1): 98 (1981); Middleton, Edinburgh J. Bot. 64: 422 (2007); Middleton, Edinburgh J. Bot. 66: 440 (2009). – TYPE: Peninsular Malaysia, Selangor, Gunung Mengkuang Lebah, 1520 m, 4 February 1913, *Robinson, H.C. s.n.* (lectotype SING [SING0035408], designated by Middleton (2007); isoelectotypes BM [BM000537105], K [K000831889]).

Epiphyte with erect and arching stems; branchlets glabrous. **Leaves** opposite; petiole 3–12 mm long, glabrous; blade coriaceous to fleshy, mid to dark green above, paler beneath, not marbled, ovate or elliptic, 2.1–13 × 0.9–5.9 cm, 1.3–5.8 times as long as wide, apex acuminate, base cuneate to rounded, glabrous above and beneath, punctate or not beneath, margin entire, secondary veins obscure to clearly visible, 3–5 pairs, tertiary venation obscure or laxly reticulate. **Inflorescences** axillary or subterminal with 1–2 flowers; peduncle absent; bracts linear, c. 2 mm long; pedicels 8–19 mm long, glabrous. **Calyx** with a tube and free lobes, rarely slightly zygomorphic, red, sometimes with some green at base, glabrous or with a few hairs only on very tips of lobes, 16–65 mm long; tube 11–37 mm long which is 45–88% of total length, 7.5–27 mm wide at top of tube; lobes triangular or narrowly triangular, erect, 2.3–32 × 1.8–11 mm, apex acuminate or acute. **Corolla** 54–102 mm long, tube curved, narrow at base, externally bright red on tube and lobes, internally red with darker markings on lower 3 lobes and pale orange at base of lobes and in tube; upper lobes oblong, slightly spreading to reflexed, 9–22 × 8.5–12 mm, sinus 5–11 mm deep, apex rounded; lateral lobes ovate or orbicular, reflexed, 7–18 × 7–16 mm, apex rounded; lower lobe oblong or obovate, spreading or reflexed, 9–21 × 8.5–12 mm, apex rounded; glabrous to sparsely eglandular puberulent outside, sometimes only around top, inside with scattered glandular hairs throughout except at base and becoming more dense in throat, sessile glands inside tube present. **Stamens** not exerted or only very slightly exerted beyond upper lobes, fused in 2 pairs; filaments bright red, with glandular hairs; anterior filaments inserted in tube at 40–50.5 mm from corolla base which is 48–59% of corolla length, filaments 32–41 mm long, anthers 3.6–5 × 1.4–2.5 mm; posterior filaments inserted in tube at 51–56 mm from corolla base which is 62–69% of corolla length, filaments 20–25 mm long, anthers 3–4.5 × 1.1–2.3 mm; staminode 0.7–4 mm long. **Disk** 0.8–1.5 mm high, a simple annular ring or 5-crenate. **Pistil** 56–84 mm long; stipe 18–33 mm long, glabrous; ovary 20–50 mm long, glabrous; style 7–22 mm long, densely glandular and eglandular pubescent. **Capsule** 11–22 cm long, 4–6 mm wide, with a long stipe. **Seed** grain 0.8–1.5 × 0.2–0.4 mm, papillose, bubble cells absent; apical appendage short and stout, 0.7–1.2 mm long; hilar appendage a single stout appendage, 0.7–1.1 mm long; appendages not papillose.

Distribution. Extreme south of Thailand, Peninsular Malaysia (Kelantan, Pahang, Perak, Selangor), Sumatra.

Habitat and ecology. Recorded from (90–)1200–2100 m altitude. Almost all collections of this species have been made in upper montane forest at over 1200 m altitude or in

Fig. 15. *Aeschynanthus rhododendron* Ridl. **A.** Flower with larger-lobed calyx from southern part of range. **B.** Flower with smaller-lobed calyx from northern part of range. **C.** Habit showing the stamens beginning to wither and reflex in the flower on the right. **D.** Flower from the front. **E.** Flower dissection. (Photos: A–B, David Middleton; C–E, Jana Leong-Škorníková)

mossy forest at even higher altitudes. However, there is a collection, *Mohd Shah & Sidek MS1073* (E, SING) recorded from much lower altitude, 300–400 feet (90–120 m) at Bukit Larut. This may be a mistake.

Fig. 16. Distribution of *Aeschynanthus rhododendron* Ridl. in Peninsular Malaysia (●).

Provisional IUCN conservation assessment. Least Concern (LC). This species is widespread and locally common.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Kelantan:** Kuala Krai, G. Tera, Permatang C, 11 Feb 2007, Yao, T.L., Kiew, R., Chew, M.Y. & Kamarudin S. FRI55845 (KEP); **Pahang:** Genting Highlands, 25 Nov 1984, Kiew, R. RK1546 (KEP); ibidem, 15 Feb 1987, Worthington, R.D. 12463 (L, NY); ibidem, 1520 m, 14 Jun 1967, Whitmore, T.C. FRI3887 (KEP, L, SING); Genting Highlands, Trail to Bt. Tunggul, 1500 m, 18 Jan 1994, Perumal, B., Gan, C.L., Angan, A. & Bedul FRI41661 (KEP); Genting Highlands, Gunung Ulu Kali, 25 Mar 2008, Phoon, S.N. & O'Byrne, P. et al. FRI60557 (K, KEP); ibidem, 9 May 1991, Tan, W.K. et al. TWK1 (SING); ibidem, 1670 m, 19 Sep 1967, Dransfield, J. s.n. (KLU); ibidem, 1500 m, 21 Dec 1982, Stone, B.C.M. 15366 (KLU); ibidem, 1767 m, 25 Mar 2008, Phoon, S.N. FRI60496 (K, KEP); ibidem, 1700 m, 24 Sep 1998, Kamarudin S. FRI33755 (KEP); ibidem, 1750 m, 12 Oct 1974, Van Balgooy, M.M.J. 2154 (E, L); ibidem, 1670 m, 18 Mar 1979, Stone, B.C.M. 14045 (KLU, L); ibidem, 1700 m, 4 Jun 1977, Siew Wei Hoe 47 (L);

ibidem, 2 Mar 1996, *Van Balgooy, M.M.J.* 7133 (K, KEP, L); ibidem, 14 Mar 1982, *Stone, B.C.M.* 15071 (BISH); ibidem, 1756 m, 22 Mar 2006, *Syahida-Emiza FRI51460* (KEP, SING); ibidem, 16 Feb 2007, *Wilkie, P., Julius, A., Nor Ezzawanis, A.T. & Imin, K.* FRI52906 (KEP); Cameron Highlands, 1976, *Anthony, S.* SA231 (KEP); ibidem, 30 Mar 1932, *Mead, J.P.* 27945 (SING); ibidem, 9 Mar 1947, *Wyatt-Smith, J.* KEP 56945 (K, KEP, L); ibidem, 1820–2000 m, Aug 1975, *Keng, H. et al.* K8010 (SINU); ibidem, *Batten Pool, A.H.* s.n. (SING); ibidem, 2120 m, 1 Feb 1962, *Togashi, M.* 622111 (TI); ibidem, 2000 m, 5 Mar 1970, *Togashi, M.* s.n. (TI); ibidem, 1820–2000 m, 25–31 Aug 1975, *Rao & et al.* K8010 (AAU, L); Cameron Highlands, Ulu Bertam Forest Reserve, 1450 m, 9 Nov 1959, *Abbe, E.C., Kadim bin Tassim, Mansor bin Omar & Abbe, L.B.* 9119 (L, NY); Cameron Highlands, Gunung Batu Berinchang, Tarred road to microwave station descending 11 km to Brinchang, 2000 m, 7 May 2007, *Yao, T.L., Nooteboom, H.P. & Angan, A.* FRI55898 (KEP); Cameron Highlands, Gunung Batu Berinchang, 1620 m, 20 Jan 2010, *Mohd Hairul, M.A., Ong, P.T., Siti Munirah, M.Y. & Kueh, H.L.* FRI69938 (KEP); ibidem, 1950 m, 20 Jan 2011, *Imin, K., Mohd Nazri, A. & Julius, A. et al.* FRI71954 (KEP); ibidem, 9 Apr 1987, *Saw, L.G.* FRI34368 (KEP); ibidem, 22 Aug 1995, *Tam Sheh May TSM2* (KEP); ibidem, 1997 m, 11 Feb 2010, *Saw, L.G., Damahuri, S. & Norzamli, A.* FRI48241 (BKF, KEP); ibidem, 2020 m, 30 Aug 1970, *Chin, S.C.* 233 (KLU); ibidem, 1980 m, 22 Mar 2007, *Julius, A.* FRI56020 (KEP, SING); ibidem, 5 Nov 1960, *Poore, M.E.D.* 466 (KLU); ibidem, 30 Jul 1967, *Stone, B.C.M.* 7218 (KLU); ibidem, 29 Jul 2007, *Low, Y.W.* LYW140 (KLU); ibidem, 1920 m, 9 Dec 1961, *Abdul Samat bin Abdullah* 68 (KLU); ibidem, 2024 m, 26 Oct 2007, *Imin, K. et al.* FRI58570 (K, KEP, SING); ibidem, 1945 m, 21 Feb 2008, *Syahida-Emiza FRI57293* (K, KEP, SING); ibidem, 1910 m, 10 Jun 1961, *Castle-Smith, P.M.* 42 (K); ibidem, 17 Mar 1996, *Van Balgooy, M.M.J.* 7228 (KEP, L); ibidem, 1910 m, 18 Apr 1968, *Woods, P.J.B.* 680 (E); ibidem, 1870 m, 26 Jul 2002, *Bramley, G. & Neale, S.* GB31 (E, K, KEP); ibidem, 2000 m, 20 Jun 1975, *Van Balgooy, M.M.J.* 2663 (E, L); ibidem, 13 Sep 1985, *Latiff, A., Zainudin, A. & Miran, S.* ALM970 (L); ibidem, 1880 m, 12 Aug 1986, *Wong, K.M.* FRI35244 (K, KEP, L, SING); ibidem, 2020 m, 4 Nov 1958, *Sinclair, J.* 9949 (E, SING); ibidem, 1970 m, 11 Oct 1963, *Chew, W.-L.* CWL922 (K, L, SING); ibidem, 2020 m, 7 Mar 1960, *Hawkins, A.S.M.* 6 (SING); ibidem, 2 Apr 1989, *Latiff, A. & Zainudin, A.* ALM3121 (UKMB); ibidem, 1520 m, 15 Feb 1975, *Mohd Shah MS 3446* (SING); ibidem, 8 Sep 1970, *Whitmore, T.C.* FRI15450 (K, KEP, L, SING); ibidem, 1820 m, 9 Apr 1930, *Henderson, M.R.* SFN23534 (NY, SING); ibidem, 2020 m, 8 Apr 1960, *Abbe, L.B., Abbe, E.C., Kadim bin Tassim & Mansor bin Omar* 9767 (K, L, NY); Gunung Benom, 14 Nov 2009, *Mohd Hairul, M.A. & Mohd Nazri, A. et al.* FRI69892 (KEP); Cameron Highlands, Gunung Berembun, 1750 m, 5 Apr 1988, *Sabari, D.* FRI32715 (KEP); ibidem, 28 Jun 1988, *Samsuri Ahmad SA96* (SINU); ibidem, 9 Aug 2008, *Rosdi, M. & Phoon, S.N. et al.* FRI59867 (KEP); ibidem, Nov 1908, *Ridley, H.N.* 13600 (BM, K, SING); ibidem, 1820 m, 25 Nov 1925, *Henderson, M.R.* 17988 (SING); ibidem, 4 Apr 1930, *Henderson, M.R.* s.n. (SING); ibidem, 1820 m, 10 Sep 1970, *Whitmore, T.C.* FRI15495 (K, KEP, L, SING); ibidem, 1670 m, 3 Oct 1963, *Chew, W.-L.* CWL772 (C, G, K, L, SING); Cameron Highlands, Trail to G. Berembun, 1670 m, 1 Mar 1968, *Ng, F.S.P.* FRI5931 (K, KEP, L); Cameron Highlands, near Parit Falls, Mar 1952, *Johnston, A.M.* 76 (SING); Cameron Highlands, Break Pressure Tank Hill, 1480 m, 31 Aug 1956, *Burkill, H.M.* HMB760 (K, L, LAE, SING); Cameron Highlands, Tanah Rata, 1400–1500 m, 12 Jan 1983, *Davis* 69248A (E [2 sheets], SING); ibidem, 1440 m, 29 Aug 1956, *Burkill, H.M.* HMB730 (K, L, SING); Cameron Highlands, Tanah Rata, Parit Waterfall, 28 Aug 1990, *Okada, H., Darnaedi, D., Akiyama, H., Kawahara, T. & Watano, Y.* 1027 (TI); Cameron Highlands, Robinson's Falls, 1430 m, 24 Mar 2007, *Julius, A., Middleton, D.J. & Lindsay, S. et al.* FRI57483 (KEP); ibidem, 1400–1840 m, 20 Mar 1992, *Klackenberg, J. & Lundin, R.* 689 (L);

ibidem, 9 May 1964, *Mahmud bin Sidek* 4816 (KLU); ibidem, 14 Apr 1968, *Woods, P.J.B., Black, M. & Wycherley, P.* 615 (E, KEP); Cameron Highlands, Tanah Rata, 1440 m, 29 Aug 1970, *Chin, S.C.* 165 (KLU); Cameron Highlands, Brinchang Mist Forest, 1670 m, 20 Feb 1962, *Poore, M.E.D.* 1028 (KLU); Gunung Benom, 31 Jul 1925, *unknown s.n.* (SING); ibidem, 28 Jul 1925, *Federated Malay States Museum Coll s.n.* (K); Gunung Mengkuang, 1520 m, 28 Mar 1959, *Wyatt-Smith, J.* 78808 (KEP); Gunung Tahan, Tangga Duabelas, 1530 m, 24 Mar 1987, *Kiew, R.* RK2430 (KEP); Above Genting Sempah, 1440 m, 23 Jul 1967, *Stone, B.C.M.* 7194 (KLU, L); Fraser's Hill, 15 Nov 1977, *Keng, H. et al.* 410 (SINU); ibidem, 1450 m, 27 Aug 1923, *Henderson, M.R.* 11365 (SING); Fraser's Hill, Pine tree hill, 1450 m, 19 Sep 1922, *Burkill, H.M. & Holttum, R.E.* 8531 (SING); ibidem, 1450 m, 27 Aug 1923, *Md Nur* 11056 (SING); Gunong [Gunung] Gedong, 3 Sep 1928, *Holttum, R.E.* 20769 (SING); Gunung Tahan, 1911, *Ridley, H.N.* 16090 (K, SING); **Perak:** unknown loc., *Scortechini, B.* s.n. (SING); Caulfield's Hill, 1210 m, Apr 1884, *Scortechini, B.* 388 (SING); ibidem, Aug 1885, *Wray, L.* 656 (K, SING); Taiping, *Scortechini, B.* 468b (SING); ibidem, 12 Nov 1889, *Curtis, C.* s.n. (SING); Taiping, Gunung Hijau, 1530 m, 7 Jun 1983, *Stone, B.C.M.* 15497 (KLU); ibidem, 7 Mar 1939, *Spare, G.H.* 2047 (SING); ibidem, Sep 1889, *Curtis, C.* s.n. (SING); ibidem, 1448 m, 19 Mar 2007, *Julius, A., Middleton, D.J. & Lindsay, S. et al.* FRI53302 (KEP, SING); ibidem, 1448 m, 14 Jul 2006, *Kamarul Hisham, M.* FRI52054 (KEP); ibidem, 1440 m, 5 Mar 1924, *Henderson, M.R.* 11829 (SING); ibidem, 1360 m, 14 Feb 1907, *Md Haniff & Md Nur* 2456 (SING); ibidem, 8 Oct 1899, *Fox, W.* s.n. (SING); ibidem, 1210 m, Dec 1887, *Curtis, C.* 1311 (K, SING); ibidem, 1210–1360 m, 4 Dec 1965, *Mohd Shah & Sidek* MS1110 (SING); ibidem, 1520 m, 1892, *Ridley, H.N.* s.n. (SING); ibidem, 1380 m, 11 Sep 1949, *Sinclair, J. & Kiah* SFN38670 (BM, E, K, L, P, SING); Sungei Pelus, 1520 m, 1889, *Wray, L.* s.n. (SING); Gunong [Gunung] Inas, 1180–1360 m, 9 Dec 1899, *Yapp, R.H.* 440 (CGE, K); Gunung Batu Puteh, 1920 m, 26 Feb 1994, *Perumal, B., Gan, C.L., Shahril, K.Z. & Angan, A.* FRI41602 (KEP, KLU); Gunong [Gunung] Jasar, 23 Aug 1977, *Ng, F.S.P.* FRI27146 (KEP); Gunong [Gunung] Jasar, 17 Apr 1968, *Woods, P.J.B.* 632 (E); Gunung Korbu, 1670 m, 10 Mar 1913, *Robinson, H.C.* s.n. (K); Taiping, Bukit Larut, Bukit Bintang Hijau, 1451 m, 1 Mar 2011, *Wilkie, P., Siti Munirah, M.Y., Mohd. Hairul, M.A. & Nazre* FRI75005 (E, KEP); ibidem, 16 Aug 1986, *Weber, A.* s.n. (KEP); ibidem, 90–120 m, 9 Dec 1965, *Mohd Shah & Sidek* MS 1073 (E, SING); ibidem, 1270 m, 20 Oct 1988, *Saw, L.G.* FRI36398 (KEP); ibidem, 27 Jun 1984, *Keng, H. et al.* D-#5 (SINU); **Selangor:** Semangkok Pass, Feb 1904, *Burn-Murdoch* s.n. (K, SING); Gunung Mengkuang Lebah, 1520 m, 16 Jan 1913, *Robinson, H.C.* s.n. (K); ibidem, 1520 m, 17 Jan 1913, *Robinson, H.C.* s.n. (K); ibidem, 1520 m, 4 Feb 1913, *Robinson, H.C.* s.n. (BM, K, SING); Bukit Fraser, Jul 1899, *Hose, G.* 46 (SING); Gunong [Gunung] Bunga Buah, 1360m acc. no. 19680624 vouchered as *Cultivated* C7315 (E, KEP); Ulu Langat, Feb 1912, *Kloss, C.B.* s.n. (K); Hulu Langat, Ulu Langat Forest Reserve, 1440 m, 25 Jan 2003, *Sani, Y.-Y.* FRI47208 (KEP); Ulu Langat, Gunung Nuang, 12 May 1940, *Symington, C.F.* 51762 (KEP); Gunong [Gunung] Nuang, 15 Aug 1974, *Lee, D.W.* s.n. (KLU); Ulu Selangor, Gunung Moyang, 3 Nov 1940, *Symington, C.F.* 56711 (KEP).

Notes. This species is rather variable in the shape of the calyx. The type of the species is from Gunung Hijau in the Taiping Hills where the calyx is generally narrow and the lobes small. This is the form also found in Thailand. In the Genting Highlands, Fraser's Hill and Gunung Benom the calyx tube flares gently from the base so that the mouth is wider and the lobes are much larger. This is the plant formerly recognised as *Aeschynanthus longicalyx*. The largest calyx seen is from Gunung Ulu Kali in the Genting Highlands. Material from the Cameron Highlands is rather intermediate.

12. *Aeschynanthus speciosus* Hook., Bot. Mag. 73: t.4320 (1847); Miquel, Fl. Ned. Ind. 2: 718 (1858); Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 33 (1883); Ridley, J. Linn. Soc. Bot. 32: 499 (1896); Ridley, J. Straits Branch Roy. Asiat. Soc. 44: 14 (1905); Ridley, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 74(2): 733 (1909); Ridley, Fl. Mal. Pen. 2: 498 (1923); Turner, Gard. Bull. Singapore 47(1): 244 (1997 ['1995']); Burtt, Thai Forest Bull., Bot. 29: 84 (2001); Smitinand, Thai Pl. Names, ed. 2: 15 (2001); Middleton, Edinburgh J. Bot. 64: 420 (2007). – *Trichosporum speciosum* (Hook.) Kuntze Revis. Gen. Pl.: 478 (1891). – TYPE: Java, Jawa Barat, Mt Asapan, Lobb, *T. s.n.* (lectotype K, designated by Middleton (2007)). (Fig. 17, 18)

Aeschynanthus aucklandiae Low, Sarawak: 386 (1848). – TYPE: Borneo, East Malaysia, Sarawak, Low, *H. s.n.* (holotype CGE).

Epiphyte with erect, arching and pendulous stems; branches glabrous. **Leaves** in whorls of 3–6; petiole generally wide and flat, sometimes slightly winged, 2–12 mm long, glabrous; blade coriaceous or slightly fleshy, mid to dark green above, paler beneath, not marbled, elliptic or ovate, 3.8–15.3 × 1.2–5.5 cm, 2.3–6.1 times as long as wide, apex acuminate to caudate, base cuneate to rounded, glabrous above and beneath, not punctate beneath, margin dentate to entire, often strongly undulate, secondary veins obscure to weakly visible, c. 7–8 pairs, tertiary venation obscure. **Inflorescences** terminal with 4–12 flowers; peduncle absent; bracts linear, 5–13 mm long; pedicels 7–14.5 mm long, glabrous or sparsely eglandular puberulent. **Calyx** of separate lobes free to the base, pale green, yellowish or dark reddish brown and then often flushed with one of the other colours, glabrous to densely eglandular or glandular puberulent; lobes narrowly triangular or linear, erect, 6.5–26.3 × 1–2.6 mm, apex acute or acuminate. **Corolla** 54–118 mm long, tube narrow at base, externally yellow, yellowish green or orangish on basal half to two-thirds of tube and orange-red to bright red above, more rarely bright red all over, lobes orange-red to bright red, internally light yellowish in tube and red or orangish on upper 2 lobes and red or orangish at the margin with darker V- or W-shaped markings on lower 3 lobes and yellowish at the base; upper lobes oblong, not spreading or reflexed, 4.5–11 × 3.6–8 mm, sinus 4–8.2 mm deep, apex rounded; lateral lobes oblong, deltoid or ovate, spreading, 5.7–14 × 5.7–13.5 mm, apex rounded; lower lobe oblong or elliptic, spreading or reflexed, 7–15.5 × 4.5–12 mm, apex retuse to rounded; outside glabrous, slightly papillose or sparsely glandular puberulent, sometimes only on ciliate lobes, inside with sparse sessile glands. **Stamens** long exserted, fused in 2 pairs; filaments bright red or white, with glandular hairs, anthers grey, pale brown or purple-black; anterior filaments inserted at 50–96 mm from corolla base which is 67–81% of corolla length, filaments 29–46 mm long, anthers 3.9–7 × 1.3–2.3 mm; posterior filaments inserted at 53–100 mm from corolla base which is 72–85% of corolla length, filaments 21–38 mm long, anthers 2.6–5 × 1.2–2.1 mm; staminode 0.3–4 mm long. **Disk** 1.2–2.5 mm high, 5-dentate or 5-crenate. **Pistil** 83–130 mm long; stipe 20–30 mm long, with few sessile glands or glabrous; ovary 27–44 mm long, with sessile glands, these sometimes very few; style yellow or green, 14–65 mm long, glandular pubescent, especially in upper half.

Capsule 20–45 cm long, 2.3–3.6 mm wide. **Seed** grain 0.9–1.3 × 0.3–0.4 mm, warty, bubble cells absent; apical appendage a filiform hair, 15–22 mm long; hilar appendage a single filiform hair, 15.5–23 mm long; appendages papillose.

Distribution. Southern Thailand, Peninsular Malaysia (Pahang, Perak, Selangor), Sumatra, Java, Borneo.

Habitat and ecology. In hill dipterocarp forest habitats at 240–760 m altitude. It has been recorded to 1900 m altitude in Sumatra and is likely to also occur at higher altitudes in Peninsular Malaysia.

Provisional IUCN conservation assessment. Least Concern (LC). This species is remarkably infrequently collected despite having very showy flowers such that it is readily observed in the forest for collection. It is likely to be relatively rare over most of its range but both the EOO and AOO are much higher than those suggesting a threat category would be merited.

Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Pahang:** Bentong Sg., Naming, 760 m, 18 Jan 1959, *unknown* KEP93108 (KEP); Rompin, Endau-Rompin State Park, Ulu Kinchin, Sg. Kinchin, *Norain, Raihana & Rosjana* 07 (SINU); **Perak:** Near Ulu Selama, 8 Jan 1900, *Yapp, R.H.* 610 (CGE); Bruseh near Bidor, 240 m, 27 Jun 1904, *Napier, W. s.n.* (SING); **Selangor:** Ulu Langat, *Gadoh, U.* KL1319 (KEP, SING); Serendah Ridge, 300 m, 18 Jul 1957, *Hawkins, A.S.M. s.n.* (SING); Bukit Elam, Jan 1891, *Kelsall, H. s.n.* (SING).

Notes. It is possible that *Aeschynanthus pseudohybridus* Mendum from Borneo is a synonym of this species but further study is necessary. It differs in the more uniformly red flowers compared to the orange and yellow flowers of *A. speciosus*.

13. *Aeschynanthus volubilis* Jack, Trans. Linn. Soc. London 14: 42 (1823); Brown, Cyrtandreae 115 (1839); Steudel, Nomencl. Bot. ed. 2, 1: 32 (1840); Brown in Bennett, Pl. Jav. Rar. 115 (1840); A.DC., Prod. 9: 262 (1845); Miquel, Fl. Ned. Ind. 2: 719 (1858); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 46 (1883); Bakhuizen van den Brink, Blumea 6: 395 (1950); Merrill, J. Arnold Arb. 33: 214 (1952); Backer & Bakhuizen van den Brink, Fl. Java 2: 524 (1965); Sinha, Fl. Gt. Nicobar Isl. 329 (1999). – *Trichosporum volubile* (Jack) Nees, Flora 8: 144 (1825). – TYPE: Plate II, fig. 3 in Jack, Transactions of the Linnean Society of London vol. 14, unnumbered page between pp. 44 and 45 (1823), lectotype designated here. Epitype: Sumatra, East Coast [Sumatera Utara], Asahan, Silo Maradja, June 1927, *Bartlett* 8695 (epitype NY, designated here; isoepitype MICH). (Fig. 19)

Aeschynanthus obovatus C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 47 (1883). – *Trichosporum obovatum* (C.B.Clarke) Kuntze, Revis. Gen. Pl. 478 (1891). – TYPE: Kalimantan, Kalimantan Selatan, Banjarmasin, *Motley, J.* 1158 (holotype K).

Fig. 17. *Aeschynanthus speciosus* Hook. **A.** Habit. **B.** Flowers, side view. The flower on the right is older with a much longer style and the stamens beginning to reflex (and with one pair becoming detached). **C.** Flower dissection with 2 calyx lobes removed to view nectary. (Photos: Jana Leong-Škorníčková)

Aeschynanthus obovatus var. *pallidus* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 48 (1883). – TYPE: Java, *Zippelius*, *A.* Leiden number 52 (lectotype L [L0281661], designated here; isoelectotypes L [L0281673, L0281674]).

Aeschynanthus hoseanus Kraenzl., J. Linn. Soc. Bot. 37: 284 (1906). – *Trichosporum hoseanum* (Kraenzl.) Merr., J. Straits Branch Roy. Asiat. Soc. special number: 530

Fig. 18. Distribution of *Aeschynanthus speciosus* Hook. in Peninsular Malaysia (●).

(1921). – TYPE: Borneo, East Malaysia, Sarawak, Saribas, 24 Nov 1893, *Haviland, G.D. & Hose, C.* 3528 (holotype K; isotype BM [BM000797673]).

Aeschynanthus flippancei Ridl., Bull. Misc. Info. Kew. 1926: 473 (1926); Turner, Gard. Bull. Singapore 47: 243 (1997 ['1995']). – TYPE: Cultivated in Penang Botanic Gardens but originally from Malaysia, Penang, Balik Pulau, *Flippance, F. s.n.* (lectotype K, designated here; isotype SING [SING0035633]).

Epiphyte with erect, arching or pendulous stems; stem glabrous. **Leaves** opposite; petiole 3–14 mm long, glabrous or sparsely puberulent; blade coriaceous, mid to dark green above, paler beneath, elliptic or ovate, $1.8\text{--}5.7 \times 0.7\text{--}3.2$ cm, 1.6–2.7 times as long as wide, apex obtuse to acuminate, base rounded to cuneate, glabrous above and beneath, not punctate beneath, not variegated, margin entire, 3–5 pairs of secondary veins, weakly visible or obscure, tertiary venation obscure. **Inflorescence** subterminal

or axillary, 3–4-flowered; peduncle 3–5 mm long; pedicels 7–12 mm long, glabrous. **Calyx** with a tube for most of length and free lobes, tube fairly broad and gently flaring from base, 10–16.5 mm long; tube 8.8–14 mm long, 83–90% of total length, c. 6 mm wide at top of tube; lobes triangular or semicircular, slightly spreading or erect, 1–2.5 × 2.3–5 mm, apex rounded to acute, rarely acuminate. **Corolla** 19.5–27 mm long, tube slightly curved or almost straight, broad at base; upper lobes oblong, not spreading or reflexed, 3.2–4.5 × 2.5 mm, sinus 1.5–2 mm deep, apices rounded; lateral lobes deltoid, reflexed, 3–5.2 × 3.8–4.4 mm, apices rounded; lower lobe oblong, spreading, 4.2–5.5 × 3.2–4 mm, apex rounded; outside glabrous except for ciliate lobes, inside with sparse glandular hairs in upper part of tube and more densely so on inside of lobes except near margin. **Stamens** long exserted, fused in 2 pairs; filaments with sparse short stalked glands throughout; anterior filaments inserted at 14–17 mm from corolla base which is 52–63% of corolla length, filaments 16–18 mm long, anthers 2.4 × 1 mm; posterior filaments inserted at 16–19 mm from corolla base which is 48–67% of corolla length, filaments 12.5–13 mm long, anthers 2–2.2 × 1–1.6 mm; staminode 0.4–1.3 mm long. **Disk** 1–1.2 mm high, a simple annular ring or 5-crenate. **Pistil** 18–32 mm long; stipe 1.7–8 mm long, glabrous; ovary 10–16 mm long, with very few sessile glands and appearing glabrous; style 4–8 mm long, glandular pubescent. **Capsule** 10–28 cm long, 2.8–3 mm wide. **Seed** grain 0.5–0.6 × 0.1–0.2 mm wide, smooth, bubble cells present at base of hilar end; apical appendage a filiform hair, 4–8.5 mm long; hilar appendage a single filiform hair, 7.5–9 mm long.

Distribution. Peninsular Malaysia (Penang), Sumatra (but see note below).

Habitat and ecology. None of the collections I have seen of this species from Malaysia or elsewhere include habitat data or altitudinal range.

Provisional IUCN conservation assessment. Data Deficient (DD). The limits of the species and its distribution are unclear.

Additional Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Penang:** Balik Pulau, *Flippance*, *F. s.n.* (K, SING); Government Hill, May 1921, *Md Haniff s.n.* (SING).

Notes. *Aeschynanthus volubilis* is the type species of the genus. It is known in Peninsular Malaysia only from a small number of specimens formerly identified as *Aeschynanythus flippancei*.

There are a number of species and specimens from Borneo and eastern Malesia which appear similar to *Aeschynanthus volubilis* but require further study to ascertain whether they are synonyms and/or extensions of the distribution of the species.

14. *Aeschynanthus wallichii* R.Br., Cyrtandreae 116 (1839); Brown in Bennett, Pl. Jav. Rar. 116 (1840); de Candolle, Prod. 9: 263 (1845); Miquel, Fl. Ned. Ind. 2: 722 (1858); C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 48 (1883); Clarke in

Hooker, Fl. Brit. Ind. 4: 343 (1884); Ridley, J. Linn. Soc. Bot. 32: 502 (1896); Ridley, J. Asiat. Soc. Bengal 74 (2): 736 (1909); Ridley, Fl. Mal. Pen. 2: 500 (1923); Turner, Gard. Bull. Singapore 45: 92 (1993); Turner, Gard. Bull. Singapore 47: 244 (1997 ['1995']). – *Aeschynanthus radicans* Wall., Num. List no. 798 (1829), nom. nud. – TYPE: Singapore, 1822, Wallich, N. 798 (lectotype K-W [K001111917], designated here; isoelectotypes CGE, K [K000831885]). (Fig. 12, 19)

Aeschynanthus brevicalyx Miq., Fl. Ned. Ind. 2: 720 (1858); C.B. Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 49 (1883). – *Trichosporum brevicalyx* (Miq.) Kuntze, Revis. Gen. Pl. 477 (1891). – TYPE: Indonesia, Sumatra, Sikilieh, Teijsmann, J.E. HB1194 (lectotype U, designated here; isoelectotype L).

Epiphytic; stems glabrous. **Leaves** opposite; petiole 5–12 mm long, glabrous; blade coriaceous or slightly fleshy, ovate or elliptic, $3.1\text{--}10.5 \times 0.8\text{--}5$ cm, 1.7–3.8 times as long as wide, apex acuminate, base cuneate to subcordate, not marbled, glabrous above and beneath, not variegated, margin glabrous, entire, 4–5 pairs of secondary veins, only weakly visible or obscure, tertiary venation obscure. **Inflorescence** subterminal or axillary, 3–6-flowered; peduncles to 2.5 mm long, subglabrous to densely eglandular puberulent; pedicels 4.2–9 mm long, green, subglabrous to densely eglandular puberulent. **Calyx** fused into a wide open cup with lobes semicircular or only as curves on rim, green or yellow-green, sparsely to densely eglandular puberulent, sparsely pubescent inside, 2.5–6.5 mm long; tube 1.9–5.5 mm long which is 70–90% of total length, tube 4–7 mm wide at apex; lobes semicircular or a weak curve of the rim, spreading or erect, $0.6\text{--}1.2 \times 3.5\text{--}5.5$ mm, apices rounded. **Corolla** 19.5–27 mm long, tube slightly curved or more or less straight, externally bright or dark red, base of tube not gibbose, outside sparsely to densely glandular to eglandular puberulent, inside with short stiff upward pointing hairs near base or throughout, sessile glands at inside sinuses of lobes; upper lobes orbicular or oblong, not spreading or reflexed, $3.8\text{--}6.6 \times 3\text{--}4.5$ mm, sinus 2.2–3.1 mm deep, apices rounded; lateral lobes ovate or deltoid, not spreading or reflexed, $5\text{--}8 \times 4.2\text{--}6.5$ mm, apices rounded; lower lobe ovate or orbicular, not spreading or reflexed, $4.7\text{--}7 \times 4.7\text{--}9$ mm, apex rounded. **Stamens** slightly or not exerted, fused in 2 pairs, filaments papillose; anterior filaments inserted at 10–12.7 mm from corolla base which is 48–51% of corolla length, filaments 14–15 mm long, anthers $1.9\text{--}2.2 \times 0.9\text{--}1$ mm; posterior filaments inserted at 11.5–14.5 mm from corolla base which is 55–58% of corolla length, filaments 10–11 mm long, anthers $1.7\text{--}2.1 \times 0.9\text{--}1$ mm; staminodes 1–1.2 mm long. **Disk** c. 0.9 mm high, a simple annular ring or 5-crenate. **Pistil** 16.5–22 mm long; stipe 1.5–4 mm long, glabrous or with few sessile glands; ovary 12.5–14.7 mm long, with sessile glands; style 2.5–3.3 mm long, glandular pubescent; stigma circular. **Capsule** 18–37 cm long, c. 4 mm wide. **Seed** grain $0.8\text{--}1.2 \times 0.2\text{--}0.3$ mm, papillose, bubble cells present at base of hilar appendage; apical appendage a filiform hair, c. 9 mm long; hilar appendage a single filiform hair, c. 10 mm long; appendages not papillose.

Distribution. Peninsular Malaysia (Johor, Pahang, Perak, Terengganu), Singapore, Sumatra.

Fig. 19. Distribution of *Aeschynanthus volubilis* Jack (▼) in Peninsular Malaysia and *Aeschynanthus wallichii* R.Br. (●) in Singapore and Peninsular Malaysia.

Habitat and ecology. In lowland dipterocarp forest, or in peat swamp forest at 0–760 m altitude.

Provisional IUCN conservation assessment. Least Concern (LC). This species is relatively infrequently collected but has an EOO and AOO considerably above levels considered to be concerning. In Singapore it is considered to be Critically Endangered and is now confined to Nee Soon Swamp.

Additional Singaporean and Peninsular Malaysian specimens examined. PENINSULAR MALAYSIA: **Johor:** 5 miles S of Labis FR, 17 Apr 1966, *Whitmore, T.C.* KEP207 (KEP); Mawai-Sedili Road, 24 Jan 1961, *Chew, W.-L.* CWL222 (C, E, K, L, SING); Kuala Sedili fresh water swamp forest, 6 m, 26 May 1961, *Burkill, H.M.* HMB2668 (SING); Kota Tinggi, Kuala Sedili New Road, 23 Jun 1959, *Kadim & Noor, M.* 138 (SING); ibidem, 23 Jun 1959, *Kadim & Noor, M.* 131 (SING); ibidem, 25 Sep 1959, *Shah, M. & Noor, M.* MS813 (E, L,

SING); ibidem, 23 Jun 1959, *Shah, M.* 138 (K); Kota Tinggi, Gunung Panti West, 550 m, 19 Jul 1981, *Maxwell, J.F.* 81-182 (L, SING); Gunung Panti, 520 m, 5 Jul 1970, *Samsuri Ahmad SA318* (SING); ibidem, 4 Mar 1987, *Kiew, R.* RK2398 (SING); ibidem, 470 m, 24 Aug 1986, *Wong, K.M.* s.n. (KEP); ibidem, 22 Jan 1994, *Kiew, R.* RK3775 (KEP); ibidem, 4 Mar 1987, *Kiew, R.* RK2398 (KEP); ibidem, 460 m, 31 Jul 2008, *Yao, T.L., Lim, C.L., Rosdi, M. & Ayau, K.* FRI65386 (KEP); ibidem, 480 m, 5 Feb 1981, *Collenette, I.S.* 2254 (E); Pontian, Pengkalan Raja, 28 Jun 1939, *Henderson, M.R.* SFN36656 (K, SING); Gunung Ledang, *Lobb, T.* 111 (K); Alor Bukit, 22 Nov 1966, *Hardial, S.* 537 (K); Sungai Kayu, 12 Oct 1936, *Kiah SFN32054* (BM, K, LAE, SING); Alor Bukit, 22 Nov 1966, *Hardial, S.* 537 (SING); Endau, Sg. Sempanong, 4 Feb 1986, *Kiew, R.* RK2112 (SING); Ulu Batu Pahat, Kampong Simpai, 1892, *Lake & Kelsall, H.* s.n. (SING); Sebrau [?Tebräu], Aug 1908, *Ridley, H.N.* s.n. (SING); Tempayang River, 1908, *Ridley, H.N.* s.n. (BM, SING); Tanjong Kupang, Jun 1890, *Ridley, H.N.* s.n. (SING); Nov–Dec 1935–1935, *Vesterdal, A.* 306 (C); Kluang, 20 Nov 1922, *Holttum, R.E.* 9489 (SING); ibidem, 7 Mar 2000, *Morgany, T., Tan, H.T.W. & Loo, A.H.B.* M260 (SINU); **Pahang:** Pekan, Pekan Forest Reserve, Sungai Bebar, 21 Apr 2005, *Zainon, A.S.* FRI50105 (KEP); Rompin, Endau-Rompin State Park, Trail to Gunung Keriong, 20 Aug 2002, *Sam, Y.-Y.* FRI47144 (KEP); **Perak:** Chenderiang, Gunung [Gunung] Bujang Melaka, 120 m, 10 Aug 1959, *Mrs. Allen & Kadim* 436 (SING); **Terengganu:** Ulu Brang, 760 m, Jul 1937, *Moysey, L. & Kiah SFN33624* (LAE, SING); Sekayu, 7 May 1988, *Kiew, R.* RK2696 (KEP); Sakayu, 29 Aug 1986, *Anthony, S.* SA639 (KEP); Dungun, Pasir Raja Forest Reserve, Hutan Lipur Cemerung, 18 Oct 2002, *Sam, Y.-Y.* FRI47158 (KEP); ibidem, 18 Mar 1998, *Anonymous* s.n. (SING); Ulu Brang, Terengganu Tambahan FR, Sg. Chih, 360 m, 26 Mar 2013, *Imin, K., Ong, P.T. & Kueh, H.L.* FRI77847 (KEP).

SINGAPORE: unknown loc., 1822, *Wallich, N.* 798 (CGE, K-W); ibidem, *unknown* s.n. (SING); Seletar, *Gan, J.T.W.M., Hardie, J.A. & Khng, Y.W.K.* 1012 (SINU); Seletar, 16 May 1992, *Gan, J.T.W.M., Hardie, J.A. & Khng, Y.W.K.* 1037 (SINU); Seletar, 2 Oct 1948, *Sinclair, J.* SFN38248 (SING); Seletar, 18 Sep 1948, *Sinclair, J.* SFN38246 (E, NY, P, SING); Jurong Road 15th mile, 19 Oct 1932, *Corner, E.J.H.* SFN26034 (K, SING); Nee Soon Swamp Forest, 26 Jan 1995, *Karim, N.A. et al.* NK206 (SING); ibidem, 5 m, 19 Mar 1982, *Maxwell, J.F.* 82-80 (SING); Chan Chu Kang, Jun 1892, *Ridley, H.N.* s.n. (MEL); Chan Chu Kang, Jan 1892, *Ridley, H.N.* s.n. (SING); ibidem, 4 Apr 1890, *Goodenough, J.S.* s.n. (SING); Kranji [Kranji], 7 Dec 1889, *Ridley, H.N.* s.n. (SING); ibidem, 1894, *Mat* s.n. (SING); Mandai Road, 19 Feb 1931, *Spare, G.H.* F905 (K); Bukit Mandai, Sep 1890, *Goodenough, J.S.* s.n. (SING).

Notes. This species is most similar to *Aeschynanthus obconicus* but the flowers, and in particular the calyx, are smaller. The calyx is also green (vs red) and more saucer-shaped than cup-shaped.

Further study necessary

Rafidah, A.R. & Nor Ezzawanis, A.T. FRI64274 (KEP) from G. Telapak Burok in Berembun Forest Reserve, Negeri Sembilan, Malaysia, has small opposite leaves, 0.9–2.1 × 0.6–1.1 cm, and seeds with one long appendage at each end. This combination of characters is otherwise unknown in Peninsular Malaysia and without flowers the identity of this plant remains a mystery. *Aeschynanthus longiflorus*, which has the same fruit and seed type, is known from the same locality but it is not known to

have leaves anywhere near as small. *FRI64274* is rather reminiscent of *Aeschynanthus fruticosus* from Sumatra in leaf shape and seed type but that species always has most leaves in whorls of three or more.

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Notes on the Annonaceae of the Malay Peninsula

I.M. Turner

Research Associate, Royal Botanic Gardens Kew,
Richmond, Surrey TW9 3AE, U.K.
j_trop_ecol@yahoo.co.uk

ABSTRACT. Notes concerning the three genera *Alphonsea* Hook.f. & Thomson, *Artabotrys* R.Br. ex Kew Gawl. and *Stelechocarpus* Hook.f. & Thomson (Annonaceae) for the Malay Peninsula are presented. *Alphonsea kingii* J.Sinclair is accepted as an endemic species and a second-stage lectotypification is presented for *Alphonsea cylindrica* King. Seven species of *Artabotrys* are lectotypified. The recently described genus *Winitia* Chaowasku is reduced to *Stelechocarpus* and a new combination is made for *Winitia expansa* Chaowasku.

Keywords. *Alphonsea*, *Artabotrys*, new combination, *Stelechocarpus*, typification, *Winitia*

Alphonsea

Alphonsea kingii

Sinclair (1955) described *Alphonsea kingii* J.Sinclair as a new species in his account of the Annonaceae of the Malay Peninsula. It had earlier been confused with a species of *Xylopi*a L. by King (1892, 1893). Kessler (1995), in revising the genus *Alphonsea* Hook.f. & Thomson, excluded *A. kingii*, suggesting that it belonged in *Mitrephora* Hook.f. & Thomson. Kessler did not report seeing any specimens; his decision was apparently based on King's plate (King 1893: t. 189A). In studying the genus in Peninsular Malaysia it became necessary to reconsider *Alphonsea kingii*. I was kindly sent photographs of the type material from the Central National Herbarium of the Botanical Survey of India (CAL). The second specimen cited by Sinclair (1955), a Scortechini collection from Perak, could not be located in SING (D.J. Middleton pers. comm.). However among material on loan from the herbarium of the Forest Research Institute of Malaysia (KEP), I found another specimen of the species, which had previously been determined as *Alphonsea elliptica* Hook.f. & Thomson. Study of the images and specimen gave no indication that Sinclair was wrong in his assignment of the species to *Alphonsea*. Flowers are still unknown, but in vegetative and fruit characters the specimens are congruent with *Alphonsea*, with leaves similar to those of *A. malayana* P.J.A.Kessler, *A. johorensis* J.Sinclair and *A. elliptica*. Notable features of the species include the rather dense reticulations of the lamina venation, and particularly the verrucose fruits that dry blackish. It seems to be a species of limestone outcrops – a habitat affinity not previously reported in Malayan *Alphonsea*. I conclude that *Alphonsea kingii* is a good species that should be listed in the Annonaceae flora of Peninsular Malaysia.

Alphonsea kingii J.Sinclair, Gard. Bull. Singapore 14: 386 (1955). – TYPE: Peninsular Malaysia, Perak, Kinta, top of limestone hills near G.M. [possibly Gunung Mesua, R. Kiew pers. comm.], January 1885, *King's Collector* [Kunstler, H.H.] 7097 (lectotype CAL [CAL0000025047], designated here; isoelectotypes CAL [CAL000025046], DD, K (reported by Sinclair (1955: 386) but not seen lately)).

Additional specimen studied. PENINSULAR MALAYSIA: **Pahang:** Raub, Bukit Serdam, 20 Jun 1971, *Chin, S.C.* 1073 (KEP [138213]).

A second-stage lectotypification

Kessler (1995: 88) reported the holotype of *Alphonsea cylindrica* King to be located in the Central Herbarium of the Botanical Survey of India (CAL), without seeing the specimen. As there are duplicates of this collection in other herbaria, Kessler (1995) effectively lectotypified the name to this specimen. However, enquiries addressed to the Botanical Survey of India were very kindly answered and I was informed that there were two specimens under the type number in CAL. Therefore, here I propose a second-stage typification to restrict Kessler's choice of lectotype to the better of the two sheets in CAL.

Alphonsea cylindrica King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(2): 127 (1892). – TYPE: Peninsular Malaysia, Perak, Ulu Bubong, July 1886, *King's Collector* [Kunstler, H.H.] 10633 (lectotype CAL [CAL0000004699], designated by Kessler (1995) at the first stage and here at the second stage; isoelectotypes A, BM [×2 mounted on same sheet], BO, CAL [CAL0000004700], DD, G, K [K000574904], L, WU).

Artabotrys

A number of names among *Artabotrys* species from Peninsular Malaysia require lectotypification. These are dealt with here.

Artabotrys crassifolius Hook.f. & Thomson, Fl. Brit. Ind. 1: 54 (1872). – TYPE: Peninsular Malaysia, Malacca, *Griffith, W. s.n.* [HEIC (Herbarium of the East India Company) no. 426] (lectotype K, designated here).

Remaining syntype. Burma, Martaban, *Brandis, D.* (n.v.).

Artabotrys lowianus Scort. ex King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(2): 34 (1892). – TYPE: Peninsular Malaysia, Perak, *Scortechini, B.* 2012 (lectotype K [K000381019], designated here; isoelectotypes BM [BM000898096], CAL [CAL0000004298, CAL0000004297, CAL0000004299], SING [SING0096241]).

Artabotrys oblongus King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(2): 33 (1892). – TYPE: Peninsular Malaysia, Perak, Larut, August 1884, *King's Collector* [Kunstler, H.H.] 6524 (lectotype K [K000381015], designated here; isoelectotypes BM [BM000898111], CAL [CAL0000004314, CAL0000004313]).

Artabotrys oxycarpus King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(2): 34 (1892). – TYPE: Peninsular Malaysia, Perak, November 1883, *King's Collector 5150* (lectotype K [K000381016], designated here; isoelectotypes BM [BM000898086], CAL, DD).

Remaining syntypes. Peninsular Malaysia, Larut, February 1884, *King's Collector 5605* (BM [BM000898087], CAL, K [K000381017]); s. loc., *Wray, L. 328b* (CAL, K [K000381018], SING [SING00096242]).

Artabotrys pleurocarpus Maingay ex Hook.f. & Thomson, Fl. Brit. India 1: 54 (1872). – TYPE: Peninsular Malaysia, Malacca, 6 February 1868, *Maingay, A.C. 3261* [Kew distrib. no. 34] (lectotype K [K000381010], designated here explicitly excluding material in attached packet which represents another gathering).

Remaining syntypes. Peninsular Malaysia, Malacca, 14 April 1868, *Maingay, A.C. 3261A* [Kew distrib. no. 34] (K [K000381009]).

Artabotrys scortechinii King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(2): 32 (1892). – TYPE: Peninsular Malaysia, Perak, *Scortechini, B. s.n.* (lectotype K [K000381008], designated here).

Remaining syntypes. Peninsular Malaysia, Perak, *Scortechini, B. 488* (BM [BM000898101], CAL [CAL0000004270, CAL0000004271, CAL0000004278], SING [SING0096243]).

Artabotrys wrayi King, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 61(2): 37 (1892). – TYPE: Peninsular Malaysia, Perak, Larut, November 1882, *King's Collector 3615* (lectotype K [K000381023], designated here; isoelectotypes BM, CAL).

Remaining syntypes. Peninsular Malaysia, Perak, *Wray, L. 4006* (SING [SING0096239]); ibidem, *Wray, L. 2663* (SING [SING0096240]).

Stelechocarpus/Winitia

In a recent analysis of the genera *Stelechocarpus* Hook.f. & Thomson and *Sageraea* Dalzell based on morphological and molecular data, Chaowasku & Van der Ham (2013¹) demonstrated the presence of three groups. These corresponded to two strongly supported clades; one consisting of the *Sageraea* species sampled, and the other to *Stelechocarpus cauliflorus* (Scheff.) R.E.Fr. plus another species. *Stelechocarpus burahol* (Blume) Hook.f. & Thomson, the type species of *Stelechocarpus*, formed the third, less strongly supported clade as sister to the *S. cauliflorus* clade. As Chaowasku & Van der Ham noted, there were three taxonomic options for reflecting this phylogenetic relationship. Firstly all the species could be included in an enlarged *Sageraea*, secondly the status quo could be maintained (i.e. the two genera *Sageraea* and *Stelechocarpus*),

¹ A corrigendum published later (Syst. Biodivers. 11(4): 537 (2013)) added L.W. Chatrou to the list of authors of the paper, but to avoid confusion the paper is referred to as first published.

or finally the three main clades could be given generic rank. Chaowasku & Van der Ham favoured the last option and described the genus *Winitia* Chaowasku to include *Winitia cauliflora* (Scheff.) Chaowasku transferred from *Stelechocarpus* and the new species from Peninsular Thailand, *Winitia expansa*. This leaves *Stelechocarpus burahol* on its own in *Stelechocarpus*.

I do not have any criticisms to make of the phylogenetic analysis but I do think the recognition of *Winitia* is a backward step for taxonomy. As a family, the Annonaceae can be characterised by its large number of genera. Some 109 are currently recognised, with 42 in the Asia-Pacific region alone (Couvreur et al., 2012). This is problematic for non-specialists. Increasing the number of recognised genera is not helpful and single-species genera (such as *Stelechocarpus sensu* Chaowasku & Van der Ham) have low information content. It seems to me that maintaining the status quo in terms of genera is a better option than splitting *Stelechocarpus*. The phylogenetic relationship could be recognised by infrageneric taxa. The added advantage of this arrangement is that *Stelechocarpus* is easy to recognise – for instance, the raised midrib on the upper surface of the leaves is a reliable vegetative character (Sinclair, 1955; Van Heusden, 1995) with few confusable taxa. *Stelechocarpus s.s.* and *Winitia* can be separated on various characters, including flower colour, relative size and spatial distribution of male and female flowers, stamen number, stigma form and pollen morphology (Chaowasku & Van der Ham, 2013), but this ignores the similarities including the raised midrib, monoecy, convex male torus and general gestalt. The recognition of *Winitia*, therefore, represents the splitting of a well-defined and distinctive genus into two less easily distinguished entities. The two *Stelechocarpus* clades could readily be considered as infrageneric taxa, perhaps subgenera, but I refrain from doing so here.

In order to allow the maintenance of *Stelechocarpus* in its broader sense, I make a new combination for *Winitia expansa* in *Stelechocarpus*.

***Stelechocarpus expansus* (Chaowasku) I.M. Turner, **comb. nov.** – *Winitia expansa* Chaowasku in Chaowasku & Van der Ham, Syst. Biodivers. 11: 203 (2013).**

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Novitates Bruneienses, 5. *Polyalthia watui* (Annonaceae), a new tree species from Brunei, Borneo

K.M. Wong¹, A.K. Muhammad Ariffin² & A.A. Joffre²

¹Herbarium, Singapore Botanic Gardens, National Parks Board,
1 Cluny Road, Singapore 259569
wkm2000@gmail.com

²Brunei National Herbarium, Forestry Department,
Ministry of Primary Resources and Tourism, Jalan Menteri Besar,
Berakas, BB3910 Brunei Darussalam

ABSTRACT. A new species, *Polyalthia watui*, is described. It resembles *Polyalthia bullata* King in having bullate leaves with a cordate base, but is distinguished by its flowers with shorter pedicels, longer sepals and petals, subsessile monocarps with long stiff erect hairs; and broad-obovate leaves with fewer pairs of secondary veins. The new species is only known from Brunei's Belait and Tutong districts and is very likely endemic to the Belait geosyncline that includes these areas.

Keywords. Annonaceae, biodiversity, Brunei, endemic species, *Polyalthia*, taxonomy

Introduction

The Annonaceae are a predominantly pantropical lowland forest family of trees, shrubs and lianas, estimated to include some 2440 species (Chatrou et al., 2012) in 122 genera (Rainer & Chatrou, 2014). *Polyalthia* Blume, a common Indo-Malesian genus in this family, was, until recently, a polyphyletic genus with some 170 accepted species, harbouring a morphologically heterogeneous assemblage of species. The reorganisation of the genus, correlating with molecular phylogenetic analyses, now recognises several distinct genera, including *Maasia* (Mols et al., 2008) *Fenerivia* Diels (Saunders et al., 2011), *Monoon* Miq. (Xue et al., 2012), *Huberantha* Chaowasku (Chaowasku et al., 2015), and *Polyalthia* s.s., as well as species that fall within *Marsypopetalum* Scheff. (Xue et al., 2011).

The taxonomically pruned version of *Polyalthia* is estimated to include some 80 species (Turner et al., 2014), with c. 30 species in Borneo (Turner, 2009, 2010; Turner et al., 2014). Various features in combination serve to distinguish the genus from others in Borneo: tree habit; hairs simple when present; non-glaucous leaves with non-prominent midrib on leaf upper surface and brochidodromous venation (with looping secondary veins); valvate perianth whorls with 3 sepals; apically flat and non-saccate petals in two similar whorls; non-verrucose non-clawed inner petals that are not tightly appressed over the reproductive parts; more than 3 carpels with 2–6 ovules per carpel; and commonly 1–2 seeds per carpel, each seed with a shallow circumferential groove (Turner et al., 2014).

In recent years, a distinctive species of *Polyalthia* with strongly bullate leaves has been collected in Brunei's Belait and Tutong districts, and during recent fieldwork there in 2015 under the auspices of the *Botanical Survey of Brunei Darussalam* programme organised by the Brunei Forestry Department and Singapore's National Parks Board (see Joffre et al., 2015), it was possible to further study this species in the field (Fig. 1). This unnamed species resembles several other species in individual characters but in the combination of characters it possesses it most resembles, and would appear to be most closely related to, *Polyalthia bullata* King (King, 1892; Sinclair, 1955; Turner et al., 2014). It also has similarities to *Polyalthia endertii* D.M.Johnson (Johnson & Murray, 1999). The new species is, however, clearly distinguished by characteristics of the flowers, fruits and leaves (Table 1). We are pleased to name this after Watu Awok of the Brunei National Herbarium's field team for his enthusiastic support and excellent company during field surveys, and for diligently searching out individuals of this extraordinary *Polyalthia* in the field.

Herbarium acronyms used follow Thiers (continuously updated). Conservation assessments follow the methodology of IUCN (2012). Dimensions in the description are for dried material. As shrinkage when dried can be quite pronounced, the dimensions from spirit material are also given for some flower parts.

***Polyalthia watui* K.M.Wong, sp. nov.**

The new species resembles *Polyalthia bullata* King in having bullate leaves with a cordate base, but differs in its flowers with shorter (8–9 mm long) pedicels, 13–14 mm long ovate sepals, 24–31 mm long and 5–9 mm wide oblanceolate petals; monocarps with only 1–2 mm long stipes and stiff erect hairs mostly 3–5 mm long; and broad-obovate leaves with 16–18 pairs of secondary veins. In contrast, *Polyalthia bullata* has flowers with 10–25 mm long pedicels, 5–7 mm long lanceolate sepals, 21–25 mm long and 2–2.5 mm wide linear petals; monocarps with c. 5 mm long stipes and short hairs less than 1 mm long; and narrowly lanceolate to oblong-lanceolate leaves with 25–40 pairs of secondary veins. – TYPE: Brunei, Tutong, Lamunin, Bukit Sulang, Lamunin Forestry office, behind ex Plantation Nursery, 17 February 2005, flowers, *Muhammad Ariffin BRUN 21189* (holotype BRUN; isotypes K, SAN, SING). (Fig. 1, Table 1)

Treelet 1–4 m high; **stem** axes proximally vertical, distally curving over to a near-horizontal orientation, the older trunk developing from a sympodium of such proximal portions and attaining 1–3.5 cm diameter at the base; leafy branches near-horizontal. Young **twigs** densely covered with medium brown suberect 2–3 mm long hairs. **Leaves** distichously arranged throughout, broad-obovate, 20–25 cm long, 9–12 cm wide, apex acute to obtuse or rounded, base markedly cordate, auriculate, the basiscopic auricle conspicuously larger than the acroscopic auricle, the auricles overlapping the twig, chartaceous to thin-coriaceous, bullate, above glabrous except for the densely brown short-hairy midrib, below with dense brown suberect 1.5–2 mm long hairs on the midrib and sparse brown suberect 0.5–1 mm long hairs on the secondary veins, midrib sunken above and prominent below, secondary veins 16–18 pairs, forming bold loops near the margin, sunken above and prominent below, tertiary and higher-order venation subscalariform to reticulate, sunken above and prominent below, medium green and

Fig. 1. *Polyalthia watui* K.M.Wong. **A.** Mature treelet displayed by Watu Awok of the Brunei National Herbarium. **B.** Strongly bullate leaf upper surfaces. **C.** A flower from the type specimen BRUN 21189 showing sepals (only one out of 3 indicated, s), 3 outer petals (op) and 3 inner petals (ip). **D.** Monocarps covered in white erect long hairs and basally subtended by the 3 persistent sepals. (Photos: A, B, D: K.M. Wong; C: Muhammad Ariffin)

slightly reflective above, pale grey-green and matt beneath, subsessile, petioles 4–8 mm long, stout. **Flowers** solitary, axillary to extra-axillary, deflexed to a pendulous position, pedicels 8–9 mm long (to 12 mm long in spirit material). **Sepals** 3, broad-ovate, apex acute, 13–14 mm long, 5–6 mm wide (29 mm long, 15 mm wide in spirit

Table 1. Comparison of *Polyalthia bullata* King, *P. endertii* D.M.Johnson and the new species. (Measurements are from dried herbarium material.)

Character	<i>Polyalthia bullata</i>	<i>Polyalthia endertii</i>	<i>Polyalthia watui</i>
Flower pedicels	10–25 mm long	c. 20 mm long	8–9 mm long
Flower sepals: shape, size	Lanceolate, 5–7 mm long, 1.5–2 mm wide	Lanceolate-ovate, 20–21 mm long, 11 mm wide	Ovate, 13–14 mm long, 5–6 mm wide
Petals: shape, size	Linear, 21–25 mm long, 2–2.5 mm wide	Oblanceolate, c. 27 mm long, 7 mm wide	Oblanceolate to strap-shaped, 24–31 mm long, 5–9 mm wide
Persistent sepals of fruit	5–7 mm long, 3–4 mm wide	(Unknown)	20–29 mm long, 10–15 mm wide
Monocarp stipes	c. 5 mm long	(Unknown)	1–2 mm long
Monocarp surface	Puberulous, hairs less than 1 mm long	(Unknown)	Covered in stiff erect hairs 3–5 mm long
Leaf shape	Narrowly lanceolate to oblong-lanceolate	Oblanceolate, slightly panduriform	Broad obovate
Leaf dimensions	25–50 × 0.5–12 cm	16.8–32 × 4.8–8 cm	20–25 × 9–12 cm
Leaf lateral veins	25–40 pairs	20–27 pairs	16–18 pairs
Leaf surface	Conspicuously bullate	Generally plane, not bullate	Conspicuously bullate

material), coriaceous, sparsely pubescent on both sides, creamy yellow. **Petals** in 2 series of 3, oblanceolate to strap-like, apices acute, coriaceous, outer petals 29–31 mm long, 8–9 mm wide (45 mm long, 10 mm wide in spirit material), with 3–5 bold longitudinal ridges on the inner surface, inner petals 24–26 mm long, 5–6 mm wide (42 mm long, 6 mm wide in spirit material), with 1–3 bold longitudinal ridges on the inner surface, all densely covered with pale hairs mostly less than 1 mm long on both surfaces, creamy yellow in live material. **Stamens** numerous, connectives slightly convex, apices of anther connectives bright yellow (measurements not taken). **Carpels** 15 seen in a single flower, elliptic-subglobose, densely pubescent, stigma sub-capitate, puberulous. **Monocarps** subglobose, 5–7 mm diameter (10–15 mm diameter when fresh), pale green to yellowish green, densely covered with stiffly erect pale 3–5 mm long hairs, 2–12 together (very rarely solitary) embraced by the 3 persistent ovate sepals 20–29 mm long, 10–15 mm wide (25–30 mm long, 20–25 mm wide when fresh); stipes 1–2 mm long. **Seeds** 2, plano-convex, with a shallow circumferential groove near the edge of the plane surface; endosperm glassy, ruminant by thin laminar intrusions of the seed coat.

Additional specimens examined. BRUNEI: **Belait:** Labi, Labi Hills Forest Reserve, Compartment 49, Ulu Sg. Rampayoh, 20 May 2009, fruits, *Azlan BRUN 22629* (BRUN, K, SAN, SING); **Tutong:** Rambai, Ladan Hills Forest Reserve, Benutan Dam catchment forest, tributary of Sungai Benutan, 7 Jun 2015, fruits, *Wong & Watu WKM 3425* (BRUN, SING), Ladan Hills Forest Reserve, Nyamokning West, southeast of LP 230, 4°24.45'N 114°48.36'E, 35 m asl, riverine mixed dipterocarp forest, 6 Jun 1996, fruits, *Joffre BRUN 17529* (BRUN).

Distribution. So far known only from Brunei, in the Belait and Tutong districts, in small populations. As discussed by Joffre et al. (2015), the Belait syncline covering both these districts is a geo-ecologically well-defined enclave that is likely to harbour its own endemic taxa. Given that the adjacent parts of Sarawak and nearby southwest Sabah have been generally well-collected and this species has not been documented in those territories, it is not likely to have a wider distribution than in these districts. The related *Polyalthia bullata* is known from Peninsular Malaysia and all territories in Borneo, including in adjacent Sarawak as well as Brunei (*Wong WKM 1710* (BRUN, K, SING)).

Habitat. Understorey of mixed dipterocarp forest on sandy clays and alluvium criss-crossed by shallow streams feeding tributaries of the Belait and Tutong rivers. The more widely distributed *Polyalthia bullata* also occurs in lowland forest but on hillsides and river terraces that are not as low-lying and moist as the habitat of *P. watui*.

Provisional IUCN conservation assessment. *Polyalthia watui* is so far documented only from undisturbed lowland primary forest in the Labi Hills Forest Reserve, Belait district, and several pockets in the Ladan Hills Forest Reserve, Tutong district. The IUCN status proposed here is Least Concern (LC) as the species is protected in forest reserves with no imminent threats. The Brunei Government officially announced in 2014 that logging will be phased out in all forest reserves (Brunei Times, 2014).

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Three new species of *Begonia* (Begoniaceae) from Sumbawa Island, Indonesia

D. Girmansyah

Herbarium Bogoriense, Research Center for Biology,
Indonesian Institute of Sciences, Jl. Raya Jakarta-Bogor Km 46,
Cibinong, 16911, Bogor, West Java, Indonesia
deden_bo@yahoo.com

ABSTRACT. Three new species of *Begonia* L., *Begonia sumbawaensis* Girm., *Begonia brangbosangensis* Girm. and *Begonia jaranpusangensis* Girm., are described from Sumbawa, Indonesia. All species are illustrated and identification keys and distribution maps are provided.

Keywords. *Begonia* sect. *Petermannia*, *Begonia* sect. *Reichenheimia*, Betulin, endemic

Introduction

Begonia L. (Linnaeus, 1753), is currently estimated to have around 1803 species distributed throughout tropical and subtropical Asia, Africa and America (Hughes et al., 2015b). In Southeast Asia, Indonesia is a centre of diversity for *Begonia* and many new species are still being discovered (Girmansyah & Susanti, 2015; Hughes et al., 2015a; Undaharta et al., 2015). Currently, 231 accepted species of *Begonia* are known from Indonesia, distributed from Sumatra to Papua. In Sumbawa (West Nusa Tenggara), only three species have been recorded to date (*Begonia bimaensis* Undaharta & Ardaka (Undaharta et al., 2015), *B. multangula* Blume (Hughes et al., 2015b) and *B. muricata* Blume (Hughes, 2008). Some specimens previously attributed to *Begonia muricata* are included below in the new species *B. sumbawaensis*.

Sumbawa is situated between Lombok to the west and Flores to the east. Botanical exploratory efforts on Sumbawa are summarised in Van Steenis-Kruseman (1950). Recent botanical explorations in March 2004 and July 2005 conducted by Herbarium Bogoriense (RCB-LIPI) and sponsored by the New England Tropical Conservatory, USA resulted in three new species of *Begonia* being collected. The new species were collected from the Mt Batu Pasak complex, the Mt Ngengas complex and the Jaran Pusang complex (Fig.1).

Three new species, *Begonia sumbawaensis* Girm., *Begonia brangbosangensis* Girm. and *Begonia jaranpusangensis* Girm., are described here. *Begonia sumbawaensis* is placed in *Begonia* sect. *Reichenheimia* (Klotzsch) A.DC. (De Candolle, 1859) as it exhibits the characters typical of the section: rhizomatous stems, protandrous inflorescences, and three locular ovaries with entire placentae (Doorenbos et al., 1998). *Begonia jaranpusangensis* and *B. brangbosangensis* are placed in *Begonia* sect. *Petermannia* (Klotzsch) A.DC. (De Candolle, 1859) as they exhibit characters

Fig 1. Distribution of *Begonia sumbawaensis* Girm. (triangles), *B. brangbosangensis* Girm. (circles) and *B. jaranpusangensis* Girm. (square).

typical of the section: upright stems, protogynous inflorescences, and three locular ovaries with branched placentas (Doorenbos et al., 1998).

Key to the species of *Begonia* from Sumbawa

- 1a. Rhizomatous or tuberous herb; leaves ovate to broadly ovate 2
- 1b. Erect herb; leaves ovate to oblong 3
- 2a. Base tuberous; leaves lobed, upper surface with long hairs ..... *B. bimaensis*
- 2b. Base rhizomatous; leaves entire, upper surface glabrescent ..... *B. sumbawaensis*
- 3a. Leaves broadly ovate or orbicular, margin shallowly lobed; fruit fleshy and indehiscent ..... *B. multangula*
- 3b. Leaves elliptic, oblong, ovate or narrowly ovate, margin entire; fruit dry and dehiscent 4

- 4a. Leaves ovate to elliptic; petiole hairy ..... *B. jaranpusangensis*
 4b. Leaves narrowly ovate to oblong; petiole glabrous ..... *B. brangbosangensis*

Begonia sumbawaensis* Girm., sp. nov. § *Reichenheimia

Similar to *Begonia lugrae* Ardhaka & Undaharta (Ardi et al., 2013) but differs in having tomentose petioles (not glabrous), stipule narrowly triangular (semicircular in *Begonia lugrae*), female flower tepals four (three in *Begonia lugrae*) and stamens 48 (90 in *Begonia lugrae*). – TYPE: Indonesia, West Nusa Tenggara, West Sumbawa, Betunin Hill, 10 July 2005, *Deden Girmansyah 461* (holotype BO; isotypes BO, E). (Fig. 2)

Perennial, creeping, rhizomatous monoecious herb, up to 30 cm tall. **Stems** rhizomatous, rooting at the nodes, internodes very close, 5–10 mm long; stipules narrowly triangular, with dense hairs along the dorsal vein, 9×4.5 mm, with a hair-like appendage at the apex covered with additional dense hairs, semi persistent. **Leaves** alternate; petioles 10–25 cm long, tomentose, reddish; lamina basifixed, $10\text{--}30 \times 9\text{--}29$ cm (in live material), asymmetric, suborbicular to broadly ovate, base cordate, lobes overlapping, apex acute to attenuate, margin sub-entire, with minute teeth at the end of the veins, adaxial surface glabrescent to sparsely hairy, light green; abaxial surface shiny red with scattered short hairs, venation palmate, primary veins 7–8. **Inflorescence** cymose, with 6–10 flowers, axillary, protandrous, bisexual; peduncle 10–30 cm long, diameter 2–4 mm, puberulous; bracts sub-orbicular, red, c. 3.3×2.5 mm, margin slightly fimbriate, persistent. **Male flowers:** pedicels c. 2 cm long, hairy; tepals 4, white to reddish, two outer tepals sub-orbicular, $1.4\text{--}2 \times 1.2\text{--}1.5$ cm, base slightly cordate, margin entire, apex rounded or slightly undulate, glabrous; two inner tepals narrowly obovate, white, $1.2\text{--}1.5 \times 0.8\text{--}1$ cm, glabrous; androecium symmetric, the cluster globose; stamens yellow, c. 48 in number, subequal; filaments 1–1.5 mm long, fused at the base; anther obovoid, c. 1 mm long, dehiscing through unilateral slits as long as anther. **Female flowers:** pedicels 12–18 mm long, puberulous; tepals 4, unequal, two outer tepals orbicular to broadly ovate, c. 11×14 mm, margin entire, apex rounded, two inner tepals narrowly obovate, c. 10×5 mm; ovary sub-globose, $5\text{--}7 \times 2\text{--}3$ mm, locules 3, placentation axile, entire, wings 3, unequal, obtuse at the apex, the widest point at the middle of the ovary, 5 mm wide, glabrous; stigmas 3, yellowish green, Y-shaped, 3 mm long. **Fruits** with pedicels 2.2–3 cm long; capsule ellipsoid, $6\text{--}10 \times 4\text{--}8$ mm (excluding wings), dehiscent, splitting between the locules and wings, wings 3, subequal, wings 7–10 mm at the widest point, thinly fibrous. **Seeds** barrel-shaped, 0.35–0.37 mm long, collar cells more than a half of seed length.

Distribution. Endemic to West Sumbawa, West Nusa Tenggara, Indonesia.

Habitat. Terrestrial herb on steep slopes in tropical forest between 1300–1600 m alt.

Additional specimens examined. **West Nusa Tenggara:** West Sumbawa, Batu Linting, 15 Jul 2005, *Deden Girmansyah 506* (BO); West Sumbawa, Mt Batu Pasak, 18 July 2005, *Deden*

Fig. 2. *Begonia sumbawaensis* Girm. A. Habit. B. Female flower. C. Style. D. Male flower. E. Stamen. F. Fruit in cross section. G. Fruit. H. Stipule. I. Seed. J. Bract. Drawn by A. Kusumawati.

Girmansyah 535 (BO); West Sumbawa, Olat Tebelah Hill, 9 Jul 2005, *Deden Girmansyah* 429 (BO); West Sumbawa, Upper Batu Dulang, Brang Bosang River Slope of Batu Linting, 15 Jul 2005, *HW* 12644 (BO); ZW Sumbawa, *De Voogd* 1634 (BO); West Sumbawa, Mt Batulanteh, 22 Apr 1961, *Kostermans* 18400 (A, K); West Sumbawa, September 1879, *Colfs* 299 (L [3 sheets]).

Notes. The epithet is derived from the name of Sumbawa Island. With its creeping habit *Begonia sumbawaensis* is typical for *Begonia* sect. *Reichenheimia*. It is a very attractive species with bright red petioles and leaf undersides, and with the inflorescence being longer than the petioles and bearing many flowers. As such the plant has potential for ornamental use. This species is found on steep slopes and hence was very difficult to collect.

Begonia brangbosangensis* Girm., sp. nov. §*Petermannia

Begonia brangbosangensis differs from *B. lombokensis* Girm. (Girmansyah, 2009) in having the female flower solitary in the leaf axils (in pairs in *B. lombokensis*), number of stamens 45 (24 in *B. lombokensis*), and the female flower pedicel 0.5–0.8 cm long (1.3 cm long in *B. lombokensis*). – TYPE: Indonesia, West Nusa Tenggara, West Sumbawa, Brang Bosang river, upper Batu Dulang Village, 18 July 2005, *Deden Girmansyah* 528 (holotype BO; isotypes BO, E). (Fig. 3)

Perennial, erect, monoecious herb, 1 m tall. **Stems** erect, internodes 2–10 cm long, diameter 5–7 mm; stipules narrowly lanceolate, c. 10 × 4.5 mm, pale green, glabrous, persistent. **Leaves** alternate; petioles 2–5 cm long, glabrous, green or reddish; lamina narrowly ovate to oblong, basifixed, asymmetric, 9–20 × 2.5–6 cm, base subcordate, margin distantly serrulate, apex attenuate, adaxial surface green, glabrous, abaxial surface green; venation pinnate, primary veins 3–4 pairs along the midrib; impressed above, prominent beneath, pale green to burgundy beneath, glabrous. **Inflorescence** racemose, bisexual, 3–7 cm long, erect, male flowers distal, female flowers basal; peduncle 1–3 cm; bracts bright green, elliptic, 9 × 3 mm, margin entire, caducous. **Male flowers:** pedicels c. 1 cm long, glabrous; tepals 2, white to pink, broadly elliptic, 8–10 × 6–9 mm, margin entire, glabrous; androecium c. 0.4 mm long, stamens c. 45 in number, filaments 1–1.5 mm long, fused at the base, anther pale yellow c. 1 mm long, obovoid, dehiscing through unilateral slits c. 1/3 as long as anther. **Female flowers:** pedicels 5–10 mm long, green, glabrous; tepals 2, white, obovate, base subcordate, apex obtuse to rounded, equal, glabrous, c. 12 × 10 mm; ovary pale green to reddish brown, subglobose to ovoid, 8–15 × 8–13 mm (wings included), capsule ovoid, locules 3, placentation axillary, placental branches 2 per locule; wings 3, unequal, rounded at the apex, 3–5 mm wide; styles 3, yellow, c. 6 mm long, free to the base, bifurcating with pale yellow stigma. **Fruits** with pedicel 15 mm long, capsule ellipsoid, 8–20 × 5–9 mm (excluding wings), dehiscent, splitting between the locules and wings, glabrous, wing shape as for ovary, wings 8–10 mm wide at the widest point. **Seeds** numerous, brown, ellipsoid, 0.34–0.36 mm long, collar cells more than a half of seed length.

Fig. 3. *Begonia brangbosangensis* Girm. **A.** Habit. **B.** Male flower. **C.** Stamen. **D.** Female flower. **E.** Style. **F.** Stipule. **G.** Seed. **H.** Fruit in cross section. **I.** Fruit. **J.** Ovary. Drawn by A. Kusumawati.

Distribution. Endemic to West Sumbawa, Sumbawa, West Nusa Tenggara, Indonesia.

Habitat. Terrestrial on the forest floor on wet and moist substrates especially along stream margins and river banks at 1300–1700 m altitude.

Additional specimens examined. **West Nusa Tenggara:** West Sumbawa, between Brangbosang river and Mt Batulinting, 15 Jul 2005, *Deden Girmansyah* 509 (BO); West Sumbawa, Upper Tepal Traditional Village, slope of Mt Ngengas, top of Batu Tunin, East Mountain Forest, 10 Jul 2005, *Deden Girmansyah* 463 (BO); West Sumbawa, upper Tepal Traditional village, Olah Tebelat, Pagenong, slope of Mt Ngengas, 9 Jul 2005, *Deden Girmansyah* 432 (BO); West Sumbawa, Mt Batulante, trail from Batu Dulang to Pusu, 19 Apr 1961, *Kostermans* 18347 (A, BO, K); West Sumbawa, Mt Batulante, 22 Apr 1961, *Kostermans* 18396 (A, BO, K).

Notes. The epithet is derived from the name of the Brang Bosang River in West Sumbawa.

Begonia jaranpusangensis* Girm., sp. nov. § *Petermannia

Begonia jaranpusangensis is similar to *B. padangensis* Irmsch. in habit and in having hairy petioles, but differs in having two tepals in the male flowers (four in *B. padangensis*), two tepals in the female flowers (five in *B. padangensis*), and female flower pedicels 0.5–0.7 cm (10–15 mm in *B. padangensis*). – TYPE: Indonesia, West Nusa Tenggara, West Sumbawa, Plampang, between Tana Silo to slope of Mt JaranPusang, 23 July 2005, *Deden Girmansyah* 552 (holotype BO; isotypes BO, E). (Fig. 4)

Perennial, erect, monoecious herb, 1 m tall. **Stem** green to reddish green, hirsute, 3–10 mm diameter when fresh, internodes 2–10 cm long; stipules narrowly lanceolate, green, puberulent, 15–25 × 4–8 mm, margin entire, apex acuminate, ending with a short hair, 1–2 mm long, persistent. **Leaves** alternate; distant; petioles red, pilose, 1–5 cm long, diameter 2–3 mm, grooved above; lamina basifixed, ovate to elliptic, 11–18 × 5–9 cm, asymmetric, base rounded on the broad side and cuneate on the narrow side, broad side 4–6.5 cm wide, narrow side 1–3 cm wide, margin denticulate, apex acute to attenuate; venation pinnate, primary veins 5–6 pairs, impressed above, prominent beneath. **Inflorescences** racemose, protogynous, bisexual; male inflorescence monochasial at base, sympodial at apex, peduncle 1.5–2.5 cm long, erect, paniculate; female inflorescence a simple dichasium with a pair of flowers, peduncle 2.5–3 cm long; bracts bright green, narrowly elliptic, c. 15 × 5 mm, persistent. **Male flowers:** pedicels 2–2.5 cm long, white to pinkish, glabrous; tepals 2, suborbicular to broadly ovate, white to pink, 12 × 9–10 mm, margin entire, apex rounded, glabrous; androecium c. 5 mm long, stamens c. 34 in number, filaments 1–1.5 mm long, fused at the base, anthers pale yellow 1.5–2 mm long, obovoid, dehiscing through unilateral slits c. ½ as long as anther. **Female flowers:** pedicels green, puberulent, 5–8 mm long; tepals 5, white, narrowly elliptic to lanceolate, glabrous, 12–13 × 6–8 mm; ovary pale green, triangular in outline, 10 × 4 mm (wings included), wings 3, subequal, rounded at the apex, the

Fig. 4. *Begonia jaranpusangensis* Girm. **A.** Habit. **B.** Male flower. **C.** Male flower tepal. **D.** Stamen. **E.** Female flower. **F.** Female flower tepal. **G.** Fruit. **H.** Style. Drawn by A. Kusumawati & Wahyudi.

widest point 5 mm wide; styles 3, yellow, 4–5 mm long. **Fruits** with pedicel c. 15 mm, capsule c. 2×1.5 cm (excluding wings), dehiscent, splitting between the locules and wings. **Seeds** numerous, brown, broadly ellipsoid to ellipsoid, c. 0.31–0.35 mm long.

Distribution. Endemic to Mt Jaranpusang, West Sumbawa district, Sumbawa, West Nusa Tenggara, Indonesia.

Habitat. Terrestrial herb, found on the slope of Mt Jaranpusang in rather dry conditions, at c. 615 m altitude.

Additional specimens examined. West Nusa Tenggara, West Sumbawa, Plampang, between Tana Silo to slope of Mt Jaranpusang, 23 Jul 2005, *Deden Girmansyah 461* (BO).

Notes. The species epithet is derived from the name of Mt Jaran Pusang in West Sumbawa. Mount Jaran Pusang is separate from the mountains in the central Mt Pasak complex and has a drier climate. The base of the mountain is covered by bamboo gardens and the habitat is noticeably dry in appearance. The peak of Mt Jaran Pusang is rocky and there are few trees of any size; the floristic composition is also rather different compared with the flora from elsewhere in the middle of West Sumbawa. *Begonia jaranpusangensis* was collected from the middle slopes of Mt Jaran Pusang and is only known from this site.

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New records of Orchidaceae from Bali, Indonesia

D. Sulistiarini, D. Arifiani & Y. Santika

Herbarium Bogoriense, Research Center for Biology,
Indonesian Institute of Sciences, Jl. Raya Jakarta–Bogor KM 46,
Cibinong, Bogor, Indonesia
dsulistiarini@yahoo.com

ABSTRACT. During plant inventory work in the forested areas of Mt Mesehe and Mt Merbuk, Jembrana district, Bali, twenty orchid species were collected. Among the species collected, five were confirmed as new records for Bali. The five newly recorded species are *Calanthe zollingeri* Rchb.f., *Plocoglottis plicata* (Roxb.) Ormerod, *Podochilus serpyllifolius* (Blume) Lindl., *Styloglossum speciosum* (Blume) T.Yukawa & P.J.Cribb, and *Vanilla albida* Blume. Descriptions of taxa and images are provided.

Keywords. *Calanthe*, Mt Mesehe, new records, orchids, *Plocoglottis*, *Podochilus*, *Styloglossum*, *Vanilla*

Introduction

Bali is famous for its beautiful landscapes and beaches, for which the island has become the number one tourist destination in Indonesia. In contrast, the plant diversity of Bali is not well known. There are few floristic publications about Bali, including little information on the orchid species of the island.

Recent classifications of the Orchidaceae recognise five subfamilies, namely Apostasioideae, Vanilloideae, Cyripedioideae, Orchidoideae and Epidendroideae, with about 27,800 species in total (Stevens, 2015). Schuiteman et al. (2014) have reported that in Malesia there are about 6000 species of which 200 are found in the Lesser Sunda Islands (Bali, Nusa Tenggara Barat and Nusa Tenggara Timur). For Bali alone, 146 species of orchids have been recorded (Girmansyah et al., 2013). Comber (1990) suggested that Java had 731 species, while Sumatra had a higher number of 1118 species (Comber, 2001). However, more recently, Schuiteman et al. (2014) have increased the number of orchid species known from Java and Sumatra to 769 and 1126 species, respectively. Therefore, it is to be expected that more species are to be found in Bali than those recorded by Girmansyah et al. (2013).

Most herbarium specimens deposited in the Herbarium Bogoriense (BO) were collected in the central and eastern parts of Bali, while fewer specimens are from the western parts of the island. Therefore, an attempt was made recently to explore plant diversity in the western parts, especially in Jembrana district in the forested areas of Mt Merbuk (1386 m asl.) and Mt Mesehe (1300 m asl.). These are the two highest mountains in Jembrana district.

Jembrana district, which covers 841.8 km² or 14.93% of Bali, is situated at 8°03'40"–8°50'48"S and 114°25'53"–114°42'40"E. The topography is gently rolling country to hilly, with a fine-grained soil texture in which the grey-brown alluvial and regosol types are dominant. Jembrana district has two seasons, i.e., the rainy and dry season. The heavy rainfall occurs from December to March and the dry season usually starts from April or May. The average rainfall in 2012 was 1663 mm/year with 112 rainy days per year on average (Anonymous, 2014).

In the Mt Mesehe area, the Yeh Mesehe waterfall (at c. 980 m asl.) is an important water source for the villages in the region. In the Mt Merbuk area, big rivers, such as Tukad Aya, Titis and Ijo Gading, are important for maintaining forest conditions. In Jembrana, 39.17% of the land area consists of protected forests which in turn preserves the water catchment. The forests in the Mt Mesehe area are in a good condition from 350 m asl upwards with cultivated areas are only below this altitude. The villagers grow cacao, coffee, banana and coconut. From 900 m asl upwards the forest is very moist and foggy, the litter is rather thick to about 10 cm, and available trails to explore the area are very steep. *Cyathea* sp., *Rhododendron* sp. and *Vaccinium* sp. are commonly found at this elevation. On Mt Merbuk wild palms are common at around 500 m asl, whereas at 600 to 760 m altitude *Dipterocarpus* sp., *Podocarpus* sp., *Fagraea* sp. and *Pavetta* sp. are common. Along the Titis river, there are, amongst others, *Nephrolepis biserrata* (Sw.) Schott, *Asplenium nidus* L., *Dryopteris* sp., *Selaginella* sp., bryophytes, *Begonia* sp. and some orchids. The rattans *Daemonorops melanochaetes* Blume and *Calamus javensis* Blume, along with climbers such as *Freycinetia javanica* Blume and members of the Vitaceae are also commonly found.

Methods

A plant inventory was conducted in the Jembrana district in the vicinity of Mt Mesehe in May 2013 and in the Mt Merbuk forest area in April 2014. The collection of orchids followed the methodology of Van Balgooy (1987). The collections were photographed when flowering and then dried as herbarium specimens. Some spirit samples of flowers were also prepared using a mix of glycerine 40%, alcohol 96% and distilled water at a ratio of 1:70:29 (Rugayah et al., 2004). Sterile specimens were also collected for a permanent record of all orchid species in Bali. All measurements in the descriptions are based on dried specimens.

Five of the orchid species found are new records as they are not included in the recently published checklist of the Flora of Bali (Girmansyah et al., 2013) and their occurrence in Bali is not noted in eMonocot (2015), Schuiteman et al. (2014), Comber (1990, 2001), Seidenfaden & Wood (1992) and Wood et al. (1993). Many orchid species are reported to be distributed in the Lesser Sunda Islands (LSI) without further elaboration on which specific island(s) they can be found. In this paper we do not include those species as new records.

Results and Discussion

The exploration of Mt Mesehe and Mt Merbuk has resulted in many new orchid specimens of 20 species (Table 1) for Herbarium Bogoriense (BO). Previously only about sixty orchid species have been recorded from Bali but among the 20 species newly collected we were able to confirm that five species are new records. Four of these species belong to the subfamily Epidendroideae, i.e. *Calanthe zollingeri* Rchb.f., *Plocoglottis plicata* (Roxb.) Ormerod and *Podochilus serpyllifolius* (Blume) Lindl., *Styloglossum speciosum* (Blume) T.Yukawa & P.J.Cribb. The remaining species is *Vanilla albida* Blume belonging to the subfamily Vanilloideae. Epidendroideae includes 78% of the species of Orchidaceae and is characterised by the presence of incumbent anthers which bend forward during column elongation (Stevens, 2015; Freudenstein & Chase, 2014). In Indonesia, *Styloglossum speciosum* and *Plocoglottis plicata* were previously known from Java, Maluku, Sulawesi, Kalimantan and Sumatra. *Calanthe zollingeri*, *Podochilus serpyllifolius* and *Vanilla albida* were previously known from Java, Kalimantan and Sumatra. These species are relatively common, yet they have not been recorded from Bali before.

Apart from the five newly recorded species, there are another eleven that have previously been recorded from the Lesser Sunda Islands but further study is needed to ascertain whether those records included Bali.

Description of taxa

Calanthe zollingeri Rchb.f., Bonplandia 5: 38 (1857); Comber, Orchids Java: 93 (1990). – TYPE: Java, Banyuwangi, *Leg. ign.* 2858 (holo W, n.v.). (Fig. 1)

Pseudobulbs close together, bearing 4–5 leaves. Leaves 23–40 cm long, 8–9 cm wide, ovate, acuminate, petiole 10–12 cm long. Inflorescences 40–60 cm tall, rachis c. 6 cm long, bearing 10–20 flowers, not all open at one time. Flowers white, about 2.5 cm wide; sepals and petals about 1 cm long, oblong; lip white and then turning yellow to orange, unlobed, circular, deeply split, outer margin incurved.

Distribution. Peninsular Malaysia, Sumatra, Java, Bali, Borneo.

Habitat. Lowland forest along river, also in primary forest.

Specimens examined. INDONESIA. **Bali: Jembrana district:** Mendoyo subdistrict, Batu Agung village, Panca Seming, forest surrounding Mt Sekar, 550 m asl., 17 May 2013, *N. Utami* 2032 (BO); Jembrana subdistrict, Dauh Waru village, Munduk Waru, forest surrounding Mt Merbuk, 520 m asl., 23 Apr 2014, *Y. Santika* 749 (BO); Jembrana subdistrict, Batu Agung village, Palungan Batu, Tuntuna, along Tukad Aya river, forest surrounding Mt Merbuk, 200 m asl., 23 Apr 2014, *S. Sunarti* 755 (BO).

Plocoglottis plicata (Roxb.) Ormerod in Comber, Orchids Sumatra: 293 (2001). – *Limodorum plicatum* Roxb., Fl. Ind. ed. 3: 465 (1832). – *Plocoglottis acuminata* Blume, Ann. Mus. Bot. Lugduno-Batavum 1: 46 (1849). – TYPE: Java, *Blume s.n.* (L, n.v.). (Fig. 2)

Pseudobulbs well-spaced along rhizome, 4–6 cm long, 0.2–0.5 cm wide, cylindrical, usually covered by leaf sheath. Rhizome creeping, branched, internodes 1.5–2.5 cm long, 0.3–0.4 cm thick. Leaf 1, ovate, 20–25 cm long, 7–8.5 cm wide, acuminate, petiole 4–7 cm long. Inflorescences from base of young pseudobulb, 30–40 cm long, bearing several flowers. Flowers opening widely, yellow with red markings, 3 cm wide; sepals and petals narrowly lanceolate, acute; lip in outline almost square.

Distribution. Sumatra, Java, Bali, Borneo, Moluccas, Sulawesi, Philippines.

Habitat. Lowland forest along river; primary forest, sometimes growing on rocks.

Specimens examined. INDONESIA. **Bali: Jembrana district:** Mendoyo subdistrict, Poh Santen village, Pasatan, forest surrounding Mt Mesehe, 400 m asl., 18 May 2013, *D. Arifiani* 1365 (BO); Mendoyo subdistrict, Batu Agung village, Panca Seming, Yeh Mesehe protected forest, 860 m asl., 17 May 2013, *Y. Santika* 548 (BO); Jembrana subdistrict, Batu Agung village, Palungan Batu, Pangkung Palir, along Tukad Aya river, forest surrounding Mt Merbuk, 280 m asl., 23 Apr 2014. *D. Arifiani* 1416 (BO).

Podochilus serpyllifolius (Blume) Lindl., J. Proc. Linn. Soc., Bot. 3: 37 (1858); Comber, Orchids Java: 202 (1990). – *Cryptoglottis serpyllifolia* Blume, Bijdr. Fl. Ned. Ind.: 296 (1825). – TYPE: ?Indonesia, *T. Lobb* 155 (AMES, n.v.). (Fig. 3)

Pseudobulbs absent. Stems hard, creeping, hanging, branching. Leaves very small, in two rows along the stem, about 1 mm apart, ovate, 3–4 mm long, c. 1 mm wide, sessile, acute. Inflorescences usually terminal, bearing up to 4 flowers. Flowers not opening widely, about 4.5 mm long and 1.5 mm wide, white with a pink-purple spot in the middle of the petal and lip.

Distribution. Sumatra, Java, Bali, Borneo.

Habitat. Primary forest, growing in moss on rocks.

Specimen examined. INDONESIA. **Bali: Jembrana district:** Mendoyo subdistrict, Batu Agung village, Panca Seming, Yeh Mesehe protected forest, 935 m asl., 17 May 2013, *Y. Santika* 570 (BO).

Fig. 1. A–B. *Calanthe zollingeri* Rchb.f. (Photos: Yessi Santika)

Fig. 2. A–B. *Plocoglottis plicata* (Roxb.) Ormerod. **A.** Habit. **B.** Detail of the flower. (Photos: Deby Arifiani)

Styloglossum speciosum (Blume) T.Yukawa & P.J.Cribb, Bull. Natl. Mus. Nat. Sci., Ser. B, 40(4): 150 (2014). – *Calanthe speciosa* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 250 (1833); Comber, Orchids Java: 93 (1990); Seidenfaden & Wood, Orchids Penins. Malaysia Singapore: 175 (1992). – *Amblyglottis speciosa* Blume, Bijdr. Fl. Ned. Ind.: 371 (1825). – TYPE: Java, *Blume s.n.* (L, n.v.). (Fig. 4)

Pseudobulbs close together, with 4–7 leaves, hidden by leaf sheaths. Leaves 40–50 cm long, 8–10 cm wide, oblong, nerves prominent, acute, leaf sheaths overlapping. Inflorescences 45–80 cm long; sterile bracts 5, boat-shaped, 2–6 cm long; bracts caducous, absent during flowering. Flowers 3 cm wide, petals and midlobe of lip yellowish, sepals golden yellow; sepals and petals ovate, acuminate; lip three-lobed, with two basal rounded calli.

Distribution. Southeastern and southern China, Japan (Ryukyu), Taiwan, Vietnam, Thailand, Peninsular Malaysia, Sumatra, Java, Bali, Borneo, Sulawesi, Moluccas, Philippines.

Habitat. Primary forest.

Specimen examined. INDONESIA. **Bali: Jembrana district:** Mendoyo subdistrict, Batu Agung village, Panca Seming, Yeh Mesehe protected forest, 700 m asl., 17 May 2013, *Y. Santika* 542 (BO).

Vanilla albida Blume, Cat. Gew. Buitenz.: 100 (1823); Comber, Orchids Java: 76 (1990); Seidenfaden & Wood, Orchids Penins. Malaysia Singapore: 127 (1992); Comber, Orchids Sumatra: 130 (2001). – TYPE: Java, *Blume s.n.* (holo L, n.v.).

Pseudobulbs absent. Stems climbing, with internodes 10–11 cm long, leaves alternate, aerial roots opposite leaves. Leaves lanceolate, 15–18 cm long, 3–4 cm wide, acute, petiole 1–1.5 cm long. Inflorescences axillary, bearing many flowers, floral bracts obtuse. Flowers open only on one day, at first widely open and then half-closing; sepals and petals pale yellow or yellowish green; lip white, but violet inside near the base, recurved, trumpet-like.

Distribution. Andaman Islands, Nicobar Islands, Sumatra, Java, Bali, Borneo.

Habitat. Lowland forest.

Specimen examined. INDONESIA. **Bali: Jembrana district:** Mendoyo subdistrict, Poh Santen village, Pasatan, forest surrounding Mt Mesehe, 360 m asl., 18 May 2013, *D. Arifiani* 1386 (BO).

Fig. 3. *Podochilus serpyllifolius* (Blume) Lindl. **A.** Habit. **B.** Detail of the flower. (Photos: Yessi Santika)

Fig. 4. *Styloglossum speciosum* (Blume) T.Yukawa & P.J. Cribb. **A.** Habit. **B.** Detail of the inflorescence with flower in front view (inset C). (Photos: Yessi Santika)

Table 1. Orchid species collected from Mt Mesehe and Mt Merbuk. (** = newly recorded species from Bali, names with cf. are based on sterile specimens).

No.	Species name	Notes
1	<i>Appendicula cornuta</i> Blume	Mt Mesehe, moist forest, alt. 500–1500 m. Epiphyte.
2	<i>Bulbophyllum lobbii</i> Lindl.	Mt Mesehe, moist forest, alt. 900–1000 m. Epiphyte.
3	<i>Calanthe</i> cf. <i>masuca</i> (D.Don) Lindl.	Mt Merbuk, shady primary forest, alt. 400–1600 m. Terrestrial.
4	<i>Calanthe flava</i> (Blume) C.Morren	Mt Merbuk, primary forest, alt. 700–2200 m. Terrestrial.
5	<i>Calanthe zollingeri</i> Rchb.f. **	Mt Mesehe and Mt Merbuk, lowland forest along river, also in primary forest, alt. 200–550 m. Terrestrial.
6	<i>Ceratostylis brevibrachiata</i> J.J.Sm.	Mt Mesehe, moist forest, alt. 800–1000 m. Epiphyte.
7	<i>Dendrobium</i> cf. <i>montanum</i> J.J.Sm.	Mt Mesehe, moss forest, alt. 900–1000 m. Epiphyte.
8	<i>Dendrobium plicatile</i> Lindl.	Mt Mesehe, lowland forest, alt. 500–800 m. Epiphyte.
9	<i>Liparis condylobulbon</i> Rchb.f.	Mt Mesehe and Mt Merbuk, lowland forest in open area, alt. 500–800 m. Epiphyte.
10	<i>Mycaranthes oblitterata</i> Blume	Mt Mesehe, lowland forest, alt. 400–800 m. Epiphyte.
11	<i>Nervilia concolor</i> (Blume) Schltr.	Mt Merbuk, lowland forest in open area, alt. 400–600 m. Terrestrial.
12	<i>Phaius pauciflorus</i> (Blume) Blume	Mt Mesehe and Mt Merbuk, lowland forest in open area, alt. 400–700 m. Terrestrial.
13	<i>Pinalia</i> cf. <i>multiflora</i> (Blume) Kuntze	Mt Mesehe, lowland forest in open area, alt. 600–800 m. Epiphyte.
14	<i>Plocoglottis plicata</i> (Roxb.) Ormerod **	Mt Mesehe and Mt Merbuk, lowland forest or primary forest, sometimes growing on rocks, alt. 200–900 m. Terrestrial.
15	<i>Podochilus serpyllifolius</i> (Blume) Lindl. **	Mt Mesehe, primary forest, alt. 900–1000 m. Epiphyte.
16	<i>Spathoglottis plicata</i> Blume	Mt Merbuk, lowland forest in open area, alt. 400–600 m. Terrestrial.
17	<i>Styloglossum speciosum</i> (Blume) T.Yukawa & P.J.Cribb **	Mt Mesehe, primary forest, alt. 700–850 m. Terrestrial.
18	<i>Trichotosia ferox</i> Blume	Mt Mesehe, primary moist forest, alt. 800–950 m. Epiphyte.
19	<i>Tropidia angulosa</i> (Lindl.) Blume	Mt Merbuk, lowland forest, alt. 400–600 m. Terrestrial.
20	<i>Vanilla albida</i> Blume **	Mt Mesehe, lowland forest, alt. 300–400 m. Terrestrial becoming climber.

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***Olea luzonica* (Oleaceae), a new name for *O. obovata* from the Philippines**

R. Kiew

Forest Research Institute Malaysia,
52109 Kepong, Selangor, Malaysia
ruth@frim.gov.my

ABSTRACT. A new name, *Olea luzonica* Kiew, is proposed to replace the later homonym *Olea obovata* (Merr.) Kiew.

Keywords. Illegitimate, *Linociera obovata*

Introduction

The Philippine species *Olea obovata* (Merr.) Kiew has an illegitimate name because *Olea obovata* Baker was earlier published for a species from Mauritius (Baker, 1877: 219). This older name came to light when Hong-Wa et al. (2014) revised *Noronhia* for Mauritius. Their *Noronhia obovata* (Baker) Hong-Wa & Callm. is based on *Olea obovata* Baker and its type. This, therefore, necessitates a new name for the Philippine *Olea* and it is here proposed to name it *Olea luzonica* Kiew because it is known only from that island.

Taxonomy

***Olea luzonica* Kiew, **nom. nov.** – *Linociera obovata* Merr.** [in Elmer, Leaflet. Philip. Bot. 5: 1652 (1913) *nom. nud.*] Philip. J. Sci. (Bot.) 10: 338 (1915); Merrill, Enum. Philip. Pl. 3: 304 (1923). – *Olea obovata* (Merr.) Kiew, Gard. Bull. Singapore 51: 94 (1999), non Baker (1877); Green, Kew Bull. 57: 116 (2002). – TYPE: Philippines, Luzon, Laguna Province, San Antonio, September 1912, *Ramos Bur. Sci. 15014* (lectotype K, designated by Kiew (1999)).

Small tree, glabrous except minutely puberulent on branchlets and inflorescences. **Twigs** grey to whitish, stout, terete, glabrous. **Leaves:** petioles 1–1.5 cm; lamina very thickly coriaceous, obovate, 4–7 × 2–4.5 cm, pale when dry, upper surface glossy, dull beneath, base narrowed and more or less decurrent, margins entire, recurved, apex broadly rounded, sometimes very shortly and broadly acuminate, sometimes even slightly retuse; lateral veins indistinct, often subobsolete, c. 8 on each side of midrib.

Inflorescences axillary, sessile, densely many-flowered cymose panicles, branched from base, brown when dry, 2–5 cm long, the branches spreading and 2–3 cm wide. **Flowers** (mature female flowers not seen) 4-merous, buds ellipsoid or obovoid, c. 2 mm long, pedicels 1–3 mm. **Male flowers:** calyx 0.5–0.7 mm long, lobes irregularly broadly triangular, 0.3–0.5 mm long, apex acute; corolla thickish, tube 0.5 mm long, lobes involute, 1 mm long; filaments 0.2 mm long, anthers ellipsoid, 0.8 mm long, with a very small terminal appendage. **Drupes** ellipsoid 6–7 × 4.5–5 mm.

Distribution. Endemic in the Philippines, Luzon (Ilocos Norte, Laguna, Nueva Ecija and Tayabas Provinces).

Ecology. In mossy forest at about 2000 m. From herbarium specimens, it apparently has the habit of many trees of mossy forest as judged from its much branched, bushy canopy with branches of upstanding, thick leaves with recurved margins at the tip of the twigs.

Additional specimens examined. PHILIPPINES: **Luzon:** Ilocos Norte, Mt. Palimlim *Ramos Bur. Sci.* 33262 (L); Nueva Ecija, Mt. Umingan *Ramos & Edano Bur. Sci.* 26328 (K); Tayabas, Mt. Alzapan *Ramos & Edano Bur. Sci.* 45667 (K), 45716 (K).

Notes. *Olea luzonica* is a very distinctive species in its small, very thick, obovate leaves with a rounded apex and decurrent base, obscure lateral veins, recurved margin and dense pyramidal inflorescences. It was first listed by Elmer (1913) as *Linociera obovata*, but lacking a Latin diagnosis the name was a *nomen nudum*. Merrill (1915) validated this name by providing a description and the required diagnosis. In 1999, Kiew recognised it was an *Olea* species and transferred it to *Olea*.

ACKNOWLEDGEMENTS. I am indebted to Jose Ignacio de Juano Clavero for pointing out the illegitimate status of *Olea obovata* (Merr.) Kiew.

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A new species and a new record in *Begonia* sect. *Platycentrum* (Begoniaceae) from Thailand

T. Phutthai¹ & M. Hughes²

¹Conservation Biology Program, Division of Biological and Natural
Resources Sciences, Mahidol University (Kanchanaburi campus),
Sai-Yok, Kanchanaburi 71150, Thailand
thamarat65@hotmail.com

²Royal Botanic Garden Edinburgh, 20A Inverleith Row,
Edinburgh, EH3 5LR, Scotland, U.K.

ABSTRACT. *Begonia khaophanomensis* Phutthai & M.Hughes is described from a collection made on granitic rock in Krabi Province in Peninsular Thailand. It is endemic to the type locality of Khao Phanom Bencha National Park, and is assessed as Least Concern using the IUCN criteria. *Begonia macrotoma* Irmsch. is noted as a new record for Thailand from collections in Chiangmai, Nakhon Ratchasima and Nakhon Nayok provinces; the species is also found in China, Myanmar, NE India, Nepal and Vietnam. Both species belong to *Begonia* sect. *Platycentrum*. A key to the species of *Begonia* sect. *Platycentrum* in Thailand is provided.

Keywords. *Begonia khaophanomensis*, *Begonia macrotoma*, China, Myanmar, NE India, Nepal, Peninsular Thailand, Vietnam

Introduction

The genus *Begonia* L. is one of the largest angiosperm genera, comprising around 1803 species (Hughes et al., 2015). Thailand has 54 accepted species of *Begonia*, which are found in habitats from near sea level to high mountain summits, with nearly half of them occurring on karst limestone (Hughes, 2008; Phutthai et al., 2009, 2012, 2014).

Begonia sect. *Platycentrum* (Klotzsch) A.DC. comprises 126 species (Hughes et al., 2015) and is widely distributed in Asia, ranging from India to the Himalayas, Indo-China, China, Taiwan, and Malesia (Doorenbos et al., 1998; Shui et al., 2002; Ding et al., 2014). In Thailand, six species are reported in the section to date: *Begonia cathcartii* Hook.f., *B. hatacoa* Buch.-Ham. ex D.Don, *B. palmata* D.Don, *B. siamensis* Gagnep, *B. smithiae* Geddes and *B. venusta* King. They are all confined to montane forests above 1000 m in altitude (Hughes, 2008; Phutthai et al., 2009). However, based on molecular data (Thomas et al., 2011), the placement of *Begonia smithiae* in *Begonia* sect. *Platycentrum* appears to be erroneous and is a phylogenetically rather isolated species closer to *Begonia* sect. *Parvibegonia* A.DC. (Doorenbos et al., 1998).

A new species and a new record in *Begonia* sect. *Platycentrum* are presented here. They are characteristic of the section in having rhizomatous stems, 2-locular ovaries with branched placentas, and anthers with extended connectives. *Begonia khaophanomensis* Phutthai & M.Hughes is a rare and narrowly endemic species which is known only from the type locality in Krabi Province. It grows in granitic rock crevices at altitudes around 1200 m in Khao Phanom Bencha National Park. We also report *Begonia macrotoma* Irmsch. as a new record for the flora of Thailand from Chiangmai, Nakhon Ratchasima and Nakhon Nayok provinces. Terminology in the descriptions follows Beentje (2010).

Key to the species of *Begonia* sect. *Platycentrum* in Thailand

- 1a. Leaf lamina ovate to lanceolate, without lobes 2
- 1b. Leaf palmatifid, with some degree of lobing 5

- 2a. Stems and petioles glabrous or subglabrous 3
- 2b. Stems and petioles with a distinct indumentum 4

- 3a. Leaf lamina ovate, tepals white ..... *B. venusta*
- 3b. Leaf lamina lanceolate, tepals with red stripes on the outer surface ..... *B. hatacoa*

- 4a. Stem and petiole puberulent, leaves glabrous above ..... *B. siamensis*
- 4b. Stem and petiole hirsute, leaves echinate above ..... *B. cathcartii*

- 5a. Stem and petioles reddish brown sericeous ..... *B. palmata*
- 5b. Stem and petioles glabrous or white hirsute or pilose 6

- 6a. Stem with red striations, leaf lamina deeply palmatifid, bulbils often present, ovary glabrous ..... *B. macrotoma*
- 6b. Stem uniform green, leaf shallowly palmatifid, bulbils absent, ovary white hirsute ..
..... *B. khaophanomensis*

Begonia khaophanomensis* Phutthai & M.Hughes, sp. nov. § *Platycentrum

Begonia khaophanomensis is similar to *B. palmata* in habit and leaf shape, but differs in having leaves occurring in opposite pairs at the apex of the plant (not alternate), with white short stiff hairs on the petioles and leaves (not brown sericeous), and a white ovary with white short stiff hairs (not pinkish green and subglabrous). – TYPE: Thailand, Krabi, Khao Phanom District, Khao Phanom Bencha National Park, trail from Ban San to top of Khao Phanom Bencha, on rock along trail in lower montane forest, 8°17'02"N 98°56'17"E, 1200 m, 19 June 2006, Williams, K., Pooma, R., Poopath, M., Chamchamroon, V. & Seasin, S. 1943 (holotype E; isotypes BKF). (Fig. 1, 2)

Fig. 1. *Begonia khaophanomensis* Phutthai & M.Hughes. **A.** Habit. **B.** Staminate and pistillate flowers. From the type *K. Williams et al. 1943*. (Photos: M. Poopath)

Fig. 2. Distribution of *Begonia khaophanomensis* Phutthai & M.Hughes (triangle) and *B. macrotoma* Irmsch. (dot).

Monoecious herb, c. 60 cm tall. **Rhizome** elongated with numerous fibrous roots, glabrous. **Stems** erect, terete, pale green. **Leaves** 6–8 per plant (occurring as an opposite pair subtending the inflorescence), lamina basifixed; petiole 7–12 cm long, with dense white short stiff hairs (hirsute); leaf blade membranaceous, asymmetric, chartaceous when dry, base deeply cordate, adaxial surface densely minutely hirsute, dull dark green, abaxial surface paler, densely hirsute especially on veins, $8\text{--}10 \times 5\text{--}13$ cm, shallowly palmatifid with 6–8 lobes, margin serrate-fimbriate with long stiff hairs, venation palmate, midrib and lateral veins concolourous with lamina, 5–7 veins, slightly impressed above and prominent beneath, apex acuminate. **Stipules** prominent, pale green, ovate-lanceolate, densely hairy, $5\text{--}15 \times 3\text{--}5$ mm, apex acute, margin entire. **Inflorescences** terminal or axillary, bisexual, 8–10 cm long, cymose with c. 3 staminate flowers and 2 pistillate flowers, protandrous; peduncle c. 8 cm long, terete, pale green with dense short stiff hairs. **Bracts** caducous, lanceolate, pale green $3\text{--}5 \times 2\text{--}4$ mm, apex acute, margin entire. **Staminate flower:** pedicels white, c. 10 mm long; tepals 4, white; outer 2 broadly elliptic, c. 15×20 mm, apex rounded, margin entire, base rounded, outer surface with dense short scabrid hairs, inner surface glabrous; inner 2 obovate, c. 12×10 mm, apex obtuse, margin entire, base obtuse, outer surface with sparse short scabrid hairs, inner surface glabrous; androecium actinomorphic, globose, stamens numerous, yellow, filaments united at the base, c. 3 mm long, anthers oblong, c. 2 mm long, dehiscing by longitudinal slits, connective extended, rounded. **Pistillate flowers:** pedicels white, c. 10 mm long; tepals 5, white, subequal; densely scabrid adaxially, $18\text{--}20 \times 20$ mm; styles 2, fused at base, crescent-shaped, stigmatic band twice spirally twisted; ovary white, densely minutely scabrid, with 3 unequal wings, 2-locular, placenta bilamellate. **Fruits** dehiscent between the two smaller wings, reddish green, drying pale brown, capsule obovate, c. 14×8 mm, abaxial wing oblong or obliquely triangular, densely minutely scabrid, c. 40 mm long, 2 lateral wings c. 4 mm long, cucullate. **Seeds** numerous, brown, barrel-shaped, 0.4–0.5 mm long.

Distribution. Endemic to Peninsular Thailand (known from only the type locality).

Habitat and ecology. On granitic rock crevices by streams in hill evergreen forest and seasonally dry evergreen forest at c. 1200 m. Flowering and fruiting June to October.

Provisional IUCN category. Least Concern (LC). This species is only known from the type locality in the Khao Phanom Bencha National Park which currently is well protected and likely covers the entire natural range of the species. Hence, although rare, the threat criteria for Critically Endangered or Endangered are not met. *Begonia khaophanomensis* potentially qualifies as Vulnerable under VUD2, although with the lack of a plausible future threat we consider Least Concern to be the most appropriate category as long as Khao Phanom Bencha remains well managed.

Notes. The opposite leaves and stiff hairs indicate an alliance to *Begonia areolata* Miq. from Sumatra and Java which differs in having leaves which are minutely bullate and with red hairs, and in having petals which are elongate-elliptic in the male flowers (not broadly elliptic). The specific epithet refers to the district in which the type material was collected, Khao Phanom.

Begonia macrotoma Irmsch., Notes Roy. Bot. Gard. Edinburgh 21: 41 (1951); Gu et al., Fl. China 13: 185 (2007); Hughes, Annot. Checklist of Southeast Asian *Begonia* 77 (2008). – TYPE: China, Yunnan, 29 June 1938, Yu, T.T. 17778 (holotype KUN, n.v.; isotype E). (Fig. 2, 3)

Monoecious herb, 60–90 cm tall. **Rhizome** elongated with numerous fibrous roots, glabrous, c. 20 mm diam. **Stems** erect, terete, pale green with numerous dark red striations. **Leaves** 3–6 per plant, lamina basifixed; petiole 10–20(–30) cm long, pilose; leaf blade membranaceous, asymmetric, chartaceous when dry, base slightly cordate, adaxial surface densely scabrid, dull dark green, abaxial surface paler, sparsely scabrid, glossy; 12–30 × 7–28 cm, palmatifid to deeply palmatifid with 3–8 lobes, margin sinuate or denticulate, venation palmate, midrib and lateral veins concolourous with lamina, 5–7 veins, slightly impressed above and prominent beneath, apex acuminate; bulbils and plantlets form at the sinus of the lamina. **Stipules** caducous, dark red, ovate, 2–3 × 1.8 cm, apex cuspidate, margin entire. **Inflorescences** terminal, bisexual, 20–40 cm long, compound cyme, branching 1–2 times with 3–12 staminate flowers and 2–8 pistillate flowers per branch, protandrous; peduncle 15–25 cm long, terete, pale green with dense brown villous hairs. **Bracts** caducous, ovate, dark red, 3–10 × 4–10 mm, apex acute, margin entire. **Staminate flowers:** pedicels pale pink, 10–20 mm long; tepals 4, white or pale pink; outer 2 orbicular, 20–25 mm diameter, apex rounded, margin entire, base rounded, outer surface magenta hirsute at the centre, inner surface glabrous; inner 2 obovate, 15–20 × 5–10 mm, apex obtuse, margin entire, base obtuse, glabrous on both sides; androecium actinomorphic, globose, stamens numerous, yellow, filaments united at base, c. 2 mm long, anthers obovate, c. 2.5 mm long, dehiscing by lateral slits, connective extended, rounded. **Pistillate flowers:** pedicels pale pink, 10–20 mm long; tepals (?3–)5, white or pale pink, unequal; outer 2 orbicular, outer surface pubescent, 18–20 × 20–25 mm, inner 1–3 obovate, c. 20 × 8–12 mm, outer surface pubescent; styles 2, crescent-shaped, fused at base, stigmatic band twice spirally twisted; ovary pale pink, minutely colliculate, with 3 unequal wings, 2-locular, placenta bilamellate. **Fruits** dehiscent dehiscent between the two smaller wings, pale green, drying pale brown, capsule obovate, c. 14 × 8 mm, abaxial wing oblong with a rounded tip, 35–40 mm long, 2 lateral wings c. 5 mm long, curved along the ovary. **Seeds** numerous, brown, barrel-shaped. 0.5–0.6 mm long.

Distribution. In Northern Thailand, in Chiangmai province, and in Southeastern Thailand, in Nakhon Ratcahsima and Nakhon Nayok Provinces. Further distribution in China, Myanmar, NE India, Nepal and Vietnam.

Fig. 3. *Begonia macrotoma* Irmsch. **A.** Leaf shape and bulbils/plantlets at the sinus of the leaf lamina. **B.** Rhizome. **C.** Pistillate flowers. **D.** Inflorescence. **E.** Staminate flowers. **F.** Magenta hirsute hairs on the outer tepals. A & C from *Middleton et al. 4515* in cultivation at the Royal Botanic Garden Edinburgh, accession number 20082075; B, D–F from *Phutthai 145*. (Photos: A & C: M. Hughes; B, D–F: T. Phutthai)

Habitat and ecology. In granitic rock crevices by streams in hill evergreen forest and seasonally dry evergreen forest at around 600 m. Flowering May to November; fruiting November to January.

Provisional IUCN category. Least Concern (LC). The species has a wide distribution in evergreen and seasonal montane forests.

Specimens examined. THAILAND: **Chiang Mai:** Doi Inthanon National Park, 25 Jan 1990, Hoover, W.S. 727 (K [3 sheets]); Doi Inthanon National Park, Wachirithan Waterfall, 19 Sep 2008, Middleton, D.J. et al. 4515 (BK, BKF, E); ibidem, 24 Nov 2007, Phutthai, T. 145 (PSU, BKF); **Nakhon Ratchasima:** Khao Yai National Park, Orchid Waterfall, 22 Oct 1969, van Beusekom, C. F. & Charoenpol, C. 1834 (AAU [2 sheets], BKF, E [2 sheets], L); ibidem, 31 Oct 1970, Charoenpol, C. et al. 4349 (AAU, BKF); Khao Yai National Park, Haew Sai Waterfall. 20 Nov 1984, McAllan A. 9 (K [3 sheets]); **Nakhon Nayok:** Khao Yai National Park, Haew Suwat Waterfall, 21 Dec 2006, Peng, C.-I. & Somprasong, W. 21017 (HAST [2 sheets]).

Notes. *Begonia macrotoma* is a widespread species. The red striations on the stem and the bulbils which appear at the sinus of the large (up to 30 cm long) palmatifid leaves are distinctive. The species was originally described from a single specimen, which according to the protologue has female flowers with three tepals. However all female material seen by the authors has five tepals; in all other aspects the specimens agree.

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The resurrection of *Boesenbergia albosanguinea* (Zingiberaceae) with a new record for Peninsular Thailand

J.D. Mood¹, A.G. Hussain² & J.F. Veldkamp³

¹Lyon Arboretum, University of Hawaii,
3860 Manoa Road, Honolulu, HI 96822, U.S.A.
boesenbergia@gmail.com

²Herbwalk Consultancy, Batu 8, Jalan Ayer Hangat,
07000 Langkawi, Kedah Darul Aman, Malaysia

³Naturalis Biodiversity Center, P.O. Box 9517,
2300 RA Leiden, The Netherlands

ABSTRACT. *Boesenbergia albosanguinea* (Ridl.) Loes. (Zingiberaceae) is resurrected from the synonymy of *B. prainiana* (King ex Baker) Schltr. It is redescribed in detail with comparative tables, figures, and illustrations. This species is a new record for Thailand.

Keywords. *Boesenbergia prainiana*, Langkawi Islands, limestone, Malaysia, Penang

Introduction

During fieldwork in Satun Province for the *Flora of Thailand* Project in 2012, a *Boesenbergia* species [J. Mood & P. Vatcharakorn M3291 (BKF)] was found growing on a limestone outcrop near the sea (Fig. 1). Although it was superficially similar to other large *Boesenbergia* species in the peninsula, such as *B. trangensis* K.Larsen and *B. plicata* (Ridl.) Holttum, its distinct inflorescence and unusual habitat placed it as an unknown species. In a follow-up review of all *Boesenbergia* published from Thailand and Peninsular Malaysia, only one species appeared to be similar, *B. albosanguinea* (Ridl.) Loes. Curiously, that species had been made a synonym of *B. prainiana* (King ex Baker) Schltr. by Holttum (1950). As this latter species had been collected on several occasions by the first author, it was well-known and could be described as a small to medium sized, 1–2 leaf ginger found growing in wet, shady forest areas on sandstone or quartz-derived soils. It is not known to occur near the sea or on limestone. In order to sort this issue of synonymy and try to positively identify the Satun collection, an in-depth investigation of the taxonomic history of these two species was initiated.

Taxonomic History

In September 1894 a ginger plant cultivated at the Botanic Gardens Penang flowered for the first time and was illustrated in excellent detail (Fig. 2). The drawing was

annotated by Charles Curtis (1853–1928) as “12–18 in. high, sepals white, linear, incurved; upper petal white with pink tinge, lower large with dark red margins, stamens/anthers two celled, Perak, 1894, Nat. size.” Five years later Ridley (1899) published this ginger as *Gastrochilus albosanguineus* [*albo-sanguineus*] with a brief description. No mention was made of the artwork or specimen. During or soon after this publication, Curtis added more annotations to the 1894 drawing, “*Gastrochilus albo-sanguineus* Ridl., collected by F.A. Wooldridge on Maxwell’s Hill, Perak, flowered in the botanical garden of Penang, Sept. 1894” and with a separate pencil note “drawing of the type collection”. This latter note refers to a specimen at Kew (K) labelled as the holotype. Both the drawing and this specimen are annotated with a stylized “A”.

In 1902 several more living plants identified as *Gastrochilus albosanguineus* were brought to the gardens by Curtis from Langkawi, from which specimens were taken (SING0155198, SING0155248, SING0155266) and a watercolour drawn by M. Hussain (Fig. 3). Five years later, Langkawi was added to the distributional record of *G. albosanguineus* based on this material (Ridley, 1907).

Although Kuntze (1891) replaced *Gastrochilus* Wall. with *Boesenbergia* Kuntze, as *Gastrochilus* Wall. is a later homonym of *Gastrochilus* D.Don (Don, 1825), some botanists of the day, including Ridley and Curtis, did not accept this change and continued to use *Gastrochilus*. It was not until Loesener (1930) that *Gastrochilus albosanguineus* was eventually moved to *Boesenbergia albosanguinea* (Ridl.) Loes. Holttum (1950) later reviewed the *Boesenbergia* of Peninsular Malaysia. He decided that *Boesenbergia albosanguinea* was the same as *B. prainiana* and discussed a number of reasons why Ridley’s taxon is just “re-describing” *B. prainiana*. Among them were minor inconsistencies in plant/stem height of the type as compared to the drawing, calling the longer stem length (noted in the protologue) as “maybe due to conditions of cultivation.” His conclusion was that “There is no other clear distinction from *B. prainiana*.” It should be noted that in this discourse, Holttum erroneously uses “*B. albo-marginata*” throughout (rather than *B. albosanguinea*) to include the holotype which he cites as “Maxwell’s Hill, per Wooldridge, cult. Penang (type of *G. albo-marginata*).” There is no doubt to which species Holttum is referring (based on the references) and this error is to be regarded as a slip of the pen and not a *nomen novum*.

Boesenbergia prainiana was first described as *Kaempferia prainiana* King ex Baker [King’s collector = Kunstler 726 (CAL, K, SING)] from Goping, Perak, Malaysia (Baker, 1890). Ridley (1899) transferred it to *Gastrochilus* Wall. and later Schlechter (1913) to *Boesenbergia*. Holttum’s (1950) description added considerable detail to the earlier protologue, as did the several publications by Ridley (1899, 1907, 1924).

Materials and Methods

Soon after the collection of *J. Mood & P. Vatcharakorn M3291*, an investigation was begun to study the taxonomic history, specimens, illustrations and photographs from Malaysia and Thailand of *Boesenbergia albosanguinea* and *B. prainiana*. In August

Fig. 1. *Boesenbergia albosanguinea* (Ridl.) Loes. **A.** Mature plants on limestone. **B.** Inflorescence and flower. **C.** Dissected inflorescence with flower. **D.** Anther with staminodal cup. **E.** Flower dissected. **F.** Rhizome with roots. From *J. Mood & P. Vatcharakorn M3291*. (Photos: J. Mood)

2013 another visit to Satun Province, Thailand was undertaken to reassess the coastal, limestone habitat and look for more populations of *B. aff. albosanguinea*. In addition, BK and BKF herbaria were visited to study and photograph specimens, as was SING herbarium later in March 2014. With considerable information in hand, a final fact-finding trip was made to Langkawi Islands, Malaysia in August 2015 to locate, study

Fig. 3. *Boesenbergia albosanguinea* (Ridl.) Loes. Ink line drawing with watercolour by Md. Hussain at Penang Botanic Gardens (1902). Reproduced with permission of the Singapore Botanic Gardens.

and document any *Boesenbergia* aff. *albosanguinea* populations which might remain, as over 100 years had passed since the last known collections. At the same time, any other *Boesenbergia* species encountered were documented, with special emphasis on finding *B. prainiana* and, if so, in what habitat.

Results

The isoelectotype of *Boesenbergia prainiana* in Singapore Botanic Gardens (SING0044027) is a two-leaved plant, c. 30 cm tall with erect leaves and a very narrow, cylindrical inflorescence c. 20 cm. long. The plant is tufted with only a c. 3 cm stem made up of a bladeless sheath and two leaf sheaths. No flowers are present. Across Peninsular Malaysia and adjoining Peninsular Thailand, considerable variation can be seen in plant height, leaf size/shape and inflorescence length/shape. Unmentioned in any known description is that this species is evergreen and as such has a growth habit distinct from deciduous *Boesenbergia* species such as *B. plicata*. With one to two thick leaves per element, *Boesenbergia prainiana* is similar to *B. minor* (Baker) Kuntze, another evergreen ginger from Perak. Since evergreen *Boesenbergia* species can grow throughout the year, plant elements do not require a large foliar area for perennation and are often unifoliate with the inflorescence coming directly off the rhizome, clasped by a bladeless sheath and one leaf sheath (Fig. 4). Due to unknown factors, occasionally up to four leaves can occur [*Corner 30209* (SING)]. The leaf number aside, stem length is c. 3 cm in material measured from Malaysia and Thailand.

To further address Holttum's synonymy, comparisons of both living fertile plants and herbarium specimens of the two species were made. The most obvious difference is vegetative, as *Boesenbergia albosanguinea* has a distinct stem made up of tightly appressed leaf sheaths with 4–6 (rarely 2) thin-textured leaves, while *B. prainiana* has a very short stem and 1 or 2 (rarely 3) thick-textured leaves per element. The inflorescence on the latter is elongate and cylindrical or sometimes slightly flattened with a short peduncle covered by the sheaths. The many dull green, red-dotted bracts (up to 22) are loosely appressed and appear puffy. As the inflorescence matures, the bracts often open outward. In comparison, *Boesenbergia albosanguinea* has a lanceolate inflorescence with fewer (up to 16), firm, tightly appressed, shiny green bracts. Both species have distichous bracts with the rachis fully covered on both sides.

In a comparative floral test, fresh flowers of *Boesenbergia* aff. *albosanguinea* (*J. Mood & P. Vatcharakorn M3291*) and of *B. prainiana* from a Peninsular Malaysian collection [*J. Mood 3395* (BKF)] were compared to the 1894 drawing of the former (Fig. 2) and a watercolour of the latter (Fig. 4). The artwork and living samples were easily matched and distinguishable by species. The same flowers were then pressed and dried to compare with those on the holotype of *Boesenbergia albosanguinea* (Fig. 5f). The flower from the Thai collection matched in shape and size (Fig. 5d), whereas the flower of *B. prainiana* was smaller with a shorter floral tube and smaller, vertically oriented lateral staminodes which barely covered the labellum (Fig. 5e). In

Fig. 4. *Boesenbergia prainiana* (King ex Baker) Schltr. Ink line drawing with watercolour by Juraimi at Singapore Botanic Gardens (1948). Reproduced with permission of the Singapore Botanic Gardens.

Boesenbergia albosanguinea, the lateral staminodes initially hide the long anther, so that it cannot be seen from the top looking down. This appearance is due to the long staminodal length, broad width and full overlap of the margins. Only later in the floral development do the broad staminodal apices slightly curl toward the corolla lobes, opening the entrance and making the anther tip slightly visible from above. Even then, the result is a narrow, tubular entrance for pollinators, something mentioned by Ridley (1899) and seen in the drawings (Figs. 2, 3, 7). Conversely, in *Boesenbergia prainiana* the lateral staminodes are shorter, narrower, acute at the apices, and only overlap at their bases. Upon opening of the flower, this morphology allows for over half the anther length to be seen from the top, providing a broad, rounded, top entrance for pollinators. The top of the anther and connective is glabrous and shiny with glandular hairs only along the thecae margins. This is an important diagnostic character state as compared with *Boesenbergia albosanguinea* which is completely covered with glandular hairs on both anther and connective. Thus the basic floral differences between these two species rest in the length of the floral tube, labellum shape/length, lateral staminode shape/length and anther length/vestiture (Table 1).

Table 1. Comparison of *Boesenbergia albosanguinea* (Ridl.) Loes. and *B. prainiana* (King ex Baker) Schltr. from living plants.

Character	<i>B. albosanguinea</i> (Thailand)	<i>B. prainiana</i> (Malaysia)
Plant height	To c. 60 cm, not tufted	To c. 40 cm, tufted
No. of leaves	(2–)4–6	1–2 (–3)
Leaf longevity	Deciduous	Evergreen
Petiole length	2–11 cm	2–15 cm
Lamina	c. 38 × 15 cm	c. 24 × 7 cm
Inflorescence	To c. 20 × 2.5 cm, lanceolate to fusiform, flattened	15–23 × 2 cm, oblong to cylindrical, slightly flattened
Bracts	Shiny green, tightly appressed	Dull green, red-dotted, puffy, later loosely imbricating
Floral tube	c. 3.7 cm long	c. 2.5 cm long
Lateral staminodes	Rotund, c. 20 × 12 mm	Obovate, c. 7 × 2 mm
Labellum	Saccate, c. 3 × 1.7 cm	Saccate, c. 2 × 1.2 cm
Labellum apex	Bilobed, margin frilled	Entire, margin plain
Labellum colour	White with dark red pattern	White with a dark red pattern
Anther	c. 13 mm long, adaxial glandular hairs throughout	c. 7 mm long, glandular hairs on the margins of thecae only
Flowering	July to mid-October	May–November
Ecology	Limestone outcrops, seashore	Evergreen forest, mountains
Elevation	5–20 m	normally >100 m

Fig. 5. Species comparison. **A.** *Boesenbergia prainiana* (Baker) Schltr. (left), *B. albosanguinea* (Ridl.) Loes. (right). **B.** *B. prainiana* inflorescence and flower. **C.** *Boesenbergia prainiana*, (left), *B. albosanguinea* (right). **D.** Pressed and dried flower of *B. albosanguinea* (M3291). **E.** Pressed and dried flower of *B. prainiana* (M3172). **F.** Pressed and dried flower of *B. albosanguinea* (holotype). (Photos: J. Mood)

When Ridley (1899) published *Boesenbergia albosanguinea*, he classified the known *Boesenbergia* species into three “groups” based on the position and source of

the inflorescence: *Acranthi* (spike borne on the top of a leafy stem), *Mesanthi* (centre of the leaf tuft), and *Exanthi* (outside the leaf tuft). *Boesenbergia albosanguinea*, along with the type of the genus, *B. pulcherrima* (Wall.) Kuntze, was placed in the first group, while *B. prainiana* was placed in *Exanthi* with species now considered as *Scaphochlamys* Baker. Holttum made no mention of this classification which, although now rather outdated, has some diagnostic importance. The character state of having a significant stem vs little or none at all is quite important. Clearly *Boesenbergia albosanguinea* is caulescent (stemmed) as can be seen in the drawings (Figs. 2, 3), although on the holotype, which is a poor specimen, it is less distinctive due to separation of the leaves and lack of inclusion of the full stem (Holttum, 1950). If the 1894 drawing is compared to this type (supposedly drawn from the same plant), it is initially hard to see distinctive similarities except in the leaves. If this drawing is compared to the isoelectotype of *Boesenbergia prainiana* at SING, the caulescent vs acaulescent (tufted) character state is very evident. If the inflorescences of the types of both species are compared with the 1894 drawing (Fig. 2), they are very similar, but differ in length and number of bracts.

The historic materials aside, if well-prepared and fully documented herbarium specimens of the two species are compared, two additional identifying clues are the date of collection and location/ecology. *Boesenbergia prainiana*, being evergreen, occurs primarily in wet, evergreen forest on sandstone or quartz derived soils while *B. albosanguinea* is deciduous, goes dormant for c. 5 months of the year and has only been found near the sea on shaded, limestone outcrops. Consequently, the latter cannot be collected November to March, whereas the former can be collected year-around. It was also stated that the original collection area of *B. albosanguinea* was Maxwell's Hill (c. 1000 m), far inland from the sea. The type locality of *Boesenbergia prainiana* is also in Perak. Currently there are no other *Boesenbergia* species known from the Taiping Hills area that have a morphology similar to *B. prainiana*, with the exception of *Boesenbergia minor*.

So how is this incongruence of habitat (mountain vs coastal) explained if *Boesenbergia albosanguinea* is synonymous with *B. prainiana* as Holttum stated? Firstly, the holotype of *Boesenbergia albosanguinea* was not collected in the field on Maxwell's Hill, but was from a cultivated plant in the botanic gardens of Penang. Supposedly this plant was originally given to the gardens by Theodore A. Wooldridge, an orchid collector who employed local people to make collections. There are many avenues for error, starting from the time of collection to months later when it flowered in Penang, e.g., labelling, accession records, etc. At least four years prior, Curtis had already collected at least one specimen in Langkawi [*Curtis* 2677 (SING)]. Given Curtis's love of horticulture and previous employment from 1878–1884 as a collector for the horticultural company Veitch & Son, England, he most likely always collected living plants for the gardens. Consequently, it seems that when the drawing was made and then the holotype processed from the same plant, the resultant components were not taken from Wooldridge's donated plant, but from a different plant collected in Langkawi by Curtis. As Ridley was writing his description prior to publication (Ridley, 1899), it is quite likely he saw living plants at the Penang Botanic Gardens as he stated

Fig. 6. *Boesenbergia albosanguinea* (Ridl.) Loes. **A.** A.G. Hussain with wild plants on limestone at Pulau Langgun, Langkawi. **B.** Mature plant population. **C.** Flowering plant. **D.** Flower in profile. **E.** Flower showing anther. (Photos: A.G. Hussain)

“an exceedingly similar if not identical plant occurs also in Langkawi (*Curtis 2677*),” an observation difficult to deduce from herbarium specimens alone. Note: Curtis made eight explorations to Langkawi Islands 1888–1902 (<http://www.nationaalherbarium.nl/FMCollectors/C/CurtisC.htm>).

As a final comparison of materials, in 2015 the second author photographed (Fig. 5 & 6) and collected plants of *Boesenbergia albosanguinea* [*Ghani s.n.* (KEP)] on Palau Langgun, a small, limestone island off the northeast coast of Langkawi Island. Based on AGH’s many years of local collecting, this is the only location where this

species has been found in recent times. Further, the only other *Boesenbergia* species known to occur on Langkawi and the surrounding islands are *B. curtisii* (Baker) Schltr. and *B. plicata*.

Taxonomy

=*Boesenbergia albosanguinea* (Ridl.) Loes. in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 15a: 566 (1930). – *Gastrochilus albosanguinea* Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 109 (1899) (“*albo-sanguinea*”). – Type: Specimens from a plant cultivated at Penang Botanical Gardens, Sep 1894, “*Wooldridge*” [but more likely Curtis] *s.n.* (holotype K! [K000255404]). (Fig. 1–3, 5–7; Tab. 1, 2).

Boesenbergia prainiana auct. non (Baker) Schltr.: Holttum, Gard. Bull Singapore 13: 111 (1950).

Deciduous, perennial herb up to 60 cm, tightly clumping; **rhizome** with multiple elements developing linearly and vertically, c. 3 cm tall, 1 cm diam., externally yellowish white, internally with two concentric rings, both dark yellow, new rhizome elements produced at some nodes; roots fleshy to 22 cm long, 4 mm diam., white, short root hairs along the full length, swollen and fusiform at the tips, these c. 5 × 1 cm, white, surface smooth, root hairs along the full length; fibrous roots few from the rhizome to 27 cm long. **Stems** five to numerous, up to 7 cm long, base ovoid, c. 2 cm diam., without bladeless sheaths (cataphylls), with (rarely 2) 4–6 leafy sheaths 6–16 cm long, dark red, changing to green towards the ligule, surface finely veined, glabrous. **Leaves** (rarely 2) 4–6, lower leaves in pairs, nearly opposite; petiole 2–11 cm, longer on upper leaves, green, glabrous; ligule bilobed, each lobe triangular, 2–15 mm long, shortest on upper leaves, translucent, glabrous, from the ligule base a red, hyaline margin extends down the leaf sheath 2–7 cm long; lamina elliptic to ovate, 15 × 9 cm (lower) to 38 × 15 cm (upper), base rounded, apex acuminate, adaxially veins raised, medium shiny green, glabrous, abaxially convex between the veins, light green, glabrous. **Inflorescence** terminal, clasped between the sheaths, peduncle short, c. 8 mm diam.; spike broadly lanceolate to slightly fusiform, 15–20 long, 2 cm wide, c. 1 cm thick, exserted for half of its length, ovate in cross-section, dull green with a reddish centre in the lower one-third. **Bracts** distichous, overlapping equally on both sides of the rachis, cymbiform, lanceolate when opened and flattened, lowest bract sterile, 9 cm long, fertile bracts open to the base, c. 3 × 3 cm, distally decreasing slightly in size, green in the centre, light red on a wide margin, glabrous; **bracteole** lanceolate, curved, open to the base, on the opposite side of the floral tube from the bract, margins overlap and fully enclose the floral tube, 4.2 cm long, 4 mm diam. at the base, white, glabrous. **Flowers** 16–18, one flower per bract, c. 6 cm. long, flowering sequence basipetalous (from the apex downward), labellum oriented 90° to the bract apex, all facing the same direction and downward. **Calyx** tubular, c. 1.1 cm long, translucent white, glabrous, apex undulate, truncate. **Floral tube** c. 3.7 cm long, c. 4 mm diam.

Fig. 7. *Boesenbergia albosanguinea* (Ridl.) Loes. Ink line drawing with watercolour by Linda Ann Vorobik (2015). Based on *J. Mood & P. Vatcharakorn M3291*.

at base, white, glabrous; dorsal corolla lobe broadly elliptical, cymbiform, c. 25×14 mm, apex cucullate, white, glabrous, ventral corolla lobes elliptical, c. 2.5×1.0 cm, apex cucullate, white, glabrous; androecial cup oriented 90° to the floral tube, c. 8×6 mm wide, throat with long hairs. **Labellum** deeply saccate, orbicular (natural shape), c. 3×1.7 cm wide, c. 3 cm wide (flattened), throat light red, maculate, lip streaked with dark red to the apex, lobe margins violet with age, glabrous and iridescent on both sides, apex emarginate, 2–3 mm, overall white; **lateral staminodes** obovate, c. 2.2×1.3 cm, apex slightly reflexed, white, sparsely pubescent, iridescent. **Stamen** c. 13 mm long, filament c. 3×2 mm, white, dorsal, with glandular hairs, thecae c. 11×2 mm (each), white, dehiscent full length, connective white, dorsally with glandular hairs, no anther crest, pollen white. **Ovary** trilocular, elongate, c. 5×2 mm, green, glabrous; **style** filiform, c. 6 cm, white, **stigma** triangular, white, ostiole oval with “v” notch, glabrous; **epigynous glands** aculeate, c. 6 mm long, yellow. **Fruit** not seen. [Measurements based on living, cultivated material of *J. Mood* & *P. Vatcharakorn* M3291 from Thailand].

Distribution. Malaysia: Langkawi, Pulau Langgun; Thailand: Satun Province.

Ecology. Found on limestone outcrops in shaded habitats in close proximity to the sea.

Phenology. Observations in Satun Province and Langkawi indicate that flowering normally occurs from July to mid-October. Flowers open in the morning and close the following day.

Etymology. Named for the white and blood-red colour of the labellum.

Specimens examined. MALAYSIA: **Kedah:** Langkawi, Pulau Langgun, limestone outcrop, shoreline forest, 10 m asl, 15 Sep 2015, *Ghani s.n.* (KEP); no exact location, Sep 1890, *Curtis*, C. 2677 (SING); no exact locations, cultivated at Penang Botanical Gardens, no dates (SING [SING0155198, SING0155248, SING0155266]).

THAILAND: **Satun:** La Ngu, Ko Kabeng, 80 m, Sep 1999, *Phengkklai*, C. 12105 (BKF), 12106 (BKF); La Ngu, Mu Ko Phetra N.P., 70 m, 10 Sep 2008, *Middleton, D.J. et al.* 4436 (BKF, E); La Ngu, Mu Ko Phetra N.P., 30 m, 20 Sep 2010, *Middleton, D.J. et al.* 5492 (E); near Ko Phetra, 10 m, evergreen scrub forest on limestone, $06^\circ 51.162'N$ $99^\circ 45.781'E$, 1 Aug 2012, *Mood, J. & Vatcharakorn, P.* M3291 (BKF); near Langu, 54 m, evergreen scrub forest on limestone, $06^\circ 51.162'N$ $99^\circ 45.781'E$, 4 Aug 2013, *Mood, J. & Vatcharakorn, P.* M3386 (BKF).

Notes. This species as it appears in Satun Province is upright to slightly decumbent with thick, multiple stems in a clump, quite similar to the vegetative habit of *Boesenbergia trangensis* and *B. plicata*. The leaves are also plicate, but tend to be slightly smaller in size with a rounded leaf base. When fertile, it is easily identified by the very symmetrical, lanceolate inflorescence that is narrow at the base, wider in the centre and slowly tapered to the apex. The bracts are symmetrical and tightly overlap on both sides of the rachis. The leaf sheath margins and lower bracts are reddish which gives the appearance of a broad, red streak on the stem and partially up the centre of

the inflorescence. The inflorescence protrudes for about half its length out of the leaf sheaths and maintains a mostly vertical stance. The flowers are pure white with a light red, narrowed, maculate pattern in the throat, and a lip lightly streaked with dark red especially on the apex margin. Ridley's comment on the narrow opening for pollination is due to the large, overlapping lateral staminodes which cover roughly two-thirds of the labellum length, forming a tube. In the Langkawi populations, the plants tend to be generally less robust, shorter in height with narrower, shorter leaves. The leaf sheaths are red but the colour does not extend onto the rachis. The inflorescences are more cylindrical, less flattened with slightly longer, narrower bracts which sometimes deflex slightly away from the rachis on some plants. Flower shape and colour are nearly identical to the Thai populations, albeit slightly smaller.

Boesenbergia prainiana (King ex Baker) Schltr., Repert. Spec. Nov. Regni Veg. 12: 316 (1913). – *Kaempferia prainiana* Baker in Hook.f., Fl. Brit. India 6: 220 (1890). – *Gastrochilus prainianus* (Baker) Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 115. (1899); Ridl., Mat. Fl. Malay Penins. 2: 18 (1907); Ridl., Fl. Malay Penins. 4: 247 (1924). – Type: Malay Peninsula, Perak, Gopeng, Kinta Valley, *King's Collector (Kunstler)* 726 [cited as “226” by Ridley (1899, 1907)] (lectotype K [K000255402!], designated here; isoelectotypes CAL [CAL0000001005!], K [K000255403!], SING [SING0044027!]). (Fig. 4; Table 1)

Conclusions

It is concluded that *Boesenbergia albosanguinea* is distinct from *B. prainiana*. The Langkawi collections by Curtis labelled as *Boesenbergia albosanguinea* are confirmed, as are those from Satun Province, the latter constituting a new record for Thailand.

The disparity of Wooldridge's type locality in the mountains of Perak as compared with the documented coastal collections in Langkawi and Satun Province cannot be explained by any known historical references such as accession books or associated Wooldridge memorabilia (pers. com. Singapore Botanic Gardens Library). The facts remain that *Boesenbergia albosanguinea* has never again been recorded from the Thaiping Hills and, ecologically, it is unlikely that species otherwise only known from coastal limestone sites would also be found in a distinctly different, mountainous environment. Therefore, the only logical explanation for this inconsistency is that the plant at Penang used for the holotype, protologue and illustration was not the same plant Wooldridge collected. More likely it was one of Curtis's plants collected from Langkawi between 1890 and 1893.

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***Boesenbergia siphonantha* (Zingiberaceae),
a new record for Thailand and Vietnam
with notes on the molecular phylogeny**

J.D. Mood¹, H.Đ. Trần², J.F. Veldkamp³ & L.M. Prince⁴

¹Lyon Arboretum, University of Hawaii, 3860 Manoa Road,
Honolulu, HI 96822, U.S.A.

boesenbergia@gmail.com

²National University, University of Science,
Ho Chi Minh City, Vietnam

³Naturalis Biodiversity Center, P.O. Box 9517,
2300 RA Leiden, The Netherlands

⁴The Field Museum, Department of Botany, 1400 S Lake Shore Dr.,
Chicago, IL 60605, U.S.A.

ABSTRACT. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. (Zingiberaceae) is newly recorded from Thailand and Vietnam. Its nomenclatural history, taxonomy, and molecular phylogeny are discussed. Figures, a comparative table and a watercolour illustration are provided.

Keywords. Andaman Islands, *Gastrochilus*, *Kaempferia*

Introduction

During field work in 2010 for the *Flora of Thailand* Project, an unusual *Boesenbergia* was discovered growing on and around limestone outcrops under deciduous forest in Kanchanaburi Province [J. Mood & P. Chalermglin M2056 (BKF)]. The plant with four, deeply plaited laminae on long petioles was highlighted by a terminal inflorescence and a single flower with a shiny lavender lip and red throat. Except for the colouration, the floral appearance was reminiscent of *Boesenbergia longiflora* (Wall.) Kuntze, due in part to the long floral tube and saccate labellum. On further examination of other plants in the Kanchanaburi population, numerous radical inflorescences were observed. Except as an abnormal occurrence, bi-positional flowering, defined here as radical and terminal inflorescences on the same element, is quite rare in Zingiberaceae. However, it is not without precedent as *Boesenbergia prainiana* (Baker) Schltr., *B. tenuispicata* K.Larsen, and *B. trangensis* K.Larsen consistently exhibit this habit. Bi-positional flowering was later observed in two other populations, a second site in Kanchanaburi [J. Mood & P. Vatcharakorn 3081 (BKF)] and in Tak Province [J. Mood & P. Vatcharakorn 3366 (BKF)].

In 2008, preceding the Thai collections, the second author discovered an unidentified *Boesenbergia* species at Cát Tiên National Park, Đồng Nai Province, Vietnam [Trần *et al.* 123 (SING, VNM)] during MSc research at the Vietnam National University, Hồ Chí Minh City (Trần, 2009). Later, photos of this plant were sent to JDM for possible identification, along with a leaf tissue sample for addition to the authors' ongoing molecular phylogenetic research on *Boesenbergia*. Although the taxon could not be identified immediately, the molecular results showed that it grouped in the same clade as the three aforementioned Thai collections. Later, morphological comparisons also indicated close similarity except for plant stature with the Thai collections being taller (Table 1). During further study, *Boesenbergia* specimens at AAU, BK, BKF, C, CAL, CMU, CMUB, E, K, L, P, SING, QBG, VNM and W were surveyed. The search produced three unidentified, morphologically similar collections from Thailand and one from northern Myanmar. Surprisingly, an Andaman Islands species, *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk., was also very similar.

Boesenbergia siphonantha is considered to be a rare, insular endemic from the evergreen and semi-deciduous forests of the Andaman Islands, India. It was described by Baker (1890) as *Kaempferia siphonantha* based on King's *Collector* 372 (K). This and three similar specimens deposited in CAL were collected by Kunstler on 21 July 1884 in the Andaman Islands during exploration for George King, then Director, Royal Botanic Garden, Calcutta. It was named to describe the flower's very long floral tube. For reasons unknown, Baker did not associate this new taxon with *Boesenbergia longiflora* which also had radical inflorescences and flowers with a long floral tube. Perhaps his statement in the *Gardeners' Chronicle* (Baker, 1894: 34) shows his sentiment: "*Gastrochilus* [*Boesenbergia* (Kuntze, 1891)] is hardly worth separating as a genus from *Kaempferia*". Consequently he classified it as a *Kaempferia* L. along with six others which had little similarity to this new species. Of these, only *Kaempferia parvula* King ex Baker and *K. elegans* Wall. have withstood the test of time and remain in *Kaempferia*.

Considering this information, the Thai and Vietnamese specimens were compared to the lectotype, protologue (Baker, 1890), and later descriptions of *Boesenbergia siphonantha* (Sabu *et al.*, 2004; Kumar *et al.*, 2010), all of which compared favourably. To further verify the tentative identification, a complete set of photos of the Thai collections was sent to J. Leong-Škorničková (SING) who had firsthand knowledge of this species. Although some differences were noted and discussed, it was eventually agreed that the non-Andaman collections were representative of *Boesenbergia siphonantha sensu lato*. Unfortunately, at the time, this conclusion could not be supported phylogenetically since a tissue sample of *Boesenbergia siphonantha* from the Andaman Islands was not available. Recent molecular research by Aishwarya *et al.* (2015), which included *Boesenbergia siphonantha*, later allowed for inclusion of partial data here. The molecular results support the decision to identify the Thai and Vietnamese taxa as *Boesenbergia siphonantha*.

Materials and Methods

Field research. In 2008, HDT collected a voucher with silica-dried leaf tissue from a single population of *Boesenbergia siphonantha* in Vietnam. Between 2010–2015, JDM collected *B. siphonantha* vouchers with silica-dried tissue samples from three different populations in Thailand. All of the populations were thoroughly studied, documented, and photographed. Ex situ nursery cultivation was accomplished in Thailand with several living collections, providing additional information.

Molecular phylogeny. The above tissue samples were used in this analysis. Additional sequences providing the scaffold were taken from the authors' ongoing research. *Boesenbergia siphonantha* Sabu 73-1 is not available in GenBank but a partial *trnK* sequence, corresponding to the *matK* genetic fingerprint region, was generously provided by M. Sabu (University of Calicut, India). ITS data were not available for that sample. A complete list of samples and GenBank accession numbers are provided in Appendix 1.

DNA extraction and analytical methods follow Mood et al. (2013) and will only be summarised here. The entire plastid *trnK* region was amplified. Amplification was done in two parts, the first using 1F and 1235R primers and the second using m1F and 2R. The nuclear ribosomal ITS (nrITS) region was amplified using the 18S-F and 26S-R primers (Prince, 2010). Data were collected on an ABI Genetic Analyzer (ThermoFisher Scientific) and trace files for each specimen were edited in Sequencher v4.9 (Gene Codes Corporation, Ann Arbor, Michigan, USA). Consensus sequences were exported from Sequencher for manual alignment in Se-al (Rambaut, 1996). Areas of ambiguous alignment were identified and analyses were conducted both including and excluding these data. Maximum parsimony analyses were run in PAUP* (version 4.0b10; Swofford, 2002) for each genomic data partition, firstly independently and later in combination. Branch and bound search methods were conducted in each case using “farthest” stepwise addition, saving a maximum of 100,000 trees. Branch support was also estimated using Branch and Bound parsimony bootstrap (BS) in PAUP*.

Results

The ITS analyses produced eight shortest trees based on 97 potentially phylogenetically informative characters (PPIC) with a consistency index of 0.6703 and a retention index of 0.7980 (excluding uninformative characters). The *trnK* analyses, with only 35 PPIC, generated 21 shortest trees (consistency index=0.7400, retention index=0.8750). The combined partition matrix yielded 132 PPIC and generated 18 shortest trees (consistency index=0.6598, retention index=0.5231) when the sample *Sabu 73-1* (partial *trnK* sequence only) was excluded from the analyses.

The ITS partition included four samples of *Boesenbergia siphonantha* (M2056, M3081, M3366, and T123), while the *trnK* partition included those already mentioned, plus a partial sequence from *Sabu 73-1*. Analyses of all data partitions, alone or in

combination, group the samples of *Boesenbergia siphonantha* together in a strongly supported monophyletic clade (100% bootstrap support for ITS, 98% for *trnK*, and 98% for the combined analyses). Exclusion of the partial *trnK* sequence for *Sabu 73-1* resulted in a clade bootstrap value of 100%. The sample *Sabu 73-1* is identical to the other four samples for the region sequenced. Characters supporting the monophyly include a large number of autoapomorphic substitutions distributed across the coding and non-coding regions (3 from the ITS1, 5 from the ITS2, 1 from the 5' *trnK*-*matK* intergenic spacer, and 4 from the *matK* coding region). A unique 3 base pair insertion was also observed in the 5' *trnK*-*matK* intergenic spacer.

For simplicity, only a single phylogeny is shown here; a phylogram of one of the most parsimonious trees from the combined data analyses where gaps are treated as missing data, and the sample *Sabu 73-1* was excluded (Fig. 1). Bootstrap values are provided above the branch. The ITS analyses further resolved a moderately supported (86% BS) relationship between the Vietnam sample (*T123*) and one sample from Thailand (*M3366*). The closest inferred relatives from the sampling utilised here were members of the *Boesenbergia longiflora* clade, but that relationship was only weakly supported (BS 68%). This contrasts with results of the *trnK* analyses, where *Boesenbergia albomaculata* S.Q.Tong and *B. pulcherrima* (Wall.) Kuntze were indicated as closest relatives, again with only weak support (74%).

Fig. 1. Combined analysis of *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. using ITS and *trnK* sequence data. Bootstrap values are provided above the branch for those with > 50% support.

Taxonomy

Boesenbergia siphonantha (King ex Baker) M.Sabu, Prasanthk. & Škorničk., Rheede 14: 55 (2004). — *Kaempferia siphonantha* King ex Baker in Hook.f., Fl. Brit. India 6: 222 (1890). — TYPE: India, Andaman Islands, 1884, *King's Collector* 372 (lectotype CAL [CAL0000000916]; isolectotypes CAL [CAL0000000912, CAL0000000913], K [K000640517]), first step designation by Sabu et al. (2004), second step here. (Figs. 2–6)

Deciduous, perennial herb 20–60 cm tall, tightly clumping. **Rhizome** with multiple elements, development in various directions forming a clonal mat, subterranean, globular, 1.2–1.5 cm diam., cream-yellow inside, faintly aromatic, bitter; primary roots few, fleshy, conical, elongate, to 12 cm long, 1 cm. diam. at the top, white, surface smooth, short root hairs full length, the terminus swollen, spherical to obovoid, 1–2.5 cm long, 0.8–2.2 cm diam., white, short root hairs the full length, many fibrous roots from the rhizome to c. 17 cm long. **Stems** c. 5 cm long, c. 1.1 cm diam., oval in cross section, leafless sheaths 1–2, deeply corrugate, green or purple-red. **Leaves** 4–7 per stem; *leaf sheaths* 10–21 cm long, finely ribbed with white blotches, many scattered hairs, dark green, margin brown; *ligule* bilobed, lobes linear to rounded, 1–6 mm long, light green or translucent turning pale brown, glabrous or with few hairs; *petiole* 3–12 cm, ribbed, green, glabrous; *lamina* oblong-lanceolate or ovate 10–26 × 4–12 cm, base cordate, sometimes oblique, apex acute or acute-acuminate, veins 3–7 mm apart, adaxially dark green, glabrous, abaxially lighter green or purple, glabrous or slightly pubescent. **Inflorescence** radical and terminal, the radical inflorescence attached to a rhizome near the stem base, the terminal inflorescence between the leaf sheaths, sometimes shortly exserted, flowering sequence basipetalous; *peduncle* 1–3 cm long, narrow, slender, branched or unbranched; *spike* cylindrical, 4–6 cm long, c. 0.4 cm diam., base white, apex dark purple-brown, ribbed; *bracts* 2–8, distichous, ovate-lanceolate to linear, 3.5–5 × 0.5–1 cm, white, green or green with maroon tinge at the apex, glabrous, overlapping equally on both sides of the rachis; *bracteole* tubular, 1–2.9 cm long, c. 0.1 cm diam., glabrous or pubescent, white or cream, translucent, apex 2 or 3-toothed, laterally split 1–3.6 mm. **Flowers** 2–8 per inflorescence, one per bract, 7–12 cm long, erect; *calyx* tubular, c. 6 × 1.5 mm, translucent white or white with tiny maroon dots, apex tri-dentate, c. 3 mm longitudinal slit; *floral tube* cylindrical, 6.5–9 cm long, c. 2 mm diam., white, glabrous; *dorsal corolla lobe* triangular to lanceolate, cymbiform, 1.2–1.3 × 0.4–0.6 cm, sometimes mucronate, cream, glabrous; *lateral corolla lobes* linear, c. 1.3 × 0.4 cm, cream, glabrous, veins translucent, margin translucent, all lobes deflexed 180° away from the labellum at maturity; *androecial tube* 4–6 mm long, c. 4 mm wide, throat with few hairs; *labellum* deeply saccate, ovate to obovate (in live plants), 2 × 0.5–1.7 cm, cream-white, yellowing with age, throat and medial line bright red, maculate, colour broadening outward, changing in last third to dark pink, maturing dark purple or distal half violet with reddish bands toward the centre, externally covered in short glandular hairs, margin slightly undulate, sometimes crumpled, apex irregular, emarginate; *lateral staminodes* obovate

Fig. 2. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. **A.** Flowering plant. **B.** Flower. **C.** Flower dissection. **D.** Seed with aril. (Photos: J. Leong-Škorničková of an ex situ plant from the Andaman Islands)

to oblong, $0.8\text{--}3 \times 0.4\text{--}1$ cm, closely appressed with the labellum towards the base, cream-white, dorsally covered with short, glandular hairs or glabrous, apex revolute. **Stamen** c. 7 mm long; *filament* 1–4 mm long, white, glabrous; *anther* elliptical, pale yellow, darker towards the tip, glabrous, thecae $5\text{--}6 \times 3\text{--}3.7$ mm (each) at opening, $5\text{--}6 \times 4\text{--}4.7$ mm at maturity, rotating away from labellum 90° , dehiscent full length,

Fig. 3. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. from Kanchanaburi, Thailand. **A.** Plants in situ. **B.** Flower on a radical inflorescence. **C.** First day flower. **D.** New flower on a terminal inflorescence. From J. Mood & P. Chalermglin M2056. (Photos: J. Mood)

white, light brown at senescence, connective white, anther crest absent, pollen white. **Ovary** trilocular, $3\text{--}6 \times 2$ mm, placentation axile, white, glabrous, shiny; **style** filiform, to 7.5 cm long, white; **stigma** white, ostiole ciliate; **epigynous glands** linear, two, 4–4.5 mm long, yellowish or pale cream, apex acute. **Fruit** a capsule, elliptical, c. 1 cm long, trilocular, white with red spots throughout, darker on the interior, dehiscence

loculicidal, valves rolling outward into coils; *seed* ellipsoidal, brown, hirsute, apex yellowish, funiculus present, yellowish, aril medusa-form, yellow-white, translucent. (Note: This description is based on the protologue and collections from Thailand and Vietnam.)

Distribution & Ecology. Andaman Islands: Moist, deciduous and inland evergreen forests on humus rich soil, 5–45 m elevation. Thailand: On and around limestone outcrops in deciduous, secondary forest with bamboo, medium to heavy shade at c. 70–800 m elevation. Vietnam: Deciduous *Lagerstroemia* L. forest on lateritic rocks.

Phenology. See Table 1.

Additional specimens examined. THAILAND: **Mae Hong Son:** Baan Bo Khai, 800 m, 12 Sep 1999, *Srisanga, P. & Puff, C. 1067* (QBG); Baan Bo Khai, 800 m, 12 Sep 1999, *Srisanga, P. & Puff, C. 1069* (QBG); **Tak:** N. of Ban Ta Song Yang, 17°32.691' N 97°56.291' E, 180 m, 28 Jul

Table. 1. Comparison of *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. from three geographical areas

Character	India (Sabu et al. 2004)	Thailand (M2056)	Vietnam (Trần 123)
Plant height	20–30 cm	50–60 cm	c. 30 cm
Petiole length	3–6 cm	10–12 cm	4–6 cm
Lamina dimensions	10–15 × 4–7 cm	23–26 × 10–12 cm	12–15 × 8 cm
Inflorescence (radical)	Branched	Unbranched	Unbranched
Inflorescence (terminal)	Unbranched	Unbranched	Unbranched
Flowers per inflorescence	4–8	2–5	2 or 3
Flower length	10.5–12 cm	7–10.5 cm	c. 9.5 cm
Labellum	c. 20 × 5–17 mm	c. 21 × 11 mm	c. 20 × 14 mm
Flowers per day	Several	One	One
Floral display position	Above the lamina	Below the lamina	Intermediate
Phenology	February–August	July–August	July–August

Fig. 4. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. from Kanchanaburi, Thailand. **A.** Inflorescence opened. **B.** Flower with calyx, bracteole and bract removed. **C.** Stamen with staminodal cup at base. **D.** Senesced flower with thecae rotated 180°. **E.** Rhizome with storage roots. From *J. Mood & P. Chalermglin M2056*. (Photos: J. Mood)

2013, *Mood, J. & Vatcharakorn, P. 3366* (BKF). **Kanchanaburi:** Sai Yok, Wangkamen, 200 m, 29 Jan 2000, *Phengklai et al. 14098* (BKF); W of Chong Sadao 20 km, 14° 12.626' N, 99° 02.925' E, 70 m, 21 Aug, 2011, *Mood, J. & Vatcharakorn, P. 3081* (BKF).

VIETNAM: Đồng Nai: Cát Tiên National Park, August 2008, *Trần et al. 123*.

Note: A *Huk*, *A. s.n.* collection from northern Myanmar, Jul 1892 (CAL) could also be this species.

Fig. 5. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. from Đồng Nai Province, Vietnam. **A.** Mature plant with terminal inflorescence. **B.** Mature plant with radical inflorescence. **C.** First day flower. **D.** Dissected inflorescence and flower (Scale in cm). From *Trần et al.* 123. (Photos: H.Đ. Trần)

Discussion

The Andaman Islands were physically connected to the Southeast Asian mainland along the Arakan Yoma ridge in southwestern Myanmar at the end of the Pleistocene

Fig. 6. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk. Ink line drawing with watercolour by Linda Ann Vorobik (2015).

c. 10,000 years ago (www.worldwildlife.org/ecoregions/im0101). This land bridge occurred due to ocean levels being c. 100 m lower than at present. Although the duration of the connection is unknown, it was long enough to allow dispersal of species to and from the islands, to the point that the present-day flora of the Andamans has 72% of its species in common with the mainland. Most of the remaining species are also found in the adjacent Nicobar Islands which have a greater species similarity to Peninsular Malaysia and Sumatra. (www.worldwildlife.org/ecoregions/im0101). It is not known which direction *Boesenbergia siphonantha* spread during this era of low sea levels but, based on its close phylogenetic relationship to the *B. longiflora* clade of six continental species, most likely its origin is also continental. The morphological variations observed among the country populations show considerable plasticity in vegetative form, floristic habit and ecology.

Vegetatively, these differences are not unlike other widely distributed *Boesenbergia* species such as *B. kingii* Mood & L.M.Prince. Floristically, the Andaman populations are very showy with multiple flowers displayed well above the leaves. In contrast, the continental plants normally only produce one flower at a time, hidden down amongst the leaves. This significant variation suggests very different pollination strategies which are yet to be investigated. Finally, although the ecology among country populations varies considerably, it has been shown from ex situ cultivation experiments in India using Andaman plants (Kumar et al., 2010) and in Thailand with Thai plants (pers. obs.), that this species is quite adaptable to a variety of environmental regimes.

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Appendix 1: GenBank accession numbers for Zingiberaceae used in this study. Identification: plant sample number [for newly sequenced samples] (collector and voucher number, herbarium), ITS GenBank number/trnK GenBank number.

Boesenbergia albomaculata S.Q. Tong: M11C83 (Murata, J. et al. 20050595K, MBK) KU159317/KU159408. *Boesenbergia clivalis* (Ridl.) Schltr.: M11C127 (Lim, C.K. s.n., UPM) KU159398/KU159409. *Boesenbergia collinsii* Mood & L.M.Prince: Mood, J. 12P171 (BK) JX992751/JX992812. *Boesenbergia kerrii* Mood, L.M.Prince & Triboun: Mood, J. & Triboun, P. 12P170 (BK) JX992756/JX992817. *Boesenbergia hamiltonii* Mood, S. Dey, & L.M. Prince: Dey NU53 (CAL) JX992754/JX992815. *Boesenbergia kingii* Mood & L.M.Prince: Mood, J. & Vatcharakorn, P. 12P173 (BK) c2-JX992789, c3-JX992790, c4-JX992791, cJX992792, c8-JX992793/JX992829. *Boesenbergia maxwellii* Mood, L.M.Prince & Triboun: Mood, J. & Triboun, P. 12P172 (BK) JX992800, JX992833. *Boesenbergia ochroleuca* (Ridl.) Schltr.: M3116 (Mood, J. & Vatcharakorn, P. 3116, BKF) KU159399/KU159410. *Boesenbergia plicata* var. *plicata* (Ridl.) Holttum: Mood, J. & Vatcharakorn, P. 3177 (BKF) JX992807/JX992840. *Boesenbergia pulcherrima* (Wall.) Kuntze: Mood, J. 08P276 (BKF) JX992748/JX992809. *Boesenbergia rotunda* (L.) Mansf.: M11P27 (Mood, J. 11P27, BKF) KU159400/KU159411. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk.: M2056 (Mood, J. & Chalermglin, P. 2056, BKF) KU159401/KU159412. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk.: M3081 (Mood, J. & Vatcharakorn, P. 3081, BKF) KU159402/KU159413. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk.: M3366 (Mood, J. & Vatcharakorn, P. 3366, BKF) KU159403/KU159414. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk.: Trần & al. 123 (SING, VNM) KU159404/KU159415. *Boesenbergia siphonantha* (King ex Baker) M.Sabu, Prasanthk. & Škorničk.: Sabu, M. 73-1(CALI) Not registered in GenBank. *Boesenbergia tenuispicata* K. Larsen: M3292 (Mood, J. 3292, BKF) KU159405/KU159416. *Kaempferia* sp.: M2043 (Mood, J. 2043, BKF) KU159395/KU159406. *Kaempferia parviflora* Wall. ex Baker: M3087 (Mood, J. 3087, BKF) KU159396/KU159407.

***Boeica ornithocephalantha* (Gesneriaceae), a new species from northern Vietnam**

F. Wen^{1,2}, T.V. Do³, X. Hong⁴, S. Maciejewski^{2,5} & Y.G. Wei^{1,2,*}

¹Guangxi Key Laboratory of Plant Conservation and Restoration Ecology
in Karst Terrain, Guangxi Institute of Botany, Guangxi Zhuang
Autonomous Region and the Chinese Academy of Sciences,
CN-541006, Guilin, Guangxi, China
wenfang760608@139.com

²Gesneriad Conservation Center of China (GCCC),
CN-541006, Guilin, Guangxi, China

³Department of Biology, Vietnam National Museum of Nature,
Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet,
Cau Giay, Ha Noi, Vietnam
dovantruong_bttm@yahoo.com

⁴The Key Laboratory of Conservation and Employment of Biological
Resources of Anhui, Herbarium, College of Life Sciences,
Anhui Normal University, Wuhu, CN-241000, Anhui, China
hongxin1989@vip.qq.com

⁵The Gesneriad Society, Inc. 1122 East Pike Street, PMB 637,
Seattle, WA 98122-3916, USA
teciu1949@gmail.com

*corresponding author: weiyigang@aliyun.com

ABSTRACT. A new species, *Boeica ornithocephalantha* F.Wen, Y.G.Wei & T.V.Do (Gesneriaceae), is described from the northern part of Vietnam. This new species is most similar to *Boeica ferruginea* Drake, but clearly differs from the latter by the unusual corolla. A provisional IUCN conservation assessment is provided.

Keywords. *Boeica*, Gesneriaceae, IUCN conservation assessments, Vietnam

Introduction

The genus *Boeica* Clarke (Gesneriaceae) was first published by Clarke (1874). It is a small genus in subfamily Didymocarpoideae, tribe Trichosporeae, subtribe Leptoboeinae of the Gesneriaceae (Weber et al., 2013). Currently, there are about twelve species of *Boeica* from China, Myanmar, Bhutan, northern India and the northern part of Vietnam (Wang et al., 1990, 1998; Li & Wang, 2004; Weber, 2004), the species described most recently being *B. glandulosa* B.L.Burt (Burt, 2001). *Boeica* species usually grow in shaded and damp locations with the different species having variable flowering and fruiting seasons, thereby often making it a challenge to collect specimens for identification. Except for *Boeica guileana* Burt (Burt, 1977), which is

a rosette plant without distinct stems, the remaining species of *Boeica* are caulescent, including the newly described species below.

During a field investigation of the flora of northern Vietnam we collected an unknown species of *Boeica* which required further investigation. Plants were grown at the nursery of Guilin Botanical Garden and the Gesneriad Conservation Center of China (GCCC) from seeds collected in the Pu Hu Nature Reserve, Quan Hóá district, Thanh Hóá province, northern Vietnam. When the plants flowered, the floral morphology provided further confirmation that the collection was a new species of *Boeica*. Michael Möller, a Gesneriaceae researcher at the Royal Botanic Garden Edinburgh, also supported this conclusion. We describe and illustrate the proposed new species here and provide a provisional IUCN conservation assessment following the guidelines in IUCN (2012).

Taxonomy

Boeica ornithocephalantha F.Wen, T.V.Do & Y.G.Wei, **sp. nov.**

Most similar to *Boeica ferruginea* Drake but *B. ornithocephalantha* is characterised by a shorter petiole (1–1.5 cm long vs 3–5 cm long in *Boeica ferruginea*), adaxial leaf blade densely glandular and non-glandular pubescent (adaxially appressed puberulent, abaxially sparsely woolly to glabrescent, woolly to villous along veins in *Boeica ferruginea*), peduncle 12–20 cm long and sparsely glandular pubescent (5–8 cm and villous in *Boeica ferruginea*), bracts 3 (2 in *Boeica ferruginea*), corolla in lateral view reminiscent of the head of a bird and outside glabrous (not reminiscent of a bird and outside sparsely pubescent in *Boeica ferruginea*), corolla tube 1–1.2 mm long (c. 2 mm long in *Boeica ferruginea*), and disc inconspicuous or nearly none (circular, c. 0.2 mm high in *Boeica ferruginea*). – TYPE: Vietnam, Thanh Hóá province, Quan Hóá district, Quan Hóá town, Pu Hu Nature Reserve, alt. 900 m, 18 July 2014, flowering, Wen Fang WF140718-01 (holotype VNMN; isotype IBK). (Figs. 1 & 2)

Herbs, stoloniferous. **Stems** 8–18 cm long, unbranched or rarely branched, densely yellowish-brown woolly to villous or pilose when young, mostly glabrescent when mature, rarely glabrous; rhizomes short, 2–4 cm long, c. 2 mm in diameter. **Leaves** alternate, internodes c. 1 cm long, usually 6–8 leaves clustered at the top of stem; petiole 1–1.5 cm long, densely brown villous; blades ovate-elliptic to oblong, 10–18 × 7–10 cm, mature leaf blades usually ascending, apex obtuse to rounded, base attenuate, margin irregularly serrate, densely glandular and non-glandular pubescent on the upper surface, upper surface distinctly bullate, lateral veins 10–13 on each side, impressed adaxially and prominent abaxially, densely yellowish-brown woolly on the veins of the lower surface, the rest yellowish-brown villous. **Inflorescence** axillary, a dichasium, 12- to 35-flowered or more; peduncle 12–20 cm long, c. 1.2 mm in diameter, sparsely purplish brown and white erect glandular pubescent, the hairs varying in length; bracts 3, the larger two narrowly lanceolate, c. 5 mm long, c. 1 mm in diameter at base, apex acute, margin entire, the remaining one linear, c. 1.5 mm

Fig. 1. *Boeica ornithocephalantha* F.Wen, Y.G.Wei & T.V.Do. **A.** Top view of plant. **B.** Upward view of plant. **C.** Cyme with open flowers. **D.** Front view of cyme. (Photos: Fang Wen)

long, 0.2–0.3 mm in diameter at base, apex acuminate, margin entire, outer surface sparsely purplish brown glandular puberulent, inside nearly glabrous; pedicels 1.5–4.5 cm long, 1–1.2 mm in diameter, sparsely purplish brown and white erect glandular pubescent. **Calyx** divided to the base, 5-lobed, apex green, the rest pinkish purple, lobes linear lanceolate, 4–5 mm long, c. 0.9 mm in diameter at base, margin entire, outside reddish purple glandular puberulent, inside nearly glabrous; **Flowers** slightly fragrant. **Corolla** small, 4–6 mm long, c. 5 mm in diameter, outside glabrous, initially shallowly campanulate, limb inconspicuously 2-lipped, two larger lobes of abaxial lip inflexed from the middle and covering the anthers; corolla tube extremely short, 1–1.2 mm long; adaxial lip 2-lobed at least to middle of lip, lobes nearly equal, 3–4.5 mm long, c. 2 mm in diameter at base, wider but mostly shorter than abaxial lip lobes, external margin of lobes white, the centre of lobes green, internal margin of lobes white to pale pink, the centre dark purplish red; abaxial lip 3-lobed, all white, lateral lobes larger, broadly lanceolate to oblong, apex obtuse, c. 3.5 mm long, c. 1.5 mm in

Fig. 2. *Boeica ornithocephalantha* F. Wen, Y.G.Wei & T.V.Do. **A.** Obliquely view of corollas. **B.** Inside of corolla. **C.** Outside of corolla. **D.** Pistil and calyx. **E.** Capsule. (Photos: A, E: Fang Wen; B–D: Hua-Fei Cen)

diameter at base, the central lobe lanceolate, apex acuminate and inflexed, 3.5–4 mm long, 1.2–1.5 mm in diameter at base. **Stamens** 4, free; filaments white, 0.5–0.8 mm long, glabrous, adnate to the base of corolla; anthers dark purplish red, cordate, c. 0.5 mm long, 0.4–0.6 mm in diameter at base, dehiscing poricidally; staminode 1, c. 0.1 mm long, dark purple to black, adnate to the base of corolla. **Disc** inconspicuous or nearly absent. **Ovary** ovoid, 1.5–2 mm long, c. 1 mm in diameter, glandular puberulent; style 5–7 mm long, mostly glabrous but glandular puberulent at the base. **Stigma** 1, apex truncate, pale green. **Capsule** linear, nearly glabrous, 1.5–2 cm long.

Distribution. Only known from Pu Hu Nature Reserve, near En Village, Quan Hóá town, Quan Hóá district, Thanh Hóá province, Vietnam.

Habitat. Primarily growing on shaded slopes in valleys above streams, often locally common, at low altitude. It occurs on rocks covered with humus under evergreen forest, not prone to human disturbance.

Etymology. The scientific name is due to the perception by the authors that the lateral view of the mature corolla looks like the head of a bird. The epithet, “*ornithocephalantha*”, is composed of the Greek elements ‘ornitho-’ for bird, ‘cephal-’ for head and ‘-antha’ for flower.

Provisional IUCN Conservation Assessment. Vulnerable VU B2ab(ii,iii). This species is only known from very few collections and details on the size of the population in Pu Hu Nature Reserve are unknown. We acknowledge that the type locality is protected from exploitation and development by being in a Nature Reserve, thereby guaranteeing the plants protected status. Based on our observations during the field work currently the plants appear to be locally abundant. However, the known habitat is also disturbed by intentional and unintentional human activity such as for path building. According to the IUCN red list categories and criteria, the species should be considered Vulnerable (IUCN, 2012).

Notes. *Boeica* species are characterised by an indumentum of shiny bristly brown hairs, a corolla with a short tube and flat limb, four free stamens, and poricidal or transverse anthers that are coherent at the tips (Pellegrin, 1926; Burt, 1977; Li & Wang, 2004). Among the 12 known species, some have a distinctly zygomorphic corolla, a very short corolla tube, a spreading corolla limb, and four obvious stamens (here connivent), traits that Burt (1977) considered to be ‘primitive’. The new species possesses some of the above-mentioned morphological traits.

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An expansion of the genus *Deinostigma* (Gesneriaceae)

M. Möller¹, K. Nishii¹, H.J. Atkins¹, H.H. Kong², M. Kang²,
Y.G. Wei³, F. Wen³, X. Hong⁴ & D.J. Middleton⁵

¹Royal Botanic Garden Edinburgh, 20A Inverleith Row,
Edinburgh EH35LR, Scotland, U.K.

²Key Laboratory of Plant Resources Conservation
and Sustainable Utilization, South China Botanical Garden,
Chinese Academy of Sciences, Guangzhou 510650, China

³Guangxi Key Laboratory of Plant Conservation and Restoration
Ecology in Karst Terrain, Guangxi Institute of Botany,
Guilin 541006, China

⁴College of Life Sciences, Anhui Normal University,
Wuhu 241000, China

⁵Herbarium, Singapore Botanic Gardens, National Parks Board,
1 Cluny Road, Singapore 259569
david_middleton@nparks.gov.sg

ABSTRACT. Based on molecular, morphological and cytological studies the previously monotypic genus *Deinostigma* W.T.Wang & Z.Y.Li has been expanded to include several species previously ascribed to *Primulina* Hance. *Deinostigma* now comprises seven species, including one previously placed in synonymy. The new combinations *Deinostigma cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller, *Deinostigma cynostyla* (B.L.Burt) D.J.Middleton & H.J.Atkins, *Deinostigma cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins, *Deinostigma eberhardtii* (Pellegr.) D.J.Middleton & H.J.Atkins, *Deinostigma minutihamata* (D.Wood) D.J.Middleton & H.J.Atkins and *Deinostigma tamiana* (B.L.Burt) D.J.Middleton & H.J.Atkins are made. *Deinostigma eberhardtii* is lectotypified. The genus is defined by a combination of an alternate leaf arrangement, hooked hairs on many plant parts, flowers with the pedicel inserted at an angle and off-centre on the receptacle, and, where known, a somatic chromosome number (2n) of < 36. This new circumscription of the genus expands its distribution from Vietnam into South China.

Keywords. Molecular phylogeny, ovary morphology, *Primulina*, taxonomy

Introduction

The genus *Deinostigma* W.T.Wang & Z.Y.Li in the Gesneriaceae currently has only one species, *D. poilanei* (Pellegr.) W.T.Wang & Z.Y.Li from the southern Annamite range of Vietnam. It was erected as a genus to accommodate the species first described as *Hemiboea poilanei* Pellegr. This species was placed in *Hemiboea* C.B.Clarke due to its bilocular ovary and the perception that one of the locules was sterile, a trait of the species in *Hemiboea*. Wang & Li (1992) argued that it did not belong in *Hemiboea* due to having alternate leaves, free bracts, inside of corolla glabrous, filaments broader

in the upper half, anthers hairy, anther locules divaricate with apices confluent, disc absent, and stigma bifid. In further arguments they noted how it differed from other Asian genera and concluded that a new genus was necessary to accommodate it. Since then, the status and relationships of *Deinostigma poilanei* have remained obscure due to being known from only very few specimens and because relatively little research has been done on the Gesneriaceae of Vietnam.

During work at the Muséum National d'Histoire Naturelle in Paris for an as-yet-unpublished checklist of the Gesneriaceae of Cambodia, Laos and Vietnam by DJM, it became clear that *Deinostigma poilanei* was similar to a number of species from Vietnam and China that were moved into *Primulina* Hance from *Chirita* Buch.-Ham. ex D.Don by Weber et al. (2011), namely *P. cynostyla* (B.L.Burtt) Mich.Möller & A.Weber, *P. cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & A.Weber, *P. eberhardtii* (Pellegr.) Mich.Möller & A.Weber, *P. minutihamata* (D.Wood) Mich.Möller & A.Weber and *P. tamiana* (B.L.Burtt) Mich.Möller & A.Weber. None of these *Deinostigma*-like species were included in the molecular phylogenetic analyses by Weber et al. (2011) but were moved into *Primulina* based on their previous inclusion in *Chirita* sect. *Gibbosaccus* C.B.Clark by Wood (1974). All species of the hitherto *Chirita* sect. *Gibbosaccus* that were included in the molecular analyses formed a single highly supported clade with *Primulina tabacum* Hance, the type of *Primulina* (Weber et al., 2011).

Deinostigma poilanei and the species of *Primulina* similar to it share a number of morphological traits that are not found in other species of *Primulina*. These are alternate leaf arrangement (opposite or verticillate in the remaining *Primulina* species), hooked hairs on many plant parts but particularly on the pedicels, and flowers with the pedicel inserted at an angle and off-centre on the receptacle. In several species the fruit is strongly curved. The alternate leaf arrangement is not particularly clear in the species with a congested rosette of basal leaves but is nevertheless observable by only a single leaf emerging from the apical meristem at a time. Differences also exist in the basic chromosome numbers, with *Primulina* having exclusively $x = 18$ (> 100 species counted out of > 150 described) (Möller & Pullan, 2015 onwards) while one *Deinostigma*-like species, *P. tamiana*, has been counted with $x = 16$ (Christie et al., 2012). In other features the plants are indeed similar to *Primulina*. It should also be noted that these *Deinostigma*-like *Primulina* species occur on a variety of substrates but not on limestone and that the majority of the remaining *Primulina* species occur on limestone substrates.

In Wang et al. (1998) *Chirita cicatricosa* W.T.Wang is placed in synonymy of *C. minutihamata* D.Wood (= *Primulina minutihamata*), typified by material from China and Vietnam respectively. We found that the material from China has longer, more slender and more falcate fruits and somewhat larger flowers than material from Vietnam. Coupled with their large disjunct distribution, and pending a revision of the species, we suspect that they may represent distinct species and treat them thus here (see also below).

The aim of this study was to investigate the relationship between *Deinostigma* and *Primulina* and clarify the status of the *Deinostigma*-like *Primulina* species.

Materials and Methods

Plant materials

Herbarium specimens and living collections of *Deinostigma poilanei* and the *Deinostigma*-like *Primulina* species were studied in the Royal Botanic Garden Edinburgh and the Muséum National d'Histoire Naturelle in Paris.

Materials for morphological and phylogenetic analyses were collected in Vietnam (*Deinostigma poilanei*, *Primulina tamiana*) and China (*Primulina cyrtocarpa*, *Chirita cicatricosa*) (Table 1). Data for the phylogenetic analyses were downloaded from GenBank (including one additional sample of *Primulina minutihamata* from China which we are treating here as *Chirita cicatricosa*). These basically represented a reduced matrix of Old World Gesneriaceae as presented in Middleton et al. (2015). Altogether 132 samples (129 species) were included, covering all 32 genera currently recognised in the subtribe Didymocarpaceae of tribe Trichosporeae (Möller et al., 2009, 2011, 2014; Weber et al., 2013; Middleton et al., 2014a, 2015). The sampling included 20 samples of 19 species of *Primulina*, including the type, *P. tabacum* (Table 1). The phylogenetic trees were rooted on samples of *Microchirita* (C.B. Clarke) Yin Z. Wang (Möller et al., 2009, 2011).

DNA extraction, PCR and phylogenetic analysis

Sequences of the nuclear ribosomal internal transcribed spacers (ITS) and the plastid *trnL*-F intron-spacer (*trnL*-F) for four samples, *Chirita cicatricosa*, *Deinostigma poilanei*, *Primulina cyrtocarpa*, and *P. tamiana*, were obtained. The extraction of genomic DNA was carried out using a CTAB procedure (Doyle & Doyle, 1987, 1990).

The PCR amplification of ITS and *trnL*-F were performed using primers '5P' (5'-GGA AGG AGA AGT CGT AAC AAG G-3') and '8P' (5'-CAC GCT TCT CCA GAC TAC A-3') (Möller & Cronk, 1997) and 'c' (5'-CGA AAT CGG TAG ACG CTA CG-3') and 'f' (5'-ATT TGA ACT GGT GAC ACG AG-3') (Taberlet et al., 1991), respectively, run on a Biorad T100™ Thermal Cycler (Hemel Hempstead, UK). The 10 µL reactions contained 1 µL 10× NH₄ reaction buffer (Bioline, UK), 1 µL dNTPs (2 mM), 0.3 µL MgCl₂ (50 mM), 0.4 µL of each primer (10 µM), 5.6 µL ddH₂O, 0.1 µL Biotaq polymerase (5U/µL) (Bioline, UK) and 1.2 µL DNA template. The PCR thermocycle profile for ITS started with an initial denaturation for 3 min at 94°C, followed by 30 cycles of 1 min at 94°C, 1 min at 55°C and 1.5 min at 72°C, finished with a final extension step for 5 min at 72°C. For *trnL*-F it was: initial denaturation for 4 min at 94°C, followed by 30 cycles of 45 s at 94°C, 45 s at 55°C and 3 min at 72°C, with a final extension step for 10 min at 72°C. PCR products were run on 1% agarose gels to check for amplification success and quality. PCR amplified fragments were purified using ExoSAP-IT (Affymetrix, UK) following the manufacturer's protocol, and sequenced using the dideoxy chain-termination method. Sequencing samples were prepared using the BigDye Terminator v3.1 Cycle Sequencing Kit (Thermo Fisher Scientific, UK) following the manufacturer's recommendations, and sequencing was carried out by the Edinburgh Genomics sequencing service (University of Edinburgh,

UK). Editing and assemblage of sequencing results were performed using the programs Sequencher 4.5 (Gene Codes Corp, Ann Arbor, USA). The newly acquired sequences were added to the reduced matrix of Middleton et al. (2015) and the matrices realigned manually. They were subsequently submitted to GenBank (Table 1).

Since the combinability of the ITS and *trnL-F* matrices, tested with the ILD test (Farris, 1995a, 1995b), implemented as PHT in PAUP* 4.0a146 (Swofford, 2002), did not indicate incongruent phylogenetic signals ($P = 0.58$), the two matrices were analysed together. The reconstruction of phylogenetic trees by maximum parsimony (MP) and Bayesian inference (BI), including the calculation of bootstrap (BS) and posterior probability (PP) branch support values, were carried out as previously described (Möller et al., 2009, 2011; Weber et al., 2011; Middleton et al., 2015): the MP analysis on the combined data was carried out in PAUP* v.4.0b10 (Swofford, 2002), on unweighted and unordered characters. Alignment gaps were treated as missing data. Starting trees were found by parsimony ratchet (Nixon, 1999), in PAUPRat (Sikes & Lewis, 2001) and PAUP*, and the saved trees further optimised in PAUP*, with both TBR and Multrees on. Statistical branch support was obtained from 10,000 heuristic bootstrap replicates each starting with a random addition tree, optimized with TBR on and Multrees off in PAUP* (Möller & al., 2009, 2011).

The BI analyses were run in MrBayes v.3.1.2 (Huelsenbeck & Ronquist, 2001; Huelsenbeck et al., 2007). Models and parameter prior settings were obtained independently for the *trnL-F*, the ITS spacers and 5.8S sequences using MrModeltest v.2.3 (Nylander, 2004), and were GTR + I + G for *trnL-F* and the ITS spacers, and SYM + I + G for the 5.8S gene, respectively, as suggested by the Akaike Information Criterion (AIC; Akaike, 1974). Five million generations were run in two independent analyses each with four Markov chain Monte Carlo (MCMC) chains. One tree was sampled every 1000th generation (= 5000 trees), and the first 250 trees (5%) discarded as burn-in, determined after plotting the generations against the Log(n) likelihoods and a majority rule consensus tree construct with the 'sumt' command and posterior probabilities (PP) obtained in MrBayes.

Cytology

The chromosome numbers for *Deinostigma poilanei* (R. Rybková HB 222) and *Primulina cyrtocarpa* (M. Möller & Y.G. Wei MMO 06-908) (Table 1), were determined from root tips as previously described (Jong & Möller, 2000; Christie et al., 2012). For *Chirita cicatricosa* (Zulin 131585, China, Guangxi, Shangsi), leaf cuttings were cultivated in pots at the South China Botanical Garden, Chinese Academy of Sciences. Actively growing root tips were harvested and pretreated in the dark with 0.1% colchicine and 0.1% 8-Hydroxyquinoline (1:1) at room temperature for 3 hours and then fixed in 3 : 1 absolute ethanol : glacial acetic acid at 4°C for 2 hours. They were macerated in a mixture of 1 : 1 1M HCl and 45% acetic acid at 37°C in a water bath for 45 min, and stained and squashed in 1% aceto-orcein.

Results and Discussion

Phylogeny

The MP analysis resulted in 204 most parsimonious trees with a length of 4123 steps, CI of 0.3772 and RI of 0.6797. For the BI runs, the average standard deviation of split frequencies was 0.003949 indicating a strong convergence of the two runs. Furthermore, a close correlation of the PP values between the two runs was observed, confirming the reproducibility of the runs.

In both the MP (Fig. 1) and BI (Fig. 2) phylogenetic trees, *Primulina* s.s. (excluding *Chirita cicatricosa*, *P. cyrtocarpa*, and *P. tamiana*) forms a highly supported clade (BS = 100%; PP = 1), and, most importantly, is the sister clade to *Petrocodon* with maximum branch support (BS = 100%; PP = 1). *Deinostigma poilanei*, together with *Chirita cicatricosa*, *Primulina cyrtocarpa* and *P. tamiana*, forms a separate clade (BS = 73%; PP = 0.88), which is sister to the monotypic *Metapetrocosmea* W.T.Wang with maximum branch support (BS = 100%; PP = 1). Although most of the genera are in highly supported clades, as in previous studies (Möller et al., 2009, 2011), the backbone of the phylogenetic tree is not resolved. However, since both *Primulina* s.s. and the *Deinostigma* clade form strongly supported sister relationships to other genera respectively, it is unlikely that the two genera are closely related. Consequently, we transfer the *Deinostigma*-like *Primulina* species to *Deinostigma* and refer to them thus hereafter.

Morphology

All species are herbs. They are all probably perennial and, judging from the numerous leaf scars on the stems of some species, they are likely to be deciduous in the dry season. In particular, *Deinostigma cynostyla* has a thick stem with numerous congested leaf scars. The other species have a relatively thin stem and species such as *Deinostigma minutihamata* are mostly procumbent.

All species have an alternate leaf arrangement although this is not so obvious in *Deinostigma cynostyla* where the leaves are very congested. The alternate leaf arrangement is in contrast to *Primulina* s.s. where the leaves are opposite or in whorls, usually of three. The leaf blade is ovate to elliptic with a weakly (*Deinostigma tamiana*) to strongly (*D. cyrtocarpa*) crenate or dentate margin. In all species the length of the petiole is very variable within an individual, but compared to most other Asian genera, it is generally long in proportion to the length of the leaf blade, and often longer than the blade.

The inflorescences arise from the axils of the upper leaves, are borne on long peduncles, and are dichasia with the typical paired-flower arrangement of the Gesneriaceae. They are few-flowered in most species to many-flowered in *Deinostigma eberhardtii*. In most species the inflorescence is fairly lax but is rather congested in the terminal branches in *Deinostigma cynostyla*. There are hooked hairs on the pedicels, which are not found in *Primulina* s.s.

The corolla is white, blue or variations on purple (or combinations of these), infundibuliform, with the lower lip 3-lobed and the upper lip 2-lobed. From the colour and morphology bee pollination is likely.

Fig. 1. Maximum parsimony strict consensus tree based on combined ITS and *trnL-F* sequence data. Clades representing entire genera are collapsed. Numbers along the branches are bootstrap values. Asterisks denote branches receiving < 50% support.

Fig. 2. Bayesian inference majority rule consensus tree based on combined ITS and *trnL-F* sequence data. Clades representing entire genera are collapsed. Numbers along the branches are posterior probability values. Asterisks denote branches with < 0.5 posterior probability.

There are two fertile stamens and three staminodes (the central one sometimes obscure). The filaments are geniculate around the middle and glandular or hairy distally. The anthers are hairy or glandular in all species.

The ovary of *Deinostigma poilanei* is small, c. 5 mm long, at an oblique or sometimes almost a right angle to the pedicel and slightly curved upwards, similar to *D. cynostyla* (c. 2.4 mm long), *D. eberhardtii* (c. 4.5 mm long), *D. tamiana* (c. 5.5 mm long) and *D. cyrtocarpa* (7–9 mm long). At maturity, the capsules in *Deinostigma poilanei*, *D. tamiana* and *D. cyrtocarpa* are 1.5–2 cm long and in *D. eberhardtii* 2.5–2.9 cm long. In these species, the capsules are falcate and inserted at an angle to the pedicel to be carried $\pm$ horizontally (not known in *Deinostigma cynostyla*).

In *Deinostigma cicatricosa* and *D. minutihamata*, the ovary is much larger, c. 12–18 mm long, and only at a slight angle in relation to the pedicel. In *Deinostigma cicatricosa*, the mature capsule is 4.5–5 cm long, has a slight curve and is slender, while in *D. minutihamata*, the capsule remains straight, 2.3–3.5 cm long, and is broader. In all *Deinostigma* species where it is known the capsule dehiscence is loculicidal.

The internal structure of the ovaries could not be studied in all species. In the species studied the internal structure varies considerably. In *Deinostigma poilanei* it is bilocular for its entire length, with axile recurved bifid placentation (Fig. 3A). In *Deinostigma tamiana* and *D. cicatricosa* only the basal part is bilocular while in the middle and distal parts the carpels are not fused and the ovary is unilocular (Fig. 3B, C). We surveyed other species previously within the circumscription of *Chirita*, and now included in other genera (i.e., *Henckelia dielsii* (Borza) D.J.Middleton & Mich. Möller, *Microchirita prostrata* J.M.Li & Z.Xia, *Primulina hochiensis* (C.C.Huang & X.X.Chen) Mich.Möller & A.Weber and *Primulina liguliformis* (W.T.Wang) Mich. Möller & A.Weber), and found them to possess a unilocular ovary for their entire length (Fig. 3E–G). The exception was *Primulina dryas* (Dunn) Mich.Möller & A.Weber, the ovary of which is bilocular throughout but with the abaxial locule being sterile (Fig. 3D).

Chromosome numbers

The chromosome number of *Deinostigma poilanei* and *D. cicatricosa* was determined as $2n = 32$, that of *D. cyrtocarpa* as $2n = c. 30$ (Fig. 4). For all species, the chromosomes within each complement did not differ significantly in size and were c. 0.8–1.2 μm in length. *Deinostigma tamiana* was counted previously as $2n = 32$ (Christie et al., 2012).

The counts for all other *Primulina* species to date (139 counts for 118 species and 4 varieties, Möller & Pullan, 2015 onwards) were uniformly $2n = 36$, except for a tetraploid count of $2n = 72$ for one accession of *P. longgangensis* (W.T.Wang) Y.Liu & Y.Z.Wang (Christie et al., 2012) and one count of $2n = 28$ for the same species (Cao et al., 2003), the latter likely erroneous since two other counts of *P. longgangensis* showed $2n = 32$ (Liu et al., 2012; Kang et al., 2014). Overall, the chromosome size of species of *Primulina* s.s. is slightly larger than those with $2n = c. 30$ and 32 chromosomes, being mostly up to 1.6 μm long, with the exception of *P. aff. balansae* (Drake) Mich. Möller & A.Weber with chromosomes up to 2.0 μm long. Overall, the chromosome numbers are in full congruence with the phylogeny, separating *Primulina* s.s. with $2n = 36$ from those with $2n = c. 30$ and $2n = 32$ chromosomes.

Fig. 3. Photographic sections taken near the base, the middle and the tip of ovaries of diverse species belonging to *Deinostigma* W.T.Wang & Z.Y.Li (A–C), species previously included in *Chirita* Buch.-Ham. (D–F) and *Microchirita prostrata* J.M.Li & Z.Xia (G). (Photos: M. Möller)

Fig. 4. Chromosome spread preparations of three *Deinostigma* W.T.Wang & Z.Y.Li species. **A.** *Deinostigma poilanei* (Pellegr.) W.T.Wang & Z.Y.Li prometaphase with $2n=32$ chromosomes. **B.** *Deinostigma cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller metaphase with $2n = 32$ chromosomes. **C.** *Deinostigma cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins prometaphase with $2n = c. 30$ chromosomes. Scale bar: $10\mu\text{m}$. (Photos: A, C: M. Möller; B: Hui-Min Li)

Geography

The Annamite range of mountains that straddles the border between Vietnam and Laos, and extends into NE Cambodia and further south in Vietnam to just north of Ho Chi Minh City, is known to be an area of high biodiversity and home to many endemic species of plants and animals (Averyanov et al., 2003; WWF, 2015). The Annamites are particularly interesting for Gesneriaceae as the genus *Billolivia* D.J.Middleton, now with seven species (all of which were also described as new), was recently described from the southern end of this range (Middleton et al., 2014a, 2014b; Vu et al., 2015). *Deinostigma*, however, occurs across almost the full length of the mountain range and into southern China, a distribution pattern not otherwise observed in other Gesneriaceae genera except for those which are generally much more widespread (e.g. *Aeschynanthus* Jack, *Didymocarpus* Wall., *Rhynchotechum* Blume).

Conclusion

In summary, phylogeny, cytology and morphology support a separation of *Chirita cicatricosa* (previously included in synonymy of *Primulina minutihamata*), *Primulina cyrtocarpa* and *P. tamiana* from *Primulina* and their integration into an expanded genus *Deinostigma* with a distribution range covering Southern China and Vietnam. *Primulina cynostyla*, *P. eberhardtii* and *P. minutihamata* must also be moved into *Deinostigma* based on their close morphological similarities to species which have been included in the phylogeny. The genus includes species with leaves in alternate arrangement with distinct nodes (except congested in *D. cynostyla*), bilocular ovaries, at least at the base, and a chromosome number smaller than $2n = 36$, these characters distinguishing *Deinostigma* from *Primulina* s.s. *Metapetrocosmea*, though monotypic and sister to *Deinostigma* in the phylogeny, is excluded from *Deinostigma* due to its many differences, such as the unilocular ovary, epipetry, free anthers, capitate stigma, and the capsule globose and straight in relation to the pedicel.

Taxonomy

We do not attempt a revision here of the species now included in *Deinostigma* but note that a revision is needed. The only major change to the existing taxonomy that we make is to resurrect *Chirita cicatricosa* from synonymy of *Primulina minutihamata* and make combinations in *Deinostigma* for both (see below). All type material cited below has been seen by the authors.

Deinostigma W.T.Wang & Z.Y.Li, Acta Phytotax. Sin. 30(4): 356 (1992). – TYPE: *Deinostigma poilanei* (Pellegr.) W.T.Wang & Z.Y.Li

Chirita subsect. *Cicatricosae* W.T.Wang, Bull. Bot. Res., Harbin 1(4): 69 (1981). – TYPE: *Chirita cicatricosa* W.T.Wang

Perennial herbs, caulescent with distinct or short stem. **Leaves** simple, alternate, sometimes congested into a rosette, petiolate; blade slightly peltate or not, margin crenate or dentate, secondary veins pinnate. **Inflorescences** axillary, cymose; pedicels with hooked hairs. **Flowers** with the pedicel inserted at an angle and off-centre on the receptacle. **Calyx** lobes divided to base, elliptic, those on ventral side slightly longer and wider. **Corolla** white, purple, blue or combinations thereof, infundibuliform, lower lip 3-lobed, upper lip 2-lobed, lobe apices rounded. **Fertile stamens** 2, filaments slightly curved, anthers adnate face to face, hairy or with glands, staminodes 3 but with central staminode sometimes obscure. **Nectary** 5-crenate or apparently lacking. **Ovary** fusiform, bilocular throughout or at least near base, then unilocular from middle to apex; stigma of only lower lip developing, broad, flat and weakly 2-lobed. **Fruit** straight to strongly falcate, oblique in relation to the pedicel, dehiscing loculicidally; many-seeded, seeds unappendaged.

Distribution. Seven species in southern China and Vietnam. Some of the Vietnamese material was collected close to the border with Laos and it may also occur in that country.

Deinostigma cicatricosa (W.T.Wang) D.J.Middleton & Mich.Möller, **comb. nov.** – *Chirita cicatricosa* W.T.Wang, Bull. Bot. Res., Harbin 1(4): 69 (1981). – TYPE: China, Guangxi, Dongxing, Banba Commune, Renbei, 3 October 1976, Fang, D. et al. 1525 (holotype GXMI [GXMI050619]). (Fig. 5A–D)

Distribution. China (Guangxi).

Notes. Wood (1974) included a specimen from Southern Guangxi (although he cited it as being from ‘Kwangtung’ (Guangdong)) in his new species *Chirita minutihamata*, along with material, including the type, from Vietnam. Wang (1981) later described *Chirita cicatricosa* from Guangxi without explicitly including the Chinese material

of *C. minutihamata* or referring to that species. Wang (1985), Wang et al. (1990) and Wang et al. (1998) placed *Chirita cicatricosa* in synonymy of *C. minutihamata* and cited localities corresponding to the type locality of *C. cicatricosa* and the material cited by Wood (1974). We acknowledge that the material from China and the material from Vietnam are indeed very similar but the differences between them, particularly in the longer, slender, more falcate fruits and the somewhat larger flowers of the Chinese material, along with the widely disjunct distribution, lead us to suspect that they may be recognised as distinct species when the group is revised. We therefore provide the combination in anticipation of this.

Deinostigma cynostyla (B.L.Burtt) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita cynostyla* B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 23: 96 (1960). – *Primulina cynostyla* (B.L.Burtt) Mich.Möller & A.Weber, Taxon 60: 781 (2011). – TYPE: Vietnam, Da Nang, Ba Na, 1000–1500 m, 27 February 1939, *Poilane, E. 29123* (holotype P [P00602510]).

Distribution. Only known from the Ba Na Hills of central Vietnam.

Notes. This species has not been included in molecular phylogenetic analyses but has been transferred to *Deinostigma* based on its morphological similarity to *Deinostigma poilanei*.

Deinostigma cyrtocarpa (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins, **comb. nov.** – *Chirita cyrtocarpa* D.Fang & L.Zeng, Acta Phytotax. Sin. 31(5): 468 (1993). – *Primulina cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & A.Weber, Taxon 60: 781 (2011). – TYPE: China, Guangxi, Hezhou City, 130–140 m, 16 June 1991, *Zhou L.S. & Zeng L. 1263* (holotype GXMI [GXMI050608]). (Fig. 5E–H)

Distribution. NE Guangxi (Hezhou).

Deinostigma eberhardtii (Pellegr.) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita eberhardtii* Pellegr., Bull. Soc. Bot. France 73: 418 (1926). – *Primulina eberhardtii* (Pellegr.) Mich.Möller & A.Weber, Taxon 60: 782 (2011). – TYPE: Vietnam, Thua Thien-Hue, Baika, *Eberhardt 2466* (lectotype P [P00602512], designated here; isoelectotype VNM).

Distribution. Vietnam (Thua Thien-Hue and Da Nang).

Notes. This species has not been included in molecular phylogenetic analyses but has been transferred to *Deinostigma* based on its morphological similarity to *Deinostigma poilanei*.

Fig. 5. *Deinostigma cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller (A–D) and *D. cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins (E–H). **A.** Habit and mature fruits. **B.** Flower cut open. **C.** Flower top view. **D.** Flower front view. **E.** Habit. **F.** Mature fruits. **G.** Flowering branch. **H.** Flowers front view. (Photos: A, B, E, F: M. Möller; C, D, G, H: Yi-Gang Wei)

Deinostigma minutihamata (D.Wood) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita minutihamata* D.Wood, Notes Roy. Bot. Gard. Edinburgh 31: 370 (1972). – *Primulina minutihamata* (D.Wood) Mich.Möller & A.Weber, Taxon 60: 783 (2011). – TYPE: Vietnam, Kon Tum, Ngok Pa Not, 2300 m, 12 December 1946, *Poilane*, E. 35803 (holotype P [P00602518]; isotype P [P00602519]).

Distribution. Vietnam (Kon Tum).

Notes. See notes under *Deinostigma cicatricosa*. This species has not been included in molecular phylogenetic analyses but has been transferred to *Deinostigma* based on its morphological similarity to *D. cicatricosa* and *D. poilanei*.

Deinostigma poilanei (Pellegr.) W.T.Wang & Z.Y.Li, Acta Phytotax. Sin. 30(4): 357 (1992). – *Hemiboea poilanei* Pellegr., Bull. Soc. Bot. France 73: 421 (1926). – TYPE: Vietnam, Khanh Hoa, Nha Trang, 300 m, 29 May 1922, *Poilane*, E. 3846 (holotype P [P00606338]; isotype P [P00634330]). (Fig. 6A–E)

Distribution. Vietnam (Khanh Hoa, Thua Thien-Hue and Da Nang).

Deinostigma tamiana (B.L.Burtt) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita tamiana* B.L.Burtt, Gloxinian 49(4): 20 (1999). – *Primulina tamiana* (B.L.Burtt) Mich.Möller & A.Weber, Taxon 60: 785 (2011). – TYPE: Originally collected as Soviet-Vietnam Expedition 0/114 from Vietnam, Vinh Phuc, Tam Dao National Park, cultivated in RBGE under accession number 19981743*A, vouchered for the herbarium as *CULTE 15738* (holotype E [E00269898]). (Fig. 6F–J)

Distribution. Vietnam (Vinh Phuc, Tam Dao NP).

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Fig. 6. *Deinostigma poilanei* (Pellegr.) W.T.Wang & Z.Y.Li (A–E) and *D. tamiana* (B.L.Burtt) D.J.Middleton & H.J.Atkins (F–J). **A.** Habit. **B.** Flower side view. **C.** Flower front view. **D.** Immature fruit. **E.** Mature fruit. **F.** Habit. **G.** Flower side view. **H.** Flower front view. **I.** Immature fruit. **J.** Mature fruit. (Photos: A, B, C, F–J: M.Möller; D, E: Sadie Barber)

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Table 1. List of the 132 Gesneriaceae samples of tribe Trichosporeae included in the phylogenetic analysis, including voucher number, deposition, origin and GenBank accession numbers for *trnL-F* and ITS respectively.

Taxon	Voucher number	Deposited in	Origin	<i>trnL-F</i>	ITS or ITS1 / ITS2
<i>Aeschynanthus bracteatus</i> Wall. ex A.DC.	Wang, Y.Z. 991113	PE	China, Yunnan, Xichou county	FJ501501	-
<i>Aeschynanthus bracteatus</i> Wall. ex A.DC.	Cherry, R. 123 [Cult. RBGE 19970165]	E	Vietnam, Lao Cai	-	AF349203 / AF349284
<i>Aeschynanthus lancilimbus</i> W.T.Wang	Wang, Y.Z. S-10868	PE	China, unknown locality	FJ501499	HQ632992
<i>Aeschynanthus micranthus</i> C.B.Clarke	Möller, M. & Qi, Y.D. MMO 01-79	E, PE, WU	China, Yunnan, Hekou county	FJ501500	-
<i>Aeschynanthus micranthus</i> C.B.Clarke	Reid, A. & Fernie, J. 004 [Cult. RBGE 19951561]	E	China, Yunnan, Xishuangbanna Dai Aut. Pref.	-	AF349218 / AF349299
<i>Aeschynanthus rhododendron</i> Ridl.	Woods, P. 600 [Cult. RBGE 19680624]	E	Malaysia, Genting Highlands	HQ632895	FJ501333
<i>Aeschynanthus roseoflorus</i> Mendum	Argent, G. 87/14	E	Indonesia, Seram	HQ632896	HQ632993
<i>Agalmyla biflora</i> (Elmer) Hilliard & B.L.Burtt	RBGE-PNH1998 25435 [Cult. RBGE 19980287],	E	Philippines, Palawan, Near summit of Cleopatra Needle	FJ501541	-
<i>Agalmyla biflora</i> (Elmer) Hilliard & B.L.Burtt	RBGE-PNH1998-25517 [Cult. RBGE 19980292]	E	Philippines, Palawan, near Thumb Peak	-	FJ501361
<i>Agalmyla bilirana</i> Hilliard & B.L.Burtt	RBGE-PNHE 1999 12	E	Philippines, Leyte Island	HQ632891	HQ632988
<i>Agalmyla clarkei</i> (Elmer) B.L.Burtt	RBGE-PNH1999(P99) 13 [Cult. RBGE 19991911]	E	Philippines, Leyte Island, Mt. Lobi	FJ501540	-
<i>Agalmyla clarkei</i> (Elmer) B.L.Burtt	RBGE-PNH1997 IS26 [Cult. RBGE 19972530A]	E	Philippines, Luzon, Barangay Penicuason	-	FJ501360

<i>Agalmyla glabra</i> (Merr.) Hilliard & B.L.Burt	<i>RBGE-PNHE 1999 28</i>	E	Philippines, Camiguin Island	HQ632892	HQ632989
<i>Agalmyla paucipilosa</i> Hilliard & B.L.Burt	<i>Smith & Galloway 261</i>	E	Indonesia, Sulawesi, Mt. Rantemario	HQ632893	HQ632990
<i>Agalmyla sojoliana</i> Hilliard & B.L.Burt	<i>Smith & Galloway 321</i>	E	Indonesia, Sulawesi, Mt. Sojol	HQ632894	HQ632991
<i>Allocheilos guangxiensis</i> H.Q.Wen, Y.G.Wei & S.H.Zhong	<i>Wei, Y.G. 06-02</i>	IBK	China, Guangxi, Yongfu county	HQ632897	HQ632994
<i>Allostigma guangxiense</i> W.T.Wang	<i>Möller, M. & Wei, Y.G. MMO 05-755</i>	E, IBK	China, Guangxi, Longzhou county	HQ632880	HQ632977
<i>Anna mollifolia</i> (W.T.Wang) W.T.Wang & K.Y.Pan	<i>Möller, M. & Qi, Y.D. MMO 01-146</i>	E, PE, WU	China, Guangxi, Napo county	FJ501543	AF055050 / AF055051
<i>Anna ophiorrhizoides</i> (Hemsl.) B.L.Burt & R.A.Davidson	<i>Möller, M. & Wei, Y.G. MMO 08-1280</i>	E, IBK	China, Sichuan, Emei Shan	HQ632937	HQ633034
<i>Anna submontana</i> Pellegr.	<i>Möller, M. & Qi, Y.D. MMO 01-85</i>	E, PE, WU	China, Yunnan, Maguan county	FJ501542	FJ501362
<i>Billolivia longipetiolata</i> D.J.Middleton & Luu	<i>Luu Hong Truong & Pham Huu Nhan BD624</i>	E	Vietnam, Lam Dong Province, Bidoup – Nui Ba National Park	KU985108	KU985112
<i>Billolivia minutiflora</i> D.J.Middleton & H.Atkins	<i>Ly Ngoc Sam LY498</i>	E	Vietnam, Lam Dong Province, Da Hoai District	KU985109	KU985113
<i>Billolivia vietnamensis</i> D.J.Middleton & Luu	<i>Luu Hong Truong & Nguyen Quoc Dat BGM1601</i>	E	Vietnam, Binh Phuoc, Bu Gia Map National Park	KU985110	KU985114
<i>Billolivia violacea</i> D.J.Middleton & H.Atkins	<i>Middleton, D.J. 4210</i>	E	Vietnam, Lam Dong, Duc Trong District	KU985111	KU985115
<i>Briggsiopsis delavayi</i> (Franch.) K.Y.Pan	<i>Fang, W. 1</i>	IBK	China, Chongqing, Nanchuan county	HQ632879	HQ632976
<i>Cathayanthe biflora</i> Chun	<i>Möller, M. & Wei, Y.G. MMO 08-1327</i>	E, IBK	China, Hainan, Tongshi county	HQ632899	HQ632996

<i>Chayamaritia banksiae</i> D.J.Middleton	<i>Middleton, D.J. 5220 (= Newman, M. et al. LAO1428)</i>	E	Laos, Khammouan, Nakai Nam Theun	KP325433	KP325426
<i>Chayamaritia smitinandii</i> (B.L.Burt) D.J.Middleton & Mich.Möller	<i>Middleton, D.J. et al. 5632</i>	E	Thailand, Nakhon Nayok, Khao Yai NP	KP325431	KP325424
<i>Chayamaritia smitinandii</i> (B.L.Burt) D.J.Middleton & Mich.Möller	<i>Middleton, D.J. et al. 5652</i>	E	Thailand, Nakhon Nayok, Khao Yai NP	KP325432	KP325425
<i>Codonoboea albomarginata</i> (Hemsl.) Kiew	<i>Weber, A. 840805-1/12</i>	WU	Malaysia, Perak, Maxwell's Hill	AJ492297	HQ632961
<i>Codonoboea codonion</i> (Kiew) C.L.Lim	<i>Lim, C.L. FRI 65040</i>	KEP	Malaysia, Terengganu, Jerangau F.R.	JF912538	JF912565
<i>Codonoboea corrugata</i> (Mendum) D.J.Middleton	<i>RBGE-PNHE 1998 s.n.</i>	E	Philippines, Palawan	FJ501484	HQ632962
<i>Codonoboea floribunda</i> (M.R.Hend.) C.L.Lim	<i>Lim, C.L. FRI 64971</i>	KEP	Malaysia, Terengganu, Sg. Nipah F.R.	JF912539	JF912566
<i>Codonoboea malayana</i> (Hook.f.) Kiew	<i>Kiew, R. & Middleton. D.J. FRI 57513</i>	KEP	Malaysia, Pahang, Fraser's Hill	JF912541	JF912568
<i>Codonoboea venusta</i> (Ridl.) Kiew	<i>Kiew, R. RK 5430</i>	KEP	Malaysia, Pahang, Fraser's Hill	JF912545	JF912572
<i>Conandron ramondiioides</i> Siebold & Zucc.	<i>Takeda Herbal Garden Kyoto [Cult. RBGE 19691267]</i>	E	Japan, unknown locality	FJ501515	FJ501340
<i>Cyrtandra cumingii</i> C.B.Clarke	<i>Kokubugata, G. 11134</i>	TNS	Japan, Ruykyus, Iriomote Island	HQ632905	HQ633002
<i>Cyrtandra cupulata</i> Ridl.	<i>Weber, A. 840806-2/4</i>	WU	Malaysia, Perak, Maxwell's Hill	FJ501532	AY818826 / AY818861
<i>Cyrtandra glabra</i> Banks ex C.F.Gaertn.	<i>Cronk, Q.C.B. & Percy, D. T91</i>	E	French Polynesia, Society Is., Tahiti, Mt. Tearoa Col	AY423136	FJ501353

<i>Cyrtandra kusaimontana</i> Hosok.	<i>NTBG 960873</i>	PTBG	Federated States of Micronesia, Caroline Islands	HQ632907	-
<i>Cyrtandra kusaimontana</i> Hosok.	<i>Flynn 5995</i>	PTBG	Federated States of Micronesia, Caroline Islands	-	EU919945
<i>Cyrtandra longifolia</i> (Wawra) Hillebr. ex C.B.Clarke	<i>Kiehn, M. 920825-2/1 [Cult. HBV]</i>	WU	USA, Hawaii, Kauai	FJ501531	EU919939
<i>Cyrtandra pendula</i> Blume	<i>Weber, A. & Anthonyamy 860730-1/2 [Cult. HBV]</i>	WU	Malaysia, Negeri Sembilan, Kuala Pilah distr., Jeram Toi	FJ501530	FJ501354
<i>Deinostigma cicatricosa</i> (W.T.Wang) D.J.Middleton & Mich.Möller	<i>Möller, M. & Wei, Y.G. MMO 07-1148 [KN173]</i>	E, IBK	China, Guangxi, Fang Cheng	KU990886	KU990890
<i>Deinostigma cicatricosa</i> (W.T.Wang) D.J.Middleton & Mich.Möller	<i>Xu, W.-B. s.n. [XWB]</i>	IBK	China, unknown locality	JX506817	JX506925
<i>Deinostigma cyrtocarpa</i> (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins	<i>Möller, M. & Wei, Y.G. MMO 06-908</i>	E, IBK	China, Guangxi, He Zhou city	KU990885	KU990889
<i>Deinostigma poilanei</i> (Pellegr.) W.T.Wang & Z.Y.Li	<i>Rybková, R. HB 222</i>	E	Vietnam, Hon Ba	KU990888	KU990892
<i>Deinostigma tamiana</i> (B.L.Burt) D.J.Middleton & H.J.Atkins	<i>Soviet-Vietnam Expedition (Liberec B.G., Czech Republic & St. Petersburg B.G) 01/114 [Cult. RBGE 19973431/19981743]</i>	E	Vietnam, Vinh Phu	KU990887	KU990891
<i>Didymocarpus antirrhinoides</i> A.Weber	<i>Jong, K. 9009 [Cult. RBGE 19650167]</i>	E	Malaysia, Perak, Bujong Melaka, Ipoh.	FJ501513	DQ912671
<i>Didymocarpus citrinus</i> Ridl.	<i>Davis, P. 69437 [Cult. RBGE 19830510]</i>	E	Malaysia, Perlis, Kedah Peak	AJ492293	DQ912669

<i>Didymocarpus cordatus</i> Wall. ex A.DC.	Weber, A. 860816-2/1	WU	Malaysia, Perak, Maxwell's Hill	AJ492294	DQ912673
<i>Didymocarpus podocarpus</i> C.B.Clarke	Noltie, H., Pradhan, Sherub & Wangdi 193	E	Bhutan, Deothang District	FJ501514	DQ912688
<i>Didymocarpus stenanthos</i> C.B.Clarke	Möller, M. & Qi, Y.D. MMO 01-156	E, PE, WU	China, Yunnan, Binchuan county	FJ501512	DQ912687
<i>Didymocarpus villosus</i> D.Don	Adhikari, B. SB 9	E	Nepal, Sundarjal	HQ632904	HQ633001
<i>Didymostigma obtusum</i> (C.B.Clarke) W.T.Wang	Möller, M. & Wei, Y.G. MMO 08-1310	E, IBK	China, Guangdong, Fengkai county	HQ632875	HQ632971
<i>Didymostigma trichanthera</i> C.X.Ye & X.G.Shi	Möller, M. & Wei, Y.G. MMO 08-1335	E, IBK	China, Guangdong, Longmen county	HQ632876	HQ632972
<i>Glabrella longipes</i> (Hemsl. ex Oliv.) Mich.Möller & W.H.Chen	Möller, M. & Qi, Y.D. MMO 01-122	E, PE, WU	China, Yunnan, Xichou county	FJ501545	AF055052 / AF055053
<i>Glabrella mihieri</i> (Franch.) Mich. Möller & W.H.Chen	Wang, Y.Z. 11315B	PE	China, Chongqing, Nanchuan county	FJ501544	FJ501363
<i>Gyrocheilos chorisepalus</i> W.T.Wang var. <i>synsepalus</i> W.T.Wang	Wei, Y.G. 07-708	IBK	China, Guangdong, Xinyi county	HQ632900	HQ632997
<i>Gyrocheilos lasiocalyx</i> W.T.Wang	Möller, M. & Wei, Y.G. MMO 06-881	E	China, Guangxi, Guiping county	HQ632901	HQ632998
<i>Gyrocheilos retrotrichus</i> W.T.Wang	Möller, M. & Wei, Y.G. MMO 07-1136	E, IBK	China, Guangxi, Wuming county	HQ632902	HQ632999
<i>Gyrocheilos retrotrichus</i> W.T.Wang var. <i>oligolobus</i> W.T.Wang	Wei, Y.G. 06-208	IBK	China, Guangxi, Rongshui county, Sirong town	HQ632903	HQ633000
<i>Hemiboea bicornuta</i> (Hayata) Ohwi	Voucher from Cult. RBGE 19951207	E	unknown origin	FJ501534	FJ501356
<i>Hemiboea cavaleriei</i> H.Lév.	Z.J.Gu, Z.J. G3	KUN	China, unknown locality	FJ501533	FJ501355
<i>Hemiboea omeiensis</i> W.T.Wang	Möller, M. MMO 08-1271	E, IBK	China, Sichuan, Emei Shan	HQ632886	HQ632983

<i>Hemiboea ovalifolia</i> (W.T.Wang) A. Weber & Mich.Möller	<i>B.M.Nong, B.M. 06-1</i>	IBK	China, Guangxi, Napo county, Nonghua	HQ632883	HQ632980
<i>Hemiboea purpureotincta</i> (W.T.Wang) A. Weber & Mich.Möller	<i>Möller, M. & Wei, Y.G. MMO 06-813</i>	E, IBK	China, Guangxi, Tian Ling county	HQ632884	HQ632981
<i>Hemiboea subcapitata</i> C.B.Clarke	<i>Wang, Y.Z. 11306</i>	PE	China, Chongqing, Chengkou county	FJ501535	FJ501357
<i>Henckelia anachoreta</i> (Hance) D.J.Middleton & Mich.Möller	<i>Middleton, D.J. et al. 4480</i>	E	Thailand, Chiang Mai, Doi Suthep	HQ632870	HQ632966
<i>Henckelia bifolia</i> (D.Don) A.Dietr.	<i>Bhaskar Adhikari L2B6</i>	E	Nepal, Chyalding, near Sybrubesi	JF912522	JF912549
<i>Henckelia dielsii</i> (Borza) D.J.Middleton & Mich.Möller	<i>Möller, M. et al. MMO 08- 1211</i>	E, KUN	China, Yunnan, Jingdong county	HQ632871	HQ632967
<i>Henckelia floccosa</i> (Thwaites) A. Weber & B.L.Burt	<i>Jang, C.G. s.n. [G 157]</i>	WU	Sri Lanka, unknown locality	FJ501486	HQ632964
<i>Henckelia grandifolia</i> A.Dietr.	<i>Möller, M. et al. MMO 08- 1222</i>	E, KUN	China, Yunnan, Jingdong county	JF912527	JF912554
<i>Henckelia incana</i> (Vahl) Spreng.	<i>Vogel, S. SVG s.n.</i>	E	India, Nilghiri mts	HQ632869	HQ632965
<i>Henckelia pumila</i> (D.Don) A.Dietr.	<i>Gaoligong Shan Expedition 1996 7938 [Cult. RBGE 19962271]</i>	E	China, Yunnan, Nujiang Lisu Aut. Pref., Fugong county	FJ501491	FJ501327
<i>Henckelia urticifolia</i> (D.Don) A.Dietr.	<i>EMAK 109 H (Edinburgh- Makalu Expedition 1991)</i>	E	Nepal, Sankhuwasabha distr., Arun valley	FJ501492	FJ501328
<i>Hexatheca fulva</i> C.B.Clarke	<i>Sang, J. & Geri, C. S99358</i>	E	Malaysia, Sarawak, Bau, Fairy Cave	HQ632873	HQ632969
<i>Liebigia barbata</i> (Jack) D.J.Middleton	<i>Woods, P. 1071 (C6570)</i>	E	Indonesia, Java, forest above Cibodas Garden	FJ501538	JF501359
<i>Loxostigma fimbrisepalum</i> K.Y.Pan	<i>Wang, Y.Z. 991005</i>	PE	China, Yunnan, Jinping county	FJ501507	KU985104

<i>Loxostigma glabrifolium</i> D.Fang & K.Y.Pan	Wei, Y.G. 709	IBK	China, Guangxi, Napo county	HQ632910	HQ633006
<i>Loxostigma griffithii</i> (Wight) C.B.Clarke	Kew/Edinburgh <i>Kanchenjunga</i> <i>Expedition (1989)</i> 940 [Cult. RBGE 19892473A]	E	Nepal, Yamphudin	FJ501508	FJ501338
<i>Loxostigma</i> sp.	<i>Gaoligong Shan Expedition</i> 1996 7668	E	China, Yunnan	AY423137	HQ633005
<i>Lysionotus chingii</i> Chun ex W.T.Wang	Wang, Y.Z. S-10669	PE	China, unknown locality	FJ501498	FJ501332
<i>Lysionotus forrestii</i> W.W.Sm.	<i>Gaoligong Shan Expedition</i> 1996 7925 [Cult. RBGE 19962269A]	E	China, Yunnan, Nuijiang Lisu Aut. Pref.,	FJ501495	AF349152 / AF349233
<i>Lysionotus pauciflorus</i> Maxim.	Möller, M. & Qi, Y.D. <i>MMO</i> 01-101	E, PE, WU	China, Yunnan, Xichou county, Cheng Jia Po	FJ501497	FJ501331
<i>Lysionotus petelotii</i> Pellegr.	Möller, M. & Qi, Y.D. <i>MMO</i> 01-100/4	E, PE	China, Yunnan, road to Xichou	FJ501496	HQ632974
<i>Metapetrocosmea peltata</i> (Merr. & Chun) W.T.Wang	Wei, Y.G. 07-702	IBK	China, Hainan, Wuzhi Shan	HQ632872	HQ632968
<i>Microchirita caliginosa</i> (C.B.Clarke) Yin Z. Wang	ex HB München- <i>Nymphenburg; M.Kiehn</i> & M.Pfossen 2000-1 [Cult. HBV GS-96-02]	WU	Malaysia, unknown locality	FJ501488	FJ501325
<i>Microchirita aff. hamosa</i> (R.Br.) Yin Z. Wang	Möller, M. & Wei, Y.G. <i>MMO</i> 05-753	E, IBK	China, Guangxi, Longzhou county	JF912524	JF912551
<i>Microchirita lavandulacea</i> (Stapf) Yin Z. Wang	Voucher from Cult. RBGE 20000897	E	China, unknown locality	FJ501487	FJ501324
<i>Microchirita sericea</i> (Ridl.) A. Weber & Rafidah	Rafidah, A.R. <i>FRI</i> 64328	KEP	Malaysia, Kelantan, Gunung Reng	JF912548	JF912521

<i>Microchirita tubulosa</i> (Craib) A. Weber & D.J.Middleton	<i>Middleton, D.J. et al. 4809</i>	E	Thailand, Nakhon Sawan, Wat Thep Satha Phon	JF912531	JF912558
<i>Microchirita viola</i> (Ridl.) A. Weber & Rafidah	<i>Rafidah, A.R. FRI 64388</i>	KEP	Malaysia, Kedah, P. Langkawi	JF912533	JF912560
<i>Oreocharis argyreia</i> Chun ex K.Y.Pan	<i>Möller, M. & Wei, Y.G. MMO 07-1131</i>	E, IBK	China, Guangxi, Wuming county	HQ632919	HQ633015
<i>Oreocharis begoniifolia</i> (H.W.Li) Mich.Möller & A. Weber	<i>Möller, M. et al. MMO 08- 1221</i>	E, KUN	China, Yunnan, Jing Dong county	HQ632929	HQ633025
<i>Oreocharis benthamii</i> C.B.Clarke	<i>Möller, M. et al. MMO 08- 1317</i>	E, KUN	China, Guangdong, Zhao Qin county	JF697584	JF697572
<i>Oreocharis cotinifolia</i> (W.T.Wang) Mich.Möller & A. Weber	<i>Chuan, Q.M. 01</i>	IBK	China, Guangxi, Dayaoshan, Jinxiu county	HQ632914	HQ633010
<i>Oreocharis craibii</i> Mich.Möller & A. Weber	<i>Möller, M. & Gao, L.M. MMO 07-1072</i>	E, KUN	China, Sichuan, Pan Zhi Hua county	HQ632921	HQ633017
<i>Oreocharis dasyantha</i> Chun var. <i>ferruginosa</i> K.Y.Pan	<i>Wei, Y.G. 07-700</i>	E	China, Hainan, Delong	HQ632918	HQ633014
<i>Oreocharis longifolia</i> (Craib) Mich.Möller & A. Weber	<i>Möller, M. et al. MMO 08- 1239</i>	E, KUN	China, Yunnan, Jingdong county	HQ632934	HQ633030
<i>Oreocharis mileensis</i> (W.T.Wang) Mich.Möller & A. Weber	<i>Shui, Y.M. 65214</i>	KUN	China, Yunnan, Shilin county	HQ632928	HQ633024
<i>Oreocharis ronganensis</i> (K.Y.Pan) Mich.Möller & A. Weber	<i>Möller, M. & Wei, Y.G. MMO 06-776</i>	E, IBK	China, Guangxi, Rong An county	HQ632927	HQ633023
<i>Oreocharis stewardii</i> (Chun) Mich.Möller & A. Weber	<i>Möller, M. & Wei, Y.G. MMO 06-917</i>	E, IBK	China, Guangxi,Shanjiang county	HQ632926	HQ633022
<i>Petrocodon coriaceifolius</i> (Y.G.Wei) Y.G.Wei & Mich. Möller	<i>Möller, M. & Wei, Y.G. MMO 06-913</i>	E, IBK	China, Guangxi, Yangshuo county	HQ632943	HQ633040
<i>Petrocodon dealbatus</i> Hance	<i>Xie, Q.J. J-042 (US 422841)</i>	US	China, Guangdong, Lianxian county	FJ501537	FJ501358

<i>Petrocodon ferrugineus</i> Y.G.Wei	Möller, M. & Wei, Y.G. MMO 06-784	E, IBK	China, Guangxi, Xincheng county	HQ632946	HQ633043
<i>Petrocodon hancei</i> (Hemsl.) A. Weber & Mich. Möller	Möller, M. & Wei, Y.G. MMO 08-1342	E, IBK	China, Guangxi, He Zhou city	HQ632944	HQ633041
<i>Petrocodon hechiensis</i> (Y.G.Wei, Yan Liu & F.Wen) Y.G.Wei & Mich. Möller	Möller, M. & Wei, Y.G. MMO 07-1077	E, IBK	China, Guangxi, Hechi city	HQ632942	HQ633039
<i>Petrocodon integrifolius</i> (D.Fang & L.Zeng) A. Weber & Mich. Möller	Möller, M. & Wei, Y.G. MMO 06-865	E, IBK	China, Guangxi, Longzhou county	HQ632940	HQ633037
<i>Petrocodon scopulorum</i> (Chun) Yin Z. Wang	Fang, W. 2010-02	IBK	China, Guizhou, Xiuwen county, Maochong village	HQ632947	HQ633044
<i>Petrocodon viridescens</i> W.H.Chen, Mich. Möller & Y.M. Shui	Shui, Y.M. et al. 82661	E	China, Yunnan, Maguan county	HQ632939	HQ633036
<i>Petrocosmea kerrii</i> Craib	Voucher from Cult. RBGE 19715592	E	unknown origin	FJ501502	FJ501334
<i>Petrocosmea minor</i> Hemsl.	Sino-Amer. Bot. Expedition, no. 1574 (US 56119)	US	China, Yunnan, Lunan Xian	FJ501504	KU985106
<i>Petrocosmea nervosa</i> Craib	Smithsonian Institute 78-057 [Cult. RBGE 19933232]	E, US	China, N Yunnan	AJ492299	FJ501335
<i>Petrocosmea sericea</i> C.Y.Wu ex H.W.Li	Gu, Z.J. 99-1104	KUN	China, unknown locality	FJ501503	KU985105
<i>Primulina dryas</i> (Dunn) Mich. Möller & A. Weber	Godfrey, T.C. 369 [Cult. RBGE 19791050]	E	China, Hong Kong	FJ501524	FJ501348
<i>Primulina fimbrisepala</i> (Hand.- Mazz.) Yin Z. Wang	B. Pan, B. s.n.	IBK	China, Guangxi	JX506785	JX506893
<i>Primulina gemella</i> (D.Wood) Yin Z. Wang	L.Averyanov, L. 1987 [Cult. RBGE 19941913]	E	Vietnam, Hong Quang Special Region, Cat Hai	FJ501523	FJ501345

<i>Primulina glandulosa</i> (D.Fang et al.) Yin Z. Wang	<i>J.M.Li, J.M. 054291</i>	PE	China, Guangxi	DQ872804	DQ872841
<i>Primulina glandulosa</i> (D.Fang et al.) Yin Z. Wang var. <i>yangshuoensis</i> (F. Wen, Q.X.Zhang & Yue Wang) Mich.Möller & A. Weber	<i>Möller, M. & Wei, Y.G. MMO 06-912</i>	E, IBK	China, Guangxi, Yang Shuo county	HQ632948	HQ633045
<i>Primulina hochiensis</i> (C.C.Huang & X.X.Chen) Mich.Möller & A. Weber	<i>Pan, B. s.n.</i>	IBK	China, Guangxi	JX506795	JX506903
<i>Primulina liguliformis</i> (W.T.Wang) Mich.Möller & A. Weber	<i>Pan, B. s.n.</i>	IBK	China, Guangxi	JX506804	JX506912
<i>Primulina linearifolia</i> (W.T.Wang) Yin Z. Wang	<i>Li, J.M. 11121</i>	PE	China, Guangxi	DQ872810	DQ872834
<i>Primulina longgangensis</i> (W.T.Wang) Yin Z. Wang	<i>A.Takhtajan, A. & Aruzytov, N. 1975 [Cult. RBGE 19941915]</i>	E	Vietnam, unknown locality	AJ492290	FJ501347
<i>Primulina luochengensis</i> (Yan Liu & W.B.Xu) Mich.Möller & A. Weber	<i>Wei, Y.G. MMO 07-1163</i>	IBK	China, Guangxi, Luocheng county, Xiaochangan town	HQ632949	HQ633046
<i>Primulina minutimaculata</i> (D.Fang et W.T.Wang) Yin Z. Wang	<i>Li, J.M. 067134</i>	PE	China, Guangxi	DQ872815	DQ872828
<i>Primulina ophiopogoides</i> (D.Fang et W.T.Wang) Yin Z. Wang	<i>Wang, Y.Z. 067134</i>	PE	China, Guangxi	DQ872814	DQ872829
<i>Primulina pinnata</i> (W.T.Wang) Yin Z. Wang	<i>Expedition Beijing 896526 (US 294374)</i>	US	China, Guangxi, Rongshui Xian	FJ501526	FJ501349
<i>Primulina renifolia</i> (D.Fang & D.H.Qin) Yin Z. Wang	<i>Möller, M. & Wei, Y.G. MMO 06-791</i>	E, IBK	China, Guangxi, Duan county	KU985103	KU985107

<i>Primulina tabacum</i> Hance	Xie, Q.J. & Ye, C.X. s.n. [Cult. RBGE 19951540]	E	China, Guangdong, Lian River	AJ492300	FJ501352
<i>Primulina wentsaii</i> (D.Fang, et L.Zeng0 Yin Z. Wang	Li, J.M. 11630	PE	China, Guangxi	DQ872812	DQ872831
<i>Pseudochirita guangxiensis</i> (S.Z.Huang) W.T. Wang	Möller, M. & Wei, Y.G. MMO 06-798	E, IBK	China, Guangxi, Mashan county	HQ632908	HQ633003
<i>Pseudochirita guangxiensis</i> (S.Z.Huang) W.T. Wang var. <i>glauca</i> Y.G.Wei & Yan Liu	Möller, M. & Wei, Y.G. MMO 05-751	E, IBK	China, Guangxi, Jingxi county	HQ632909	HQ633004
<i>Raphiocarpus sinicus</i> Chun	Möller, M. & Wei, Y.G. MMO 07-1141	E, IBK	China, Guangxi, Shangsi county	HQ632877	HQ632973
<i>Ridleyandra petiolata</i> (Ridl.) A. Weber	Mohd.Hairul, M.A. FRI 60092	KEP	Malaysia, Kedah, Gunung Inas	HQ632935	HQ633032
<i>Ridleyandra porphyrantha</i> (A. Weber & Kiew) A. Weber	Weber, A. 870420-2/4	WU	Malaysia, Pahang, side ridge of Gunung Bunga Buah	FJ501520	HQ633031
<i>Ridleyandra quercifolia</i> (Ridl.) A. Weber	Yao, T.L. FRI 65405	KEP	Malaysia, Perak, Maxwell's Hill	HQ632936	HQ633033

The valid publication of *Monolophus* (Zingiberaceae) revisited

J.F. Veldkamp

Naturalis Biodiversity Center, P.O. Box 9517,
2300 RA Leiden, The Netherlands
jef.veldkamp@naturalis.nl

ABSTRACT. The nomenclatural history of *Monolophus* Delafosse, Guill. & J.Kuhn is discussed. The combinations *Monolophus picheansoonthonii* (Phokham & Prasarn) Veldk. and *Monolophus pubescens* (Picheans. & Phokham) Veldk. are made.

Keywords. *Kaempferia*, new combination, nomenclature, Wallich

Introduction

Mood et al. (2014) argued that *Monolophus* (Zingiberaceae) was validated by Wallich (1832), having first been mentioned by Wallich (1830: April) in the second issue of the *Plantae Asiaticae Rariores*. However, the name was validated earlier. There is a review of Wallich's book by Guillemain (1830: July) in the *Bulletin des Sciences Naturelles et de Géologie*. The French text for *Kaempferia elegans* Wall. is a more or less summarised translation of that by Wallich (1830) and thus *Monolophus* is not validated in this work: "suffirait peut-être pour éloigner cette plante du *Kaempferia*... en former un genre sous le nom de *Monolophus*".

On page 31 of the Index in the next volume of *Bulletin des Sciences Naturelles et de Géologie*, published in October 1830 (fide printers mark on p. [1] of the issue) *Monolophus* is mentioned without an author and with the comment "Genre nouveau de Scitaminées" [New genus of the Scitaminae]. This may be regarded as an acceptance and validation of the name here. Wallich as the original author was not mentioned.

The journal was edited by [G.] Delafosse [mineralogist], [J.B.A.] Guillemain [botanist] and [J.] Kuhn [zoologist] and the name is, therefore, to be cited as: *Monolophus* Delafosse, Guill. & J.Kuhn, Bull. Sci. Nat. Géol. 23, Index: 31 (October 1830).

Mood et al. (2014) have shown that *Kaempferia elegans* is not a suitable candidate for the lectotype of *Monolophus*. Yet, Picheansoonthon (2016) erroneously maintained it as such. He also, mistakenly, thought that the new combinations in *Monolophus* by Mood et al. are illegitimate, which is against Art. 55.1 of the ICN (McNeill et al., 2012).

A proposal to conserve *Caulokaempferia* K.Larsen by Inthararapichai et al. (2014) has not yet been considered by the appropriate committee. Since the publication

of Mood et al. (2014) two new species of *Caulokaempferia* have been published. These are here transferred to *Monolophus*.

Monolophus picheansoonthonii (Phokham & Prasarn) Veldk., **comb. nov.** – *Caulokaempferia picheansoonthonii* Phokham & Prasarn in Phokham et al., J. Jap. Bot. 90: 155, t. 1, 2 (2015). – TYPE: South-western Thailand, Kanchanaburi, Sankhla Buri Distr., Thung Yai Narasuan Wildlife Sanctuary, Mt Kulu Huamee, near Ro Kee stream, 15°12'97.4"N 98°29'58.2"E. CP [*Chayan Picheansoonthon*] 160814-1 (holotype BK).

Monolophus pubescens (Picheans. & Phokham) Veldk., **comb. nov.** – *Caulokaempferia pubescens* Picheans. & Phokham in Phokham et al., Taiwania 60: 77, t. 1, 2. (2015). – TYPE: Northern Thailand, Mae Hong Son, Mueang Mae Hong Son Distr., CP [*Chayan Picheansoonthon*] 130713-3 (holotype BK).

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